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Abstract

Objective: To examine longitudinal trends and associated factors in dental service utilization by adolescents progressing to early adulthood in the United States.
Data Source: The National Longitudinal Study of Adolescent Health from Waves I (1994-95), II (1996), III (2001-2002) and IV (2007-2008).
Study Design: This is a retrospective, observational study of adolescents' transition to early adulthood. We obtained descriptive statistics and performed logistic regression analyses to identify the effects of baseline and concurrent covariates on dental service utilization from adolescence to early adulthood over time.
Principal Findings: Dental service utilization within the prior 12 months peaked at age 16 (72%), gradually decreased until age 21 (57%), and thereafter remained flat. Whites and Asians had a 10-20 percentage points higher proportion of dental service utilization at most ages compared to Blacks and Hispanics. Dental service utilization at later follow-up visits was strongly associated with baseline utilization with OR= 10.7, 2.4 and 1.5 at the 1-year, 7-year and 13-year follow-ups respectively. These effects decreased when adjusted for current income, insurance and education. Compared to Whites, Blacks were consistently less likely to report any dental examination.
Conclusion: Dental service utilization was highest in adolescents. Gender, education, health insurance and income in young adulthood were significant predictors of reporting a dental examination. Blacks had lower odds of reporting a dental examination either as adolescents or as young adults.

Keywords: Adolescents, dental service utilization, racial/ethnic minority, adulthood

Introduction

Most studies on dental service utilization have hitherto focused largely on children and adults, with little published on adolescents progressing to early adulthood in the United States [1-3]. Adolescence transition to early adulthood represents a significant period for developing positive oral health habits and healthy lifestyles over the life span of an individual [1]. Yu et al. [4] reported that health insurance and family income are associated with adolescents' use of preventive dental care; however, their study lacks information on dental service utilization during the transition to early adulthood.

Results from the National Health and Nutrition Examination Survey indicate that 80 percent of parents of adolescents reported that their children had made a dental visit in the previous year [2]. Findings from the Medical Expenditure Panel survey show that 53 percent of young children and adolescents aged 6 through 20 had at least one dental visit in the year 2004, and that this remained virtually

unchanged from the 51 percent reported in 1996 [1,5]. However, both national studies provide contradictory results and inconclusive information regarding dental visits among adolescents in the United States [1].

Additionally, the two national surveys referenced above relied for the most part on parental reports of adolescents' dental service use, thus creating a possible risk of over-reporting, based on the notion of "social expectation" that all children should receive two dental visits each year [1]. Furthermore, the surveys also risked under-reporting service use especially if parents were not fully aware or had forgotten about other non-traditional settings where the children could have received services such as school-based dental service programs [1]. Our study recognizes the relevance of a life course health development framework that may influence health, and views health status and the use of health services as a trajectory, with early events and influences shaping later outcomes [6]. The aim of this study was to examine longitudinal trends and associated factors in dental service utilization by adolescents progressing to early adulthood using data from a school-based longitudinal survey in the United States.

Methods

Study Design and Sample

We used the restricted-use contractual dataset from the National Longitudinal Study of Adolescent Health (Add Health), Waves I (1994-95), II (1996), III (2001-2002) and IV (2007-2008) for adolescents through their transition to adulthood. The Add Health database was derived from a multistage, stratified, school-based, clustered sampling design and included collection of information from three in-home interviews extending into early adulthood. A total of 132 schools, with students living in 35 states were included in the study. The adolescent periods in Add Health were Waves I and II. The Wave I in-home sample was the basis for all subsequent longitudinal follow-up interviews. Seventy-nine percent of all sampled students in all of the groups participated in Wave I of the in-home phase of the survey (20,745) [7]. A parent, usually the resident mother, also completed a 30-minute op-scan assisted-interview. Over 85 percent of parents of participating adolescents completed the parental interview in the first wave. One year later, in 1996, all adolescents in grades 7 through 11 of Wave I were followed up for the Wave II in-home interview (N=14,738). Waves III and IV represented the period of transition to adulthood. Add Health Wave III was a follow-up interview with original

Wave I respondents as they began the transition to adulthood [8]. The third wave of in-home interviews allowed researchers to map early trajectories out of adolescence in health and economic status and to document how adolescent experiences and behaviors are related to health outcomes in the transition to adulthood. Wave III data collection was conducted nationwide (including Hawaii and Alaska) between August 2001 and April 2002 [8]. Respondents were then aged 18-26 and in the midst of the transition to adulthood. Add Health completed interviews with 15,170 respondents at Wave III, resulting in a 76% response rate. Add Health Wave IV is a follow-up with original Wave I respondents in 2007-08 when they were aged 24-32, representing an age when the Add Health cohort assumed adult roles and responsibilities, developed crucial health habits and lifestyle choices that set pathways for their future adult health and well-being [8]. Since our research question focused on transitions over time, only subjects that participated in all four waves were included. Further details about Add health database are available from Add Health Study Design [7] and Harris [8].

