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PARENTAL INCOME, EDUCATION AND THE DIAGNOSIS OF ADHS IN CHILDREN AND ADOLESCENTS: THE CASE FOR GERMANY

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Abstract

Using survey data for Germany, we examine how parental income and education are associated with the severity of ADHD symptoms and the likelihood of diagnosis in children and adolescents. We find that children from low-income families tend to have higher ADHD symptom scores and are more likely to be diagnosed than children from higher-income families. However, they were also shown to have a higher likelihood of being underdiagnosed (conditional on not having a diagnosis) and were less likely to visit a pediatrician. Interestingly, migrants were significantly less likely to be diagnosed than non-migrants, but were more likely to visit a pediatrician.

Parental education variables were shown to "absorb" the effect of income when added to all of these regressions, considerably reducing the significance of the effect of income on all outcome variables. These results seem to suggest that children from families of low socioeconomic status in Germany may be at a "double jeopardy" in terms of having a higher prevalence of ADHD, and yet not receiving the appropriate diagnoses necessary for further treatment.

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1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a highly disruptive neurodevelopmental disorder that is believed to affect about 1 in 20 children in the USA and at least as many in other countries (Faraone et al. 2003). The overall lifetime prevalence of ADHD diagnosis in Germany is estimated to be about 4.8% (Huss et al. 2008). The disorder has its onset in childhood and is associated with a high level of morbidity and dysfunction, with pervasive effects into adolescence and adulthood. It has been shown to have detrimental effects on children's human capital accumulation, such as increasing the probability of delinquency, grade repetition and being placed in special education, as well as reducing future reading and mathematics scores (Currie and Stabile 2006). Its adverse effects on personal and social functioning, academic achievement and vocational outcomes can become a huge financial and emotional burden for these individuals and their families. As a result, a better understanding of the aetiology and barriers to treatment of this disorder will help to direct policy towards preventive measures, as well as the optimization of mental health care resources and support for at-risk and affected youths.

According to Faraone et al. (2003), there has been a misconception in nearly the last half-century that ADHD is largely an American disorder due to the predominance of American research on the subject. However, in their analysis of 50 ADHD-related study results from both US and non-US populations (including Germany), they find that the prevalence of ADHD is at least as high in many non-US children as in US children. While data on the prevalence of the disorder in Germany is available, very little is known about how socioeconomic and demographic factors in the country play a role the disorder's development, diagnosis or access to further treatment. Moreover, little is known about the frequency of over- or underdiagnoses of this disorder in Germany, and whether or not certain socioeconomic and demographic factors are associated with these outcomes. Accordingly, the aims of the present study will be twofold: (i) to explore whether income, education and occupation have an effect on both ADHD symptom severity, as well as on the diagnosis of

ADHD in German children, and (ii) to verify whether or not there are over- or underdiagnoses of ADHD in certain socio-demographic groups. Data from the German Health Interview and Examination Survey for Children and Adolescents (KiGGS), a cross-sectional, representative, nationwide survey on child and adolescent health in Germany, are used in this analysis.

1.1 ADHD in Children and Adolescents: Contributing Factors

ADHD is a clinically heterogeneous disorder in that patients manifest different patterns of symptoms, symptom severities and comorbidities with other disorders. This phenotypic heterogeneity may also reflect a heterogeneity in aetiological factors, which consist of both genetic and environmental factors (Langley et al. 2007). While genetic factors contribute largely to the phenotypic variance of ADHD (between 75-91% heritability) (Langley et al. 2007), pre, peri- and postnatal environmental factors, as well as exposure to psychosocial adversity during childhood, have also been shown to be associated with the development of ADHD symptomatology (Langley et al. 2007; Linnet et al. 2003; Sprich et al. 2000; Faraone and Biederman 1998; Thapar et al. 2005; Rutter 2005). Twin studies have also shown that shared and unique environmental factors account for between 12 and 40% of the variance in twin ADHD scores (Langley et al. 2007; Thapar et al. 2005).

Among other important environmental factors, socioeconomic and demographic factors have been associated with the risk of ADHD. In general, children affected by psychological disorders tend to be of low socioeconomic status (SES) (Verhulst and Van der Ende 1997; McLeod and Shanahan 1996; Costello 2003; Lipman et al. 1994). Unsurprisingly, epidemiological and clinical studies have documented that a considerably greater proportion of children and adolescents affected by ADHD also tend to come from families of low SES (Hölling et al. 2008; Huss et al. 2008; Döpfner et al. 2008; Langley et al. 2007; Biederman et al. 2002; Froehlich et al. 2007; Pineda et al. 1999). In one nationally representative US study, the poorest children were more than twice as likely as the wealthiest to meet the criteria for ADHD (Froehlich et al. 2007).

Among the different possible indicators of SES, lower family income alone has repeatedly been shown to be correlated with the risk of ADHD (Froehlich et al. 2007; Scahill et al. 1999; Graetz 2001; Pineda et al. 1999). Information on the effect of parental education is less apparent in the literature, with very few documenting the negative effect of higher maternal education on the risk of developing ADHD (Graetz et al., 2001). Higher parental educational attainment has, however, been revealed to have a significant negative association with child psychosocial morbidity and behavioural problems in general (Gortmaker et al., 1990; Kalff et al., 2001; Lipman et al., 1994). A positive association of parental education with better overall health outcomes in children has also been recognized (Case et al., 2002; Flores et al., 1999).

Children with greater ADHD symptom severity are also more likely to live in an urban area, in a single parent household, and come from families with history of dysfunction and parental psychiatric treatment (Scahill et al. 1999; Lesesne et al. 2003). Some of these factors can be said to be indicative of exposure to psychosocial adversity during childhood, which has been previously found to be associated with the risk of ADHD. Biederman et al. (2002), for example, reveal in their study that all the components of the Rutter's Index of Adversity, one of the best studied measures of psychosocial adversity, were shown to be correlated with the risk for ADHD, even after controlling for possible confounding factors such as a history of parental ADHD and gender. The indicators of the Rutter's Index used in this study included severe marital discord, low social class, large family size, paternal criminality, maternal mental disorder, and placement in foster care (Biederman et al. 2002).

