Oregon Health & Science University
School of Medicine

Scholarly Projects Final Report

Title *(Must match poster title; include key words in the title to improve electronic search capabilities.)*
Investigating demographic and comorbidity-based predictive factors in ADHD remission

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Date of Submission *(mm/dd/yyyy)*
3/20/2026

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Project Course *(Indicate whether the project was conducted in the Scholarly Projects Curriculum; Physician Scientist Experience; Combined Degree Program [MD/MPH, MD/PhD]; or other course.)*
Conducted in the Scholarly Projects Curriculum

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Project/Research Question
In a sample of study participants who were initially diagnosed with attention deficit/hyperactivity disorder (ADHD) and were later found to no longer meet criteria for an ADHD diagnosis by the end of the study, would it have been possible to predict their remission with demographic data and/or comorbidity data?

Type of Project *(Best description of your project; e.g., research study, quality improvement project, engineering project, etc.)*
Research study

Key words *(4-10 words describing key aspects of your project)*
Attention deficit/hyperactivity disorder (ADHD), remission, comorbidity, logistic regression

Scholarly Project Final Report

Meeting Presentations
If your project was presented at a meeting besides the OHSU Capstone, please provide the meeting(s) name, location, date, and presentation format below (poster vs. podium presentation or other).
No additional meetings/presentations

Publications *(Abstract, article, other)*
If your project was published, please provide reference(s) below in JAMA style.
Not published

Submission to Archive
Final reports will be archived in a central library to benefit other students and colleagues. Describe any restrictions below (e.g., hold until publication of article on a specific date).
No additional restrictions

Next Steps
What are possible next steps that would build upon the results of this project? Could any data or tools resulting from the project have the potential to be used to answer new research questions by future medical students?
Future directions include pursuing similar studies with larger sample sizes to ensure adequate study power, as well as expanding to multi-point longitudinal diagnostic tracking and analyses to avoid missing possible fluidity in ADHD diagnoses. Further studies should aim to achieve sample sizes large enough to assess underrepresented groups without the need to collapse categories and would likely benefit from assessing trauma-related disorders to explore any associations with ADHD remission.

Please follow the link below and complete the archival process for your Project in addition to submitting your final report.
https://ohsu.ca1.qualtrics.com/jfe/form/SV_3ls2z8V0goKiHZP

Student's Signature/Date *(Electronic signatures on this form are acceptable.)*
This report describes work that I conducted in the Scholarly Projects Curriculum or alternative academic program at the OHSU School of Medicine. By typing my signature below, I attest to its authenticity and originality and agree to submit it to the Archive.
Alaina Holm, 3/18/2026

Mentor's Approval *(Signature/date)*
Suzanne Mitchell, 03/15/2026

Scholarly Project Final Report

Report: *Information in the report should be consistent with the poster but could include additional material. Insert text in the following sections targeting 1500-3000 words overall; include key figures and tables. Use Calibri 11-point font, single spaced and 1-inch margin; follow JAMA style conventions as detailed in the full instructions.*

Introduction *(≥250 words)*

Attention deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder that is diagnosed based on the presence of hyperactive-impulsive and/or inattentive symptoms occurring in different settings for at least 6 months. Notably, these symptoms must cause at least some degree of impairment, and they must first present in childhood[1]. The disorder has been found to be more prevalent in male children, with nearly twice as many boys being found to have ADHD in a large meta-analysis[2], and among children aged 3-17 years old, 9.8% were reported by parents to have been ever diagnosed with ADHD[3]. Other genetic factors have been shown to be associated with a greater risk of ADHD, and studies have revealed that several genetic variations can contribute to summative increases in risk of the disorder[1,4]. These genetic influences may also have an effect on sub-threshold ADHD symptomology[1,4,5].

Considering the growing evidence for a genetic component of ADHD, it may come as no surprise that what once was thought to be primarily a disorder of childhood is more and more being recognized as one that persists into adulthood, though prevalence seems to vary across studies[6-8] and among those adults who may fit criteria for ADHD, not all are treated or formally diagnosed[8]. It is notable, however, that the updated DSM-5 does include diagnostic criteria to allow for more effective diagnosis in adult populations[9-11]. This, for many, is good news, given how the challenges associated with ADHD can be quite burdensome. Individual impairments can range from academic challenges, self-esteem issues, workplace difficulties, and risky behaviors[1], and when considered in conjunction with its prevalence in both pediatric and adult populations, it should come as no surprise that the economic burden of ADHD is extreme.

