

Similarities and differences of international educational experiences of dental hygienists

Jacquelyn K. Lee; RDH, MS; Dorothy J. Rowe, RDH, MS, PhD

Abstract

Purpose: Better understanding of dental hygienists' educational experiences may contribute to a more globally integrated dental hygiene (DH) profession. The purpose of this study was to assess similarities and differences of the educational experiences of dental hygienists who had completed DH programs in a broad spectrum of countries.

Methods: Dental hygienists, educated in DH programs outside of the United States (US), were surveyed regarding their educational experiences in various subject areas/courses and their clinical skills. The International Federation of Dental Hygienists distributed study information, link for the informed consent, and 28-item survey to their member country House of Delegates representatives, along with a request to forward the survey information to their association members. Additionally, DH faculty at programs outside of the US were identified and invited to participate. Descriptive statistics were used to analyze the data.

Results: A total of 513 dental hygienists from 22 countries outside of the US agreed to participate. More than half of all respondents, from over half of the countries, reported holding a baccalaureate degree. Nearly all respondents from all 22 countries reported having courses in periodontology and dental anatomy. Reviewing health histories, scaling using hand and/or ultrasonic instrumentation and the application of fluoride via trays or varnish, were the most common clinical skills, reported by nearly all respondents from almost all countries.

Conclusion: Understanding the similarities of DH educational experiences, such as the emphasis on preventive therapy and maintenance of periodontal health, with educational content delivered at the university level, may facilitate greater global collaboration and a more unified workforce.

Keywords: dental hygienists, dental hygiene education, dental hygiene curriculum, health promotion, professional development

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

Submitted for publication: 2/20/19; accepted: 12/7/19

Introduction

Prevention of oral diseases and promotion of oral health are essential to the well-being of the global population. Preventive oral health care, along with the need for and value of dental hygiene (DH) services, has been gaining importance internationally.^{1,2} By providing preventive and therapeutic services, the DH workforce has been shown to have a positive impact on a population's oral health worldwide. The important role dental hygienists play in supporting oral health was established in the foundational studies of Axelsson and Lindhe, who demonstrated reductions in caries and periodontal disease associated with dental hygienists delivering regularly repeated oral hygiene instructions and

a dental prophylaxis, including scaling and root planning, during the 1970's in Sweden.³ The need for DH professionals to deliver these services has been recognized by an increasing number of countries.^{1,2} Belgium recently granted official recognition to dental hygienists, becoming the twenty-sixth European country to recognize the DH profession.⁴ The International Federation of Dental Hygienists (IFDH), an international organization, is uniting DH associations from around the globe in their common cause of promoting oral health. Current membership in the IFDH includes associations from 31 countries, of which 13 are outside of Europe. One of the IFDH's goals is to "promote and

coordinate the exchange of knowledge and information about the profession, its education, evidence-based research, and best practice.”⁵ Activities, such as the biannual International Symposium on Dental Hygiene, facilitates collaboration with DH professionals from around the world.

Global integration and collaboration within the DH profession is challenging without more extensive knowledge of the educational experiences of dental hygienists throughout the world.^{2,6,7} Collaboration in educating healthcare providers at the international level currently exists in medicine and nursing. The Global Health Service Partnership (GHSP), a collaborative effort with the Peace Corps and Seed Global Health, is focused on strengthening the quality of medical and nursing education and delivery in locations with a high burden of disease and a shortage of qualified health care professionals.⁸ Medical and nursing educators serve alongside fellow educators in the host country for a period of one year with the goal of sharing educational and clinical best practices.⁸ The DH profession has not achieved the same level of globalization as the medicine and nursing.^{6,7} A partnership similar to GHSP, may help facilitate the collaboration of international DH educators and dental hygienists in establishing DH education programs in countries, that would benefit from an expanded DH workforce. Dental hygienists establishing these new education programs may use their own experiences as a foundation for the development of these programs, and variations of their experiences are unknown.

There is a gap in the literature regarding whether dental hygienists educated in countries located around the world, gained their knowledge in similar educational content and through a similar level of instruction. It is also not known whether dental hygienists educated throughout the world gained clinical competencies in similar skills and tasks. The purpose of this study was to assess the similarities and differences of educational experiences of dental hygienists who had completed DH education programs across a broad range of countries.

Methods

This quantitative, cross-sectional study was approved by the Institutional Review Board of the University of California, San Francisco. The target population was dental hygienists who had completed entry-level DH educational programs in countries outside of the United States (US), and possessed a minimal fluency in the English language. While some countries describe the professional as an “oral hygienist,” for the purposes of this study the term “dental hygienist” will be used exclusively.

A 28-item survey was developed to obtain detailed information about the respondents’ educational experiences. Survey items consisted of five categories: general information, including country of the DH program attended (6 items); entrance requirements (5 items); types of required classes/subject areas (4 items); clinical skills competencies (8 items); demographic information (5 items). Content validity was determined by feedback from 11 dental hygienists who had graduated from DH programs outside of the US and from officers of the IFDH. Pilot testing for comprehension and clarity was conducted by students and faculty from the University of California Master of Science program in DH. Revisions were made based on feedback. Internal validity was maximized by utilizing simple English terms to decrease bias based on English language fluency.

The International Federation of Dental Hygienists distributed study information, a link for the informed consent, and a 28-item survey to their member country House of Delegates representatives, along with a request to forward the survey information and invitation to participate to their association members. Additionally, DH faculty members at programs outside of the US were identified and invited to participate. Study materials consisted of an introductory message, a link to the informed consent along with the survey, administered by a research software program (Qualtrics®; Provo, UT). DH faculty members were asked to answer the survey based on their own experiences as a DH student in their respective education programs, and not the program of their current employment.

Data were collected and all responses were collated. Frequencies (percentages) of responses to each survey item were calculated and data were displayed by country. The cross-tabulation tool, used to determine relationships between survey items: degree granted and licensing type and degree granted and research project required, was included in the research software. Cross-tabulation analysis, also known as contingency table analysis, was used as the statistical test for these survey items, since the reported data were categorical. A chi-square statistic was generated, using a two-dimensional table, which recorded the frequency of respondents reporting the specific characteristic. Statistical analysis determined whether the observed relationships between survey items could have occurred by chance. A *p*-value of 0.05 was chosen as the level of statistical significance.

