The Impact of Oral Health on the Academic Performance of Disadvantaged Children

Hazem Seirawan, DDS, MPH, MS, Sharon Faust, DDS, and Roseann Mulligan, DDS, MS

Objectives. We measured the impact of dental diseases on the academic performance of disadvantaged children by sociodemographic characteristics and access to care determinants

Methods. We performed clinical dental examinations on 1495 disadvantaged elementary and high school students from Los Angeles County public schools. We matched data with academic achievement and attendance data provided by the school district and linked these to the child's social determinants of oral health and the impact of oral health on the child's school and the parents' school or work absences.

Results. Students with toothaches were almost 4 times more likely to have a low grade point average. About 11% of students with inaccessible needed dental care missed school compared with 4% of those with access. Per 100 elementary and high school–aged children, 58 and 80 school hours, respectively, are missed annually. Parents averaged 2.5 absent days from work or school per year because of their children's dental problems.

Conclusions. Oral health affects students' academic performance. Studies are needed that unbundle the clinical, socioeconomic, and cultural challenges associated with this epidemic of dental disease in children. (*Am J Public Health.* 2012;102:1729–1734. doi:10.2105/AJPH.2011.300478)

Poor oral health affects systemic health with consequences that can seriously compromise quality of life and life expectancy. Oral diseases can lead to systemic diseases, emergency hospital visits, hospital stays, medications, even death. Moreover, oral disease can increase personal, societal, and financial burdens and contribute to rising health care costs in general.[1]

Anecdotally, we know that there is an epidemic of dental diseases among disadvantaged children in Los Angeles County, as is consistently observed by health professionals and community stakeholders. To quantify this observation, we established a campus–community project with the goals of measuring this epidemic and its impact and designing appropriate intervention programs to ultimately reduce the burden of poor oral health among these children. Previously, we documented that the overall prevalence of dental caries in this population of disadvantaged children was 73% and that no important racial/ethnic differences were found between Blacks, Asians, White, and non-White or "other" Hispanics.[2] One aspect of this project, which we have reported in this article, is to measure the impact of dental diseases on the academic performance of these disadvantaged children by their sociodemographic characteristics and access to care determinants.

It has been suggested that objective measures of oral health should be linked to measures of social outcome to place dental conditions within a broader context that is relevant to policymakers.[3] Based on the National Health Interview Survey of 1989, it has been estimated that 51 million school hours are lost yearly because of dental disease based on a 15-day recollection.[4] This result has been widely cited. A Google search provided more than 57 000 hits when queried for "dental" + "51 million school hours." According to the Thomson Scientific's Institute for Scientific Information web of knowledge, this resource has been cited in the scientific literature 55 times. More recently, the California Health Interview Survey asked about the number of school days missed in the past year because of dental problems; the question was asked only in the survey of 2007.[5] No other literature sources provide definitive estimates of the number of school hours missed because of dental problems besides that reported by Gift et al.,[4] nor is there any estimation of the impact of oral health on the students' academic achievement. Furthermore, it should be noted that the means and SDs reported by Gift et al. were acknowledged as being inaccurate, and no corrected estimates were subsequently published.[6] We have provided an updated estimate of the impact of dental problems on disadvantaged children missing school and parents missing school or work based on their 1-year recall. Also, we explored the relationship of oral health with academic achievement and attendance by school level, gender, and race/ethnicity. We will report other aspects of the project elsewhere.[2]

METHODS

We have published the detailed methods of the study previously.[2] In summary, the study recruited children in the age groups of 2 to 5, 6 to 8, and 14 to 16 years to represent the 3 stages of dentition in children: deciduous, mixed, and permanent. The sampling frame for each group included Women, Infants, and Children centers and Head Start preschools (for those aged 2–5 years), elementary schools (for those aged 6–8 years), and high schools (for those aged 14–16 years) in Los Angeles County, California. We determined 2 site inclusion criteria: (1) the site must be either a Women, Infants, and Children center or a Head Start preschool, or (2) the elementary and high schools needed at least 50% of their students to be from a minority race or ethnic group with at least 62% of them receiving the reduced or free meals program. We chose 62% because it represents the average percentage of public schools' students receiving reduced or free meals programs in Los Angeles County. We selected the inclusion

criteria to ensure that any selected school in the sample would have a majority of racial or ethnic minorities. We randomly selected the sample sites in a proportional-to-size random sample clustered by age group except for the Head Start preschools, for which we used simple random sampling. As the study progressed, we added several schools that met the above criteria to increase the representation of Asian and Black children. Our sample goal was to recruit 50 students from 45 sites (15 sites for each age group) for a total of 2250 children.