It should be noted however, that it is the presence of not just one, but two or more environmental risk factors and the interaction between them that significantly increases the risk for the development of mental disorders (Biederman et al. 2002; Faraone and Biederman 1998). It is generally complicated to separate the isolated effects of these environmental risk factors for ADHD, since they tend to be highly correlated (Langley et al. 2007). Furthermore, it is also challenging to show the causal risk effects of these environmental indicators disentangled from genetic factors,

since it has been argued that many environmental risk factors may actually be mediated by a gene-environment interaction. In other words, through their genetically influenced behaviours, individuals select and shape their environments which, in turn, influence the psychological disposition and behaviour of their offspring (Rutter 2005).

Nevertheless, learning more about these environmental risk factors for ADHD and how their possible effects can be minimized or eliminated are clearly important in order to prevent the disorder's adverse effects on children's academic and professional outcomes.

1.2 Consequences of ADHD for Child Education and Employment Outcomes

Although it was previously thought that children eventually outgrow ADHD, 30-60% of the individuals continue to show significant symptoms of the disorder into adulthood (Harpin 2005). These symptoms may have a huge negative impact on the child's social skills, personal relationships, academic achievement, and future employment prospects (Harpin 2005). Developmental risks such as learning disabilities and/or language problems often affect children with ADHD (Barkley 2002). They also tend to have other comorbid disorders such as oppositional defiant disorder (ODD), conduct disorder (CD), substance abuse and depression (Hurtig et al. 2007), which exacerbate the serious effects of ADHD on the child's educational outcomes and social relationships.

A study by Barkley et al. (2006) using data from the Milwaukee Young Adult Outcome Study shows that youths with ADHD are more likely than controls to be held back, be suspended and be expelled. They also had lower grade point averages and approximately 32% of adolescents with ADHD never graduated from high school (compared to the 5% national average for adolescent high school drop-outs). Finally, few people with ADHD enter college and of those who do, only 5% graduate (Barkley et al. 2006).

Currie and Stabile (2006) show in their study that hyperactivity has negative effects on certain measures of child human capital outcomes in the US and Canada which include grade repetition,

delinquency, being placed in special education, and math and reading scores. This effect was also shown generally not to differ between low- and high-income families in both countries, with the exception of grade repetition, where children of higher-income families were less likely to repeat grades regardless of hyperactivity scores. An initial hypothesis of Carrie and Stabile's study was that children from low income families would be at a "double jeopardy," where they are at a higher risk for both the development of ADHD as well as for not receiving effective treatment to minimize the effects of ADHD on future outcomes. Although initially plausible, they found this to not be the case.

In adulthood, individuals with ADHD are more likely to be dismissed from employment and often have difficulty finding a job in which they can succeed (Harpin 2005). They also often have interpersonal difficulties with employers and colleagues in the workplace, and frequently experience problems related to lateness, absenteeism, work errors, and an inability to accomplish an expected workload (Harpin 2005). According to a study by Kessler et al. (2005), ADHD was a significant predictor of overall lost work performance, with regression slopes equivalent to 35 days and $5661 of salary-equivalent lost performance per worker with ADHD per year. A study by Biederman and Faraone (2006) shows that a smaller percentage of individuals with ADHD were fully-employed compared to controls and that mean household income among ADHD subjects was also significantly lower, regardless of academic achievement or personal characteristics. In addition, this study estimated that the aggregate workforce productivity loss associated with ADHD in the US in 2003 was between $67 billion and $116 billion (Biederman and Faraone 2006).

Studies have shown that proper management using alternative educational strategies, behavioural treatments and pharmacotherapy can help provide long-term control of ADHD's core symptoms, and thus help overcome the burden of this disorder (Faraone et al. 2003; American Academy of Pediatrics 2001). However, without proper recognition through a doctor diagnosis and adequate adherence to treatment measures, children and adolescents with ADHD are unlikely to receive the appropriate professional assistance they need in order to achieve their full potential.

1.3 Children and Mental Health Service Use

Considerable evidence has shown that children and adolescents underutilize mental health services and are at an increased risk of unmet need for psychological and behavioural disorders. Various sociodemographic factors have also been shown to influence the rate of diagnoses, mental health service use and treatment of children with psychological disorders. In the United States, unmet need has been shown by various studies to be highest among racial and ethnic minorities (Garland et al. 2005; Stevens et al. 2005; Kataoka et al. 2002; Bussing et al. 2003). Garland et al. (2005) show in their study that race/ethnicity was shown to be a significant predictor of mental health service use among high-risk youths[2], even in the presence of other confounding factors such as caregiver strain, socioeconomic status and insurance coverage. Concerning ADHD specifically, African-Americans, Hispanic-Americans, as well as children without insurance have also been shown as less likely to be diagnosed and to receive stimulant medication (Stevens et al. 2005).

In Europe, ethnic minority groups, and particularly migrants, also face several barriers in access to care (Carta et al., 2005). Although migrants generally do not differ from non-migrants in terms of the prevalence of mental health disorders, immigrant status is associated with lower rates of mental health service use, even in countries with universal health insurance (Lindert et al. 2008). This discrepancy likely reflects linguistic and cultural barriers to care, including different beliefs and understanding about the causes and treatment of mental health disorders.

Findings on the effect of socioeconomic factors on mental health service use is mixed, with some studies indicating a significant influence (Cohen et al. 1992; Cunningham and Freiman 1996; Bussing et al. 2003) while others do not (Zimerman 1996; Verhulst and Van der Ende 1997; Szatmari et al. 1989). Cohen et al. (1992), for example, reveal that middle income children in the US were less likely to use mental health services than both high and low income individuals, because they were neither able to afford private insurance or to qualify for subsidized services. In contrast, Currie and Stabile (2006) found that income had little effect on the probability of treatment

[2] High risk youths were defined in this study as youths in public service sectors such as child welfare, juvenile justice, and special education services.

in both the US and Canada. Low family income has, however, been associated with lower adherence and response to ADHD treatment, as has low parental education (Bussing et al. 2003; Rieppi et al. 2002). In a Canadian study, Steele et al. (2007) demonstrate that patient education level significantly predicted mental health service use, whereas income had no effect. This result illustrates the fact that the gap between need and mental health service use may still be greatest for individuals with low SES, even when a universal healthcare system is in place. Higher maternal education has also been shown to increase the probability of treatment for ADHD (Currie and Stabile 2006).

