Attention-deficit/hyperactivity disorder (ADHD) as a product of evolutionary mismatch: Identification of possible benefits using mixed methods

Amanda E. Kunkle

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Reading Committee:

Dan T.A. Eisenberg, Chair

Melanie Martin

Bettina Shell-Duncan

Program Authorized to Offer Degree:

Department of Anthropology

University of Washington

Abstract

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Amanda E. Kunkle

Chair of the Supervisory Committee:

Dan T.A. Eisenberg

Department of Anthropology

Characterized by persistent inattention, hyperactivity, and/or impulsivity that interferes with functioning across settings, attention-deficit/hyperactivity disorder (ADHD) is among the most commonly diagnosed psychiatric disorders, affecting around 11% of children and 6% of adults in the US and around 8% of children and 7% of adults, globally. Due to its high prevalence and heritability (~80%), ADHD has been hypothesized to represent a case of evolutionary mismatch, wherein previously adaptive or neutral phenotypes become maladaptive in new environments. ADHD appears to be context-dependent, with symptom severity fluctuating during the life course in response to environmental demands. Thus, ADHD phenotypes may be less impairing—and potentially even beneficial—in some contexts. This dissertation seeks to investigate the contexts in which ADHD is beneficial using a mixed

methods approach, integrating methodologies from biological and sociocultural anthropology, demography, and genetics to identify whether and when ADHD confers meaningful benefits.

The first study is a preregistered (https://osf.io/m7x69/) replication study examining the 7-repeat (7R) allele of the gene *DRD4*, an ADHD-associated allele that has been previously linked to better nutrition in nomadic adult men and worsened nutrition in settled adult men of the northern Kenyan Ariaal group. In a previous replication, 7R was associated with increased economic status in families of children belonging to a closely related group, the Rendille, but was not associated with nutrition in the children themselves. Here, I utilize a sample of 161 adolescents from a neighboring semi-nomadic, traditionally pastoralist group, the Samburu, to understand the effects of 7R on measures of nutrition and health, economic status, and metrics of school attendance. I hypothesized that 7R may influence nutrition and health directly by modifying adolescents' behaviors or indirectly through the behaviors of a 7R-carrying parent. I found no associations between 7R and most measures of nutrition and health, or between 7R and school metrics. Contrary to expectations based on community-based differences in mobility and sex-based differences in hunting, I observed no relationships between 7R-by-community or 7R-by-sex interaction terms and any outcomes. 7R was significantly positively associated with hemoglobin concentration (0.99 g/dL increase; $p = 0.01$) and was non-significantly associated with increased household economic status, proxied by weighted livestock units (6.78 unit increase; $p = 0.08$), with this effect in the direction expected based on the results found in the Rendille. Overall, the results of this first study suggest that the ADHD-associated 7R allele may confer modest health and economic benefits, but interpretation is limited by the complex socioeconomic conditions of the region and the small sample size.

The second study of this dissertation builds on existing qualitative research centered on identifying the positives of ADHD. In this study, I utilized semi-structured interviews and surveys of ADHD symptom profiles (Adult ADHD Self-Report scale; ASRS-v1.1) in a sample of adults with (n = 14) and without (n = 4) ADHD to identify the strengths associated with ADHD and the contexts in which they occurred. This chapter explicitly sought to center participant voices and experiences in the research and ground future hypotheses in rich qualitative data. Data gathered from the interviews and surveys of individuals with ADHD highlighted the variable nature of ADHD, as well as the complex feelings surrounding the disorder. Following coding and analysis of interview data, including selective coding of major groups, and comparisons with the non-ADHD sample, the results of this qualitative work identified five areas or contexts in which ADHD symptoms are experienced as beneficial: (1) problem solving and creativity, (2) physical movement, (3) fine, manipulative tasks, (4) dynamic, active environments, and (5) varied tasks. These areas were then used to generate testable hypotheses for the final chapter.

The final, preregistered (https://osf.io/p4zag/) study tests the hypotheses generated in the previous qualitative work using nationally representative longitudinal data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), linked with occupational characteristics from the Occupational Information Network (O*NET), to test whether individuals diagnosed with ADHD disproportionately occupy job roles involving greater amounts of those five strength domains. 21 O*NET job characteristics were isolated based on the five areas identified in the preceding study, and five O*NET characteristics were expected to be most associated with ADHD diagnosis: Originality, Adaptability, Innovation, Complex Problem Solving, and Thinking Creatively. Multiple models were used to understand the effects of

individual-level and family-level covariates on outcomes, and a Bonferroni correction was used to adjust for multiple testing issues (Bonferroni-adjusted $p = 0.0024$). In the models including only ADHD diagnosis and age and no other individual- or family-level covariates, ADHD diagnosis was positively associated with increased values of two O*NET job characteristics: Innovation (0.100 increase; $p = 0.047$) and Visualization (0.090 increase; $p = 0.013$), although these associations were not Bonferroni-significant. Thus, these findings point to moderate advantages conferred by ADHD in occupations requiring innovation, or the use of creativity and alternative thinking in the development of new ideas, and visualization, or the ability to imagine the process needed to achieve a desired product. Importantly, however, ADHD diagnosis showed negative or null associations with many of the characteristics, including Bonferroni-significant negative associations between ADHD diagnosis and Level/Impact values for eight of the 21 characteristics across one or more model types. Generally, the results of this study did not support the areas identified in the previous study or in the broader qualitative literature regarding the strengths of ADHD, and critical re-evaluation of this hypothesis is warranted.

This dissertation aims to reframe ADHD as a product of mismatch of naturally-occurring neurobiological and behavioral variation with modern environmental demands. Based on the results of the three studies presented here, it may be that ADHD is more broadly mismatched to environments than initially expected and only rarely confers any benefits in modern contexts or that ADHD was not as beneficial in past environments as an evolutionary mismatch hypothesis would suggest. Nonetheless, further research that seeks to identify the benefits or positives of ADHD would be broadly beneficial in that it may help to alleviate stigma around the disorder, improve wellbeing in those diagnosed, and provide potential avenues for therapeutic interventions.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

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DEDICATION

To Apo and Pappap. Inniibig kita.

Chapter 1. Introduction

Attention deficit/hyperactivity disorder (ADHD) is one of the most commonly diagnosed psychiatric disorders, and is characterized by persistent patterns of inattention, hyperactivity, and/or impulsivity that interfere with daily functioning (American Psychiatric Association, 2013; Faraone et al., 2021). Given its commonality and its high heritability, it has been argued that ADHD represents an evolutionary mismatch, wherein previously adaptive or neutral phenotypes become maladaptive in new environments (e.g. Williams & Taylor, 2005). This dissertation investigates this idea by integrating multiple lines of evidence using a mixed methods approach, building across chapters in order to identify whether ADHD is beneficial in some capacity or context.

This dissertation is structured as a multi-chapter thesis representing three research papers, with plans to submit each for peer review. Chapters are as follows: a background chapter, three distinct research chapters, and, finally, a chapter detailing overarching conclusions and future directions. In the background section (Chapter 2), I introduce ADHD as a disorder and review the empirical evidence regarding the possible fitness benefits of ADHD as well as the clinical and qualitative evidence supporting ADHD as a disorder which is highly variable and context dependent. I argue that, while the current empirical evidence for the adaptive benefits of ADHD is mixed, there are areas which have yet to be addressed. Then, I highlight the relatively recent acknowledgment in psychiatric literature of ADHD's context dependency and fluctuating pattern of remission, which are seemingly caused by changes in circumstances or environments. Finally, I propose that these lines of evidence point contexts in which ADHD is beneficial rather than detracting from success—contexts which may be identified by looking at ADHD through the lens of evolutionary mismatch.

My first research chapter, Chapter 3, represents a study attempting to replicate previous findings of positive benefits conferred by an ADHD-associated allele, the 7-repeat (7R) allele of the gene encoding the dopamine D4 receptor (*DRD4*), in a sample of adolescents residing in two communities of a Northern Kenyan semi-nomadic, pastoralist group, the Samburu. Previous research in a population of semi-nomadic adult Ariaal men observed that the 7R allele of *DRD4* was associated with better nutrition in nomadic men and worsened nutrition in settled men (Eisenberg et al., 2008). This result has been suggested to provide evidence of the context-dependent effects of ADHD: benefits for nomads and costs in more settled contexts. An analysis of the effect of *DRD4* 7R in children from a nearby, closely related group, the Rendille, found no nutritional differences between children with and without the 7R allele but found an association between the 7R allele and household economic sufficiency (Kunkle et al., 2025). In consideration of Open Science principles, analyses were preregistered (https://osf.io/m7x69/) on Open Science Framework (OSF) prior to the addition of the predictor variable to the dataset. Any deviations or post hoc analyses are explicitly stated in the manuscript, which is slated for submission to *PLOS One*. The results in Chapter 3 similarly suggests that, given the presence of at least one 7R allele in either parent, *DRD4* 7R may have had an impact on parental economic success. The results of this chapter suggest that *DRD4* 7R may confer modest benefits towards nutritional status in adolescents, but that real benefits may not be observable until adulthood. Finally, this chapter demonstrated the need for a more nuanced look into the contexts in which ADHD may be beneficial, which I sought to address in the following chapter.

With Chapter 4, my second research chapter, I focus on more broadly identifying the benefits of ADHD by directly asking individuals about their strengths and the contexts in which they see their ADHD as beneficial. Here, I administered semi-structured interviews and surveys

to individuals with and without ADHD in order to understand the contexts in which adults with ADHD feel their symptoms are less negatively impactful or beneficial to them. This chapter seeks to center the voices and experiences of adults with ADHD as a central component of the research process. Finally, I isolated five areas in which ADHD may be most beneficial, allowing me to build hypotheses that could be tested in my final chapter.

My final and third research chapter, Chapter 5, involves the use of data from nationally representative, longitudinal database: the National Longitudinal Study of Adolescent to Adult Health (Add Health). Similar to Chapter 3, in adherence to Open Science principles, hypotheses and model designs were preregistered prior to analyses (https://osf.io/p4zag/). With this chapter, I sought to test how commonly individuals with ADHD held occupations which were characterized by the five areas of strength outlined in the previous chapter compared to people without ADHD. In order to understand job characteristics, I used the Occupational Information Network (O*NET), a comprehensive database sponsored by the U.S. Department of Labor describing occupations and the knowledge, skills, abilities, activities, and tasks necessary for those occupations. The results of this chapter showed that individuals with ADHD may be more likely to hold jobs in which they are required to be innovative or required to visualize final products, in line with the prediction that problem solving and creativity may be areas of strength for individuals with ADHD. Finally, this chapter further suggests that ADHD may be more broadly mismatched to modern contexts, or that an evolutionary mismatch hypothesis is incorrect and the behaviors associated with ADHD were not beneficial in past environments.

Chapter 6 centers on the overall conclusions of this dissertation and details possible future research in this area. Here, I present a brief summary of conclusions for each chapter before zooming out to consider these conclusions more broadly, and what these conclusions

mean for research concerning ADHD as potentially beneficial. Finally, I look forward towards possible future projects, such as comparing ADHD phenotypes and associated benefits across populations or using more direct measures to capture variation, expanding my qualitative work by incorporating findings from my final chapter into my study design and interview questions, retesting hypotheses presented in Chapter 5 using longitudinal data or using ADHD genetic risk to look more deeply at variation over time and within ADHD, or by considering how ADHD may be associated with the development of aging-related diseases.

Together these chapters represent a novel, interdisciplinary attempt to identify the contexts in which ADHD may be beneficial. By using a mixed methods approach that draws on methods from biological and sociocultural anthropology, demography, and genetics, I present evidence for positive aspects of a disorder typically characterized as detrimental to success. With this dissertation, I aim to present evidence of ADHD as a disorder borne of a mismatch between naturally occurring neurobiological and behavioral variation and modern environmental demands rather than one caused by personal deficits, with the broad goals of decreasing stigma towards individuals with ADHD and providing potentially translatable therapeutic interventions that will help individuals with ADHD flourish.

Chapter 2. Background

Attention-deficit/hyperactivity disorder (ADHD) is one of the most commonly diagnosed neurodevelopmental disorders (Danielson et al., 2024). Characterized by symptoms of inattention, hyperactivity, and/or impulsivity, ADHD often results in impairment of function across multiple settings (American Psychiatric Association, 2013). Additionally, ADHD has been associated with a range of negative health, educational, occupational, and economic outcomes (Faraone et al., 2021; Nigg, 2013). In comparison, few studies have focused on the benefits or positive aspects of the disorder. Acknowledgement of the benefits of ADHD and self-reported strengths, combined with therapeutic approaches that emphasize strengths-based approaches may help improve overall wellbeing in individuals with ADHD (Hargitai et al., 2025). As such, research concerning the benefits of ADHD is of clinical interest (Greven et al., 2018; Wurth et al., 2025) and of interest to the public more broadly (Gupta, 2025; Moskowitz, 2024; Nall & Matysiak, 2021). This chapter provides an overview of current ADHD literature, with a focus on integrating concepts from biological anthropology with contemporary psychological and clinical research to understand potential benefits and strengths associated with the disorder and the contexts in which benefits may occur. The structure of this dissertation includes three distinct research papers, and, therefore, some material presented here is revisited in the introductions of subsequent chapters.

2.1 Attention-deficit/hyperactivity disorder (ADHD)

The core symptoms of ADHD—inattention, hyperactivity, and impulsivity—have standardized definitions and descriptions in the *Diagnostic and Statistical Manual of Mental Disorders (DSM)* in order to aid diagnosis. In the fifth and most recent edition of the *DSM*

(*DSM-5)*, published in 2013, inattention is defined as the inability to carefully complete a task or pay attention to, listen to, think about, or watch someone or something, hyperactivity refers to high levels of activity or excitement, notably in settings where this behavior is inappropriate, and impulsivity is defined as acting on desires, ideas, and feelings suddenly and without careful consideration. Detailed examples of each behavior are provided in the *DSM-5*. For example, individuals who display symptoms of inattention may fail to pay close attention to details or make mistakes on schoolwork or during meetings, may lose or misplace important items needed to complete activities or tasks, may become easily sidetracked by external or unimportant stimuli, and may be reticent to start homework assignments or activities that require concentration. An individual who is displaying hyperactivity may squirm or fidget with hands or feet when being seated is required, may appear or feel as if they are being "driven by a motor," and may be overly talkative or lack the ability to quietly participate in play or leisure activities. Finally, individuals who display impulsivity may have difficulty waiting their turn or standing in lines, may inappropriately intrude on the conversations or activities of others, or may interrupt others during conversations or to answer questions before they are finished (American Psychiatric Association, 2013).

In order to be considered for diagnosis, six or more symptoms of inattention and/or hyperactivity/impulsivity must be present in children up to 16 years old, and five or more symptoms of inattention and/or hyperactivity/impulsivity must be present and have been present by the age of 12 for individuals older than 17. Additionally, for diagnosis in both children and adults, ADHD symptoms must have persisted for at least six months across two or more settings (e.g., school, work, and/or home). ADHD is typically diagnosed by a licensed clinician following interview(s) with parents or caregivers (for children) and/or with patients (for children and

adults). These interviews are comprised of a series of questions which document the type, impact, and history of symptoms based on *DSM-5* criteria. Rating scales, neuropsychiatric tests, and brain imaging may be used early in or during the diagnostic process to screen for ADHD and/or determine symptom profile or severity, but cannot be used alone for diagnosis (Faraone et al., 2021). During the diagnostic process, individuals may be diagnosed with a particular presentation of ADHD (previously, "subtype") based on their symptoms: combined, predominantly inattentive, or predominantly hyperactive-impulsive (American Psychiatric Association, 2013).

