

Self-Perceived Public Health Competency Among Recent Dental Graduates

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Abstract: The aim of this study was to assess the level of self-perceived competency in dental public health in recent graduates from the Faculty of Stomatology of the Universidad Peruana Cayetano Heredia. One hundred and nineteen graduates (28.6 percent males and 71.4 percent females) were asked to rate their self-perception of proficiency on each of the twenty-one dental public health functions identified in a dental practice competency matrix. Students assessed their competence in these dental public health functions using a three-point ordinal scale with 0 indicating “not at all competent,” 1 indicating “competent,” and 2 indicating “very competent.” Males scored themselves higher than females for items concerning “design, develop, and evaluate community restorative interventions,” “apply basic maintenance to dental equipment and instruments,” and “participate in an epidemiological surveillance system.” However, there were no significant differences for any item according to age. A confirmatory factorial analysis provided two factors with Eigenvalues greater than one (13.09 and 1.53, respectively), which explained 62.3 percent and 7.3 percent of the variance in the graduates’ responses respectively. However, the fact that all twenty-one dental public health functions loaded higher than 0.55 on the first factor led to the conclusion that the dental public health competency is perceived by students to be a one-dimensional construct. Graduates perceived themselves as very competent for solving dental health needs at the community level. This study also provided further evidence in support of the rationale for the competency-based dental curriculum of the Faculty of Stomatology of the Universidad Peruana Cayetano Heredia.

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In the 1970s, the faculty team in charge of developing the Faculty of Stomatology at the Universidad Peruana Cayetano Heredia (Lima, Peru) performed function and task analyses of dental practice to determine the appropriate content and structure for the curriculum.¹⁻⁴ This process led to the development of a taxonomy for competency-based dental curricula,⁵ which has been recently disseminated to the international scientific and educational community.⁶ According to this taxonomy, a competency in dental practice is “a holistic and teleological highly complex mental scheme ready to be implemented with the objective of solving problems in the realm of the interaction of six dental needs and six kinds of dental care required to attend those needs.”⁵⁻⁷ This interaction between the public’s health care needs and the oral health care provided by dentists creates a two-way matrix for the curricular design that is displayed in Figure 1.

The six dental needs of the public are 1) diseases and conditions of the dental tissues, 2) diseases and conditions of the periodontal tissues, 3) variations in occlusion, 4) other conditions in the maxillofacial region, 5) systematic diseases with effects on the tissues of the oral cavity, and 6) needs assessed at the community level. The six kinds of oral health care provided by dentists are 1) diagnosis and treatment planning, 2) health promotion, 3) prevention of disease, 4) recovering a healthy status, 5) rehabilitation of form and function, and 6) administration.

The professional profile of the dentist is made up of a number of competencies. Each one of these competencies requires the dental practitioner to perform a certain number of activities and tasks, which are named functions.^{1,2,4,6} In the two-way matrix displayed in Figure 1, the columns and rows represent a total of twelve competencies. Thus, dental public health competency includes the six kinds of patient

Dental care Health needs	Diagnosis and Treatment Planning	Health Promotion	Prevention of Disease	Recovering a Healthy Status	Rehabilitation of Form and Function	Administration
Diseases and conditions of the dental tissues						
Diseases and conditions of the periodontal tissues						
Variations in occlusion						
Other conditions in the maxillofacial region						
Systemic diseases						
Needs assessed at the community level	DENTAL PUBLIC HEALTH COMPETENCY					

Diagnosis and Treatment Planning, Health Promotion, Prevention of Disease, and Rehabilitation of Form and Function are self-explanatory. Recovering a Healthy Status means the treatment of specific diseases in order to recover the healthy condition (i.e., treatment of a carious lesion or periodontitis). Administration involves all the management procedures needed to address the dental public needs in the community (i.e., personnel management in community settings).

Figure 1. Curricular matrix of the Faculty of Stomatology at the Universidad Peruana Cayetano Heredia

care provided by dental professionals that are required to solve the oral health care needs of the public at the community level.

