A Cross-Sectional Analysis of Prescription Medication Use by Children:

The Implications and Impact of Acculturation

by

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A Thesis

Presented to the Department of Public Health & Preventive Medicine
and the Oregon Health & Science University
School of Medicine
in partial fulfillment of
the requirements for the degree of
Master of Public Health

School of Medicine
Oregon Health & Science University

CERTIFICATE OF APPROVAL

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ACKNOWLEDGEMENTS

Christy Bethell - for mentorship and advice on conceptual approach

Erin Fitch - for support and humor

Mike Lasarev - for statistical advice

Tomi Mori - for statistical help and mentorship

Cindy Morris - for mentorship, conceptual ideas and approach

Deb Read - for patience, conceptual and statistical advice, and being a source of and backboard for ideas

Tamela Stuchiner - for help with cleaning the data set

The Oregon Clinical and Translational Research Institute - for financial, logistic and advisory support

Abstract:

Background: There are significant health and health care disparities between Hispanic and white children in the United States. Hispanic children are a heterogeneous group by nationality, level of acculturation and immigrant status. Prescription medications are key to the management of many childhood conditions, and disparities in the use of prescription medications have been found between Hispanic and white children. It is not known whether these disparities are the same or different across different groups of Hispanic children.

Objectives: This study examined how Hispanic children, stratified by language of interview to indicate level of acculturation, differ in socio-demographic characteristics and both overall and specific classes of medication use. We also examined which factors are associated with the use of different classes of prescription medications.

Methods: We used data from the 2004 Medical Expenditure Panel Survey linked to the National Health Interview Survey to analyze children's use of medications in 2004. Independent variables were grouped as predisposing characteristics, enabling factors, perceived need, and evaluated need. Multivariable logistic regression was used to assess the impact of independent variables on the outcomes of overall and specific types of medication use.

Results: Spanish-interviewed Hispanics were less likely to have a usual source of care than English-interviewed Hispanics (79.4% versus 90.7%), and Spanish-interviewed Hispanic children were twice as likely to be uninsured all year than English-interviewed Hispanic children (18.6% versus 8.9%). Both groups of Hispanic children had lower odds of using any prescription medication compared to White children, which was largely explained by enabling factors such as having a usual source of care but also by perceived need characteristics such as perceived health status. The lower use of psychiatric medications in the Spanish-interviewed group compared to white children was not explained by the independent variables (final model odds ratio = 0.28, 95% confidence interval: 0.10, 0.79) while the use of antibiotics was (final model odds ratio = 1.07, 95% confidence interval: 0.76, 1.51). There was no significant difference in the use of any respiratory medication among the groups of children, but Hispanic, Spanish-interviewed children were less likely to have reported active asthma (p-value = 0.007).

Conclusions: There are significant differences between Hispanic children by acculturation as indicated by language of interview, and acculturation impacts prescription medication use. Hispanic children from more acculturated backgrounds do not experience a disparity compared to white children in their use of psychiatric medications while Hispanic children from less acculturated backgrounds do. These findings may be used to more specifically address disparities and the medical needs of Hispanic children.

Background:

Hispanic children make up 20% of children in the United States (NCHS, 2006). Research consistently reveals significant health and health care disparities between Hispanic and white children (Flores, 2008; Durden, 2007; Scott, 2004; Zambrana, 2000; Flores, 2002). Most studies treat Hispanic children as a homogeneous group, but the designation of Hispanic ethnicity alone does not adequately capture the underlying diversity of nationality, immigration status and acculturation. At least one half of Hispanic children in the United States live in "mixed status" families with at least one non-citizen parent (Ojeda, 2005) and between 40-50% of Hispanics nationally report limited English proficiency or choose to respond in Spanish when contacted for household interviews (Pippins, 2007; Read, 2007). So while we know there are disparities between white and Hispanic children, taken as a group, it is not clear whether these disparities persist or are different across the subgroups or strata of Hispanic children.

Acculturation is one way in which the Hispanic population is heterogeneous, and acculturation may play a significant role as an effect modifier per disparities in health and health care access. Acculturation is a complex concept but can be defined as "the acquisition of the cultural elements of the dominant society" (Lara, 2005). There are two main iterations or models of acculturation. One, a unidimensional model, essentially asserts a linear process in which a person gradually gives up the culture of their origin and takes on the dominant culture of their new setting. A refinement of that model is that of bidimensional acculturation. This model states that any assimilation into the new culture and any loss of the old cultural roots are independent processes. Some people both maintain their old cultural roots and adopt aspects of the new culture (bicultural), some completely reject their old culture and adapt the new in a non-linear fashion not captured by the unidimensional model, and others fall somewhere along that spectrum of experiences. This study assumed a more unidimensional model in this analysis for sake of simplicity with the understanding that this model may not completely reflect the life experience of many immigrants.

Of the measures used to indicate degree of acculturation, language is one of the most robust, explaining most of the variance of acculturation scales (Deyo, 1985; Lara, 2005). Using language as a marker does have limitations; it may not capture other aspects of culture such as food, music, cultural heritage etc. Additionally, using language as the measure of acculturation may be subject to the limitation of misclassification of exposure since language may also be a communication barrier and thus impact health outcomes and health care access. Despite these potential limitations, it is a robust marker for acculturation, and we will attempt to take into account any potential effect of language as a communication barrier.

Acculturation, measured by parental language, is strongly associated with children's timely access to quality health care (Read, 2007; Seid, 2003; Weinick, 2000; Yu, 2006). In one study, adjusting for insurance status and poverty level reduced, but did not completely account for, the disparity in Hispanic children's access to a usual source of health care (Weinick, 2000). However, taking into account the language of interview of the parent eliminated the remaining differential between Hispanic and white children.

Prescription medications are essential in the management of many acute and chronic pediatric conditions. Lower use of prescription medications in the U.S. Hispanic child population is well documented (Flores, 2008; Hahn, 1995; Weinick, 2004). Of these studies, two examined the relationship between family acculturation and medication use in the Hispanic population, using language as the measure for acculturation (Flores, 2008; Weinick, 2004). However, Weinick, et al. adjusted for age but did not analyze children separately, and Flores, et al. adjusted for primary language spoken at home but did not separately examine its interaction with Hispanic ethnicity. Adjustment may not be appropriate if acculturation, measured by language, is an effect modifier.

Read et al. came closest to examining the question of the potential effect modification of acculturation on prescription medication use (Read, 2007). They used the children with special health care needs (CSHCN) screener questions, one of which asks about need for chronic prescription medication. While their method does not address the question exactly, they did have some interesting findings. They found that the prevalence of prescription medication use, as measured by the CSHCN question, to be 70 percent lower among Hispanic children whose parents responded to an interview in Spanish compared with those whose parents responded in English (Read, 2007). Aside from this study, there have been no studies on the potential variations in the use of prescription medication in the Hispanic child population, either overall or by therapeutic class, according to markers of family acculturation.

Why might we expect a difference by acculturation for use of prescription medications? One reason is the Latino Epidemiologic Paradox. The Latino

Epidemiologic Paradox is essentially the finding in the Hispanic population that despite the higher prevalence of risk factors for poor health outcomes such as lower income, lower education and less access to health care, the population does as well or better than whites in many categories (life expectancy, infant mortality etc). Moreover, the paradox appears to be strongest in less acculturated Hispanics (Abraido-Lanza, 1999; Hayes-Bautista, 2002). While there is little evidence specific to children per this paradox, given the overall finding, we might expect that less acculturated Hispanics use fewer medications than more acculturated Hispanics because they are healthier.

Another potential reason for a difference is lack of access to care. Language has been shown to have an impact on having a usual source of care (Weinick, 2000), insurance status and emergency room utilization (Yu, 2006). There is also evidence indicating that mother's immigration status and time spent in the U.S. impact children's access to care (Durden, 2007), and acculturation measures such as language correlate with immigration status. Therefore, assuming language is a marker for acculturation, we might expect a lower prevalence of use of medications by children from less acculturated family backgrounds due to access to care issues.

All of the studies on children's use of medications by acculturation have looked at overall medication use. We also wanted to investigate the use of specific classes of medications as acculturation likely has differential effects on the use of medications depending on the type or class of medication.

Particularly for respiratory medications, there is evidence indicating that there is a lower prevalence of asthma among less acculturated Hispanic children, particularly

Mexican-American children (Martin, 2007). Furthermore, Puerto Rican children have been found to have the highest rates of asthma of any children (Lara, 2006), and these children may also come from more acculturated backgrounds given Puerto Rico's status as a U.S. territory. Therefore, one might expect less acculturated Hispanics to use fewer respiratory medications than more acculturated Hispanic children.

Medications for attention-deficit/hyperactivity disorder (ADHD) are another example of a commonly used medication in childhood that may be influenced by acculturation. There is some indication that less acculturated Hispanics are less inclined to interpret similar symptoms as ADHD than more acculturated Hispanics (Visser, 2007; Perry, 2005). Given this evidence, we might expect to see a lower use of psychiatric medications in the less acculturated Hispanic group in comparison to white children, while the more acculturated group may show little difference compared to white children.

Objectives and Hypotheses:

Objective 1: To describe the differences, if any, in socio-demographic, health status and prescription medication use characteristics among Hispanic children from more acculturated family backgrounds; Hispanic children from less acculturated family backgrounds; white children; and non-Hispanic, non-white children.

Hypothesis 1: There are significant differences among these groups with Hispanic children from more acculturated family backgrounds being more similar to white children socio-demographically and in their use of medications than Hispanic children from less acculturated family backgrounds. We used design-based F-statistics to test this hypothesis.

Objective 2: To elucidate what factors are associated with the lower use of prescription medications in the Hispanic child population.

Hypothesis 2: Hispanic children, both English and Spanish interviewed, use fewer prescription medications primarily due to barriers in access to care, but also due to differences in perceived need for medications. We used multivariable logistic regression to test this hypothesis.

Objective 3: To describe the use of specific classes of prescription medications and the factors associated with their use among Hispanic children from more acculturated family backgrounds, Hispanic children from less acculturated family backgrounds, white children, and non-Hispanic, non-white children.

