Identifying the Best Predictors of Unmet Health Care Needs in Patients with Disruptive Behavior Disorder

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Abstract: Disruptive Behavior disorders in young children are very prevalent and when untreated, cause numerous complications later in life. Studies have shown that unmet health care among children is a significant problem in the United States. The purpose of this study was to identify the best predictors of unmet health care needs in children 6-17 years of age with Disruptive Behavior problems. The predictors considered were based on the literature of the domain including child, demographic, family, and neighborhood factors. Participants were children from the National Survey of Children's Health (NSCH) 2011-2012. A traditional survey logistic statistical approach and a machine learning approach using the random forest algorithm were used to identify the best predictors of unmet health care needs. Not having a medical home, not having constant health insurance, and having experienced an adverse family event were the best predictors of unmet health care needs. These findings suggest that the identification of these predictors is important for the policy makers and health care providers who work to deliver an effective health care system in this population, children with Disruptive Behavior Disorder.

Objective: To identify the best predictors of unmet health care needs in children 6-17 years of age with Disruptive Behavior problems.

Background: Disruptive Behavior disorders include many disorders, not limited to conduct disorder (CD), oppositional Defiant Disorder (ODD) and Disruptive behavior Disorders not otherwise specified (DBD-NOS) (Findling 2008). The American Psychiatric Association (APA)

defines conduct disorder (CD) as a "repetitive and persistent pattern of behavior that violates the basic rights of others or violates major age appropriate societal rules or norms" based on Diagnostic and Statistical manual of mental Disorders, 4th edition, revised (DSM-IV-TR) (APA, 2000). These conduct problems have been shown to be the most common reasons for mental health department referrals (Reid, 1993). ODD is diagnosed if the child satisfies 4 or more of these following behaviors: losing temper, often arguing with adults, frequently refusing to comply with rules, deliberately annoying people, often blaming others for his or her mistakes or misbehavior, is often touchy and easily annoyed by others, often exhibiting anger and resent, and often exhibiting spiteful and vindictive tendencies (APA, 2000).

The importance and impact of this study relies on the notion that many of the behavioral symptoms for these disorders are early in onset (as early as 1-3 years of age) and continue into adolescence (Briggs-Gowan, 2008). The fundamental consequences that arise from leaving these conditions untreated are severe academic underachievement (Masten 2005, Fergusson 1998) and reduced social competence and mental health disorders (Nock 2007). In a majority of cases, disruptive behavioral problems occur jointly with Attention Deficit Hyperactivity Disorder (ADHD) (Barkley 2006, Connor 2010). Anxiety and depression frequently occur simultaneously with disruptive behavior problems as well (Steiner 2007). These factors and consequences of leaving health care needs unmet in children with disruptive behavior disorders show that identifying the major factors associated with this outcome is the major step in order to alleviate this problem.

The median 12-month prevalence rate of Disruptive Behavior is 6% with a range from 5% to 14% (Costello, 2004). CD has a prevalence rate in the general population that is estimated to be between 1.5% and 4% of children and adolescents according to clinical interview. Male children

tend to be affected by CD more than girls do (Steiner 1997). CD in childhood leads to multiple negative outcomes in adulthood (Moffitt, 2002). ODD has a prevalence rate in the community that is reported to range from 2% (Loeber 1998) to 16% (Cohen, 1993). Unlike CD, some studies find higher rates in male children, while others find similar rates between the two genders (Loeber, 2000). Without timely health care when necessary, these children develop avoidable adverse disorders throughout adulthood and life.

Studies have shown that unmet health care among children is a significant problem in the United States. Simpson and colleagues, in 1997, estimate that as many as 1.3 million children in the US were unable to receive needed and important medical care. They also estimate that almost 4.2 million children were unable to receive needed dental care, while 800,000 children were unable to receive prescription medicine and/or glasses in 1993. For 2.7 million children, medical care was delayed due to the simple worry of cost of care. Other studies have explored unmet health care needs in various children with health care needs in a broad manner (Boulet, 2010; Dusing, 2004; Perrin, 2000; Silver & Stein, 2001) and specifically in children diagnosed with Cerebral Palsy (Jackson 2011), as well as those with mental health conditions (Brown, 2014), but not exclusively in the population of children with DBD without Autism spectrum disorder or mental retardation.

