Overview of education system for oral hygienists in Taiwan

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Background/purpose: Currently, Taiwan has a very complete education system of oral hygiene, but there is still no licensing system for oral hygienists. This study explored mainly the profile of education system for oral hygienists in Taiwan from 2017 to 2021.

Materials and methods: This study used the documentary analysis and secondary data analysis to survey mainly the development of oral hygiene education system in Taiwan, and the changes of oral hygiene students and graduates from 2017 to 2021.

Results: In Taiwan, currently, there are 8 oral hygiene schools which offer associate, bachelor, and master degrees in oral hygiene. The oral hygiene enrollment quotas determined by the Ministry of Education increased from 343 quotas in 9 programs in 2017 to 500 quotas in 13 programs in 2021, while new oral hygiene students who completed registration increased from 282 students in 2017 to 353 students in 2021. The registration rate of the five-year training program of junior college was significantly higher than the other programs. The number of oral hygiene students with official student status increased from 604 students in 2017 to 1349 students in 2021.

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Introduction

Most patients are familiar with general dentists. General dentists provide comprehensive services from dental examinations to various procedures for dental treatment. A comprehensive dental team consists of several members, including dentists, oral hygienists, dental technologists/technicians, dental nurses, and dental assistants. Each of dental team members has different works or plays different roles in providing people with good oral health and prevention of oral diseases in the future.¹ In Taiwan, however, the licensing systems for the dental team members only include dentists and dental technicians. For dental nurses, they are under the management of the licensing system for nursing personnel. Although there is still no licensing system for oral hygienists and dental assistants so far, the Standard Occupational Classification System of Taiwan includes the definition and work content of dental assistants. Only oral hygienists have none of relevant regulations or rules to define their work content.

Dental hygienists are responsible for removing tartars, stains, and dental plagues from teeth and teach patients oral hygiene techniques, such as how to properly brush the teeth. They are also responsible for the use of sealants and fluorides to help protect the teeth.²,³ In fact, according to the current regulations or rules in Taiwan, except for oral hygiene instructions, all the above-mentioned behaviors (which are medical practices) must be performed by a dentist. Therefore, it is illegal for a person not qualified as a dentist to perform the above medical practices in Taiwan. Taking the licensing system for dental hygienists in the United States as an example, dental hygienist evaluates a patient’s oral health by performing various cleanings and inspections. They also help dentists as needed and work with patients to maintain good oral health by teaching them proper procedures for oral hygiene.⁴ Dental hygienists require an associate degree in oral hygiene and state licensure. Those dental hygienists trying to advance in their careers should consider earning a bachelor or master degree in dental hygiene. These advanced degrees can help them to obtain positions outside the dental office, such as teaching and research positions in oral hygiene schools.

Although Kaohsiung Medical University established Institute of Oral Hygiene in 1993 with the aim for cultivating professional research personnel related to oral hygiene, the first educational institution in Taiwan for cultivating oral hygienists was Taipei Medical University School of Oral Hygiene established in 2001. It has been over 20 years. Taiwan has education system for oral hygienists, but still has no licensing system for oral hygienists since 2001. In addition to one medical university whose oral hygiene department has stopped enrolling new students in 2016, currently, there are 8 departments of oral hygiene in Taiwan. Among them, there are two in medical universities which offer bachelor degrees, one in a technological college which offers bachelor degrees, and five in junior colleges of medical care and management which offer associate degrees. In addition, Kaohsiung Medical University also offers master degrees in oral hygiene. Therefore, Taiwan currently has a very complete education system of oral hygiene. There are more than 100 oral hygiene graduates every year, and more than 1000 graduates have been accumulated in the past. It is a pity and embarrassment that most of them can only work as dental assistants in the dental offices or choose to change their jobs due to no licensing system for them in Taiwan.

This study used the documentary analysis and secondary data analysis to find various information about education for oral hygienists and tried to piece together the appearance of education for oral hygienists in Taiwan. The results of this study would be used as a reference for the establishment of the education system for oral hygienists.