Though it is now more accepted that ADHD can continue into adulthood, research has shown that remission does occur. An established pattern is that symptoms related to hyperactivity/impulsivity diminish over time, but those associated with inattention more often persist[12]. In a 7-year adult follow up study, 30.2% of participants failed to continue to meet ADHD criteria, and 12.4% fully remitted with less than 4 remaining symptoms[13]. In a sample of young adults who were initially clinic-referred with ADHD as children, 15% maintained full ADHD diagnostic criteria; an extra 50% maintained symptoms causing impairment (i.e. they met criteria for ADHD in partial remission, per DSM-IV)[14]. Given what is understood about the numerous challenges associated with ADHD, this project hopes to further explore possible factors leading to remission in our study sample. Understanding prognosis, whether hopeful for remission or realistic about chronicity, may motivate patients and families to engage more effectively with treatment and mental health support, and identifying predictive factors may aid in developing more efficacious, population-specific treatments.

The question this project primarily seeks to answer is the following: in a sample of study participants who were initially diagnosed with attention deficit/hyperactivity disorder (ADHD) and were later found to no longer meet criteria for an ADHD diagnosis by the end of the study, would it have been possible to predict their remission with demographic data and/or comorbidity data?

Methods *(≥250 words)*

Preliminary Work

All data that was used in this project had already been collected for use in a study within the Translational Neuroeconomics Lab, headed by Dr. Suzanne Mitchell. Some of this data was received from a separate longitudinal study performed by Nigg et al.[15], including certain demographic and diagnostic information, which participants consented to share upon enrollment of the longitudinal study.

Sample

Participants were a subset of individuals participating in the Nigg et al. study and grouped into ADHD and healthy controls based on diagnoses made by the Nigg research group[15]. All participants completed all necessary assessments upon recruitment to the Translational Neuroeconomics Lab study. Participants for the Translational Neuroeconomics Lab study were pulled directly from the pool of participants in the Nigg et al. study[15], who established a "typically developing" healthy control group. Participants were included in this group if their IQ fell within the normal range and they did not have any major medical or psychiatric issues at the onset of the study, though mild psychiatric conditions (e.g. dysthymia, anxiety) were not excluded in an attempt to avoid creating a "super healthy" control group. Nigg et al.[15] also established an initial ADHD cohort, in which participants had a normal IQ and met diagnostic criteria for ADHD from the DSM-IV[16]. This original pool of participants for the Nigg study was representative of the local region in regards to race, ethnicity, and socio-economic status. Diagnostic data was collected throughout the course of the Nigg study by way of assessments completed by members of the diagnostic team (D-Team).

Recruitment to Translational Neuroeconomics Lab study was done first through direct contact by the researchers in the Nigg study group. Upon the conclusion of the Nigg study period, recruitment was done through more traditional written communication from researchers in the Translational Neuroeconomics Lab. The final number of participants recruited to the Translational Neuroeconomics Lab study was 109, ranging in age from 7-11 years old at the onset. Of note, the diagnostic classification for ADHD had shifted slightly at the end of the Translational Neuroeconomics Lab study period, as by this time DSM-5[9] diagnostic criteria was employed for diagnostic assessments.

For the purposes of the current study, participants were further categorized by clinical status assigned by the D-Team (diagnostic team) at their first and their final Nigg study visit. We excluded participants that had fewer than four diagnostic Nigg study visits and those whose final Nigg study visit was three or more years prior to their Translational Neuroeconomics Lab study visit. A total of 51 participants had met criteria for ADHD on their first Nigg study visit; 25 of those met criteria for ADHD on their final visit and were assigned to the "ADHD Control" group, and 26 of those no longer met criteria for ADHD on their final visit and were thus assigned to the "ADHD Remission" group as the comparator.

