School Hours Lost Due to Acute/Unplanned Dental Care

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Objective: We estimated the school-hours lost for acute/unplanned dental care and examined the associated factors among children aged 5-17 years using 2008 National Health Interview Survey data. **Methods:** We used bivariate and multivariate regression models to investigate the associations between school hours lost and socioeconomic and oral health factors (p < .05). **Results:** Acute/unplanned dental care accounted for a loss of 34 million school-hours annually. Compared to children with very good oral health, children with fair/poor oral health were 2.8 times more likely to lose ≥1 hours. Children in high-income families had 31% less likelihood of losing any school hours due to acute dental care than those in low-income families. **Conclusion:** Numerous school-hours are lost due to acute/unplanned dental care and socioeconomic disparities exist in those lost hours.

Untreated dental problems contribute directly to significant healthcare costs and can have many indirect costs including time lost from school or work. Dental caries is one of the most prevalent childhood chronic diseases and can impact a child's physical, social, and emotional wellbeing.[1,2] One study found that among children with urgent dental problems, two-thirds had a report of tooth decay and more than half had a report of toothache.[3] Dental caries and/or its sequelae are the major contributors to emergency care use,[4] and cost much more than a routine dental visit. A 2014 study using national data estimated a mean hospital emergency department charge per visit involving dental conditions to be $760.[5]

Among children, dental problems can lead to embarrassment, anxiety, withdrawal, absence from school, inability to concentrate,[6] and poor academic performance.[7] A 2012 study using data from Los Angeles County public schools found that a significantly higher percentage of students with toothache missed school compared to those without toothache (16% vs 3%) and were 4 times more likely to have a low grade point average.[6] The same study concluded that students averaged 2.2 absentee days per school year for dental problems and parents averaged 2.5 absentee days from work or school per year due to their children's dental problems. Another state-level study found that children with poor oral health status were almost 4 times more likely to miss school due to dental pain or infection and had a higher likelihood of poor school performance due to school absences related to dental pain compared to their counterparts.[8] These state- and county-level studies provide some insights on how dental problems affect school performance and attendance. However, we do not have any recent information on hours lost due to dental problems at the national level.

The most frequently cited study, using the 1989 National Health Interview Survey (NHIS) data, reported an annual loss of 52 million school hours due to dental problems or dental visits.[9] However, findings from that study are over 25 years old. Furthermore, the study reported hours lost for any dental visit. The 1989 survey questions did not al-

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low any distinction made for hours lost by type of visits, namely routine/planned versus emergency/unplanned dental care.

In this paper, using the most current available data from NHIS 2008, we estimated hours lost from school for acute/unplanned dental care. In 2008, the NHIS core questionnaire implemented an additional child oral health supplement and provided an opportunity to disaggregate the hours lost by type of dental care visits. We also examined the association of hours lost for acute/unplanned dental care with demographic, socioeconomic and oral health factors.

METHODS
Data Source and Study Population

We used publicly available cross-sectional data from the 2008 NHIS and its child oral health supplement. The target population included children and adolescents 5 to 17 years old.

The NHIS is an annual household survey that follows a multistate area probability design. The survey is conducted by the US Centers for Disease Control and Prevention that supports national estimates of health status, healthcare access, and utilization for the civilian, non-institutionalized, US population. Since 1957, along with the core survey, NHIS had optional oral health supplements in years 1989, 1999, and 2008. Interviews are conducted in-person in respondents' homes. In the 2008 NHIS, a parent or adult household member responded for the sampled child. Additional information regarding the survey design, questionnaire, and implementation is available at http://www.cdc.gov/nchs/nhis/about_nhis.htm. For this study, NHIS family, person, and sample child files were merged.

Measures

Parents who reported that their child had seen a dentist in the past 6 months were asked the question: "Please tell me how many hours of school (sample child) has missed IN THE PAST 6 MONTHS for each one."

- "for emergency dental care where (sample child) saw the dentist within 24 hours or as soon as was possible;"
- "planned routine dental or orthodontic care;"

and

- "for tooth whitening or other cosmetic procedures."

We used all 3 responses to the above question to estimate total hours lost due to any dental visit. To obtain the average hours lost, we aggregated the midpoint hours from individual responses. For those with a response of 7 or more hours, we assumed 7 hours lost. The total hours lost for any type of dental care were doubled to get an annual estimate.