Since its creation, the Faculty of Stomatology has based its teaching-learning experiences in dental public health at the undergraduate level on twenty-one different public health functions that were identified as being essential to the attainment of the dental

public health competency indicated in Figure 1. These functions appear in Figure 2 and were identified by the function and task analyses previously described that was used to create the public health curriculum at this dental school.^{1,2,4,6,8}

The Social Dentistry Department of the Faculty of Stomatology at the Universidad Peruana Cayetano Heredia is responsible for teaching public

health and community dentistry. Teaching-learning activities of the Social Dentistry Department are made up of two well-defined stages: experiences in low-income urban communities, and experiences in low-income rural communities.⁸⁻¹¹ In Peru, dental education consists of ten academic semesters or five calendar years.

During the first stage, which takes five academic semesters (three to six weekly hours), students learn by investigating public health and oral health needs and problems in a low-income urban community. Initially, students develop a socioeconomic, cultural, and epidemiological oral health diagnosis of the assigned community by using systematic observations and face-to-face structured interviews for

collecting data.^{8,11} Previous to the clinical examinations, students are appropriately trained, including calibration exercises.¹² Results are then discussed with persons in the evaluated community in order to design preventive-promotional interventions in general and oral health. Thereafter, students implement and evaluate the plan for interventions in physical facilities provided by the community, using simplified equipment from the Faculty of Stomatology.^{8,11}

During the second stage, known as the Rural Internship, senior students spend four full-time months in distant rural communities in the Peruvian highland and jungle towns. The Ministry of Health supports most of the activities. During this period, students carry out similar activities to those devel-

Function	Item
1	To elaborate the socio-economic-cultural diagnosis of a community
2	To elaborate the health diagnosis of a community
3	To elaborate the oral health diagnosis of a community
4	To develop activities to promote the community development
5	To promote health and oral health through health education
6	To promote health and oral health through training of community agents
7	To promote health and oral health through creation of healthy settings
8	To design, develop and evaluate community preventive interventions
9	To design, develop and evaluate community restorative interventions
10	To apply basic maintenance to dental equipment and instruments
11	To plan and program delivery of oral health services at community level
12	To manage health care systems to groups
13	To manage the dental practice at public and private area
14	To integrate into the public health system
15	To use appropriate technology and ergonomics in the dental practice
16	To adapt the dental practice to the existing laws and regulations
17	To participate in an epidemiological surveillance system
18	To adapt the dental practice to situations of restriction that limit it
19	To interact with other health professionals for satisfying community health needs
20	To contribute to the production and dissemination of scientific knowledge
21	To incorporate the dental practice into your personal and community development

Figure 2. Functions included in dental public health competency according to the taxonomy for competency-based dental curricula

oped previously in urban communities, with the difference being that students work alone by themselves with limited supervision performed by means of periodic visitations by dental school faculty.⁸⁻¹¹ In the rural communities, dental students benefit from close working association with other health care professionals (physicians, nurses, and midwives).

Evaluation of the students' performance in relation to the specified competencies is an important task for purposes of student evaluation¹³⁻¹⁵ and for assessing the curriculum and making necessary revisions.¹⁶⁻¹⁸ In some cases, it is also useful for obtaining information required by accreditation standards.^{16,17}

A commonly used method for assessing competencies is surveying recent dental graduates to determine their perceived level of proficiency in specific areas of dental practice at the time of graduation.^{15,19-21} There are numerous reports of the results of dental practitioner surveys to assess self-perceived levels of competency, but these studies generally cover only the clinical competency side of professional practice, with no reference to dental public health competencies.^{13-17,19-22}

The purpose of this study was to assess the level of self-perceived competency in dental public health among recent dental graduates. It was also theorized that the graduates' responses to the twenty-one functions would be strongly correlated (e.g., graduates respond in a similar manner to all items), because all functions contribute to the same theoretical construct of dental public health competency.

