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A Survey of Program Directors: Trends, Challenges, and Mentoring in Prosthodontics. Part 1

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Abstract

Purpose: This study consisted of two parts. Part 1, a survey of program directors, was conducted to examine current trends in advanced education in prosthodontics in the United States. Part 2 will report on the survey results distributed to the deans of US dental schools to evaluate their observations of trends in prosthodontics.

Materials and Methods: A national e-mail survey of 45 program directors was used to collect enrollment data for years 1 to 3 of prosthodontics training for US and international dental school graduates, the total number of applicants and applications considered, and the trends over time of applicants to prosthodontic programs for US dental school graduates and for international graduates. In addition, the program directors were asked to rank 13 key factors that may have contributed to any changes in the prosthodontic applicant pool. Comments were accepted on why more or less US- or internationally trained applicants have applied. Program directors were also asked for information on student financial incentives, whether their programs were state or federally funded, and whether their sponsoring institution was a dental school.

Results: Of the 45 program directors, 39 responded, for an 86.7% response rate. Respondents reported that 64% of their enrollments were graduates of US dental schools. Between 2000 and 2004 the applicant pool in prosthodontics increased by 23%, with 41% of program directors reporting an increase in US-trained applicants, 46.2% reporting no change, and only 12.8% reporting a decrease. Using the Spearman correlation, there was a moderate, positive statistically significant correlation that the following factors contributed to an increase in the number of US dental graduates applying to prosthodontic programs: (1) mentoring by prosthodontists at the predoctoral level, (2) interest in prosthodontics among US dental students, and (3) society's demand for a higher level of training and credentialing, (4) data depicting current and projected income for dental specialists, and (5) number of trained prosthodontists full- or part-time faculty at the predoctoral level. Only five programs offered no financial packages to offset tuition. The remaining 34 respondents reported some financial package. Among the respondents, there were 25 state-sponsored programs, 9 sponsored by private universities, and 5 sponsored by hospitals or federal agencies.

Conclusion: An increased applicant pool and more US-trained applicants to prosthodontics programs create a more competitive applicant pool for our specialty. Program directors reported that factors such as mentoring, society's demand for a higher level of training and credentialing, data depicting current and projected income for prosthodontists, exposure to prosthodontic faculty at the predoctoral level, the dollar value of prosthodontic training, and advances in implant, aesthetic, and reconstructive dentistry have all had some impact on increasing the applicant pool to prosthodontic training in the United States.

Limited information exists regarding the current state of the applicant pool and factors influencing interest in prosthodontic programs in the United States. The 2002 American Dental Association (ADA) report on advanced dental education revealed a 35.9% decline in the number of applicants to prosthodontics programs and a 21.4% decline in first-year enrollment between 1991/92 and 2000/01.[1] Although the following year the ADA reported that the number of applications to prosthodontics programs rose from 905 in 2000/01 to 1069 in 2001/02, many authors called the future of the specialty into question.[2] In 2001, Felton et al[3] reported that from 1991 to 1999 there was a 40.2% decline in applications and a 31.7% decline in enrollment. Only periodontics faced a similar decline. This trend was in contrast to the other specialties of endodontics, oral and maxillofacial surgery, orthodontics and dentofacial orthopedics, and pediatric dentistry, which had experienced on average a 12.2% increase in applications and a 3.5% increase in enrollment. From 1994 to 2002, there were more international graduates enrolled in prosthodontic programs than US graduates.[1,4] Prior to 1987, there were still some training programs in prosthodontics that were either fixed or removable prosthodontics. In 1987, the specialty of prosthodontics and the ADA revised the educational standards to include clinical and didactic training in both fixed and removable prosthodontics. The period of decline for prosthodontics from 1991 to 1999 began just 5 years after the specialty and the ADA mandated the changes in the educational standards to include training in fixed and removable prosthodontics. In January 2000, the ADA also mandated changes in the educational standards regarding program length. Advanced education programs in prosthodontics went from 2-year programs to 3-year programs in 2000. The 1995 Institute of Medicine Report, "Dental Education at the Crossroads: Challenges and Change," reported that the percentage of specialists in dentistry would increase from 15% to 25% in the second decade of the 21st century.[5]