We sent invitation letters to selected schools and then telephoned principals to further explain the project. We sent consent forms and a questionnaire to the parents to collect information about their child's sociodemographic determinants, access to care, oral health behaviors, and the parents' attitudes toward oral health. The investigated sociodemographic determinants were race/ethnicity, gender, place of birth, language spoken at home, parents' education, number of people living at home, family household income, and whether the child receives reduced or free meals at school. Questions in the section "Access to care" included recent toothache in the past 6 months and unmet dental needs in the past 12 months. The Association of State and Territorial Dental Directors[7] proposed and worded these questions as "During the past 6 months, did this child have a toothache more than once, when biting or chewing?" and "During the past 12 months, did this child need dental care but was not able to get it?" The questionnaires were available to the parents in English, Spanish, Vietnamese, and Chinese. The parents reported race/ethnicity. These questions included asking the number of days over the past year the child missed school because of dental problems or parents missed school or work because of the child's dental problems. Two general dentists conducted the clinical oral health examinations for all the children at their respective schools subsequent to having successfully completed several calibration sessions. This process resulted in an acceptable κ of 80%. We adapted the Association of State and Territorial Dental Directors protocol for basic screening surveys for the clinical examinations.[7] The outcome variables of the examination included presence of dental caries and type of treatment needed. We defined cavitated dental caries as a minimum of 0.5 millimeters discontinuity of enamel and white spot lesions (noncavitated dental lesions) as demineralization in which the color and translucency of the tooth surface are altered. We determined types of treatment needed as (1) "urgent" for immediate care involving pain, infection, swelling, extensive carious lesions, advanced periodontal conditions, or suspicious soft tissue lesions; (2) "early" for care needed within 15 days to treat dental caries, mild gingivitis, and minimal calculus; or (3) "routine" for dental care within 6 months for prevention.

The Los Angeles Unified School District (LAUSD) Office of Data and Accountability compiled and provided the academic achievements and attendance information of the students. The information included the students' number of absent days, California Standards Tests scores, proficiency levels for English language arts and mathematics, and grade point averages (GPAs; available for high school students only). These data were for the past 2 years, when available. We coded proficiency levels from 1 to 5, where 1 indicates "far below basic" (a serious lack of performance) and 5 indicates "advanced" (superior performance). Levels 2, 3, and 4 indicate "below basic," "basic," and "proficient," respectively.

We computed frequency tables, the χ^2 test, and logistic regression models. The dependent variables were the total number of the child's absent days (reported by the school), numbers of the child's and parents' absent days because of the child's dental problems (reported by the parent), scores and proficiency levels in English language arts and mathematics, and GPA. We averaged the school performance items per year from the available information for the past 2 years, and when used in logistic regression models, we coded them into binary variables based on their medians. The independent variables were type of school (elementary vs high), gender, race/ethnicity, plus 3 objective measures and 2 subjective measures of oral health. The objective measures included all untreated caries, untreated cavitated caries only, and emergent dental needs. The subjective measures were the reported variables of toothache in the past 6 months and inaccessible but needed dental care in the past year. We tested 2 additional independent variables for their effects on the study outcomes: dental insurance and English as the first or main language spoken at home. We adjusted the logistic regression models for type of school, gender, and race/ethnicity when needed.