Materials and methods

This study used the methods of the documentary analysis and the secondary data analysis to find the profile of education system for oral hygienists in Taiwan. The distribution of oral hygiene schools and their academic programs, enrollment students and educational goals were obtained from the websites of these schools.

In addition, the numbers of enrollment quotas of oral hygiene schools and new oral hygiene enrollees who completed registration, total number of students with official student status by gender, and the number of graduates from 2017 to 2021 were also obtained from the website of the Ministry of Education. With the data collected above, we examined the registration rates of oral hygiene students in various academic education systems, the distributions of oral hygiene students and graduates in different academic education systems, and their changes over the past 5 years. All data were open to access and could be collected from the related websites. The selected data were stored in excel files and used for the descriptive analysis.
statistics. The distribution of oral hygiene students was analyzed by independent t-test and chi-square test for trend analysis. The result was considered to be significant if the *P*-value was less than 0.05.

Results

The education system for oral hygienists in Taiwan

Currently, there are 8 oral hygiene schools in Taiwan, and all of them are private (Table 1). Among them, there are two in medical universities, one in a technological college, and five in the junior colleges of medical care and management. In addition to Kaohsiung Medical University which provides graduate programs and offers master degrees in oral hygiene, three oral hygiene schools in medical universities or one technological college provide four-year undergraduate programs and offer bachelor degrees in oral hygiene. The five oral hygiene schools in the junior colleges provide the five-year or two-year training programs and offer associate bachelor degrees in oral hygiene. The undergraduate programs of university or college and the two-year training program of junior college enroll senior high school graduates, while the five-year training program of junior college enroll junior high school graduates. Of these 8 oral hygiene schools, there are four schools located in the northern region of Taiwan, one in the central region, and three in the southern region of Taiwan. There is no oral hygiene school in the eastern region of Taiwan.

The educational goals of oral hygiene schools in Taiwan

According to the information posted by each oral hygiene school on its website, the educational goals of oral hygiene schools in Taiwan could be summarized as follows.

1. Graduate programs

   Based on the increasing importance of oral preventive medicine and oral hygiene education to the oral health of the whole people, the purposes of graduate programs of oral hygiene were to cultivate professional research talents in oral hygiene, to devote themselves to the promotion of oral health and hygiene education, the practice of preventive health care, and the research of oral epidemiology, and to train oral public health talents with independent research ability.

2. Undergraduate programs

   Based on the fact that high-quality dental services, comprehensive oral preventive medicine, and perfect oral hygiene education should be assisted by excellent auxiliary personnel, the purpose of undergraduate programs was to cultivate oral hygiene professionals who could independently promote oral hygiene education and have both communication and oral preventive healthcare and care skills, so that they could contribute to the improvement of national oral hygiene.

3. Five-year and two-year training programs

   Based on the importance of oral hygiene healthcare to human health and quality of life, the purpose of the five-year and two-year training programs was to cultivate professionals who had basic oral hygiene knowledge, oral hygiene healthcare skills for serving the community, residents of long-term care institutions, and people with special needs, and management and marketing capabilities of oral health industry, so that they were qualified to work as oral hygiene professionals or salespersons in dental institutions or oral health-related industries.

The numbers of enrollment quotas of oral hygiene schools and their new oral hygiene enrollees who completed registration from 2017 to 2021

During the past 5 years (from 2017 to 2021), the oral hygiene enrollment quotas determined by the Ministry of Education increased from 343 quotas in 9 programs in 2017 to 500 quotas in 13 programs in 2021, while new oral hygiene students who completed registration increased from 282 students in 2017 to 391 students in 2020, then decreased to 353 students in 2021 (Table 2). Furthermore, the registration rate increased from 82.22% in 2017 to 83.86% in 2018. However, the registration rate further decreased to 70.6% in 2021. In overall, there were a total of 2249 oral hygiene enrollment quotas in 56 programs, while there were a total of 1741 newly registered students with a registration rate of 77.41% over the past 5 years. Except that there was no two-year training program (on-the-job) of junior college in 2017, there were the highest numbers of oral hygiene enrollment quotas and newly registered students in the five-year training program of junior college, followed in a descending order by the undergraduate program, the two-year training program (on-the-job) of junior college, and the graduate program (including on-the-job) over the past 5 years. Except that the graduate program (including on-the-job) had high level registration rate in 2017 and 2018, there were the highest registration rate in the five-year training program of junior college, followed in a descending order by the undergraduate program, the graduate program (including on-the-job), and the two-year training program (on-the-job) of junior college over the past 5 years (Table 2).