Methods

The last two classes (years 2003 and 2004) of graduates from the Faculty of Stomatology of the Universidad Peruana Cayetano Heredia (Lima, Peru) were invited to participate in this study by completing a questionnaire immediately after their graduation ceremonies. A response rate of 97 percent was obtained (119 out of 123 graduates, fifty-six for 2003 and sixty-three for 2004). In this faculty, there is a gender proportion of one male to 2.5 females. The university ethics board approved the research methodology, including the questionnaire content.

A self-administered questionnaire was developed and its respective psychometric properties (validity and reliability) were assessed as follows. First, an initial version of the questionnaire was developed by formulating a question for each of the twenty-one dental public health functions identified in the

curricular matrix of the faculty.^{5,6} Content validity was assessed by a panel of eight experts made up of dental educators and administrators. The purpose was to depict those items with a high degree of agreement among experts.^{23,24} Aiken's V was used to quantify the concordance between experts for each item; values higher than 0.88 were always obtained.²⁵ Moreover, the panel of experts recommended modifying the wording of some questions and randomly sequencing the questions.

To evaluate the construct validity, a pilot study was conducted in which twenty dental graduates (ten males and ten females) from the class of 2003 completed the twenty-one-item questionnaire. Students participating in the pilot study did not repeat the survey, but their results were duly included for analysis. Correlations between the items as well as between individual items and the overall score were estimated to assess the appropriateness of each of the items.^{26,27} The correlations between the items ranged from 0.44 to 0.90, whereas the correlations between individual items and the overall score varied between 0.60 and 0.83 ($p < .001$ in all cases).

None of the initially developed items was removed from the final questionnaire after analyzing the results of the pilot study. During the pilot study, the ease of the participants in responding to each item was also examined.^{23,24} Finally, the Cronbach's alpha coefficient was used to assess the internal consistency of the questionnaire through the split-half technique. The obtained value (0.987) was higher than the recommended standard, which is 0.80.²⁴

The final version of the questionnaire included twenty-one items (Figure 2), which were randomly ordered. The 119 subjects completed the questionnaire immediately after their graduation ceremony. There was no time limit, and questionnaires were collected immediately after completion.

Graduates were asked to rate their self-perception of proficiency on each dental public health function using a three-point ordinal scale with 0 indicating "not at all competent," 1 indicating "competent," and 2 indicating "very competent." According to this scale, the maximum score is forty-two points. This overall score was divided into three equal-length categories: from 0 to 13 indicating "not at all competent," from 14 to 28 indicating "competent," and from 29 to 42 indicating "very competent." According to the Likert-type scale method,²⁸ these three categories were established to be able to identify which of the three respondents belong as a group.

Measures of central tendency and variability for each item were initially calculated. Then, graduates' age and scores were compared by gender using the Mann-Whitney test as a nonparametric alternative because assumptions of normality within each group and equality of variances between groups could not be demonstrated in all cases. To evaluate differences between item scores according to the graduates' age, the data were dichotomized using the median as a cut-off point (twenty-three years). Again, the Mann-Whitney test was used because normality and equality of variances assumptions could not be corroborated.

Thereafter, a confirmatory factorial analysis was conducted to identify the number of underlying factors that explained most of the variance in the graduates' responses. The factorial analysis can be developed from two different perspectives: exploratory or confirmatory.²³ The latter is used when the research team has some preconceived ideas about the real organization of the data based on theoretical elaboration, empirical evidence, or previous studies.²⁴ With this purpose, factorial analysis is utilized in psychometrics to evaluate construct validity.^{23,24,27} The confirmatory factorial analysis makes it possible to evaluate the adjustment of the data to a previously established construct.^{26,27}

As for the rotation, the direct OBLIMIN method was chosen because it yields an oblique rotation, in which factors are not orthogonal, that is, factors have non-zero correlations among themselves, which is exactly what is presumed for dental public health competency in our taxonomy. Based on the requirements of sample size, only those loading factors higher than 0.55 were considered significant in the rotated solution.²⁶

Results

From the pool of participants, 28.6 percent and 71.4 percent were male and female respectively. The mean age of the dental graduates was 23.14 ± 1.54 years, and 82.2 percent of the respondents were between twenty-two and twenty-four years old. No statistically significant difference was found for the graduates' age according to gender ($p=.095$).