Less than 25% of young children that are identified with behavioral problems receive treatment (Jensen, 2011; Kataoka, 2002). Addressing the prevalence of delayed or unmet health care needs and the specific factors associated with this unmet health care need in a nationally representative sample of non-institutionalized 6-17 year old children with DBD is what this study focuses on. This study hopes to help better understand the characteristics of these children so that effective policy changes can be implemented to help these children to get the appropriate medical care

they need and help them avoid developing lifelong chronic conditions. For this study, different methodologies will be used to identify which factors are most associated with unmet health care needs, the outcome variable of interest.

Methods: This study sample was obtained from the 2011-2012 National Survey of Children's Health (NSCH). NSCH is a population-based, cross-sectional telephone survey of US Households that have at least one resident child that is aged 0 to 17 years at the time of the interview. This survey used a complex, multi-cluster probability sampling design (http://www.cdc.gov/nchs/data/slaits/2011NSCHQuestionnaire.pdf) that asks parents or other primary caregivers about their selected child's information not limited to health, family characteristics, and need for, and use of, health services. It uses stratification by state and sample type (landline or cell-phone) method. The interview was conducted in one of two languages, English or Spanish. Households in the 50 states and District of Columbia were screened for these age-eligible children. The overall response rate was 23% for the combined dual-frame sample; 38.2% for the landline sample and 15.5% for the cell phone sample. The completion rate for the landline sample was 54.1% while the completion rate for the cell phone sample was 41.2%. This study was conducted to get the prevalence estimates for both national and state-specific children's health and experiences with the US health care system in an effort to bring a facet of the healthcare system that can be improved to the forefront. The final national sample included the surveys for 95,677 children with ages 0–17 that were conducted between February 2011 and June 2012. This dataset is publicly available due to the fact that it does not contain identifying subject information and thus is exempt from human subject review. For further details, refer to the original study documentation (NSCH 2011).

For this analysis, children between the ages of 6-17 years with information for current DBD were selected, after excluding children reporting conditions of Autism, Asperger's, Pervasive Developmental Disorders, other Autism Spectrum Disorders, or children with mental retardation. The overall prevalence of Disruptive Behavior Disorder was 2.8% and in children without Autism Spectrum Disorders, Asperger's, Pervasive Developmental Disorders, other Autism Spectrum Disorders, or Mental Retardation, the prevalence rate was 2.54%. The sample was also restricted to those with information on whether or not their health care needs were met as the outcome variable of interest. The prevalence rate for unmet health care needs in all patients was 5.9%, while the prevalence rate for unmet health care needs in 6-17 year old patients without autism or mental retardation was 6.1% (Table 1).

A sample size of 1602 children having DBD currently remained. Based on literature, variables that had been shown to be associated either with the disease condition (DBD) or the outcome (Unmet Health Care Needs) along with various demographic characteristics were selected and thus considered for further evaluation by 2 techniques, one statistical and one machine learning approach, in an effort to garner the best predictors of this outcome.

Analysis: Analysis was conducted using 2 methods: traditional survey logistic regression using R 3.1.1 and the R 3.1.1 Package "survey"(Lumley 2014) and random forest using the R 3.1.1 Package 'random forest'. Respondents with missing or unknown values or who refused to answer specific questions were included in the final models with a value of 'NA' signifying missing. The language spoken at home variable was taken out due to the fact that less than 4% of households spoke a primary language other than English.

In the traditional survey logistic regression analysis, three different methodologies were implemented in an effort to isolate the best predictors of Unmet Health Care Needs in children aged 6-17 with Disruptive Behavior Disorder. First, the appropriate survey design was coded using the svydesign function in the survey package to account for the complex study design. Results reflect weighted estimates and standard errors computed using design-based variance estimation methods. The first model was built using all the potential predictors as identified in the literature, the second was built using data-based predictors significant univariately at p<0.10 using Wald chi-square and the third was built by evaluating child, demographic, family and neighborhood predictors separately using group-wise survey logistic models. The predictors from every group-wise model that were significant were aggregated and another logistic model using those predictors was created. The best predictors were extracted by choosing only those variables that were significant at alpha < 0.05. Odds ratios and corresponding 95% confidence intervals are generated. The list of the selected variables and their definitions are described in Table 2. Details on the membership of factors for group-wise models are in Table 6.