As stated at the beginning of this chapter, ADHD represents one of the most common psychiatric disorders. In 2022, 11.4% (or 7.1 million) of US children between the ages of 3 and 17 were recorded as having ever been diagnosed with ADHD (Danielson et al., 2024). For adults, a 2023 analysis reported that 6.0% of US adults had previously received an ADHD diagnosis (Staley et al., 2024). The number has risen in recent years, as a 2007 meta-analysis of population-representative samples from epidemiological studies estimated prevalence to be lower, at 5.3% (Polanczyk et al., 2007). Globally, ADHD prevalence is estimated to be around 8.0% (ever diagnosed) for children and 6.8% for adults (Ayano et al., 2023; Song et al., 2021). In comparison, other common psychiatric disorders include major depressive disorder (MDD), which had an estimated prevalence of around 8% in 2019, and generalized anxiety disorder (GAD), which has an estimated global (combined lifetime) prevalence of 3.7% (Ruscio et al., 2017).

ADHD is often comorbid with other psychiatric disorders, including major depressive disorder, anxiety disorders, bipolar disorder, oppositional defiant disorder, and substance use

disorder (Faraone et al., 2021; Kessler et al., 2006). An estimated 79% of individuals with ADHD are diagnosed with at least one other disorder in their lifetimes (Kessler et al., 2014).

Following diagnosis, treatment options can vary between medications, behavioral interventions, cognitive therapies, or combinations of these methods (Caye et al., 2019; Safren et al., 2010). Most common first-line treatments for ADHD include pharmacological treatments. In children, treatment of symptoms using methylphenidate (e.g., Ritalin, Concerta, Methylin, Daytrana, Quillivant, or Relexxii) is typically first, although this may be followed by the prescription of lisdexamfetamine (e.g., Vyvanse, Elvanse, or Arynta), other amphetamines (e.g., Adderall, Dexedrine, Dyanavel, or Adzenys), or non-stimulants (e.g., Wellbutrin, Strattera, Clonidine, or Viloxazine) if methylphenidate is unsuccessful at treating symptoms. In adults, both methylphenidate and amphetamines may be considered as first-line treatments (Faraone et al., 2024). However, evidence from a recent review of meta-analyses for various ADHD treatment modalities has suggested that, currently, no intervention is successful, at a high certainty, at treating ADHD symptoms long term (Gosling et al., 2025).

Finally, it is important to consider that ADHD may be a socially-bound disorder, where behaviors associated with ADHD are violations of social norms rather than purely pathological deficits (Freedman & Honkasilta, 2017). Supporting this notion, the language used in the *DSM-5* diagnostic criteria and features of ADHD frequently utilizes descriptions or definitions that explicitly reference social expectations for behaviors. The terms “inappropriate” (used 1 time), “not appropriate” (used 1 time), “required” (used 1 time), or “expected” (used 1 time) appear in the descriptions of nine associated symptoms for inattention and hyperactivity/impulsivity. Other diagnostic criteria indirectly reference context-specific social expectations, such as not listening carefully when being spoken to, being easily distracted, talking excessively, difficulties being

quiet, interrupting or "intruding on" others, and difficulties waiting in lines (American Psychiatric Association, 2013). Out of the 18 diagnostic criteria presented in the *DSM-5*, 10 appear to be deficits that are contingent primarily upon the social contexts in which they occur. For example, fidgeting and squirming in one's seat, or leaving one's seat, is only inappropriate in settings where there is a social expectation for stillness and being seated. In other settings, such as at home or in casual conversation, such behaviors do not violate social expectations, as those expectations may not exist. Thus, an adequate understanding of ADHD also requires consideration of the social norms of the contexts individuals are present in—what is inappropriate, required, or expected in one context is not always the same in another context.

2.1.1 The etiology of ADHD

Over the past few decades, genetic research has established that ADHD is a complex, polygenic trait most likely caused by a large number of common genetic variants exerting small effects (Faraone & Larsson, 2018). Estimates from family and twin studies place the heritability of ADHD at around 80% (Faraone et al., 2024). This estimate is similar for both children and adults, with differences in heritability estimates for adults most likely reflecting biased reporting of symptoms in adult self-reports (Brikell et al., 2015), and across sexes (Martin et al., 2018). Genetic studies over the past two decades have sought to identify the particular variants underlying ADHD, first using genetic linkage analyses (Arcos-Burgos et al., 2004; Zhou et al., 2008), then candidate gene association methods (Bonvicini et al., 2016; Franke et al., 2012; Gizer et al., 2009), and more recently using genome wide association studies (GWAS; Demontis et al., 2019, 2023; Franke et al., 2009).

The recent application of GWAS methodologies for the discovery of ADHD-associated single nucleotide polymorphisms (SNPs) has led to the development and application of

polygenic scores (aka, polygenic risk scores) in studies concerning ADHD. Briefly, polygenic scores (PGS) represent a measurement of risk for the development of a particular trait or disorder, calculated by summing the number of associated variants (identified through GWAS) and weighting each variant by its estimated contribution to the trait in question (Demontis et al., 2019). A meta-analysis of ADHD polygenic risk scores (PRS) found that ADHD PRS were predictive of both diagnosis of ADHD and number of ADHD symptoms, comorbid psychopathology, and impaired cognitive and education outcomes, with the last two associations consistent with the broader ADHD literature (Green et al., 2022). While of potential clinical utility, researchers have suggested caution in using PGS, as its predictive ability is limited by a number of factors and may not be useful in its current form during the diagnostic process (Uffelmann & Posthuma, 2021). Notably, PGS are limited by the samples on which they are built, which tend to be overwhelmingly comprised of white European individuals, preventing PGS from being fully predictive in other non-European, non-white, or admixed populations (Duncan et al., 2019).

When estimating heritability, it is also possible to measure the effect of shared and nonshared environments on the development of a trait or disorder. Shared environment refers to the settings, experiences, and events which increase similarity between related individuals, while nonshared environment refers to those events that are experienced individually and which increase differences between related individuals. For ADHD, research has shown that shared environmental effects contribute very little to a diagnosis, but nonshared environmental effects and unique events, such as a traumatic brain injury, have been shown to contribute between 10-30% of the variance (Adeyemo et al., 2014; Asarnow et al., 2021; Burt et al., 2012). Generally, environmental causes of ADHD are difficult to identify and measure, and many of the identified

risks carry low risk ratios and may be due to confounding or reflect an unmeasured third variable (Faraone et al., 2024; Kim et al., 2020).

Neuroimaging studies of ADHD patients have shown volume abnormalities in subcortical regions, like the basal ganglia and insula, as well as volume reductions in the accumbens (reward processing), caudate (movement, learning, memory, reward, motivation and emotion; Driscoll et al., 2026), putamen (learning and motor control; Ghandili & Munakomi, 2026), amygdala (emotional regulation and recognition), and hippocampus (long-term memory and, potentially, emotional and motivational regulation) as well as intracranial volume (Hoogman et al., 2017). Additionally, consistent with ADHD symptomology, ADHD patients show under-activation in the dorsolateral prefrontal and dorsal inferior frontal gyrus, areas associated with maintenance of attention and stimuli selection and response (Norman et al., 2017). Individuals with ADHD also appear to have deficits in grey matter volumes. However, these volumes reached normal ranges as age increased, suggesting that differences in grey matter volumes were driven primarily by delays in the development of implicated regions in individuals with ADHD (Nakao et al., 2011). Similarly, there appears to be a delay in the maturation of cortical thickness and surface area (Shaw et al., 2012). Reflecting the behavioral complexity of ADHD and the variability of ADHD symptomology, there is substantial heterogeneity in the cognitive impairments associated with the disorder, suggesting that there may be multiple, intersecting neurobiological pathways implicated in the development of ADHD (Rubia, 2018).

While genetic profiles, particularly PGS, as well as neuroimaging and electrophysical (EEG) results have been proposed as possible biomarkers for ADHD diagnosis, existing research has not supported the integration of these into the clinical diagnostic process in part due to the limitations of the available research (Michelini et al., 2022). More recent attitudes toward

neuroimaging studies advocate for a more “global” view of the brain in regard to ADHD, wherein broad brain morphology is emphasized, rather than differences in localized regions. Finally, recognition of ADHD as a dimensional phenotype and not a fixed categorical trait that likely has numerous underlying etiologies has led to calls for more investigation into the heterogeneity of ADHD presentation and its relation to neurophysiological mechanisms (Koirala et al., 2024).

2.1.2 ADHD in children and adolescents

Generally, children with ADHD are diagnosed based on observations reported by parents and/or teachers and through clinically validated questionnaires and diagnostic interviews (Wolraich et al., 2019). Observable symptoms of ADHD for school-aged children can range from disruptive behaviors in the classroom and emotional dysregulation to disorganization and poor school performance (Nigg, 2013; Nigg et al., 2020). A recent review of meta-analyses of treatment interventions showed that alpha-2 agonists (e.g., Clonodine or Guanfacine), atomextine/Straterra, viloxazine/Qelbree, as well as methylphenidate and amphetamines were successful in reducing symptom severity, but only short term, and some non-drug interventions, namely acupuncture and cognitive behavioral therapies, were also successful at reducing symptom burdens in children and adolescents (Gosling et al., 2025).

While ADHD symptom profiles can vary substantially between individuals, there appears to be gendered differences in the way ADHD is both diagnosed and experienced. During childhood, boys are four times more likely than girls to be diagnosed with and receive treatment for ADHD. However, the ratio of diagnosed ADHD begins to even between boys and girls during adolescence, shifting to 2:1 (Faraone et al., 2024). As there are no differences in the heritability of ADHD between sexes (Martin et al., 2018), it is likely that unbalanced diagnostic rates during

childhood and adolescence may reflect biases in how diagnostic criteria are applied across boys and girls. Additionally, it has been suggested that young girls are less likely to be diagnosed than boys because boys tend to exhibit hyperactive behaviors that are easily observable by parents and teachers. Young girls are more likely to exhibit inattentive behaviors, which tend to be experienced internally (Hinshaw et al., 2022), and therefore may not be observable by parents and teachers. As such, girls with ADHD are more likely to develop internalized comorbid psychiatric disorders like depression and anxiety (Wolraich et al., 2019).

2.1.3 ADHD in adults

Prior to the publication of the *DSM-V* in 2013, clinicians experienced in treating and studying patients with ADHD called for significant changes to the diagnostic criteria, notably that ADHD be recognized explicitly as a disorder which can be diagnosed at older ages. Until relatively recently, ADHD was considered to be a disorder of childhood. Thus, the diagnostic criteria available for ADHD in the *DSM-IV* and in previous editions were targeted towards children and required symptoms to have been present in individuals since before age 7 to diagnose adolescents and adults (Bell, 2011; Epstein & Loren, 2013).

As would be expected due to the lack of parental or teacher input as individuals become adults, a majority of diagnoses for ADHD in adulthood are sought via self-referral (Faraone et al., 2024). Gender differences in ADHD diagnosis rates tend to disappear in adulthood; the ratio of men to women diagnosed with ADHD evens to around 1:1. It is likely that this is due to adult women “catching up” to men, as women are more likely to seek out treatment for mental health issues (Faraone et al., 2024). Generally, it appears that both drug- and therapy-based treatments are somewhat successful in treating adults, with atomoxetine/Straterra, methylphenidate,

amphetamines, as well as cognitive behavioral therapies and mindfulness practices are moderately effective in treating ADHD symptoms (Gosling et al., 2025).

ADHD is associated with higher levels of risk-taking behaviors in adolescents and adults (Matthies et al., 2012; Pollak et al., 2019). Some evidence has shown that this propensity for risk taking stems from perceptions of the potential benefits of such behaviors, rather than a desire for risk more generally (Shoham et al., 2016, 2021). Adults with ADHD are also more likely to have ever been arrested or issued a traffic ticket (Faraone et al., 2006). Additionally, in adults, ADHD has been associated with lowered quality of life and increased morbidity and mortality risk (Geffen & Forster, 2018). Long term outcomes for individuals with ADHD also include poorer long-term self-esteem and social functioning (Harpin et al., 2016).

Variable patterns of fluctuation in symptom severity have been observed in adults diagnosed with ADHD, with some adults showing persistent patterns while others move into "remission," wherein ADHD-associated symptoms fall below clinically relevant thresholds (Sibley et al., 2022). Periods of remission seem to coincide with greater environmental demands, with individuals who report higher demands being more likely to experience partial or full remission of symptoms (Sibley et al., 2024).

2.2 A brief history of ADHD as a defined disorder

The first description of ADHD has been attributed to Hippocrates in approximately 493 BC, when he described patients who "... quickened responses to sensory experience, but also less tenaciousness because the soul moves on quickly to the next impression" (Martinez-Badía & Martinez-Raga, 2015). The first mention of ADHD in a medical textbook occurred in 1775, when a German physician, Melchior Adam Weikard, referred to a disorder involving a lack of

attention (*Attentio Volubilis*). He described individuals with this attention disorder as "unwary, careless, flighty and bacchanal," who are akin to children, "distracted by a hundred minor matters, when they are perused or conversed with about a serious matter" (Barkley & Peters, 2012). Around the same time, in 1798, Scottish physician Alexander Crichton published a medical textbook centered around mental disorders in which one chapter focused primarily on disorders of attention (Palmer & Finger, 2001). This was followed by a mention in a poem by German physician Heinrich Hoffman, who frequently wrote about children he encountered in his medical practice, about "Fidgety Phil," nearly 70 years later in 1865 (Stewart, 1970), and about 40 years after that, George Still described a behavioral condition he observed in children that closely reflects modern conceptions of ADHD (Still, 1902).

In the United States, the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*) represents the formal guide to the classification, diagnosis, and treatment of mental disorders (American Psychiatric Association, 2013). The first edition of the *DSM* was published in 1952 (Blashfield et al., 2014), but ADHD was only included in the 2nd edition (*DSM-II*), published in 1968, where it was designated as "hyperkinetic reaction" (American Psychiatric Association, 1968). In 1980, the 3rd edition of the *DSM* (*DSM-III*) published its first operationalizable description of ADHD diagnostic criteria, although it was initially called "Attention Deficit Disorder (ADD)" and possible subtypes included "with hyperactivity" or "without hyperactivity" (American Psychiatric Association, 1980; Faraone et al., 2015). The subsequent release of the revised version of this edition (*DSM-III-R*) renamed the disorder to "Attention Deficit/Hyperactivity Disorder (ADHD)," and removed the possible subtype of ADD without Hyperactivity (American Psychiatric Association, 1987; Epstein & Loren, 2013).

In the *DSM-5*, published in 2013, ADHD represents one of over 500 disorders presented and described (American Psychiatric Association, 2013). This edition included additional changes to the description of ADHD. Many of these changes were implemented in direct response to changing views regarding the presence of ADHD in adults and the continuous nature of ADHD symptoms (Bell, 2011). Some changes included the shift from "subtypes" to "presentations," meant to reflect the variation apparent in symptom profiles across individuals, the removal of the diagnostic requirement for evidence of impairment, which recognized the inherent subjectivity and complexity in judging levels of impairment (as compared to simply counting symptoms), the lowered symptom thresholds for diagnosis in those 17 and older, likely changed in recognition of the limited effectiveness of the higher thresholds for treating older adolescents and adults, and the shift in maximum age of onset to 12 as compared to 7 years old, which was in response to research showing little difference between outcomes for individuals who first display symptoms prior to age 7 and those who experience symptoms later (Epstein & Loren, 2013).

A revised version of the edition, the *DSM-5-TR*, was released in 2022, and included changes for a majority of the disorders, with updates most often occurring in the sections regarding prevalence/risk factors, culture- and gender-related diagnostic features, association with suicidality, and comorbid disorders for each disorder included in the manual (First et al., 2022). When comparing this revised version to the *DSM-5*, diagnostic criteria for ADHD remained unchanged (American Psychiatric Association, 2022).

It is important to note that not all countries and regions recognize ADHD as a disorder, and even regions that do recognize ADHD may have different diagnostic criteria or may not accurately or consistently publish data about it (Conrad & Bergey, 2014; Faraone et al., 2024).

The *International Classification of Diseases* (*ICD*), published by the World Health Organization (WHO) and now on its 11th edition (*ICD-11*), includes somewhat stricter diagnostic criteria for ADHD that differs from those in the *DSM-5* in important ways. Namely, the *ICD-11* includes differences in the descriptions and number of symptoms included and does not specify diagnostic thresholds directly and instead uses more arbitrary terms (e.g., requirement of "several symptoms") (Gomez et al., 2023). In addition to differences in diagnostic standards, global differences in the diagnosis of ADHD may also reflect cultural or socioeconomic differences and/or differences in health care systems across countries (Bergey & Filipe, 2018).