Results

A total of 513 dental hygienists from 22 countries outside of the US agreed to participate (Table I). Most respondents

Table I. Respondents and respective country (n=513)

Country	Abbreviation	n
Australia	AU	26
Canada	CA	55
China	CH	2
Czech Republic	CZ	53
Denmark	DK	5
Finland	FI	121
Ireland	IE	1
Japan	JP	2
Jordan	JO	1
Latvia	LV	14
Lithuania	LT	22
Malta	MT	10
Netherlands	NL	31
New Zealand	NZ	17
Norway	NO	5
Pakistan	PK	1
Portugal	PT	2
Saudi Arabia	SA	32
South Africa	ZA	17
Spain	ES	14
Sweden	SE	34
United Kingdom	GB	48

reported entering their DH program between the ages of 18-22 years (Table II) and were predominately female. The average reported DH class size ranged between 16-30 students and were most frequently affiliated with a dental school located within a university. Programs in institutions, such as community colleges, technical institutes/vocational schools, or colleges of allied health, were less frequently reported. The degree most frequently awarded upon completion of the DH program was the baccalaureate, and in half of the participating countries, the number of respondents with baccalaureate degrees exceeded 50%. The number of respondents receiving diplomas varied; for example, 87.5% of the respondents from Canada received diplomas. The average number of years needed to complete a DH education program was reported to be two or three years for most countries. Saudi Arabia was the only country where completing the program with a degree required more than four years.

Respondents agreed that completion of secondary school at the minimum had been required to enter their respective

DH program (Table III). Most of the respondents reported that dental assisting experience, observing a practicing dental hygienist in a clinical setting, or the completion of specific prerequisite courses, was not required for entrance to their DH program. In countries requiring post-secondary school level prerequisites, the most common prerequisite was biology, followed by chemistry (Table IV).

Four categories were developed for the courses content areas included in the DH program curricula: dental sciences, research, clinical skills with joint classroom learning, and miscellaneous topics. Dental anatomy and periodontology were the most frequently identified dental science courses, with 90% or more of the respondents from nearly all countries having taken them. More than three quarters of respondents from nearly all 22 countries reported taking additional dental sciences, however cariology and general pathology were reported by fewer than half of the respondents from six countries. The distribution of course content areas is shown in Table V.

Respondents reported that the research-related subject areas were included at lower frequencies than the dental sciences. These lower frequencies of research related subjects were reported from countries where the majority of respondents were granted diplomas, not degrees. Cross-tabulation analysis indicated that respondents, who had received a baccalaureate degree, were more likely to have conducted a research project during their DH program than those who had received a diploma ($p = 0.05$, degrees of freedom=5, and chi square=38.44). Dental materials and radiology were the most common topics in the category of “clinical skills with joint classroom learning.” Pain management was variable. Under the miscellaneous category, providing dental hygiene care for patients with systemic diseases, professional ethics, and public/community health were the subject areas most frequently acknowledged by over half of the respondents. Dental jurisprudence was reported by fewer respondents.

Reviewing the health history, applying fluoride trays and/or varnish, scaling using hand instrumentation, and scaling with an ultrasonic scaler were the most common clinical skills reported across all countries and the majority of respondents reported being competent with these skills (Table VI). Other clinical skill competency areas included providing dietary and tobacco cessation counseling, exposing radiographs, and applying sealants. Low numbers of respondents reported competencies in bacterial testing, administering antimicrobials locally, applying silver diamine fluoride, and using a laser. The ability to perform simple tooth extractions and placing restorations was reported by

Table II. Student demographics and program characteristics (n=513)

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
Student age range upon entering DH program	n=26	n=51	n=2	n=39	n=5	n=104	n=1	n=2	n=1	n=10	n=22	n=9	n=29	n=16	n=4	n=1	n=2	n=26	n=17	n=8	n=30	n=46
< 18	4%	2%	0%	3%	0%	1%	0%	0%	0%	10%	5%	11%	3%	6%	0%	0%	0%	0%	0%	0%	0%	0%
18-22	23%	57%	0%	64%	60%	64%	100%	100%	100%	30%	77%	33%	79%	56%	25%	0%	100%	85%	82%	25%	30%	48%
23-27	54%	31%	50%	10%	20%	23%	0%	0%	0%	30%	18%	22%	7%	25%	25%	0%	0%	8%	12%	13%	60%	48%
28-32	12%	2%	50%	5%	0%	4%	0%	0%	0%	20%	0%	0%	0%	6%	0%	0%	0%	4%	0%	50%	7%	4%
> 32	8%	8%	0%	18%	20%	8%	0%	0%	0%	10%	0%	33%	10%	6%	50%	100%	0%	4%	6%	13%	3%	0%
Gender of the majority of the DH class cohorts	n=26	n=51	n=2	n=37	n=5	n=102	n=1	n=2	n=1	n=10	n=22	n=9	n=29	n=16	n=4	n=1	n=2	n=15	n=17	n=7	n=30	n=47
Male	0%	0%	50%	0%	0%	3%	0%	0%	0%	10%	0%	22%	0%	0%	0%	100%	0%	7%	0%	0%	0%	0%
Female	100%	100%	50%	100%	100%	97%	100%	100%	100%	90%	100%	44%	100%	100%	100%	0%	100%	93%	100%	100%	100%	100%
Usually an equal #	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Number of students enrolled in the DH class	n=26	n=51	n=2	n=38	n=5	n=100	n=1	n=2	n=1	n=9	n=22	n=9	n=27	n=15	n=4	n=1	n=2	n=26	n=17	n=7	n=28	n=47
1-15	15%	2%	50%	26%	20%	14%	100%	0%	100%	11%	9%	100%	0%	0%	25%	0%	0%	50%	35%	29%	4%	64%
16-30	50%	39%	0%	74%	40%	81%	0%	50%	0%	89%	82%	0%	48%	20%	50%	100%	50%	50%	47%	71%	50%	34%
31-45	19%	47%	50%	0%	0%	5%	0%	50%	0%	0%	9%	0%	4%	60%	25%	0%	50%	0%	18%	0%	39%	2%
> 45	15%	12%	0%	0%	40%	0%	0%	0%	0%	0%	0%	0%	48%	20%	0%	0%	0%	0%	0%	0%	7%	0%
DH program institutional affiliation	n=24	n=50	n=2	n=39	n=5	n=99	n=1	n=2	n=1	n=10	n=19	n=8	n=31	n=18	n=4	n=1	n=2	n=33	n=17	n=6	n=26	n=44
College of Allied Health	0%	2%	0%	18%	0%	16%	0%	0%	0%	0%	37%	12%	16%	0%	0%	100%	0%	39%	0%	0%	8%	0%
Community college	0%	46%	0%	10%	0%	3%	0%	0%	0%	0%	21%	0%	0%	0%	0%	0%	0%	0%	0%	33%	4%	0%
Technical institute or vocational school	25%	8%	50%	10%	0%	12%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	0%	2%
University w/out a dental school	33%	0%	0%	8%	0%	7%	0%	0%	0%	0%	5%	0%	7%	28%	25%	0%	0%	12%	6%	0%	35%	9%
University w/dental school	42%	40%	50%	41%	100%	41%	100%	100%	100%	100%	26%	63%	74%	72%	75%	0%	100%	81%	94%	0%	54%	66%
Other	0%	4%	0%	13%	0%	20%	0%	0%	0%	0%	11%	38%	3%	0%	0%	0%	0%	6%	0%	17%	0%	23%
Degree received upon completion of DH program	n=26	n=48	n=2	n=31	n=4	n=79	n=1	n=2	n=1	n=10	n=19	n=9	n=26	n=16	n=4	n=1	n=2	n=24	n=15	n=3	n=27	n=44
Associate	0%	0%	50%	7%	25%	4%	0%	0%	0%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%
Bachelor	73%	2%	50%	29%	50%	56%	0%	100%	100%	0%	90%	56%	39%	69%	75%	0%	100%	100%	40%	33%	56%	30%
Certificate	0%	2%	0%	0%	0%	17%	0%	0%	0%	11%	0%	0%	4%	6%	0%	0%	0%	0%	0%	0%	26%	5%
Diploma	12%	88%	0%	55%	25%	6%	100%	0%	0%	78%	5%	44%	58%	25%	25%	100%	0%	0%	60%	67%	7%	66%
Masters	0%	0%	0%	3%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%
Other	15%	8%	0%	7%	0%	11%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%
Years required to complete DH program	n=26	n=49	n=2	n=31	n=4	n=82	n=1	n=2	n=1	n=9	n=19	n=9	n=26	n=16	n=4	n=1	n=2	n=24	n=15	n=5	n=27	n=46
1 year	0%	14%	0%	0%	0%	2%	0%	0%	0%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	7%	15%
2 years	19%	55%	0%	0%	0%	4%	100%	0%	0%	78%	0%	0%	35%	25%	25%	100%	0%	0%	60%	100%	22%	44%
3 years	81%	29%	50%	97%	100%	55%	0%	0%	0%	11%	84%	100%	31%	75%	75%	0%	100%	4%	40%	0%	70%	41%
4 years	0%	2.0%	0%	3%	0%	38%	0%	100%	100%	0%	16%	0%	35%	0%	0%	0%	0%	42%	0%	0%	0%	0%
> 4 years	0%	0%	50%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	54%	0%	0%	0%	0%