The second method was a machine learning technique, the Random Forest. Using the "randomForest" R 3.1.1 package, the random forest's variable importance algorithm was utilized for predictor evaluation. Since random forest does not take into consideration sample weights, data was split into training and test sets and then blown-up according to each observations sample weight. These splits were done to reflect an approximate 90/10 percent split in the training and test data respectively after blowing the samples up. This methodology was done 5 times randomly and the results of each of these models were aggregated. The default settings were used except for 2000 trees, 16 maximum terminal nodes, and a class weight vector of (0.54, 0.46) for the outcome's two states respectively. The mean decrease accuracy metric which

checks exactly how the performance of the random forest classifier is impacted with the removal of a certain variable from the model is utilized for analysis. The mean decrease accuracies across the five models from the five training sets for each predictor were averaged and then reported.

Results: After weighting to national averages, our sample included 1355161 children with DBD and 19.6% of those reported having unmet health care needs. Table 3 describes the selected sample with the distribution of demographic and potential predictors of the outcome. Children with & without unmet health care needs were similar in age, race, BMI, household education, federal poverty level (FPL) and in the number of kids and adults in the household (p>0.05). Boys were represented more in both the groups than girls (>65%). Covariates which were marginally different in the distribution between both groups were child feeling sad, having one or more co-morbid conditions (p<0.10), mental-emotional health of the mother, social support, general health of the child and severity of ADHD (p<0.15). Higher proportion of children with unmet health care needs reported having ADHD currently (79.6% vs. 69.8%), having no insurance or interrupted insurance (31% vs. 6.3%), and having parental stress with child care (66.1% vs. 51.2%). Majority of children did not meet the criteria for a medical home (91% vs. 58.1%). Among the neighborhood factors, children with unmet health care needs reported having more detracting elements than the other group (56.3% vs. 38.1%). Missing school for 11 or more days/year (27.9% vs. 13.2%) and not having adequate sleep (29.1% vs. 14.3%) were observed more among children with unmet health care needs than among those without the health care need problem. Almost 80% of children with unmet health care needs reported having experienced 2 or more adverse family events when compared to 63% by those without health care needs problem.

Step 1 of the analytic methods using all the potential predictors in the survey logistic multiple regression (MLR) model indicate that not having a medical home, with inadequate number of sleep nights, and having experienced an adverse event to be the most important factors having a significantly positive association with the unmet health care needs. But the estimates were large with wider confidence intervals (data not shown here) pointing to the possible collinearity between predictors and over-fitting of the model. Table 4 shows the results of significant univariate association of covariates with the outcome. Thus step 2 of the MLR model building process included currently having ADHD, health insurance, parental stress due to child care, medical home, feeling sad, passive smoking, neighborhood detraction, missed school days, number of adequate sleep nights, AFE, and number of comorbid conditions as covariates in the MLR model. Having no medical home (OR: 6.3, 95% CI: 2.92 to 13.5), having no or interrupted health insurance (OR: 5.4, 95% CI: 2.61 to 11.25) and those children having experienced one AFE (OR: 3.9, p=0.02) or those who had experienced 2 or more AFEs (OR: 4.9, p=0.001) were more likely to have unmet health care needs when compared to their referent levels. These 3 covariates were the only significant independent predictors identified by this method (Table 5).

For the step 3 of the model building process, covariates were categorized into 4 distinct groups with child factors, demographic factors, family factors, and neighborhood factors as described in table 6. Survey MLR was built for each of the groups using all of the predictors in its respective group. The best predictors, those significant at alpha < 0.05, are given in Table 7. In the child factors group, medical home and AFE were significant. In the demographic group health insurance, household education were the only two significant parameters, while in the family factors group, none of the predictors turned out to be significant. Lastly, in the neighborhood factors group, only detraction was significant. These significant parameters were then aggregated

and put into another final logistic model and the estimates along with the 95% CI for the aggregated model are given in Table 8. Medical Home, number of missed school days, AFE, health insurance and passive smoking were the significant independent predictors of unmet health care needs at alpha < 0.05.