2.3 Evolutionary mismatch and ADHD

When a disorder is as common as ADHD, a question emerges: why has this phenotype, which has negative consequences, been able to persist at such a high prevalence? With ADHD, some have argued that ADHD as a phenotype may have been advantageous in ancestral environments and therefore subject to positive selection over the course of human history (Williams & Taylor, 2005). As such, it is only as the mismatch between this previously adaptive (or otherwise neutral) phenotype and the environmental contexts we currently reside in widened that ADHD became maladaptive. Additionally, ADHD represents a disorder that is substantially socially-bound, including many of its consequences. It is also possible that ADHD persisted as a phenotype, even without being beneficial, simply because the negative consequences conferred by ADHD phenotypes are social in nature and therefore not sufficiently harmful to reproductive fitness to warrant selection against these phenotypes.

A primary hypothesis to emerge from the work of human evolutionary biologists concerns the concept of *evolutionary mismatch* (Eaton et al., 1988; Riggs, 1993; Williams &

Nesse, 1991). Evolutionary mismatch, wherein traits which were adaptive or neutral in past environments become maladaptive in new environments, occurs as a result of adaptive lag (Bourrat & Griffiths, 2024). As environments change, natural selection is limited in its ability to respond to such changes quickly. Thus, fast or dramatic changes to the environment cause "lag" in adaptations—traits which were previously beneficial in the previous context become meaningless or harmful in the new context (Nesse & Williams, 2012). Evolutionary mismatch has been argued to be at the core of numerous common disorders as a direct result of rapid changes to the environment, including diseases such as type-II diabetes (Neel, 1962), cardiovascular disease (Kuzawa, 2008), autoimmune diseases (Rook, 2012b), and other health issues (Bateson et al., 2004).

When hypothesizing that a particular disorder is caused by mismatch, it is important to consider the specific differences between past and modern environments, and then how these differences may help explain modern health problems. For example, modern public health interventions, particularly sanitation, have led to substantial decreases in human mortality rates. At the same time, these interventions have also decreased the number of parasites, bacteria, and other infectious agents encountered in our environments dramatically—a departure from what would have been expected in past environments. It is due to this absence of our "old friends" that we may have caused increased prevalence of diseases such as multiple sclerosis, type-I diabetes, and allergies (Nesse & Stearns, 2008; Rook, 2012a).

As a framework, mismatch has the potential to be particularly useful in research on human psychology and in recontextualizing psychiatric disorders (Li et al., 2018). Rather than focusing internally on how neurobiological mechanisms inadequately interpret or sort through external stimuli, using mismatch, we can instead view certain conditions as "normal" reactions

of a brain misaligned with the requirements of modern environments. In turn, this may translate to treatment modalities that, when possible, focus primarily on changing the environment to fit the individual, rather than changing the individual to fit the environment.

Considering the substantial genetic basis and relatively high prevalence of ADHD, it is argued that ADHD represents an example of mismatch (Jensen et al., 1997; Swanepoel et al., 2017; Williams & Taylor, 2005) and this is a prominent idea in the popular consciousness (e.g., Allen, 2024; Barrington, 2024; Sands, 2024). When applied to behavioral traits, an evolutionary mismatch hypothesis argues that the behaviors that once contributed to fitness in past environments may be harmful to success in modern environments and are therefore categorized as "disordered" (Li et al., 2018). Although not explicitly explored by the *DSM-V*, there is a general consensus that the behaviors associated with ADHD (inattention, hyperactivity, impulsivity) exist on a continuum wherein diagnostic cut-offs are largely arbitrary and socially bound (Blashfield et al., 2014; Epstein & Loren, 2013; Kraemer et al., 2012). In other words, the behaviors observed to negatively impact functioning, and thus used to justify an ADHD diagnosis, exist in "normal" degrees for all non-ADHD diagnosed individuals, and ADHD-associated behaviors may simply represent the far ends of normal variation.

2.3.1 Proposed hypotheses concerning ADHD as an adaptive phenotype

Arguments of ADHD as a disorder born of a mismatch between modern environments and ADHD-associated behaviors hypothesize that ADHD-associated behaviors were adaptive in past environments. Careful consideration of how common these behaviors are amongst individuals with ADHD, as well as whether these behaviors would have increased fitness in past environments is necessary. Hypotheses of the adaptive benefits of ADHD have included an increased propensity to migrate and explore novel environments and an ability to respond to

multiple, unknown stimuli (Chen et al., 1999; Jensen et al., 1997; Shelley-Tremblay & Rosén, 1996; Williams & Taylor, 2005). However, these hypotheses have been met with skepticism from researchers specializing in ADHD, in part because they have not been adequately tested or do not suggest ways in which they might be reliably tested (Swanson et al., 2002).

2.3.1.1 ADHD as adaptive: migration to and exploration of novel environments

A proposed adaptive function of ADHD is that it may increase the propensity to migrate to new environments. Primary evidence supported this hypothesis comes a gene which has been implicated in candidate gene studies seeking to understand the genetic causes of ADHD: the gene encoding the dopamine D4 receptor, *DRD4*. An ADHD-associated allele of *DRD4*, the 7-repeat (7R) allele, has been found at higher frequencies in populations with histories of migration and who led more nomadic lifestyles (Chen et al., 1999; Matthews & Butler, 2011; Tovo-Rodrigues et al., 2010). Linkage disequilibrium patterns, or the dynamics of how genes located near each other are inherited as distinct blocks, indicate that the 7R allele arose approximately 50,000 years ago before being positively selected for (Ding et al., 2002; Wang et al., 2004). However, it is worth noting that the evidence of selection at this locus has been contested (Naka et al., 2011). *DRD4* 7R has been shown to functionally impact the pharmacological response of the DRD4 receptor to various ADHD medications (Herrera, 2017; Misganaw, 2021). A more in-depth explanation of this allele is provided in the introduction of Chapter 3.

Given the higher observed frequency of *DRD4* 7R in populations which have histories of migration or more mobile (nomadic) societies, it has been suggested that ADHD might both increase the propensity of migration into new, unfamiliar environments and an individual's success in these new environments. Impulsivity and exploratory behaviors, traits which have been associated with ADHD, have been hypothesized to be advantageous in environments where

extensive searches for resources are necessary (Jensen et al., 1997; Williams & Taylor, 2005). In an effort to test this, a recent study in a representative sample of US adults (mean age of 46) by Barack et al. (2024) asked participants to complete a computer-based task in which they had to gather berries from bushes in randomized "patches", or collections of bushes. Barack and colleagues found that individuals that scored highly on an ADHD screening tool were more successful at the foraging task; individuals who screened positive for ADHD spent less time in patches but had higher reward rates (calculated as cumulative collected berries divided by cumulative time in patch) than individuals who screened negative for ADHD. Conversely, Arildskov et al. (2022) found that Danish children with ADHD did not outperform non-ADHD peers in a physical search task. School children aged 7 to 9 were tasked with finding coins hidden at varying degrees around a room, a test which the authors argue would test the children's ability to explore and forage for limited resources in a novel environment. The results of this experiment showed no significant difference in the number of coins found based on the degree of ADHD-associated traits exhibited.

Research has also shown that, in addition to exploring their physical environments more than non-ADHD peers, individuals with ADHD exhibit greater exploration in cognitive domains as well. A study from Van den Driessche et al. (2019) testing fourth grade French children's performance on visual and semantic search tasks showed that children with ADHD exhibited more variety in exploration patterns. Van den Driessche and colleagues used two methods to understand exploratory behaviors in children with and without ADHD: a visual search task involving the Bells Test, a paper test wherein children searched for bells with a predetermined number of "distractors" present, and a semantic search task, designed to understand internal, cognitive exploration ability, where children named aloud as many words as they could about a

single topic within two minutes. Children with higher ADHD symptom scores performed similarly to those with lower ADHD scores on the visual search task but tended to move around the page more during their searches. During the semantic search task, children with higher ADHD symptoms scores performed better than those with lower ADHD symptoms scores in addition to inserting more "semantic leaps" between answers, suggesting that the greater cognitive exploration was beneficial for this task. This may also have implications regarding the common claim that ADHD is associated with increased creativity (Boot et al., 2020; Hoogman et al., 2020), as greater cognitive exploration may also translate into greater capacity for novel idea generation and creative thought (Mehta & Dahl, 2019).

Finally, a recent cross-sectional study of 521 adults showed that hyperactive/impulsive ADHD traits were associated with increased curiosity (Le Cunff et al., 2026), which may drive individuals to explore and engage with novel environments, factors, or, more intangibly, concepts. Curiosity and impulsivity have also been shown to share overlapping neural mechanisms, particularly in regards to frontoparietal circuits (implicated in goal-directed behaviors, attention, working memory, and decision-making) (Marek & Dosenbach, 2018) and dopaminergic reward systems (Marvin et al., 2020).

2.3.1.2 ADHD as adaptive: responses to novel stimuli

Another proposed hypothesis regarding the adaptive benefits of ADHD focuses primarily on the ability to respond to stimuli present in a novel environment. Novelty seeking has previously been observed at higher rates in individuals diagnosed with ADHD (Donfrancesco et al., 2015). Novelty seeking refers to the desire to explore new, unfamiliar environments and stimuli. Novelty seeking behaviors, and ADHD broadly, have been implicated as drivers of exploratory behaviors, but they may also drive individuals to seek out and respond differently to

the sights, sounds, and things encountered in those novel environments (Jensen et al., 1997; Matthews & Butler, 2011; Shelley-Tremblay & Rosén, 1996; Williams & Taylor, 2005).

The differences in the responses of individuals diagnosed with ADHD towards novel stimuli may be due to difficulties with sustained attention. Alternatively, these differences may be due instead to heightened vigilance of their surroundings, which may be adaptive in some contexts (Le Cunff, 2024; Shelley-Tremblay & Rosén, 1996). However, some evidence contradicts this argument; during a computerized vigilance task, children and adults with ADHD performed worse than non-ADHD peers (Tucha et al., 2009). Another study of 31 ADHD-diagnosed adults saw similar results, with ADHD adults performing worse on eight different tests of vigilance while also, predictably, performing worse on a sustained attention task (Fuermaier et al., 2022). Eye-tracking studies have reported that while individuals with ADHD exhibit more variability in eye movements, frequently shifting their gazes to other parts of the visual field, this is usually accompanied by worsened performance on the assigned task (Levantini et al., 2020). These results suggest that variability in eye movements may not broadly beneficial for certain tasks—it may, however, be helpful in other contexts or tasks not tested by the current battery of neuropsychological tests.

These results presented in this section provide mixed evidence for the benefits of ADHD in responses to novel stimuli. However, current tests scoring vigilance or response to novel stimuli are likely inadequate to test evolutionarily salient hypotheses, and the development of such tasks may represent a gap in current research about the adaptive history of ADHD-associated behaviors.

2.4 Integrating the evolutionary and the clinical: identification of the contexts in which ADHD is beneficial

The same skills that contributed to greater success in some of the tasks explored in the previous section may be beneficial in other areas of contemporary life for individuals with ADHD. Approximately two-thirds of individuals with ADHD report symptom abatement during adolescence and adulthood (Faraone et al., 2024). This might be because, with age, we are able to exercise greater control over our environments (e.g. choose jobs, friends and romantic partners which better fit our strengths). As ADHD diagnosis rates have increased over the past decade (Faraone et al., 2021), there has also been an increased emphasis in psychology and popular media on presenting the ways in which ADHD may be beneficial, representing a shift in the depiction of ADHD towards a more positive portrayal (Moskowitz, 2024; Nordby et al., 2023). Additionally, in clinical research spaces, there is growing recognition of the strengths of qualitative and mixed-methods approaches to assess the experiences and perspectives of individuals with ADHD (Rosenthal et al., 2025). In particular, qualitative and mixed methods research has been highlighted as salient ways to contextualize research findings from empirical studies and communicate these findings across methodological and academic boundaries (Weisner, 2016).

In one study, the acknowledgement of strengths associated with ADHD and greater use of those strengths were associated with improved ratings of wellbeing, quality of life, and mental health, suggesting that individuals with ADHD may benefit by focusing on their strengths rather than their deficits (Hargitai et al., 2025). Thus, some recent research has attempted to identify areas of strength associated with ADHD. Traits like heightened creativity and problem solving abilities have been suggested as advantages or positives of ADHD (Hoogman et al., 2020; Le Cunff, 2024; Maisano et al., 2026; Steele et al., 2021), and qualitative research has generally

supported this. For example, Sedgwick and colleagues (2019) showed that core strengths and/or advantages of ADHD included divergent thinking, hyperfocus, creativity, curiosity, bravery, and persistence in a sample of 6 adult men. Schippers et al. (2022) saw similar results when analyzing open-ended responses from 206 individuals with ADHD: individuals with ADHD highlighted creativity, being dynamic, flexibility, socio-affective skills, and higher-order cognitive skills as positive aspects and strengths of the disorder. Finally, a qualitative study involving a sample of nine adults with ADHD conducted by Redshaw and McCormack (2022) reported higher energy, adventurousness, curiosity, and better problem-solving abilities as areas of strength conferred by ADHD. Another recent qualitative study of adults with ADHD and/or Autism Spectrum Disorder (ASD) observed that individuals with ADHD frequently reported "positive energy" and the "drive to find things out" as benefits attributable to the disorder. Furthermore, the number of benefits and positive perception of diagnoses (i.e., participants "accepting/liking" their diagnosis) were positively associated with quality of life, suggesting that individuals who saw their diagnoses as helpful in some way also saw general improvements in their wellbeing (Wurth et al., 2025).

In addition to research on strengths of ADHD, some qualitative research has sought to understand the particular areas in which ADHD symptoms may be most and least impactful. Given the previously discussed evidence of ADHD as fluctuating based on environmental demands, areas where symptoms are least impairing may represent contexts in an ADHD phenotype better "matches" the environment. Lasky et al. (2016) analyzed interview data from over a hundred young adults diagnosed with ADHD which showed that 55% of respondents described a connection between ADHD symptoms and their environments. With this evidence, it is likely that ADHD symptoms are largely context dependent, with the functional impact of

ADHD symptoms based on the setting or task required at a particular time. Reflecting this context-dependence, individuals with ADHD often feel that their problems stem from a lack of motivation or interest, rather than due to simply a lack of focus (Ginapp et al., 2022; Lasky et al., 2016). Therefore, in addition to or combination with medications and/or therapeutic interventions, treatment for ADHD may be possible at the occupational level, and individuals with ADHD may be benefitted by choosing jobs and careers that work with their ADHD rather than against it (Lasky et al., 2016). This parallels research which centers on career decision-making strategies and job retention, wherein "fit" between an employee and their job is a major predictor of career success and job satisfaction (Hoff et al., 2020; Verquer et al., 2003).

2.5 Conclusion

ADHD is one of the most common neurodevelopmental disorders, has a strong genetic component underlying its development, and has been associated with a number of adverse outcomes across the lifespan. More recently, clinical literature has begun to recognize the dimensionality of ADHD, wherein ADHD traits exist in some degree for all individuals, and that it is only in combination and in certain contexts that impairments occur. Notably, the diagnostic criteria for ADHD are deeply socially-bound and many negative consequences of ADHD-associated behaviors are often social in nature (increased isolation and bullying, poor social functioning), suggesting that many of the behaviors associated with ADHD are "disordered" because they may violate context-bound social expectations. Thus, ADHD phenotypes are likely not uniformly disadvantageous, and there may be contexts or tasks are *advantageous* instead.

Qualitative research has suggested that traits like creativity, cognitive flexibility, hyperfocus, curiosity, and exploratory behaviors may be associated with ADHD and could be

emphasized, or even harnessed, for the benefit and success of affected individuals. Some empirical research has found that individuals with ADHD or ADHD-associated phenotypes show advantages in some foraging and exploratory tasks and exhibit greater cognitive exploration and curiosity, but other research provides mixed results for proposed advantageous traits like heightened vigilance and improved responses to novel stimuli. Overall, evidence for the benefits of ADHD remains somewhat scarce and untested, even as the topic has gained traction in the popular media.