Hypothesis 3: Fewer Hispanic children from less acculturated family backgrounds use respiratory and psychiatric medications than white children, and there is no difference between white children and Hispanic children from more acculturated family backgrounds in the use of these medications. For respiratory medications, this is due to perceived and evaluated health need due to a lower prevalence of asthma. For psychiatric medications, this difference cannot be attributed to any explanatory factors, but is primarily an acculturation effect. We used multivariable logistic regression to test these hypotheses.

Methods:

Data Source and Survey Design:

This study used data from the 2004 Medical Expenditure Panel Survey (MEPS) linked to 2002 and 2003 National Health Interview Survey (NHIS) data for this analysis (Cohen, 1997; NCHS, 2003). Data from MEPS are linked to the NHIS using unique person identifiers as MEPS is a subset of the NHIS. The MEPS is a longitudinal, panel-based survey carried out by the Agency for Healthcare Research and Quality. The survey panel for each year of MEPS is derived from the prior year's NHIS and uses an overlapping, complex sampling design to survey the U.S. civilian, non-institutionalized population (Figure 1). The primary sampling unit for the NHIS survey, and by extension the MEPS survey, is on the county level. Density strata are then formed within each county to account for the distribution of minority populations. Within each stratum, clusters of housing units are identified for the survey. Hispanic and black households are over-sampled at 2 and 1.5 times the rate, respectively, of other households.

Data Collection:

The MEPS survey collects data from individuals and their families, their medical providers (doctors, hospitals, home health care providers and pharmacies), and their employers asking about insurance types and coverage offered. There are two publicly available components, the household and the insurance (the medical provider component is a third collected by MEPS but then integrated into the household for public release). The household component used a face-to-face, computer-assisted personal interviewing (CAPI) method. The data collected include demographic characteristics, health conditions, health status, use of medical services, charges and source of payments, access to care, satisfaction with care, health insurance coverage, income, and employment (Cohen, 1997). The household respondent provided all information for children in the sample.

Prescribed medication data are collected for every member in the household during each round of the MEPS (Figure 1). While these data are part of the Household component of the survey, they are separated for analysis purposes into their own section, the Prescribed Medications file. The data are obtained during the interview by asking the household respondent to list and bring out all the prescribed medications for each person in the household. The prescription data for each household member are verified with the dispensing pharmacy through a follow back survey. National Drug Codes are later assigned to each medication by independent coders. The National Drug Codes are further grouped into therapeutic classes based on the Multum Lexicon Plus (*Cerner Multum, Inc*). In the Prescribed Medications file, each prescription medication is coded as its own event. For example, if a child is taking 3 medications, she will have 3 cases or events in the prescription medications dataset. More details on the coding and utilization of the prescription medications data can be found in the outcome variables section.

Sample Size, Eligibility and Weighting:

The 2004 MEPS sample contains data on 32,737 individuals from 13,018 families. After restricting to those age 0-17 on December 31, 2004, the sample size was 9,786 children. We further restricted the sample to those with linked data to the NHIS which yielded a sample of 8415. Children with any missing data on the variables of interest were excluded if the missing data made up less than 1% of the sample. The final exclusion was for interviews conducted in English and Spanish or interviews conducted in a language other than English or Spanish giving a final sample size of 7539 children. The survey sample weights for MEPS were based on Current Population Survey data to reflect the U.S. civilian, non-institutionalized population in December 2004 after taking into account the complex sampling design of the survey.

Conceptual Approach:

Our study used an adaptation of the Behavioral Model of Health Services Use to account for the complexity of factors potentially influencing the outcome of whether a child used prescription medications (Andersen 1995). This model has three main components: predisposing characteristics, enabling resources, and need, which together lead to the outcome of health services use. Predisposing characteristics are those that 'predispose' a person to use a given health service – for example, older male children may be more predisposed to using a medication for ADHD. These are also less mutable characteristics. Enabling factors are those that allow a person to use the health service – having insurance, a usual source of care etc. We divided the concept of need into perceived need (health status) and evaluated need (provider visits), evaluated need being closely related to utilization of care (Andersen, 1995). This division for the need component is an important one, since parsing out whether a child is healthy or not is likely dependent on whether the child has been evaluated (seen a physician). Therefore, dividing these variables into perceived need and evaluated need will allow for the assessment of the impact of need (health status) independent of the medical system.

Variables:

Independent Variables:

Reported race, ethnicity, and language of interview were combined to create one variable with four categories: Hispanic, English interview; Hispanic, Spanish interview; white, English interview; non-Hispanic, non-white, English interview. We excluded children with interviews conducted in both English and Spanish or in any language other than English to more clearly assess the effect of acculturation. Others have previously combined the English and Spanish-interviewed groups with the Spanish-interviewed group. While it would be valuable to analyze this group separately to assess a potential 'dose-response' relationship, the sample size did not allow for that analysis here. While we will use the terms 'less acculturated' and 'more acculturated' to describe children for literary ease, these terms should be interpreted as 'from less or more acculturated family backgrounds.'

Predisposing characteristics were mother's citizenship, age, sex and family size. Respondent reported nationality was also examined. Mother's citizenship was obtained from linking to the NHIS data and was coded dichotomously as: 'Yes, a citizen' or 'No, not a citizen.' Age was transformed from a continuous to a categorical variable of: 0-5 years of age; 6-11; 12-17. Sex was coded as male or female. Family size is based on the total number of persons reported to be living in the same house who are related and was coded as: 3 or fewer; 4-5; 6 or more family members. Nationality was respondent reported and coded as Puerto Rican; Mexican; combined Cuban and Dominican (for cell size considerations); combined Central, South American and other (for cell size).

For enabling resources, we used variables of mother's education, family income, region in the U.S., metropolitan statistical area (MSA) denoting rural vs. urban, insurance status, having a usual source of care, transportation to the usual source of care, and ethnicity of the provider. Mother's education was obtained from linking to NHIS data and was coded as: less than high school; completed high school; more than high school; refused, don't know or not ascertained. Family income was coded as: <100% of the Federal Poverty Line (FPL); 100-199% of FPL; 200-399% of FPL; ≥400% of FPL. Region in the U.S. was coded as: Northeast; Midwest; South; West. Metropolitan statistical area (MSA) was coded as a binary variable of either living in an MSA or not. Insurance status was coded as: any private insurance during the year; any public insurance (including the military insurance Tricare) during the year; uninsured for the entire year. Having a usual source of care was coded as: 'Yes, have a usual source of care' or 'No, do not have a usual source of care or usual source of care is the emergency room.' Transportation to provider was only available for those children with a usual source of care and was coded as: very difficult or somewhat difficult; not too difficult or not at all difficult. Ethnicity of provider information was only available for those who reported both a usual source of care and that their usual source of care was a person, not a facility; it was coded as 'Yes, Hispanic provider' or 'No, not Hispanic provider.'

Perceived need variables included perceived health status, perceived mental health status, missed days of school due to illness or injury, and having an illness or injury requiring urgent care. The perceived health status variable was created using a set of six questions asked in the interview that are part of the well validated Child Health

Questionnaire (Landgraf, 1996). For this set of six questions, a composite score was created with a potential score range from 0-100 with a score of 100 being the best perceived health. There are 25 levels to this scoring system. A nationally-based mean for this score was reported as 73.0 with standard deviation of 17.3 and a number of standardized means for various conditions are also reported with the mean for those with asthma, for example, being 59.7 with a standard deviation of 17.4 (Landgraf, 1996). Perceived mental health status was respondent-reported and coded as: very good or excellent; good; fair or poor. Missed days of school due to an illness or injury was respondent-reported for each round and was coded as: missed 0 days of school; missed 1-2 days of school; missed 3-4 days of school; missed 5 or more days of school; not asked because less than 3 years old; not asked because older than 3 years old but not in school. For the variable of any illness or injury, parents (respondents) were asked if the child had an illness, injury, or condition that needed care right away from a clinic, emergency room, or doctor's office, and this variable was coded dichotomously as yes or no.

The evaluated need variables were any outpatient visit, any emergency room visit, and any inpatient stay. Each of these variables was coded dichotomously as had 0 visits or had 1 or more visits to the respective source of health care.

Outcome variables:

We created a binary outcome corresponding to any new or refilled prescription obtained for the child during 2004 using the data on prescription medications collected as described above. Additional binary variables were constructed to assess prescription medication use for the five most frequently prescribed therapeutic categories of medication for children: anti-infective, psychiatric, topical, respiratory, and central nervous system (CNS) medications. These variables were created using the Multum Lexicon Plus (*Cerner Multum, Inc*) coding system which is built into the MEPS data files. The Lexicon is organized into therapeutic classes, subclasses, sub-subclasses etc though only 3 levels of information are provided in the public release files. For most medications (~95%), there is only one clinical use and so only one therapeutic class and subclass. However, for ~5% of medications, there is more than one clinical use (e.g. anti-histamines classified as both respiratory and CNS medications). The Lexicon accommodates this by creating a 2^{nd} and 3^{rd} set of therapeutic classes. The decision of which therapeutic class a medication falls under is not hierarchical in terms of the most common conditions or any other ranking. It is therefore necessary to cross-compare medications listed in >1 class or subclass with the self-reported conditions associated with those medications to determine which class makes more sense from a clinical perspective. This was done for approximately 5% of all medications. For the vast majority of the 5% of cases, this was a very straightforward process - e.g. amantadine for flu and for Parkinson's disease (no children had Parkinson's disease reported as the reason for taking this medication).

Additional variables for conditions:

We also examined the limited condition data available for asthma and ADHD. For asthma, respondents were asked if their child had ever received a diagnosis of asthma. Of those who said yes, respondents were asked if their child still had asthma, and of those, if they had an episode or attack in the last 12 months. A number of questions specific to asthma medication use were also asked, including whether or not the child has used any preventive medications for asthma.

Variables for ADHD were obtained from the linked NHIS data. Respondents were first asked if their child had any limitation. If they responded yes, they were provided a list of conditions defined as potentially limiting, of which a diagnosis of ADHD was one. This was coded as either “received a diagnosis” or “did not receive a diagnosis.”

