Who Will Serve? Assessing Recruitment of Underrepresented Minority and Low-Income Dental Students to Increase Access to Dental Care

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Abstract: This article uses data from the 2007 American Dental Education Association survey of dental school seniors to assess their intentions to serve underserved populations according to the students' underrepresented minority (URM) and income status. Dental school recruitment and retention programs that concentrate exclusively on URM students will not benefit most low-income students since 83 percent of them are not URM. Recruiting URM students leads to more graduating students with intentions to serve minorities. Whether the income of URM students was high or low, about half in each income group stated that more than 25 percent of their patients would be underserved minorities, compared to 28 percent of the low-income non-URM students and 17 percent of the higher income non-URM students. However, our multivariable results suggest that recruitment of both low-income groups (URM and non-URM) rather than high income regardless of ethnicity might be especially helpful in producing graduates who choose public service. URM/income status was not significantly related to serving special care or rural populations.

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In 2002–03, the Robert Wood Johnson Foundation (RWJF) and The California Endowment (TCE) funded fifteen U.S. dental schools under the Pipeline, Profession, and Practice: Community-Based Dental Education program. The primary goal of the Pipeline program was to reduce disparities in access to dental care. A major objective to achieve this goal was to increase the number of underrepresented minority and low-income students (URM/LI) enrolled in Pipeline dental schools.[1]

Most Pipeline schools increased their URM recruitment efforts. The Pipeline program was quite successful in increasing the enrollment of entering URM (African American, Hispanic, and American Indian) students in Pipeline schools by 29 percent between 2002–03 and 2006–07 and by 54 percent if the minority schools (Howard University College of Dentistry and Meharry Medical College School of Dentistry) are excluded.[2] Further, Pipeline schools showed significantly greater increase in the odds of URM enrollment over this time period than did the rest of the U.S. dental schools.[2]

In contrast, relatively little effort was devoted in the Pipeline program to explicitly recruit more low-income students. This would not be such an important issue if the URM and LI students largely overlapped. However, of all the students in the 2007 American Dental Education Association (ADEA) survey of dental school seniors whose parents reported an income of $50,000 or less (our proxy definition of an LI student), only 17 percent were URM students. Conversely, of all URM students in this survey, only 32 percent were LI students.[2] Further, the proportion of LI students in the entering classes did not appear to increase over the course of the program. In 2002–03, 28 percent of the senior students had a reported parents' income of $50,000 or less (unadjusted dollars), while in 2006–07 this decreased to 21 percent. Even

if we adjust for inflation, the proportion of LI students remains higher in 2002–03 than in 2006–07.[3]

The Pipeline program aimed to improve access to dental care by increasing the number of URM and LI students enrolled in dental schools. In this study, we wish to investigate the likely effects of URM as well as LI graduates on access to dental care by examining their intentions to serve underserved and vulnerable populations using data reported from the 2007 ADEA senior survey. Because of the limited overlap between the two subgroups, we will consider the intentions of LI graduates who are and are not URMs, as well as URMs in the higher income group. Further, because there are multiple ways for dentists to provide care to underserved patients, we will examine intentions to serve minorities, special needs patients, and patients in rural areas and to provide dental care in community clinics or government service (that is, public service).

Figure 1 shows our measurement model for examining the relationship of the student's URM/ LI status to his or her intentions to provide care to underserved patients upon graduation. The model suggests potential factors that influence the senior dental student's intentions, including predisposing characteristics of the student upon entering dental school (ethnicity/income status and demographic characteristics). Intentions might also be influenced during a student's time in dental school by contextual factors such as characteristics of the dental school and the community in which it is located. The model further suggests that students' attitudes about dental practice as they graduate and their level of debt accumulated during dental school might also influence their practice plans.

Literature Review

Our literature review yielded no studies reporting specifically on the practice plans of low-income students in either the dental or medical literature. In
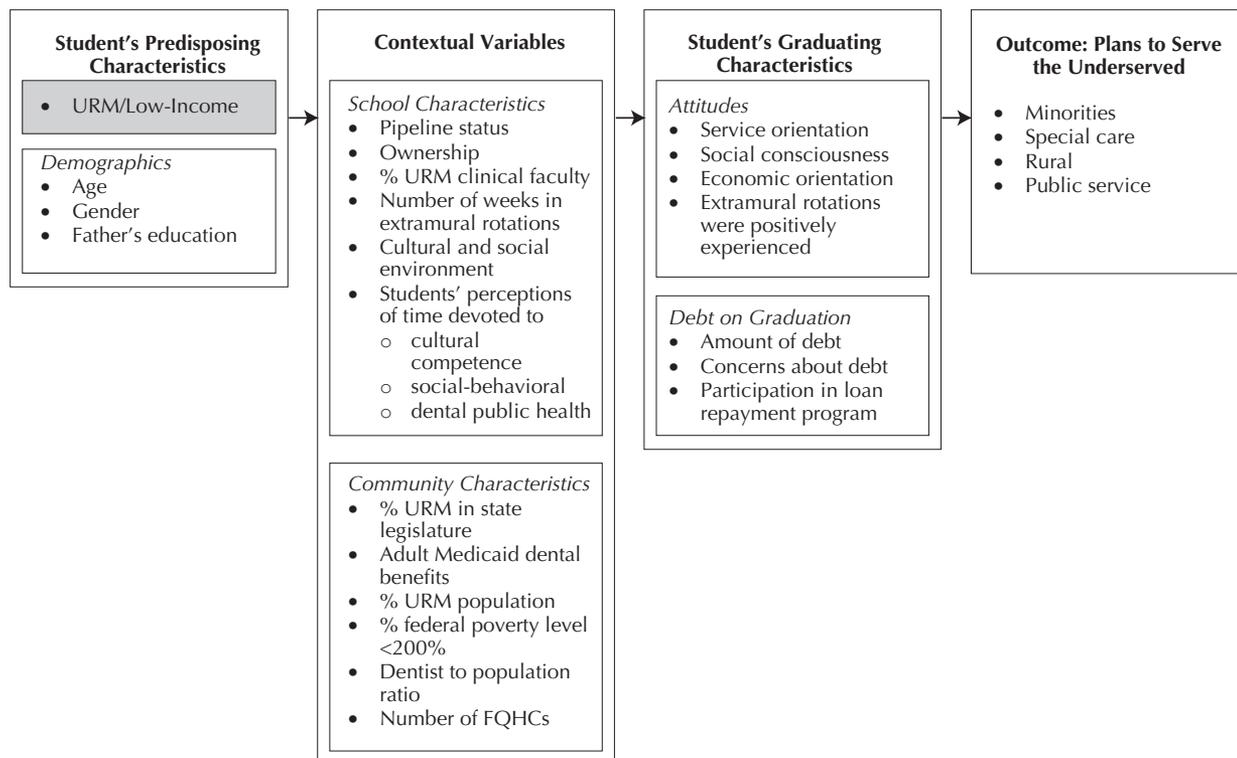