The primary outcome variable was school hours lost for emergency dental care (referred as acute/unplanned dental care). Predictor variables included age in years [5-10 (elementary school), 11-13 (middle school), 14 - 17 (high school)], sex, parental education level (high school or less, more than high school), ethnicity (Hispanic, non-Hispanic), family income (<$35,000, $35,000 to $74,999, and $75,000 or above), oral health status (very good, good, fair/poor), and dental care affordability (yes/no).

Data Analysis

Data management and analyses were conducted using STATA (version 13) to account for survey weighting and to adjust the variance for the multistage, clustered survey design. All data were weighted using survey weights to produce national estimates for US children and adolescent population. For all variables, the responses of "*don't know*" or "*unknown*" were set to missing due to their small sample size. For bivariate analysis, the outcome variable was categorized in 4 groups: 0 to less than 1 hour lost, 1 to less than 3 hours lost, 3 or more, and doesn't apply, which included those who did not go to school or had this type of dental care. We used multivariate analysis to examine:

- If the factors that impact losing any school hours for acute/unplanned care were different from not needing that type of care.
- If the factors that impact losing less than one hour for acute/unplanned care were different from loosing one or more hours.

Hence, we created 2 logistic regression models.

Table 1
Sample Characteristics - National Health Interview Survey, 2008

Characteristics	Unweighted Sample	Weighted %
Total	3833	100%
Age (Years)		
5-10	1639	45.52%
11-13	889	23.29%
14-17	1305	31.19%
Sex	3833	
Male	1922	49.65%
Female	1911	50.35%
Ethnicity	3833	
Hispanic	923	17.67%
Non-Hispanic	2910	82.33%
Parent Education	3827	
≤ High school	1073	25.96%
> High school	2754	74.04%
Family Income	3554	
$0 - $34,999	915	22.89%
$35,000 - $74,999	1155	32.08%
$75,000 or above	1484	45.03%
Oral Health Status	3829	
Very good	2238	59.35%
Good	1249	31.59%
Fair / Poor	342	9.06%
Dental Care	3830	
Can't afford	157	3.84%
Can afford	3673	96.16%

Both models excluded those who did not go to school. Estimates calculated from fewer than 50 observations or with more than 30% relative standard error were considered statistically unstable, and therefore, not presented. Chi-square test of independence and Wald F statistics examined the associations among sociodemographic factors, oral health status, dental care affordability, and school hours lost due to acute/unplanned care. All p-values < .05 were considered statistically significant.

RESULTS

In 2008, 3866 children and adolescents 5-17 years old had a report of a dental visit in the past 6 months and were eligible to answer questions about lost school hours due to a dental visit. For our main outcome for analysis, school hours lost due to acute/unplanned dental care, the sample included 3833 children, because 33 children had a missing response for the hours lost question for acute/unplanned care, and were removed from the final sample. An estimated average of 142 million hours were lost annually due to any dental visit among school-age children including routine/orthodontic (79.8 million), acute/unplanned (34.4 million), and cosmetic dental care (27.8 million).

In our sample, nearly one-third (31%) were high school age, 23% middle school age, and 46% elementary school age; moreover, 50% were male, 18% were Hispanic, 9% had fair/poor oral health and 4% could not afford dental care. Nearly 74% of children had a parent with more than high school education, 23% children lived in the family with incomes <$35,000 and 45% in families with incomes at or above $75,000. About 7% of the sample had missing data for family income (Table 1).

An estimated average of 34.4 million school hours were lost annually for acute/unplanned dental care (minimum: 8 million and maximum: 61 million hours); mean hours missed per child was 1.02. When stratified by age, for every 1000 children who saw a dentist in the past 6 months, 1091 hours were missed in the elementary age group, 966 hours in the middle school age group, and 969 hours in the high school age group.

Among children who lost at least one but less than 3 hours, 46% were elementary age, 26% were middle school age, and 28% were high school age. Similarly, among those who lost 3 or more hours of school, 60% were elementary age, 14% were middle school age, and 26% were high school age (Figure 1). However, these differences were not statistically significant.

Among children who saw a dentist in the past 6 months, 25% did not need any acute/unplanned dental care where they had to see the dentist within 24 hours or sooner, 2.6% had a report of missing at least one but less than 3 hours, nearly 2% had a report of missing 3 or more hours, and 70% had a report of missing zero to less than one hour of school (Table 2).