Despite a decade of declining applicants, disappointing enrollment numbers for US graduates, and widespread concerns within the specialty, Douglass et al[6] reported a large need for prosthodontic treatment that will exceed the supply and a manpower shortage in the years 2005, 2010, and 2020. Recently, the US Department of Labor, Bureau of Labor Statistics reported higher earnings for prosthodontists than all other specialties of dentistry, aside from oral and maxillofacial surgery.[7] Nash and Pfeifer[8] reported that the internal rate of return for the expenses associated with prosthodontic training was positive, indicating that prosthodontic training is a financially attractive investment and that there will be a continuing demand for prosthodontic specialty training. In another report, Nash and Pfeifer[9] reported that the average net earnings for a prosthodontist were 35% higher than general practitioners, and that the average net earnings are competitive with other specialties. *Forbes* magazine recently reported that prosthodontists had the sixth highest income among professionals—just two places lower than oral and maxillofacial surgery.[10]

Student recruitment and mentoring have been the focus of many prosthodontics organizations, including the Greater New York Academy of Prosthodontics, which began a program in 2000. The American College of Prosthodontists (ACP) held discussions of mentoring at each of the educators'/mentors' seminars beginning in 1999, and the 2001 seminar was described by Wright in the *ACP Messenger*.[11] Friedman et al[12] describe mentoring as a strategy to address recruitment. Mentoring is defined as a voluntary or reciprocal interpersonal relationship in which an individual with acknowledged expertise shares his or her experience. Mentoring relationships are usually long-term, and there are benefits not only to the protégé, but also personal satisfaction and stimulation for the mentor.

Aesthetic dentistry, improvements in materials, implant prosthodontics, and associated science and technology have all had a positive impact on the specialty of prosthodontics. In addition, this contemporary era of total body fitness and patients' expectations and self-interest are driving higher standards in prosthodontics.[13]

Materials and methods

During 2005, a survey was developed and distributed electronically to all US prosthodontics program directors. Current lists of program directors were obtained from published ADA records along with a list from the ACP. An internet-based survey company (KeySurvey, Inc, www.keysurvey.com, Braintree, MA) was employed to conduct the distribution and processing of completed questionnaires, validate and process follow-up e-mails to nonrespondents, and store survey information in an electronic format. A cover letter (RW and RD), which communicated the purpose of the survey and included a statement of confidentiality to safeguard data and identity of respondents, accompanied all electronic mailings. Also included was a listing of a contact at the Office for Research Subject Protection at Harvard Medical School to allow the respondent an opportunity to validate the legitimacy of the survey.

The first survey questionnaire was sent to 45 program directors and covered several topics, including:

1. Number of current US and international dental school graduates in each year of training,
2. Number of applicants over the past 5 years as well as change in the number of US-trained and international applicants over the past 5 years,
3. Educational, social, economic, or technological factors affecting change in the demographics of applicants in the past 5 years,
4. Financial incentives used to recruit applicants,
5. Type of institution (state-funded, private university, hospitals, or federal).

This survey was designed to represent a partial, introspective view of the current state of prosthodontic education in the United States according to program directors. Program directors were viewed as legitimate indicators of change within predoctoral and postdoctoral prosthodontic education. Statistical analysis was carried out with SAS Version 9.1 (SAS Institute, Cary, NC).