Measures

This was a retrospective exploratory study intended to investigate whether demographic and/or comorbidity-based predictive factors may contribute to remission from ADHD. As such, we selected the following variables as possible demographic predictive factors: age at first Nigg study visit, time from first to last Nigg study visit, sex, a combined race and ethnicity variable (Person of Color and/or Hispanic versus White and Non-Hispanic), a combined race variable (Person of Color versus White/Middle Eastern), ethnicity (Hispanic/Latinx versus Non-Hispanic), a primary race variable (Black or collapsed Asian/East Indian/Native Hawaiian/Pacific Islander versus White/Middle Eastern), primary yearly income ($35,000 to $99,999 or $100,000 and above versus less than $35,000), self-defined community standing (reported on a 1 to 10 scale and collapsed into high standing versus low standing), and Wechsler Intelligence Scale for Children (WISC) full scale IQ.

We selected the following variables as possible comorbidity-related predictive factors at the first Nigg study

visit: ADHD subtype, presence of a lifetime mood disorder, presence of a current mood, anxiety, oppositional defiant, conduct, or learning disorder, and presence of a current manic episode. We also selected the following variables as possible comorbidity-related predictive factors at the last Nigg study visit: presence of a mood disorder in the past year, presence of a current mood, anxiety, oppositional defiant, conduct, or learning disorder, and presence of a current manic or hypomanic episode.

Data Analysis

Per the recommendation and support of Rebecca Rdesinksi, Scholarly Projects Statistician, we used IBM SPSS Statistics, version 30.0.0.0, to calculate descriptive statistics for both groups and performed univariate logistic regressions to determine crude odds ratios (OR) for remission; where zero-cell counts occurred, we applied Haldane's correction. For all variables assessed as possible comorbidity-related predictive factors at the last Nigg study visit, it was found that seven to 12 participants had missing data (14 to 24% of the total sample). Due to the missing data being a large proportion of the sample, we opted to analyze it as a separate group for these variables of interest.

Results *(≥500 words)*

Participant Characteristics

The average age at the initial Nigg study visit for participants in the ADHD Control group was 8.85 years, while those in the ADHD Remission group were 9.86 years old on average. Approximately 9.98 years passed between the first and last Nigg study visit for the participants in the ADHD Control group, with a range of 5.23 to 12.69 years, whereas those in the ADHD Remission group saw an average of 8.19 years pass between visits, ranging from 5.10 to 11.09 years.

The majority of the participants were male, with a total of 35 compared to only 16 females in the study. There were 17 (68%) males and eight (32%) females in the ADHD Control group, and 18 (69%) males and eight (31%) females in the ADHD Remission group. The majority of the participants were both white and non-Hispanic, with 37 of the 51 participants meeting both criteria. Of the ADHD Controls, six (24%) identified as either a Person of Color and/or Hispanic, and eight (31%) thus identified in the ADHD Remission group. See Table 1 for additional participant race and ethnicity characteristics.

Most participants (26 of the 51 total, or 51%) reported a primary income of $35,000 to $99,999; 11 (22%) reported incomes of less than $35,000, and ten (20%) reported incomes of $100,000 or more. Self-defined community standing was nearly equivalent, with 25 (49%) of the participants reporting low community standing compared to 26 (51%) reporting high community standing.

In the ADHD Control group, WISC full scale IQ was 111.40 on average, compared to 105.19 in the ADHD Remission group.

The vast majority of participants (39 of the 51 total, or 76%) were found to meet criteria for the combined ADHD subtype at the first Nigg study visit, whereas only eight (16%) and four (8%) were diagnosed with inattentive and hyperactive subtypes, respectively. Only two (4%) met criteria for a lifetime history of mood disorders at this visit; none were diagnosed with a current mood disorder. Ten (20%) participants met criteria for a current anxiety disorder at the first visit, and an equal number met criteria for oppositional defiant disorder (ODD). Five (10%) participants were diagnosed with a learning disorder on the first study visit. None were diagnosed with conduct disorder, and none were assessed to be in a current manic episode.

At the final Nigg study visit, seven of the 51 participants (14%) were found to meet criteria for a mood disorder in the past year, though, of note, 12 (24%) of the sample were missing this data and ten (20%) were in the ADHD Control group. Similarly, seven of the 51 participants (14%) were also missing data in the remaining comorbidity-related variables of interest; five (10%) of the participants with missing data were in the ADHD Control group. With that in mind, seven (14%) of participants were diagnosed with a current mood disorder at the final visit, and 14 (27%) were diagnosed with a current anxiety disorder. One (2%) was diagnosed with ODD at this visit, and this participant was in the ADHD Remission group; none were diagnosed with conduct disorder. Three (6%) met criteria for a learning disorder at the final visit. None were found to be in a current manic or hypomanic episode.