Figure 1. A model for who will serve the underserved

contrast, several studies focused on underrepresented minority students and their practice intentions. A growing body of literature suggests that dental students who are from traditionally underrepresented minority population groups are more likely to serve populations that are underserved with respect to oral health care.[2] Price et al. report that minority dentists are significantly more likely to treat patients from urban, less formally educated, and economically disadvantaged backgrounds than are their nonminority peers.[4] Furthermore, a study conducted by Solomon et al. found that African American dentists in Texas practiced in lower socioeconomic, predominantly African American residential areas.[5] Also, Butters and Winter found African American students were more motivated to become a dentist with the intention to serve the public than to obtain a higher income in comparison to the white dental students, who were more motivated by family commitments.[6] Several studies report that minority dental students plan to treat higher percentages of minority and low-income patients and patients from rural or inner-city communities compared to white dental students.[6-12]

In our previous research, we conducted a baseline and impact analysis to investigate the significant factors associated with plans to care for more underserved minority patients using ADEA senior survey data from 2002–03 and 2006–07.[7,8,13,14] Race/ethnicity and parental income both increased the odds that senior dental students planned to care for minority patients. Specifically, compared to white graduating seniors, URMs were three times more likely (OR=3.23, p<.001) to plan to care for minorities, and Asian/Pacific Islanders were almost two times (OR=1.88, p<.001) more likely to plan to care for minorities. The effects were different in the California Pipeline versus National Pipeline schools, but overall, having a parental income level of $30,000 to $50,000 (compared to higher income) increased the odds of a student's planning to provide care to underserved minority patients (OR=1.37, p<.01).[8]

The Pipeline program's National Evaluation Team also previously examined factors associated with the intentions of graduating seniors to provide care to special needs patients.[15] Greater social contact, percentage of older adults treated, and percentage of low-income adults treated during dental school and number of federally qualified health centers and dentist-to-population ratio in the dental school's location were significantly associated with students' intentions to provide more care to special needs patients upon graduation. We also found more time spent in extramural clinical rotations was associated with intentions to care for more special needs patients.

Concerning plans to practice in rural areas, Rosenblatt and Andrilla found African American medical students were more interested in inner-city practice than any other identified racial or ethnic group, but were much less likely to consider rural practice compared to Hispanic and American Indian medical students.[11] Furthermore, a study examining the background of graduates from a California medical residency program found that graduation from a high school in a rural census tract was linked with rural practice and that graduation from high school in a census tract with a higher proportion of minorities was associated with practice in a proportionally high minority community.[16]

Regarding public service, Mofidi et al. found that, among dentists who had participated in the National Health Service Corps (NHSC) between 1980 and 1997, significantly more of the African Americans (73 percent) continued to work with underserved groups after completing their required service compared to 59 percent of the Latinos and 41 percent of the whites.[10] Our own Pipeline program evaluation also examined the significant factors associated with public service plans in community clinic or government service and found in bivariate analysis that URM dental graduates in 2007 were more likely (14 percent) than whites (9 percent) to plan public service, but a multivariable impact analysis did not find a significant difference between the public service plans of URMs and whites.[14] This multivariable impact analysis found factors significantly related to public service plans to include lower parental income; the most significant predictor was access to any federal or state loan repayment program (OR=7.78, p<0.001).

Methods

The primary data source used for this study was the 2007 ADEA survey of dental school seniors. This survey, administered annually using a questionnaire distributed to graduating seniors in all accredited U.S. dental schools, collects information about students' financing of dental education, graduating indebtedness, practice and postdoctoral education plans following graduation, decision factors that influence postgraduation plans, and impressions about the adequacy of time in the curriculum directed to various areas of predoctoral instruction. Each school uses its

own survey distribution and collection system. For this study, we used the same fifty-two schools in our Pipeline program evaluation, which analyzed ADEA survey data from 2003 through 2007. For 2007, the overall response rate was 86 percent; for two of the schools, Boston University and University of Maryland, we used ADEA survey data from 2006 since the response rates for these two schools were less than 5 percent each in 2007.