Measures

We adopted the defined age ranges of the National Longitudinal Study of Adolescent Health (Carolina Population Center, 2007) as adolescents being children in grades 7-12 and young adults being those aged 18-32. Other covariates included gender, household income, health insurance, parental and self- education levels and race/ethnicity. Race and ethnicity were self-designated under the following categories: White, Black or African-American, Asian or Pacific Islander, American Indian or Native American and Other. Multiracial respondents were asked to identify the category that best described their racial background. Ethnicity was a self-designation as being of either Hispanic or Latino origin. We combined race and ethnicity into one variable and collapsed the categories with low numbers to increase the stability of estimates. Blacks who self-identified as Hispanics or as being of Latino origin were placed in the Hispanic group and participants of unknown race/ethnicity were included in the 'Other' group. Our final groups were Whites, Blacks, Hispanics, Asians, and Other.

Household income was defined as pre-tax income during the previous year from all sources in the household in which the participant resides. This information was collected at Waves I, III and IV. While we did not have an estimate of current household income for Wave II, since it was only one year removed from Wave I, we assumed that the household income at baseline was likely a good

indication of that at Wave II. Additionally, the exact answer options offered varied between waves, but more detailed information was collected at some waves, and we grouped the answers into four categories that were well defined in every wave. Specifically, cutoffs of $30,000, $50,000, and $75,000 per year were used. Health insurance information was obtained at Waves I, III, and IV, with the exact response choices varied over the waves. We categorized the options into No Insurance, Medicaid, Private, Other, and Unknown. The last two categories were very rare (<1.5%) in Waves III and IV, so they were combined into an "other/unknown insurance" category for the regression analyses but not for the descriptive statistics.

Educational attainment was collected for the parents at Wave I and for the respondents at Waves III and IV. The resident parent information of either the mother or father figure living in the same household as the adolescent was used regardless of the actual biological relationship. Parents/participants without a high school diploma or GED were assigned to the "less than high school" category, those with such diplomas but without a college degree (but potentially with some college-level education) were assigned to the "high school" category- and those with a college degree but no post-graduate or professional degree were assigned to the "college" category. Parents/participants with a post-graduate or professional degree made up the "beyond college" category. Additionally, for parental education, a "mother not in the household or father not in the household" category was created.

Analytical approach

All analyses were adjusted for the survey design using weights that accounted for loss to follow-up from Wave I to Wave IV. All analyses were performed in SAS 9.2, using the Surveyfreq procedure for descriptive statistics and the Surveylogistic procedure for logistic regression (SAS Institute, Cary, NC). Counts are reported as both the actual frequencies among the survey respondents and as weighted frequencies representing the estimated counts in the entire population from which the respondents were sampled. All the estimates are reported with standard errors. The Institutional Review Boards of Marquette University and the Medical College of Wisconsin approved this study.

Journal of Adolescent Health, Vol. 53, No. 5 (November 2013): pg. 663-670. DOI.

Age-period-cohort effects

In longitudinal studies there are three potential time-related effects on the outcome: age, period, and cohort. In the Add Health study, the age and period effects are the age of the participant and the calendar date of each response collection, while the cohort effect is the age of enrollment in the study. However the study design does not allow a separation of these effects: there is essentially no overlap of studied ages at waves I, III, and IV, which implies that the period effect is confounded with the age effect. We investigated the presence of a cohort effect by obtaining separate estimates of the effect of age on the probability of a dental examination for each of age enrollment. Polynomial logistic regression with appropriate interaction terms of cohort by powers of centered and scaled age was used, with backward selection of the polynomial order starting from a fifth degree polynomial.

Within-subject changes

We performed four separate sequential logistic regressions to identify the effects of baseline and concurrent covariates on dental service utilization from adolescence to young adulthood over time. Indicators for dental service utilization at earlier waves were included as predictors for later waves to explicitly estimate the effect of earlier behavior on later outcomes.

Results

Descriptive statistics

Table 1 shows the demographic characteristics of the study population including the proportion with reported dental examinations at Waves I-IV. A total of 9,402 participants representing 18,502,981 adolescents aged 12-19 years old in 1994-1995 participated in all four waves. About half of the respondents were males (50%), whites (68%) and Blacks (15%). Approximately 70% of the respondents in Waves I-II reported having a dental examination in the previous 12 months. In all waves, the proportion of respondents who had a dental examination was highest among those with mothers and fathers in the 'beyond college education' group and in household reporting earnings of $75,000 or more.