few respondents with the exception of those coming from Australia, New Zealand, and the United Kingdom. Respondents from Denmark, Finland, Norway, and Sweden were more likely to be competent in placing fillings. Administration of nitrous oxide was the least common skill mastered by any of the respondents. The number of respondents who reported competency in administering local anesthesia varied significantly from zero (Jordan, Pakistan, Portugal, Spain) to 100% (Denmark, Ireland, Norway, Sweden).

Upon completion of their educational programs, respondents from all but two countries (Denmark and Ireland) reported being required to pass a licensing examination prior to practicing DH (Table VII). Either a written examination or a combination of both a written examination and a clinical component on a patient was the most common format. The relationship between requirement of licensing examinations and the type of degree upon completion of the program was considered to be significant by cross-tabulation analysis ($p=0.01$, degrees of freedom=10, chi square=23.50). Saudi Arabia was the only country, in which the majority (over 90%) of the respondents reported being required to participate in an internship or residency program following the completion of their DH program.

Discussion

This study surveyed dental hygienists who had completed entry-level DH education in a broad range of countries outside of the US. Participants reported a number of similarities across their educational experiences. Respondents' knowledge of educational content, such as periodontology, was mostly at the baccalaureate level of instruction and they had achieved competency at similar skills and tasks, such as hand and ultrasonic scaling and the application of fluoride. The emphasis on preventive therapy and maintenance of periodontal health was similar throughout the world.

Most of the respondents in this study reported obtaining a baccalaureate degree upon completion of their entry-level DH program. Based on the studies by Johnson, the number of baccalaureate programs has increased from 1987 to 2006, demonstrating a gradual shift from diploma programs which had previously been the predominant type of educational format.² The proportion of respondents in this study with baccalaureate degrees versus diplomas may not reflect the current increase in baccalaureate degree programs, as the respondents may have completed their DH education prior to this shift.² Since 2002, all the DH programs in the Netherlands have become 4-year baccalaureate degree programs,⁹ however only 39% of the respondents from the Netherlands in this study reported having received a baccalaureate degree upon completion of their education. The data collected in this study may be a conservative estimate of the current number of dental hygienists being educated at the baccalaureate level. Currently Australia, Czech Republic, Denmark, Finland, Japan, Lithuania, Netherlands, New Zealand, Norway, Portugal, Saudi Arabia and Sweden offer baccalaureate degree programs as the sole or predominant type of DH educational program.^{2,10}

However, in Canada, the number of diploma programs in community colleges had increased, while baccalaureate ones in universities had declined.¹² Those data support our findings, in which the majority of respondents from Canada reported having attended a diploma program lasting two years. A comparable trend has been observed in the US, with significantly greater numbers of associate degree programs,¹³ which can be considered to be similar to diploma programs in terms of hours and instruction content. This length of study has been a great concern for the DH profession in North America. The American Dental Hygienists' Association (ADHA) has policy supporting the establishment of

Table III. Entrance requirements of DH program (n=513)