Key Independent Variable: URM/LI Status

We examined the relationship between URM and LI dental students and intentions to serve underserved and vulnerable populations upon graduation. URM students were defined as Hispanic, African American, or American Indian. Non-URM students were defined as white, Asian/Pacific Islander, or "other" race. Low-income students were defined as those whose combined parental income was $50,000 or less. Because of the large number of respondents who did not report their parents' income, missing cases were imputed using Stata's hotdeck method, employing a single imputation approach.[17,18] The four questionnaire items used in imputing income were 1) age (less than twenty-nine vs. twenty-nine or older); 2) father's education (at least some college vs. high school diploma or less); 3) one or both parents a dentist (yes/no); and 4) concerns about being able to finance or obtain financial support for your dental education (five-point scale ranging from no to very much). In all, 22.5 percent of missing cases were imputed.

Next, we cross-classified income and race to create four categories: income less than or equal to $50,000 and URM; income less than or equal to $50,000 and non-URM; income more than $50,000 and URM; and income more than $50,000 and non-URM.

Other Predictor Variables

Besides race/ethnicity and income, we examined other indicators thought to be important in predicting a student's intentions to provide dental care to underserved and vulnerable populations. These indicators were suggested by the literature review and the overarching evaluation framework we developed for the Pipeline program.[19] These variables were grouped into three categories: 1) students' predisposing demographic characteristics,

2) contextual variables, and 3) students' graduating characteristics (Figure 1).

Students' predisposing demographic characteristics (ADEA survey) included age (twenty-nine years and over vs. less than twenty-nine years), gender (male vs. female), and father's educational attainment (at least some college vs. less than college education). Contextual school characteristics (ADEA survey plus sources listed with Table 2), included Pipeline program status of each school (California Pipeline program school, National Pipeline program school, or Non-Pipeline program school), ownership of school (private or public), percent URM clinical faculty members in school, the school mean score for the number of weeks students spent in extramural rotations, the school's mean score for the question "The school's cultural and social environment promotes the acceptance and respect of students and patients of different races, ethnicities, and cultures" (ranging from 1=strongly disagree to 4=strongly agree), time spent on cultural competence instruction (inadequate, appropriate, or excessive), time spent on instruction in social/behavioral determinants (inadequate, appropriate, or excessive), and time spent on instruction in dental public health (inadequate, appropriate, or excessive).

Contextual community characteristics included measures of the community in which the students' dental school was located that may influence students' intentions to serve. These community measures were constructed from a variety of non-ADEA data sources (listed with Table 2) and included the percent of minority lawmakers in the state legislatures, adult Medicaid dental benefits by state, percent URM population by county, percent Federal Poverty Level (FPL) less than 200 percent by county, dentist to population ratio by state, and number of federally qualified health centers (FQHCs) by county.

Students' graduating characteristics included attitudes and beliefs measured by three constructed scales: social consciousness, service orientation, and economic orientation. The social consciousness scale was constructed from responses to the following four items (each scored from 1=strongly agree to 4=strongly disagree): 1) access to oral health care is a societal good and right; 2) access to oral health care is a major problem in the United States; 3) ensuring and providing care to all segments of society is an ethical and professional obligation; and 4) everyone is entitled to receive basic oral health care. The service orientation scale was constructed from responses to the following three reasons for choosing dentistry as

a profession (each scored from 1=low to 5=high): 1) service to others, 2) service to my own race or ethnic group, and 3) opportunity to serve vulnerable and low-income populations. The economic orientation scale was constructed from responses to the following two reasons for choosing dentistry as a profession (each scored from 1=low to 5=high): 1) opportunity for self-employment and 2) high-income potential. A fourth attitude variable was student belief that extramural clinical rotations were a positive or negative experience (dichotomized as very positive/positive vs. neutral/negative/very negative).

Student graduating characteristics also included three measures concerning student educational debt and debt repayment upon graduation: 1) amount of educational debt after graduation (quartiled into four categories: less than $70,000, $70,000–$119,000, $120,000–$167,000, and $168,000–$350,000); 2) extent student considers debt after graduation to be a financial burden, divided into two categories (much/very much vs. somewhat/very little/no); and 3) whether the student participates in any federal or state loan repayment program.

Outcome Variables

In measuring access to dental care, we examined four questions from the ADEA survey that involve students' plans to serve underrepresented or underserved groups. Three access outcomes stemmed from the ADEA question "When you enter practice, about what percent of your patients do you expect will be from underserved . . .":

1. racial/ethnic minority populations,
2. special care populations (frail elderly, medically compromised, physically/mentally disabled), or
3. rural areas.

The respondent was asked to choose from the following categories what percent of these groups he or she plans to serve in professional practice: 1) 0 percent, 2) 1–10 percent, 3) 11–24 percent, 4) 25–50 percent, or 5) greater than 50 percent. We defined "serving the underserved" if respondents selected categories 4 or 5 (i.e., 25 percent or more) for each type of patient.

The fourth access measure involved public service after graduation, which came from this question: "Immediately upon graduation from dental school do you intend your primary activity to be . . . ?" The "public service" variable we constructed consisted of the following response categories: 1)

employed by a community clinic, or 2) employed in government service (military, Department of Veterans Affairs [VA], National Health Service Corps [NHSC], Indian Health Service [IHS], state or local health department). The variable was coded as "1" community clinic or government service and "0" all other response categories from the original question (self-employed, private practice, dental school, postdoctoral student, student in nondental area of study, undecided).

Analysis

Our analysis consisted of race/ethnicity by income (Table 1), predictors (student demographic characteristics, contextual variables, and student graduating characteristics) by income/URM (Table 2), our four service intention outcomes by income/URM (Table 3), and multivariate logistic regressions for each of our outcomes regressed on selected predictors (Table 4).