The lower rates of treatment for some racial/ethnic groups indicate that underdiagnoses of ADHD may be occurring in certain demographic groups. According to Currie and Stabile (2006), mental illnesses may be overdiagnosed due to parents' desire to justify their child's poor outcomes, or school incentives to get low achieving students into special education. Similarly, they suggest that mental illnesses could also be underdiagnosed compared to their true prevalences due to stigma associated with having a mental problem. Critics have tended to claim in the past that ADHD is being overdiagnosed, since parents and teachers were viewed as willing to accept diagnostic labels and psychostimulant prescriptions in order to find relatively straightforward, inexpensive and fast acting solutions to complex problems. However, research on treatment utilization suggests that only half of children with ADHD actually receive treatment and less than half receive specialty care, supporting the claim that ADHD is being underdiagnosed (McLeod et al. 2007). The state of over and underdiagnoses of ADHD in different demographic groups in Germany is still not clear.

1. Method

2.1 KiGGS Survey and Subjects

Between May 2003 and May 2006 a total of 17, 641 participants aged 0-17 from 167 communities were enrolled in the KiGGS study. The German federal ministry of health commissioned the Robert Koch institute to conduct the study in order to fill an official gap in

national data concerning the health and health care needs of children and adolescents in Germany. Objective measures of the physical and mental health of participants were collected by health professionals, as well as self- and parent-reported information collected through surveys regarding topics such as subjective health status, health behaviour, health care services use and environmental determinants of health *(www.kiggs.de)*.

2.2 Outcome measures

The following outcome measures are used in our statistical analysis:

ADHD Diagnosis. ADHD diagnosis was determined through the parent questionnaire of children ages 3-17 years old with the question "has your child ever been diagnosed with an attention deficit-/hyperactivity disorder?" Three responses to the question were possible ("yes", "no" or "I don't know") and were categorized accordingly (Huss et al. 2008). This information was later used for our binary outcome variable for having a diagnosis ("I don't know" answers not included). If their child had received a diagnosis, the parents were also asked whether this diagnosis was given by a paediatrician, a psychologist or "other". For our analyses, we only used responses where diagnoses were given by paediatricians and psychologists. From 14,836 participants between the ages of 3 and 17, information on pediatrician or psychologist diagnoses of ADHD was available for 13,488 children (6, 751 boys and 6,737 girls).

SDQ Score. In order to compare ADHD diagnosis information to an objective measure of the children's symptoms, the Strength and Difficulties Questionnaire (SDQ) score from the parent survey was used. The SDQ is a brief screening tool for assessing the psychological adjustment of children and youths (Goodman 2001). It consists of 25 items, divided between 5 subscales of 5 items each (conduct problems, hyperactivity-inattention, emotional symptoms, peer problems and prosocial behaviour). Scores from the hyperactivity-inattention subscale were calculated for 14, 499 participants. Potential ADHD is considered evident if participants reach a score of ≥7 on the hyperactivity-inattention subscale of the SDQ. In addition, those participants who achieve an

overall symptom score of ≥6 are considered borderline with respect to the cardinal symptoms of ADHD. The Cronbach's α of the hyperactivity-inattention subscale of the KiGGS sample averaged to α = 0.77 and ranged from α=0.77 (age cohort 3-6 years) to α = 0.79 (age cohort 11-13 years) (Huss et al. 2008).

Pediatrician and Psychologist Visit. Pediatrician and Psychologist visits were ascertained with the question "which of the following doctors – Pediatricians, Dentists and Psychologists included, did you consult for your child in the past 12 months and how often? (home visits included)". For the purposes of our analysis, we only took account of whether or not the participants had been to see a paediatrician or psychologist at all in the past 12 months, and disregarded the information on the frequency of visits. Of the KiGGS participants in the age range 3 to 13 (parent reports of doctor visits only available until age 13), 10,201 reported that their child had been to the paediatrician in the past 12 months and 379 reported that they had consulted a psychologist.

Over- and Under-Diagnosis. Binary outcomes for over and under-diagnoses were created by combining the information from the SDQ and the ADHD diagnosis responses. A child was considered to be over-diagnosed if his or her hyperactivity- inattention SDQ symptom score was normal (i.e. < 6) and the child received a diagnosis from a pediatrician or psychologist. Conversely a child was considered to be under-diagnosed if his or her hyperactivity-inattention SDQ symptom score was borderline or evident (i.e. ≥6) and the child did not receive a diagnosis from a pediatrician or psychologist. All other cases were considered to be a correct diagnosis (either correctly judged to have ADHD or correctly judged not to have the disorder). By these terms, for the 13,406 participants for whom both SDQ score data and diagnosis data were available, 1,352 received an under-diagnosis and 240 received an over-diagnosis, leaving 11,814 children who received a correct diagnosis.

2.3 Main Independent Variables

An initial analysis of the KiGGS data by Huss et al. 2008 reveal that, in accordance with other studies of large representative samples, higher symptoms and diagnoses of ADHD tend to be reported for children from lower SES groups. A composite measure (Winkler index) was used for SES in Huss et al.'s (2008) analysis, classifying the participants into high, medium and low socioeconomic groups. While composite scores are useful for classification purposes, they prevent an understanding of the effects of particular SES factors on health. Rieppi et al. (2002), for example, have questioned the advantages of using a composite score for SES as opposed to individual SES variables based on inconsistent findings in previous research on ADHD treatment response. They have encouraged further investigations to use independent SES variables for maximal explanation of SES effects. Others have further argued that despite the dynamic, complex relationship of parental income, education and occupation on child mental health disorders and service use, income alone is often used as the sole proxy for SES (Steele et al. 2007; Kaliff et al. 2001). As a result, in this study we chose to use individual indicators of socioeconomic status such as parental income, education and occupation in order to more clearly visualize the effects of these factors on ADHD symptoms and diagnosis. Furthermore, in each of our analyses, we compared the effects of using income alone vs. including variables for all three of the socioeconomic indicators (income, education and occupation) on the outcome variable.

The 13 monthly household income categories in the KiGGS data range from "<€500" per month to "≥€5000" per month. The categories increase in increments of €250 until "€2250-<€2500" per month, and then continue to increase in increments of €500 thereafter. For our analysis, we took the interval midpoints for each of these ranges, using €249.5 for the lowest category and €5499.5 for the highest category, in continuation with the second pattern of increments.