RESULTS

We recruited a total sample of 2313 children from 59 sites (7 Women, Infants, and Children centers, 10 Head Start preschools, 21 elementary schools, and 21 high schools) to represent disadvantaged children in Los Angeles County. Of them, 1495 students were elementary and high school students, with their parents indicating that 6.4% of the parents and 5.5% of the children missed school days or workdays because of their children's dental problems. We excluded children aged 2 to 5 years from this analysis because they did not have academic records. We retrieved and included the academic records of 629 children from LAUSD (considered the LAUSD subsample) in the analyses. These academic records represented 87% of all the LAUSD elementary and high school students enrolled in the study who, with their parents, consented to the release of these records (720 gave permission, but not all records were retrievable from the school district). Approximately half of the children in this LAUSD subsample were boys (45%), 10% Asians, 24% Blacks, and 66% Hispanics (Table 1). About 73% of the children lived in homes with household family incomes of less than $35 000. Both parents of about one third of the children had less than a high school education. About 36% of the children lived in a home where English was not spoken at all, and 15% were born outside the United States (data not shown). In the total subsample, the prevalence of cavitated caries was 40%, and the prevalence of cavitated or white lesions (noncavitated caries) was 69%. Nineteen percent of the children had a toothache in the past 6 months, 22% had dental needs but could not access dental care in the past year, and 8.5% needed immediate dental care (data not shown). These results from the LAUSD subsample are similar to the results from the complete sample (LAUSD or non-LAUSD).[2]

TABLE 1—Academic Achievements, School Attendance, and Impact on Parents: Impact of Oral Health on Children and Parents, Los Angeles County, California, 2008–2009

		Academic Achievements[a]					Attendance		Impact on Parents
Variables	No. (%)	Test Score (English Language Arts), Mean (SD)	Proficiency (English Language Arts), Mean (SD)	Test Score (Mathematics), Mean (SD)	Proficiency (Mathematics), Mean (SD)	GPA, Mean (SD)	No. of Child's Total Absent Days,[a] Mean (SD)	No. of Child's Absent Days (for Dental Problems),[b] Mean (SD)	No. of Parent's Absent Days (for Child's Dental Problems),[b] Mean (SD)
Level of school									
Elementary	287 (45.6)	349.9 (53.8)**	3.5 (1.1)	369.7 (69.6)***		. . .	6.0 (5.5)***	2.1 (1.4)	2.6 (2.8)
High	342 (54.4)	338.2 (45.9)	3.3 (1.0)	307.5 (52.4)	2.5 (1.0)	2.6 (0.9)	2.6 (3.4)	2.3 (1.2)	2.4 (2.1)
Gender									
Boy	283 (45.0)*		3.3 (1.1)	340.6 (69.0)*	3.1 (1.2)	2.4 (0.9)**	3.8 (4.3)	2.0 (1.2)	2.3 (1.9)
Girl	346 (55.0)	347.3 (48.3)	3.5 (1.0)	330.1 (66.8)	2.9 (1.2)	2.7 (0.8)	4.4 (5.1)	2.3 (1.4)	2.8 (3.0)
Race/ethnicity									
Asian	60 (9.7)	380.9 (47.0)***	4.2 (0.8)***	389.1 (62.7)***	3.8 (0.8)***	3.3 (0.7)***	2.1 (3.0)**	1.8 (1.0)	1.5 (0.7)
Black	147 (23.8)	345.9 (49.5)	3.4 (1.1)	338.9 (70.1)	3.1 (1.2)	2.6 (0.7)	4.8 (5.0)	2.5 (1.5)	2.9 (3.5)
White Hispanic	32 (5.2)	356.8 (58.3)	3.6 (1.4)	344.5 (71.5)	3.3 (1.3)	2.6 (0.9)	5.4 (6.9)	1.8 (0.5)	1.8 (0.5)
Other Hispanic	378 (61.3)	335.7 (46.4)	3.2 (1.0)	323.9 (62.3)	2.8 (1.2)	2.5 (0.9)	4.0 (4.6)	2.2 (1.4)	2.6 (2.0)
Total	629	343.3 (49.8)	3.4 (1.1)	334.7 (67.9)	3.0 (1.2)	2.6 (0.9)	4.1 (4.8)	2.2 (1.3)	2.5 (2.5)

Note. GPA = grade point average. LAUSD = Los Angeles Unified School District.
[a]Data are from the LAUSD Academic Records database with n = 629.
[b]Data are from the questionnaire completed by the parents with n = 1495.
*$P < .05$; **$P < .01$; ***$P < .001$.