A two-step approach was used to derive the final multivariable model. First, we examined a correlation matrix and selected those candidate variables that were correlated with our outcome at the p=0.20 significance level or less. We found high intercorrelations between two pairs of predictors: 1) percent URM in county with less than 200 percent of the federal poverty level, and 2) seniors' perceptions of time spent in the curriculum on social-behavioral determinants with time spent on cultural competence. To avoid possible multicollinearity in our final models, we removed percent URM in county (because it was also strongly correlated with URM legislature) and time spent on social-behavioral determinants (because we were particularly interested in the possible effects of the cultural competence curriculum on plans to serve diverse populations). Then, we regressed the outcome on our remaining candidate predictors using a best-subset regression approach. The best-subset regression is used to select the predictor variables that will be used in a final multivariable model. It involves examining all models created from all possible combinations of predictor variables and selecting the "best" model(s) based on a selection criterion, such as a residual sum of squares. Several different measures are available to select the best model; we used the smallest AIC (Akaike information criteria) and the smallest Mallows C(p) criteria.[17] The results of the best-subset model were then used in a final random effects multivariable logistic regression model. This introduces a random effect into the linear

model which allows each school to have its own influence (or intercept) that deviates from the population intercept. All tests of significance reported in Table 4 were adjusted for clustering among students within the same school, as these students are more likely to be similar on a variety of characteristics compared to students in other schools. Only those predictors significant at the p=0.05 level are shown in Table 4.

Results

URM Status by Income

Table 1 shows recruitment and retention programs that focus exclusively on URM students will not assist the majority of low-income applicants and students. A large majority (83.2 percent) of the low-income students are non-URM. Nearly half (47 percent) of these low-income students are white, and one-third are Asian/Pacific Islander. Conversely, URMs make up only 16.8 percent of the low-income group (Hispanic, 8.9 percent; black, 7.0 percent; and American Indian, 0.9 percent). So, while it is true that URM students make up a greater proportion of the low-income group (16.8 percent) than the high-income group (9.6 percent), this low-income group is clearly heterogeneous including large numbers of non-URM students. Thus, we chose in our subsequent analyses to investigate four groups separately, each defined by income (low vs. high) and URM status (URM vs. non-URM).

Student, Community, and School Characteristics

Table 2 compares demographic characteristics, contextual variables, and graduating characteristics for students in various income/URM status groups. Among the demographic characteristics, we found the low-income groups (both URM and non-URM) to be older. Higher income URM students were more likely to be female. The high-income groups (both URM and non-URM) were twice as likely to come from highly educated families as were low-income URM students.

A number of contextual school characteristics were significantly different between URMs and non-URMs regardless of income (Table 2). URM students were more likely to go to Pipeline schools, private schools, and schools with a higher proportion of URM clinical faculty. These differences largely reflect the fact that the Pipeline program includes Howard and Meharry, both minority private schools. For all the other school characteristics in the model, the differences shown among the income/URM student categories were substantively small and mostly not significant.

A number of the contextual community characteristic differences between URMs and non-URMs (Table 2) appear substantively important and significant regardless of income. URM students were more likely to go to schools in states with a greater proportion of URM legislators and counties with a higher proportion of URM residents, a higher percentage of residents with incomes below 200 percent of the federal poverty level, and fewer FQHCs. However, more high-income URM students went to schools in states that had significantly higher dentist to population ratios than lower income URM and all non-URM students.

Upon graduation, both the low- and high-income URMs had more service-oriented and socially conscious attitudes than the non-URMs (Table 2). However, all four groups responded similarly that economic reasons were important in their choice of dentistry and did not differ in reporting that their extramural rotations had been a positive experience. Finally, level of debt upon graduation appeared highest among non-URMs, who were also the most worried about the debt they accumulated. Participation in loan repayment programs appeared to be highest for the high-income URMs and lowest for the high-income non-URMs.

Service Intentions

Given the limited overlap between the low-income and URM dental student populations, we examined plans to provide care to underserved patients according to both the students' income level and URM status (Table 3). When considering "who will serve," we should first consider the proportion of all students in each of the income/URM status groups. Table 3 shows students who are both low-income and URM make up only 3.6 percent of the total student population, while those who are low-income but not URM make up 17.8 percent. Among the higher income groups, URMs make up 7.6 percent of the total student population while non-URMs constitute a large majority of the total, 71.8 percent.

While 23 percent of all students (Table 3) plan to serve more than 25 percent minorities, one-half of both URM groups (lower and higher income) plan

Table 1. Racial/ethnic status by income, by percentage and number of total respondents by category

Race/Ethnicity	Income Less Than or Equal to $50,000	Income More Than $50,000	Total
URM	16.8% (129)	9.6% (271)	11.2% (400)
Hispanic	8.9% (68)	4.2% (118)	5.2% (186)
Black	7.0% (54)	4.7% (132)	5.2% (186)
Native American	0.9% (7)	0.7% (21)	0.8% (28)
Non-URM	83.2% (637)	90.4% (2,547)	88.8% (3,184)
Asian/Pacific Islander	33.2% (254)	21.1% (596)	23.7% (850)
White	47.8% (366)	6.7% (1,902)	63.3% (2,268)
Other	2.2% (17)	1.7% (49)	1.8% (66)
Total	21.4% (766)	78.6% (2,818)	100% (3,584)

to serve minorities. In contrast, 28 percent of the low-income non-URM and only 17 percent of the high-income non-URM plan to serve more than 25 percent minorities. Nine percent of all students plan to serve more than 25 percent disabled patients as part of their practice, and 19 percent plan to serve more than 25 percent rural patients. We found no significant differences in plans to serve disabled and rural patient groups according to the student's income/URM status.