Scores for the functions concerning "design, develop, and evaluate community restorative interventions," "apply basic maintenance to dental equipment and instruments," and "participate in an epidemiological surveillance system" were significantly

lower in females than in males ($p=.004$, $p=.014$, and $p=.013$, respectively) (Table 1). On the other hand, when item scores were compared according to age, no statistically significant difference was found between graduates with an age equal to or higher than twenty-three years and those with an age less than twenty-three years.

Based on the aforementioned findings, dental functions were ranked in decreasing order from highest to lowest scores (Table 2). The five highest scores were obtained for the functions concerning "promote health and oral health through health education," "elaborate the socioeconomic-cultural diagnosis of a community," "incorporate the dental practice into your personal and community development," "elaborate the oral health diagnosis of a community," and "design, develop, and evaluate community preventive interventions," whereas the five lowest scores were obtained for the functions concerning "integrate into the public health system," "apply basic maintenance to dental equipment and instruments," "manage the dental practice at public and private area," "manage health care systems to groups," and "participate in an epidemiological surveillance system." Scores for the twenty-one items were summed in order to obtain an overall score, which included both classes. The mean overall score was 32.57 ± 9.91 points, indicating that these two classes of dental graduates felt "very competent" in solving oral health needs at the community level.

Before conducting factorial analysis, assumptions in the matrix of correlation between items were corroborated. The determinant of the correlation matrix was lower than 0.001, indicating the presence of items with very high linear associations between themselves. In addition, Kayser-Meyer-Olkin measure of sampling adequacy (0.861) determined that the partial correlations between items were small, whereas Bartlett's test of sphericity demonstrated that the correlation matrix was different from an identity matrix ($p<.001$), and therefore, indicating in both cases that the correlation matrix was appropriate to conduct factorial analysis.

The initial factorial analysis of the self-perceived dental public health competency provided two factors with Eigenvalues greater than one (13.09 and 1.53, respectively) which explained 69.6 percent of the variance in the graduates' responses (62.3 percent and 7.3 percent, respectively). Then, a rotated solution was obtained to simplify the interpretation of both factors. According to the factor loadings in

Table 1. Comparison of item scores by recent dental graduates' gender

Function	Male (n=38)		Female (n=95)		p value
	Mean	S.D.	Mean	S.D.	
01	1.56	0.62	1.60	0.54	0.891
02	1.56	0.62	1.53	0.64	0.788
03	1.56	0.62	1.60	0.59	0.783
04	1.63	0.49	1.55	0.55	0.568
05	1.69	0.47	1.60	0.54	0.487
06	1.56	0.62	1.58	0.55	0.928
07	1.56	0.50	1.45	0.55	0.353
08	1.69	0.47	1.55	0.50	0.183
09	1.63	0.49	1.25	0.63	0.004
10	1.56	0.50	1.23	0.65	0.014
11	1.50	0.62	1.53	0.55	0.965
12	1.31	0.78	1.35	0.53	0.851
13	1.31	0.69	1.35	0.62	0.875
14	1.38	0.71	1.25	0.58	0.236
15	1.56	0.50	1.38	0.58	0.136
16	1.63	0.49	1.45	0.63	0.229
17	1.56	0.62	1.25	0.63	0.013
18	1.56	0.50	1.33	0.61	0.069
19	1.63	0.49	1.53	0.50	0.338
20	1.44	0.62	1.48	0.50	0.941
21	1.63	0.49	1.58	0.50	0.629

S.D.=Standard Deviation

the structure matrix, none of the functions attained the minimum level required (0.55) for the second factor. Similar findings were obtained when factorial analysis was recalculated using an orthogonal rotation (VARIMAX method) instead of a nonorthogonal rotation (OBLIMIN method). Therefore, from the interpretation of this matrix it could be deduced that the dental public health competency is a one-dimensional construct, since all the functions included in this competency had factor loadings higher than 0.55 only on the first factor.