The final method using random forest models provided a simple ranking of the predictors based on mean decrease accuracy. Medical Home, health insurance, neighborhood detraction, passive smoking, and AFE were the five most important predictors according to mean decrease accuracy. Medical Home had the highest mean decrease accuracy of approximately 3% (0.032), while health insurance was approximately 2% (0.022), neighborhood detraction was approximately 1.3% (0.013), passive smoking was approximately 1.1% (0.011), and AFE was approximately 1% (0.010) (Table 9).

Discussion: This study has attempted to evaluate the significant predictors of unmet health care needs in children with disruptive behavior disorder. The strength of this study is providing both individual and separate domain specific predictors of unmet health care needs. The study results are generalizable to non-institutionalized US children between the ages of 6-17. The results support almost the same set of predictors of the outcome no matter which method was used to identify the best predictors of the outcome from a list of potential predictors. The full logistic model with all the variables that are clinically and demographically relevant according to the literature performed poorly and gave a very large standard error probably due to over-fitting and hence the results gathered from this model were not used in the evaluation of the best predictors of the outcome. Both Wald chi-square univariate screening as well as group-wise method showcased a simpler model in the identification of best predictors of outcome. These 2 strategies eliminated a large amount of noise and redundancy that could not be eliminated using the first

model design. Using a threshold of 0.1, the Wald screening eliminated around 2/3rds of the parameters, and a much simpler model was built with a much smaller standard error, and therefore a narrower confidence interval for each of the predictors (Table 5). Similarly, the Groupwise aggregation methodology utilized related variables (Tables 7, 8) to identify which of the variables in a certain intrinsically similar group were most associated with the outcome. Both the Wald and Groupwise models identified health insurance, Medical home, and adverse family experience as significant independent predictors of unmet health care needs while the Groupwise method also identified missing more than 10 days of school in a year (p=0.03) and having a smoker inside the house (p=0.04) as significant predictors of the outcome. Due to the high cost of medical expenses, children with no or interrupted insurance are even at higher risk for unmet health care needs given their health conditions than those having constant insurance coverage. Children with special health care needs require increased interaction with health care system. A medical home provides continuous community-based accessible, comprehensive, family-centered, coordinated care (AAP, 2002). Our results concur with other studies (Strickland 2009, Benedict 2008, Lewis 2005) in that those having a medical home are less likely to have delayed care, fewer unmet needs for dental, health and specialty care. Our study has identified AFE to be one of the important predictors of unmet health care needs, stressing the importance of this variable that it is not only an established precursor for later serious behavior problems (Dodge, 2008), but also increasing their odds of not getting the timely medical care that they need. Since having traumatizing or difficult family experiences can take a toll on a child's physical and/or mental health as well as strain the relationship between a child and their caregiver, an association between adverse family experiences and unmet health care needs seems plausible. Even though we did not find any specific demographic or neighborhood related

variables as important independent predictors of unmet health care needs in the final multivariate models, missing more days of school and having a household member smoking inside the house indirectly addresses some of family's social and school concerns.

The Random Forest results were very similar to the above methods. The importance scores given in Table 9 show the 10 best predictors of unmet health care needs in this group of children with disruptive behavior problems. These are ranked from most important to least important as given by their mean decrease accuracy metric. Medical home, a variable describing whether or not a child has a medical home, and health insurance, a variable describing whether or not a child has constant insurance or has disrupted/no insurance, discriminate the controls and risk cases the most and are the two best predictors. These results are supported by the cost of care and availability of care. Without insurance, a child is much less likely to get the care they need due to the severe financial burden that such an endeavor would bring on. Without having an appropriate medical home, a child is less likely to be evaluated on time and given a regiment to manage the illness. Random Forest identified neighborhood detraction to be an important predictor of unmet health care need. Some of the other parameters seem to have a significant mean decrease accuracy as well (AFE and passive smoking specifically), but are not as good as the three covariates described above.

Conclusions: The statistical approach using survey logistic regression models, and the machine learning approach by the random forest approach, provided similar best predictors. Both design paradigms conclude that Medical Home, health insurance, and AFE are significant predictors of unmet health care needs in children with disruptive behavior disorder in both simple logistic relationships and in complicated tree relationships.