The mean registration rate was calculated by each class under the same program over the past 5 years. The results showed that the registration rates were 66.07% in the graduate program (including on-the-job), 74.39% in the undergraduate program, 89.80% in the five-year training program of junior college, and 54.62% in the two-year training program (on-the-job) of junior college (Table 3). The registration rate of the five-year training program of junior college was significantly higher than the graduate program (including on-the-job) (*P* < 0.01), the undergraduate program (*P* < 0.05), and the two-year training program (on-the-job) of junior college (*P* < 0.001). In addition, the registration rate of the undergraduate program was significantly higher than the two-year training program (on-the-job) of junior college (*P* < 0.05) (Table 3).
| No. | School name                                      | School category                      | Department name                  | Academic program                        | Graduation conferring degree | Established time | Location                        | Region of Taiwan  |
|-----|-------------------------------------------------|--------------------------------------|----------------------------------|-----------------------------------------|------------------------------|------------------|---------------------------------|------------------|
| 1   | Kaohsiung Medical University                    | General university                  | Department of Oral Hygiene       | Graduate program                        | Master of Science (M.S.)     | 1993             | Kaohsiung City                  | Southern Taiwan   |
|     |                                                 |                                      |                                  | Graduate program (on-the-job)           | Master of Science (M.S.)     | 2000             |                                 |                  |
|     |                                                 |                                      |                                  | Undergraduate program                   | Bachelor of Science in Oral Hygiene (B.S.) | 2002             |                                 |                  |
|     |                                                 |                                      |                                  | Two-year undergraduate program (on-the-job) | Bachelor of Science in Oral Hygiene (B.S.) | 2004             |                                 |                  |
|       |                                                 |                                      |                                  | The two-year undergraduate program (on-the-job) stopped enrolling new students in 2015. |                             |                  |                                 |                  |
| 2   | Taipei Medical University                       | General university                  | School of Oral Hygiene           | Two-year undergraduate program          | Bachelor of Dental Hygiene (B.D.H.) | 2001             | Taipei City Northern           | Northern Taiwan   |
|     |                                                 |                                      |                                  | Undergraduate program                   | Bachelor of Dental Hygiene (B.D.H.) | 2012             |                                 |                  |
|       |                                                 |                                      |                                  | The two-year undergraduate program (on-the-job) stopped enrolling new students in 2013. |                             |                  |                                 |                  |
| 3   | China Medical University                        | General university                  | Department of Dental Hygiene     | Undergraduate program                   | Bachelor of Science (B.S.)   | 2003             | Taichung City                  | Central Taiwan    |
|     |                                                 |                                      |                                  |                                         |                              |                  |                                 |                  |
|     |                                                 |                                      |                                  | Stopped enrolling new students in 2016   |                              |                  |                                 |                  |
| 4   | Ching Kuo Institute of Management and Health    | Technological college               | Department of Oral Hygiene Care  | Undergraduate program                   | Bachelor of Science (B.S.)   | 2017             | Keelung City                   | Northern Taiwan   |
|     |                                                 |                                      | Hygiene                          |                                          |                              |                  |                                 |                  |
| 5   | Hsin Sheng Junior College of Medical Care and Management | Technological college               | Department of Oral Hygiene       | Five-year training program              | Associate of Science (A.S.)  | 2015             | Taoyuan City                   | Northern Taiwan   |
|     |                                                 |                                      |                                  |                                          |                              |                  |                                 |                  |
| 6   | Cardinal Tien Junior College of Healthcare and Management | Technological college               | Department of Oral Hygiene Healthcare | Two-year training program              | Associate of Science (A.S.)  | 2018             | New Taipei City                | Northern Taiwan   |
|     |                                                 |                                      |                                  |                                          |                              |                  |                                 |                  |
| 7   | Shu-Zen Junior College of Medicine and Management | Technological college               | Department of Oral Hygiene       | Five-year training program              | Associate Bachelor of Science (A.B.S.) | 2017             | Kaohsiung City                 | Southern Taiwan   |
|     |                                                 |                                      |                                  |                                          |                              |                  |                                 |                  |
| 8   | Jenteh Junior College of Medicine, Nursing and Management | Technological college               | Department of Oral Hygiene       | Five-year training program              | Associate Bachelor of Science (A.B.S.) | 2019             | Miaoli County                  | Central Taiwan    |
|     |                                                 |                                      |                                  |                                          |                              |                  |                                 |                  |
| 9   | Tzu Hui Institute of Technology                  | Technological college               | Department of Oral Hygiene       | Five-year training program              | Associate of Science (A.S.)  | 2021             | Pingtung County                | Southern Taiwan   |
The numbers of oral hygiene students with official student status by gender, school location, and academic program from 2017 to 2021