Finally, about one-tenth of all graduates reported intentions to go into public service (Table 3). In rank order from high to low, public service intentions were reported by the following: 1) 15.5 percent of the low-income URMs; 2) 14.0 percent of the high-income URMs; and 3) 11.6 percent of the low-income non-URMs and 8.4 percent of the high-income non-URMs. According to the Duncan's means test, only the difference between the highest group (low-income URM) and lowest group (high-income non-URM) was significant.

Practice Intentions

The multivariable analyses of Table 4 show the odds that dental students plan to provide care to underserved patients is significantly associated with their income/URM status in regards to underserved minorities and practicing in public service settings (community clinics or government service) but not in regards to special care or rural patients. URM students, both low- and high-income, are almost three times as likely to plan to care for more than 25 percent minority patients as high-income non-URM patients. And low-income but non-URM students are about one and one-half times as likely to do so. Low-income URM students are about twice as likely to plan to practice in public service as high-income non-URM

students. Low-income non-URM students were also more likely to plan to practice in public service than high-income non-URM students (OR=1.43, p<.05), but the odds ratio for the high-income URM students (OR=1.33, p>.05) was not significantly different in this multivariable analysis.

Other significant demographic characteristics, contextual school and community variables, and graduating characteristics in the multivariable analyses vary somewhat depending on the type of service (Table 4). For serving more than 25 percent minority patients, significant student demographics include greater odds that females will serve. Among school and community characteristics, students from schools in states without adult Medicaid dental benefits, in counties with more FQHCs, and in schools where students reported the time in their curriculum spent on cultural competence was excessive were more likely to plan to serve minorities. Significant student attitudes included a high service orientation, a high score on the social consciousness scale, and a low score on the economic orientation scale. Finally, those who had much worry about debt and those who participated in a loan repayment program were more likely to plan to serve minority populations.

For service to special care patients, significant predictors included older age, higher proportion of residents with less than 200 percent poverty level in the county, and students reporting the time spent on cultural competence in their curriculum was inadequate, high service orientation, lower economic orientation, and participation in a loan repayment program (Table 4).

Factors significantly associated with plans to serve more than 25 percent rural patients differed most from other types of service (Table 4). Older age and having fathers with less education were

Table 2. Comparison of student, community, and school characteristics of the four income/URM status groups

	Income Less Than or Equal to $50,000: URM (n=129)†	Income Less Than or Equal to $50,000: Non-URM (n=637)‡	Income More Than $50,000: URM (n=271)§	Income More Than $50,000: Non-URM (n=2,547)†‡	All Students (n=3,584)‡#
STUDENT PREDISPOSING CHARACTERISTICS					
Demographics					
Age 29 and up (%)	48.1%[a]	49.3%[a]	29.9%[b]	23.5%[b]	29.5%
Male (%)	50.4%[a]	56.2%[a]	42.1%[b]	55.4%[a]	54.3%
Father had at least some college education (%)	43.4%[a]	57.3%[b]	79.0%[c]	84.7%[c]	77.9%
CONTEXTUAL VARIABLES					
School Characteristics					
School type (%)					
Pipeline					
Pipeline	45.0%[a]	32.0%[b]	42.8%[a]	26.7%[b]	29.5%
CA Pipeline (TCE)	11.6%[ab]	15.5%[a]	7.4%[b]	10.4%[ab]	11.2%
National Pipeline (RWJF)	33.3%[a]	16.5%[b]	35.4%[a]	16.3%[b]	18.4%
Non-Pipeline	55.0%[a]	68.0%[b]	57.2%[a]	73.3%[b]	70.5%
Private school (%; reference is public)	49.6%[abc]	45.2%[ac]	55.4%[b]	40.2%[c]	42.6%
URM clinical faculty (%)[1]	26.22% (30.84)[a]	8.10% (8.02)[b]	26.56% (30.66)[a]	7.64% (6.19)[b]	9.94% (13.72)
Mean # of wks (SD) expected to serve in extramural rotations	7.18 (2.85)[a]	7.48 (3.22)[a]	7.24 (2.86)[a]	7.16 (3.21)[a]	7.28 (3.19)
Mean score (SD): school environment promotes tolerance/diversity	3.23 (0.18)[a]	3.20 (0.18)[a]	3.20 (0.18)[a]	3.21 (0.18)[a]	3.21 (0.18)
Time spent on cultural competence: mean percent (SD)					
Inadequate	0.17% (0.09)[a]	0.17% (0.08)[a]	0.18% (0.09)[a]	0.17% (0.08)[a]	0.17% (0.08)
Appropriate	0.73% (0.09)[a]	0.72% (0.10)[a]	0.73% (0.08)[a]	0.73% (0.09)[a]	0.73% (0.09)
Excessive	0.10% (0.11)[a]	0.11% (0.13)[a]	0.10% (0.10)[a]	0.10% (0.11)[a]	0.10% (0.11)
Time spent on social/behavioral determinants: mean percent (SD)					
Inadequate	0.12% (0.07)[a]	0.12% (0.06)[a]	0.13% (0.07)[b]	0.12% (0.05)[a]	0.12% (0.06)
Appropriate	0.81% (0.09)[a]	0.81% (0.10)[a]	0.80% (0.08)[a]	0.81% (0.09)[a]	0.81% (0.09)
Excessive	0.07% (0.09)[a]	0.08% (0.10)[a]	0.07% (0.07)[a]	0.07% (0.09)[a]	0.07% (0.09)
Time spent on dental public health: mean percent (SD)					
Inadequate	0.14% (0.08)[a]	0.12% (0.06)[b]	0.15% (0.09)[a]	0.12% (0.07)[b]	0.13% (0.07)
Appropriate	0.74% (0.09)[a]	0.73% (0.11)[a]	0.74% (0.09)[a]	0.74% (0.11)[b]	0.74% (0.10)
Excessive	0.12% (0.11)[ab]	0.14% (0.13)[c]	0.12% (0.11)[b]	0.14% (0.12)[ac]	0.14% (0.12)
Community Characteristics					
URM legislative members in state (%)[2]	27.55% (24.34)[a]	17.87% (10.82)[b]	24.95% (21.91)[c]	16.35% (10.45)[b]	17.82% (13.21)
Adult Medicaid benefits in state (%)[3]					
No coverage	21.0%[a]	9.9%[b]	25.6%[a]	9.9%[b]	11.4%
Emergency coverage	30.3%[ab]	23.2%[b]	31.4%[a]	25.4%[ab]	25.6%