The 45 surveys were distributed to the program directors. Faulty e-mail addresses can occur when new faculty members are appointed, e-mail systems are changed, or alternative e-mails are used. The software was configured to allow respondents to change entries after completion of the survey, but to

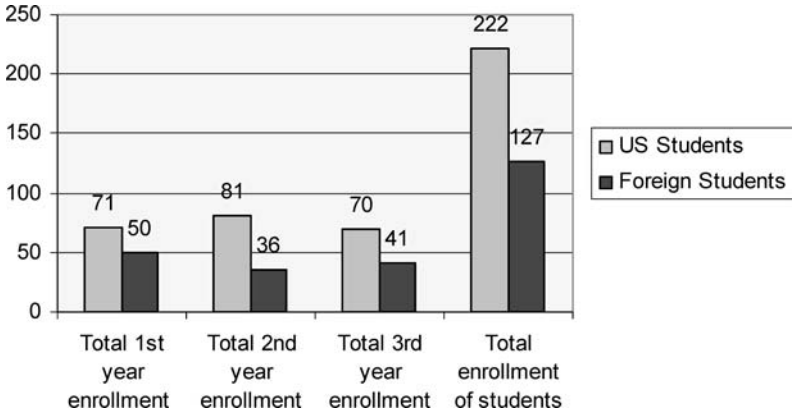

Figure 1 Total surveyed enrollment from 2004 to 2005 (US and International): 349.

allow only one response per respondent e-mail address. Each potential survey respondent was given a unique link to the survey software to monitor progress of the questionnaire and to remove completed surveys from the reminder e-mail list.

Results

Thirty-nine program directors responded to the survey, for a response rate of 86.7%. A total of 25 of the respondents were program directors at state-supported schools, nine were at privately supported schools, and five were from hospitals, military, or federal institutions.

The 39 program directors reported that the current enrollment for all 3 years was 349. The average class size was approximately three per class for years 1 to 3. US-trained students comprised 64% of the enrollment, and internationally-trained residents comprised 36% of the current total enrollment (Fig 1). Between 2000 and 2004 the applicant pool in prosthodontics increased by 23% ($n = 165$) (Fig 2). The maximum number of applications received by any program increased from 46 to 60 and the median applications received increased from 19 to 23. Forty-one percent of program directors reported an increase in the number of US-trained applicants to their prosthodontics programs, and 46.2% reported no change. A decrease in the US-trained applicant pool was reported by 12.8% of the program directors. Similarly, 33% reported an increase in the internationally trained applicant pool, and 59% reported no change. Only 8% reported a decrease in the internationally-trained applicant pool.

Program directors were asked to identify factors that have affected the US- and internationally trained applicant pool over the last 5 years. They ranked 13 separate factors on a five-point scale (strong increase, slight increase, no change, slight decrease, and strong decrease). Results are reported in Tables 1 and 3.

The 13 factors were analyzed to see if there was a correlation between the change in the number of US applicants and the 13 factors. For further analysis of the factors, the responses for "In your opinion have the following factors led to an increase, decrease, or no change in the number of US-trained applicants to your program?" were collapsed into three categories: increase, no change, decrease. The responses for "Have you seen an increase, decrease, or no change in the number of US-trained applicants to your prosthodontics program in the last five years?" were increase, no change, and decrease. The Spearman correlation was used to rank order the relationship between these two survey responses. Mentoring of predoctoral students ($\rho = 0.62$, $p < 0.0001$), interest in prosthodontics among US dental students ($\rho = 0.57$, $p < 0.0001$), society's demand for higher level of training and credentialing ($\rho = 0.42$, $p = 0.008$), data depicting current and projected income for dental specialists ($\rho = 0.34$, $p = 0.04$), and the number of trained prosthodontic faculty (full time or part time) ($\rho = 0.31$, $p < .05$) (Table 2) all showed moderate positive significant