In the bivariate analysis, we found that, 3.6% of Hispanic children lost at least one but less than 3

Figure 1
Distribution of School Hours Lost by Age – National Health Interview Survey, 2008
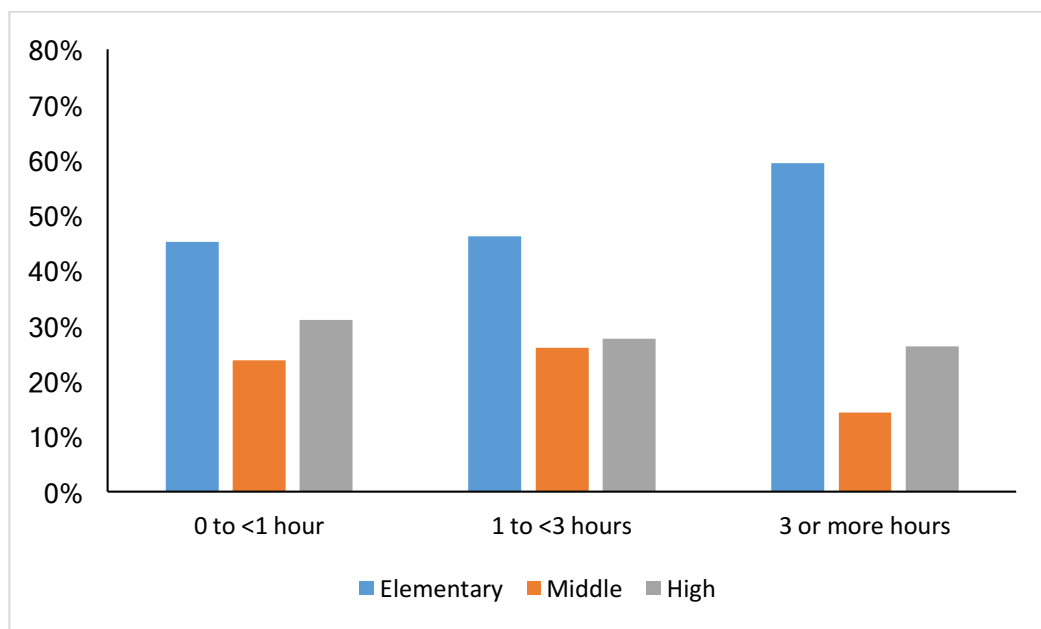
Note.
5 to 10 years = elementary school age, 11 to 13 years = middle school age, and 14 to 17 years = high school age

hours, and 3 or more hours, compared to 2.4% and 1.6% of non-Hispanic children respectively. Similarly, a greater proportion of children whose parents' had high school or less than high school education (3.9%), or children in families with incomes less than $35,000 (3.5%), lost 3 or more hours compared to their counterparts whose parents had more than a high school education (1.3%) or those living in families with incomes of $75,000 or more (1.1%) respectively. Among children with fair/poor oral health, 6.3% lost 3 or more hours compared to 1.3% of those with very good oral health.

In the multivariate models, model 1 compared children who lost any amount of school hours due to acute/unplanned care to those who did not need that type of care. We found that children with family incomes ≥$75,000 were less likely to need acute dental care compared to those in low-income families (OR = 0.69; 95% CI (0.51-0.92)) (Table 3).

Model 2 compared children who lost less than one school hour to those who lost one or more school hours due to acute/unplanned dental care.

Children with good oral health were 1.6 times and those with fair/poor oral health condition were 2.7 times more likely to lose one or more hours compared to those with very good oral health condition (Table 3).

DISCUSSION

Significant advances have been made in the past decades to reduce the burden of oral diseases and to increase access to oral healthcare among children. However, disparities persist.[10] Our findings show that 34.4 million school hours were lost annually because of acute/unplanned dental care. Out of every 4 children, 3 visited a dentist in the past 6 months for some type of acute/unplanned dental care. One of the explanations for this finding could be that dental care is utilized mainly when there is urgent need/problem.[3]

Compared to 1989 data, when researchers found 52 million hours were lost due to any dental visit,[9] we found 142 million hours were lost due to any dental visit. However, when disaggregated by the

Table 2
Percentage of Children and Adolescents Who Lost School Hours for Acute/Unplanned Dental Care by Selected Characteristics – National Health Interview Survey, 2008