The literature reviewed in this chapter highlights the complexity of ADHD as a neurodevelopmental disorder and presents the hypothesis that ADHD may be caused by evolutionary mismatch. Framed through this lens, ADHD is not so much a disorder, but instead naturally-occurring neurobiological and behavioral variation that is at odds with modern environments like formal schooling and structured employment. Furthermore, given the recent evidence that ADHD symptoms appear to fluctuate depending on context and environmental demands, the question of how the broader environment shapes ADHD symptom severity, as well as when symptoms are experienced positively or negatively, remains unexplored. Additionally, only a few studies have sought to present positive or advantageous aspects of ADHD as explicitly informed by those diagnosed, and fewer still test how common or meaningfully beneficial identified strengths of ADHD are across contexts. Therefore, there is a rich area of potential future research centered on identifying the tasks and contexts in which ADHD may be an advantage—or conversely in rejecting commonly held assumptions about advantages of ADHD.

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Chapter 3. The ADHD-associated *DRD4* gene and nutrition, economic status, and schooling in semi-nomadic Samburu adolescents of Kenya: a replication study

Chapter Preface

This chapter represents a near-complete manuscript concerning the effects of an allele associated with attention-deficit/hyperactivity disorder (ADHD): the 7-repeat (7R) allele of the gene encoding the dopamine D4 receptor (*DRD4*). Following approval from co-authors Charles E. Hilton, Charles Owuor Olungah, and Bilinda Straight, this chapter will be submitted for peer review and publication.

3.1 Abstract

The 7-repeat (*7R*) allele of the *DRD4* gene is associated with attention-deficit/hyperactivity disorder (ADHD). Given ADHD's high prevalence and heritability, an evolutionary mismatch hypothesis suggests that ADHD confers advantages in certain contexts. Prior research among northern Kenyan populations supports this hypothesis. Among Ariaal pastoralist men, *DRD4-7R* was associated with better nutrition in nomadic men but worsened nutrition in settled men. In another sample comprised of settled Rendille children, *DRD4-7R* was not associated with any measures of nutrition but was associated with greater household economic status. Our preregistered study attempted to replicate these past results in a sample of adolescents from the neighboring semi-nomadic, traditionally pastoralist Samburu. We hypothesized that *DRD4-7R* may influence nutrition directly by modifying adolescents' behaviors or through parental effects on household wealth.

We found no association between *DRD4-7R* and most measures of nutritional status or metrics of school attendance. *DRD4-7R* was positively associated with hemoglobin concentration, with allele presence corresponding to an increase of 0.99 g/dL in hemoglobin concentration (p=0.01). Contrary to expectations based on community-level mobility differences and sex-based differences in hunting behaviors, no interaction effects were observed between *DRD4-7R* and sex or *DRD4-7R* and community. Presence of a *7R* allele was non-significantly associated with increased household wealth, corresponding to an increase of 0.23 standard deviations in weighted livestock units (p=0.08).

These results suggest that adolescents with a *7R* allele may receive modest nutritional and economic benefits. Interpretation is limited by the small sample size and the region's complex environmental and socioeconomic conditions. Future research in this area should seek to replicate results using adult male samples in contexts similar to the Ariaal and utilize approaches that acknowledge the polygenic and behaviorally complex nature of ADHD.

3.2 Introduction

Attention-deficit/hyperactive disorder (ADHD) is one of the most commonly diagnosed psychiatric disorders (Faraone et al., 2024). ADHD is characterized by persistent symptoms of inattention, hyperactivity, and/or impulsivity which are observed to impair function across multiple domains (American Psychiatric Association, 2013). Globally, estimates for ADHD diagnosis are approximately 8% for children and 7% for adults, although diagnostic criteria and reported diagnoses vary between countries (Conrad & Bergey, 2014; Song et al., 2021). Due to its prevalence and high heritability (estimated at around 80%), it has been hypothesized that ADHD represents an example of evolutionary mismatch, which suggests that once adaptive traits

or evolutionarily neutral phenotypic variation may become maladaptive in new environments (Brikell et al., 2015; Jensen et al., 1997; Swanepoel et al., 2017; Williams & Taylor, 2005). Thus, there may be contexts in which ADHD is less impairing or even advantageous.

The *7-repeat* (*7R*) allele of the gene encoding the dopamine receptor D4 (*DRD4*) has been associated with ADHD (Brookes, 2013; Gizer et al., 2009; Li et al., 2006). The *DRD4* gene contains a variable number tandem repeat (VNTR) polymorphism involving a 48 base pair (bp) motif located in exon III that repeats between two and ten times, with the *7R* allele of *DRD4* corresponding to 7 repeats of this motif (Nikolaidis & Gray, 2010). Differences in the number of 48 bp repeats result in changes to the structure of the DRD4 protein, and these changes have been shown to impact the response of DRD4 to various ADHD medications (Herrera, 2017; Misganaw, 2021). Patterns of linkage disequilibrium, or the nonrandom association of genes located closely on the same chromosome, at the *DRD4* locus indicate that the *7R* allele arose approximately 50,000 years ago before subsequently undergoing positive selection (18). *DRD4 7R* has been found at higher frequencies in populations with histories of migration and who led more nomadic lifestyles (Chen et al., 1999; Matthews & Butler, 2011; Tovo-Rodrigues et al., 2010). *DRD4 7R* has also associated with traits such as increased exploratory behaviors and low reactivity to novel stressors, which may be advantageous in new and/or variable environments (Matthews & Butler, 2011). Additionally, *DRD4 7R* has been associated with novelty seeking, or the propensity to prefer or seek out novel stimuli or environments, although meta-analyses of have yielded mixed results (He et al., 2018; Kluger et al., 2002). Novelty seeking and exploratory behaviors, in particular, have also been observed at higher rates in individuals diagnosed with ADHD (Donfrancesco et al., 2015; Van den Driessche et al., 2019). The evidence of positive selection at the *DRD4 7R* locus, coupled with the association of the polymorphism

with ADHD, lends support to the idea that ADHD may have conferred advantages in past environments, and, therefore, may confer advantages in contemporary environments that reflect similar conditions or challenges.

The research here concerns previous and ongoing findings from three closely related, semi-nomadic pastoralist groups: the Ariaal, Rendille, and Samburu. The Ariaal are a population residing in the Marsabit district of northern Kenya. This population primarily practices pastoralism, a form of subsistence based on the products of animals such as camels, cattle, goats, and/or sheep. In the same region reside the Rendille and Samburu groups, who are also traditionally pastoralist. Among the three groups, variable patterns of settlement and subsistence strategies have been observed throughout the last few decades, although some communities remain at least partially mobile and dependent on pastoralist practices (Fratkin, 2001; Fratkin et al., 1999; Lenaiyasa et al., 2020; Smith, 2005). The three groups are also highly related, and the Ariaal are thought to be a hybrid of the Rendille and Samburu groups (Fratkin, 1986; Fratkin et al., 1999; Fratkin & Roth, 1990). These groups regularly deal with resource scarcity and undernourishment caused by droughts (Fratkin & Roth, 1990; Shell-Duncan & Obiero, 2000).

Given its association with potentially advantageous behaviors and the observation of higher frequencies of the alleles in more nomadic populations, the *7R* allele may be advantageous for mobile/nomadic individuals living in unstable or highly variable environments. Consistent with this hypothesis, a previous study in the Ariaal found that *DRD4 7R* was associated with better nutrition in nomadic Ariaal adult men and worsened nutrition in settled Ariaal adult men (Eisenberg et al., 2008). In this study, approximately half of the sample lived as nomads and half had settled three decades prior at the time of data collection. In mobile/nomadic adult men, presence of at least one *7R* allele was associated with better nutrition: nomadic men

with a *7R* allele had higher arm muscle plus bone area (AMPBA), fat free mass, and body mass index (BMI). In settled adult men, the opposite was observed: *7R* allele presence was associated with lower AMPBA, fat free mass, and BMI.

A previous attempt was made to replicate the results observed among Ariaal men using a different sample (Kunkle et al., 2025). This sample consisted of Rendille children from two communities, Korr and Karare, located a short distance north of the Ariaal in the Marsabit District (Fratkin, 1986). This replication study aimed to understand the *7R* allele's effect on nutritional status and household economic success of 5- to 10-year old children. While the Rendille are traditionally nomadic, both Korr and Karare had been settled prior to data collection due to severe droughts (Shell-Duncan & Obiero, 2000). Contrary to what was observed among adult Ariaal men, there was no association between the presence of a *7R* allele and any measure of nutritional status. This may be because younger children rely on parents and other adults for the majority of their provisioning, and the effects of behaviors conferred by the *7R* allele have little effect on overall nutrition in children. Interestingly, *DRD4 7R* was associated positively with household economic status: Rendille children with at least one *7R* allele were 1.8 times more likely to live in a household that was economically sufficient. Since child genotype can be used as a proxy for parent genotype (a child with one *7R* allele must have inherited it from one of their parents), this association may reflect economic sufficiency attained prior to settling, potentially due to behavioral advantages conferred by a *7R* allele.

More research is necessary to confirm and better understand the effect of *DRD4 7R* on nutrition and economic status. The analyses presented here involve Samburu adolescents from two communities located in Samburu County, Kenya. Given the previous findings amongst Ariaal men, we expected that *DRD4 7R* to be associated with better nutrition in more mobile

(nomadic) contexts and worse nutrition in less mobile (more sedentary) contexts. We also expected *DRD4 7R* would be associated with greater economic success based upon previous analyses in the sample of Rendille children. Included in this analysis are two communities: the lowland community, which is generally more mobile with larger livestock holdings, and the highland community, which is less mobile with smaller livestock holdings. Pedometer data indicates moderate differences in daily mean steps between adolescents in the highland and lowland communities, with boys and girls in the lowland community walking more and reporting more herding behaviors than those in the highland community (Straight et al., 2025). Income in the form of cash is difficult to accurately capture, and livestock represent a valuable measure of household economic success. Therefore, economic status was proxied through tropical livestock units (TLU), a weighted measure of family livestock holdings (Ashley-Martin et al., 2022; Iannotti et al., 2022).

Due to the disparity in the degrees of pastoralism practiced between the two communities, we expected the *7R* allele to have a less positive, or potentially negative, effect on nutrition for those in the highland community relative to the lowland community. In the more mobile lowland community, we expected the *7R* allele to be associated with generally better nutritional outcomes. Based on the results in Rendille children, we expected *DRD4 7R* to also be associated with greater economic success, or TLU, in both communities. In the US, ADHD has been associated with higher risk for high school dropout and repeated grades (Fried et al., 2016) Thus, we also investigated the effect of the *7R* allele on the number of years that Samburu adolescents attended school as well as the number of times adolescents repeated grades when in school. Here, we expected that the presence of a *7R* allele would be associated with fewer reported years in school and a greater number of repeated grades.

3.3 Materials and Methods

3.3.1 Study population and data collection

The samples included in this analysis come from two communities (one highland, one lowland) residing in Samburu County, Kenya. The region is located in the Rift Valley of northern Kenya and is characterized by an arid climate and frequent droughts. The Samburu, Rendille, and Ariaal populations are geographically close and highly related (Fratkin & Roth, 1990). The distinct names of these populations are largely social and somewhat fluid. All individuals in this study self-identified as Samburu. Individuals in the highland community tend to have fewer livestock holdings but higher cash income from sources outside livestock trade, and highland children are more likely to be enrolled in school. Individuals in the lowland community on average have greater livestock holdings but lower cash income from sources outside livestock trade. Children in the lowland community are less likely to attend school due to the family labor demands for livestock herding, with lowland girls being the least likely to attend school (Ashley-Martin et al., 2022; Iannotti et al., 2022).

Our study sample consists of 161 individuals, 97 from the highland community and 64 from the lowland community. Data collection and participant observations were collected from June to July 2017, with methods piloted in the previous year. The original study design selected participants from both the highland and lowland communities to compare the influences of environmental and socioeconomic conditions on adolescent health and psychological vulnerability (Straight et al., 2025). Adolescents with estimated ages between 10 to 19 years with no history of pregnancy or severe malnutrition were eligible to enroll. 164 adolescents were initially recruited, but three were excluded either due to pregnancy (n = 1) or participant concerns regarding blood sample and data collection (n = 2). Exact age is not commonly kept

track of among the Samburu, so self-reported ages or approximate ages were recorded at time of data collection. Birth dates for 89 out of 161 individuals were then later confirmed using available birth documentation or by trusted members of the community. Detailed descriptions of data collection methods can be found in Ashley-Martin et al. (2022) and Iannotti et al. (2022).

3.3.2 Biological sampling and genotyping

Whole blood was collected on Whatman 903 filter paper using sterile lancets and was dried for four hours. DNA was extracted from dried blood spots (DBS) using Qiagen QIAmp DNA Investigator Kit using a protocol modified for greater DNA yield. A more detailed explanation of extraction methods can be found in Rej et al. (2021).

The *DRD4* 48 bp VNTR polymorphism was amplified by polymerase chain reaction (PCR) using a version of the protocol described in Eisenberg et al. (2008) modified to allow for smaller volumes of DNA per reaction. Each reaction well contained 1X Q-Solution (Qiagen), 1X buffer (Qiagen), 1 μM primer 1 (5′GCGACTACGTGGTCTACTCG3′), 1 μM primer 2 (5′AGGACCCTCATGGCCTTG 3′), 200 μM dATP, 200 μM dTTP, 200 μM dCTP, 100 μM dITP, 100 μM dGTP, 0.3 U of HotStar Taq (Qiagen), and 1 μl of DNA template in a total reaction volume of 10 μl. The PCR profile utilized consisted of 15 minutes at 95°C for enzyme activation and DNA template denaturation followed by 40 cycles of 1 minute denaturation at 94°C, then 1 minute of annealing at 55°C followed by a 1.5 minute extension at 72°C, and finishing with a 10 minute extension at 72°C. PCR amplicons were visually analyzed using gel electrophoresis in 1.5% agarose gel containing SYBR Safe (Invitrogen) and compared to 50 bp ladders (New England Biolabs) to determine genotype. Previous genotyping of the *DRD4* 48 bp repeat have noted issues with allelic dropout that can cause heterozygotes to appear as homozygotes (Eisenberg et al., 2007, 2008; Hamarman et al., 2005). Therefore, all 95 of the homozygotes

were reanalyzed at 2X and 1/40X DNA template dilutions. No evidence of allelic dropout was found.

Hardy-Weinberg equilibrium (HWE) was tested using the *gap* package in R (Zhao, 2007). Results indicated that our overall sample was in violation of HWE (p=0.01) (Supplementary Table A.1). Hardy-Weinberg equilibrium was violated as well as within the lowland community (p = 0.02). The highland community did not significantly deviate from Hardy-Weinberg equilibrium (p = 0.07). Expected and observed genotype frequencies, as well as the difference between expected and observed frequences, can be found in Supplementary Table A.1. It does not appear that the observed deviations from Hardy-Weinberg equilibrium were due to an overrepresentation of homozygotes, which would indicate potential genotyping errors. Instead, it appears as though there is instead a slightly greater-than-expected number of *4R*/*7R* heterozygotes. Out of a concern that the over-representation of *4R/7R* individuals might have been driven by miscalls where *6R* or *8R* alleles were assumed to be *7R*, gel images were re-checked and no deviations were found.

3.3.3 Nutritional status

Nutritional status was proxied using BMI-for-age, height-for-age (HAZ), and arm mass plus bone area (AMPBA). BMI-for-age and height-for-age Z-scores were calculated in R using the *anthroplus* package (de Onis et al., 2007), which generates Z-scores based on World Health Organization (WHO) 2007 references for children and adolescents aged 5 to 19 years old. AMPBA was calculated as $[\mathrm{MUAC} - (\pi \times \mathrm{TCSF}/10)]2/4$. Mid upper arm circumference (MUAC) and triceps skinfold (TCSF) were measured in centimeters and millimeters, respectively, and averaged after three repeated measures. These measures were chosen as they were consistent with measures of nutrition from previous studies involving *DRD4* (Eisenberg et

al., 2008; Kunkle et al., 2025). BMI-for-age and HAZ could not be calculated for six individuals due to ages greater than the recommended WHO age range (5-19 years old). Following preregistration of secondary analyses, hemoglobin concentration was included as an additional measure of nutrition and health given the availability of the data. Hemoglobin concentration was assessed using Hemocue Hb201+.