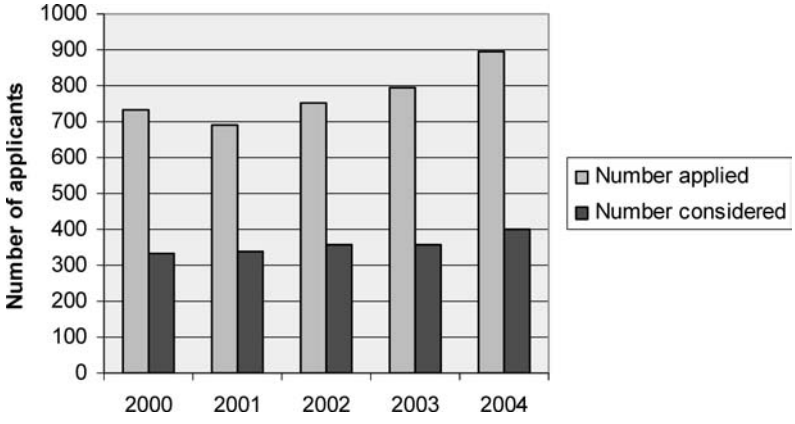

Figure 2 Increase in applications from 2000 to 2004.

Table 1 Response to survey—number of respondents

	Strong increase	Slight increase	No change	Slight decrease	Strong decrease
Loss of GME funding for residents	0	6	14	11	8
Interest in prosthodontics among US dental students	2	16	13	5	3
Growth in the economy	**1**	**14**	**22**	**2**	**0**
Predoctoral curriculum time pertaining to prosthodontics	2	5	19	9	4
Demand for prosthodontic services in the public sector	**4**	**15**	**20**	**0**	**0**
Number of trained prosthodontic full- or part-time faculty at the predoctoral level	1	5	22	4	7
Marketing of prosthodontics as a career	**1**	**10**	**27**	**0**	**1**
Mentoring of predoctoral students by prosthodontic faculty	**4**	**14**	**18**	**2**	**1**
Literature concerning the need for prosthodontists in the future	**2**	**12**	**24**	**0**	**1**
Data depicting current and projected income for dental specialists	3	10	23	2	1
The dollar value of prosthodontic training	2	6	23	7	1
Society's demand for higher level training and credentialing	**2**	**10**	**25**	**2**	**0**
Advances in implant, aesthetic, and reconstructive dentistry	**12**	**18**	**9**	**0**	**0**

The question was "In your opinion, have the following factors led to an increase, decrease, or no change in the number of US-trained applicants to your program?"

Factors in bold have very high responses in number in the increase categories and a very low number of responses in the decrease categories.

correlations. The same analysis was performed for internationally trained applicants and three factors with moderate, positive significant correlation were advances in implant, aesthetic, and reconstructive dentistry ($\rho = 0.40$, $p = 0.01$) the dollar value of prosthodontic training ($\rho = 0.34$, $p = 0.04$), and demand for prosthodontic services in the public sector (Table 4).

The statistics were broken into three regions of the United States as determined by the US Census Bureau to analyze the number of applicants by region from 2000 to 2004. Region 1 included the New England, Mid-Atlantic, and South Atlantic states; Region 2 consisted of the East South Central, East North Central, West North Central, and the West South Central states; and Region 3 included the Mountain and Pacific states. There were 19 respondents from Region 1, 15 from Region 2, and 5 from Region 3. The 39 respondents reported that Region 1 had a 38% ($n = 132$) increase in applications considered from 2000 to 2004; Region 2 had a 7.7% increase ($n = 23$); Region 3 had a 12% increase ($n = 10$) in the number of applications considered (Fig 3). Figure 4 shows the number of applications considered by region had an overall increase from 2000 to 2004 (Region 1, 35%; Region 2, 2%; and Region 3, 2%). The change in the number of US applicants was also sorted by region and analyzed. For each region, the least common answer was a decrease in number of US-trained applicants (Fig 5).

Program directors also reported what incentives they offered to recruit applicants to their programs. Most common responses were stipend (45.7%) and tuition reduction (30.4%), followed by teaching fellowships (17.4%), graduate medical education (GME) funding (17.4%), scholarships (15.2%), clinical production incentive programs (6.5%), and grants (4.3%). Thirteen percent of programs offered no incentives to recruit applicants. Other incentives (23.9%) included military, Veterans Affairs medical centers, or hospital salary as the most common answers. A review of the data revealed that only five (5/39) offer no financial packages or incentives to students in advanced education in prosthodontics programs.