Limited coverage	28.6%[b]	38.9%[a]	22.9%[b]	38.4%
Full coverage	20.2%[a]	27.9%[b]	20.2%[a]	24.6%
URM in county (%)[4]	45.62% (21.90)[a]	36.69% (16.41)[b]	43.06% (21.39)[a]	36.37% (17.59)
Federal poverty level less than 200% in county: mean (SD)[4]	36.58 (9.11)[a]	33.75 (6.51)[c]	35.30 (7.88)[b]	33.84 (6.71)
Dentist to population of 10,000 ratio in state: mean (SD)[5]	6.56 (2.11)[ab]	6.60 (1.28)[b]	6.95 (2.40)[c]	6.46 (1.41)
Number of FQHCs in county: mean (SD)[6]	2.95 (2.92)[a]	4.02 (3.54)[b]	2.87 (2.88)[a]	3.58 (3.33)
Student Graduating Characteristics				
Attitudes: mean (SD)				
Service orientation scale	4.18 (0.81)[a]	3.54 (0.88)[b]	4.06 (0.83)[a]	3.46 (0.87)
Social consciousness scale	3.27 (0.58)[a]	3.04 (0.58)[c]	3.18 (0.67)[b]	3.02 (0.60)
Economic orientation scale	4.27 (0.84)[a]	4.25 (0.81)[a]	4.26 (0.83)[a]	4.28 (0.76)
Extramural clinical rotations were positive/v. positive experiences (%)	66.4%[a]	61.7%[a]	64.2%[a]	63.8%
Debt on graduation				
Amount of debt ($) after graduation (%)				
Less than $69,000	18.3%[a]	14.8%[a]	18.6%[a]	17.6%
$70,000–$119,000	12.2%[ab]	7.9%[a]	16.1%[b]	9.6%
$120,000–$167,000	25.2%[a]	23.9%[a]	20.3%[a]	25.8%[a]	25.0%
$168,000–$350,000	44.4%[a]	53.5%[a]	44.9%[a]	46.9%[a]	47.8%
Do you worry (much/v. much) about debt on graduation? (%)	46.1%[b]	58.5%[a]	50.8%[ab]	51.8%[ab]	52.7%
Participation in loan repayment program (%)	11.7%[ab]	10.3%[ab]	15.0%[a]	8.4%[b]	9.3%

Note: Percentages and means (standard deviations) are reported. Percentages and means with the same letter (a, b, c, d) are not significantly different from each other at the p=0.05 level, using an unadjusted (not accounting for clustering by school) Duncan's multiple means test. Percentages may not total 100% because of rounding.

†n=128 for service orientation scale, n=125 for social consciousness scale, n=127 for economic orientation scale.

‡n=636 for service orientation scale, n=607 for social consciousness scale.

§n=261 for social consciousness scale.

††n=2,460 for social consciousness scale.

‡‡n=3,829 for service orientation scale, n=3,676 for social consciousness scale, n=3,829 for economic orientation scale.

Sources:
1. American Dental Association Survey of Predoctoral Education, 2007.
2. National Conference of State Legislators, 2007.
3. Adult Benefits Chart, Medicaid/SCHIP Dental Association, 2007.
4. American Community Survey, 2006.
5. American Dental Association Distribution of Dentists in the United States by Region and State, 2003.
6. Health Resources and Services Administration, Bureau of Primary Health Care's (BPHC) Uniform Data System, 2003.

Table 3. Plans to serve according to income/URM status, by percentage of respondents by category

	Income Less Than or Equal to $50,000: URM (n=129)	Income Less Than or Equal to $50,000: Non-URM (n=637)	Income More Than $50,000: URM (n=271)	Income More Than $50,000: Non-URM (n=2,547)	All Students (n=3,584)
More than 25% minorities (%)	50.8%[a]	27.9%[b]	49.3%[a]	17.2%[c]	22.7%
More than 25% special care patients (%)	11.7%[a]	10.4%[a]	11.6%[a]	8.3%[a]	9.1%
More than 25% rural patients (%)	18.6%[a]	20.2%[a]	18.3%[a]	19.5%[a]	19.5%
In public service (%)	15.5%[a]	11.6%[ab]	14.0%[a]	8.4%[b]	9.7%
Percent of all students	3.6%	17.8%	7.6%	71.0%	100%

Note: Percentages with the same letter (a, b, c, d) are not significantly different from each other at the p=0.05 level, using an unadjusted (not accounting for clustering by school) Duncan's multiple means test.

significant student characteristics associated with greater intentions to serve rural populations. Significant community characteristics included fewer URM state legislators, states without adult Medicaid dental benefits, and a lower number of FQHCs in the county.