3.3.4 Preregistration and statistical analyses

An initial analysis plan was preregistered on Open Science Framework (OSF) prior to the addition of *DRD4* genotype into the complete dataset but following calculation of Hardy-Weinberg Equilibria for the full sample and for both communities separately. Following feedback from collaborators and other researchers with experience with the study population on the first round of results, a second set of analyses were preregistered with hemoglobin concentration added as an additional measure of health and nutritional status, and all original models were re-run with an interaction term between *7R* allele presence and sex.

We expected *DRD4 7R* to influence nutritional status through two possible pathways: (1) a direct effect on the adolescent's behavior and/or (2) an indirect effect on the adolescent's nutritional status through the behaviors of the allele-carrying parent(s). Thus, restricted and expanded models, wherein the expanded models included a measure of household economic success (a proxy of parental success), were used to understand which pathway was driving an observed association. Additionally, we tested the association of *DRD4 7R* with household economic success. Five individuals were excluded from these models because they did not reside with either parent at time of data collection.

The *7R* allele presence-by-sex interaction term was added to analyses due to the observation that several Samburu boys (and no Samburu girls) reported consuming wild meat

obtained through hunting when asked about their primary food sources (Iannotti et al., 2022). Therefore, we hypothesized that *DRD4 7R* and its associated behavioral traits may lead to increased success when hunting or foraging for food and expected that the presence of at least one *7R* allele would be associated with generally better nutrition, with the *7R* allele having a more positive effect in boys than in girls. Initial and secondary preregistrations can be found at: https://osf.io/m7x69/.

Consistent with previous studies (Eisenberg et al., 2008; Nikolaidis & Gray, 2010), *DRD4* genotypes were encoded as either the presence or absence of a *7R* allele (wherein *7R* allele presence represents both homozygotes and heterozygotes). Models which find a significant association with *7R* allele presence were re-run with *DRD4* genotype coded as the number of *7R* alleles (0, 1, 2) in order to understand if the 7R allele has dose-response effects.

Household economic success was proxied via tropical livestock units (TLUs). TLUs were calculated by totaling livestock holdings, weighting each category of livestock based on their current market value (Iannotti et al., 2022). The number of grades repeated were calculated for each individual by subtracting the highest grade from the number of years in school. Birth date documentation was rare for fathers, so father age-set (culturally constructed birth cohorts which form approximately every 14 years) was used as an approximation of age (Straight, 2004). From youngest to oldest these age-set categories are: Lmooli (initiated 1990), Lkiroro (initiated 1976), Lkishili (initiated 1961), Lkimaniki (initiated 1948), Lmekuri (initiated 1936) (Fratkin, 2015; Needham et al., 2021). Four categories of maternal marital status were included as a culturally meaningful representation of wife number and family marital structure following previous work done in the region (Iannotti et al., 2022; Straight et al., 2022, 2025). These categories included: "1st polygynous wife" (first wife of father), "2nd+ polygynous wife" (including second wives or

later wives), “Monogamous wife” (family unit includes only one wife), and “Other” (any other family structure, including widowed, unmarried, or separated/divorced).

All statistical analyses were run using R version 4.4.1 (R Core Team, 2024). All models included were multiple linear regressions. Covariates included: age, sex, community (highland or lowland), TLUs, number of siblings, father age-set, and maternal marital status. Nutritional status outcome variables included: BMI-for-age, HAZ, AMPBA, and hemoglobin concentration. Community and sex were analyzed as interaction terms with *7R* allele presence for nutritional status models.

Minor differences between some reported descriptive statistics presented in the preregistrations and those presented here, mainly age and maternal marital status, are due to corrections made to the original dataset used in the preregistration. For models predicting effect of the presence of a *7R* allele on tropical TLU, individuals listed as not living with at least one parent were excluded from analysis. Rather than calculating 95% confidence intervals for model estimates, we instead chose to calculate 83.4% confidence intervals. This was done in order to arrive at a type 1 error rate of 0.05 (Knol et al., 2011). Due to evidence of positive skew in TLUs, we log-transformed the measure in a post hoc analysis (i.e. not in the preregistered methods). Brief descriptions of models are available in Appendix A as a supplementary table (Supplementary Table A.2).

3.4 Results

Descriptive statistics for categorical and continuous variables are presented in Table 3.1 and Table 3.2, respectively. More detailed descriptive statistics, including sex-specific and community-specific counts and averages can be found in Supplemental Table A.3 and Table A.4.

At least one *7R* allele was present in 39% of Samburu adolescents included in this study (Table 3.1), with 36% of lowland teens and 41% of highland teens having at least one *7R* allele (Supplementary Table A.3). This is similar to the reported *7R* allele presence in the studies of Ariaal adult men (35%) and Rendille children (32%) (Eisenberg et al., 2008; Kunkle et al., 2025). 56 adolescents, or 35% of the total sample, were heterozygous for the *7R* allele (possessing only one *7R* allele), and 7 adolescents (4%) were homozygous for the *7R* allele (possessing two *7R* alleles).

Table 3.1 Descriptive statistics of categorical variables.

Variable		%
7R allele presence		39.1
Sex (Male)		48.4
Community (Highland)		60.2
Maternal marital status	1st polygynous wife	24.8
	2nd+ polygynous wife	21.1
	Monogamous wife	24.8
	Other	29.2
Father age-set[1]	Lmooli (1990)	26.1
	Lkiroro (1976)	42.2
	Lkishili (1961)	22.4
	Lkimaniki (1948)	8.1
	Lmekuri (1936)	1.2

[1]Year of initiation for each age-set is in parentheses. N = 161.

Nutritional status was assessed through BMI-for-age Z-scores, height-for-age (HAZ) Z-scores, arm muscle plus bone area (AMPBA), and hemoglobin concentration. Averages BMI-for-age and HAZ were low compared to WHO standards (Table 3.2). For hemoglobin concentration, suggested minimum concentrations are typically 13 g/dL for boys and 12 g/dL for girls (Iannotti et al., 2022). Sex-specific hemoglobin concentration averages were 12.8 g/dL for Samburu boys and 12.3 g/dL for Samburu girls and 12.8 g/dL across both communities (Supplementary Table

A.4). Mean hemoglobin concentrations were at or below recommended cut-offs for highland (12.8 g/dL) and lowland (12.9 g/dL) boys and for lowland girls (11.3 g/dL), indicating a potential concern for anemia in these groups (Supplementary Table A.5) (Domenica Cappellini & Motta, 2015).

Table 3.2 Descriptive statistics of continuous variables.

Variable	Mean	SD[1]
Age (years)	14.3	3.1
Height (cm)	152.1	14.1
Weight (kg)	35.4	10.2
BMI-for-age Z-score	-2.5	1.1
Height-for-age Z-score	-0.9	1.1
Arm muscle plus bone area (AMPBA)	8.2	1.2
Hemoglobin concentration (g/dL)	12.5	1.7
Number of wives in the household	2.0	1.0
Number of siblings	5.4	1.9
Tropical livestock units (TLU)	21.1	28.8
Log-transformed TLU [log(TLU + 1)]	2.4	1.2
Years in school	5.7	3.4
Number of repeated grades	2.4	1.7

[1]SD = standard deviation. N = 161.

In line with previously published research on these communities (Straight et al., 2022), TLUs differed substantially between the lowland and highland communities, with an average of 36.1 TLUs in the lowland community and 11.3 TLUs in the highland community (Supplementary Table A.4). Notably, for the entire sample and in both communities, standard deviations for TLUs were larger than calculated means. This likely reflects the skewed nature of livestock ownership in the region, wherein some families maintain large herds as a primary mode of income, some families keep small numbers of livestock while looking to other avenues for

additional income, and some families own no livestock at all and pursue income from other ventures exclusively (Lenaiyasa et al., 2020).

Highland teens attended school for more years (Supplementary Table A.4: 6.4 years compared to 4.7 years for lowland teens) and repeated more grades (Supplementary Table A.4: 3.0 years compared to 1.5 years for lowland teens). However, the observed greater number of repeated grades among highland teens likely reflects differences in overall time spent in school rather than actual differences in performance: lowland teens generally completed fewer years of school and had less time in which to repeat grades. Lowland girls spent the least amount of time in school with an average of 3.2 years (Supplementary Table A.4), likely reflecting gender-based differences in expectations for the division of labor (Straight et al., 2025).

As we were expecting *DRD4 7R* to impact nutritional status either via direct effects of individual behaviors or via indirect effects of a parent carrying *7R* allele, we therefore ran two models for each outcome. Odd numbered models were designed to understand direct effects of the *7R* allele, whereas even numbered models were expanded to include a metric of economic success (TLU) and were designed to evaluate any indirect effects of the *7R* allele via parental behaviors.

We included an interaction term, *7R* allele presence-by-Community, in our nutrition models as we expected community to moderate the interaction between *7R* allele presence and our nutritional outcomes due to differences in the degree of mobility between the two communities. In particular, we hypothesized that the effect of *7R* alleles on nutrition outcomes would be greater in the lowland community (the more mobile of the two communities) than the highland community. As such, we expected the *7R* allele presence-by-Community interaction term to be positive. Although the interaction term was non-significant across all nutrition models,

it trended in the expected direction for all nutritional outcomes with the exception of HAZ (Table 3.3). We found no significant associations between *7R* allele presence with any of the included nutritional outcomes (BMI-for-age and height-for-age Z-scores, AMPBA, or hemoglobin concentration) with an α of 0.05 (Table A.3; Models 1-8). There was a positive non-significant association ($p = 0.09$) between *7R* allele presence and hemoglobin concentrations (Models 7 & 8). When comparing odd versus even models, the inclusion of TLU as a control variable resulted in only minimal changes to the regression coefficients for *7R* allele or *7R* allele presence-by-Community interaction terms (Table 3.3). Finally, estimates were also only minimally impacted when TLUs were replaced with log-transformed TLUs in our expanded models post hoc (Supplementary Table A.6).

Table 3.3 Regression models predicting effect of 7R allele presence-by-Community interaction term on nutrition variables.

		BMI-for-age				**Height-for-age (HAZ)**				**Arm muscle plus bone area**				**Hemoglobin Conc.**			
Model:		1		2		3		4		5		6		7		8	
		β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*
7R allele presence		-0.26	0.26	-0.28	0.22	0.01	0.97	-0.01	0.98	-0.24	0.83	-0.15	0.89	*0.60*	*0.09*	*0.61*	*0.09*
7R allele presence-by-Community		0.54	0.16	0.55	0.15	-0.05	0.90	-0.05	0.91	2.83	0.11	2.72	0.13	0.29	0.60	0.27	0.63
Community (Highland = 0)		-0.23	0.35	-0.30	0.26	0.12	0.66	0.07	0.80	**-2.50**	**0.05**	*-2.18*	*0.10*	**-0.96**	**0.02**	**-0.90**	**0.03**
Sex (F = 0)		**-0.75**	**<0.001**	**-0.75**	**<0.001**	**-0.56**	**0.004**	**-0.60**	**0.004**	*-1.58*	*0.06*	*-1.60*	*0.06*	**0.58**	**0.03**	**0.58**	**0.03**
Age[1]										**1.37**	**<0.001**	**1.37**	**<0.001**	0.00	0.99	0.00	0.99
Number of siblings		0.06	0.18	0.05	0.26	0.06	0.21	0.06	0.26	0.06	0.81	0.10	0.68	-0.09	0.23	-0.08	0.29
Maternal Wife Status	2^{nd}+ polygynous wife	*0.47*	*0.09*	0.44	0.12	0.15	0.62	0.13	0.68	1.25	0.33	1.44	0.27	-0.27	0.51	-0.23	0.57
	Monogamous wife	-0.02	0.94	0.02	0.94	-0.11	0.69	-0.09	0.77	-0.50	0.68	-0.68	0.59	-0.23	0.56	-0.26	0.51
	Other	0.06	0.81	0.10	0.68	-0.07	0.78	-0.05	0.86	0.39	0.74	0.24	0.84	-0.08	0.83	0.11	0.77
Tropical livestock units (TLU)				0.00	0.46			0.00	0.91			-0.01	0.44			0.00	0.64

Statistically significant values ($p < 0.05$) are bolded. P-values < 0.1 are italicized. All models are multiple linear regressions; Models 1, 3, 5, and 7 represent restricted models; Models 2, 4, 6, and 8 include TLU and represent expanded models. N = 146 (BMI-for-age, HAZ), N = 157 (Arm muscle plus bone area, Hemoglobin Conc.). [1]Age not included in BMI-for-age or HAZ models.

Due to differences between Samburu boys and girls regarding self-provisioning via hunting, we additionally tested if the effects of *7R* allele presence on nutritional outcomes were modified by sex. We expected that males with a *7R* allele would have better nutritional status than males without a *7R* allele, with females without a *7R* allele having the worst nutritional status—which would result in positive coefficients for the interaction term. In the *7R* allele presence-by-Sex interaction models (Table 3.4; Models 9-16), no association was found between the *7R* allele presence-by-Sex interaction with BMI-for-age, HAZ, AMPBA, or hemoglobin concentration. While non-significant, the interaction terms were in the expected direction for all nutritional variables except for hemoglobin concentration. As in Table 3.3 regression models, the inclusion of TLUs in Table 3.4 only minimally changed coefficients (odd versus even models). Results were only minimally impacted by replacing TLUs with log-transformed TLUs in the expanded models (Supplementary Table A.6).

Interestingly, a significant positive association (Table 3.4; Models 15 & 16) between *7R* allele presence and hemoglobin concentration was observed wherein the presence of at least one *7R* allele corresponded with a 0.99 g/dL increase ($p = 0.01$) in hemoglobin concentration (equivalent to a 0.58 SD increase in hemoglobin). Figure 1 depicts hemoglobin concentration for Samburu adolescents, with WHO anemia cut-offs denoted as red lines. In this figure, median hemoglobin concentration for boys without a *7R* allele fell slightly below the WHO anemia cut-off, with boys without a *7R* allele having a median of 12.8 g/dL and a mean of 12.7 g/dL. Conversely, median concentration for boys with at least one *7R* allele were above the cut-off, with a median of 13.4 g/dL and a mean of 13.1 g/dL. For Samburu girls, both girls with and without a *7R* allele were above the WHO anemia cut-off, although girls with at least one *7R* allele had a higher median (13.0 g/dL) and mean (12.9 g/dL) hemoglobin concentration than girls

without a *7R* allele, who, comparatively, had a median concentration was 12.4 g/dL and a mean concentration of 11.9 g/dL, slightly below the WHO anemia cut-off. This relationship between presence of a *7R* allele and an increase in hemoglobin concentration is observable even when hemoglobin concentrations are pooled across sexes (Figure 3.2).

Table 3.4 Regression models predicting effect of 7R allele presence-by-Sex interaction term on nutritional variables.