Odds of ADHD Remission by Demographic Factors

Only two demographic variables of interest were found to yield statistically significant results, namely age at first Nigg study visit and time from first to last Nigg study visit. For each unit increase in age, the odds of ADHD remission increased by 66.5% (OR 1.665, 95% CI 1.085-2.554). For each unit increase in years between the first and last study visits, the odds of ADHD remission decreased by 46.2% (OR 0.538, 95% CI 0.358-0.807). The remaining variables all had 95% confidence intervals crossing 1. Of note, three of the variables (combined race, ethnicity, and primary race) had some zero-cell counts necessitating the use of Haldane's correction. See Table 1 for additional details on odds of remission by demographic factors.

Odds of ADHD Remission by Comorbidity Factors

Only one of the comorbidity variables of interest were found to yield statistically significant results, which happened to be the group with missing past year mood disorder data at the final study visit. In this group, the odds of ADHD remission decreased by 89.5% compared to those with no past year mood disorder history (OR 0.105, 95% CI 0.019-0.565). Of the remaining non-significant comorbidity factors, seven had zero-cell counts necessitating the use of Haldane's correction (presence of current mood or conduct disorder at initial visit, presence of current manic episode at initial visit, presence of current ODD or conduct disorder at final visit, and presence of current manic or hypomanic episode at final visit). See Table 2 for additional details on odds of remission by comorbidity factors.

Table 1. Demographic factors associated with ADHD remission

Variables	ADHD Controls (n=25)	ADHD Remission (n=26)	Crude OR (95% CI)
Age at First Nigg Visit mean (range) (SD)	8.85 (7.03-12.33) (1.498)	9.86 (7.06-12.35) (1.314)	1.665 (1.085, 2.554)
Time from First to Last Nigg Visit mean (range) (SD)	9.98 (5.23-12.69) (1.665)	8.19 (5.10-11.09) (1.770)	0.538 (0.358, 0.807)
Sex			
Male	17 (48.6%)	18 (51.4%)	1
Female	8 (50.0%)	8 (50.0%)	0.944 (0.289, 3.083)
Combined Race and Ethnicity			
Person of Color (POC) and/or Hispanic	6 (42.9%)	8 (57.1%)	1.407 (0.408, 4.860)
White and Non-Hispanic	19 (51.4%)	18 (48.6%)	1
Combined Race			

POC	5 (38.5%)	8 (61.5%)	1.778 (0.491, 6.433)
White/Middle Eastern	20 (52.6%)	18 (47.4%)	1
Ethnicity			
Hispanic/Latinx	2 (100%)	0 (0.0%)	0.177 (0.008, 3.885)[a]
Non-Hispanic	23 (46.9%)	26 (53.1%)	1
Primary Race			
Asian/East Indian/Native Hawaiian/Pacific Islander	5 (62.5%)	3 (27.5%)	0.705 (0.160, 3.098)[a]
Black	0 (0.0%)	5 (100%)	12.189 (0.630, 235.828)[a]
White/Middle Eastern	20 (52.6%)	18 (47.4%)	1
Primary Income			
<$35,000	6 (54.5%)	5 (45.5%)	1
$35,000-$99,999	11 (42.3%)	15 (57.7%)	1.636 (0.396, 6.764)
$100,000 or more	8 (80.0%)	2 (20.0%)	0.300 (0.043, 2.112)
Community Ladder			
Low Standing (Scores 1-5)	11 (44.0%)	14 (56.0%)	1
High Standing (Scores 6-10)	14 (53.8%)	12 (46.2%)	0.673 (0.223, 2.031)
WISC Full Scale IQ mean (range) (SD)	111.40 (82-138) (14.265)	105.19 (72-138) (16.130)	0.973 (0.936, 1.010)

[a]Haldane's corrected OR and CI.