Limitations: This is a cross-sectional survey design and so we cannot provide the causes of unmet health care needs in children with behavior disorder. Also there could be a recall bias of events and responses from the caregivers. All the responses were self-reported and there is no definite diagnosis of the behavior condition. Because of this, unmet needs could be over or under reported leading to misclassification bias.

Future Directions: This study acts as a baseline study to identify the best predictors of unmet health care needs in 6-17 year old children with disruptive behavior problems. To generalize this work to the population without a bias, a clinically ascertained dataset should be used. Comparing models by means of the receiver operating characteristic (ROC) curve could provide a better evaluation. Moderator (sub group analysis) and mediator analysis could also be carried out. To elicit causal relationship between these predictors and outcome, studies using longitudinal design need to be conducted. An analysis of how to weight the classes in a nontrivial fashion using clinical expertise will boost the study's generalizability and clinical relevancy. A better algorithm for dealing with survey design and sampling weights will also be utilized for the random forest algorithm.

Tables:

Table 1: Frequency Distribution of DBD and Unmet HCN among children 6-17 year old without Autism or Mental Retardation

	N	%
DBD+	1611	2.54
DBD-	61789	97.5
total	63400	
	N	%
Unmet_HCN - Yes	3860	6.1
Unmet_HCN - No	59441	93.9
total	63301	

HCN=health care need

Table 2: Definition of variables

Variable name	QNR items	coding
IDNUMR	Unique ID number for this household	Cluster variable
STATE,	State of residence,	Stratification variable 1
SAMPLE	Telephone sample type	Stratification variable 2
NSCHWT	NSCH Final weight	Survey Weight variable
Currently have DBD	Has a doctor or other health care provider ever told you that [S.C.] had behavioral or conduct problems such as Oppositional Defiant Disorder or Conduct Disorder and whether the child currently has the condition	1=yes ; 0=no
UNMET_HCN	How many children had medical, dental, mental health, or other health care needs that were delayed or not met during the previous 12 months?	1=yes; 0=no

Currently have ADHD	Does [S.C.] currently have Attention Deficit Disorder or Attention Deficit Hyperactive Disorder, that is, ADD or ADHD?	1=yes ; 0=no
DBD_Severity	Would you describe [his/her] behavioral or conduct problems as mild, moderate, or severe?	1=mild; 2=moderate/severe
ADHD_Severity	Would you describe [his/her] ADHD problems as mild, moderate, or severe?	0=no ADHD; 1=mild; 2=moderate/severe
Age of the child	Selected Child's (S.C) Age in years	1=11-12 years; 0=6-11 years
Gender of the child	Selected Child's (S.C) gender	1=male; 0=female
Body mass index (BMI)	Body mass index for age classification for sample child	0=normal; 1=overweight; 2=obese
Race / ethnicity	How many children of different races or Hispanic ethnicity are in the 0-17 year old U.S.population?	0=White; 1=Hispanic; 2=NH black;3=NH others
Household education	What is the highest grade or year of school [you have / [S.C.]'s [Mother, father TYPE] have completed?	1 = Less than high school 2 = 2-12 years, High school graduate 3 = More than high school
Health insurance	What type of health insurance coverage, if any, did [child name] have at the time of the survey?	0=constant insurance 1=uninsured/disrupted insurance
Federal poverty level (FPL)	Household income level expressed as percentage of Federal Poverty Level (FPL)	1=FPL <200 pcnt 0=FPL >=200 pcnt
Number of kids at home	How many people less than 18 years old live in this household	0=1-3 kids in household 1=>=4 kids in household