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
Minimum level of education required	n=24	n=51	n=2	n=30	n=4	n=85	n=1	n=2	n=1	n=8	n=20	n=9	n=27	n=15	n=4	n=1	n=2	n=25	n=15	n=6	n=27	n=45
None required	0%	0%	0%	3%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	17%	0%	0%
Some years at secondary school	0%	2.0%	0%	7%	0%	6%	0%	0%	0%	13%	0%	11.1%	0%	7%	0%	0%	0%	4%	0%	17%	22%	11%
Completion of secondary school	88%	50%	50%	67%	100%	79%	100%	100%	100%	25%	90%	67%	89%	93%	75%	100%	100%	76%	93%	33%	74%	62%
Some years at technical institute	0%	4%	0%	0%	0%	1%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0%	0%	0%	17%	0%	11%
Some university courses	4%	32%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	2%
Completion of a university degree	0%	0%	50%	20%	0%	2%	0%	0%	0%	13%	5%	11%	0%	0%	25%	0%	0%	0%	7%	0%	0%	0%
Other	8%	12%	0%	3%	0%	11%	0%	0%	0%	50%	0%	11%	11%	0%	0%	0%	0%	0%	0%	17%	7%	13%
Experience in dental assisting	n=26	n=50	n=2	n=31	n=5	n=87	n=1	n=2	n=1	n=8	n=19	n=9	n=29	n=16	n=4	n=1	n=2	n=25	n=14	n=6	n=29	n=46
Yes	23%	16%	0%	19%	0%	6%	0%	0%	100%	38%	5%	11%	0%	6%	0%	100%	0%	8%	0%	33%	7%	17%
No	77%	84%	100%	81%	100%	94%	100%	100%	0%	63%	95%	89%	100%	94%	100%	0%	100%	92%	100%	67%	93%	83%
Observing a practicing DH in a clinical setting	n=24	n=49	n=2	n=32	n=5	n=86	n=1	n=2	n=1	n=7	n=18	n=9	n=29	n=15	n=4	n=1	n=2	n=25	n=14	n=6	n=29	n=43
Yes	8%	16%	0%	31%	0%	9%	0%	0%	100%	43%	33%	11%	3%	13%	0%	100%	0%	20%	0%	50%	0%	42%
No	92%	84%	100%	69%	100%	91%	100%	100%	0%	57%	67%	89%	97%	87%	100%	0%	100%	80%	100%	50%	100%	58%
Completion of specific pre-requisite courses	n=25	n=49	n=2	n=27	n=5	n=82	n=1	n=1	n=1	n=8	n=18	n=9	n=28	n=13	n=4	n=1	n=2	n=23	n=15	n=5	n=25	n=44
Yes	48%	63%	0%	22%	40%	1%	100%	0%	0%	50%	33%	78%	29%	15%	50%	100%	0%	48%	27%	40%	36%	57%
No	52%	33%	100%	78%	60%	99%	0%	100%	100%	50%	67%	22%	71%	85%	50%	0%	100%	52%	73%	60%	64%	43%

Table IV. Required prerequisite courses at post-secondary school level for DH program entrance* (n=513)

	AU	CA	CZ	DK	FI	IE	LV	LT	MT	NL	NZ	NO	SA	ZA	ES	SE	GB
Basic sciences	n=12	n=31	n=6	n=2	n=1	n=1	n=4	n=6	n=7	n=8	n=2	n=2	n=11	n=4	n=2	n=9	n=25
Anatomy	17%	36%	83%	0%	0%	100%	75%	33%	14%	13%	0%	0%	82%	0%	100%	0%	12%
Biochemistry	8%	7%	50%	0%	0%	0%	0%	33%	0%	0%	0%	0%	55%	0%	0%	11%	4%
Biology	67%	77%	50%	0%	0%	100%	100%	83%	100%	100%	50%	0%	73%	100%	50%	22%	96%
Chemistry	27%	68%	33%	100%	0%	0%	25%	83%	71%	88%	0%	0%	64%	0%	0%	44%	28%
Microbiology	0%	7%	67%	0%	0%	0%	50%	33%	14%	13%	0%	0%	46%	0%	0%	0%	0%
Physics	8%	10%	0%	100%	0%	0%	25%	17%	43%	0%	0%	0%	64%	50%	50%	0%	16%
Physiology	8%	19%	50%	0%	0%	0%	25%	17%	0%	0%	0%	0%	55%	0%	50%	0%	0%
Social studies																	n=16
Psychology	0%	48%	84%	0%	0%	0%	50%	33%	14%	13%	0%	0%	46%	0%	0%	0%	0%
Sociology	0%	26%	33%	0%	0%	0%	25%	33%	0%	13%	0%	0%	9%	0%	0%	11%	0%
Miscellaneous																	n=16
Computer science	0%	0%	50%	0%	0%	0%	50%	33%	29%	0%	0%	0%	73%	0%	50%	0%	0%
English	33%	77%	83%	100%	0%	100%	50%	33%	43%	13%	50%	0%	91%	75%	0%	56%	40%
Mathematics	17%	36%	0%	100%	0%	100%	0%	33%	43%	38%	0%	0%	55%	100%	0%	89%	32%
Classes Not Listed	17%	26%	33%	0%	0%	0%	0%	17%	29%	0%	0%	100%	18%	0%	0%	11%	8%

*Question: Is the completion of specific courses at post-secondary school level required to entering your dental/oral hygiene program?
If all respondents from a country or region responded “no” to this question, they are not represented.

the baccalaureate degree as the minimum entry-level for DH practice¹⁴ due to the challenges of achieving increased scope and depth of educational content in a two-year curriculum. Advanced opportunities for DH practice along with the complex health needs of the current aging population demand more thorough scientific knowledge, especially in terms of the relationship between oral and systemic health.

In general, baccalaureate education provided at the university level of instruction, focuses on increasing students’ knowledge base and critical thinking skills. These findings were demonstrated in a Canadian study where the majority of the respondents who had earned a baccalaureate degree following a diploma reported that their baccalaureate education improved their abilities in critical thinking, problem solving, and use of research.¹⁵ Graduates completing baccalaureate DH programs may be better prepared to use research to make evidence-based clinical decisions in their DH practices. The longer time-frame of these programs has allowed for increased breadth and depth of educational content, facilitating the broadening scope of practice and relaxing restrictions on DH practice.²

The most common core subject areas/courses, periodontology and dental anatomy/tooth morphology, reflect the educational content of the proposed IDFH¹ and the European Federation of Periodontology (EFP) guidelines.¹⁶ The courses proposed by these organizations do not preclude integration of the subject areas and low response rates in certain courses does not necessarily mean that the respondents did not gain knowledge in these subject areas. For example, the low number of respondents indicating having taken a cariology course may have been because the content had been integrated into other courses, such as oral biology, dental hygiene science, or preventive dentistry. Accordingly, general pathology concepts may have been integrated into an oral pathology course, as evidenced by higher response rates indicating having taken a course in oral pathology.

The prevalence of research methodology courses in most curricula may be due to the increasing length of most programs, from two to three years, as well as the increased number of baccalaureate programs.¹⁰ Longer baccalaureate programs allow more opportunity to incorporate research skills into the curriculum.¹ Time and critical thinking skills are needed to develop competence in searching for scientific evidence, critically appraising it, and implementing the findings into clinical practice. These evidence-based principles have been shown to be practiced by US graduates of baccalaureate programs more frequently than by those completing certificate or associate degree programs.¹⁷ When comparing the differences between one and two years of DH education in Sweden, Ohrn found that dental hygienists with two years of education were more active in achieving evidence-based practice than graduates from one-year programs.¹⁸ In this study, respondents from Canada and Czech Republic receiving diplomas did not report a research methodology course requirement.