Characteristics	School hours lost due to acute/unplanned dental care (%, SE)				p-value
	0 to less than 1	**1 to < 3**	**3 or more**	**Does not apply**[a]	
Total	70.46 (1.28)	2.63 (0.38)	1.94 (00.26)	24.96 (1.19)	
Age (Years)					.530
5-10	70.04 (1.74)	2.67 (0.56)	2.53 (0.46)	24.75 (1.64)	
11-13	71.74 (2.10)	2.95 (0.77)	1.19 (0.33)	24.12 (2.02)	
14-17	70.10 (1.92)	2.34 (0.65)	1.64 (0.38)	25.91 (1.74)	
Sex					.858
Male	69.95 (1.59)	2.47 (0.50)	1.89 (0.34)	25.67 (1.55)	
Female	70.95 (1.64)	2.79 (0.53)	1.98 (0.38)	24.27 (1.52)	
Ethnicity					.015
Hispanic	68.98 (2.09)	3.61 (0.96)	3.62 (0.74)	23.79 (1.92)	
Non-Hispanic	70.77 (1.39)	2.42 (0.41)	1.58 (0.27)	25.22 (1.32)	
Parent Education					<.001
≤ High school	71.77 (1.92)	2.77 (0.70)	3.88 (0.68)	21.56 (1.73)	
> High school	69.93 (1.52)	2.59 (0.43)	1.26 (0.24)	26.21 (1.47)	
Family Income					.005
< $34,999	73.45 (2.02)	2.96 (0.80)	3.52 (0.67)	20.07 (1.77)	
$35,000-$74,999	69.62 (1.96)	3.01 (0.72)	2.31 (0.56)	25.06 (1.83)	
$75,000 or above	68.38 (1.99)	2.56 (0.54)	1.11 (0.30)	27.93 (1.91)	
Oral Health Status					<.001
Very good	70.99 (1.58)	1.93 (0.36)	1.27 (0.24)	25.81 (1.49)	
Good	70.92 (1.71)	3.79 (0.80)	1.95 (0.46)	23.33 (1.61)	
Fair/ Poor	65.72 (3.65)	[b]	6.26 (1.62)	25.73 (3.32)	
Dental Care					.002
Can't afford	74.97 (4.43)	[b]	[b]	16.86 (3.87)	
Can afford	70.25 (1.31)	2.67 (0.39)	1.77 (0.25)	25.31 (1.23)	

Note.
a: those who had a report of "doesn't go to school or did not have this type of dental care"
b: Unreliable estimates, RSE => 30%

type of dental care visit, 34.4 million were lost due to acute/unplanned care, 79.8 million due to routine/orthodontic care, and 27.8 million hours due to cosmetic care. Following reasons can explain why our findings differ from those of Gift et al.[9] First, a significant loss of hours in routine and orthodontic care could be attributed to the increased awareness of oral care in the past few decades. Second, the population has increased in the past 2 decades resulting in the overall increase in the loss of total hours although the mean hours lost per child declined. Finally, the survey questions used and methods employed by Gift et al[9] differed from ours.

Numerous school hours are lost due to acute/unplanned dental care. Researchers have found that school absences caused by dental pain or infection were significantly related to poor school performance, but school absences for routine dental care were not.[8] Timely and regular use of preven-

Table 3
Adjusted Odds Ratio for Lost School Hours Due to Acute/Unplanned Dental Care among School Children – National Health Interview Survey, 2008

Variable	Emergency or unplanned dental care	
	Model 1[a] Odds Ratio (95% Confidence Intervals) N = 3516	Model 2[b] Odds Ratio (95% Confidence Intervals) N= 2696
Sex		
Male	1	1
Female	1.06 (0.85 – 1.31)	1.15 (0.76 – 1.73)
Age (Years)		
5-10	1	1
11-13	1.02 (0.79 – 1.34)	0.75 (0.45 – 1.26)
14-17	0.93 (0.74– 1.17)	0.86 (0.52 – 1.43)
Ethnicity		
Hispanic	1	1
Non-Hispanic	1.04 (0.82 – 1.34)	0.67* (0.43 – 1.02)
Parent Education		
≤ High school	1	1
> High school	0.89 (0.68– 1.17)	0.74 (0.47 – 1.19)
Family Income		
< $34,999	1	1
$35,000-$74,999	0.80 (0.59 – 1.06)	1.07 (0.66 – 1.73)
$75,000 or above	0.69** (0.51 – 0.92)	0.96 (0.56 – 1.62)
Oral Health Status		
Very Good	1	1
Good	1.05 (0.85 – 1.29)	1.63** (1.07 – 2.48)
Fair / Poor	0.92 (0.62 – 1.37)	2.76*** (1.54 –4.94)
Dental Care		
Can afford	1	1
Can't afford	1.76* (0.97 – 3.19)	1.25 (0.60 – 2.61)

* p < .10; ** p < .05; *** p < .01

Note.
a: Model 1 compared children who lost school hours to those who did not lose any school hours [Did not have this type of dental care].
b: Model 2 compared children who lost less than one school hour to those who lost an hour or more school hours.

tive dental services can limit the incidence as well as progression of dental problems,[2] and help to reduce school hours lost due to unplanned care.