Table 2. Comorbidity factors associated with ADHD remission

Variables	ADHD Controls (n=25)	ADHD Remission (n=26)	Crude OR (95% CI)
ADHD Subtype at Initial Visit			
Inattentive	5 (62.5%)	3 (37.5%)	0.570 (0.119, 2.721)
Hyperactive	1 (25.0%)	3 (75.0%)	2.850 (0.272, 29.844)
Combined	19 (48.7%)	20 (51.3%)	1
Presence of Lifetime Mood Disorder at Initial Visit			
No	24 (49.0%)	25 (51.0%)	1
Yes	1 (50.0%)	1 (50.0%)	0.960 (0.057, 16.232)
Presence of Current Mood Disorder at Initial Visit			
No	25 (49.0%)	26 (51.0%)	1
Yes	0 (0.0%)	0 (0.0%)	0.962 (0.018, 50.353)[a]
Presence of Current Anxiety Disorder at Initial Visit			
No	18 (43.9%)	23 (56.1%)	1
Yes	7 (70.0%)	3 (30.0%)	0.335 (0.076, 1.483)
Presence of Current Oppositional Defiant Disorder at Initial Visit			
No	21 (51.2%)	20 (48.8%)	1
Yes	4 (40.0%	6 (60.0%)	1.575 (0.386, 6.423)
Presence of Current Conduct Disorder at Initial Visit			
No	25 (49.0%)	26 (51.0%)	1

Yes	0 (0.0%)	0 (0.0%)	0.962 (0.018, 50.353)[a]
Presence of Current Learning Disorder at Initial Visit			
No	24 (52.2%)	22 (47.8%)	1
Yes	1 (20.0%)	4 (80.0%)	4.364 (0.452, 42.085)
Presence of Current Manic Episode at Initial Visit			
No	25 (49.0%)	26 (51.0%)	1
Yes	0 (0.0%)	0 (0.0%)	0.962 (0.018, 50.353)[a]
Presence of Mood Disorder in Past Year at Final Visit			
No	11 (34.4%)	21 (65.6%)	1
Yes	4 (57.1%)	3 (42.9%)	0.393 (0.074, 2.077)
Missing	10 (83.3%)	2 (16.7%)	0.105 (0.019, 0.565)
Presence of Current Mood Disorder at Final Visit			
No	16 (43.3%)	21 (56.8%)	1
Yes	4 (57.1%)	3 (42.9%)	0.571 (0.112, 2.923)
Missing	5 (71.4%)	2 (28.6%)	0.305 (0.052, 1.779)
Presence of Current Anxiety Disorder at Final Visit			
No	14 (46.7%)	16 (53.3%)	1
Yes	6 (42.9%)	8 (57.1%)	1.167 (0.325, 4.190)
Missing	5 (71.4%)	2 (28.6%)	0.350 (0.058, 2.096)
Presence of Current Oppositional Defiant Disorder at Final Visit			
No	20 (46.5%)	23 (53.5%)	1
Yes	0 (0.0%)	1 (100.0%)	2.617 (0.101, 67.833)[a]
Missing	5 (71.4%)	2 (28.6%)	0.397 (0.079, 1.980)[a]
Presence of Current Conduct Disorder at Final Visit			
No	20 (45.5%)	24 (54.5%)	1
Yes	0 (0.0%)	0 (0.0%)	0.837 (0.016, 44.054)[a]
Missing	5 (71.4%)	2 (28.6%)	0.380 (0.076, 1.895)[a]
Presence of Current Learning Disorder at Final Visit			
No	19 (46.3%)	22 (53.7%)	1
Yes	1 (33.3%)	2 (66.7%)	1.727 (0.145, 20.578)
Missing	5 (71.4%)	2 (28.6%)	0.345 (0.060, 1.990)
Presence of Current Manic Episode at Final Visit			
No	20 (45.5%)	24 (54.5%)	1
Yes	0 (0.0%)	0 (0.0%)	0.837 (0.016, 44.054)[a]
Missing	5 (71.4%)	2 (28.6%)	0.380 (0.076, 1.895)[a]
Presence of Current Hypomanic Episode at Final Visit			
No	20 (45.5%)	24 (54.5%)	1
Yes	0 (0.0%)	0 (0.0%)	0.837 (0.016, 44.054)[a]
Missing	5 (71.4%)	2 (28.6%)	0.380 (0.076, 1.895)[a]

[a]Haldane's corrected OR and CI.