Historically, dental hygienists have had a major role in promoting the oral health of the public, so it was not surprising that respondents from all of the participating countries reported having taken one or more public/community health courses. Likewise, coursework on DH care for patients with systemic disease would be expected to be a common DH program component, especially considering the global focus on the relationship between oral and systemic diseases. This topic may also have been included as part of periodontology, a course included in the majority of programs. Law in dentistry was not indicated by many respondents but this may have

Table V. Courses or content areas included in the DH program curriculum (n=513)

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
Dental Sciences	n=26	n=49	n=2	n=30	n=4	n=81	n=1	n=2	n=1	n=9	n=19	n=9	n=26	n=15	n=4	n=1	n=2	n=24	n=15	n=5	n=27	n=46
Cariology	73%	40%	100%	80%	100%	100%	100%	100%	100%	67%	47%	44%	92%	73%	100%	0%	100%	38%	47%	40%	100%	80%
Dental anatomy	100%	100%	100%	100%	75%	100%	100%	100%	100%	100%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
General anatomy	73%	82%	100%	97%	75%	85%	100%	100%	100%	44%	95%	56%	54%	87%	100%	100%	100%	58%	53%	80%	78%	96%
General pathology	46%	71%	100%	70%	75%	42%	100%	50%	100%	22%	63%	89%	73%	87%	100%	0%	100%	38%	47%	60%	78%	85%
Head/neck anatomy	100%	93%	50%	90%	75%	100%	100%	100%	100%	67%	84%	78%	92%	93%	100%	100%	100%	75%	100%	80%	74%	100%
Oral biology	81%	82%	100%	90%	75%	75%	100%	100%	100%	67%	84%	67%	96%	100%	100%	100%	100%	100%	100%	60%	100%	98%
Oral histology	89%	88%	50%	90%	75%	63%	100%	50%	100%	100%	84%	89%	92%	100%	75%	100%	100%	67%	87%	40%	96%	96%
Oral pathology	96%	96%	100%	77%	75%	58%	100%	100%	100%	56%	79%	78%	100%	100%	100%	0%	100%	100%	100%	80%	100%	96%
Periodontology	100%	98%	100%	100%	100%	99%	100%	100%	100%	100%	95%	100%	92%	93%	100%	100%	100%	75%	100%	80%	100%	100%
Pharmacology	80%	96%	100%	97%	100%	88%	100%	100%	100%	67%	100%	44%	69%	93%	100%	100%	100%	96%	73%	80%	89%	85%
Research																						
Research methodology	54%	45%	50%	43%	75%	86%	100%	100%	100%	67%	84%	67%	54%	93%	75%	0%	100%	88%	53%	20%	100%	54%
Statistics	73%	35%	50%	37%	50%	64%	0%	100%	100%	44%	84%	44%	50%	60%	50%	0%	100%	63%	40%	80%	96%	33%
Clinical skills with joint classroom-based learning																						
Dental materials	85%	84%	50%	77%	75%	100%	100%	100%	100%	89%	90%	56%	96%	87%	100%	100%	100%	100%	100%	80%	85%	78%
Dental assisting/four-handed dentistry	19%	14%	50%	37%	25%	69%	100%	100%	100%	56%	47%	67%	15%	33%	0%	100%	0%	63%	73%	80%	22%	37%
Pain management	73%	49%	0%	27%	75%	86%	100%	100%	0%	11%	79%	44%	35%	73%	100%	100%	0%	58%	53%	80%	74%	65%
Radiology	96%	96%	50%	87%	100%	98%	100%	100%	100%	78%	90%	67%	100%	100%	100%	0%	100%	100%	100%	80%	100%	94%
Miscellaneous Topics	n=22	n=49	n=2	n=30	n=4	n=81	n=2	n=2	n=1	n=9	n=19	n=9	n=26	n=15	n=2	n=1	n=2	n=24	n=15	n=5	n=27	n=46
DH care for patients with developmental disorders and special needs	85%	82%	0%	80%	75%	94%	100%	100%	100%	78%	84%	89%	77%	93%	100%	100%	100%	96%	93%	40%	93%	89%
DH care for patients with systemic diseases	80%	78%	0%	83%	100%	96%	100%	100%	100%	78%	84%	89%	85%	93%	100%	100%	100%	96%	100%	60%	93%	91%
Educational methodology	35%	43%	0%	60%	75%	61%	100%	50%	100%	67%	79%	44%	39%	40%	100%	0%	100%	67%	87%	60%	67%	41%
Law in dentistry	58%	25%	50%	43%	75%	61%	0%	100%	0%	44%	79%	33%	31%	60%	100%	0%	0%	21%	67%	60%	74%	48%
Pediatric dentistry	73%	45%	50%	70%	75%	89%	100%	100%	100%	100%	66%	56%	65%	73%	100%	0%	50%	92%	93%	60%	89%	85%
Professional ethics	85%	94%	100%	77%	75%	90%	100%	100%	100%	89%	100%	78%	62%	93%	100%	0%	100%	79%	100%	60%	96%	78%
Public/community health	92%	98%	0%	67%	75%	94%	100%	100%	100%	78%	100%	89%	50%	87%	100%	100%	100%	100%	100%	60%	85%	87%

been due to the overlapping subject area with professional ethics or public/community health, or the lack of importance of the legislative regulation of the DH profession and practice. Johnson reported that professional regulation through government agencies varies according to a country's historical ties and that statutes as related to accountability and autonomy have varying influence on the delivery of DH care.²

Educating patients in the prevention of oral diseases has been a primary focus in DH education worldwide. Preventive measures, such as fluoride treatments and application of sealants, were clinical skills that most respondents reported having mastered during their DH program. They are also tasks that all dental hygienists need to be educated to perform, according to the proposed curricular guidelines, developed by the education committee of the IFDH¹ and by the EFP's recommendations for DH education and training.¹⁶ In a study of eight countries by Inukai, items related to the prevention of dental caries including topical fluoride application and pit and fissure sealants, were a common component of clinical education.¹⁹

In addition to preventive clinical skills, respondents reported learning educational content in oral health guidance/education. Respondents who felt competent in dietary counseling, tobacco cessation counseling, and screening for oral cancer reflect the current global emphasis on counseling for risk behavior modification and public health promotion. The use of behavioral interventions, such as motivational interviewing, were reported by one-third of Swedish DH respondents in a study by Liss et al., and significantly more dental hygienists with a 3-year education, as compared those with a shorter education, worked with tobacco cessation.²⁰ Clinical training of preventive skills appears to relate to scope of practice; preventive skills were reported to be part of the scope of practice in all eight of the countries Inukai studied.¹⁹ Newer technologies, such as bacterial testing and laser therapy, and the application of caries therapeutic agents, such as silver diamine fluoride, were reported by few respondents, possibly because they may not have reached common usage.