		BMI-for-age				**Height-for-age (HAZ)**				**Arm muscle plus bone area**				**Hemoglobin Conc.**			
Model:		9		10		11		12		13		14		15		16	
		β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*
7R allele presence		-0.32	0.22	-0.33	0.21	-0.08	0.78	-0.08	0.77	0.34	0.78	0.33	0.79	**0.99**	**0.01**	**0.99**	**0.01**
7R allele presence-by-Sex		0.50	0.18	0.48	0.19	0.14	0.73	0.13	0.75	1.02	0.57	1.16	0.52	-0.57	0.31	-0.55	0.33
Sex (F = 0)		**-0.96**	**<0.001**	**-0.95**	**<0.001**	**-0.62**	**0.02**	**-0.61**	**0.02**	*-1.91*	*0.09*	*-2.00*	*0.08*	**0.82**	**0.02**	**0.81**	**0.02**
Community (Highland = 0)		0.00	0.98	-0.06	0.79	0.09	0.64	0.06	0.80	-1.34	0.20	-1.00	0.36	**-0.84**	**0.01**	**-0.80**	**0.02**
Age[1]										**1.35**	**<0.001**	**1.35**	**<0.001**	0.00	0.97	0.00	0.96
Number of siblings		0.06	0.22	0.05	0.29	0.06	0.21	0.06	0.26	0.03	0.88	0.08	0.72	-0.08	0.24	-0.08	0.29
Maternal Wife Status	2^{nd}+ polygynous wife	*0.50*	*0.07*	*0.47*	*0.10*	0.15	0.62	0.13	0.68	1.29	0.32	1.51	0.25	-0.26	0.53	-0.22	0.59
	Monogamous wife	0.10	0.71	0.13	0.63	-0.10	0.73	-0.07	0.80	-0.22	0.86	-0.42	0.74	-0.27	0.48	-0.30	0.45
	Other	0.12	0.63	0.15	0.55	-0.06	0.82	-0.04	0.90	0.48	0.68	0.31	0.79	-0.14	0.71	-0.16	0.67
Tropical livestock units (TLU)				0.00	0.56			0.00	0.68			-0.02	0.35			0.00	0.68

Statistically significant values ($p < 0.05$) are bolded. P-values < 0.1 are italicized. All models are multiple linear regressions; Models 12, 14, 16, and 18 represent restricted models; Models 13, 15, 17, and 19 include TLU and represent expanded models. N = 146 (BMI-for-age, HAZ), N = 157 (Arm muscle plus bone area, Hemoglobin Conc.). Reference category is in parentheses. [1]Age not included in BMI-for-age or HAZ models.

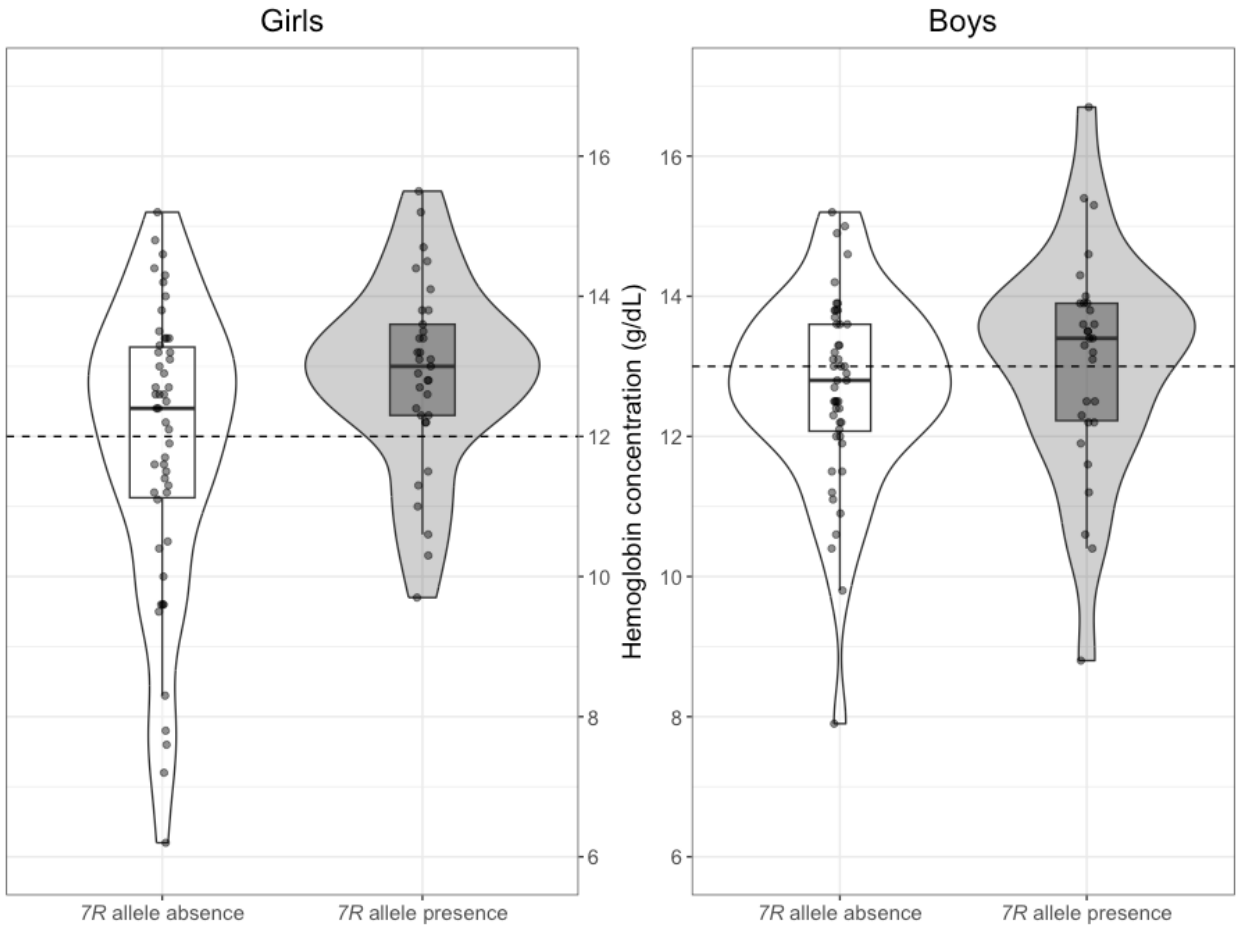

Figure 3.1 Comparison of hemoglobin concentration for Samburu adolescents with and without a 7R allele. Violin plots depicting density estimates of hemoglobin concentrations for Samburu girls and boys with a 7R allele (grey) and without a 7R allele (white). Hemoglobin concentration cut-offs indicating potential anemia are shown as a horizontal dashed line. Individual data points are shown with random horizontal positions to prevent overplotting.

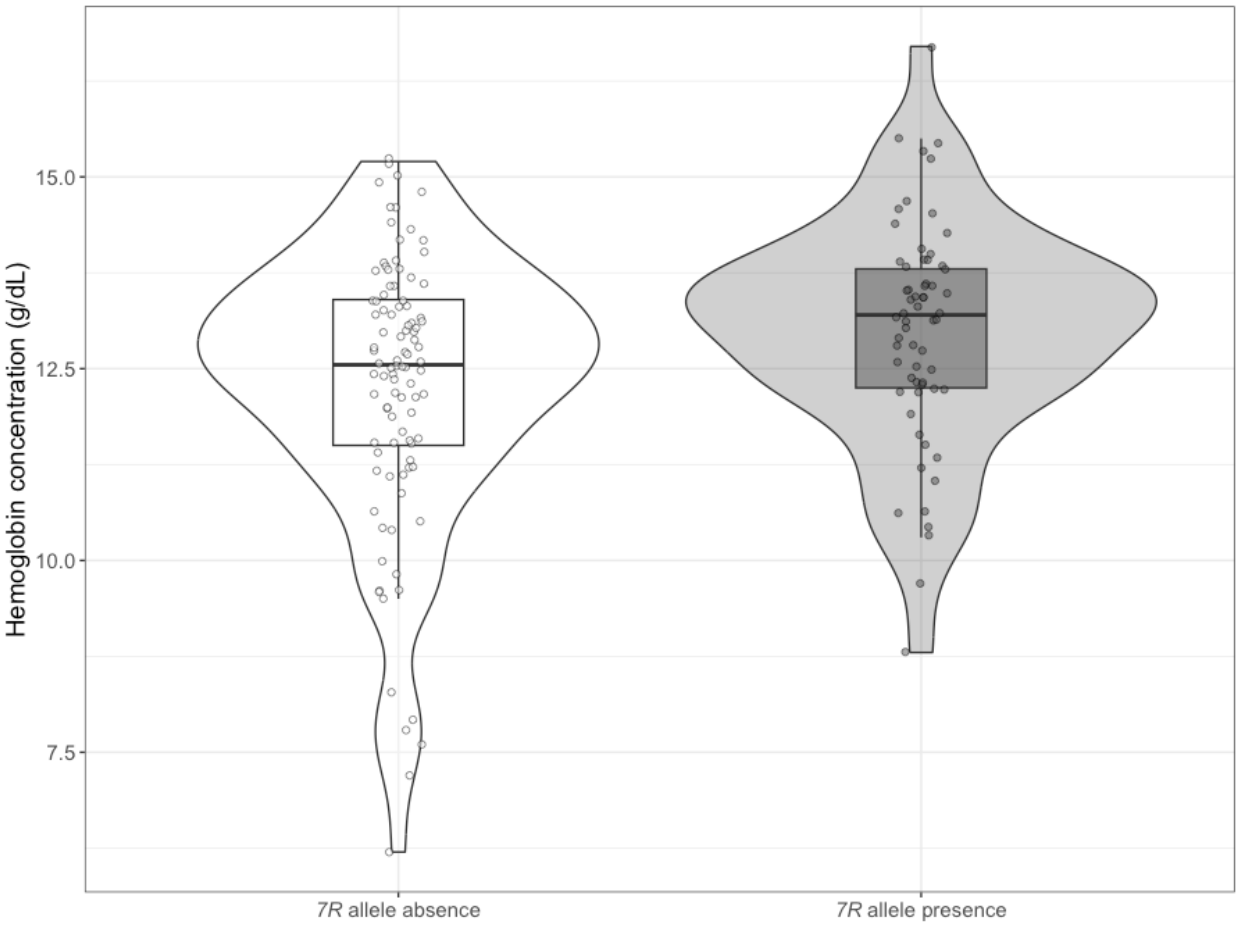

Figure 3.2 Comparison of hemoglobin concentration for Samburu adolescents with and without a 7R allele. Violin plots depicting density estimates of hemoglobin concentrations across full sample. Individual data points are shown with random horizontal positions to prevent overplotting.

Associations between *7R* allele presence and hemoglobin concentration were non-significant in the models including a *7R* allele presence-by-Community interaction term (Table 3.3). Here, the estimates were 0.60 (Model 7; p = 0.09) and 0.61 (Model 8; p = 0.09) for the association between *7R* allele presence and hemoglobin concentration. We observed no significant association of either *7R* allele presence-by-Community (Table 3.3; Models 7 & 8) or *7R* allele presence-by-Sex (Table 3.4; Models 15 & 16) interaction terms with hemoglobin concentration, although both community (Model 15: -0.84, p = 0.01; Model 16: -0.80, p = 0.02)

and sex (Model 15: 0.82, p = 0.02; Model 16: 0.81, p = 0.02) were significantly associated with hemoglobin concentration. The positive association between being male and increased hemoglobin concentration is to be expected, as adolescent males tend to have higher concentrations on average (Jorgensen et al., 2019). Additionally, the observation that residence in the highland community corresponded with increased hemoglobin concentration was previously seen in other research using this data (Iannotti et al., 2022), and likely reflects differences in nutrient availability and infection load between the two communities (Habtegiorgis et al., 2022). In post hoc expanded models including log-transformed TLUs in place of raw TLUs, our estimate for the effect of *7R* on hemoglobin concentration in the model including a *7R* allele presence-by-Community interaction lessened from 0.61 (p = 0.09) in the original model to 0.57 (p = 0.11; Supplementary Table A.5); in the post hoc model including a *7R* allele presence-by-Sex interaction, the estimate lessened slightly from 0.99 (p = 0.01) in the original model to 0.97 (p = 0.01; Supplementary Table A.6).

Models 7 and 8 (Table 3.3) differ from Models 15 and 16 (Table 3.4) in important ways due to the inclusion of different interaction terms. Therefore, we ran post hoc sensitivity analyses in which both interaction terms were excluded from the restricted and expanded models in an effort to understand the effect of the interaction terms on our estimates (Supplementary Table A.7; Models 28 & 29). In these models, *7R* allele presence was significantly associated with an increase in hemoglobin concentration across both the restricted and expanded models, with presence of the allele corresponding to an increase in hemoglobin concentration of 0.71 g/dL (p = 0.01) and 0.72 g/dL (p = 0.01), respectively. This represents a decrease in the regression coefficients from the *7R* allele presence-by-Sex interaction models (Table 3.4; Models 15 & 16), but an increase in the regression coefficients from the *7R* allele presence-by-Community

interaction models (Table 3.3; Models 7 & 8). When comparing 83.4% confidence intervals for *7R* allele presence between the models, there is substantial overlap between the models, with the upper confidence intervals of Models 28 and 29 slightly lower than the other hemoglobin concentration models (Supplementary Table A.8). Standard errors of the main effect (*7R* allele presence) for Models 28 and 29 (0.28 for both models) were also lower than those for Models 7 and 8 (0.35 for both models) and Models 15 and 16 (0.39 for both models) (Supplementary Table A.9).

Economic success was proxied in this analysis by tropical livestock units, or TLUs, as the sale of livestock and surplus milk and meat products represents an important source of subsistence and income for these Samburu communities (Iannotti et al., 2022; Needham et al., 2021). The association between *7R* allele presence and TLUs (Table 3.5; Model 17) was non-significant ($p = 0.08$) but in the direction expected based on results observed among household of Rendille children (Kunkle et al., 2025). The presence of at least one *7R* allele corresponded with an increase of 6.78 TLUs, equivalent to a 0.23 standard deviation change in TLU. Figure 3.3 compares TLUs for individuals with and without a *7R* allele across the full sample. An additional model was run post hoc in which TLUs were log-transformed (after adding 1) as we expected the relative impact of each successive TLU to decrease (i.e., the relative difference in economic impact between 1 and 2 TLUs would be greater than between 50 and 51 TLUs). Here, the estimate remained in the expected direction and was more significant than in the original model, with presence of at least one *7R* allele corresponding to an increase of 0.30 log-transformed TLUs, equivalent to an increase of 0.25 standard deviations ($p = 0.05$; Supplementary Table A.10; Model 30).

Table 3.5 Regression model (Model 17) predicting effect of 7R allele presence on tropical livestock units (TLU).

	β	*p*
7R allele presence	*6.78*	*0.08*
Community (Highland = 0)	**17.21**	**<0.001**
Father age-set	-0.60	0.78
Number of wives in household	**14.65**	**<0.001**

Statically significant values ($p < 0.05$) are bolded. P-values < 0.1 are italicized. N = 156.

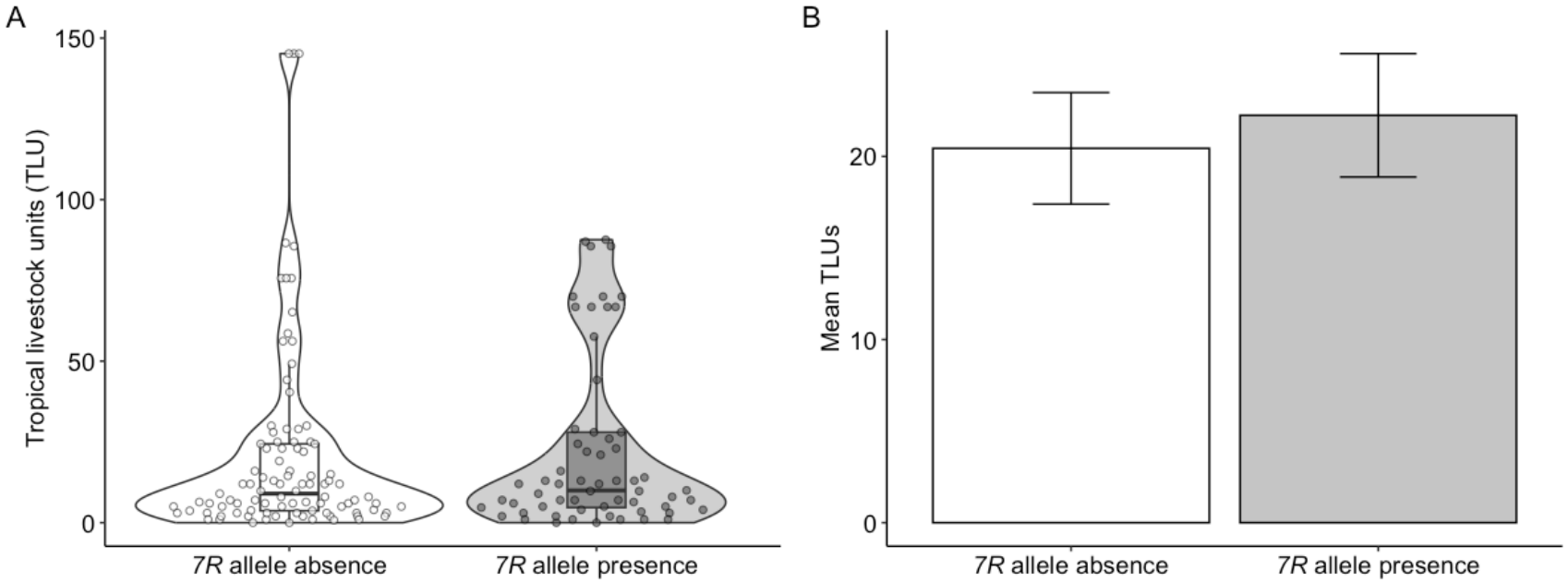

Figure 3.3 Comparison of household tropical livestock units (TLU) for Samburu adolescents with and without a 7R allele. (A) Violin plots depicting household TLU for Samburu adolescents with a 7R allele (grey with black dots) and without a 7R allele (white with open dots). (B) Comparison of mean TLUs for Samburu adolescents with and without a 7R allele with standard errors represented as error bars.