The number of oral hygiene students with official student status increased from 604 students in 2017 to 1349 students in 2021. The total increase was 745 students from 2017 to 2021 with a total increase rate of 123.34% (Table 4). According to gender, the number of male students increased from 139 students in 2017 to 246 students in 2021, while the number of female students increased from 465 students in 2017 to 1103 students in 2021. The total increase of male students was 107 students from 2017 to 2021 with a total increase rate of 76.98%, while the total increase of female students was 638 students from 2017 to 2021 with a total increase rate of 137.20%. Although both male and female students increased in number, the proportion of male students decreased slightly (Table 4).

According to location of oral hygiene schools, the number of students in the northern region increased from 341 students in 2017 to 702 students in 2021, while those in

| Program | Number of programs | Number of enrollment quotas | Number of registered students | Registration rate (%) |
|---------|--------------------|-----------------------------|------------------------------|----------------------|
| 2017    | A 2                | 24                          | 17                           | 70.83                |
|         | B 3                | 127                         | 82                           | 64.57                |
|         | C 4                | 192                         | 183                          | 95.31                |
|         | D 0                | 50                          | 18                           | 36                   |
| Overall | 9                  | 343                         | 282                          | 82.22                |
| 2018    | A 2                | 22                          | 20                           | 90.91                |
|         | B 3                | 127                         | 100                          | 78.74                |
|         | C 4                | 210                         | 205                          | 97.62                |
|         | D 1                | 50                          | 18                           | 36                   |
| Overall | 10                 | 409                         | 343                          | 83.86                |
| 2019    | A 2                | 22                          | 14                           | 63.64                |
|         | B 3                | 125                         | 100                          | 80                   |
|         | C 4                | 251                         | 206                          | 82.07                |
|         | D 3                | 105                         | 52                           | 49.52                |
| Overall | 12                 | 503                         | 372                          | 73.96                |
| 2020    | A 2                | 23                          | 12                           | 52.17                |
|         | B 3                | 125                         | 97                           | 77.6                 |
|         | C 4                | 241                         | 212                          | 87.97                |
|         | D 3                | 105                         | 70                           | 66.67                |
| Overall | 12                 | 494                         | 391                          | 79.15                |
| 2021    | A 2                | 22                          | 12                           | 54.55                |
|         | B 3                | 119                         | 86                           | 72.27                |
|         | C 5                | 261                         | 209                          | 80.08                |
|         | D 3                | 98                          | 46                           | 46.94                |
| Overall | 13                 | 500                         | 353                          | 70.6                 |

The mean registration rate of oral hygiene schools by programs from 2017 to 2021 and their comparison.

| Program | Registration rate (%) | Comparison (independent t-test) |
|---------|-----------------------|----------------------------------|
| A       | 66.07 ± 17.77         | C > B, P < 0.05                  |
| B       | 74.39 ± 25.85         | C > A, P < 0.01                  |
| C       | 89.80 ± 18.69         | C > D, P < 0.001                 |
| D       | 54.62 ± 21.78         | B > A, P = 0.18, B > D, P < 0.05, A > D, P = 0.11 |