The highest degree obtained per household was used as an indicator for parental education. These include: no degree, hauptschulabschluss, realschulablschluss/POS, fachhochschulreife, abitur, fachhochschule, and universität. These German degrees correspond to the number of years of

schooling achieved per household (no degree= less than 9 years, hauptschulabschluss= 9 years, realschulabschluss/POS= 10 years, fachhochschulreife= 12 years, abitur= 13 years, fachhochschule= 16 years and universität= 17 or more years). Parental occupation dummies were used for the following categories: not working (retired, student), unemployed, temporary exemption from employment, part-time employment, fully employed and trainee.

Apart from these socioeconomic variables several other sociodemographic factors are included. These are: age of parents, log of household size, dummies for family structure[3] (single-parent, biological parents, adoptive/foster parents, grandparents or other relatives), respondent to the questionnaire (mother, father, both parents or other), having full private insurance, maternal smoking during pregnancy[4], parity of birth (only child, youngest, middle, oldest, or only same-age siblings), dummies for living in East Germany and rural areas, being a twin, sex of the child[5] and a full set of age dummies.

2.4 Statistical Analysis

Binary logistic regression models were used to estimate the effect of income, education and occupation on symptoms (SDQ score), ADHD diagnosis, pediatrician and psychologist visits and the prevalence of over- and under diagnoses. For each of these analyses, two regressions were conducted: one using only income as a proxy for SES, and a second using income, education and occupation variables. Results were considered significant at the $\alpha < 0.05$ level.

[3] For our analyses, 36 observations were dropped representing participants living in a children's home as these do not fit the classic family structure/environment on which this study is based.
[4] Maternal smoking during pregnancy is one of the environmental factors that is most robustly and consistently associated with ADHD in offspring and the associated risk is shown to increase with the number of cigarettes smoked (Thapar et al. 2005; Thapar et al. 2003; Langley et al. 2007; Linnet et al 2003). However, it is not clear if it is the smoking itself that is responsible for the development of ADHD in the offspring, or if it is the inheritance of a common set of genes that determine both smoking behavior as well as ADHD.
[5] ADHD has been found to be more common in male children, although it clearly also affects female children as well (Sprich et al. 2000).

3. Results

3.1 Descriptive statistics

The distribution of ADHD diagnosis cases among the sample characteristics are shown in Table 1. From the information available on ADHD diagnoses from a doctor or psychologist, 660 children and adolescents, or 4.89% of the sample for which this data was available, received a positive diagnosis for ADHD. Of these, 79.85% were boys (7.81% of boys in the sample) and 20.15% were girls (1.97% of girls in the sample). The prevalence of ADHD diagnosis in the sample increases from 1.60% for the '3-6 years' age group until 7.26% for the '11-14 years' age group. The rate then decreases again thereafter to 5.50% for the 14-17 year olds. Diagnoses were more apparent in participants who came from a household where the highest degree attained amounted to less than 12 years of schooling (5.75%) compared to those with 12 years of schooling or greater (3.37%). The rate of diagnoses in households with a monthly income below the '€1,750-<€2000' range (midpoint: €1874.5) was 6.61% compared to 4.24% in households with a monthly income greater than or equal to this range. 5.13% of the sample non-migrants had ADHD diagnoses compared to 2.97% of the sample migrants. Of the respondents to the questionnaire, 83.33% were the child's mother, 9.30% were the child's father and 6.58% were both parents (results not shown in table). Less than 1% consisted of respondents including grandparents or other relatives, adoptive/foster parents, guardian, mother's life partner, or 'other'.

3.2 The effect of income and education on ADHD symptoms and diagnosis

The first set of results, displayed in Table 2, show the effect of income and education on both the SDQ score and ADHD diagnosis. The variable for migrant status is also included in these tables. As can be observed, for each of these outcomes the two logistic regression analyses mentioned earlier were conducted (one using only income as a proxy for SES and one using income, education and occupation variables). The parental occupation variables were, however, excluded from all the tables of results in this paper because they were not significant. All other control variables were also

not displayed in these tables. In this manner, we were able to compare the two pairs of models in order to observe how the socioeconomic variables and migrant status differentially affect the probability of having high SDQ scores and an ADHD diagnosis in the sample.

In the models where income alone was included as a single proxy for SES (M1 and M3), a negative relationship was observed between parental income and the chances of having a high SDQ score as well as between income and the chances of having a diagnosis. For every unit increase in income, the odds of having a high SDQ score decreases by 34.6%. Similarly, for every unit increase in income the odds of being diagnosed with ADHD decreases by 28.7%.

An interesting observation is that the strength and significance of the income variables appear to decrease or disappear when the education variables are added to the regression, after which the significance appears to be 'loaded on' to the education variables. Because a set of dummies is used for the education variables, where one category is arbitrarily chosen as a reference group, no meaningful conclusions can be drawn from the significance of the individual categories. Instead, a Wald test was conducted on all of the education dummies together as a whole for each of these regressions. The group of education variables was revealed to be significant for both regressions (*SDQ Score:* chi2(6)= 42.20, Prob > chi2= 0.0000; *Diagnosis:* chi2(6)= 14.70, Prob > chi2= 0.0289). As a result, education seems to absorb some of the explanatory effect of income on these outcome measures. Moreover, the income gradients for ADHD diagnosis in general appear to be slightly weaker than those for SDQ score. This may suggest that although lower income children appear to have both higher symptom levels and diagnoses, the rate of diagnoses does not seem to match the rate of prevalence in these lower income/lower education populations. Consequently, there is a chance that underdiagnoses in these low SES groups and/or overdiagnoses in higher SES groups are occurring. The prevalence of over- and under- diagnoses will be examined later in this paper.

There is also an interesting effect for migrants in the sample. In the case of SDQ scores, they do not seem to differ significantly from non-migrants. However, in terms of diagnosis, migrant status

appears to have a significant negative effect which holds even in the presence of education and occupation variables. This suggests that migrants significantly obtain fewer diagnoses than their non-migrant counterparts.

A dummy for high symptom scores was not initially included in the regressions for ADHD diagnoses, because of the possibility of reverse causality (i.e., children and adolescents who received diagnoses may be receiving treatment, which in turn lowers their overall symptom score). However, if we do include a dummy variable for high SDQ score (Table 3), the negative effect migrant status on the odds of acquiring an ADHD diagnosis remains significant, whereas the other socioeconomic variables lose their previous significance. Naturally, the higher symptoms scores were very strongly and significantly associated with the likelihood of obtaining a diagnosis for ADHD.