Table 2 Correlation between change in the number of US applicants and variables in Table 1

Factors	Spearman correlation (ρ)	*p*-value
Mentoring of predoctoral students by prosthodontic faculty*,†	0.62	<0.0001
Interest in prosthodontics among US dental students*	0.57	<0.0001
Society's demand for higher level training and credentialing*,†	0.42	0.008
Data depicting current and projected income for dental specialists*	0.34	0.04
Number of trained prosthodontic full- or part-time faculty at the predoctoral level*	0.31	0.05
Marketing of prosthodontics as a career†	0.22	0.17
Predoctoral curriculum time pertaining to prosthodontics	0.30	0.19
Literature concerning the need for prosthodontists in the future†	0.21	0.21
Advances in implant, aesthetic, and reconstructive dentistry†	0.16	0.33
Demand for prosthodontic services in the public sector†	0.16	0.35
Growth in the economy†	−0.08	0.62
Loss of GME funding for residents	0.07	0.68
The dollar value of prosthodontic training	0.001	0.99

For this analysis, responses for "In your opinion, have the following factors led to an increase, decrease, or no change in the number of US-trained applicants to your program?" were collapsed into three categories: Increase, No Change, and Decrease.

The responses for "Have you seen an increase, decrease, or no change in the number of US-trained applicants to your prosthodontics program in the last five years?" were Increase, No Change, Decrease.

*Moderate, positive significant correlation at the $p = 0.05$ level.

†Factors that had very high responses in number in the increase categories and a very low number of responses in the decrease categories.

Table 3 Response to survey—number of respondents

	Strong increase	Slight increase	No change	Slight decrease	Strong decrease
Loss of GME funding for residents	1	2	35	1	0
Interest in prosthodontics among foreign dental students	3	5	29	1	1
Growth in the economy	2	7	30	0	0
Predoctoral curriculum time pertaining to prosthodontics	1	5	30	2	1
Demand for prosthodontic services in the public sector	**4**	**10**	**25**	**0**	**0**
Number of trained prosthodontic full- or part-time faculty at the predoctoral level	0	4	32	3	0
Marketing of prosthodontics as a career	4	6	27	1	1
Mentoring of predoctoral students by prosthodontic faculty	2	5	31	1	0
Literature concerning the need for prosthodontists in the future	0	9	29	0	1
Data depicting current and projected income for dental specialists	2	8	29	0	0
The dollar value of prosthodontic training	**4**	**11**	**23**	**1**	**0**
Society's demand for higher level training and credentialing	6	6	26	1	0
Advances in implant, aesthetic, and reconstructive dentistry	**11**	**11**	**17**	**0**	**0**

The question was "In your opinion, have the following factors led to an increase, decrease, or no change in the number of foreign-trained applicants to your program?"

Factors in bold have very high responses in number in the increase categories and a very low number of responses in the decrease categories.

Discussion

The size of the applicant pool in prosthodontics has increased by at least 23% in the last 5 years. While this amount of growth over 5 years can be called modest in relation to the growth of other specialties including pedodontics and endodontics, the specialty of prosthodontics has begun to show signs of positive growth after 10 years of consistent decline. In addition, the percentage of US dental school graduates who are enrolled in prosthodontic programs, as reported by the 39 respondents, is now at 64%. This is in sharp contrast to the 1994 to 2002 ADA data, which revealed that the majority of students enrolled in prosthodontic programs were international students. One limitation of our study is that we did not survey program directors regarding enrollment citizenship, so a small percentage of the US dental school graduates could be noncitizen students who might return to their respective countries to practice prosthodontics, or they could be international graduates who remain in this country as prosthodontists. The increasing number of applicants reported by this study is comparable to the data from the ADA, including the most recent survey from 2005, which also revealed an increasing applicant pool. The 2005 ADA survey showed a 5% increase in the applicant pool (985 applicants) and a 7% increase in first year enrollment (155) when compared with 2004 (938 applicants and first year enrollment at 145).[14]