The students had an average proficiency level of 3.4 in English language arts and 3.0 in mathematics, indicating that their level was between basic and proficient. High school students performed poorer in mathematics than did elementary school students ($P < .001$). High school boys had a lower GPA than did high school girls ($P = .002$). Asian students performed consistently and statistically significantly better than did other races/ethnicities ($P < .001$) and were the only race/ethnicity to achieve an average GPA above 3 points and a proficiency level between proficient and advanced in English language arts. Elementary school students averaged 6 absent days compared with 2.6 among high school students. Asian students had an overall average of 2.1 absent days per school year less than did all others ($P < .001$). Children averaged 2.2 absent days per school year for dental problems, and parents averaged 2.5 absent days from work or school per year because of their children's dental problems (Table 1).

Table 2 details the impact of different subjective (toothache and inaccessible needed dental care) and objective (dental caries and immediate dental needs) measures of oral health on students' school absences because of dental problems. Almost 16% of students with toothaches in the past 6 months missed school compared with 3% of those without toothaches ($P < .001$). Also, almost 11% of students with inaccessible needed dental care in the past year missed school compared with 4% of those who had access to dental care ($P < .001$). The impact of these subjective measures of oral health (toothache and inaccessible needed dental care) on attendance was consistently and statistically significantly higher among those with poorer oral health when we compared levels of schooling, genders, and between Asians and other Hispanics. Of students with caries, 6% missed school compared with 4% of those without caries, which was not statistically significant; however, 9% of students with urgent dental needs missed school compared with 5% of those without urgent dental needs ($P = .048$; Table 2). Neither whether the child had dental insurance nor whether English was the first or main language spoken at home was statistically significantly correlated with the child's number of missing school days for dental problems (data not shown).

Table 3 shows the odds ratios (ORs) of different subjective and objective measures of oral health on students' academic achievements and attendance and on the parents' missing school days or workdays because of their children's dental problems. Students with toothaches in the past 6 months were almost 4 times more likely to have a GPA lower than the median of 2.8 compared with students without a recent toothache ($P < .001$). Also, students having toothache resulted in students being nearly 6 times more likely to miss school days and their parents 4 times more likely to miss school or work because of the children's dental problems compared with students not having toothache ($P < .001$). Students with inaccessible needed dental care were 3 times more likely to miss school days because of dental problems than were those with access to dental care ($P < .001$). Objective measures of oral health were not as statistically significantly associated with the outcome variables. Students having caries were more than 2 times as likely to result in their parents missing school or work days because of their children's dental problems ($P = .01$). Students categorized as having urgent dental needs were also more

TABLE 2—School Absences Resulting From Subjective and Objective Measures of Oral Health (n = 1495): Impact of Oral Health on Children and Parents, Los Angeles County, California, 2008–2009

	Subjective Measures of Oral Health, No. (%)				Objective Measures of Oral Health, No. (%)				Missing School Days Because of Dental Problems, No. (%)	Total No. (%)
Variables	Toothache, Present	Toothache, Not Present	Inaccessible Needed Dental Care, Present	Inaccessible Needed Dental Care, Not Present	Cavitated or Noncavitated Caries, Present	Cavitated or Noncavitated Caries, Not Present	Urgent Dental Needs, Present	Urgent Dental Needs, Not Present		
Level of school										
Elementary	20 (13.7)	18 (3.2)***	15 (11.9)***		35 (6.3)	5 (2.8)	6 (6.3)	34 (5.4)	40 (52.0)	781 (52.2)
High	19 (18.5)	16 (3.0)***	11 (9.7)	20 (4.0)*	27 (5.7)	10 (5.1)	6 (17.7)	31 (4.9)**	37 (48.0)	714 (47.8)
Gender										
Boy	13 (12.3)	14 (2.8)***	11 (10.3)	16 (3.4)**	23 (4.9)	6 (3.4)	4 (6.7)	25 (4.3)	29 (37.7)	689 (46.1)
Girl	26 (18.2)	20 (3.5)***	15 (11.3)**		39 (6.9)	9 (4.6)	8 (11.6)	40 (5.8)	48 (62.3)	806 (53.9)
Race/ethnicity										
Asian	3 (7.3)	2 (1.0)**	3 (7.9)	3 (1.5)*	6 (3.0)	0 (0.0)	1 (3.1)	5 (2.2)	6 (8)	269 (18.7)
Black	9 (17.0)	10 (4.4)***	4 (10.3)	13 (5.3)	14 (6.8)	6 (6.7)	3 (11.1)	17 (6.4)	20 (26.7)	307 (21.3)
White Hispanic	1 (11.1)	3 (5.9)	2 (20.0)	2 (4.4)	3 (6.3)	1 (7.7)	0 (0.0)	4 (6.9)	4 (5.3)	64 (4.4)
Other Hispanic	25 (17.5)	18 (3.1)***	17 (11.6)	22 (4.1)***	37 (6.7)	8 (3.9)	8 (12.9)	37 (5.3)*	45 (60)	800 (55.6)
Total	39 (15.7)	34 (3.1)***	26 (10.8)	41 (3.9)***	62 (6.0)	15 (4.0)	12 (9.3)	65 (5.1)*	77 (5.5)	1495(100)