Discussion

Our study was conducted to evaluate the level of self-perceived competency for solving oral health needs at the community level among graduates of the Faculty of Stomatology at the Universidad Peruana Cayetano Heredia. There are no previous studies assessing self-perceptions of dental public health competency; however, some educators have advocated placing more attention on dental public health in the dental school curriculum.^{29,30} Our study is, to our understanding, the first attempt for assess-

ing the level of self-perceived competency in dental public health at the undergraduate level.

Although the use of self-administered questionnaires is the most widely reported method for collecting data about self-perceived dental competencies,^{15,18,21,31,32} the possibility of bias (e.g., respondents' overestimation of competencies) in the responses should be considered. It has been previously reported that graduates' responses could be influenced by the respondents' emotional commitment to their alma mater and their gratitude for receiving a professional degree.¹⁸ Besides, the administration of the questionnaire immediately after the graduation ceremony could have encouraged students to respond quite quickly and not in a very differentiated manner, thus affecting the final results. This issue has not been previously dis-

cussed in the literature. Nevertheless, some advantages of the use of questionnaires are their ease of administration and confidentiality. These advantages make data collection by questionnaire the first choice in comparison with other methods.^{23,24}

Community-based dental education, as a component of competency-based dental education, is a type of experiential learning conducted in community settings.³³ However, this component of the curriculum is not simply practicing clinical dentistry at the community setting; rather, through this experience, students enhance their appreciation and understanding of the larger social, economic, and cultural determinants of dental health care and how such determinants affect the access and delivery of dental care.^{33,34}

The objective of this competency-based curriculum is that the student become capable of recognizing the socioeconomic-cultural conditions of the country, as a base to understand the causes and the nature of general and oral health problems, thus surpassing the simple biomedical approach.^{8,11} It is expected that the direct interaction with social reality, especially in low-income communities, helps the student to be aware of the socioeconomic-cultural conditions in order to adopt a positive attitude and organizational and administra-

Table 2. Item and overall self-perceived scores among recent dental graduates

Rank	Function	Mean	S.D.	Not at All Competent		Competent		Very Competent	
				n	%	n	%	n	%
1°	5	1.63	0.52	2	1.7	40	33.6	77	64.7
2°	1	1.59	0.56	4	3.4	40	33.6	75	63.0
3°	21	1.59	0.50	0	0.0	49	41.2	70	58.8
4°	3	1.59	0.60	6	5.0	36	30.3	77	64.7
5°	8	1.59	0.50	0	0.0	49	41.2	70	58.8
6°	6	1.57	0.57	4	3.4	43	36.1	72	60.5
7°	4	1.57	0.53	2	1.7	47	39.5	70	58.8
8°	19	1.55	0.50	0	0.0	53	44.5	66	55.5
9°	2	1.54	0.63	9	7.6	38	31.9	72	60.5
10°	11	1.52	0.57	4	3.4	49	41.2	66	55.5
11°	16	1.50	0.60	6	5.0	47	39.5	66	55.5
12°	7	1.48	0.54	2	1.7	57	47.9	60	50.4
13°	20	1.46	0.54	2	1.7	60	50.4	57	47.9
14°	15	1.43	0.57	4	3.4	60	50.4	55	46.2
15°	18	1.39	0.59	6	5.0	60	50.4	53	44.5
16°	9	1.36	0.62	9	7.6	60	50.4	50	42.0
17°	17	1.34	0.64	11	9.2	58	48.7	50	42.0
18°	12	1.34	0.61	9	7.6	62	52.1	48	40.3
19°	13	1.34	0.64	11	9.2	57	47.9	51	42.9
20°	10	1.31	0.64	11	9.2	59	49.6	49	41.2
21°	14	1.29	0.62	11	9.2	64	53.8	44	37.0

S.D.=Standard Deviation

tive changes to contribute to the solution of health problems in the community.^{8,11}

Our findings indicate that dental graduates of the Faculty of Stomatology at the Universidad Peruana Cayetano Heredia perceived themselves more competent in performing some dental public health functions than others. Promotion of general and oral health through health education was the function with the highest self-perceived score. The elaboration of the socioeconomic-cultural diagnosis as well as the oral health diagnosis of the community, the implementation of preventive interventions, and the incorporation of dental practice into personal and community development were the functions with the second highest self-perceived score. It is not surprising that these particular functions obtained the higher scores since the dental public health learning experiences put a higher emphasis on these activities at the undergraduate level.