Table 1
Descriptive statistics for study population characteristics and proportion with dental examination in each wave (I–IV)

Predictor	Frequency	Weighted frequency	% (standard error)	Dental exam, % (standard error)			
				Wave I	Wave II	Wave III	Wave IV
Overall	9,402	18,502,981	100%	69.2 (1.3)	70.2 (1.3)	57.3 (1.1)	54.8 (.9)
Sex							
Male	4,268	9,249,808	50.0 (.7)	67.4 (1.6)	68.3 (1.5)	55.7 (1.5)	50.1 (1.2)
Female	5,134	9,253,173	50.0 (.7)	70.9 (1.3)	72.2 (1.3)	58.9 (1.2)	59.4 (1.0)
Race/ethnicity							
White	5,295	12,568,996	67.9 (2.9)	74.7 (1.2)	76.4 (1.2)	60.9 (1.3)	57.3 (.9)
Black	1,918	2,798,301	15.1 (2.0)	53.8 (2.2)	53.5 (2.0)	46.7 (2.0)	46.6 (2.0)
Hispanic	1,443	2,210,244	11.9 (1.7)	56.9 (2.5)	57.8 (2.6)	49.6 (2.2)	49.9 (2.2)
Asian	587	634,076	3.4 (.8)	71.2 (3.0)	66.3 (4.0)	62.1 (2.6)	60.1 (3.6)
Other	159	291,364	1.6 (.3)	68.0 (5.5)	68.2 (6.4)	50.1 (5.5)	49.6 (5.5)
Wave I: age group							
12–13 years	1,523	3,839,195	20.7 (2.2)	69.0 (2.2)	74.2 (2.2)	66.5 (2.0)	54.7 (1.7)
14–15 years	3,423	7,117,653	38.5 (1.0)	71.0 (1.5)	72.6 (1.5)	57.4 (1.4)	53.2 (1.3)
15–17 years	3,735	6,314,504	34.1 (2.4)	69.0 (1.7)	68.5 (1.7)	52.8 (1.7)	57.5 (1.3)
18–19 years	721	1,231,629	6.7 (.7)	60.3 (3.0)	53.4 (3.2)	50.8 (2.9)	50.1 (2.6)
Wave I: mother's education							
<High school	1,406	2,727,570	15.4 (1.1)	52.4 (2.1)	53.8 (2.3)	45.5 (1.9)	46.8 (2.3)
High school	4,621	9,636,514	54.5 (1.4)	70.6 (1.2)	71.1 (1.2)	56.3 (1.2)	55.4 (1.0)
College	1,808	3,277,897	18.5 (1.1)	79.1 (1.5)	81.2 (1.5)	69.3 (1.6)	60.1 (1.7)
Beyond college	744	1,221,914	6.9 (.7)	84.8 (2.4)	86.8 (2.2)	72.3 (2.6)	67.9 (2.6)
Mother not in household	424	824,403	4.7 (.4)	56.4 (3.4)	62.5 (3.3)	51.7 (3.3)	49.7 (2.8)
Wave I: father's education							
<High school	1,020	2,007,547	11.3 (.9)	55.0 (2.3)	52.5 (2.4)	46.5 (2.3)	50.4 (2.6)
High school	3,243	6,670,929	37.7 (1.4)	71.3 (1.3)	72.2 (1.3)	58.9 (1.2)	57.5 (1.2)
College	1,385	2,739,975	15.5 (.9)	83.3 (1.7)	84.7 (1.7)	69.5 (1.9)	60.8 (1.7)
Beyond college	771	1,360,160	7.7 (.9)	88.1 (1.7)	91.1 (1.3)	76.6 (2.1)	64.4 (2.9)
Father not in household	2,546	4,919,204	27.8 (1.3)	60.5 (1.7)	62.8 (1.7)	48.5 (1.5)	48.9 (1.4)
Wave I: household income							
<$29,999	2,560	5,299,075	35.4 (2.0)	56.1 (1.7)	56.3 (1.7)	45.2 (1.4)	48.0 (1.5)
$30,000–$49,999	1,993	4,011,066	26.8 (.9)	71.4 (1.5)	72.3 (1.5)	56.8 (1.7)	54.6 (1.5)
$50,000–$74,999	1,726	3,518,496	23.5 (1.1)	80.7 (1.3)	81.3 (1.4)	68.6 (1.4)	59.3 (1.5)
≥$75,000	1,098	2,135,594	14.3 (1.4)	88.0 (1.4)	90.2 (1.2)	76.0 (2.3)	65.1 (2.4)
Wave I: health insurance							
None	967	2,011,996	10.9 (.8)	44.8 (2.0)	47.1 (2.3)	45.5 (1.9)	49.6 (2.3)
Medicaid	670	1,530,284	8.3 (.9)	57.4 (2.8)	60.7 (2.7)	36.0 (2.7)	42.8 (2.9)
Private	6,326	12,535,655	67.7 (1.7)	76.1 (1.1)	77.1 (1.1)	62.9 (1.1)	57.2 (.9)
Other	402	736,414	4.0 (.4)	59.4 (3.3)	56.6 (3.5)	54.3 (3.3)	53.6 (3.2)
Unknown	1,037	1,688,632	9.1 (.7)	61.6 (2.6)	61.8 (2.7)	50.1 (2.3)	54.6 (2.0)