The majority of program directors reported an increase in the number of US graduates as well as international graduates to their prosthodontic programs. A moderate, positive correlation between the change in number of US graduates and the factors for choosing prosthodontics was seen for mentoring of predoctoral students by prosthodontic faculty, interest in prosthodontics among US dental students, society's demand for a higher level of training and credentialing, data depicting current and projected income for dental specialists, and the number of trained prosthodontists (faculty) at the predoctoral level. A weak, positive correlation between the change in number of US graduates and the factors for choosing prosthodontics included:

Table 4 Correlation between change in the number of foreign applicants and variables in Table 3

	Spearman correlation (ρ)	p-value
Advances in implant, aesthetic, and reconstructive dentistry*,‡	0.40	0.01
The dollar value of prosthodontic training*,‡	0.34	0.04
Demand for prosthodontic services in the public sector*,†,‡	0.33	0.04
Interest in prosthodontics among foreign dental students	−0.24	0.15
Society's demand for higher level training and credentialing	0.21	0.21
Data depicting current and projected income for dental specialists	0.16	0.33
Predoctoral curriculum time pertaining to prosthodontics	0.12	0.46
Growth in the economy	0.09	0.60
Number of trained prosthodontic full- or part-time faculty at the predoctoral level	0.09	0.61
Literature concerning the need for prosthodontists in the future	−0.08	0.62
Loss of GME funding for residents	−0.08	0.64
Mentoring of predoctoral students by prosthodontic faculty	−0.06	0.71
Marketing of prosthodontics as a career	−0.004	0.98

For this analysis, responses for "In your opinion, have the following factors led to an increase, decrease, or no change in the number of foreign-trained applicants to your program?" were collapsed into three categories: Increase, No Change, and Decrease.

The responses for "Have you seen an increase, decrease, or no change in the number of foreign-trained applicants to your prosthodontics program in the last five years?" were Increase, No Change, Decrease.

*Moderate, positive significant correlation at the $p = 0.05$ level.

†Weak, positive significant correlation at the $p = 0.05$ level.

‡Factors that had very high responses in number in the increase categories and a very low number of responses in the decrease categories.

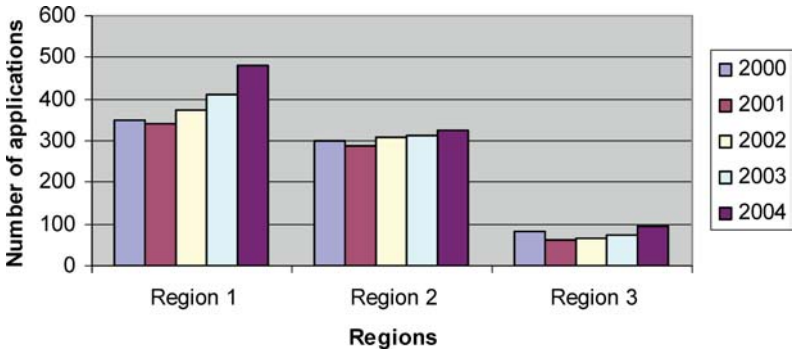

Figure 3 Number of applications by year and region

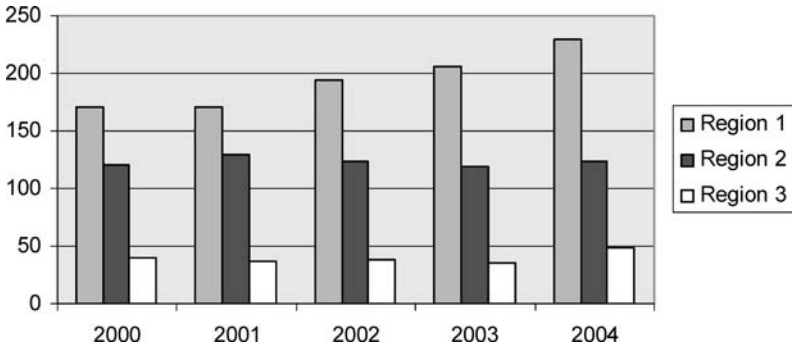

Figure 4 Number of applications considered by year and region.