We found differences in school hours lost by socio-demographic and oral health factors. Family income was a strong predictor of losing any school hours versus not needing acute/unplanned dental care, whereas oral health status was a significant factor to predict loss of one or more school hours. One plausible explanation for these differences could be the prevalence of untreated dental needs. According to a 2009-2010 National Health and

Nutrition Examination Survey, untreated decay was twice as high among children living in families with incomes under 100% of the federal poverty level compared to their counterparts.[11] Decayed teeth in children from lower-income households are more likely to remain untreated, contributing to poor oral health and a need for more complicated and time-consuming treatments. Another reason could be that low-income families may face barriers in seeking routine dental care such as barriers due to cost of care, distance from the provider, or the nature of the parents' non-flexible jobs that may prompt them to go without addressing their dental problems for extended periods of time.[2] Similar disparities were reported in the 1992 study.[9]

Effective public health programs such as school oral health prevention program including screening, oral health education, school based sealant programs (SSP) and fluoride varnish programs can help to reduce dental caries and improve oral health outcomes.[12,13] SSP provides sealants on 1st and 2nd molar to second grade and sixth grade children and are proven to be cost effective in high risk students.[12] However, SSPs are greatly underutilized. According to a 2013 PEW research center report, only 15 states had SSP in 50% or more high need schools.[14]

Research suggests a strong association among dental problems, school attendance, and academic performance.[6,7] Disparities in loss of school hours due to acute/unplanned care as evident from our results may widen this gap in the academic performance across various groups. Our findings emphasize the need for reducing the overall number of school hours lost in unplanned care, in addition to creating more awareness of oral health among educators and parents.

This study has several limitations. The data used were parent-reported and subject to recall or social desirability bias. Most children (70%) reported missing 0 to 1 hour of school due to acute/unplanned dental care. We do not know if the unplanned dental care was sought at a dental clinic or at the emergency clinic/hospital. However, the reported loss of time is less than the usual visit time for dental care at either location.[15,16] Another reason for having a report of losing less than one hour may be that the parents sought care at the end of the school day or after school hours. Nevertheless,

if a child has an active dental problem, related pain and discomfort may interfere with his/her attention and engagement level in school. This may lead to additional unaccounted hours lost that cannot be determined from our data, thereby possibly making our estimates conservative. It is important to note that the question about school hours lost was asked only to those children who visited a dentist in the past 6 months. Finally, we were not able to account for the time lost among children who did not visit a dentist in the past 6 months that might also have underestimated the total school hours lost. Despite these limitations, this is the first study to provide national estimates of school hours lost due to dental problems and examine the associated factors.

IMPLICATIONS FOR HEALTH BEHAVIOR OR POLICY

Numerous school hours are lost due to acute/unplanned dental care; moreover, socioeconomic disparities exist in school hours lost. Our findings have implications for parents, educators, policymakers, and researchers.

School-based oral health programs provide an opportunity to prevent oral disease among children and should be expanded in schools with high risk populations.[14] Schools with existing oral health programs should adopt best practices and innovative approaches to improve consent form return rates which is a primary barrier in the successful functioning of their school based programs.[17] For instance, strategies to increase consent rates could be to involve the school nurses or finding innovative ways of communicating with parents instead of relying on children to take the forms home.

At the school level, oral health could also be promoted through the 'Whole School Whole Child model' by providing healthy lunch options, reduction of sugar availability, and safer playgrounds.[18]

Families from low socioeconomic backgrounds may face more challenges to maintain oral health, such as finding a dentist close to home, cost of treatment, and taking time off from work. Policymakers can help to address these barriers by increasing access to dental care through dental homes, alternative oral health delivery models in the community, and influencing regulations that expand the scope of practice of dental hygienists across states.[14]

Finally, availability of national data is essential to monitor these oral health disparities and their trends. Thus, continued efforts towards collection of these data are critical.

Thus improving access and use of routine dental care among children and ongoing innovative oral health education and awareness initiatives are crucial for reducing burden of oral disease.

Acknowledgment

Human Subjects Approval Statement

The conduct of the NHIS is approved by the National Center for Health Statistics research ethics review board. This study used de-identified, publicly released 2008 NHIS data and did not require separate institutional review board approval.

Conflict of Interest Disclosure Statement

The authors have no conflicts of interests to declare.

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