Figure 1 shows the results of the cohort analysis, a plot of the probability of having had a dental examination within the past 12 months as a function of age for each age of enrollment smoothed using third-degree polynomials. This probability appears to peak at age 14 years (73%), gradually fall until age 22 (53%), and thereafter become flat. This finding is consistent with the pattern seen in Table 1. Additionally, while each curve corresponds to a separate cohort, they align well with most curves falling within the confidence bands of the other curves, forming a single overall age pattern. This shows the lack of a substantial cohort effect and thus it was not included in further analyses.

Journal of Adolescent Health, Vol. 53, No. 5 (November 2013): pg. 663-670. DOI.

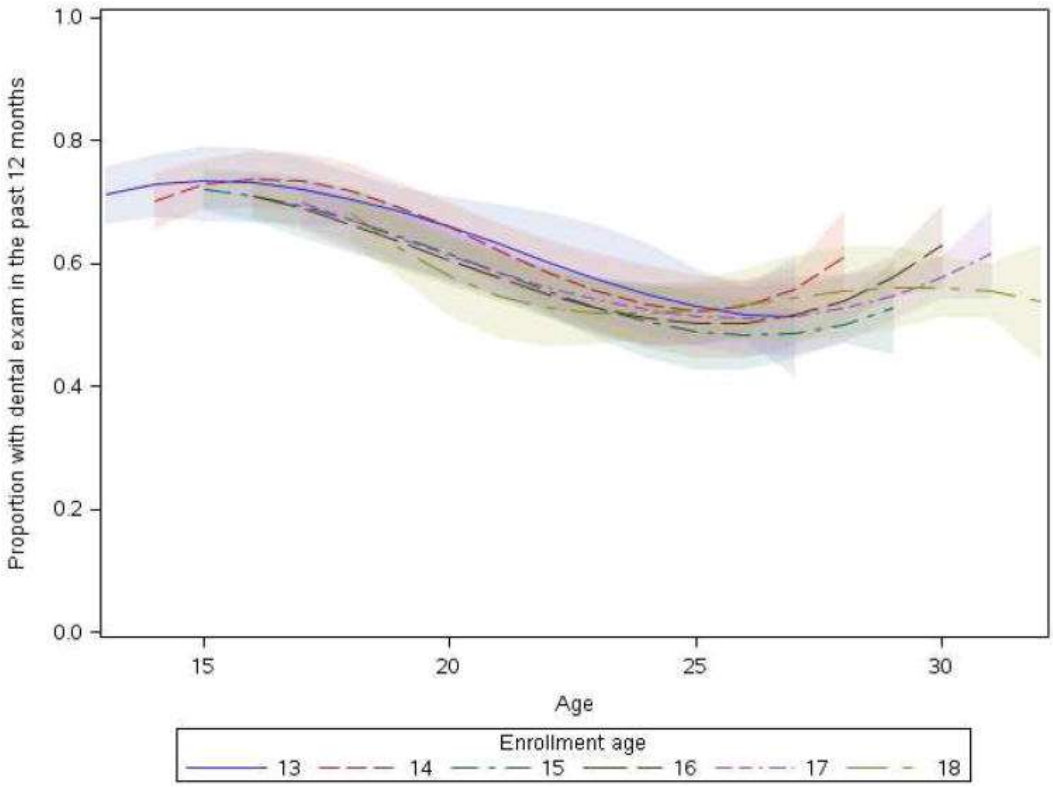
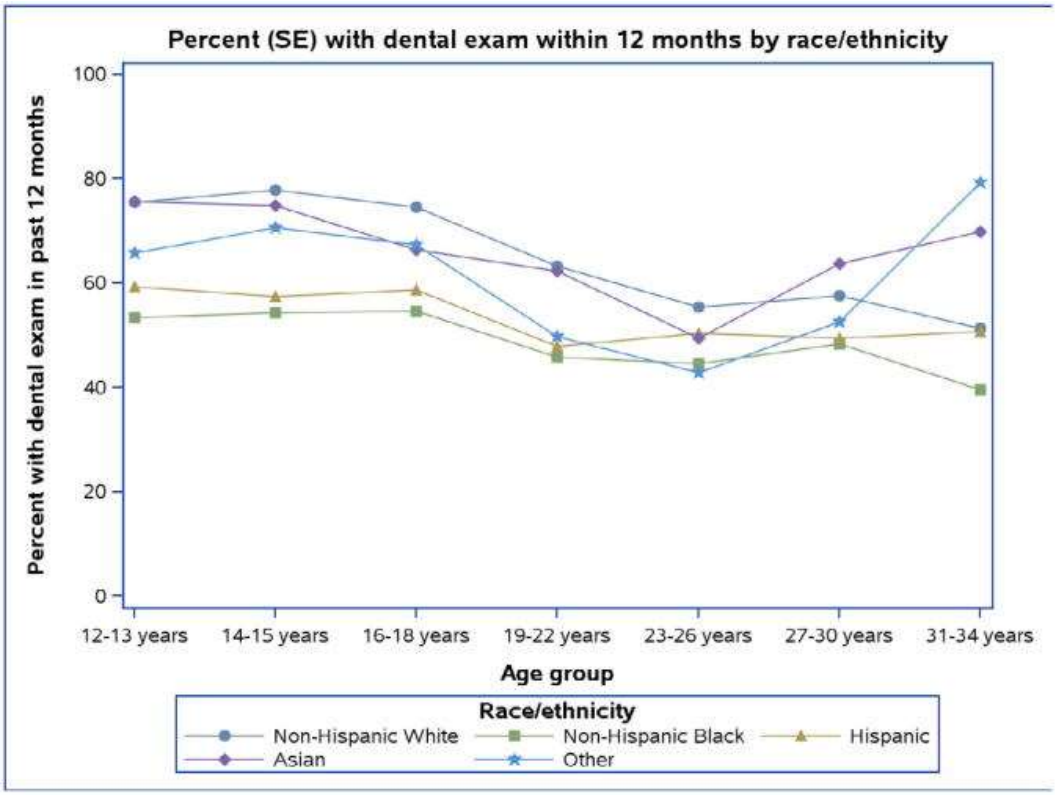