Statistics:

We used design-based F-statistics, the complex samples version of a chi-square statistic, to examine differences in the distributions of predisposing characteristics, enabling resources, perceived need, and evaluated need across the four ethnic/language groups defined. We then tested the bivariate association of these factors with the use of any prescription medication using design-based F-statistics. Variables that did not have a significant bivariate association with any prescription medication use at the $p<0.05$ level were not included in the subsequent regression analyses. We estimated four multivariable models to sequentially evaluate the contribution of the different sets of factors in the conceptual model (predisposing, enabling, perceived need, and evaluated need) on the outcomes of use of any prescription medication and for each of the different classes of medication.

All statistical procedures were conducted in SPSS 15.0 with Complex Samples to appropriately adjust the sample variances for the complex design of the survey (SPSS, 2006). Figure 2 was created using GraphPad Prism, version 5.00, San Diego, CA.

Results:

Socio-demographic differences between groups:

Overall, 10.2% of the sample reported Hispanic ethnicity and were interviewed in English; 7.6% of children were Hispanic with a Spanish interview; 61.0 % were white with an English interview, and 21.2% were non-white, non-Hispanic with an English interview. The Hispanic, Spanish-interviewed group was much less likely to have U.S. citizen mothers compared to the Hispanic, English-interviewed group (33.4% vs. 85.4%) (Table 1). The Spanish-interviewed group was also poorer and was twice as likely to have been uninsured the entire year compared to English-interviewed Hispanics. Only 79.4% of Hispanic, Spanish-interviewed children had a usual source of care versus 90.7% of their English-interviewed Hispanic counterparts and 93.1% of white children. The Hispanic, Spanish-interviewed group also had a lower proportion with very good or excellent reported mental health status. However, the same group reported missing fewer days of school due to illness or injury and had fewer reported injuries or illnesses. Hispanic, Spanish-interviewed children also had fewer visits, both outpatient and emergency, than other groups.

Prescription medication use:

In comparison with the Hispanic, English-interviewed group and the white, English-interviewed group, there was a smaller proportion of Hispanic, Spanish-interviewed children who used any medication (36.8% vs. 45.8% for Spanish vs. English-interviewed Hispanics, respectively) (Table 1). We also found significant differences between groups in the use of specific classes of medications. Spanish-interviewed

Hispanics were much less likely to have used psychiatric medications and somewhat less likely to use antibiotics or topical medications than white children. Fewer children in the Hispanic, Spanish-interviewed group used a respiratory medication, but overall there was no significant difference between the groups (design-based F-test, p-value = 0.268). A higher proportion of the Hispanic, Spanish-interviewed used CNS medications, though this was also not significant using this method (design-based F-test, p-value = 0.113).

Factors associated with overall medication use:

For predisposing factors, having a mother who was a citizen, being of younger age, and living in a smaller family were all associated with a greater likelihood of using any medication (Table 2). There was no observed difference for sex (design-based F-test, p-value = 0.523). Greater maternal education and higher family income were also associated with a greater likelihood of prescription medication use. Children of Mexican nationality had the lowest use of medications within Hispanics (design-based F-test, p-value = 0.022). Uninsured children were much less likely to have used a medication (33.1% of uninsured vs. 51.2% of privately insured), as well as children without a usual source of care (24.3% of those without vs. 51.6% of those with a usual source of care). Ease of transportation to the usual source of care or having a Hispanic provider did not increase the probability of using any prescription medicine. The more days a child missed from school due to illness or injury, the more likely they were to have used a medication (80.8% of those who missed 5 or more days vs. 40.8% of those who missed 0 days). Having any illness or injury and having any type of visit to a provider were also strongly associated with prescription medication use.

Logistic Regression Results for Any Medication Use:

In the unadjusted model, Hispanic, English-interviewed children were somewhat less likely than white children to have used any medication (odds ratio (OR) = 0.71, 95% confidence interval (CI): 0.57, 0.88), and both the Hispanic, Spanish-interviewed and the non-white, non-Hispanic groups had about half the odds of using any medication as white children (Table 3). After taking predisposing factors into account, the odds that Hispanic, Spanish-interviewed children used any medication were still about half of the odds for white children (OR = 0.55, 95% CI: 0.44, 0.69). Interestingly, mother's citizenship was not a significant predictor (p-value = 0.210), while age and family size were.

After taking into account enabling factors (Table 3), the Hispanic, Spanish-interviewed group had the same statistical odds of using any medication as white children (OR = 0.79, 95% CI: 0.59, 1.04). The strongest predictor was having a usual source of care, though insurance status and region played a role as well. The predisposing factors of age and family size also significantly contributed to the model. Enabling factors did not explain the difference in medication use compared to white children for either the Hispanic, English-interviewed or the non-white, non-Hispanic children.

After adding the perceived need variables to the model (Table 3), the Hispanic, English-interviewed group had the same odds of using a medication as white children (OR = 0.80, 95% CI: 0.64, 1.01). The only variable of this set that was not a significant predictor of overall medication use was perceived mental health status (p-value = 0.324); perceived health status score, missed school, and having any illness or injury were all strong predictors. The non-Hispanic, non-white group still had lower odds than white children (OR = 0.60, 95% CI: 0.50, 0.72).

In the final model, after adding all of the explanatory variables (Table 3), only the non-Hispanic, non-white group of children had statistically lower odds of using a medication compared to white children (OR = 0.61, 95% CI: 0.51, 0.74). Interestingly, insurance (p-value = 0.088) and age (p-value = 0.106) were no longer significant predictors of medication use after taking into account the evaluated need variables. Of the evaluated need variables, an outpatient visit and an emergency (ER) visit were significant contributors to the model. Having a usual source of care was a strong predictor of prescription medication use even after taking into account provider visits, and the perceived health status score and having any illness or injury variables were as well (Table 3).

We also examined the Hispanic population alone using the English-interviewed group as the reference with white and non-Hispanic, non-white children set as missing (Table 4). For this sample, a bivariate analysis using design-based F-statistics showed that sex was significantly associated with any prescription medication use (44.6% of males used any medication vs. 39.1% of females, p-value = 0.025), so sex was included in these models. Looking at only Hispanic children, mother's citizenship and sex of the child were either significant or borderline significant contributors to the models, whereas when all children were included previously, these variables were not significant. Of note, having a mother who was not a citizen was associated with a greater likelihood of using any medication. Similar to the model with all children, the Hispanic, Spanish-interviewed group did have the same odds of using any prescription medication as the English-interviewed group after taking into account enabling factors such as having a usual source of care and insurance status (Table 4).

Specific medication class use and the factors associated with that use:

Anti-infective medications:

All groups had about half the odds of using any anti-infective medication compared with white children in the unadjusted model (Figure 2a, Table 5). Adjustment for predisposing characteristics had little effect on these odds with age being the strongest explanatory variable and mother's citizenship not significantly contributing. After adding enabling factors to the model, the Hispanic, Spanish-interviewed group had the same odds as white children (OR = 0.91, 95% CI: 0.66, 1.24) (Table 5, Figure 2c). Having a usual source of care was strongly associated with using anti-infective medications, and insurance and income were not (Table 5). The addition of both perceived and evaluated need variables did little to change the odds of using anti-infective medications (Figure 2d,e) despite the fact that many of these factors were significant contributors to the model (Table 5). The Hispanic, Spanish-interviewed group had the same odds as white children (OR = 1.07, 95% CI: 0.76, 1.51); the Hispanic, English-interviewed group had slightly lower odds (OR = 0.73, 95% CI: 0.57, 0.94), and the non-Hispanic, non-white group had about half the odds of using any anti-infective medication (OR = 0.51, 95% CI: 0.42, 0.62) compared to white children.

Psychiatric medications:

Of Hispanic children, only those with a Spanish interview had lower unadjusted odds than white children for using psychiatric medications (Table 6, Figure 2a). These markedly lower odds remained despite adjusting for all explanatory variables (final model OR = 0.28, 95% CI: 0.10, 0.79). In contrast, the Hispanic, English-interviewed group had the same odds as white children for the use of any psychiatric medication (final model OR = 0.99, 95% CI: 0.62, 1.59). In the final model, aside from sex and age (being male and older), the strongest explanatory variables for use of any psychiatric medication were mother's citizenship (being a U.S. citizen), perceived mental health status, and having an outpatient visit with a provider (Table 6). Validating the theoretical model, perceived mental health status was a strong predictor with worse mental health status associated with greater odds of use, while any physical illness or injury was not associated with use of psychiatric medications.

Respiratory medications:

None of the groups of children significantly differed in their unadjusted odds of using any respiratory medication (Figure 2a, Table 7). The estimate for the Hispanic, Spanish-interviewed group was lower than the others but not significantly (OR = 0.78, 95% CI: 0.60, 1.01). In the final model, younger children, children with a usual source of care, having insurance, reporting any illness or injury, and having an outpatient visit were all associated with respiratory medication use (Table 7).

Topical medications:

All groups had lower unadjusted odds of using topical medications compared to white children, and these lower odds remained essentially unchanged after adjusting for all explanatory variables (Figure 2, Table 8). Of the predisposing characteristics, only family size significantly contributed to the model (Table 8) with larger families (6 or more) having lower odds than those of smaller families (3 or fewer). Of the enabling factors, only region in the U.S. was significant. Of the perceived need variables, having any illness or injury, perceived health status and missing school were significant, of the evaluated need variables, only an outpatient visit was significantly associated with any topical medication use (Table 8).

Central nervous system (CNS) medications:

Hispanic, Spanish-interviewed children were more likely to use a CNS medication than their white counterparts in the unadjusted model (Figure 2a, Table 9). The final model strengthened this relationship with Spanish-interviewed Hispanics having twice the odds of using a CNS medication as white children (final model OR = 1.96, 95% CI: 1.24, 3.10). Notably, having a usual source of care was not a significant predictor of any CNS medication use while ER and inpatient visits were (Table 9). Other factors strongly associated with any CNS medication use were age (older), insurance (public vs. uninsured), and perceived health status. The class of CNS medications includes two sub-classes: analgesics and anti-convulsants. Hispanic, Spanish-interviewed children only differed from other groups in their use of analgesics (Table 12), though this did not reach significance (p-value = 0.068).

