**Multilevel Model to Estimate County-Level Untreated Dental Caries among US Children Aged 6–9 Years using the National Health and Nutrition Examination Survey**

**Authors:** Mei Lin, Xingyou Zhang, James B. Holt, Valerie Robison, Chien-Hsun Li, Susan O. Griffin

**Appendix**

***Appendix A. Primary Data Source***

National Health and Nutrition Examination Survey (NHANES) is a cross-sectional survey using multistage probability sampling, representative of the US civilian non-institutionalized population(Centers for Disease Control and Prevention). Data on health status and risk factors are collected through interviews, health examinations and laboratory tests. We pooled data from three 2-year NHANES cycles, 2005**–**2006, 2007**–**2008 and 2009**–**2010. The data from 2005**–**2010 are the most recent years available that included six years of data based on the same dental caries examination protocol, i.e., the Basic Screening Examination (BSE)(Centers for Disease Control and Prevention, 2005). We used three NHANES cycles (six years) based on NHANES recommendation to produce stable estimates after sociodemographic stratification (Centers for Disease Control and Prevention).

***Appendix B. Individual-Level Covariates***

We considered select individual-level covariates from NHANES 2005–2010. Race/ethnicity was categorized into Non-Hispanic white, Non-Hispanic black, Hispanic, and other races/ethnicities, including multi-racial. NHANES 2005-2006 oversampled Mexican Americans rather than Hispanics overall. Since 2007, NHANES has oversampled Mexican Americans and Hispanics overall(Centers for Disease Control and Prevention). However, the Census population data we later used for poststratification had Hispanics overall rather than Mexican Americans as a separate group. To mirror the Census population race/ethnicity grouping, we used Hispanics overall in NHANES. Poverty status was defined as the percentage of family income relative to the Federal Poverty Level (FPL) and was classified into <100% FPL, 100%**–**199% FPL, and ≥200% FPL. Child’s current health insurance status was grouped as Medicaid/Children's Health Insurance Program (CHIP), private or other insurance, and no insurance. Other variables included sex, age (in single years), and survey cycles. For children living in more than one household, they were sampled if they resided with the NHANES household as their primary residence(Centers for Disease Control and Prevention).

***Appendix C. Statistical Analyses***

We used NHANES 2005**–**2010 data linked with tract-, county- and state-level data to construct and fit multilevel logistic regression models to quantify associations between untreated caries and individual and area-level covariates. The base model included basic individual-level demographic characteristics sex, age and race/ethnicity. We then added other individual- and area-level covariates and kept those significant at *P*<0.05 in the model. The full model included sex, age, race/ethnicity, poverty status, and insurance status at the individual level; poverty rate at the tract level; poverty rate, percentage of 25+ year olds with education level ≥ high school graduate, percentage of Hispanic children, dentist population ratio, and urban-rural classification at the county level; and percentage of children enrolled in Medicaid/CHIP receiving dental services at the state level. We conducted a model sensitivity analysis to evaluate models with individual-level poverty and health insurance status and confirmed that the model with health insurance only produced an estimate closer to the direct estimate from NHANES than the model with both poverty and health insurance and the model with poverty only. Thus the final model included variables in the full model except for the individual-level poverty.

**Appendix References**

Centers for Disease Control and Prevention, National Health and Nutrition Examination Survey - Questionnaires, Datasets, and Related Documentation. <http://www.cdc.gov/nchs/nhanes/nhanes_questionnaires.htm>. Accessed: June 8, 2016.

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