3.3 The effect of income and education on pediatrician and psychologist visits

Regressions on pediatrician and psychologist visits were conducted in order to determine the extent of access barriers for different sociodemographic and economic groups within Germany with respect to paediatric and psychological care. The results of these regression analyses are presented in Table 4. Income appears to have a significant effect only for pediatrician visits. Income actually appears to have a negative trend with respect to having visited a psychologist in the past 12 months, although this result is not significant. In M2, although the individual variables are not significant the Wald test results for the education variables together appear to be significant (chi2(6)= 13.02, Prob > chi2 = 0.0427). The added education variables in M4 are not significant and neither is the Wald test result. Irrespective of significance, almost all of the education odds ratios appear to be positively related to pediatrician and psychologist visits. The strength and significance of the effect of income on the odds of a pediatrician visit do, however, decrease with the addition of the education variables.

The effect of migrant status remains significant in both the pediatrician and psychologist visit regressions, even in the presence of the education variables. Interestingly, the odds of migrants visiting a pediatrician are positive, whereas the odds of seeing a psychologist are negative.

For the sake of comparison, when a dummy for the symptom severity is included in the regression (Table 5), the effect of income on the likelihood of a pediatrician visit remains significant, as does the effect of migrant status. The strength and significance of the effect of the SDQ score is greater in the psychologist visit regression, suggesting that a high SDQ score more strongly predicts psychologist visits than pediatrician visits. Moreover, the odds ratios for the lower education degrees become negative for the psychologist visits, though still non-significant.

3.4 The effect of income and education on the prevalence of over- and underdiagnoses

Finally, regressions were run to determine the odds of over- or underdiagnosis for these demographic and socioeconomic variables. These regressions were run first conditioning on having a diagnosis, and then on SDQ score. The results of the former are shown in Table 6. M1 and M2 test the likelihood of being overdiagnosed, conditional on having a diagnosis. Thus, the first two models test which participants of those who have a diagnosis, have SDQ scores that are considered normal (<6), and therefore are undeserving of the diagnosis. Conversely, M3 and M4 test the likelihood of being underdiagnosed, conditional on not having a diagnosis. Hence, these two models test which participants of those who don't have a diagnosis, have an SDQ score that is considered abnormal (≥6), and are therefore in need of a diagnosis and further treatment. In the overdiagnosis regressions it appears that the income and education variables do not have an effect. In the case of underdiagnoses, income has a significant negative effect in M3. In M4, with the addition of the education and employment variables, income is no longer significant. Instead, the education variables become significant. Surprisingly, migrant status appears to have no effect on the likelihood of having an overdiagnosis or underdiagnosis when the samples are conditioned on having or not having a diagnosis.

If the regressions are conditioned on SDQ score, however, very different results are obtained. Results for these are shown in Table 7. The regressions for overdiagnoses (M1 and M2) are conducted on a sub-sample conditioned on having an SDQ score of <6. By implication, these models test which participants of those who have normal SDQ scores received a diagnosis for ADHD undeservingly. Conversely, M3 and M4 are conducted on a sub-sample conditioned on having an SDQ score of ≥6. In this case, these models test for which participants of those who have an abnormal SDQ score have not yet received a diagnosis. In these models, none of the socioeconomic variables appear to have a significant effect on either outcome. Migrant status is only significant in the underdiagnosis models, where it appears to have a positive effect on the likelihood of being underdiagnosed.

4. Discussion

In support of previous research findings, the results of this study show that income is negatively correlated with a high level of ADHD symptoms (SDQ score). Income was also negatively correlated with the likelihood of obtaining a diagnosis, though this gradient appeared to be weaker in strength in comparison to the gradient for symptoms. These results were deemed to be possibly suggestive of underdiagnosed cases. When conditioning on having a diagnosis, we indeed see that children from low income and low education families do have a higher likelihood of being underdiagnosed. As a result and in contrast to the findings by Currie and Stabile (2006), our findings would seem to suggest that children and adolescents in the lower income population indeed appear to be at a "double jeapordy" in Germany, since they are significantly worse off in terms of having a higher prevalence of ADHD, as well as in terms of not receiving the appropriate medical recognition for this disorder.

There could be several possible explanations for why income has this effect on both the development of ADHD symptomatology and acquiring a diagnosis. Higher income could indicate that parents are financially capable of purchasing better medical care as well as safer and healthier

environments for their children, thus preventing the development or exacerbation of the disorder (Case et al. 2002; Currie 2009). Income is also likely to be a proxy for other, non-economic parental risk factors that are highly correlated with it. For example, lower income is associated with other putative risk factors of ADHD, such maternal smoking during pregnancy, low birth weight, and lead exposure (Froehlich et al. 2007). Low-income is also associated with higher maternal psychopathology, family dysfunction, overcrowding in the home and other indicators of psychosocial adversity, which have been shown to be related to the prevalence of ADHD and other behavioural problems in children (Shaw et al. 1994; Biederman et al. 1994).

In terms of seeking medical attention and a possible diagnosis for children, parental income may also play a role. In the US, poor parents were more likely to report financial barriers when it came to seeking treatment for their children's mental health problems (Bussing et al. 2003). In addition, uninsured children are at a substantial risk for underdiagnosis and undertreatment with respect to ADHD (Stevens et al. 2005) and mental health problems in general (Kataoka et al. 2002). However, these effects would appear to be less likely in Germany, where virtually every citizen is health-insured and where health care costs of those with no insurance are covered by social services (Kunze et al. 2004). Our analyses included a dummy for the possession of private insurance, which was revealed to have no significant effect on any of our outcomes (results not shown). Accordingly, in our results, income may be a proxy for other non-financial barriers to care that are more prevalent in low SES families.

Incidentally, the fact that the education variables seem to absorb the effect of income on both ADHD symptoms and diagnosis seem to suggest that parental education is a stronger predictor for these outcome variables than income. There could be several reasons for this. Higher education could signify that the parents are more adept at caring for the health of their child by being more patient and nurturing (Case et al. 2002). It may also facilitate the acquisition of positive social, psychological and economics skills and assets such as positive attitudes about access to preventive health services and treatment outcomes, membership in peer groups that promote the adoption and

continuation of positive health behaviours, a well as higher self-esteem and self-efficacy (Winkelby et al. 1992). Furthermore, education is often viewed as a proxy for intellectual functioning and mental ability. Thus, parents with higher education may tend to have greater awareness and understanding of mental disorders, their causes and the benefits of treatment. This in turn, may result in a different approach to dealing with these problems in their children and the choice of whether or not to seek medical attention (Kaliff et al. 2001; McLeod et al. 2007).