Figure 1: Probability of Having a Dental Examination in the Past 12 Months as a Function of Current Age Estimated Separately for each Age of Enrollment. The bands represent pointwise 95% confidence limits.

Figure 2 shows the trend for dental examinations as observed for the different racial/ethnic groups by age. The general shape of these patterns is similar to the overall age trend. However, Whites and Asians consistently had a 10-20 percentage point higher proportion of dental examination at all ages compared to Blacks and Hispanics. Figure 3 shows detailed estimates of the probability that a participant would have a dental examination given their past dental examination pattern. Participants with a dental examination in Wave I had a much higher probability of having a dental exam one year later at Wave II ("Y" arrow) compared to those who did not ("N" arrow). By Wave III, seven years later, there appear to be three subgroups: those who had dental exam at both Wave I and II ("YY") with the highest probability of having a dental exam, those who had not had a dental exam at either Wave I or wave II ("NN") with the lowest probability, and those who had a dental exam only at one of the first two waves ("YN" and "NY") having an intermediate probability. After Wave III, the effect of the early patterns seems to diminish, with the effect of having had a dental examination at Wave III dominating. For example, participants with a "YYN" pattern had a lower probability of having a dental exam

at Wave IV than those with a "NNY" pattern, showing that later experiences can override earlier ones.



Age group	White % (SE)	Black % (SE)	Hispanic % (SE)	Asian % (SE)	Other % (SE)
12-13 years	75.5 (1.8)	53.4 (4.4)	59.3 (5.8)	75.7 (5.5)	65.8 (18)
14-15 years	77.9 (1.4)	54.3 (2.8)	57.5 (3.2)	75.0 (3.2)	70.7 (7.4)
16-18 years	74.6 (1.5)	54.6 (2.2)	58.7 (3.1)	66.5 (4.3)	67.4 (5.8)
19-22 years	63.3 (1.3)	45.9 (2.2)	48.0 (2.6)	62.3 (3.8)	49.8 (6.5)
23-26 years	55.5 (1.3)	44.6 (2.5)	50.3 (3.0)	49.4 (3.5)	42.8 (8.5)
27-30 years	57.6 (1.1)	48.3 (2.3)	49.5 (2.4)	63.7 (3.5)	52.7 (5.7)
31-34 years	51.3 (3.5)	39.6 (5.8)	50.8 (4.2)	69.8 (11)	79.3 (14)