Number of Adults at home	Number of Adults in the household	0=1-2 adults at home; 1=3 or more adults at home
Caregiver Relationship	Would you say that your relationship is completely happy, very happy, fairly happy, or not too happy?	0=caregiver very happy 1=caregiver not very happy
Parental stress	Parental stress: How parents felt during the past month: child was much harder to care for than other children; often bothered a lot by their child's behavior; and/or angry with child.	0=no stress from parenting 1=usually/always have stress
Social support	Is there someone you can turn to for day to day emotional help with parenthood/raising children	1=No social support 0=yes, has support
Mental & emotional health of mother	Would you say that, in general, [[S.C.]'s [MOTHER TYPE]'s / your] mental and emotional health is excellent, very good, good, fair, or poor?	0=Excellent/very good 1=Fair/poor
Physical & mental health of mother	Would you say that, in general, [[S.C.]'s [MOTHER TYPE]'s / your] mental and physical health is excellent, very good, good, fair, or poor?	0=Excellent/very good 1=not excellent/ very good
General health	In general, how would you describe [S.C.]'s health?	0=excellent/very good 1=poor health
Medical Home	Children whose health care meets criteria for all 5 components of medical home: personal doctor or nurse, usual source of care, family centered care, getting referrals when needed, and effective care coordination when needed	1= Does not meet criteria 0=Meets criteria
Feelsad	[He/She] is unhappy, sad, or depressed	1=yes; 0=no
Passive_smoking	Does anyone living inside of [child name]'s home smoke inside the home?	0=non-smoking household 1=no inside smoking 2=inside smoking
Share_ideas with child	How well can you and [S.C.] share ideas or talk about things that really matter?	0=shares ideas with child 1=does not share well

Neighborhood support	How many children live in supportive neighborhoods?	0=has neighborhood support 1=no neighborhood support
Neighborhood amenity	How many children live in neighborhoods that contain certain amenities -- parks, recreation centers, sidewalks or libraries?	0=2 or more amenities 1=none or one amenity
Neighborhood detraction	In your neighborhood, is there litter or garbage on the street or sidewalk? poorly kept or [dilapidated/rundown] housing? How about vandalism such as broken windows or graffiti?	0=no detracting elements 1=has detracting elements
Safety_Neighborhood	How often do you feel [child name] is safe in your community or neighborhood?	1=never 0=usually
Safety in school	How often do you feel [child name] is safe at school?	0=usually felt safe at school 1=never felt safe
Missed school days	During the past 12 months, about how many days did [child name] miss school because of illness or injury?	0=missed school 0-11 days 1=missed school > 11 days
Sleep nights	During the past week, on how many nights did [child name] get enough sleep for a child [his/her] age?	1= 4 or more nights of adequate sleep 0=None <=3 nights sleep
Adverse Family Experience)	A modified version of nine adverse childhood experiences list was developed for this survey: (1) socioeconomic hardship, (2) divorce/separation of parent, (3) death of parent, (4) parent served time in jail, (5) witness to domestic violence, (6) victim of neighborhood violence, (7) lived with someone who was mentally ill or suicidal, (8) lived with someone with alcohol/drug problem, (9) treated or judged unfairly due to race/ethnicity	0=No adverse family experience (AFE) 1=one AFE 2=2 or more AFE
Adult_mentor	Other than adults in your home or [S.C.]'s parents, is there at least one other adult in [S.C.'s] school, neighborhood, or community who	0=Has adult mentors outside of home 1=No adult mentors outside of home

	knows [S.C.] [him/her] well and who [he/she] can rely on for advice or guidance?				
Number of co-morbidities	How many children currently have one or more chronic health conditions from a list of 18 conditions other than behavioral disorder?			0=No comorbid conditions 1=1comorbid condition 2=2 or more comorbid conditions	

Table 3: Frequency Distribution of Selected Characteristics for Unmet Health care needs in 6-17 year old children with Behavior disorder (DBD) without ASD or MR

Characteristics		UnmetHCN-yes WgtFreq	UnmetHCN-yes Percent	UnmetHCN no WgtFreq	Unmet HCN- no Percent
Age	6-11 years	123017	46.34	536786	49.26
	12-17 years	142468	53.66	552890	50.74
gender	Female	90829	34.26	342483	31.43
	Male	174301	65.74	747193	68.57
Body mass index	Normal	121757	64.56	432313	60.98
	Overweight	27114	14.38	138646	19.56
	Obese	39727	21.06	137982	19.46
Race	Hispanic	55798	21.49	207816	19.39
	NH White	125878	48.48	526453	49.12
	NH Black	43808	16.87	239861	22.38
	NH All others	34177	13.16	97668	9.11
Education- household	Less than HS	27792	10.55	188675	17.53
	12 years, HS graduate	78621	29.85	331452	30.8
	More than HS	157003	59.6	556071	51.67
Insurance	Constant insurance	182945	69.04	1014124	93.66
	Uninsured/disrupted insurance	82023	30.96	68665	6.34
FPL- Fed	FPL>=200%	65750	24.77	345206	31.68