The fact that there is a significant positive relationship between income and pediatrician visits even when controlling for symptoms is also telling, as paediatricians often act as the gatekeepers to further mental health treatment for children. One study showed that having a routine source of pediatric care increased a child's chances of receiving a diagnosis six-fold, since pediatricians render the majority of ADHD assessments and treatments in the US (Bussing et al. 2003). A recent study found that most ADHD diagnoses in Germany are also reported mainly by pediatricians (Schlander 2007). Thus, the lack of diagnoses in lower-income populations may be due in part to less frequent child primary care visits. The odds ratios of the education variables in this regression, although non-significant, also appear to have some absorbent effect by reducing the strength and significance of the income odds ratio for the likelihood of a paediatrician visit in the past 12 months.

This effect is also shown in the models testing for underdiagnosis conditional on not having a diagnosis (Table 6). Income is again shown to have a strong, significant effect when the education and employment variables are not included in the regression, but this effect disappears and is transferred to the education variables when they are included. The consistency of this finding supports the notion that parental education or some unobserved variable for which parental education is the best proxy seems to play a crucial role in both the development of ADHD symptomatology and receiving appropriate medical attention.

The consistent negative effect of migrant status on the likelihood of obtaining a diagnosis is also a notable finding. In the case of paediatrician and psychologist visits, migrants seem to visit

pediatricians even more frequently than non-migrants and yet have significantly fewer psychologist visits. This may reflect a bias in paediatrician referrals to further psychological treatment for children in the migrant population, which are largely comprised of ethnic and racial minorities in many European countries.

As discussed earlier, racial/ethnic differences have been reported with respect to the use of mental health services for children in the US (Bussing et al. 2003; McLeod et al. 2007; Kataoka et al. 2002; Stevens et al 2005; Sue and Zane 2009; Garland et al. 2005). Generally, lower rates of use have been documented among African-American, Latino and Asian American/Pacific Islander children compared to non-Hispanic white children (Garland et al. 2005; Stevens et al. 2005). The causes of this underuse could be due to distinct parental and cultural beliefs, language barriers and stereotypes against ethnic-minority groups. This may be very similar to the case of migrants in Germany.

Important differences in parental beliefs about mental disorders exist across different racial/ethnic groups. Parental "threshholds" in their assessments of child behaviour and their opinions about whether or not the child is in need of professional help have been shown to vary in cross-cultural studies (Bussing et al. 2003). Parents' opinions about the origins of their child's behaviour and whether or not they believe the child is capable of behaving differently tend to determine their responses and attitudes towards the disorder (Bussing et al. 2003). African-American parents, for example, are less likely than white parents to have heard of ADHD and to consider ADHD a serious medical problem. They are also more likely to attribute ADHD to excessive sugar in the child's diet and have more negative expectations regarding treatment of the disorder (McLeod et al. 2007; dosReis 2006). Culturally influenced discrepancies between client and provider beliefs about the causes of mental disorders and treatment goals may also lead to a failure to initiate or continue compliance with certain treatment processes (Yeh et al. 2005).

Preferences on how to best deal with psychological problems have also been shown to differ among different cultures. In cultures where a strong reliance on familial and community networks

or on spirituality/religion is common, individuals may prefer to manage mental health problems through these familiar forms of support as opposed to seeking formal care (Cauce et al 2006). There is also the belief in some cultures that the best way to deal with psychological problems is simply to ignore them and not dwell on upsetting thoughts. In many East Asian cultures, seeking outside help is even often regarded as a source of shame (Cauce et al. 2002).

Barriers to access of mental health care for migrants in Europe have been linked to a lack of information and knowledge about the health care services available, mistrust of government institutions, and fear of losing residence rights or even imprisonment (Lindert et al. 2008). Socioeconomic factors may also account for the decreased use of mental health services in the migrant population since these individuals tend to be of lower social class in many European countries. Finally, problems in the interaction between therapists and patients, such as language barriers, discrimination and stereotypes therapists have of ethnic clients, and the inability of therapists to provide culturally sensitive forms of treatment, may complicate the diagnostic process, lead to misdiagnoses and ultimately, prevent ethnic minorities and migrants from receiving appropriate care.

5. Conclusion

We have observed through this study that, in Germany, parental income and education have unique effects on ADHD symptom scores, the likelihood of obtaining a diagnosis, paediatrician visits in the past 12 months, and the likelihood of a child being underdiagnosed. Parental income had a significant effect on all of these outcome measures. However, the effect was greatly reduced or disappeared with the inclusion of education and occupation variables, after which the education variables became significant. These results illustrate the importance of parental education as a socioeconomic predictor for child mental health disorders and services use, which stands in contrast to the current norm of using income as a single proxy for SES.

While it is a widely accepted finding that low socioeconomic status and poverty are related to child psychopathology, it is likely that the main risk effect is mediated by family- and parent-child relationships rather than by direct economic pressures (Costello et al. 2003; Froehlich et al. 2007). Hence, low-income and poverty can be viewed as important distal risk factors that can be assumed to be highly predictive of the proximal environmental risk factors directly impacting children's psychological development (Rutter 2005). In addition, although the importance of psychosocial adversity for ADHD has been shown in many studies, these factors tend to be universal predictors of children's functional development and emotional health, and not only specific to ADHD. Thus, they can be viewed as nonspecific triggers of an underlying predisposition to many different disorders, deficiencies or illnesses (Faraone and Biederman 1998).

Nevertheless, future policy interventions should be aimed at improving access to mental health services and the rate of ADHD diagnoses of children from low-income, low education families, as these families also seem to be considerably more affected by this disorder. The cooperation of the German child health and social welfare system with schools should be further strengthened in order to better identify affected children and provide them with adequate support, particularly in cases where families from low SES or minority groups are unable to obtain medical attention for these children on their own.

Another important finding is the lesser propensity of migrant children to be diagnosed with ADHD and visit a psychologist. This may reflect both provider referral biases based on uncertainty regarding culturally-sensitive treatment for ethnic minority migrants, as well as language, cultural and information barriers that differentially affect migrant usage of mental health services. As a result, policy should also place an emphasis on eliminating barriers to access for the migrant population. The number of bilingual therapists in practice who are able to provide culturally responsive treatment could be increased, and the use of these services could be encouraged through better information about the health care system and services which are available to migrants.