Psychiatric Medication Use and Attention Deficit/Hyperactivity Disorder:

Given the pattern of use of psychiatric medications, we wanted to assess whether this difference could be attributed to differences in ADHD diagnosis or management. We restricted the sample to children age 6-17 for this analysis since nearly no children age 0-5 receive a diagnosis of ADHD. A significantly lower proportion of Hispanic, Spanish-interviewed children used psychiatric, CNS stimulant or anti-depressant medications (Table 10). The vast majority (75.2%) of psychiatric medications used by children in the sample were CNS stimulants (e.g. methylphenidate), and these medications are used in the management of attention-deficit/hyperactivity disorder (ADHD). The Hispanic, Spanish interviewed group did have a lower prevalence of parent reported ADHD as a limitation for the child, though this was not significant (design-based F-stat = 1.307, p-value=0.254) (Table 10). Of those with a reported ADHD diagnosis, only 13.0% of Hispanic, Spanish-interviewed children used a CNS stimulant medication vs. 59.6% for English-interviewed Hispanics and 66.9% for white children, and this approached significance (design-based F-test = 2.595, p-value = 0.062).

Respiratory Medication Use and Asthma:

We examined the prevalence of asthma diagnosis and found a significantly lower prevalence in the Hispanic, Spanish-interviewed group of children ever diagnosed with asthma (5.1%), children who still have asthma (3.8%), and children with an asthma episode or attack in the last 12 months (1.6%) (Table 11). An examination of the sub-classes of respiratory medications showed that there were significant differences in use for the sub-classes of anti-histamines (p-value = 0.006) and leukotriene modifiers (p-value = 0.03) with a lower prevalence of use for both sub-classes among Hispanic, Spanish-interviewed children.

Of those with active asthma, defined as an asthma episode or attack in the last 12 months, there was no difference in respiratory medication use (Table 11). A similar proportion of Hispanic, Spanish-interviewed children used leukotriene modifiers as the other groups, and, though not significant, a larger proportion of Hispanic, Spanish-interviewed children used anti-histamines. Of those with active asthma, there was no difference among the groups who used preventive asthma medications. Of those who had never received a diagnosis of asthma, there was no difference between Hispanic children by acculturation in overall respiratory medication use (Table 11). A lower proportion of Hispanic, Spanish-interviewed children used the sub-classes of antihistamines and of leukotriene modifiers among those who had never been diagnosed with asthma (Table 11).

***Discussion*:**

The Hispanic child population is not monolithic. In this thesis, we have shown that one important distinguishing characteristic for this population is acculturation, as measured by language. Hispanic children from less acculturated family backgrounds generally experience a greater degree of disparity in health care access and medication use compared to white children than do Hispanic children from more acculturated backgrounds. For some specific classes of medications, the differences in use between Hispanic and white children can be explained by access to care variables (antibiotics), while for others (psychiatric medications), the difference is not explained by any of the models.

Objectives:

Per the first objective, we found that more acculturated, or English-interviewed, Hispanic children are quite distinct from less acculturated, or Spanish-interviewed, Hispanic children in many socio-demographic ways. We also found distinct differences in the use of medicines between the groups of children. In particular, the less acculturated Hispanic children seemed to experience a greater degree of disparity (less insured, lower proportion with a usual source of care, and lower use of medications) in comparison to white children than the more acculturated Hispanic children.

For our second objective of the factors associated with prescription medication use, we found that predisposing factors such as age and mother's citizenship did not explain the lower overall use of prescription medications in either the more or less acculturated groups of Hispanic children. Our hypothesis that the differences in the use of medications between white and Hispanic children could be largely attributed to enabling factors such as having a usual source of care proved true for Hispanic children from less acculturated family backgrounds but not for those from more acculturated family backgrounds. For more acculturated Hispanics, accounting for perceived need as well explained the difference in medication use between them and white children. In the final model with all explanatory variables added, we saw that having a usual source of care was strongly associated with prescription medication use while insurance was no longer significantly associated, and the variables of perceived need and evaluated need were significantly associated with use of medications. This finding underscores the importance of a usual source of care while demonstrating that insurance status makes little difference after accounting for more proximal measures of access such as having an outpatient visit.

The separate analysis comparing the two Hispanic child groups to each other showed some interesting differences from the analysis comparing both groups to white children. In this model, before accounting for enabling factors, mother's citizenship was not a significant contributor to the model; however, after accounting for these factors, having a non-citizen mother was positively associated with medication use. This suggests that given equal access to care between these groups, having a mother who was not a citizen increased the likelihood of using any prescription medication.

Finally, the third objective was to describe the use of specific classes of medications and to elicit what factors were associated with their use. Per our specific hypotheses, we found that fewer Hispanic children from less acculturated family backgrounds used psychiatric medications than white children, while there was no difference for more acculturated Hispanic children. We saw the same trend for the use of respiratory medications, though this finding was not statistically significant. Having a mother who was a citizen and having a provider visit were significantly associated with the use of psychiatric medications suggesting some combination of acculturation and access being important. However, the odds of medication use in this group remained almost unchanged after adjusting for all explanatory variables.

Acculturation, language and their effects:

The current study used language of interview as a surrogate for acculturation because language is a robust marker for acculturation (Deyo, 1985; Lara, 2005). Aside from being a marker for acculturation, language may influence medication use as a communication barrier. Limited English proficiency can restrict a parent's ability to communicate effectively with their child's provider (Pippins, 2007; Rivadeneyra, 2000). We expected that having a Hispanic provider would increase the likelihood of having used any medication but found this not to be true. However, a child must first have a provider to not be able to communicate with, and the findings in the Hispanic, Spanish-interviewed group of twice the uninsured rate and markedly fewer children with a usual source of care were striking.

Additionally, the findings for specific classes of medication use argue against the interpretation that language as a communication barrier versus language as a marker for acculturation accounts for the findings. Hispanic, Spanish-interviewed children were less likely to use psychiatric medications even after adjusting for provider visits. Moreover, the Hispanic, Spanish-interviewed group was just as likely as white children to have used antibiotics after adjusting for the access to care variables, operationalized by enabling factors. While we cannot rule out that the Spanish-interviewed group used fewer medications due to communication barriers, it would have to be the case that the language barrier was specific to certain classes of medications. Such an interpretation argues for a stronger role for acculturation than any possible communication barrier.

Reasons for not using prescription medications:

We found that a lower proportion of the less acculturated Hispanic group used any prescription medication, and this difference was largely explained by a usual source of care, perceived health status and provider visits. Our analysis of specific types of medications revealed a much more complex picture and is the subject of the remainder of this discussion.

There are multiple reasons why a child or a group of children may not use a medication. The first is lack of access to care. A child with an ear infection without a usual source of care or insurance may be less likely to receive antibiotics for their condition. In our study, anti-infective medications, important for treating many common illnesses of childhood such as respiratory or ear infections, were used less in the Hispanic population than in white children, a finding consistent with the literature (Miller, 2005). The finding that enabling factors eliminated this difference in the Hispanic, Spanish-interviewed population suggests that for these types of acute illnesses, the difference in medication use may largely be an access to care issue.

Another reason for not using medication is that the child may not be sick. To illustrate, previous evidence suggests that Puerto Rican Hispanics have a higher rate of asthma than non-Hispanic whites, while Mexican Hispanics have a lower rate (Davis, 2006; Lara, 2006; Martin, 2007). Less acculturated Hispanics, particularly Mexican-American children, have a lower prevalence of diagnosed asthma than other children (Martin, 2007). We saw a lower, but not statistically significant, prevalence of use of respiratory medications in the less acculturated group, which is composed of more Mexican-Americans. We examined the prevalence of asthma among the groups of children and found a significantly lower prevalence in the less acculturated Hispanic group. A recent study (Mosnaim, 2007), suggests that the observed lower prevalence of asthma in less acculturated Hispanics may not be due to a truly lower underlying prevalence of asthma as suggested by others. They found that of those who had symptoms suggestive of asthma, children of parents interviewed in English were more likely to have an asthma diagnosis (Mosnaim, 2007). Our result that a significantly lower proportion of the Hispanic, Spanish-interviewed group had a diagnosis of asthma while there was no significant difference in the use of respiratory medications would be consistent with this finding if more children from the less acculturated group were using respiratory medications without a diagnosis of asthma. However, we did not find this to be true, and so this study is inconclusive per this question.

Of those with a diagnosis of asthma, there was no difference in respiratory medication use overall or for the different sub-classes of respiratory medications. These findings suggest a story, at least at the gross level, of equitable access to care for those with asthma among the different groups of children. An emphasis should be placed on the term gross however, as these findings do not assess the quality of management of asthma.

There is evidence to suggest that Hispanics with Spanish-speaking parents are less likely to receive adequate therapy for asthma (Halterman, 2000). The larger proportion, though non-significant, of less acculturated Hispanic children with a diagnosis of asthma who used the sub-class of expectorants may suggest that they did not have the same access to the most appropriate medications for management of asthma, though this study cannot directly assess this quality of care measure.

A third reason a child may not use medication is the lack of recognition of symptoms as illness or different cultural constructions of illness. There is evidence to indicate a lower rate of reporting and diagnosis of ADHD in the Hispanic population (Stevens, 2004; Schneider, 2006), and Hispanic children are less likely to have used stimulant medications (Hudson, 2007; Zuvekas, 2006). Our findings showed that adjustment for access to care and evaluated need variables did not affect the odds of using a psychiatric medication for less acculturated Hispanics. A recent study showed markedly lower use of stimulant medications by Hispanic children with ADHD compared with non-Hispanic children (Visser, 2007). Our study suggests that this observed difference may have been due to the subset of less acculturated Hispanic children, because the more acculturated group had the same odds of using a psychiatric medication as white children.

The literature is limited on the impact of acculturation on ADHD symptom interpretation and treatment, but there is some indication that less acculturated Hispanics are less inclined to interpret similar symptoms as ADHD (Perry, 2005; Schmitz, 2003). Schmitz et al. found that acculturation may impact the interpretation of hyperactivity symptoms but not attention-deficit symptoms. The stark contrast of psychiatric medication use by acculturation in the Hispanic child population seen in our study and the finding that mother's citizenship was a significant predictor of use of these medications are consistent with the literature and suggest that acculturation may play a strong role in recognizing and treating ADHD in the Hispanic population.