Respondents from all countries reported scaling using hand instrumentation as one of the most common clinical skills respondents had become competent in during DH education. It is also one of the most common treatment procedures performed in DH practice.¹⁹ Emphasis on periodontal therapy also relates with the data that most all respondents took a course in periodontology. The removal of supragingival and subgingival hard deposits has been traditionally the major therapeutic service provided by dental hygienists. However, in a study by Virtanen et al., Finnish educators stated that the training in their programs seldom extends beyond basic periodontal treatment and maintenance care and that more extensive training in periodontics would allow greater utilization of dental hygienists' skills in treating periodontal diseases.²¹ The number of respondents indicating competency scaling with an ultrasonic scaler was similar to hand instrumentation. These data confirm the results of a Canadian survey of new graduates: most respondents perceived being well prepared in hand and ultrasonic scaling as a significant outcome of their DH educational experiences.²²

A high percentage of respondents reported the provision of fillings as a clinical competency; this may reflect the number of respondents who are dually trained as dental therapists or dental nurses. In some countries, such as Australia, dual education programs have been developed to combine the roles of DH and dental therapy and to allow these practitioners to perform diagnostic, preventive, and restorative services.^{10,23,24} In the countries where respondents had been taught and licensed to provide fillings, these respondents also reported competence in administering local anesthesia. Respondents

Table VI. Required clinical skill competencies to complete the DH program (n=513)

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
Non-clinical or risk assessment procedures	n=26	n=49	n=2	n=30	n=4	n=78	n=1	n=2	n=1	n=9	n=19	n=9	n=26	n=15	n=4	n=1	n=2	n=24	n=15	n=5	n=27	n=45
Review of health history	96.2%	98%	100%	70%	100%	84.6%	100%	100%	100%	88.9%	84.2%	88.9%	100%	93.3%	100%	100%	100%	95.8%	100%	60%	96.3%	95.6%
Screening for oral cancer	88.5%	79.6%	100%	60%	75%	73.1%	100%	0%	0%	55.6%	78.9%	44.4%	84.6%	80%	100%	0%	100%	70.8%	93.3%	60%	74.1%	88.9%
Testing for bacteria	30.8%	20.4%	100%	60%	25%	67.9%	0%	50%	0%	44.4%	26.3%	0%	53.8%	26.7%	75%	0%	50%	20.8%	40%	20%	77.8%	6.7%
Providing diet counseling	84.6%	93.9%	100%	90%	75%	94.9%	100%	100%	100%	100%	52.6%	88.9%	69.2%	73.3%	75%	0%	100%	79.2%	93.3%	60%	92.6%	97.8%
Providing tobacco cessation	80.1%	75.5%	100%	73.3%	75%	94.9%	100%	50%	100%	100%	52.6%	66.7%	57.7%	80%	100%	100%	100%	66.7%	86.7%	80%	92.6%	89.1%
Prevention																						
Administering chlorhexidine or other antibacterial rinses	88.5%	65.3%	50%	96.7%	100%	100%	100%	50%	0%	100%	100%	88.9%	84.6%	93.3%	100%	100%	100%	100%	100%	60%	88.9%	95.6%
Exposing of radiographs	92.3%	95.9%	100%	50%	75%	74.4%	100%	0%	100%	88.9%	84.2%	22.2%	96.2%	93.3%	100%	100%	100%	91.7%	100%	60%	100%	91.1%
Fluoride application (trays)	88.5%	98%	100%	83.3%	50%	53.8%	100%	50%	100%	77.8%	94.7%	55.6%	92.3%	73.3%	100%	100%	100%	95.8%	100%	80%	66.7%	44.4%
Fluoride application (varnish)	92.3%	77.6%	100%	83.3%	100%	100%	100%	50%	100%	100%	94.7%	88.9%	96.2%	100%	100%	100%	100%	95.8%	100%	40%	100%	100%
Sealant application	92.3%	95.9%	50%	43.3%	100%	88.5%	100%	100%	100%	88.9%	94.7%	66.7%	84.6%	93.3%	100%	100%	100%	95.8%	100%	60%	85.2%	100%
Treatment																						
Administering local anesthesia (injections)	92.3%	40.8	50%	6.7%	100%	79.5%	100%	0%	0%	11.1%	89.5%	66.7%	76.9%	86.7%	100%	0%	0%	87.5%	86.7%	0%	100%	82.2%
Local delivery of antimicrobials	11.5%	8.2%	50%	10%	25%	20.5%	0%	0%	0%	44.4%	42.1%	0%	42.3%	6.7%	75%	0%	50%	16.7%	40%	20%	11.1%	55.6%
Administering nitrous oxide	3.8%	6.1%	0%	3.3%	0%	6.4%	0%	0%	0%	0%	15.8%	0%	3.8%	6.7%	0%	0%	0%	4.2%	13.3%	20%	3.7%	4.4%
Air polishing	23.1%	42.9%	100%	90%	100%	71.8%	0%	100%	100%	66.7%	94.7%	55.6%	53.8%	60%	75%	100%	100%	70.8%	46.7%	40%	51.9%	26.7%
Applying silver diamine fluoride	7.7%	4.1%	0%	16.7%	25%	16.7%	0%	100%	0%	22.2%	21.1%	0%	11.5%	6.7%	25%	0%	50%	8.3%	26.7%	0%	11.1%	0%
Applying topical anesthetic gel	69.2%	57.1%	100%	76.7%	75%	91.0%	100%	0%	0%	88.9%	94.7%	66.7%	46.2%	93.3%	100%	100%	50%	79.2%	86.7%	20%	85.2%	82.2%
Extracting teeth	50%	2.0%	50%	3.3%	0%	2.6%	0%	0%	0%	11.1%	10.5%	0%	11.5%	73.3%	25%	0%	0%	0%	0%	0%	0%	48.9%
Placing fillings	50%	24.5%	50%	3.3%	50%	65.4%	0%	0%	0%	11.1%	15.8%	0%	50%	66.7%	25%	0%	0%	4.2%	46.7%	0%	55.6%	48.9%
Providing laser therapy	0%	2.0%	50%	10%	25%	1.3%	0%	0%	0%	11.1%	21.1%	0%	0%	0%	0%	0%	0%	12.5%	0%	20%	0%	2.2%
Scaling using hand instrumentation	92.3%	100%	100%	100%	100%	96.2%	100%	100%	100%	100%	94.7%	100%	100%	100%	100%	100%	100%	100%	100%	40%	100%	100%
Scaling with an ultrasonic scaler	92.3%	91.8%	100%	90%	100%	96.2%	100%	100%	100%	100%	84.2%	100%	92.3%	100%	100%	100%	100%	100%	100%	60%	100%	97.8%
Soft tissue curettage	19.2%	34.7%	50%	50%	25%	32.1%	0%	0%	100%	55.6%	57.9%	88.9%	42.3%	20%	75%	100%	0%	83.3%	53.3%	40%	33.3%	22.2%
Teeth whitening	46.2%	36.7%	50%	90%	50%	88.5%	0%	0%	100%	44.4%	89.5%	22.2%	11.5%	80%	50%	100%	100%	70.8%	66.7%	40%	33.3%	4.4%
Miscellaneous																						
Dental assisting/four-handed dentistry	23.1%	10.2%	100%	30%	25%	60.3%	100%	100%	100%	44.4%	47.4%	66.7%	15.4%	33.3%	0%	100%	0%	50%	66.7%	60%	18.5%	37.8%