A: Graduate program (including on-the-job).
B: Undergraduate program.
C: Five-year training program of junior college.
D: Two-year training program (on-the-job) of junior college.
Central and southern regions increased from 58 to 205 students in 2017 to 208 and 439 students in 2021, respectively (Table 4). The total increase of students in the northern region was 361 students from 2017 to 2021 with a total increase rate of 105.87%, while those in the central and the southern regions were 150 and 234 students from 2017 to 2021 with a total increase rate of 258.62% and 114.15%, respectively (Table 4). Although all students of each region increased in number, the proportion of students in the northern region decreased slightly and that in the central region increased slightly, while that in the southern region did not change much (Table 4).

Furthermore, according to academic program of oral hygiene schools, the number of students in the graduate program (including on-the-job) decreased from 38 students in 2017 to 27 students in 2021, while those in the undergraduate program, the five-year training program of junior college, and the two-year training program (on-the-job) of junior college increased from 289, 277, and zero students in 2017 to 309, 894, and 119 students in 2021, respectively. The total decrease of students in the graduate program (including on-the-job) was 11 students from 2017 to 2021 with a total decrease rate of 28.95%, while the total increase of students in the undergraduate program and the five-year training program of junior college were 20 and 617 students from 2017 to 2021 with a total increase rate of 6.92% and 222.74%, respectively (Table 4). The proportion of students in the graduate program (including on-the-job) and the undergraduate program decreased, while those in the five-year training program and the two-year training program (on-the-job) of junior college increased (Table 4).

To compare the distribution of oral hygiene students with official student status by gender, school location, and academic program in 2021, the number of female students was significantly higher than the number of male students (Table 5). However, proportionally, there were fewer male students in the northern region. On the other hand, there were relatively more male students in the graduate programs

| Year | Number (proportion) of oral hygiene students |
|------|---------------------------------------------|
|      | Gender Male | Female | — | — | Total |
|      | Location Northern | Central | Southern | — |
|      | Program A | B | C | D |
| 2017 | Gender 139 (23.01%) | 465 (76.99%) | — | — | 604 |
|      | Location 341 (56.46%) | 58 (9.60%) | 205 (33.94%) | — |
|      | Program 38 (6.29%) | 289 (47.85%) | 277 (45.86%) | 0 |
| 2018 | Gender 170 (20.07%) | 677 (79.93%) | — | — | 847 |
|      | Location 486 (57.38%) | 87 (10.27%) | 274 (32.35%) | — |
|      | Program 45 (5.31%) | 317 (37.43%) | 467 (55.14%) | 18 (2.13%) |
| 2019 | Gender 182 (17.30%) | 870 (82.70%) | — | — | 1052 |
|      | Location 596 (56.65%) | 130 (12.36%) | 326 (30.99%) | — |
|      | Program 40 (3.80%) | 306 (29.09%) | 642 (61.03%) | 64 (6.08%) |
| 2020 | Gender 221 (18.03%) | 1005 (81.97%) | — | — | 1226 |
|      | Location 659 (53.75%) | 175 (14.27%) | 392 (31.97%) | — |
|      | Program 32 (2.61%) | 317 (25.86%) | 763 (62.23%) | 114 (9.30%) |
| 2021 | Gender 246 (18.24%) | 1103 (81.76%) | — | — | 1349 |
|      | Location 702 (52.04%) | 208 (15.42%) | 439 (32.54%) | — |
|      | Program 27 (2.00%) | 309 (22.91%) | 894 (66.27%) | 119 (8.82%) |
|      | Total increase Gender 107 | 638 | — | — | 745 |
|      | Location 361 | 150 | 234 | — |
|      | Program —11 | 20 | 617 | 119 |
|      | Total increase rate (%) Gender 76.98 | 137.20 | — | — | 123.34 |
|      | Location 105.87 | 258.62 | 114.15 | — |
|      | Program —28.95 | 6.92 | 222.74 | — |

A: Graduate program (including on-the-job).
B: Undergraduate program.
C: Five-year training program of junior college.
D: Two-year training program (on-the-job) of junior college.
(including on-the-job) and the undergraduate programs. In addition, the number of students in the northern region was significantly higher than those in the other regions, while the number of students in the five-year training program of junior college was significantly higher than those in the other programs ($P < 0.0001$) (Table 5, the lower third). However, proportionally, there were more students of the northern and central regions in the five-year training program of junior college. On the other hand, there were relatively more students of the southern region in the graduate program (including on-the-job) and the undergraduate program (Table 5).