The lower prevalence of ADHD reported as a limitation in the less acculturated Hispanic group was not significant though this may be secondary to both limited sample size and the way in which the question was asked. Regardless, the finding that of those with ADHD, fewer children in the less acculturated Hispanic group used psychiatric medications is striking and shows that not only may there be a lower prevalence of diagnosis but also of choosing to treat with medications upon receiving a diagnosis.

Another potential reason for not using prescription medications is the use of alternative or over the counter medications. Using an alternative medication from a traditional healer or antibiotics from a flea market would not have been detected in this study. There is evidence of greater use of alternative or traditional healers among less acculturated Hispanics (Howell, 2006; Mikhail, 2004). However, it is doubtful that any potential undetected use would account for all of the differences we found, particularly as the use of these medications may be in addition to rather in lieu of prescription medications (Risser, 1995).

Finally, Hispanic, Spanish-interviewed children were twice as likely to have used CNS medications (nearly all analgesics) as white children, and a separate analysis showed a significant difference between Spanish and English-interviewed Hispanic children. This reversal of the overall trend has no clear explanation in the literature. Are they using analgesics to treat conditions for which other children are using antibiotics? Is there a cultural preference for analgesics? One clue from this study is that, in the final model, having a usual source of care was not associated with CNS medication use while ER and inpatient visits were. This suggests that these CNS medications may have been given outside of the context of continuity of care and may not necessarily be the most appropriate for the condition.

Limitations:

Medication use is both a useful and difficult outcome to assess. On the one hand, it is a concrete measure of access and utilization. On the other hand, we cannot assess whether the comparison group was using the right number of medications, too few, or too many. Also, as our assessment of medication use does not take condition data into account, direct inference about appropriate medication use is impossible. Our study attempted to take into account condition data when available – asthma and ADHD – but even for these, the analysis was done based on comparative prevalence and no linkage between the child with the diagnosis and medication use was done. Another limitation is that if a child used two anti-infective medications or 18 of them, they would be considered the same in this analysis as having used any. This method allows for population interpretation of any use and is useful for this analysis but cannot be used for making any inferences about population health care utilization patterns.

As this study was cross-sectional, we cannot infer causality for any of the associations we found. Despite the limitation of a cross-sectional analysis, it does seem reasonable to assume that the exposure of ethnicity and acculturation precedes any use of medications. Therefore under this assumption, a judgment of causality may be acceptable, particularly for the psychiatric medications data. There is evidence to suggest plausibility of the association between acculturation and psychiatric medication use; the association is particularly strong, and the finding is consistent with prior evidence.

All socio-demographic data are based on parent report. We used parental language of interview to approximate the level of acculturation, and the use of language has its limitations as discussed above in that it may also represent a communication barrier. We used parental level of acculturation and assumed that this would approximate the child's level of acculturation. This may well be the case for younger children but may not as accurately reflect the prescription medication use of older children whose cultural experience may be quite different from their parents.

Additionally, while some survey questions could be interpreted in different ways in Spanish, our outcome variables and the vast majority of our independent variables are not vulnerable to this potential bias (insurance status, provider visits, missed school, etc). Finally, Hispanics differ by nationality as well, but this variable is less practically meaningful since it is easy to ascertain language but less so to ascertain nationality and what that might mean. Furthermore, nationality did not add to the model and was therefore not included in the regression analyses.

Significance:

This study contributes to the field by examining medication use in the Hispanic child population while stratifying by, rather than adjusting for, acculturation. Given that about half of all children used a medication in 2004 and that the Hispanic population makes up approximately 20% of children, these findings have implications for policy and practice.

In terms of policy, less acculturated Hispanic children are generally more vulnerable as this group is less insured, poorer, and has more non-citizen mothers. The impact that health care and appropriate medication use can have on a child's health and life is important to keep in mind as the debate over how and to whom to provide health care services in regards to immigrant families continues.

The findings for psychiatric medications in particular may have relevance for practitioners working with less acculturated Hispanic families, since untreated ADHD can significantly impair a child's ability to reach their potential. Further qualitative studies may be particularly helpful in ascertaining the health beliefs and choices of less acculturated Hispanic families per ADHD and its treatment. Finally, the importance of having a usual source of care for a child's health is reinforced by these data – we do not need more research into this aspect, we need more action.

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Table 1: Descriptive analysis using design-based F-statistics of the independent variables and the prescription medication outcomes.

Reported Ethnicity/Race and Language of interview	**All**	**Hispanic, English**	**Hispanic, Spanish**	**White, English**	**Non-Hispanic, non-white, English**		
Number of children	7539	1184	1411	3066	1878	**F-statistic**	**p-value**
Predisposing Characteristics							
Mother's Citizenship						300.806	<0.001
Yes, Citizen	88.6	85.8	33.4	95.8	89.1		
No, not citizen	11.4	14.2	66.6	4.2	10.9		
Sex						0.832	0.469
Male	51.6	52.6	51.4	52.1	49.7		
Female	48.4	47.4	48.6	47.9	50.3		
Age						2.291	0.043
0-5	24.6	28.2	27.4	23.9	23.9		
6-11	36.8	35.4	40.0	36.4	37.2		
12-17	38.6	36.5	32.6	39.6	38.9		
Family Size						13.754	<0.001
3 or fewer	20.8	20.8	11.7	20.7	26.9		
4-5	58.8	58.8	56.2	65.0	54.3		
6 or more	20.5	20.5	32.1	14.3	18.8		
Nationality:						10.315	<0.001
Puerto Rican	9.1	13.7	3.0	n/a	n/a		
Mexican	70.9	64.8	79.2	n/a	n/a		
Cuban or Dominican	4.7	6.1	2.8	n/a	n/a		
Central/South American or other	15.3	15.5	15.0	n/a	n/a		

Enabling Resources							
Mother's Education						92.607	<0.001
< High school	16.0	26.7	72.4	6.9	16.6		
High school	25.9	28.8	15.5	24.8	31.1		
> High school	56.4	43.0	10.5	66.2	51.2		
Don't know, refused	1.7	1.5	1.7	2.0	1.0		
Family Income						46.386	<0.001
<100 % FPL	16.8	22.5	37.2	9.6	27.5		
100-199% FPL	20.8	24.1	43.0	16.1	24.9		
200-399% FPL	32.6	32.3	16.6	35.9	29.2		
>400% FPL	29.7	21.1	3.2	38.5	18.4		
Region in U.S.						20.874	<0.001
Northeast	17.5	15.2	8.2	19.3	16.7		
Midwest	22.5	8.1	7.6	27.8	19.6		
South	36.4	37.7	29.1	34.2	45.0		
West	23.6	38.9	55.1	18.7	18.2		
Metropolitan Statistical Area (MSA)						8.473	<0.001
In MSA	82.9	89.1	93.8	79.1	86.8		
In non-MSA	17.1	10.9	6.2	20.9	13.2		
Insurance Status						74.485	<0.001
Private	65.5	50.9	21.4	78.1	52.1		
Public	28.0	40.2	60.0	16.9	42.5		
Uninsured	6.5	8.9	18.6	5.0	5.3		
Usual source of care (USC)						20.591	<0.001

Yes, have	91.2	90.7	79.4	93.1	90.2		
No, don't have or is ER	8.8	9.3	20.6	6.9	9.8		
Transportation to USC						5.585	0.002
Very or somewhat difficult	5.0	5.0	11.0	4.3	5.2		
Not too or not at all difficult	95.0	95.0	89.0	95.7	94.8		
Hispanic Provider						52.598	<0.001
Yes, Hispanic provider	9.5	23.9	48.4	4.5	7.0		
No, not Hispanic provider	90.5	76.1	51.6	95.5	93.0		
Perceived Need							
Perceived health status (mean score)	80.1 (79.5-80.8)	77.6 (76.1-79.1)	74.5 (73.2-75.7)	81.7 (80.9-82.5)	78.7 (77.4-80.0)		
Perceived mental health status						6.244	<0.001
Very good or excellent	82.8	82.1	75.8	85.5	78.0		
Good	14.9	15.3	21.8	12.6	19.0		
Fair or poor	2.2	2.5	2.5	1.9	2.9		
Days missed from school due to illness						5.670	<0.001
<3 years old	7.7	8.8	8.8	7.3	8.0		
Not in school	9.3	10.0	11.8	9.0	9.1		
0 days missed	63.2	62.4	68.8	60.8	68.6		
1-2 days missed	13.2	11.7	6.0	15.8	9.1		
3-4 days missed	3.6	4.5	3.1	3.8	2.7		
5 or more days missed	2.9	2.6	1.6	3.3	2.5		
Illness or injury requiring urgent care						18.833	<0.001

Yes, had	22.6	19.9	13.1	25.7	18.6		
No, didn't have	77.4	80.1	86.9	74.3	81.4		
Evaluated Need							
Outpatient visits						26.857	<0.001
No, no visits	24.3	30.1	38.4	19.9	28.9		
At least 1 visit	75.7	69.9	61.6	80.2	71.1		
Any visits to ER						4.525	0.007
No, no visits	87.3	88.0	91.6	86.3	88.2		
At least 1 visit	12.7	12.0	8.4	13.7	11.8		
Inpatient stays						0.545	0.612
No, no stays	98.2	98.6	98.3	98.3	98.0		
At least 1 stay	1.8	1.4	1.7	1.7	2.0		
Outcomes							
Used any medication	49.2	45.8	36.8	54.5	40.0	30.401	<0.001
Used any anti-infective	28.9	23.7	22.5	34.2	18.5	39.200	<0.001
Used any respiratory	19.4	19.0	16.4	20.1	18.6	1.320	0.268
Used any central nervous system (CNS)	7.4	6.8	10.2	7.3	6.9	2.013	0.113
Used any psychiatric	5.1	5.4	0.8	6.2	3.1	14.470	<0.001
Used any topical	14.0	10.8	7.6	16.5	10.8	16.952	<0.001