[a]Ninety parents did not answer the question about number of missing school days because of dental problems.
*$P < .05$; **$P < .01$; ***$P < .001$.

than 2 times as likely to miss more than 2.5 school days than were those without urgent needs ($P = .02$; Table 3). None of these ORs were confounded by level of school, gender, or race/ethnicity.

DISCUSSION

Oral diseases affect individuals and societies, contributing to students' lower academic achievements and compromising adults' ability to maintain a job or receive promotions.[8] These effects are more prominent when accompanied by oral deformity.[9,10] Even at the family level, the functioning of a family might be affected when a member cannot play his or her usual familial role because of oral health conditions.[8] Not surprisingly, we found severe caries to be associated with feelings of embarrassment, withdrawal and anxiety, and absence from and inability to concentrate in school, with the associated pain possibly affecting social interactions and daily behaviors and resulting in physical, social, and economic effects.[10,11] Because of oral health disparities, the impact of oral health on populations that suffer from poor oral health conditions might be more pronounced.[8]

The impact of oral health on social functioning and quality of life has been documented in the literature. Sanders et al. found that the impact of oral disease disproportionately affected disadvantaged groups.[12] Another study found that dental caries in the primary dentition had a significant impact on children's well-being in terms of eating patterns and sleep habits.[13] The World Health Organization acknowledged the social impact of oral diseases resulting in restricted school, work, and home activities and loss of millions of school and work hours annually.[14] The recent US Surgeon General's report on oral health acknowledged that people with oral diseases might avoid conversation, laughing, smiling, and other nonverbal expressions to hide their mouth and teeth; therefore, oral diseases are likely to damage self-esteem and compromise the ability to sustain and build social relationships, affecting dating and mating behaviors, other interpersonal contacts, and participation in social or community activities.[15] The report also emphasized that ignoring oral health compromises well-being, has financial and social costs, and diminishes quality of life.[15]

There is, however, little published research investigating the indirect costs of oral health measured by absences as a productivity factor.[8] A study of 1992 employed adults in Hartford, Connecticut found that almost 1 in 4 adults had an annual episode of work hours lost because of dental problems with a mean of 1.3 hours lost per person per year. The study found that the most important predictors of these annual episodes (having lost time as a yes or no question) were previous time lost, frequent dental visits, being young, and belonging to the higher social classes, whereas total time lost from work (actual lost hours measured) because of oral health was related to not only previous time lost but also poverty, being a member of a minority group, poor oral health, and greater treatment need. The authors of this study further explained that those who engaged in receiving preventive care were less likely to be absent from work overall, whereas non-Whites and the less affluent were more likely to miss more work hours because of extensive dental care needs, perhaps as a result of delayed treatment. The study suggested that because of the high prevalence of dental disease, workdays lost may be a useful population statistic in measuring the impact of oral health.[16]

Gift et al. reported that females miss more school hours than do males, White children miss more school hours than do Blacks, and the mean school hours missed increase with age.[4] This study also reported that Hispanics, those with income less than $35 000, and

TABLE 3—Subjective and Objective Measures of Oral Health: Impact of Oral Health Problems on Children and Parents, Los Angeles County, California, 2008–2009