In addition to significant income/URM relationships, other factors significantly related to public service included a high service orientation but low economic orientation score, school in a state without adult Medicaid benefits, and academic preparation in a Non-Pipeline program school (Table 4). Issues concerning graduation debt were importantly related to plans for public service. Students with a large debt ($168,000–$350,000) were three times less likely to plan public service than those with a low debt (less than $70,000), and those participating in a loan repayment program were almost ten times more likely to plan public service as those not participating.

Summary and Implications

A long-term objective of the Pipeline program was to improve dental care access for the underserved by increasing enrollment of underrepresented minorities (URMs) and low-income (LI) students in dental schools. However, the program in fact emphasized URM recruitment but not the recruitment of LI students. We have shown in this article that the majority of LI students are not URMs and, conversely, that the majority of URMs are not LI. Consequently, recruitment programs targeted toward URMs will miss large segments of LI applicants.

We have also shown that LI students who are URMs differ in other important aspects from those who are not URMs. Similarly, URM students who are low-income differ in important ways from those

who are not low-income. Thus, in analyzing who among graduating dental students have intentions to serve underserved populations, we have examined four groups separately: 1) low-income URMs, 2) low-income non-URMs, 3) high-income URMs, and 4) high-income non-URMs. Our income variable constructed for these analyses used parents' income less than $50,000 as "low-income." Under this definition, about one-fifth of graduating students are low-income; 17 percent of those are URM and 83 percent are non-URM. The vast majority of dental students, four-fifths, are categorized as higher income, with parental income reported at more than $50,000; 10 percent of those are URM and 90 percent are non-URM.

Because there are multiple ways of providing dental care to underserved populations, we examined students' intentions to include in their practice 25 percent or more minority patients, special care populations, or rural patients and whether they intended their primary activity upon graduation to be "public service" (employed in a community clinic or government service). Importantly, the intentions to serve of low-income and URM students varied considerably depending on the type of service.

Quite clearly, recruiting URM students leads to more graduating students with intentions to serve minorities. Whether the income of URM students was high or low, about half in each income group stated they would provide care to underserved minority patients, compared to 28 percent of the low-income non-URM students and 17 percent of the higher income non-URM students. Even after a multivariable analysis controlling for other student demographic characteristics, contextual variables, and students' graduating characteristics, the odds that URM students would serve minorities were almost three times

Table 4. Multivariable analysis of plans to serve (all students): odds ratios

	More Than 25% Minorities	More Than 25% Special Care Patients	More Than 25% Rural Patients	In Public Service
STUDENT PREDISPOSING CHARACTERISTICS				
Demographics				
Income/URM (reference is high income/non-URM)				
Low income (less than or equal to $50,000)/URM	2.99***			2.19*
Low income (less than or equal to $50,000)/non-URM	1.56***			1.43*
High income (more than $50,000)/URM	2.85***			1.33
Age 29 and up		1.28*	1.23*	
Male (reference is female)	0.82*			
Father had at least some college education			0.80*	
CONTEXTUAL VARIABLES				
School Characteristics				
Time spent on cultural competence (reference is appropriate)				
Inadequate	0.77	0.11*		
Excessive	2.52*	0.46		
Pipeline school (reference is non-Pipeline)				0.67*
Community Characteristics				
URM legislative members in state (%)			0.97***	
Adult Medicaid benefits in state (reference is no coverage)				
Emergency coverage	0.80		0.73	0.73
Limited coverage	0.66**		0.60*	0.75
Full coverage	0.64**		0.57*	0.50*
Federal poverty level less than 200% in county		1.02*		
Number of FQHCs in county (%)	1.03*		0.93**	
Student's Graduating Characteristics				
Attitudes				
Service orientation scale	1.58***	1.42***		1.25**
Social consciousness scale	1.28**			
Economic orientation scale	0.76***			0.81**
Debt on graduation				
Amount of debt ($) after graduation (reference is <$70,000)				
$70,000–$119,000				0.69
$120,000–$167,000				0.46***
$168,000–$350,000				0.31***
Do you worry about debt on graduation? (much/v. much)	1.32**			
Participation in loan repayment program	1.32*	1.72**	2.53***	9.78***

Note: Random-effects logistic regression models were used.
*p<.05; **p<.01; ***p<.001

the odds that high-income non-URM students would do so. This multivariable analysis also revealed that recruiting low-income non-URM students might also lead to greater odds of serving minorities (OR=1.56) than high-income non-URMs, but URM status was considerably more important than income level in determining intentions to serve minorities. These findings are consistent with our earlier work showing the significant relationship between URM status and plans to care for underserved minority patients;[7,8]

however, these findings reveal that, regardless of parental income, the URM dental students are relatively steadfast in their intentions to provide care to underserved minority patients upon graduation.

Turning to the bivariate and multivariable analyses of intentions to provide dental care to other underserved populations, we found the income/URM status categories not significantly related to serving special care or rural populations. This suggests that recruiting more low-income or URM students may

not lead to improved access to dental care for those populations.

Finally, the bivariate analyses of intentions of students to enter public service as their primary activity upon graduation revealed that both the URM groups and the low-income non-URM group had significantly higher percentages intending to go into public service than the high-income non-URM group. Further, the multivariable analyses showed both the low-income groups had significantly greater odds (URMs' OR=2.19; non-URMs OR=1.43) of public service than high-income non-URM students, but the odds for the high-income URMs (OR=1.33) was not significantly different. These multivariable results suggest that recruitment of both low-income groups (URM and non-URM) might be especially helpful in producing graduates who choose to practice in public service.