The number of oral hygiene graduates by gender from 2017 to 2021

During the past 5 years (from 2017 to 2021), the oral hygiene graduates increased from 84 graduates in 6 programs in 2017 to 136 graduates in 9 programs in 2021, while male graduates fluctuated between 15 and 27 students from 2017 to 2020, and female graduates increased from 60 students in 2017 to 115 students in 2020 (Table 6). In overall, there was a total of 465 oral hygiene graduates (107 male graduates and 358 female graduates) in 32 programs over the past 5 years. There was no graduate in the five-year training program and the two-year training program (on-the-job) of junior college from 2017 to 2019 due to their late establishment. In overall, there was the highest number of graduates in the undergraduate program, followed in a descending order by the five-year training program of junior college, the graduate program (including on-the-job) and the two-year training program (on-the-job) of junior college over the past 5 years. Furthermore, the number of female graduates was higher than the number of male graduates among various academic programs of oral hygiene schools (Table 6).

Discussion

Unlike the United States and Japan, there is still no licensing system for oral hygienists in Taiwan so far. This may be related to the development history of the dental industry and the current medical legal concept in Taiwan. In 1916 (Taisho 5) during the Japanese colonial period (1895–1945), the government announced the Taiwan Dentist Order to recognize the dentist as a kind of legal physician. However, the post-war Taiwan’s dentistry experienced a difficult time. The post-war Kuomintang government did not recognize the dentists as a kind of legal physician in the legal system of Physicians Act. It was not until the new Physicians Act of 1975 that dentists were recognized as legal physicians. We can infer that before the legal system for dentists themselves has been established, the time schedule of the establishment of the legal and licensing systems for other paramedical personnel of dentistry must also be delayed. In fact, the earliest educational institution in Taiwan for cultivating dental technicians was established in 1981, but the legal and licensing system of Dental Technicians Act was not established until 2009. This delayed period lasted for 28 years.

On the other hand, Taiwan’s medical legal concept classified the behaviors of caring for patients into medical practices and non-medical practices. Under the norms of the Physicians Act, only physicians, doctors of Chinese Medicine, and dentists are qualified to perform medical practices within the scope of their respective fields of
experts. These medical practices include not only the interventional treatment of diseases, but also the management of disease prevention. Therefore, the cleansing of teeth and the use of sealants and fluorides for the dental patients are both classified as medical practices. These factors greatly compress the possibility of implementing the legal and licensing system for oral hygienists in Taiwan. For example, in 2017, the draft of the "Oral Hygiene Personnel Act" promoted by the Ministry of Health and Welfare stipulates that the work content of oral hygienists is under the direction of dentists to engage in (1) evaluation and formulation of oral health management plans; (2) guidance and consultation for oral health, and (3) assistant behaviors for oral clinical treatment. Although the draft excludes scaling, the application of sealants and fluorides on teeth, and sets the work content of oral hygienists tantamount to that of dental assistants, the draft was still rejected finally.

In Taiwan, oral hygiene education for cultivating oral hygienists started late yet comprehensive. The establishment of oral hygiene schools is clearly marked by two waves: 1993–2003 and after 2015. In the former wave, 3 medical universities have established oral hygiene schools, mainly providing graduate program and undergraduate program; in the latter wave, 6 technological colleges have established oral hygiene schools, mainly providing the five-year training program and the two-year training program of junior college. Even if oral hygiene education started late, Taiwan currently has a very complete education system for oral hygienists.