Outcome Variables	Control Group	Median	Subjective Measures of Oral Health, OR (95% CI)		Objective Measures of Oral Health, OR (95% CI)	
			Toothache	Inaccessible Dental Needs	Cavitated or Noncavitated Caries	Urgent Dental Needs
Child's attendance						
No. of child's total absent d (for any reason)[a]	< 2.5	2.5	1.4 (0.9, 2.2)	0.9 (0.6, 1.4)	1.0 (0.7, 1.5)	2.3* (1.2, 4.7)
The child had ≥ 1 absent d (for dental problems)[b]	No absence	. . .	5.7*** (3.5, 9.3)	3.0*** (1.8, 5.0)	1.5 (0.9, 2.7)	1.9 (1.0, 3.6)
No. of child's absent d (for dental problems)[b]	< 2	2	1.5 (0.5, 4.1)	1.2 (0.4, 3.7)	0.3 (0.1, 1.3)	0.4 (0.1, 1.6)
Parent's absences because of child's dental problem						
The parent had ≥ 1 absent d (for child's dental problems)[b]	No absence	. . .	4.1*** (2.5, 6.5)	2.3** (1.4, 3.8)	2.2* (1.2, 4.0)	1.3 (0.7, 2.7)
No. of parent's absent d (for child's dental problems)[b]	< 2	2	1.2 (0.4, 3.5)	0.8 (0.2, 2.3)	1.5 (0.4, 5.2)	1.1 (0.2, 4.8)
Academic achievement						
Test score in English language arts	≥ 347	347	1.2 (0.8, 1.9)	1.5 (1.0, 2.4)	1.3 (0.9, 1.9)	1.1 (0.6, 2.1)
Test score in mathematics	≥ 329	329	1.2 (0.8, 1.9)	1.1 (0.7, 1.8)	1.3 (0.9, 1.8)	1.3 (0.7, 2.5)
Proficiency in English language arts	≥ 4	4	1.3 (0.8, 2.1)	1.5 (0.9, 2.3)	1.5* (1.1, 2.2)	1.0 (0.5, 1.9)
Proficiency in mathematics	≥ 3	3	1.0 (0.6, 1.5)	1.3 (0.8, 2.0)	1.2 (0.8, 1.8)	0.8 (0.4, 1.7)
GPA	≥ 2.8	2.8	3.7*** (1.8, 7.6)	0.7 (0.4, 1.3)	1.1 (0.7, 1.8)	2.6 (0.8, 8.6)

Note. CI = confidence interval; GPA = grade point average; OR = odds ratio.
[a]Data are from the LAUSD Academic Records database (n = 629).
[b]Data are from the questionnaire completed by the parents (n = 1495).
*P < .05; **P < .01; ***P < .001.

those without insurance appear to have more missed school hours. The California Health Interview Survey found that 4.3% of 6- to 8-year-old children who were under 185% of the federal poverty level (the level of the guidelines that, in 2009, made a student eligible for the reduced lunch program[17]) lost 1 or more school days in 2007 because of dental problems (not related to check-ups or cleaning visits). This increased to 5.5% among 14- to 16-year-old poor (under 185% of the federal poverty level) children.[5] In our study, we also found that about 5.5% of the children missed school days because of dental problems in the past year, which was not statistically different by level of school, gender, or race/ethnicity; boys had 55 and girls 86 hours missed per 100 students of the same gender compared with 82 and 155, respectively, in the study by Gift et al.[4]

Overall in our sample of children whose parents completed the survey, there were almost 169 days lost by students (77 students × 2.19 days) because of dental problems and 218 days lost (86 parents × 2.53 days) by parents because of their children's dental problems. Given the size of the LAUSD (136 873 students), these numbers translate to 16 431 school days annually. This is equivalent to 58 school hours missed each year per 100 elementary school-aged children and 80 school hours missed each year per 100 high school–aged children (based on the number of instructional minutes in LAUSD schools[18]). Our estimate is lower than the estimate by Gift et al. of 117 school hours missed each year per 100 school-aged children.[4]

To our knowledge, this is the first comprehensive study of dental caries among disadvantaged children of Los Angeles County that also investigates associated sociodemographic and access to care determinants. We have provided an estimate of the indirect cost of oral health on school performance and attendance of children and the school- or work-related absence of parents. Our estimate of absence as a result of oral conditions appears more conservative than does the previous estimation by Gift et al.[4] This might be related to an improvement in the oral health conditions during the elapsed 20-year period in the US population of children during which the prevalence of caries in the permanent dentition of 6- to 11-year-old children dropped from 9% to 7% between 1988 and 2002.[19] Another limitation of this direct comparison with the previous study is that our results are based on a sample of disadvantaged children from a specific geographic region and we attempted to recall activities of the past year, whereas Gift et al.'s study was based on a representative sample of US children with only a 15-day event recall.[4]