poverty level	FPL<200%	199734	75.23		744471	68.32
Number of kids at home	1- 3 kids in household	220699	83.13		917040	84.16
	4 or more kids in household	44785	16.87		172637	15.84
Stress from Child care	No stress from parenting	89983	33.93		531529	48.81
	one or more stress -usually/always	175244	66.07		557547	51.19
Mental, emotional health-Mother	Excellent/Very good	170478	72.41		745000	80.91
	Fair/poor	64955	27.59		175819	19.09
Physical, mental health -mother	Excellent/very good	50535	21.46		269448	29.28
	Not excellent/ Very good	184899	78.54		650735	70.72
Current ADHD	No ADHD	54063	20.36		328942	30.19
	Currently has ADHD	211421	79.64		760735	69.81
DBD_Severity	Mild DBD	80702	30.4		378255	34.73
	Moderate/severe DBD	184783	69.6		710736	65.27
ADHD_Severity	No ADHD	54063	20.42		328942	30.25
	Mild ADHD	58927	22.26		183468	16.87
	Moderate/severe ADHD	151720	57.32		575120	52.88
Medical home	Meets criteria for Medical home	23111	8.96		447375	41.92
	Does not meet criteria	234718	91.04		619947	58.08
Number of adults at home	1-2 adults in household	217363	81.99		884593	81.23
	3 or more adults in household	47751	18.01		204408	18.77

caregiver relationship	caregiver very happy	120669	88.82		561540	91.67
	caregiver not too happy	15184	11.18		51041	8.33
Socialsupport	Have social support	199203	75.23		898356	82.49
	No social support	65573	24.77		190720	17.51
General Health-Child	Good/excellent	225586	84.97		991813	91.02
	poor health	39898	15.03		97864	8.98
Feel sad,depressed, unhappy	No	77619	29.34		429848	39.84
	yes	186971	70.66		649199	60.16
passive smoking	Non smoking Household	94927	35.86		589683	54.39
	No Inside smoking	91564	34.59		321795	29.68
	yes, inside smoking	78196	29.54		172727	15.93
Share ideas with child	yes, shares very well	231095	87.05		909583	83.48
	No, not well	34390	12.95		179953	16.52
NH_support	Has neighborhood support	188740	72.64		776864	72.56
	No NH support	71096	27.36		293841	27.44
NH_amenity	2 or more amenities	235990	89.62		947357	87.97
	None or one amenity	27327	10.38		129521	12.03
NH_detraction	No NH detracting elements	115089	43.72		664803	61.88
	any one of garbage, vandalism, housing	148128	56.28		409506	38.12
safety Neighborhood	usually safe NH	189527	73.09		870762	80.54
	never felt safe	69789	26.91		210428	19.46

Safety_School	usually felt safe at school	197177	77.95		894844	84.42
	Never felt safe at school	55760	22.05		165104	15.58
number of missed school days	Missed school <11 days	184278	72.09		919780	86.84
	Missed school >=11 days	71350	27.91		139388	13.16
number of nights of adequate sleep	Got 4 or more night's sleep	186086	70.87		922459	85.73
	None/LE 3 nights sleep	76500	29.13		153487	14.27
Adverse Family experiences (AFE)	No adverse family experiences	7150	2.71		154909	14.3
	one adverse family experience	49248	18.7		251375	23.2
	Two or more adverse family experiences	207018	78.59		677071	62.5
Adult_mentor	Has Adult mentors outside of home	239644	91.33		947387	87.97
	No adult mentors outside of home	22746	8.67		129580	12.03
Number of comorbidities	No current chronic Health condition	13687	5.16		122897	11.28
	Has 1 chronic HC	46801	17.63		242165	22.22
	has 2 or more chronic HC	204997	77.22		724615	66.5

HCN=health care need

Table 4: Survey Wald Chisq Screening P-Values for the significant univariate association with

the outcome for All Predictors at p<0.10

Predictor	P-value
Current ADHD	0.0435

Health Insurance	<0.0001
Parental stress	0.0156
Medical Home	<0.0001
feelsad	0.0772
passive_smoking	0.0084
NH_detraction	0.0063
Missed school days	0.0121
sleep_nights	0.0104
AFE	<0.0001
Number of comorbidities	0.0623