from countries allowing for independent practice also reported developing this competence. However, dental hygienists practicing independently may have their ability to administer local anesthesia restricted by regulations requiring dentists to be present during the administration or preventing the purchase of the anesthetic²⁵. Administering nitrous oxide was the least common clinical skill competency. Perhaps, this may be due to strict drug laws in certain countries restricting the use of nitrous oxide and its possible misuse as a recreational drug.²⁵

Licensing and requirements for a post-graduate residency not only varied from country to country, but also within the countries. Based on the cross-tabulation results, the requirement of passing a licensing exam was significantly related to the type of degree awarded; greater numbers of baccalaureate degree graduates were not required to take a licensing exam. Accordingly, Canada had a high number of respondents who graduated with a diploma and who were required to take a licensing examination. A licensing requirement may have been established to ensure dental hygienists are sufficiently competent to practice after the completion of the shorter programs. Longer programs, usually awarding a baccalaureate degree, would allow for greater depth and breadth of learning needed for evidence-based, comprehensive DH care. Post-graduate residency programs were not a requirement to practice in most countries with the exception of Saudi Arabia. Nearly all respondents from this country were required to complete a residency program; data relating to the more than four years required to complete their DH education.

A limitation of this study was that the survey was written and distributed only in the English language. Therefore, respondents unable to read or understand English fluently may have experienced difficulties answering the survey. Larger numbers of respondents were also from countries with English as their primary language, such as Australia, Canada, United Kingdom, or that have English as a prerequisite course at a post-secondary school level prior to entering the DH program. Future studies should consider translating the survey into each country's native language.

The IFDH distributed the survey to the delegates from each member country with the request that the delegates forward the survey to the members of their association. However, some delegates may not have the means to distribute the survey to their membership, such as the email addresses of their members. This would have resulted in fewer or no respondents from that country. Another limitation was that respondents completed their DH education over a wide range of years. Since the curricula may have changed over time, responses may not have been reflective of the current curriculum. Additionally, respondents who are both dental therapists and dental hygienists may have responded to the survey items based on skills related to both types of practitioners.

Table VII. Licensing requirements prior to practicing DH (n=513)

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
Required to pass a licensing exam prior to practicing	n=25	n=49	n=2	n=30	n=4	n=77	n=1	n=2	n=1	n=9	n=19	n=8	n=26	n=15	n=4	n=1	n=2	n=24	n=15	n=4	n=27	n=45
Yes	16%	78%	100%	43%	0%	26%	0%	100%	100%	89%	63%	50%	42%	13%	50%	100%	100%	38%	33%	50%	30%	9%
No	84%	22%	0%	47%	100%	62%	100%	0%	0%	11%	26%	50%	39%	80%	50%	0%	0%	58%	60%	50%	59%	78%
I don't know	0%	0%	0%	10%	0%	12%	0%	0%	0%	0%	11%	0%	19%	7%	0%	0%	0%	4%	7%	0%	11%	2%
Type of licensing exam required	n=3	n=38	n=0	n=12	n=0	n=19	n=0	n=2	n=1	n=8	n=11	n=4	n=10	n=2	n=2	n=1	n=0	n=9	n=5	n=2	n=7	n=9
Written exam only	33%	74%	N/A	8%	N/A	37%	N/A	100%	0%	0%	0%	0%	0%	0%	0%	0%	N/A	56%	0%	0%	14%	0%
Clinical exam w/ patient	0%	16%	N/A	8%	N/A	5%	N/A	0%	0%	13%	0%	0%	0%	0%	0%	0%	N/A	0%	0%	50%	0%	0%
Clinical exam w/ mannequin teeth	0%	0%	N/A	0%	N/A	5%	N/A	0%	0%	0%	9%	0%	0%	0%	0%	0%	N/A	0%	0%	0%	0%	0%
Written exam + clinical exam w/ patient	33%	11%	N/A	50%	N/A	21%	N/A	0%	100%	88%	91%	100%	70%	0%	100%	100%	N/A	33%	100%	50%	57%	56%
Written exam + clinical exam w/ mannequin teeth	33%	0%	N/A	17%	N/A	11%	N/A	0%	0%	0%	0%	0%	0%	0%	0%	0%	N/A	0%	0%	0%	0%	0%
Other	0%	0%	N/A	17%	N/A	21%	N/A	0%	0%	0%	0%	0%	30%	100%	0%	0%	N/A	11%	0%	0%	29%	44%
Required to complete an internship or residency	n=25	n=49	n=2	n=26	n=4	n=71	n=1	n=2	n=1	n=9	n=17	n=7	n=24	n=15	n=4	n=1	n=2	n=22	n=14	n=3	n=27	n=44
Yes	0%	2%	100%	50%	0%	10%	0%	0%	0%	67%	24%	57%	4%	13%	25%	0%	0%	91%	14%	67%	19%	5%
No	100%	98%	0%	50%	100%	90%	100%	100%	100%	33%	77%	43%	96%	87%	75%	100%	100%	9%	86%	33%	82%	96%

Conclusion

The findings of this study suggest that the global education of dental hygienists has many similarities. Most respondents reported receiving education, emphasizing preventive therapy and maintenance of periodontal health, with educational content at the university level. Understanding that other countries emphasize similar educational standards of courses and clinical skills within their educational programs may help to create a global standardization of the DH profession. Global collaboration may be able to facilitate the international exchange of dental hygienists or DH students and to promote the establishment of the DH profession in countries that are underserved in respect to oral health needs.