The registration rate of oral hygiene schools peaked to 83.86% in 2018, and then dropped to 70.6% in 2021. This may be related to the effect of the draft of the "Oral Hygiene Personnel Act" which was decided not to be passed in 2018, leading the students and parents to think that oral hygiene personnel may be a less promising profession. Among them, the registration rate of graduate program has decreased predominantly. This may come from the different orientations to job-seeking: those studying for a postgraduate degree have higher expectations to be engaged in oral hygienists, while those in the undergraduate program or junior colleges may not. For the latter, either a dental assistant or a salesperson in dental industries may be taken into consideration for finding a job.

According to a career survey of oral hygiene graduates from Kaohsiung Medical University, the results showed that the highest proportion of graduates work as clinical dental assistants (37%), followed in a descending order by others (16%), dental instruments and materials industry marketing personnel (15%), higher education candidates (13%), government health institution personnel (8%), medical administrators in dental or medical institutions (5%), senior teachers (5%), and oral care personnel in the community and long-term care institutions (1%). The proportion of those actually engaged in oral hygiene-related work is less than 40%. Especially, only 1% of oral hygiene graduates engage in oral hygiene healthcare in community and long-term care institutions. This phenomenon reflects the impact of lack of licensing system for oral hygienists on oral hygiene graduates. Taking Japan as an example, there is an independent legislation of "Dental Hygienists Act" for dental hygienists in Japan. The number of active dental hygienists in Japan in 2016 was 123,831. The roles of dental hygienists are prevention of oral diseases, oral health education, and chairside treatment assistance. About 90% of dental hygienists work in private dental clinics predominantly, about 5% in hospitals, 2.2% in public sectors, and 0.7% in education institutes to work as a teaching staff. Therefore, in Taiwan, how to promote the oral health personnel to apply for a work related to what they have learned in oral hygiene schools will be the key direction for future oral hygiene education and policy to be strengthened.

In this study, the male to female ratio of oral hygiene students is about 1:4 from 2017 to 2021. However, the male to female ratio of oral hygiene graduates changed from 1:2.5 in 2017 to 1:5.48 in 2021. This finding indicates that proportionally more female students are enrolled in oral hygiene education and they tend to have a higher rate of graduation than male students. We also found that the resources of oral hygiene education are still unevenly distributed. Among 8 oral hygiene schools, currently, 4 schools are in the northern region of Taiwan, and more than 1711

### Table 6 The number of oral hygiene graduates by gender from 2017 to 2021.

| Program | Number of programs | Male | Female | Total |
|---------|-------------------|------|--------|-------|
| 2017    | A 2               | 3    | 8      | 11    |
|         | B 4               | 21   | 52     | 73    |
|         | C 0               | 0    | 0      | 0     |
|         | D 0               | 0    | 0      | 0     |
|         | Overall 6         | 24   | 60     | 84    |
| 2018    | A 2               | 4    | 4      | 8     |
|         | B 3               | 11   | 42     | 53    |
|         | C 0               | 0    | 0      | 0     |
|         | D 0               | 0    | 0      | 0     |
|         | Overall 5         | 15   | 46     | 61    |
| 2019    | A 2               | 2    | 8      | 10    |
|         | B 3               | 25   | 46     | 71    |
|         | C 0               | 0    | 0      | 0     |
|         | D 0               | 0    | 0      | 0     |
|         | Overall 5         | 27   | 54     | 81    |
| 2020    | A 2               | 3    | 6      | 9     |
|         | B 3               | 13   | 39     | 52    |
|         | C 1               | 4    | 26     | 30    |
|         | D 1               | 0    | 12     | 12    |
|         | Overall 7         | 20   | 83     | 103   |
| 2021    | A 2               | 1    | 8      | 9     |
|         | B 4               | 12   | 51     | 63    |
|         | C 1               | 3    | 34     | 37    |
|         | D 2               | 5    | 22     | 27    |
|         | Overall 9         | 21   | 115    | 136   |
|         | Overall A 10      | 13   | 34     | 47    |
|         | B 17              | 82   | 230    | 312   |
|         | C 2               | 7    | 60     | 67    |
|         | D 3               | 5    | 34     | 39    |
|         | Overall 32        | 107  | 358    | 465   |

A: Graduate program (including on-the-job).
B: Undergraduate program.
C: Five-year training program of junior college.
D: Two-year training program (on-the-job) of junior college.
half of the oral hygiene students are in the northern region of Taiwan (Table 5). There is no oral hygiene school in the eastern region of Taiwan. Our previous studies found that the uneven distribution of dental resources is a long-standing problem in Taiwan. We believe that this problem includes not only the uneven distribution of dentists or dental institutions, but also the uneven distribution of various dental-related personnel such as oral hygienists, dental technicians, and dental nurses.