Figure 2: Percent with Dental Exam within 12 months by Race/Ethnicity

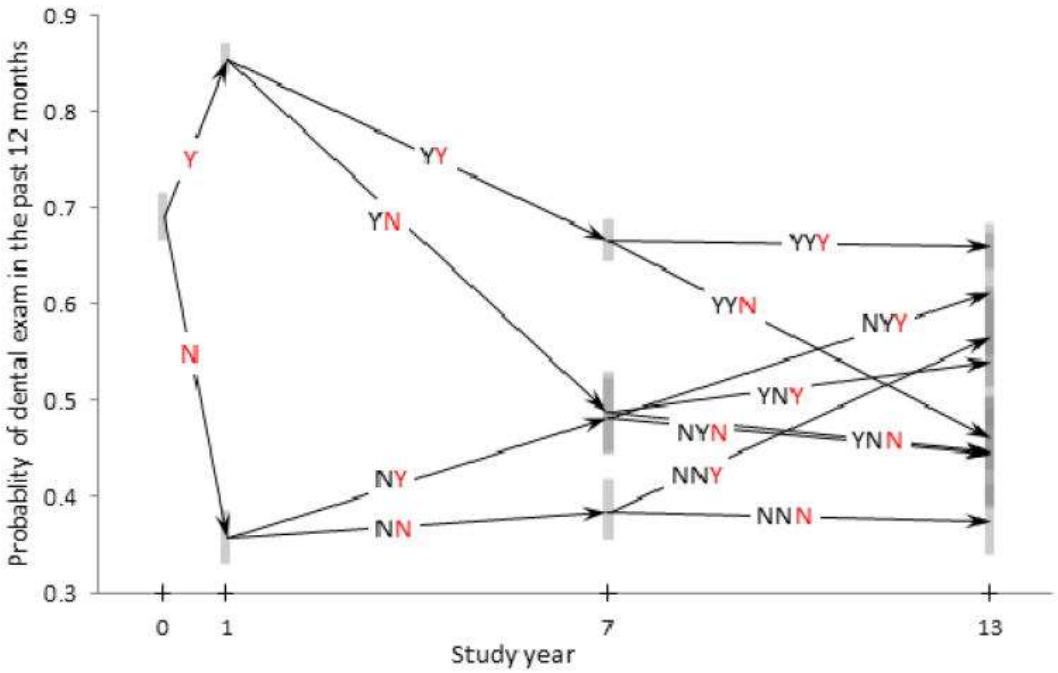


Figure 3: The effect of dental examination history on the probability of having a dental examination within the past 12 months: Waves I-IV. Each point with a standard error bar shows the estimated probability of a dental examination within the past 12 months for a subset of subjects defined by history of dental examinations reported at previous waves as indicated by the incoming arrow. The arrows are labeled with the corresponding history sequence, Y denoting "yes" for dental examination, and N denoting "no". For example YYN denotes report of dental exam at waves I and II, but not III.

Multivariate logistic regression

Table 2 presents the results of four separate multivariate logistic regression models exploring the effects of socio-demographic covariates and past dental examination patterns on the probability of a dental examination fitted for Waves I-IV. In addition to the predictors shown in the table, all the analyses were adjusted for age group. However, these estimates are not comparable across the waves due to limited overlap and are thus not shown. In general, having a dental examination in adolescence was a strong predictor for future dental examination in early adulthood. Confirming the unadjusted patterns seen in Figure 3, adolescents that reported a dental examination in Wave I had almost 9 times higher odds of having an examination in Wave II, but this became weak with progression to Wave III. Having an examination in Wave II had a similar effect, while at Wave IV the effect of having had a dental examination in Wave III dominated.

Table 2
Results from four separate multivariate logistic regressions for each wave: effect of prior dental visit and covariates on probability of dental visit within past 12 months