Several limitations to this study need to be addressed. First, the data collected consisted of parent-reported responses on the mental health of their children and their use of services. Even the more 'objective' measure of the children's' symptom states (SDQ score) were based on parent responses to a standardized questionnaire. Self-reports are generally subject to cognitive and culturally influenced biases. For example, stigma against the labelling of ADHD and cross-cultural differences in the comfort of disclosing information on mental health problems may actually lead to the withholding of accurate information.

One requirement of participation in the survey was the respondents' fluency in the German language. This naturally excludes an important population of non-German speakers, who are likely to experience more severe language and cultural barriers when it comes to accessing care. As a result, the sample is not likely to be representative of the major ethnic/racial groups in the German population, causing our results for the effect migrant status on our outcome variables to be understated.

Furthermore, this analysis was limited to a cross-sectional view of parent-reported information on child ADHD status and diagnostic information without further data on subsequent treatment initiation, adherence and outcomes. Consequently, there is a substantial gap in our knowledge about racial/ethnic and socioeconomic differences in unmet treatment needs, and the effectiveness of the German mental health care system in addressing these needs. Because this data was unavailable, we based our overdiagnosis and underdiagnosis analyses on the assumption that these children were not being treated or that treatment was not effective. Without the inclusion of this information, significant conclusions cannot be drawn from the under and overdiagnosis regression results.

Evidently, more research is needed to examine the dynamic and complex processes that lead to mental health service use among children and adolescents with ADHD in Germany, and how these processes differ among different socioeconomic and racial/ethnic groups. In addition, a closer insight into the referral and diagnostic practices of pediatricians and psychologists with respect to

ADHD would also be crucial in understanding and being able to more completely address the barriers to care for the at-risk and affected youths in the population.

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Table 1. Distribution of ADHD Diagnosis Cases[a] for Children and Adolescents Ages 3-17 Years

	N	%
Total	660	4.89
Sex		
Male	527	7.81
Female	133	1.97
Age Group		
3-6 years	57	1.60
7-10 years	215	5.72
11-13 years	202	7.26
14-17 years	186	5.50
Parental Years of Schooling		
<12 years	401	5.75
≥12 years	195	3.37
Monthly Family Income		
Less than '€1,750-<€2000'	219	6.61
Greater than or Equal to '€1,750-<€2000'	406	4.24
Migrant Status		
Migrant	41	2.97
Non-migrant	619	5.13

[a] Cases diagnosed by a doctor or psychologist.

Table 2. The Effect of Income and Education on ADHD Symptoms and Diagnosis: Odds Ratios

	M1 SDQ Score	M2 SDQ Score	M3 Diagnosis	M4 Diagnosis
Log Family Income	0.654***	0.840*	0.713**	0.890
	(-5.79)	(-2.02)	(-2.67)	(-0.77)
Migrant	1.098	1.123	0.412***	0.444**
	(0.92)	(1.11)	(-3.57)	(-3.23)
Highest Degree in Household:				
No Degree		2.768***		2.049
		(3.38)		(1.08)
Hauptschulabschluss		2.028***		2.042**
		(5.27)		(3.23)
Realschulabschluss/POS		1.741***		1.596*
		(4.83)		(2.47)
Fachhochschulreife		1.994***		1.508
		(4.74)		(1.62)
Abitur		1.223		0.995
		(1.30)		(-0.02)
Fachhochschule		1.362*		1.284
		(2.12)		(1.07)
Universität(Ref)				
Observations	9032	9032	8543	8543

Exponentiated coefficients; *t* statistics in parentheses
Additional control variables for all models include age of parents, log of household size, dummies for family structure and respondent to the questionnaire, dummies for East Germany and rural areas, having full private insurance, smoking during pregnancy, parity of birth, being a twin, sex of child and a full set of age dummies. The models containing additional controls for education (M2 and M4) also include dummies for parental employment status. Highest degree in household also corresponds to the highest years of schooling per German household (No degree= <9 years, Hauptschulabschluss=9 years, Realschulabschluss/POS=10 years, Fachhochschulreife=12 years, Abitur=13 years, Fachhochschule=16 years, Universität=17 years or more)
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3. The Effect of Income and Education on ADHD Diagnosis: Odds Ratios (Controlling for Symptoms)

	M1 Diagnosis	M2 Diagnosis	M3 Diagnosis	M4 Diagnosis
SDQ Score			15.14***	14.88***
			(22.00)	(21.71)
Log Family Income	0.713**	0.890	0.865	0.949
	(-2.67)	(-0.77)	(-1.05)	(-0.32)
Migrant	0.412***	0.444**	0.430**	0.453**
	(-3.57)	(-3.23)	(-3.16)	(-2.92)
Highest Degree in Household:				
No Degree		2.049		1.169
		(1.08)		(0.21)
Hauptschulabschluss		2.042**		1.468
		(3.23)		(1.59)
Realschulabschluss/POS		1.596*		1.252
		(2.47)		(1.10)
Fachhochschulreife		1.508		1.173
		(1.62)		(0.58)
Abitur		0.995		0.942
		(-0.02)		(-0.20)
Fachhochschule		1.284		1.072
		(1.07)		(0.28)
Universität(Ref)				
Observations	8543	8543	8521	8521

Exponentiated coefficients; *t* statistics in parentheses
Additional control variables for all models include age of parents, log of household size, dummies for family structure and respondent to the questionnaire, dummies for East Germany and rural areas, having full private insurance, smoking during pregnancy, parity of birth, being a twin, sex of child and a full set of age dummies. The models containing additional controls for education (M2 and M4) also include dummies for parental employment status. Highest degree in household also corresponds to the highest years of schooling per German household (No degree= <9 years, Hauptschulabschluss=9 years, Realschulabschluss/POS=10 years, Fachhochschulreife=12 years, Abitur=13 years, Fachhochschule=16 years, Universität=17 years or more)
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4. The Effect of Income and Education on Pediatrician and Psychologist Visits: Odds Ratios