Table 2: Analysis of the impact of independent variables on the outcome of use of any prescription medication using design-based F-statistics (row percent)

		Used ≥ 1 medication	p-value
Predisposing Characteristics:			
Mother's citizenship	Yes, Citizen	50.3	<0.001
	No, not citizen	41.0	
Sex	Male	49.7	0.523
	Female	48.7	
Age	0-5	56.9	<0.001
	6-11	48.6	
	12-17	44.9	
Family size	3 or fewer	57.5	<0.001
	4-5	49.2	
	6 or more	38.9	
Nationality (Hispanic only)	Puerto Rican	44.0	0.022
	Cuban or Dominican	51.3	
	Mexican	38.9	
	Other	52.1	
Enabling Resources			
Mother's education	< High school	39.2	<0.001
	High school	46.9	
	> High school	53.1	
	Don't know or refused	50.2	
Family income	<100 % FPL	44.8	<0.001
	100-199% FPL	44.6	
	200-399% FPL	49.0	
	>400% FPL	55.1	

Region in U.S.	Northeast	51.3	<0.001
	Midwest	49.1	
	South	52.5	
	West	42.7	
Metropolitan statistical area (MSA)	In MSA	48.5	0.020
	In non-MSA	52.9	
Insurance status	Private	51.2	<0.001
	Public	48.3	
	Uninsured	33.1	
Usual source of care (USC)	Yes, have	51.6	<0.001
	No, don't have or is ER	24.3	
Transportation to USC	Very or somewhat difficult	46.2	0.189
	Not too or not at all difficult	51.9	
Hispanic provider	Yes	58.4	0.077
	No	51.2	
Perceived Need			
Mean score for perceived health status		77.3 (76.4-78.1)	
Perceived mental health status	Very good or excellent	48.2	<0.001
	Good	52.5	
	Fair or poor	66.0	
Days missed from school due to illness	<3 years old	65.9	<0.001
	Not in school	52.1	
	0 days missed	40.8	
	1-2 days missed	64.4	
	3-4 days missed	72.9	
	5 or more days missed	80.8	

Illness or injury requiring urgent care	Yes, had	74.0	<0.001
	Didn’t have	42.0	
Evaluated Need			
Outpatient visits	No visits	22.1	<0.001
	At least 1 visit	57.9	
Any visits to ER	No visits	45.5	<0.001
	At least 1 visit	74.8	
Inpatient stays	No stays	48.6	<0.001
	At least 1 stay	84.0	

Table 3: Multivariable logistic regression analysis of the factors associated with any prescription medication use for children (age 0-17) in 2004. Reported as odds ratios (95% CI).

	Unadjusted odds ratio	**Model 1 - Add Predisposing Factors**	**Model 2 - Add Enabling Resources**	**Model 3 - Add Perceived Need**	**Model 4 - Add Evaluated Need**
Number in model	7539	7539	7539	7539	7539
White, English interview	1.00	1.00	1.00	1.00	1.00
Hispanic, English Interview	0.71 (0.57-0.88)	0.71 (0.57-0.88)	0.79 (0.62-0.99)	0.80 (0.64-1.01)	0.84 (0.65-1.07)
Hispanic, Spanish Interview	0.49 (0.40-0.59)	0.55 (0.44-0.69)	0.79 (0.59-1.04)	0.88 (0.64-1.21)	0.90 (0.65-1.26)
Non-Hispanic, non-White, English Interview	0.56 (0.48-0.65)	0.55 (0.47-0.64)	0.56 (0.48-0.67)	0.60 (0.50-0.72)	0.61 (0.51-0.74)
	Significance of contribution of explanatory variables (Wald F-statistics (p-value)):				
Predisposing Factors					
Mother Citizenship		*1.577 (NS)*	*0.243 (NS)*	*0.123 (NS)*	*0.001 (NS)*
Age		*22.379****	*15.040****	*4.306**	*2.265 (NS)*
Family Size		*24.094****	*19.190****	*12.059****	*10.171****
Enabling Factors					
Mother's Education			*2.558 (NS)*	*2.620 (NS)*	*1.957 (NS)*
Family Income			*2.467 (NS)*	*4.850**	*2.706**
Region in U.S.			*5.543****	*7.663****	*7.107****
Metropolitan Statistical Area (MSA)			*2.448 (NS)*	*3.705(NS)*	*5.592**
Insurance Status			*8.419****	*5.009**	*2.452 (NS)*
Usual Source of Care			*72.097****	*50.654****	*24.302****

Perceived Need		
Perceived Health Status Score	*68.600****	*52.346****
Perceived Mental Health Status	*1.129 (NS)*	*0.755 (NS)*
Days missed from school due to illness	*21.598****	*15.819****
Illness or injury requiring urgent care	*162.788****	*64.112****
Evaluated Need		
Outpatient visits		*135.559****
ER visits		*40.325****
Inpatient stays		*3.075 (NS)*

NS = not significant (p>0.05)
* = significant (0.05>p>0.001)
*** = significant (p<0.001)

Table 4: Multivariable logistic regression analysis of the factors associated with any prescription medication use restricted to Hispanic children in 2004. Reported as odds ratios (95% CI).

	Unadjusted Odds ratio	Model 1 - Add Predisposing Factors	Model 2 - Add Enabling Factors	Model 3 - Add Perceived Need	Model 4 - Add Evaluated Need
Number in model	2595	2595	2595	2595	2595
Hispanic, English Interview	1.00	1.00	1.00	1.00	1.00
Hispanic, Spanish Interview	0.69 (0.55-0.87)	0.71 (0.54-0.93)	1.01 (0.74-1.38)	1.05 (0.75-1.48)	1.07 (0.75-1.52)
	Significance of contribution of explanatory variables (Wald F-statistics (p-value)):				
Predisposing Factors					
Mother's Citizenship		*0.079 (NS)*	*3.201 (NS)*	*3.973**	*3.686 (NS)*
Age		*31.361****	*13.988****	*9.206****	*6.066**
Family Size		*10.063****	*2.561 (NS)*	*1.839 (NS)*	*0.725 (NS)*
Sex		*5.407**	*2.458 (NS)*	*3.267 (NS)*	*3.021 (NS)*
Enabling Factors					
Mother's Education			*5.090**	*4.194**	*3.726**
Family Income			*8.569****	*7.978****	*7.565****
Region in U.S.			*2.643 (NS)*	*2.806**	*2.389 (NS)*
Metropolitan Statistical Area (MSA)			*1.961 (NS)*	*1.719 (NS)*	*3.284 (NS)*
Insurance Status			*15.637****	*12.397****	*7.798**
Usual Source of Care			*86.267****	*64.725****	*32.333****
Perceived Need					
Perceived Health Status Score				*34.249****	*27.969****
Perceived Mental				*0.743 (NS)*	*0.609 (NS)*

Health Status		
Days missed from school due to illness	*7.770****	*5.824****
Illness or injury requiring urgent care	*67.463****	*24.350****
Evaluated Need		
Outpatient visits		*38.606****
ER visits		*29.898****
Inpatient stays		*1.676 (NS)*

NS = not significant (p>0.05)
* = significant (0.05>p>0.001)
*** = significant (p<0.001)

Table 5: Multivariable logistic regression analysis of the factors associated with any anti-infective medication use in 2004. Reported as odds ratios (95% CI).

Number in model	**Unadjusted Odds ratio** 7539	**Model 1 - Add Predisposing Factors** 7539	**Model 2 - Add Enabling Factors** 7539	**Model 3 - Add Perceived Need** 7539	**Model 4 - Add Evaluated Need** 7539
White, English interview	1.00	1.00	1.00	1.00	1.00
Hispanic, English Interview	0.60 (0.48-0.75)	0.58 (0.46-0.73)	0.69 (0.54-0.89)	0.71 (0.56-0.90)	0.73 (0.57-0.94)
Hispanic, Spanish Interview	0.56 (0.45-0.70)	0.58 (0.44-0.74)	0.91 (0.66-1.24)	1.05 (0.75-1.47)	1.07 (0.76-1.51)
Non-Hispanic, non-white, English interview	0.44 (0.37-0.53)	0.42 (0.35-0.52)	0.46 (0.38-0.57)	0.50 (0.41-0.61)	0.51 (0.42-0.62)
	Significance of contribution of explanatory variables (Wald F-statistic (p-value)):				
Predisposing Factors					
Mother's Citizenship		*0.135 (NS)*	*0.025 (NS)*	*0.001 (NS)*	*0.062 (NS)*
Age		*50.115****	*45.327****	*23.370****	*18.640****
Family Size		*8.688****	*7.106**	*2.917 (NS)*	*2.183 (NS)*
Sex		*6.724**	*7.236**	*10.391**	*10.774**
Enabling Factors					
Mother's Education			*2.839**	*2.579 (NS)*	*2.137 (NS)*
Family Income			*2.309 (NS)*	*4.170**	*2.739**
Region in U.S.			*5.485**	*7.292****	*6.958****
Metropolitan Statistical Area (MSA)			*4.111**	*5.546**	*6.646**
Insurance Status			*0.933 (NS)*	*0.539 (NS)*	*0.376 (NS)*
Usual Source of Care			*30.638****	*20.683****	*8.954**

Perceived Need		
Perceived Health Status Score	*28.827****	*22.060****
Perceived Mental Health Status	*0.745 (NS)*	*0.960 (NS)*
Days missed from school due to illness	*20.677****	*16.082****
Illness or injury requiring urgent care	*92.420****	*38.376****
Evaluated Need		
Outpatient visits		*68.437****
ER visits		*13.458****
Inpatient stays		*0.478 (NS)*

NS = not significant (p>0.05)
* = significant (0.05>p>0.001)
*** = significant (p<0.001)

Table 6: Multivariable logistic regression analysis of the factors associated with any psychiatric medication use in 2004. Reported as odds ratios (95% CI).