In addition to the uneven distributions in terms of gender and region, Taiwan’s dental hygiene talent training has gradually shifted from the oral hygiene personnel of bachelor degrees to those of associate bachelor degrees, and is dominated by the five-year training program of junior college. The dental hygiene talent training in those of master degrees remains stable. The study also found that among all oral hygiene schools, the registration rate of the five-year training program of junior college was significantly higher than those of the other programs. In Taiwan’s educational system for oral hygienists, the five-year training program of junior college (also called five-year training school) recruits the junior high school graduates. The first three years of this program are equivalent to senior vocational school, and the last two years are equivalent to junior college. For the junior high school graduates, it is a good choice to obtain a five-year training program for an associate bachelor degree in a competition for admission. In this regard, there is usually a higher registration rate for the five-year training program. While the junior high school graduates are still in their teens, they usually choose schools closer to home. We believe that it is a better direction to use the five-year training program of junior college as the main force for training oral hygiene personnel at this stage because of its continual coverage of a 5-year training from senior vocational school to junior college. The balanced distribution of oral hygiene schools which provide the five-year training programs will finally contribute to the balanced distribution of oral hygiene personnel. In terms of knowledge or technology, the five-year training schools can give students more specialized training in the field of oral hygiene. In addition, Taiwan currently has a very complete education system of oral hygiene. For those students who are interested in developing in this field, they also have the opportunity to pursue a bachelor or master degree in oral hygiene at the university. Therefore, it is imperative to think about how to improve Taiwan’s oral hygiene education system and enhance the status of oral hygiene personnel to make it a promising career. We believe that these professionally trained oral hygiene graduates will contribute to the field of oral hygiene healthcare at all levels.

The services currently provided by Japanese dental hygienists are composed of (1) prevention of dental caries and gum diseases (including specialized treatments to prevent dental caries and gum diseases and to maintain and improve the health of the oral cavity), scaling and root planning, and application of caries-preventive agents such as fluorides and sealants; (2) assisting dentists in dental treatment under the supervision of a dentist; and (3) providing individual and group health guidance to induce health-promotion behavioral changes. The number of dental hygienists currently exceeds 100,000, which is greater than the number of both dentists and dental technicians. Allowing the work of dental hygienists to be covered by health care insurance since 1990 also led to an increase in the number of dental hygiene schools to over 160 in Japan. We think that this has some impacts on dentists in Japan.

Taking the dental technicians in Taiwan as an example, before the implementation the licensing system for dental technicians, there was already a demand for this profession in the market, and the dental technicians engaged in dental work without involving the scope prohibited by the Physicians Act and without restrictions. However, because there is still no licensing system for oral hygienists at present, no matter whether there is a demand for this profession in the market, the oral hygiene graduates can only engage in the work of oral hygiene instructions and do not involve medical practices to assist the work of dentists. Their job content is almost equivalent to that of a dental assistant. Therefore, we have to admit that the dental industry in Taiwan is not mature enough to accept the role of oral hygienists as paramedical personnel (like the oral hygienists or dental hygienists in the United States and Japan with qualifications for performing prevention of dental caries and gum diseases).

Before the implementation of the licensing system for oral hygienists in Taiwan, it seems more appropriate to train oral hygiene professionals at the level of junior college. We believe that oral hygiene graduates remain an important human resource in oral healthcare, and they remain an important force in improving the oral health of the people in Taiwan. We suggest that Taiwan should continue to promote the legislative work of the licensing system for oral hygienists in the future. Under the circumstance of conforming to Taiwan’s medical legal concept, it is possible to implement the licensing system for oral hygienists with the functions of assisting dentists and providing individual and group oral health guidance.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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