Despite differences in legal, cultural, educational, and health care delivery systems, a unified workforce of highly educated and clinically skilled dental hygienists would facilitate the prevention of oral diseases and the promotion of oral health, which is essential to the well-being of the global population.

Acknowledgements

The authors would like to express their appreciation to the International Federation of Dental Hygienists (IFDH) for disseminating the survey to the representatives of each member country's association. We also want to thank the IFDH officers who assisted with survey development, the representatives who forwarded the survey to the members of

their association, and all the dental hygienists who responded to the survey.

Jacquelyn K. Lee, RDH, MS is a graduate of the Master of Science Program in Dental Hygiene; *Dorothy J. Rowe, RDH, MS, PhD* is an associate professor emeritus, Department of Preventive and Restorative Dental Sciences, both at the University of California, San Francisco, CA.

Corresponding author: Dorothy J. Rowe, RDH, MS, PhD; dorothy.rowe@ucsf.edu

References

- Blitz P, Hovius M. Towards international curriculum standards. *Int J Dent Hyg.* 2003 Feb;1(1):57-61.
- Johnson PM. International profiles of dental hygiene 1987 to 2006: A 21-nation comparative study. *Int Dent J.* 2009 Apr;59(2):77.
- Axelsson P, Lindhe J. Effect of controlled oral hygiene procedures on caries and periodontal disease in adults. *J Clin Periodontol* 1978 May; 5:135-51.
- European Federation of Periodontology. Belgium grants official recognition to dental hygiene. [Internet]. Madrid: European Federation of Periodontology; [cited 2018 Dec 4]. Available from: <http://www.efp.org/newsupdate/belgium-recognises-hygienists/>
- International Federation of Dental Hygienists. About the IFDH [Internet]. Rockville (MD): International Federation of Dental Hygienists; [cited 2018 Dec 4]. Available from: <http://www.ifdh.org/about.html>
- Saito A, Sato Y, Nakamura A, et al. Development of an international collaborative dental hygiene programme between Japan and Canada. *Int J Dent Hyg.* 2008 Nov;6(4):328-36
- Takenouchi A, Sakurai/Matsukubo M, Matsukubo T. Interest in international programmes - a survey of Japanese dental hygiene students and educators. *Int J Dent Hyg.* 2016 Nov;15(4):93-99
- Stuart-Shor EM, Cunningham E, Foradori L, et al. The global health service partnership: an academic-clinical partnership to build nursing and medical capacity in Africa. *Front Public Health.* 2017 Jul 24;5:174
- Jongbloed-Zoet C, Bol-van den Hil EM, La Riviere-Ilsen J, Van der Sanden-Stoelinga MSE. Dental hygienists in The Netherlands: the past, present and future. *Int J Dent Hyg.* 2012 Aug; 10(3):148-54.
- Luciak-Donsberger C, Eaton KA. Dental hygienists in Europe: trends towards harmonization of education and practice since 2003. *Int J Dent Hyg.* 2009 Nov;7(4): 273-84.
- Yoshida N, Endo K, Komaki M. Dental hygiene in Japan: present status and future directions. *Int J Dent Hyg* 2004 Nov;2(4):179-84.
- Kanji Z, Sunell S, Boschma G, Imai P, Craig BJ. A discourse on dental hygiene education in Canada. *Int J Dent Hyg* 2011 Nov;9(4): 242-9.
- American Dental Association. Commission on Dental Accreditation: 2017-2018 survey of allied dental education [internet]. Chicago (IL): American Dental Association; [cited 2019 July 9] Available from <https://www.ada.org/em/coda/find-a-program/program-surveys>
- American Dental Hygienists' Association. ADHA policy manual. Adopted June 2018. [Internet]. Chicago (IL): American Dental Hygienists' Association; [cited 2019 June 14]. Available from https://www.adha.org/resources-docs/7614_Policy_Manual.pdf.

15. Sunell S, McFarlane RDD, Biggar HC. Differences between diploma and baccalaureate dental hygiene education: a quantitative perspective. *Can J Dent Hyg* 2013 Oct; 47(3):109-21.
16. European Federation of Periodontology. Curricular guidelines in dental hygienists' education. [Internet]. Madrid: European Federation of Periodontology; [cited 2018 Aug 24] Available from <https://www.efp.org/education/dental-hygienist/dental-hygienist.pdf>
17. Chichester SR, Wilder RS, Mann GB, Neal E. Incorporation of evidence-based principles in baccalaureate and nonbaccalaureate degree dental hygiene programs. *J Dent Hyg*. 2002 Winter;76(1):60-6.
18. Ohrn K, Olsson C, Wallin L. Research utilization among dental hygienists in Sweden – a national survey. *Int J Dent Hyg* 2005 Aug;3(3):104-111
19. Inukai J, Saurai M, Nakagaki H, et al. Comparison of clinical practice education in dental hygiene schools in eight countries. *Int Dent J*. 2012 Jun; 62:122-126.
20. Liss A, Alian AY, Wennstrom JL, Abrahamsson KH. Professional competencies and work-related support in relation to periodontal therapy and work satisfaction: a questionnaire study among Swedish dental hygienists. *Int J Dent Hyg* 2018 Aug;16(3):349-56.
21. Virtanen JI, Pelikka E, Singh S, Widstrom E. The professional role of a dental hygienist in Finland – educators' views. *Int J Dent Hyg* 2016 Aug;14(3): 231-8.
22. Asadoorian J, Botbyl D, Goulding MJ, Dental hygienists' perception of preparation and use for ultrasonic instrumentation. *Int J Dent Hyg* 2015 Feb;13(1):30-41
23. Teusner D, Satur J, Gardner S, et al. Variations in Australian dental therapy practice by practitioner and workplace characteristics. *Int Dent J* 2018 Aug; 68(4):235-44.
24. Gatermann Strobel B, Perno Goldie M. Independent dental hygiene practice worldwide: a report of two meetings. *Int J Dent Hyg* 2005 Aug;3(3):145-54
25. Kaar SJ, Ferris J, Waldron J, et al. The rise of nitrous oxide abuse. An international survey of contemporary nitrous oxide use. *J Physcopharmacol*. 2016 Apr;30(4):395-401.