Other student demographics, contextual variables, and students' graduating characteristics were also significantly associated with intentions to serve the underserved in the multivariable analyses. Results for the student predisposing demographic characteristics suggest that recruiting more older students (twenty-nine and up) might increase intentions to serve special care and rural populations among graduates. Females appear more likely to serve minorities, and students whose parents are less well educated (fathers had no college) are more likely to serve rural populations.

Multivariable results for the contextual school variables suggest that students from schools where the student body was more likely to describe the time spent in the cultural competence curriculum as "excessive" actually had greater intentions to serve minorities than students who thought the cultural competence curriculum was appropriate. Does this mean that individuals who choose to serve minorities are significantly more likely to think they received too much cultural competence training? The answer is no. Among students choosing to serve minorities, only 9 percent described their cultural competence training as excessive compared to 10 percent of students not intending to serve minorities. Rather, students as a whole in those schools turning out more students intending to serve minorities are more likely to describe the cultural competence curriculum as excessive. Thus, it may be that schools turning out more students intending to serve minorities emphasize the cultural competence curriculum to the extent that students not intending to serve minorities are more likely to describe it as "excessive."

Students from schools where the students were more likely to describe the cultural competence curriculum as "inadequate" were less likely to intend service to special needs populations. It is possible that, in this case, schools where more of their students describe the cultural competence instruction as "inadequate" are less likely to produce graduates who intend to serve patients with special needs. In the multivariable analyses, we found students attending Pipeline schools less likely to plan for public service upon graduation than students in non-Pipeline program schools. This is a bit surprising given the long-term objective of the program to encourage graduates to serve the underserved. However, this finding is partially explained by the fact that Pipeline program schools include proportionately more low-income and URM students who are more likely to seek public service, and these characteristics are controlled for in the multivariable analysis.

Turning to the multivariable findings for the contextual community characteristics, we did find a number of community variables correlated with students' practice intentions. Students from schools in states with proportionately more URM members in the state legislature were less likely to intend serving rural populations. This may be partially explained by the likelihood that states with more URM legislative members tend to be less rural and students attending schools in those less rural states are less likely to intend serving rural populations. We also found dental students in states with no adult Medicaid dental benefits were more likely to intend to serve minorities and rural populations and go into public service than those in states with limited or full Medicaid dental benefits. It may be that student exposure to patients with no benefits might encourage them to serve underserved populations. Students in schools in counties with a higher percent of the population with incomes less than 200 percent of the federal poverty level were more likely to intend service to special care populations, possibly suggesting that, in this case, student exposure to increased poverty might increase their intention to serve the underserved. Finally, we found the number of FQHCs in the county in which the school was located to be positively related to intentions to serve minorities but negatively related to intentions to serve rural populations. The former finding might suggest that greater student exposure to community clinics might increase their intentions to serve minorities, while the latter finding might suggest that FQHCs are less likely to be in less populated counties and students from schools

in those counties are the ones more likely to intend service to rural populations.

The last major component of our model—students' graduating characteristics—includes students' attitudes and their experience with debt and debt repayment. Our results showed a number of significant relationships in the multivariable analyses. Recruiting students who report going into dentistry to serve others may produce graduates who are more likely to plan in their practice to serve minorities and patients with special needs and to be employed in public service. Students who scored higher on the social consciousness scale and lower on the economic orientation scale might also be recruited with the intent of increasing those who intend minority service and public service. Students with high debt upon graduation were much less likely to plan public service. Any approaches to reduce the level of debt of graduating seniors would appear to significantly increase the proportion of graduates who might choose public service. Increasing access to loan repayment programs through better financing is an incremental policy approach to improve short-term access and should be examined more closely in a cost-effective analysis to quantify the gain in access.[14]

More worry about debt upon graduation was associated with increased likelihood that students planned to serve minorities. Those planning to provide more care to minority patients may be especially concerned that their choice of service will make it especially difficult to repay their debt. Finally, we found that participation in a loan repayment program significantly increased the likelihood that graduating seniors intended to serve the underserved according to every measure of service we examined: service to minorities, special care populations, rural populations, and especially public service (the odds ratio of 9.78 for the latter was the largest of any in our analyses). There seems little doubt that increasing participation in loan repayment programs could have a substantial impact on graduating dental school students' intentions to serve the underserved.

The findings reported here are from the 2007 ADEA survey of dental school seniors, which represent the views and experience of one cohort of graduating seniors in the United States after the Pipeline program. Although the results are cross-sectional and only reflect a single cohort, these results are consistent with our previous findings and extend our knowledge regarding the predictors of serving all of the vulnerable population subgroups. Parental income was used as a proxy for student income be-

cause the ADEA survey does not ask a direct question about the student's income level, but rather focuses on debt and loan repayment. Further, in the Pipeline program schools we found that administration did not have systematic records on the income status of students or their parents. This dearth of systematic data made it challenging to investigate the influence of income on the Pipeline program outcomes, but this study has substantially advanced what we know about the important influence that income plays in practice plans. Income and URM status should figure into future efforts to recruit individuals with characteristics associated with improving access for high-risk populations.

Conclusions

More research to examine the trends in practice plans (including where they actually practice as well as their intentions) over time by income/URM status would strengthen the validity of these findings. It might also be informative to examine the differences in the non-URM category of students by assessing practice plans for Asian/Pacific Islander and white students separately that were shown to be different in earlier analyses.

This study has addressed a critical evaluation question—namely, the relationship between income and URM status and practice plans upon graduation from dental schools to address access to dental care concerns in the United States. It is unclear how or if health care reform measures will affect the financing for dental care to improve access. A relatively low-cost policy intervention appears to be to expand financing for loan repayment in exchange for public service.

Acknowledgments

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