Visualization of TLUs parsed by community shows a greater degree of difference between those with and without a *7R* allele in the lowland community (Figure 3.4). Thus, an additional post hoc test involving the addition of a *7R* allele presence-by-Community interaction to the was run with both TLUs (Supplementary Table A.11; Model 31) and with log-transformed TLUs as outcome variables (Supplementary Table A.12; Model 32). In both of these post hoc models, the *7R* presence-by-Community interaction term was not significant. However, visualization of log-transformed TLUs parsed by community and *7R* allele presence (Supplementary Figure A.1) shows a greater degree of difference log-transformed between individuals with and without a *7R* allele in the lowland community, as would be expected based on the observation in Figure 3.4. When log-transformed TLUs are pooled across communities, the difference between individuals with and without a *7R* allele becomes more subtle (Supplementary Figure A.2). Interestingly, the effect size of *7R* allele presence generally increased when the *7R* presence-by-Community interaction term was added to the models, with *7R* allele presence corresponding to an increase of 9.27 TLUs ($p = 0.06$) in Model 31 (as compared to 6.78 TLUs in Model 17) and to an increase of 0.38 log-transformed TLUs ($p = 0.05$) in Model 32 (as compared to 0.30 log-transformed TLUs in Model 30).

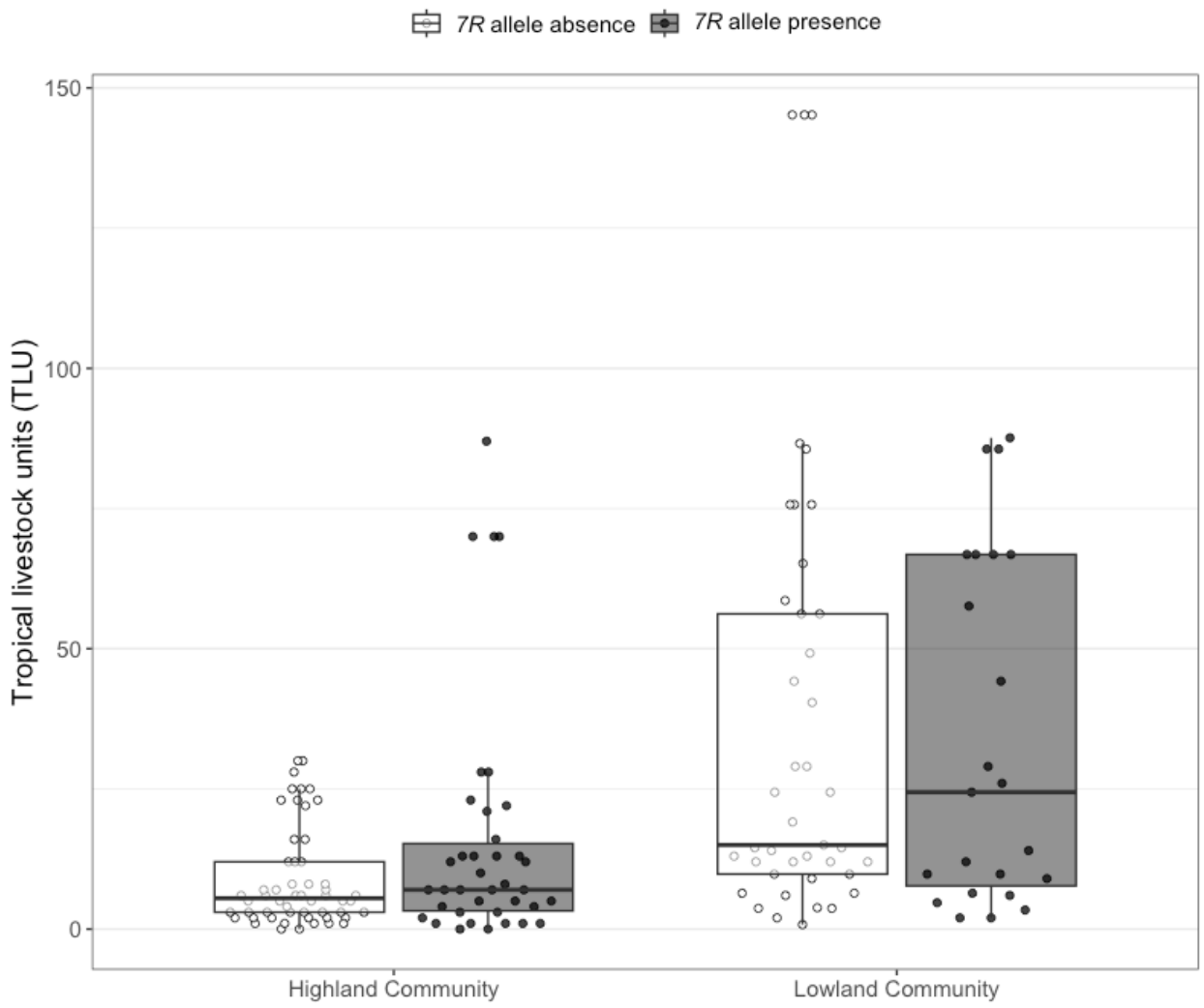

Figure 3.4 Comparison of household tropical livestock units (TLU) for Samburu adolescents with and without a 7R allele parsed by community.

Variables with the greatest effect on TLUs included community and the number of wives present in the household. These variables were expected to significantly influence the amount of TLUs due to the observed difference in the degrees of pastoralism practiced between both communities as well as known trends indicating that polygynous households were generally more economically successful in these two communities (Iannotti et al., 2022). We additionally re-ran our model to include a *7R* allele presence-by-Community interaction term as a post hoc

sensitivity analysis (Supplementary Table A.11). We expected the interaction term to be positive, with lowland households of *7R* allele carriers to be most successful and highland households without a *7R* allele to be least successful. While the *7R* allele presence-by-Community interaction term was not significant ($p = 0.41$), it was unexpectedly in the negative direction. Interestingly, our estimate for *7R* allele presence effects on TLUs increased from 6.78 ($p = 0.08$; Table 3.5) in the original model to 9.27 ($p = 0.06$; Supplementary Table A.11) in the post hoc model. When TLUs were log-transformed in the model including the interaction term, the interaction term remained negative and non-significant (Supplementary Table A.12). In this model, *7R* allele presence was associated with an increase of 0.38 log-transformed TLUs, or equivalent to an increase of 0.32 standard deviations ($p = 0.05$).

Finally, we observed no association between *7R* allele presence with years in school or number of repeated grades (Table 3.6; Models 18 & 19). In a sensitivity analysis (not in the preregistered model design) we added years in school as an additional covariate, however, this addition did not change our results in any meaningful way (Supplementary Table A.13; Model 33). Community, age, and sex were implicated by our analyses as significantly associated with the number of years spent in school, while community, sex, and years in school were associated with the number of repeated grades.

Table 3.6 Regression models predicting effect of 7R allele on metrics of school attendance.

	Years in school		**Number of repeated grades**	
Model:	18		19	
	β	*p*	β	*p*
7R allele presence	-0.04	0.95	-0.05	0.84
Community (Highland = 0)	**-2.83**	**<0.001**	**-1.20**	**<0.001**
Age	**0.29**	**0.01**	-0.07	0.14
Sex (F = 0)	**1.07**	**0.04**	**0.49**	**0.04**
Number of siblings	-0.06	0.69	0.00	1.00
Tropical livestock units (TLU)	0.01	0.45	0.00	0.99

Statically significant values ($p < 0.05$) are bolded. N = 157.

3.5 Discussion

The results the analyses presented here did not replicate the observed associations between the *DRD4 7R* allele and nutritional status in Ariaal men (Eisenberg et al., 2008). Our analyses found no associations between *7R* allele presence, and most measures of nutrition included here, with the exception of hemoglobin concentration. The presence of at least one *7R* allele corresponded with an increase of 1.0 g/dL, or a change of 0.6 standard deviations, in hemoglobin. Contrary to our preregistered hypotheses, neither sex nor community modified the effect of *DRD4 7R* on any of the included measures of nutritional status. We hypothesized that sex would impact the effect of the *7R* allele on nutrition due to evidence that Samburu teen boys participated in hunting more frequently than Samburu teen girls and that the 7R allele would promote beneficial phenotypes for this. However, we observed no significant associations between the *7R* allele presence-by-Sex interaction with any nutritional measures. We also expected the effect of *DRD4 7R* to mimic that which was observed in nomadic Ariaal men—better nutrition in more mobile/nomadic contexts and worsened nutrition in less mobile/settled contexts—due to the differences in how much members of each community herded livestock, with the lowland community generally more mobile than the highland community. However,

community showed no significant modifying effect on the *7R* allele's association with any measures of nutrition. The direction of association of the 7R by Community interaction was in the expected direction, but not significant. These results, in combination with the lack of any association between *7R* allele presence and nutrition in settled Rendille children (Kunkle et al., 2025), diverge from the previous findings from adult Ariaal men of worsened nutrition in settled contexts (Eisenberg et al., 2008).

The positive associations between hemoglobin concentration and *7R* allele presence in Models 15 and 16 indicate that *DRD4 7R* may have a positive effect on short-term health and nutrition. Notably, the significance and strength of this association was less in the *7R* allele presence-by-Community interaction models (p-values = 0.1). Hemoglobin concentration is impacted by access to iron-rich foods, and this association may suggest that adolescents with a *7R* allele may be better able to acquire these food types. However, hemoglobin concentration also impacted by immune response and inflammation (Karakochuk et al., 2019) as well by parasites infection (Olsen et al., 1998) or due to poor iron absorption associated with chronic autoimmune disorders like celiac disease (Kulnigg & Gasche, 2006). Therefore, hemoglobin concentration may not an adequate biomarker for assessing nutritional status. The observed effect may also be a result of differential risk to particular environmental factors. For example, *DRD4 7R* may impact hemoglobin concentration by contributing to the risk of encountering pathogens in the environment due to the allele's association with increased exploratory behaviors. Hemoglobin concentration was slightly higher among highland girls and slightly lower among lowland girls, indicating that there may be differences in nutritional availability of iron, infectious burdens, or the prevalence of chronic autoimmune conditions between the two communities. Lowland girls generally have greater regular contact with livestock herds than their

highland counterparts and may be more likely to be exposed to zoonotic diseases and parasites (Barnes et al., 2017; Lanker et al., 2023; Oketch et al., 2025).

DRD4 7R had a positive, although not significant ($p = 0.08$), association with economic success, as measured though TLUs. This finding is consistent with the previous findings of *7R*-carrying Rendille children being more likely to be found in economically sufficient households (Kunkle et al., 2025). While we did not genotype parents for *DRD4 7R*, for each teen with a *7R* allele at least one biological parent is necessarily a carrier of the allele. Therefore, the positive association between *7R* and TLUs suggests that the allele may have conferred benefits by affecting the behavior of parents, who may be instrumental in the accumulation and care of herds, or by affecting the behavior of the teens, who frequently participate in caring for the herds.

However, across all models, the inclusion of TLU had little to no impact on estimates between any included variables and our measures of nutrition, suggesting that the *7R* allele was not exerting any effects on nutritional status via parental (or teen) behaviors regarding familial livestock herds. This finding is in contrast to current understandings of the social and economic determinants of health in this region (Fratkin et al., 1999). Previous research using the same sample found that greater household livestock holdings were positively associated with an increase in magnesium concentrations, which has important implications for metabolic health (Iannotti et al., 2022; Vormann, 2016), and a longitudinal study of dietary and micronutrient intake showed that livestock ownership predicted levels of vitamin A, B_{12}, and zinc (Iannotti & Lesorogol, 2014). Livestock holdings represent an important nutritional and economic resource, as both a source of food and a tradable commodity. For Samburu children, the amount, composition, and location of familial livestock herds are informative for understanding access to fresh milk, meat, and other valuable proteins (Fratkin et al., 1999; Fujita et al., 2025). However,

it may be that family TLU, the metric used in our analyses, is not representative of actual access to meat and other nutrients for the adolescents in our sample.

Differences in nutritional status among individuals with and without a *7R* allele may be masked by general undernutrition in the region. Averages for BMI-for-age and height-for-age Z-scores across boys and girls in both communities were negative, and BMI-for-age Z-scores in both communities were less than -2, indicating potential undernutrition. Additionally, the ages of those individuals used in the nutrition models spanned from 9- to 19-years old (due to WHO estimate age cut-offs). Thus, a number of the adolescents included in the sample may have been in different stages of pubertal development when measurements were taken. This variation may not be adequately controlled for in our analyses, as pubertal timing data for this sample is not available. The lack of association between TLU and any of the nutritional indices reported here may indicate that this measure of economic status was inadequate to explore the indirect effects of *DRD4 7R* on the adolescents' nutrition.

The lack of any association between the *7R* allele and metrics of school attendance is most likely due to the variable demands required of adolescents in this region. Because of greater family labor demands for livestock herding, lowland children have tended to be less likely to attend school than highland children (Ashley-Martin et al., 2022; Iannotti et al., 2022). Thus, Samburu adolescents may leave school or need to repeat grades much more due to familial or herding obligations rather than educational performance or ADHD symptoms.

We did not include a multiple testing correction in our preregistered methods and acknowledge that this represents a limitation of our analyses. Employing a simple Bonferroni correction in response to this issue leads to a loss of significance for all reported findings.

Therefore, it is important to consider our findings in relation to the number of independent tests being performed.

This study is additionally limited by its sample size and the complex socioeconomic and environmental conditions of the study population. The two Samburu communities in this sample had settled relatively recently prior to data collection, and the transition from nomadic pastoralism to sedentary life has complex effects on overall health (Fujita et al., 2004). This region had also undergone significant nutritional stress from a recent drought at the time of data collection, which may obscure any effect of *DRD4 7R* on the measures of nutrition included here. In addition, this analysis involved secondary data, and the methodological design reflects the aims of the original research (Straight et al., 2025). Following our failure to replicate its results in a closely related population, it may be that the previous results found in adult Ariaal men were spurious, and *DRD4 7R* is not associated with any changes in nutritional outcomes. Alternatively, the benefits of the *7R* allele may only be evident in adult men. This replication, as well as the previous replication among the Rendille (Kunkle et al., 2025), involved adolescents and children respectively, and is there not fully comparable to the initial study. For example, the behaviors associated with the *7R* allele may not manifest until adulthood, and/or behavioral benefits conferred by the *7R* allele may only result in benefits to nutritional status and economic success later in adult life. In this case, we may not expect children and adolescents to show direct benefits, and this would be consistent with the association between the *7R* allele and economic status observed here and among the Rendille (Kunkle et al., 2025). Finally, the behaviors necessary to succeed in pastoralist environments, particularly for a population in transition, are likely variable and may not be adequately proxied by measuring the effect of a single allele. Future research should aim to replicate previous findings in a sample of adult men utilizing a

broader, polygenic approach and measure potentially advantageous behaviors more directly to understand if ADHD-associated genes or behaviors are advantageous in particular contexts.