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Discussion *(≥500 words)*

The goal of this analysis was to determine if certain demographic and/or comorbidity-based predictive factors in an existing longitudinal dataset may contribute to remission from ADHD. Significant demographic predictors of remission included an increased odds of 66.5% as age at the initial study visit increased, as well as a decreased odds of 46.2% as total follow up time increased in the Nigg study (see Table 1). Perhaps older participants took longer to seek out a diagnosis because their symptoms were less severe, and thus they were more likely to remit after developing coping strategies as they grew. No other significant demographic predictors were found. The only significant comorbidity-related predictor was a decreased odds of remission of 89.5% for those with an unknown past year history of mood disorder(s) at the final study visit, as in Table 2; between seven and 12 participants were missing comorbidity data from this visit for unclear reasons.

This leads us to a discussion about the limitations of this study, one of which is the small sample size. Our sample was very likely underpowered, as evidenced by multiple wide confidence intervals that cross 1.0, and we also had to rely on the use of Haldane's correction for certain groups, making these findings difficult to interpret (though reassuringly, none of the statistically significant findings were determined with Haldane's correction). Additionally, the size of our sample necessitated the collapse of the race variable in our analysis, such that discrete information about Asian and/or East Indian participants and Native Hawaiian and/or Pacific Islander participants was lost. Future studies should endeavor to have a more robust sample size to determine if the non-significant findings in this study were truly non-significant or a function of its low power. Larger sample sizes in the future would also reduce the need to collapse groups and thus ensure that patients from diverse backgrounds are appropriately represented in the analysis.

Another significant limitation of this study is the missing final visit comorbidity data, which presents a challenge in that it accounts for 14 to 24% of the sample and it is unclear whether this data is missing randomly or non-randomly. If non-randomly, it could suggest possible confounders; for example, perhaps those with more severe ADHD symptoms required more time for primary assessment by the diagnostic team, leading to time constraints preventing the completion of secondary assessment for comorbid disorders. If randomly, it may have simply been due to a clerical error in the data coding. It is difficult to say why the data was missing, but it is important for future studies to ensure that parameters in place to minimize data loss and ensure that all necessary measures are completed at each study visit.

To maximize participant numbers and ease project complexity, we opted to designate the final Nigg study visit for each participant as the endpoint for grouping, but this only represents a snapshot of what was often a fluid diagnosis in our sample and our groups and results may have differed if alternative endpoints had been selected. Perhaps a more accurate representation of each participant's "final" ADHD status would instead have been a single amalgamated status from a combination of statuses from multiple later time point, and though this posed too great a challenge for the scope of this project, it could be considered for future research.

In some cases, however, diagnostic status was not agreed upon by all members of the Nigg study D-Team, which raises the possibility that subjective assessments may have inaccurately captured either true pathology or true remission in certain participants. There is always a degree of subjectivity in psychiatric diagnosis, as the field does not yet have the luxury of utilizing many biologic or neuroanatomic tools for assessment, and this is highlighted in cases where clinicians disagree on diagnoses. Additionally, given the longitudinal nature of this study, there was a transition from the DSM-IV[16] to the DSM-5[9] over the study

period, such that variability between DSM editions could have introduced inconsistencies in the thresholds for which participants continued to meet or no longer met criteria for ADHD at their final study visit. Future research may opt to use one diagnostic paradigm over the course of the study to avoid this possibility, though our team felt it more appropriate to utilize the most recent DSM to most accurately reflect how clinicians in the community would have been assessing each participant at the later time points.

Finally, other limitations of the study include the lack of trauma-related comorbidity data and the grouping of White and Middle Eastern participants together during initial data collection. Such grouping could have masked potential socioeconomic stressors or cultural factors that may have impacted each individual group separately, which in turn could impact ADHD status. As for the absence of trauma-related comorbidity data, it is known that post-traumatic stress disorder (PTSD) and ADHD co-occur fairly frequently[7,17], and this can impact treatment approaches, including deprioritization of stimulant medication in youth after receiving a PTSD diagnosis[18]. Future research would do well to assess for PTSD or other trauma-related disorders given the potential for increased ADHD burden in this population.

Conclusions *(2-3 summary sentences)*

This exploratory study utilizing existing longitudinal data identified that age at initial visit and follow up duration were significant predictors for ADHD remission, as was missing past year mood disorder data at the final study visit. However, larger sample sizes are needed in future research to establish greater study power and to more robustly investigate outcomes for diverse populations.

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