Variable	Wave I		Wave II		Wave III		Wave IV	
	OR (SE)	p value	OR (SE)	p value	OR (SE)	p value	OR (SE)	p value
Dental exam				<.0001		<.0001		
Wave								
I			8.7 (.92)***		1.6 (.15)***		1.0 (.10)	.9323
II					1.5 (.13)***		1.2 (.11)	.0504
III							1.7 (.12)***	<.0001
Race/ethnicity		<.0001		.0001		.3340		.0646
White	Reference		Reference		Reference		Reference	
Black	.5 (.05)***		.6 (.07)***		.8 (.09)*		.8 (.08)*	
Hispanic	.7 (.09)**		.9 (.13)		.9 (.11)		.9 (.09)	
Asian	1.1 (.22)		.7 (.18)		1.1 (.18)		.9 (.16)	
Other	.7 (.23)		.8 (.33)		.8 (.21)		.7 (.19)	
Sex		.0683		.00052		.0617		<.0001
Male	Reference		Reference		Reference		Reference	
Female	1.2 (.11)		1.2 (.10)**		1.2 (.09)		1.4 (.10)***	
Wave I: Household income		<.0001		<.0001		.0008		.7187
<$29,999	.7 (.08)**		.8 (.08)*		.9 (.09)		1.1 (.10)	
$30,000–$49,999	Reference		Reference		Reference		Reference	
$50,000–$74,999	1.4 (.15)**		1.2 (.14)		1.3 (.13)**		1.0 (.09)	
> $75,000	2.0 (.28)***		1.8 (.29)***		1.5 (.21)**		1.1 (.13)	
Wave I: Mother's education		.0003		.2227		.0183		.0921
Beyond college	1.1 (.21)		1.2 (.26)		1.2 (.21)		1.2 (.20)	
College	1.1 (.12)		1.2 (.14)		1.3 (.13)**		1.1 (.13)	
High school	Reference		Reference		Reference		Reference	
<High school	.7 (.08)***		.9 (.12)		1.0 (.12)		.8 (.10)	
Mother not in household	.5 (.10)**		1.0 (.20)		1.0 (.18)		.9 (.15)	
Wave I: Father's education		.0004		<.0001		.6338		.7644
Beyond college	2.0 (.43)**		2.3 (.51)***		1.2 (.19)		.8 (.14)	
College	1.6 (.24)**		1.5 (.24)*		1.1 (.12)		.9 (.11)	
High school	Reference		Reference		Reference		Reference	
<High school	.9 (.11)		.7 (.09)**		1.0 (.14)		1.0 (.14)	
Father not in household	1.0 (.10)		1.1 (.13)		1.1 (.10)		.9 (.09)	
Current education						.0023		.4493
Beyond college					.9 (.34)		1.2 (.14)	
College					1.3 (.17)*		1.1 (.13)	
High school					Reference		Reference	
<High school					.7 (.08)**		1.1 (.18)	
Current household income						.0088		<.0001
<$29,999					1.0 (.09)		.9 (.12)	
$30,000–$49,999					Reference		Reference	
$50,000–$74,999					1.4 (.20)**		1.3 (.15)*	
> $75,000					1.3 (.18)*		1.6 (.15)***	
Health insurance		<.0001		.0002		<.0001		<.0001
None	Reference		Reference		Reference		Reference	
Medicaid	1.9 (.30)***		1.7 (.34)**		1.3 (.26)		2.3 (.35)***	
Private	2.0 (.23)***		1.6 (.24)**		2.4 (.19)***		2.7 (.26)***	
Other/unknown	1.8 (.33)**		.7 (.15)		1.6 (.61)		2.2 (.92)	

OR = odds ratio; SE = standard error.
Data were adjusted for age: *p <.05; **p <.001; ***p <.0001.

In Waves I-II, compared to Whites, Blacks were significantly less likely to have a dental examination and for Hispanics it was only significant in Wave I. It is notable that the effect of race/ethnicity was present even after adjusting for income, education, health insurance status, and past dental visit patterns, indicating the presence of disparities. While the statistical significance of the effect of gender varied in Wave I-III, the estimated odds ratio was fairly constant at OR= 1.2. The gender effect was noticeably higher in Wave IV, with females having 1.4-fold higher odds of having a dental examination.

In Waves I-III, respondents with income above the threshold of $30,000 to $49,999, had 1.2-2 times higher odds of having a dental examination. By Waves III and IV, the effect of baseline household income is replaced by current household income, which had a similar effect. Compared to respondents with no insurance, those with Medicaid and private insurance had a significantly higher likelihood of reporting a dental examination in all waves.

Journal of Adolescent Health, Vol. 53, No. 5 (November 2013): pg. 663-670. DOI.

The effect of parental education as measured at the baseline is somewhat complicated and differs by parent. Low maternal education had a strong effect at Wave I, with children who lived in households with a mother who did not graduate from high school or without a maternal figure having significantly lower odds of having a dental examination. However, maternal education beyond high school did not seem to change the odds of the child having had a dental exam in the previous year. In Waves II-IV the effect of maternal education was weak to none. In contrast, high paternal education was highly predictive of receipt of a dental exam in both Waves I and II, with children of fathers with college and beyond college education having progressively higher odds of having had a dental exam compared to those with fathers who only had a high school education. Children without a father figure in the household had similar results to those with high school educated fathers. However, by early adulthood in Waves III and IV, paternal education had no detectable effect. The current education of respondents was a significant predictor in this period, with higher educated respondents more likely to report having had a dental examination in the previous year than less educated respondents.

Discussion

We found that the effect of having a dental examination within the prior 12 months peaked at age 16, gradually fell until age 21 and thereafter became flat. This finding could be a reflection of the effect of dental insurance coverage based on the fact that Medicaid dental eligibility and parents' employer–based dental insurance for most American youth ends around age 18 (including young adults who are full-time students). However, with the enactment of the Patient Protection and Affordable Care Act of 2010 which allows for coverage for children under their parents' insurance until the age of 26 years [9], we expect to see changes in dental service utilization.