Despite these methodological and temporal differences, our results are remarkably consistent with the results of Gift et al.[4]: both conclude that there is a significant impact of oral health on overall child school attendance. Although we did not collect information about the reason for the dental visits associated with absences, we have pointed out the high rate of urgent dental needs expressed particularly in the high school population. It is relevant to mention that Reisine and Miller found that preventive visits accounted for most episodes of time lost from work because of dental problems (as a yes or no question) but fewer hours of work loss, suggesting that individuals with low socioeconomic characteristics postpone treatment until symptoms are more severe; thus they need more time off from school or work because of greater treatment needs.[16]

Limitations

This study has several limitations. The target population of the study is disadvantaged children in Los Angeles County; still we have made inferences to all public schools' students in Los Angeles. In Los Angeles County, the average and median percentages of public schools' students receiving reduced or free meals programs are 62% and 71%, respectively, and the average and median percentages of public schools' White students are 16% and 6%, respectively, which could justify profiling students in public schools in Los Angeles County as disadvantaged. Despite assurances of confidentially, parents might have been biased or might not have had accurate recall in their responses to the questionnaire, which would result in lower estimations of recent toothaches or unmet dental needs. Some parents did not consent to the release of the academic records of their children. It is possible that the unreleased records belong to students with low academic standing, which might have resulted in an underestimation of the correlations between poor oral health and poor academic achievement.

We did not record the number of invitations sent to the parents to participate in the study at each site. Site coordinators resent the invitations when no response (agreeing or declining to participate in the study) had been received from the parents, and then the coordinators expanded the invitations to other classrooms until the target goals of the sample from each school site were reached. It is worth noting that only 68 parents declined to participate in the overall study.

Conclusions

We have illustrated that there is indeed an impact of oral health on the student's academic performance. Although at an individual level the actual number of days absent from school to deal with dental problems may be trivial, our subjective and objective measures suggest that there are likely to be many more days wherein the student is suffering from the pain of untreated dental disease, thus accounting for poorer academic performance.

In addition, the aggregated impact of these indirect costs on the nation is enormous.[8] There are very few high-quality outcome measures in use in the evaluation of oral health policy and environmental interventions; developing these measures might advance oral health promotion programs.[20] We suggest that measures such as school and work absence because of dental problems calculated at the population level will serve these purposes. We agree with previous recommendations that to eliminate disparities, oral health education and programs must be more integrated into other health, educational, and social programs.[21] More studies are needed to unbundle the clinical, socioeconomic, and cultural challenges associated with this epidemic of dental disease in children. ■

About the Authors

At the time of this study, Hazem Seirawan, Sharon Faust, and Roseann Mulligan were with the Ostrow School of Dentistry, University of Southern California, Los Angeles.

Correspondence should be sent to Roseann Mulligan, DDS, MS, Charles M. Goldstein Professor of Community Dentistry at the Ostrow School of Dentistry, University of Southern California, 3305B South Hoover St., Bldg A, Rm 120, Los Angeles, CA 90089-7001 (e-mail: mulligan@usc.edu). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

This article was accepted September 19, 2011.

Contributors

H. Seirawan and R. Mulligan contributed to the study design and data analysis and interpretation. S. Faust was a clinical examiner during the study. All authors participated in the drafting and revision of the article.

Acknowledgments

The primary study from which this work was derived was supported by First 5 LA, the Annenberg Foundation, the California Endowment, and the California Wellness Foundation.

The authors would like to thank Caswell Evans (University of Illinois at Chicago), Julie Jenks and Harold Slavkin (University of Southern California), and Kim Uyeda and Cynthia Lim (Los Angeles Unified School District) for their valuable input. The authors would also like to thank the following program officers: Conrado Barzaga, MD, Reena John, MPH (First 5 LA), Beatriz Solis, PhD (California Endowment), Mark Eiduson (Annenberg Foundation), Sandra Martinez, MPH (California Wellness Foundation), and Jan Kern (Southern California Grantmakers).

Human Participant Protection

The approval of the University of Southern California and the Los Angeles Unified School District institutional review boards was obtained and satisfied throughout the project.

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