NH=neighborhood, AFE=adverse family experience

Table 5: Multivariate Logistic Regression Model's Best Predictors using Wald screening predictors

Predictor	Effect	Odds Ratio	95% CI Low	95% CI High	P-Value
Health Insurance	Constant insurance	1.00			
	Uninsured/disrupted insurance	5.42	2.61	11.25	<0.0001
Medical Home	meets criteria for medical home	1.00			
	does not meet criteria for medical home	6.28	2.92	13.50	<0.0001
AFE	No AFE	1.00			
	one AFEs	3.98	1.30	12.20	0.0156
	Two or more AFEs	4.90	1.94	12.41	0.0008

AFE=adverse family experience

Table 6: Groups and Their Respective Predictors in Group wise Method

Group Name	Size	List of Predictors
Child Factors	10	Current ADHD, DBD severity, ADHD severity, General health, medical home, feel sad, Miss school days, sleep nights, AFE, Number of comorbidities

Demographic Factors	8	age, gender, BMI, Race, Education, Insurance, FPL, passive smoking
Family Factors	8	Number of kids at home, # adults at home, Caregiver relationship, parental stress, Social support, Mental emotional health- mother, Physical mental health- mother, share ideas
Neighborhood Factors	6	NH_Support, NH_amenity, NH_detraction, safety_Neighborhood, safety school, adult mentor

FPL=federal poverty level, NH=neighborhood

Table 7: Each Group's Best Predictors in Groupwise Logistic Regression

Predictor	Effect	Odds Ratio	95% CI Low	95% CI High	P-Value
Child Factors Group					
Medical Home	meets criteria for medical home	1.00			

Predictor	Effect	Odds Ratio	95% CI Low	95% CI High	P-Value
	does not meet criteria for medical home	7.30	3.23	16.51	<0.0001
AFE	No AFE	1.00			
	one AFEs	4.36	1.59	11.91	0.0042
	Two or more AFEs	5.69	2.41	13.46	<0.0001
Missed School days	Missed school <11 days	1.00			
	Missed school >=11 days	2.23	1.13	4.41	0.0204
Demographic Factors Group					
Health Insurance	Constant insurance	1.00			
	Uninsured/disrupted insurance	5.45	2.37	12.53	<0.0001
Household education	Less than HS	1.00			
	12 years, HS graduate	1.97	0.75	5.16	0.1687
	More than HS	3.21	1.22	8.41	0.0180
Family Factors Group					
N/A	N/A	N/A	N/A	N/A	N/A
Neighborhood Factors Group					
NH_detraction	No NH detracting elements	1.00			
	any one of garbage, vandalism, housing	2.33	1.32	4.08	0.0033

NH=neighborhood, AFE=adverse family experience

Table 8: Aggregated Groupwise Logistic Regression Model's Best Predictors

Predictor	Effect	Odds Ratio	95% CI Low	95% CI High	P-Value
Medical Home	meets criteria for medical home	1.00			
	does not meet criteria for medical home	7.85	3.51	17.57	<0.0001
Missed School days	Missed school <11 days	1.00			
	Missed school >=11 days	2.13	1.07	4.24	0.0321
AFE	No AFE	1.00			
	one AFEs	4.64	1.47	14.59	0.0088
	Two or more AFEs	5.12	2.16	12.13	0.0002

Health Insurance	Constant insurance	1.00			
	Uninsured/disrupted insurance	5.06	2.50	10.25	<0.0001
Passive smoking	Non smoking Household	1.00			
	No Inside smoking	1.40	0.79	2.49	0.2502
	yes, inside smoking	2.08	1.02	4.23	0.0428

AFE=Adverse Family experience

Table 9: Best Predictors and their Importance Scores (Random forest)

Predictors	Mean Decrease Accuracy
Medical Home	0.032010014
Health insurance	0.021866918
Neighborhood detraction	0.012567412
Passive smoking	0.010531208
Adverse family experience (AFE)	0.009938936
Missed School days	0.009550455
Inadequate sleep nights	0.008757273
Number of comorbidities	0.006576257
Household education	0.006376283
Feeling sad	0.005436914

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