	Unadjusted odds ratio	Model 1 - Add Predisposing Factors	Model 2 - Add Enabling Factors	Model 3 - Add Perceived Need	Model 4 - Add Evaluated Need
Number in model	7539	7539	7539	7539	7539
White, English interview	1.00	1.00	1.00	1.00	1.00
Hispanic, English Interview	0.85 (0.59-1.24)	1.01 (0.69-1.48)	1.03 (0.69-1.53)	0.99 (0.63-1.57)	0.99 (0.62-1.59)
Hispanic, Spanish Interview	0.13 (0.06-0.27)	0.27 (0.12-0.60)	0.29 (0.12-0.66)	0.28 (0.10-0.77)	0.28 (0.10-0.79)
Non-Hispanic, non-white, English interview	0.47 (0.34-0.67)	0.49 (0.34-0.70)	0.41 (0.28-0.60)	0.40 (0.25-0.62)	0.40 (0.25-0.64)
	Significance of contribution of explanatory variables (Wald F-statistic (p-value)):				
Predisposing Factors					
Mother's Citizenship		*12.268**	*10.855**	*10.447**	*9.368**
Age		*30.572****	*33.333****	*20.487****	*21.767****
Family Size		*5.166**	*3.848**	*2.597 (NS)*	*2.223 (NS)*
Sex		*22.947****	*21.491****	*31.259****	*32.587****
Enabling Factors					
Mother's Education			*0.240 (NS)*	*0.453 (NS)*	*0.173 (NS)*
Family Income			*1.608 (NS)*	*1.157 (NS)*	*1.119 (NS)*
Region in U.S.			*3.372**	*3.844**	*3.476**
Metropolitan Statistical Area (MSA)			*0.014 (NS)*	*0.147 (NS)*	*0.203 (NS)*
Insurance Status			*6.810**	*4.439**	*3.656**
Usual Source of Care			*11.422**	*10.024**	*6.686**

Perceived Need		
Perceived Health Status Score	*5.033**	*2.864 (NS)*
Perceived Mental Health Status	*53.358****	*48.635****
Days missed from school due to illness	*2.740**	*1.739 (NS)*
Illness or injury requiring urgent care	*0.046 (NS)*	*0.402 (NS)*
Evaluated Need		
Outpatient visits		*23.023****
ER visits		*0.022 (NS)*
Inpatient stays		*23.023****

NS = not significant (p>0.05)
* = significant (0.05>p>0.001)
*** = significant (p<0.001)

Table 7: Multivariable logistic regression analysis of the factors associated with any respiratory medication use in 2004. Reported as odds ratios (95% CI).

	Unadjusted odds ratio	**Model 1 - Add Predisposing Factors**	**Model 2 - Add Enabling Factors**	**Model 3 - Add Perceived Need**	**Model 4 - Add Evaluated Need**
Number in model	7539	7539	7539	7539	7539
White, English interview	1.00	1.00	1.00	1.00	1.00
Hispanic, English Interview	0.93 (0.72-1.20)	0.92 (0.71-1.19)	0.93 (0.72-1.21)	0.93 (0.71-1.21)	0.95 (0.73-1.25)
Hispanic, Spanish Interview	0.78 (0.60-1.01)	0.87 (0.65-1.17)	1.01 (0.72-1.41)	1.07 (0.75-1.52)	1.09 (0.76-1.57)
Non-Hispanic, non-white, English interview	0.91 (0.76-1.09)	0.90 (0.75-1.09)	0.86 (0.70-1.05)	0.91 (0.74-1.11)	0.93 (0.76-1.15)
		Significance of contribution of explanatory variables (Wald F-statistic (p-value)):			
Predisposing Factors					
Mother's Citizenship		*0.969 (NS)*	*0.022 (NS)*	*0.134 (NS)*	*0.044 (NS)*
Age		*33.628****	*25.444****	*10.968****	*7.638**
Family Size		*9.788****	*6.887**	*3.549**	*2.951 (NS)*
Sex		*2.665 (NS)*	*2.756 (NS)*	*2.297 (NS)*	*2.100 (NS)*
Enabling Factors					
Mother's Education			*0.905 (NS)*	*0.557 (NS)*	*0.405 (NS)*
Family Income			*0.948 (NS)*	*2.087 (NS)*	*1.248 (NS)*
Region in U.S.			*12.414****	*12.215****	*12.442****
Metropolitan Statistical Area (MSA)			*1.969 (NS)*	*2.190 (NS)*	*2.539 (NS)*
Insurance Status			*6.407**	*5.703**	*4.496**
Usual Source of Care			*32.963****	*22.709****	*12.547****

Perceived Need		
Perceived Health Status Score	*141.475****	*122.959****
Perceived Mental Health Status	*4.705**	*5.277**
Days missed from school due to illness	*10.686****	*8.697****
Illness or injury requiring urgent care	*40.662****	*17.305****
Evaluated Need		
Outpatient visits		*62.590****
ER visits		*8.223**
Inpatient stays		*0.020 (NS)*

NS = not significant (p>0.05)
* = significant (0.05>p>0.001)
*** = significant (p<0.001)

Table 8: Multivariable logistic regression analysis of the factors associated with any topical medication use in 2004. Reported as odds ratios (95% CI).

	Unadjusted Odds ratio	**Model 1 - Add Predisposing Factors**	**Model 2 - Add Enabling Factors**	**Model 3 - Add Perceived Need**	**Model 4 - Add Evaluated Need**
Number in model	7539	7539	7539	7539	7539
White, English interview	1.00	1.00	1.00	1.00	1.00
Hispanic, English Interview	0.61 (0.46-0.82)	0.60 (0.45-0.81)	0.67 (0.49-0.92)	0.67 (0.49-0.91)	0.69 (0.51-0.95)
Hispanic, Spanish Interview	0.42 (0.31-0.56)	0.40 (0.29-0.55)	0.52 (0.35-0.76)	0.54 (0.37-0.78)	0.54 (0.37-0.81)
Non-Hispanic, non-white, English interview	0.62 (0.50-0.76)	0.60 (0.49-0.74)	0.64 (0.51-0.80)	0.67 (0.54-0.84)	0.69 (0.55-0.87)
	Significance of contribution of explanatory variables (Wald F-statistic (p-value)):				
Predisposing Factors					
Mother's Citizenship		*2.505 (NS)*	*3.340 (NS)*	*2.806 (NS)*	*3.140 (NS)*
Age		*2.888 (NS)*	*2.145 (NS)*	*0.564 (NS)*	*0.264 (NS)*
Family Size		*12.237****	*9.600****	*6.474**	*5.747**
Sex		*2.158 (NS)*	*1.941 (NS)*	*2.444 (NS)*	*2.281 (NS)*
Enabling Factors					
Mother's Education			*2.703 (NS)*	*2.326 (NS)*	*1.813 (NS)*
Family Income			*2.239 (NS)*	*3.297**	*2.442 (NS)*
Region in U.S.			*3.176**	*3.476**	*3.210**
Metropolitan Statistical Area (MSA)			*0.267 (NS)*	*0.312 (NS)*	*0.463 (NS)*
Insurance Status			*3.397**	*2.739 (NS)*	*1.675 (NS)*
Usual Source of Care			*5.924**	*3.245 (NS)*	*0.163 (NS)*

Perceived Need		
Perceived Health Status Score	*27.460****	*20.804****
Perceived Mental Health Status	*1.063 (NS)*	*1.472 (NS)*
Days missed from school due to illness	*3.620**	*2.557**
Illness or injury requiring urgent care	*21.437****	*9.282**
Evaluated Need		
Outpatient visits		*70.079****
ER visits		*0.149 (NS)*
Inpatient stays		*0.186 (NS)*

NS = not significant (p>0.05)
* = significant (0.05>p>0.001)
*** = significant (p<0.001)

Table 9: Multivariable logistic regression analysis of the factors associated with any central nervous system (CNS) medication use in 2004. Reported as odds ratios (95% CI).

	Unadjusted Odds ratio	**Model 1 - Add Predisposing Factors**	**Model 2 - Add Enabling Factors**	**Model 3 - Add Perceived Need**	**Model 4 - Add Evaluated Need**
Number in model	7539	7539	7539	7539	7539
White, English interview	1.00	1.00	1.00	1.00	1.00
Hispanic, English Interview	0.93 (0.66-1.31)	0.97 (0.69-1.36)	0.85 (0.59-1.22)	0.93 (0.65-1.32)	0.98 (0.68-1.39)
Hispanic, Spanish Interview	1.45 (1.04-2.02)	1.75 (1.25-2.44)	1.45 (0.94-2.23)	1.83 (1.18-2.84)	1.96 (1.24-3.10)
Non-Hispanic, non-white, English interview	0.95 (0.73-1.23)	0.95 (0.74-1.23)	0.82 (0.61-1.09)	0.93 (0.68-1.27)	0.94 (0.69-1.29)
	Significance of contribution of explanatory variables (Wald F-statistic (p-value)):				
Predisposing Factors					
Mother's Citizenship		*0.889 (NS)*	*0.504 (NS)*	*0.370 (NS)*	*0.126 (NS)*
Age		*11.199****	*13.466****	*16.396****	*18.224****
Family Size		*2.715 (NS)*	*1.648 (NS)*	*0.249 (NS)*	*0.307 (NS)*
Sex		*0.216 (NS)*	*0.364 (NS)*	*0.416 (NS)*	*0.910 (NS)*
Enabling Factors					
Mother's Education			*0.165 (NS)*	*0.318 (NS)*	*0.245 (NS)*
Family Income			*0.604 (NS)*	*1.694 (NS)*	*1.298 (NS)*
Region in U.S.			*1.709 (NS)*	*1.225 (NS)*	*1.672 (NS)*
Metropolitan Statistical Area (MSA)			*1.761 (NS)*	*1.935 (NS)*	*1.141 (NS)*
Insurance Status			*11.715****	*8.416****	*6.895**
Usual Source of Care			*7.674**	*3.850 (NS)*	*2.939 (NS)*

Perceived Need		
Perceived Health Status Score	*9.593**	*6.172**
Perceived Mental Health Status	*4.062**	*4.993**
Days missed from school due to illness	*7.412****	*5.398****
Illness or injury requiring urgent care	*56.653****	*6.381**
Evaluated Need		
Outpatient visits		*4.573**
ER visits		*71.417****
Inpatient stays		*9.452**

NS = not significant (p>0.05)
* = significant (0.05>p>0.001)
*** = significant (p<0.001)

Table 10: The use of psychiatric medications and reporting of attention-deficit/hyperactivity disorder (ADHD) among children age 6-17 in 2004.