marketing of prosthodontics as a career; predoctoral curriculum pertaining to prosthodontics; literature concerning the need for prosthodontists in the future; advances in implant, aesthetic, and reconstructive dentistry; and the demand for prosthodontic services. A moderate, positive correlation between the change in number of foreign graduates and the factors leading to the increase was seen for advances in implant, aesthetics, and reconstructive dentistry and for the dollar value of prosthodontic training. All of these factors are thought to have a positive impact on the future of the specialty.

The choice to enter specialty training is a complex one. Nash and Pfeifer reported net earnings as a specialist, potential earnings lost during residency training, and tuition and expenses required for residency as major determinants in choosing advanced dental education.[8] They also reported earnings for private practicing prosthodontists to be relatively high compared to other dental professionals. Net earnings are often seen as an indicator of health within a profession, but high net earnings do not sufficiently explain the current rise in applications to prosthodontic residencies. An important result of this survey attempts to demonstrate some of the factors other than financial gain that may influence dental students to choose a career in prosthodontics.

An increasing applicant pool is an indicator of the health of a specialty education program; the true answer as to why more students are choosing prosthodontics as a career lies with the applicants themselves. It would be extremely beneficial to administer a survey to all applicants and incoming first-year residents to prosthodontic residency programs to record what their motivations were in applying. With such data, dental administrators would be able to evaluate their efforts to recruit students into the specialty of prosthodontics.

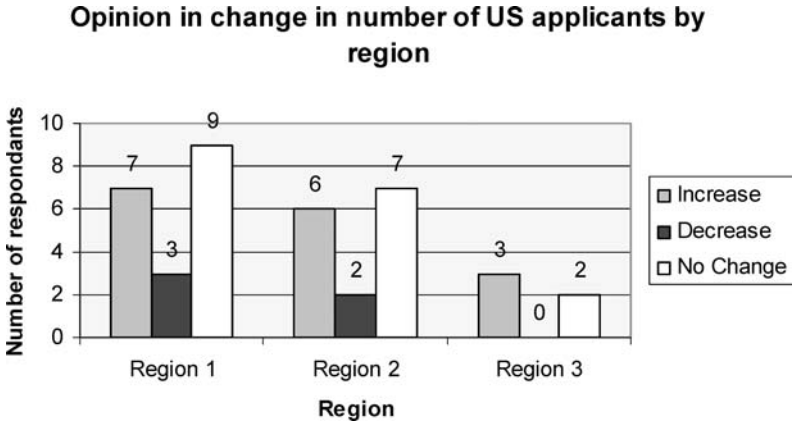

Figure 5 Have you seen an increase, decrease, or no change in the number of US-trained applicants to your prosthodontics program in the last 5 years? Sorted by regions.

Conclusion

The health of a specialty training program can be examined by the sheer number of applicants and the competitiveness of the application process. Increasing size and competitiveness of the applicant pool during the past 5 years suggests that the prosthodontic programs have become more attractive to dental students. Our findings suggest that the factors such as mentoring, society's demand for a higher level of training and credentialing, data depicting current and projected income for prosthodontists, exposure to prosthodontic faculty at the predoctoral level, the dollar value of prosthodontic training, demand for prosthodontic services, and advances in implant, aesthetic, and reconstructive dentistry have all had some impact on increasing the applicant pool to prosthodontic training in the United States.

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