In all waves, health insurance was a strong predictor of dental service utilization, a finding consistent with that of previous studies [4,10] Compared to respondents with no insurance, Medicaid and private insurance enrollees were approximately 2 to 3 times more likely to report that they had dental examinations in Waves I to IV. Furthermore, our analysis revealed an association between dental service utilization at later follow-ups and baselines with odds ratios as high as 10 after one year to as low as 2 after a 13-year follow-up. These findings suggest a need for health education and promotion to help sustain or improve upon the dental service utilization of adolescents as they progress into early adulthood.

Journal of Adolescent Health, Vol. 53, No. 5 (November 2013): pg. 663-670. DOI.

In our analyses of Waves I-II data, approximately 70% of adolescents reported that they had had a dental examination in the previous 12 months. In Wave IV (early adulthood), the proportion reporting a dental examination decreased to 55%. This finding is in contrast with the two national surveys [3,4] referenced earlier in this paper. The decrease in prevalence of dental service utilization from adolescence to early adulthood could be linked to the lack of access to preventive care which has also been demonstrated to be associated with more visits to emergency departments and avoidable hospitalization by young adults in the medical and dental literature [11-14]. While there are slight differences in the age stratifications used in the different survey analyses, the description of how dental services utilization information was captured in all the surveys is fairly consistent. Based on prior survey results and on our findings, we feel that the current rate of adolescent dental service utilization is probably between 70-75% and that the rate of utilization by young adults is 50-55%. Accessibility, affordability of care and willingness to utilize dental care is vital to the short and long-term prevention of dental diseases and should be a continual process throughout life.

Despite the complexity in behavior and the societal influences that exist in the transition from adolescence to early adulthood, we found that more females reported that they had a dental examination in Waves I-IV. This descriptive finding did not change much in the multivariate analysis. Compared to males, females had significantly higher odds of reporting that they had a dental examination in Waves II and IV. This finding is consistent with those of previous studies [5, 15] which confirm that a typical dental patient is most likely to be female.

Racial/ethnic disparities in dental service utilization after adjustment for relevant covariates such as income and education in infants, children and adults have been reported [16-19]. We found similar disparities, but the evidence from our analyses is much more robust because we were able to adjust for past dental examination patterns in our regression model. Compared to Whites, Blacks and Hispanics were less likely to have had a dental examination. However, this trend was most noticeable for Blacks who consistently had lower odds of reporting that they had had a dental examination either as adolescents or as young adults. This finding raises further questions regarding adolescent health and clearly adds oral health to the list of already documented adolescent health disparities.

In general, the effect of the predictors measured in adolescence diminishes over time and subjects' current socioeconomic position

prevailed. In Wave IV, the effect of baseline household income is replaced by current household income and the effect is similar. However, it was intriguing to find that maternal education beyond high school did not seem to change the odds of a child having had a dental examination. In contrast, high paternal education was highly predictive of receipt of dental examination in both Waves I and II, with children of fathers who had college and beyond college education having progressively higher odds of having had a dental exam compared to those with fathers who only had a high school education. Nonetheless, in young adulthood paternal education had no detectable effect. The current education of the respondent became a significant predictor in this period, with higher educated respondents being more likely to report having had a dental examination in the previous year than less educated respondents.

Certain limitations of our study should be noted. First, the use of a school-based design with schools as the primary sampling units, could possibly limit the generalizability of our findings to adolescents who are enrolled in schools. Second, the absence of information on the motive for dental service utilization in light of attempts by other researchers to differentiate preventive visits from those motivated by pain, trauma or other reasons. Third, the wide spacing of the data collected compared to the age ranges included at enrollment, resulted in a confounding of the period effect with age effect. Thus we cannot exclude the possibility that decreased use of dental services in young adulthood is due to secular trends and not aging. On the other hand, since all participants were followed simultaneously, the conclusions based on between-subject comparisons, such as the regression analysis of effects of baseline covariates on later behavior are still valid. Another limitation is the availability of health insurance and not dental insurance data. Finally, omitted variable bias is another possible limitation in our study. Despite the above limitations, this study demonstrates that dental service utilization was highest in adolescence and reporting a dental examination in the past is a strong predictor of future dental examinations. Gender, health insurance, education and income in young adulthood were significant predictors of having a dental examination. Blacks had lower odds of reporting a dental examination either as adolescents or as young adults.

Implications and Contributions

This study on dental service utilization of adolescents progressing to early adulthood is important for developing appropriate oral health intervention strategies and public policy. Findings from this study are generalizable and expand the literature regarding predictors of dental service utilization in adolescents progressing to early adulthood.

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Footnotes

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