Reported Ethnicity/Race and Language of interview	**All**	**Hispanic, English**	**Hispanic, Spanish**	**White, English**	**Non-Hispanic, non-white, English**		
Number of children	5612	854	1033	2320	1405	**F-statistic**	**p-value**
Overall use:							
Used any psychiatric medication	6.5	7.0	1.1	8.0	3.9	13.788	<0.001
Used any CNS stimulant	4.9	5.2	0.6	6.0	3.1	10.687	<0.001
Used any anti-depressant	2.4	2.4	0.3	3.1	1.3	6.939	<0.001
Used any anti-psychotic	1.0	1.1	0.3	1.1	0.6	1.226	0.293
Of those who used any psychiatric medication:							
Used any CNS stimulant	75.2	73.3	50.6	75.3	78.9	0.693	0.538
ADHD							
Mentioned ADHD as limitation	1.9	2.5	0.8	2.1	1.7	1.307	0.254
Of those with ADHD:							
Used any CNS stimulant	59.3	59.6	13.0	66.9	40.0	2.595	0.062

Table 11: The use of respiratory medications and asthma diagnosis among children age 0-17 in 2004.

Reported Ethnicity/Race And Language of interview	**All**	**Hispanic, English**	**Hispanic, Spanish**	**White, English**	**Non-Hispanic, non-white, English**		
Number of children	7539	1184	1411	3066	1878	**F-statistic**	**p-value**
Medication use:							
Used any respiratory medication	19.4	19.0	16.4	20.1	18.6	1.320	0.268
Used any bronchodilator	7.0	7.6	5.9	6.5	8.6	2.449	0.068
Used any anti-histamines	7.4	6.7	4.3	8.3	6.5	4.357	0.006
Used any expectorants	0.5	0.4	0.6	0.6	0.3	0.871	0.445
Used any inhalants	2.2	2.0	1.0	2.2	2.4	1.219	0.302
Used any leukotriene modifiers	2.9	2.4	0.8	3.2	3.1	3.147	0.030
Used any respiratory combination medication	6.5	6.0	8.7	6.6	5.6	1.897	0.131
Asthma:							
Ever diagnosed with asthma	10.3	11.6	5.1	9.7	13.3	4.688	0.001
Still have asthma	7.5	8.6	3.8	6.9	10.3	3.756	<0.001
Had episode or attack in last 12 months (active asthma)	4.2	4.5	1.6	4.2	5.1	4.337	0.007
Of those with active asthma:							
Used preventive medications	55.3	41.7	49.8	57.5	56.5	1.178	0.315
Used any respiratory medication	81.9	80.8	84.9	83.0	79.5	0.192	0.845
Used any bronchodilator	67.0	61.6	68.1	66.4	70.6	0.334	0.761
Used any anti-histamines	22.0	20.4	14.3	23.9	19.2	0.337	0.784

Used any expectorants	0.6	0.4	3.7	0.3	1.1	1.481	0.226
Used any inhalants	26.8	16.9	15.8	29.2	26.4	1.090	0.346
Used any leukotriene modifiers	30.2	17.2	31.1	32.7	30.0	1.073	0.353
Used any respiratory combination medication	18.0	15.8	19.1	19.0	16.2	0.170	0.880
Of those without an asthma diagnosis:							
Used any respiratory medication	14.6	13.8	13.8	15.9	11.5	3.568	0.018
Used any bronchodilator	2.7	2.9	3.3	2.8	1.8	1.262	0.287
Used any anti-histamines	6.2	5.9	3.9	7.1	4.6	5.092	0.003
Used any expectorants	0.5	0.3	0.6	0.6	0.3	1.090	0.349
Used any inhalants	0.6	0.8	0.6	0.6	0.3	0.595	0.612
Used any leukotriene modifiers	1.0	1.2	0.1	1.4	0.4	4.762	0.010
Used any respiratory combination medication	5.8	5.7	8.1	5.9	4.8	2.196	0.090

Table 12: The use of central nervous system (CNS) medications among children age 0-17 in 2004.

Reported Ethnicity/Race and language of interview	**All**	**Hispanic, English**	**Hispanic, Spanish**	**White, English**	**Non-Hispanic, non-white, English**		
Number of children	7539	1184	1411	3066	1878	**F-statistic**	**p-value**
Used any CNS medication overall	7.4	6.8	10.2	7.3	6.9	2.013	0.113
Used any analgesic	6.4	5.7	9.4	6.3	6.1	2.419	0.068
Used any anti-convulsants	0.9	1.0	0.7	0.9	1.1	0.308	0.793

Figure 1: Graphic depiction of the Medical Expenditure Panel Survey showing the overlapping panel design and when data collection rounds occurred in 2004.

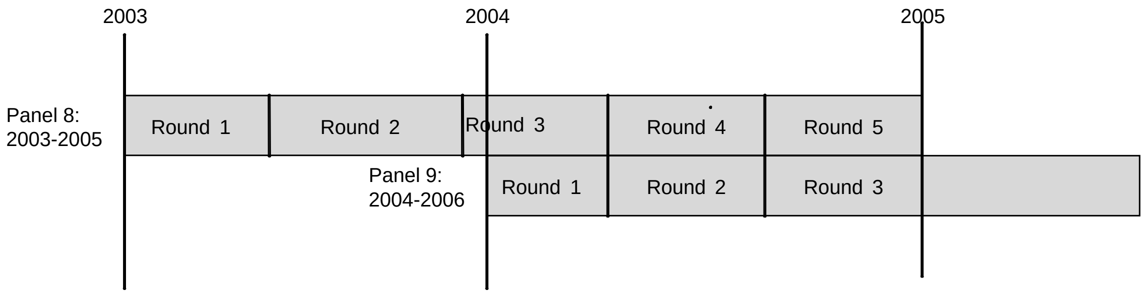
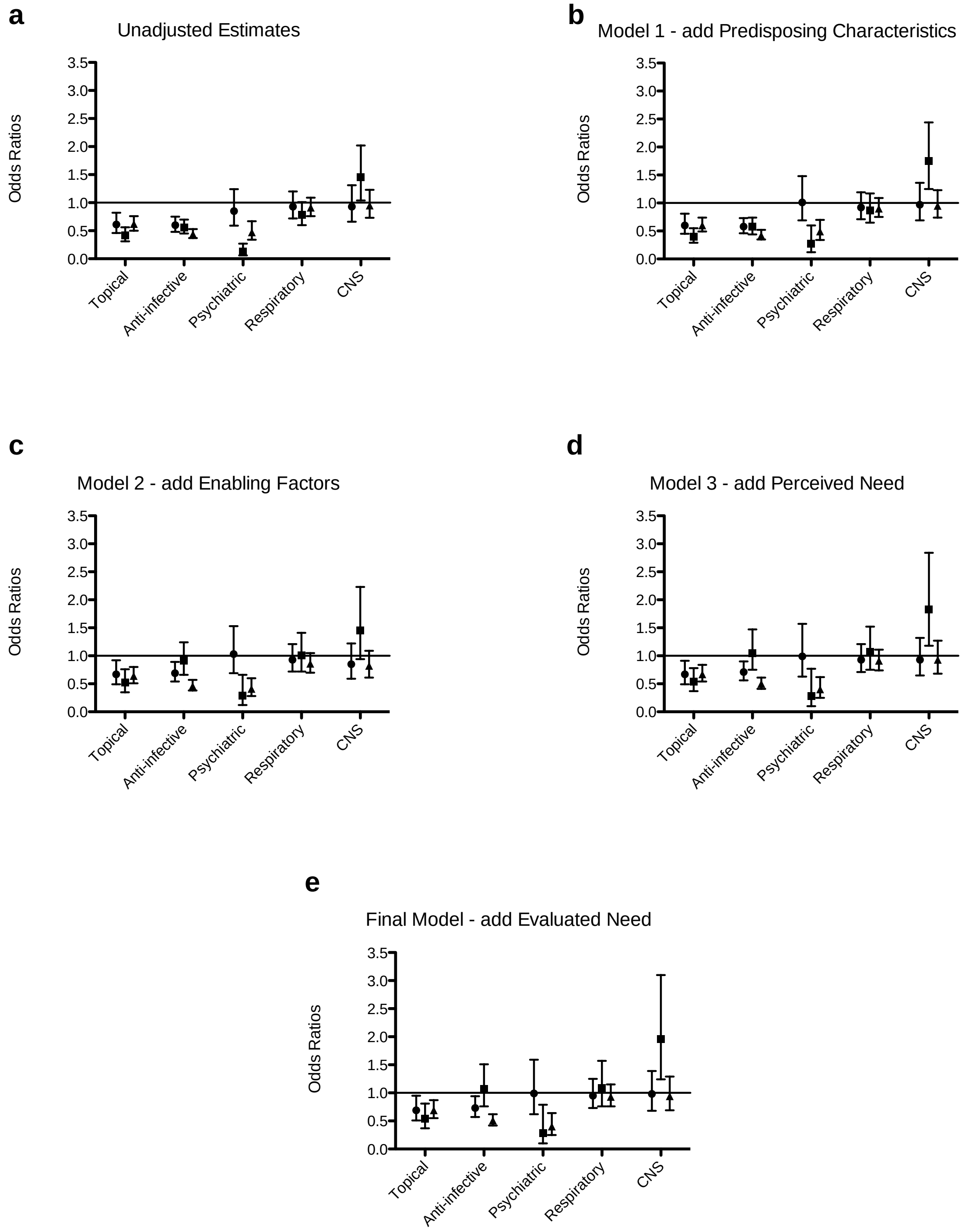


Figure 2: Mutltivariable logistic regression for the top five types of prescription medications for children in 2004. Odds ratios are for each group in comparison to white children (black line at OR = 1.00) are shown with 95% CI as bars.



Legend: ● Hispanic, English-interview
■ Hispanic, Spanish-interview
▲ Non-white, non-Hispanic