	M1 Pediatrician	M2 Pediatrician	M3 Psychologist	M4 Psychologist
Log Family Income	1.197**	1.179*	0.731	0.880
	(2.69)	(2.14)	(-1.94)	(-0.67)
Migrant	1.466***	1.408***	0.279***	0.273***
	(4.02)	(3.52)	(-3.69)	(-3.71)
Highest Degree in Household:				
No Degree		1.550		1.080
		(1.18)		(0.07)
Hauptschulabschluss		1.066		1.228
		(0.58)		(0.69)
Realschulabschluss/POS		0.880		1.215
		(-1.44)		(0.81)
Fachhochschulreife		1.162		1.084
		(1.20)		(0.24)
Abitur		1.054		1.703
		(0.43)		(1.81)
Fachhochschule		1.093		1.072
		(0.80)		(0.23)
Universität(Ref)				
Observations	8239	8239	6938	6888

Exponentiated coefficients; *t* statistics in parentheses
Additional control variables for all models include age of parents, log of household size, dummies for family structure and respondent to the questionnaire, dummies for East Germany and rural areas, having full private insurance, smoking during pregnancy, parity of birth, being a twin, sex of child and a full set of age dummies. The models containing additional controls for education (M2 and M4) also include dummies for parental employment status. Highest degree in household also corresponds to the highest years of schooling per German household (No degree= <9 years, Hauptschulabschluss=9 years, Realschulabschluss/POS=10 years, Fachhochschulreife=12 years, Abitur=13 years, Fachhochschule=16 years, Universität=17 years or more)
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5. The Effect of Income and Education on Pediatrician and Psychologist Visits: Odds Ratios (Controlling for Symptoms)

	M1 Pediatrician	M2 Pediatrician	M3 Psychologist	M4 Psychologist
SDQ Score	1.218*	1.219*	4.397***	4.494***
	(2.29)	(2.28)	(9.52)	(9.55)
Log Family Income	1.199**	1.185*	0.834	0.936
	(2.66)	(2.14)	(-1.10)	(-0.34)
Migrant	1.455***	1.389***	0.277***	0.270***
	(3.86)	(3.30)	(-3.70)	(-3.73)
Highest Degree in Household:				
No Degree		1.519		0.802
		(1.12)		(-0.20)
Hauptschulabschluss		1.070		0.972
		(0.60)		(-0.09)
Realschulabschluss/POS		0.877		1.032
		(-1.45)		(0.13)
Fachhochschulreife		1.210		0.870
		(1.48)		(-0.41)
Abitur		1.071		1.672
		(0.56)		(1.72)
Fachhochschule		1.095		0.947
		(0.81)		(-0.18)
Universität(Ref)				
Observations	6930	6930	6909	6859

Exponentiated coefficients; *t* statistics in parentheses
Additional control variables for all models include age of parents, log of household size, dummies for family structure and respondent to the questionnaire, dummies for East Germany and rural areas, having full private insurance, smoking during pregnancy, parity of birth, being a twin, sex of child and a full set of age dummies. The models containing additional controls for education (M2 and M4) also include dummies for parental employment status. Highest degree in household also corresponds to the highest years of schooling per German household (No degree= <9 years, Hauptschulabschluss=9 years, Realschulabschluss/POS=10 years, Fachhochschulreife=12 years, Abitur=13 years, Fachhochschule=16 years, Universität=17 years or more)
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6. The Effect of Income and Education on the Prevalence of Over- and Underdiagnoses: Odds Ratios (Restricted Samples: Diagnosis[a])

	M1	M2	M3	M4
	Overdiagnosis	Overdiagnosis	Underdiagnosis	Underdiagnosis
Log Family Income	1.092	1.074	0.630***	0.837
	(0.31)	(0.22)	(-5.13)	(-1.67)
Migrant	2.170	2.950	1.040	1.047
	(1.43)	(1.80)	(0.30)	(0.35)
Highest Degree in Household:				
No Degree				2.936**
				(2.62)
Hauptschulabschluss		0.745		2.089***
		(-0.58)		(4.49)
Realschulabschluss/POS		0.936		1.806***
		(-0.15)		(4.26)
Fachhochschulreife		0.762		2.146***
		(-0.46)		(4.37)
Abitur		0.825		1.227
		(-0.30)		(1.08)
Fachhochschule		0.866		1.337
		(-0.26)		(1.65)
Universität(Ref)				
Observations	365	361	8148	8148

Exponentiated coefficients; *t* statistics in parentheses
Additional control variables for all models include age of parents, log of household size, dummies for family structure and respondent to the questionnaire, dummies for East Germany and rural areas, having full private insurance, smoking during pregnancy, parity of birth, being a twin, sex of child and a full set of age dummies. The models containing additional controls for education (M2 and M4) also include dummies for parental employment status.
[a]In the overdiagnosis regressions, samples were restricted to those who did have a diagnosis. In the underdiagnosis regressions, samples were restricted to those who did not have a diagnosis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7. The Effect of Income and Education on the Prevalence of Over- and Under-diagnosis: Odds Ratios (Restricted Samples: Symptoms[a])

	M1	M2	M3	M4
	Overdiagnosis	Overdiagnosis	Underdiagnosis	Underdiagnosis
Log Family Income	0.743	0.953	0.987	1.055
	(-1.44)	(-0.20)	(-0.07)	(0.24)
Migrant	0.526	0.569	2.836**	2.905**
	(-1.72)	(-1.50)	(2.74)	(2.71)
Highest Degree in Household:				
No Degree				0.692
				(-0.42)
Hauptschulabschluss		2.019*		1.085
		(2.08)		(0.23)
Realschulabschluss/POS		1.706		1.264
		(1.86)		(0.76)
Fachhochschulreife		1.460		1.164
		(0.96)		(0.38)
Abitur		1.125		1.660
		(0.28)		(1.13)
Fachhochschule		1.204		1.253
		(0.51)		(0.60)
Universität(Ref)				
Observations	7054	6999	986	986

Exponentiated coefficients; *t* statistics in parentheses
Additional control variables for all models include age of parents, log of household size, dummies for family structure and respondent to the questionnaire, dummies for East Germany and rural areas, having full private insurance, smoking during pregnancy, parity of birth, being a twin, sex of child and a full set of age dummies. The models containing additional controls for education (M2 and M4) also include dummies for parental employment status. Highest degree in household also corresponds to the highest years of schooling per German household (No degree= <9 years, Hauptschulabschluss=9 years, Realschulabschluss/POS=10 years, Fachhochschulreife=12 years, Abitur=13 years, Fachhochschule=16 years, Universität=17 years or more)
[a] For the over-diagnosis regressions, the sample was restricted to only those individuals without symptoms, whereas for the under-diagnosis regressions the sample was restricted to only those individuals with symptoms.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$