The items with the lowest self-reported scores were integration into the public health system, application of basic maintenance of dental equipment and instruments, management of health care systems to groups, as well as dental practice at public and private areas, and participation in an epidemiological surveillance system. These findings showed that there are public health dental functions in which re-

cent graduates consider their undergraduate training to be insufficient. This finding should be taken into consideration for the planning of curricular changes in dental education, as has been suggested by other authors.¹⁶⁻¹⁸

Several powerful external factors, including changing demographics, advances in biological science, and fundamental changes in health care delivery systems, are forcing dental educators to question the appropriateness of retaining the traditional dental school curriculum into the twenty-first century.³⁵ In community-based dental education, students can gain additional understanding from these experiences provided that they are guided through a reflective process. Reflective teaching approaches have been suggested as a useful method to increase the impact of the community learning experiences.³³ Photographic documentation, written narratives, critical incident reports, and mentored post-experiential small group discussions, in addition to fieldwork, can be used to enrich community-based learning experiences in the dental education arena.³³ The courses taught in the Faculty of Stomatology at the Universidad Peruana Cayetano Heredia have included these learning experiences ever since it was founded.

During the courses in dental public health, the faculty perform evaluations of each student by means

of various methods. In addition to objective evaluation for course content, competency evaluation is performed by a committee of instructors with input from an extensive period of observation of the student's performance.⁶ The self-appraisal conducted in the present study was applied to students who have already achieved all the course content requirements. It is important to emphasize that a competency needs to be evaluated not just by the number of functions the student has completed, but also by the relationships the students are able to establish between those functions.

Previous studies on competencies among dental graduates have examined individual survey items when reporting self-competency,^{13-19,21,31,32} but no study in the dental education literature, to our knowledge, has attempted to identify the underlying dimensions associated with dental graduates' competencies. In the present study, factorial analysis was used to provide additional insight into the basic construct around which dental public health competency is organized.

An important issue about the use of factorial analysis is the measurement scale of the evaluated variables. Although a recommendation for conducting factorial analysis is that the variables had been measured quantitatively, there have also been previously reported examples of factorial analyses using binary variables (coded 0-1)²⁶ and ordinal variables, especially those based on Likert-type scales,²⁷ such as the one reported here (a three-point ordinal scale).

According to the factorial analysis, graduates' responses to the twenty-one functions were strongly correlated among themselves, indicating that all of them contribute to the same theoretical construct of dental public health competency. These results provide further evidence to support the validity of the taxonomy for the competency-based dental curricula of the Faculty of Stomatology at the Universidad Peruana Cayetano Heredia. However, it must be taken into consideration that the short length of the scale utilized in this study could have limited the variability in the responses and, therefore, contributed to the finding that dental public health competency is perceived by students to be a one-dimensional construct. Further studies should be undertaken to confirm this finding and to assess the other eleven competencies of our dental curricula.

Comparison of the present findings with those obtained from dental schools without community-based public health experiences is highly recom-

mended. Similarly, additional worldwide information about education for dental public health in dental schools is required to facilitate dissemination, interchange, and comparison of experiences. It is recommended that one include systematic feedback from recent graduates, since it would be useful for ensuring that a curriculum meets new community needs in dentistry as they arise, as has previously been suggested.¹⁶

In conclusion, dental graduates of the Faculty of Stomatology at the Universidad Peruana Cayetano Heredia perceived themselves as very competent for solving dental health needs at the community level. Also, further evidence was obtained in support of the validity of our competency-based dental curriculum in dental public health education.

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