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Chapter 4. "I love my ADHD brain:" Exploring experiences of adults diagnosed with attention-deficit/hyperactivity disorder (ADHD) through semi-structured interviews

3.1 Introduction

> "… I wouldn't trade my ADHD for all of the… struggles I've had. That's, first of all, made me who I am—it's made me more resilient in the long run."

As explored in previous chapters, I have argued that attention-deficit/hyperactivity disorder (ADHD) is a disorder caused by a mismatch between natural neurobiological and behavioral variation and modern demands. Attention-deficit/hyperactivity disorder, or ADHD, is one of the most commonly diagnosed neurodevelopmental disorders, and research has shown that ADHD symptom severity may be variable across symptom domains in different settings (Rommelse et al., 2015; Sibley et al., 2024). Thus, it has been argued that the degree to which ADHD behaviors impact function is context dependent (Lasky et al., 2016). Clinical recommendations for treatment of ADHD in adults suggest that changes in environment may help alleviate symptoms or reduce the severity of impacted functioning, particularly in regard to occupational environments (Faraone et al., 2024; Wolraich et al., 2019). An analysis of fluctuations in ADHD symptom remission (periods of time when ADHD symptom scores drop below clinical thresholds) found that individuals reported better symptom management in fast-paced, stimulating environments (Sibley et al., 2022, 2024). Therefore, adults with ADHD may benefit greatly from reduced stress and symptom burden by adjusting their environments. Given the apparent context dependent nature of ADHD, individuals with ADHD may flourish in some environmental contexts more than others. Identification of such environments, hobbies, or areas

of life would be broadly beneficial for individuals with ADHD and other neurodiverse individuals who share similar traits.

While some literature has attempted to empirically test this idea using a number of different methods, evidence is largely mixed as to the degree that ADHD and its associated behaviors may benefit individuals in particular settings or tasks (Arildskov et al., 2022; Barack et al., 2024; Thagaard et al., 2016; Van den Driessche et al., 2019). However, it should be noted that these few empirical tests largely include tasks not directly informed by individuals with ADHD. Further, much of the literature concerning ADHD focuses on the negative outcomes associated with the disorder (Caye et al., 2016), and this focus on negative outcomes may contribute to the already substantial amount of stigma ADHD individuals face (Lebowitz, 2016; Mueller et al., 2012). Thus, there has been a recent effort to identify and focus on the positives associated with ADHD, both in the scholarly literature and in popular media (Hargitai et al., 2025; Moskowitz, 2024; Nordby et al., 2023; Sedgwick et al., 2019). Research into online perspectives from individuals diagnosed with ADHD about the disorder revealed a general trend toward the idea that ADHD itself is beneficial—a perspective that allowed for the alleviation of guilt about ADHD symptoms (Fleischmann & Fleischmann, 2012).

Some qualitative studies have attempted to identify areas of strength associated with ADHD. Sedgwick and colleagues (2019), in a sample of 6 adult men diagnosed with ADHD, showed that core strengths and/or advantages of ADHD included divergent thinking, hyperfocus, creativity, curiosity, bravery, and persistence. In another study of members of a Dutch organization for individuals with ADHD, dyslexia, and dyscalculia, Schippers et al. (2022) saw similar results when analyzing open-ended responses from individuals with ADHD. From a sample of 206 respondents, Schippers et al. found that individuals with ADHD highlighted

creativity, being dynamic, flexibility, socio-affective skills, and higher-order cognitive skills as positive aspects and strengths of the disorder. Additionally, traits like creativity and problem solving ability have been previously suggested as advantages of ADHD (Hoogman et al., 2020; Le Cunff, 2024; Steele et al., 2021). In support of this, a qualitative study involving a sample of nine adults with ADHD conducted by Redshaw and McCormack (2022) found that adults with ADHD saw higher energy, adventurousness, curiosity, and better problem-solving abilities as areas of strength conferred by their ADHD.

Despite growing interest in the positive aspects of ADHD, the existing literature remains limited. Based on the limitations of the previous chapter of this dissertation, namely the focus on a singular ADHD-associated allele, I believed it to be more useful to directly interview adults with ADHD about their experiences and perceptions regarding the benefits of ADHD. Additionally, following a diagnosis of ADHD late during my graduate studies, I realized that adults with ADHD may already have some understanding of the environments and contexts in which they thrive. Thus, for my second research chapter, I have utilized qualitative methods, including semi-structured interviews and surveys, to understand the possible benefits of ADHD and the environments where their ADHD conferred benefits. This study adds to existing literature by using semi-structured interviews and surveys with adults diagnosed with ADHD to explore perceived strengths conferred by the disorder and the specific environments, occupations, and domains of life in which those strengths are most salient. This approach centers the experiences and voices of adults with ADHD, allowing for a more complete understanding of how and where ADHD may be beneficial. This research represents a relatively novel contribution to the literature in its focus on reframing ADHD as naturally occurring, variable phenotype that is mismatched with modern environments. Additionally, this research is

potentially translational, with implications for how individuals, clinicians, and institutions may better support neurodivergent adults by identifying the environments in which they are most likely to thrive.

4.2 Methods

4.2.1 Grounded Theory

Grounded theory is a framework in which hypotheses and concepts are "grounded" in empirical data generated from interviews and/or surveys, seeking to build theoretical constructs by more directly referencing observed patterns and obtaining and interpreting data concurrently. This framework allows for considerable flexibility in the data collection process and allows researchers to adjust data collection procedures more freely in response to previously collected data in order to capture and distill observations from messy, complicated natural environments (Glaser & Strauss, 1967/2017). As such, information can be gathered from the environments using a variety of methods, including observation, interviews, and surveys, which can inform hypotheses, guide how researchers collect their data, or impact the direction or topics explored by the research itself.

Using a grounded theory approach, analysis of data is typically done via coding of phrases or excerpts which are able to be adjusted or collapsed into other categories as common themes emerge from data. "Codes" represent short phrases or ideas that capture the meaning or intention of interview responses in succinct way. Definitions for codes, housed in "code dictionaries," are recorded by the researcher following generation of the code to ensure that meanings are not misinterpreted or lost. The iterative process of data collection and interpretation is captured through the composing of memos, which record researchers' thoughts, definitions of important terms, and interpretations of data throughout analysis. In grounded theory, it is typical

of researchers to adjust study questions and procedures in order to include more data, different data, or different samples in order to further explore or adequately characterize observed trends or themes (Charmaz, 2001; Corbin, 2017).

Applying this theoretical framework is distinctly helpful in hypothesis generation, as it allows the data to guide the methodological choices of the researcher, with conclusions able to be drawn from the crosstalk occurring between the data and the researcher. Thus, for the purposes of identifying the potential benefits of ADHD, sometimes referred to as "areas of strength" in this chapter, grounded theory allows for the generation of hypotheses that are more directly informed by participant experiences. Additionally, utilizing a grounded theory approach is useful for this type of exploratory research as it represents a structured, but flexible, way to discern patterns from complex data, and the iterative nature of data collection and analysis allow for adjustment of research design and goals in response to the data itself.

4.2.2 Data collection

4.2.2.1 Eligibility criteria and recruitment

Initially, only adults previously diagnosed with ADHD who were not enrolled full-time undergraduate study were eligible to participate. Later, following the presentation of preliminary results at my dissertation colloquium, a decision was made following feedback to additionally enroll any adult, including those without ADHD, in order to add a control group for later analyses and to understand how common certain responses were among individuals without ADHD. I additionally expanded inclusion criteria and enrollment efforts to enroll the partners, spouses, and roommates of individuals with ADHD who could be used as informants or observers of other ADHD participants. This decision was made in part due to the potential for positive illusory bias, wherein individuals with ADHD will overstate their abilities compared to

their actual abilities (Volz-Sidiropoulou et al., 2016). However, overconfidence bias is also a larger phenomenon observed among larger groups, and there may even be adaptive benefits to overestimating or overstating one's ability (Johnson & Fowler, 2011). Enrolling observers would allow for comparison between ADHD-diagnosed participants, who can speak to symptoms, strengths, and other patterns of behavior. Participants were recruited via both snowball sampling and through posts to social media by myself and one other person. Initial recruitment consisted of a few individuals known to be diagnosed with ADHD amongst my own social networks. Digital flyers were used to recruit friends, family, and co-workers who were identified to be potentially interested in participating, and study participants were also asked to share these flyers with others.

4.2.2.2 Interview procedures

Interview guidelines were generated initially based on a thorough reading of ADHD literature. Following standard practice when using a grounded theory approach, interview guidelines were subsequently edited following ongoing analysis of the data, with some questions added, edited, or removed throughout the course of the study. Final interview guidelines can be found as supplements in Appendix B.

Participant's ADHD diagnosis was not clinically verified; however, participants were asked to describe their experiences with the diagnostic process. Semi-structured interviews were used to learn about their lives at home, at work, and in other aspects of daily life in regard to their experiences with ADHD. Although interview guidelines were generated, a conversation-like atmosphere was maintained during interviews. Participants were encouraged to stray from interview topics if desired, and additional questions were included ad hoc if topics strayed towards areas of interest. Interviews were recorded for later transcription. Transcription for the

interviews were first generated using the available transcription feature on Zoom or using the Apple Voice Memos app. Following generation of the initial transcript, an undergraduate assistant or I corrected the transcript, adding notes when necessary to mark any long pauses or gestures during interviews. Recording of one interview failed without knowledge until completion of interview, and a transcript could not be generated. Instead, detailed notes regarding the interview content were taken immediately following the interview and then analyzed in a manner similar to other transcripts.

4.2.2.3 Survey administration and compensation

A survey was administered following the interview: the Adult ADHD Self-Report Scale (ASRS v1.1; Kessler et al., 2005). Survey data were collected and managed using REDCap electronic data capture tools hosted at the Institute of Translational Health Sciences. REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies (Harris et al., 2009, 2019). The ASRS v1.1 generated a score corresponding to symptom profiles for each participant. One participant out of the 18 total participants did not complete the survey. Therefore, survey results reported here are for 17 individuals. Scores for both the overall 18-question scale as well as for the validated ASRS v1.1 6-question screener, which contains a subset of the questions for the 18-question scale were calculated. Additionally, questions on the ASRS v1.1 can be used measure inattention and hyperactivity/impulsivity symptoms, and scores were calculated for these symptom categories as well.

Study participants were compensated for their time interviewing and completing surveys with emailed electronic gift cards (Tango e-Gift cards): $30 following their interview and $10 following completion of the surveys. Study design and procedures were reviewed and approved

as an exempt study under the criteria of Exempt Category 2 (educational tests, surveys, interviews, or observations of public behavior where there is little to no risk towards or identification of subjects, or where adequate protections of subject identity are in place) by the University of Washington Human Subjects Division (IRB STUDY00020491). Funding for this project was provided by the University of Washington Department of Anthropology's Dissertation Pilot Fund.

4.2.3 Qualitative and statistical analyses

Finalized transcripts were downloaded in Atlas.ti (version 25.0.2.33323), a qualitative analysis software (Atlas.ti, 2025), and then analyzed using principles from grounded theory. Codes were generated during analysis of interviews and then grouped into broader "code groups" that captured similar meanings across individual codes. Coding of interviews occurred throughout data collection, notably following the collection of 8 initial interviews, then after 12 interviews, and finally after all 18 interviews were conducted. Interview guidelines (Appendix B) were edited throughout this process based on these initial and subsequent analyses. Memos were generated throughout the analysis process to record thoughts, ideas, and noticed trends in the data, and were used to aid in guiding data collection and analysis. Descriptions and names for emerging themes were generated by consulting participants' interviews directly, at times using language directly from the participant to describe their experiences, and through careful consideration of all codes generated during analysis combined with knowledge of current literature concerning this area. While a second coder was available and was able to code three transcripts, an intercoder reliability score was not able to be calculated at the time of this manuscript.

Counts for categories of codes were exported from Atlas.ti as Excel spreadsheets and then analyzed using R (version 4.5.2). Survey results were exported from REDCap and then visualized using R. Codes generated from interview data were then combined with survey data to understand the relationships between questionnaire score with individual codes and code groups from interviews.

4.3 Results

> " I think [ADHD] helps me with a lot of things. It helps me be pretty successful at what I do for work—just being more creative and being able to strategize and find patterns and stuff like that."

Diagnosis counts for males and females in the sample are presented in Table 4.1. Of the 14 diagnosed with ADHD, nine individuals were diagnosed as an adult, with the other five having been diagnosed as a child or adolescent. Five individuals were diagnosed as ADHD–combined presentation, one individual was diagnosed as ADHD–hyperactive-impulsive presentation, one individual was diagnosed with as ADHD–inattentive presentation, and the remaining seven individuals did not recall their presentation. Current job, as reported by participants during interviews, are presented in Table 4.2 using associated standard occupational classification (SOC) code names.

Table 4.1 ADHD diagnosis by sex (N = 18).

	ADHD diagnosis	**No ADHD diagnosis**
Female	44.4% (8)	16.7% (3)
Male	33.3% (6)	5.6% (1)
Total	77.8% (14)	22.2% (4)

Table 4.2 Current jobs for full sample (N = 18).

ADHD diagnosis (n = 14)	
Standard Occupational Classification (SOC) Code	**Count**
Commercial and Industrial Designers	2
Biological Scientists	2
Retail Salespersons	2
Physical Therapists	2
Education Teachers	1
First-Line Supervisors of Retail Sales Workers	1
Marketing Managers	1
Hairdressers, Hairstylists, and Cosmetologists	1
Software Engineering Managers	1
Web and Digital Interface Designers	1
No ADHD diagnosis (n = 4)	
Standard Occupational Classification (SOC) Code	**Count**
Data Scientists	1
Therapists, All Other	1
Personal Care Aides	1
Education Administrators, Postsecondary	1

Adult ADHD Self-Report Scale (ASRS v1.1) scores are reported in Table 4.3. Means for individuals without ADHD were below clinical thresholds, and, in the case of the overall scale, the mean was well below the threshold by just over nine points. On the ASRS v1.1 screener, the mean for individuals who reported an ADHD diagnosis were above the threshold, in line with expectations. However, the mean for diagnosed individuals for the full 18-question scale was slightly below clinically significant thresholds. While this may have been due to fluctuations in symptom severity experienced by individuals in our sample, as has been noted to occur in adults (Sibley et al., 2024), it is also possible that there are other reasons for the lower-than-expected average score. For instance, the low mean may be attributable to ascertainment bias; this sample of adults are relatively successful: nearly all individuals in the sample held at least a bachelor's

degree and all were employed at the time of data collection. Additionally, many diagnosed participants were actively being treated with medication (n = 8), which may lead to lessened symptom severity. Figure 4.1 depicts scores for the ASRS-v1.1 18-question questionnaire as well as scores for the shorter ASRS-v1.1 screener comprised of a subset of 6 questions from the full questionnaire. While four ADHD-diagnosed individuals fell below the clinical threshold for the full scale (Figure 4.1; A), most diagnosed participants scored at or above the threshold of the 6-question screener (Figure 4.1; B). The four participants who were not diagnosed with ADHD all fell below the clinical thresholds for both scales.

Table 4.3 Mean Adult ADHD Self-Report Scale (ASRS-v1.1) scores for individuals with and without ADHD (N = 17).

	ADHD-diagnosed Mean (SD)	**Non-diagnosed Mean (SD)**	**Clinical thresholds[1]**
Full Scale Score [*18*]	13.5 (3.8)	3.5 (3.9)	≥ 14
ASRS-v1.1 Screener Score [*6*]	4.9 (1.3)	1.5 (1.3)	≥ 4
Inattention Score [*9*]	7.2 (2.0)	2.3 (2.1)	
Hyperactive/Impulsive Score [*9*]	6.2 (2.1)	1.3 (1.9)	

Highest possible score for each section is noted in brackets. Standard deviations (SD) are provided for means.
[1] Clinical thresholds based on Kessler et al. (2007).

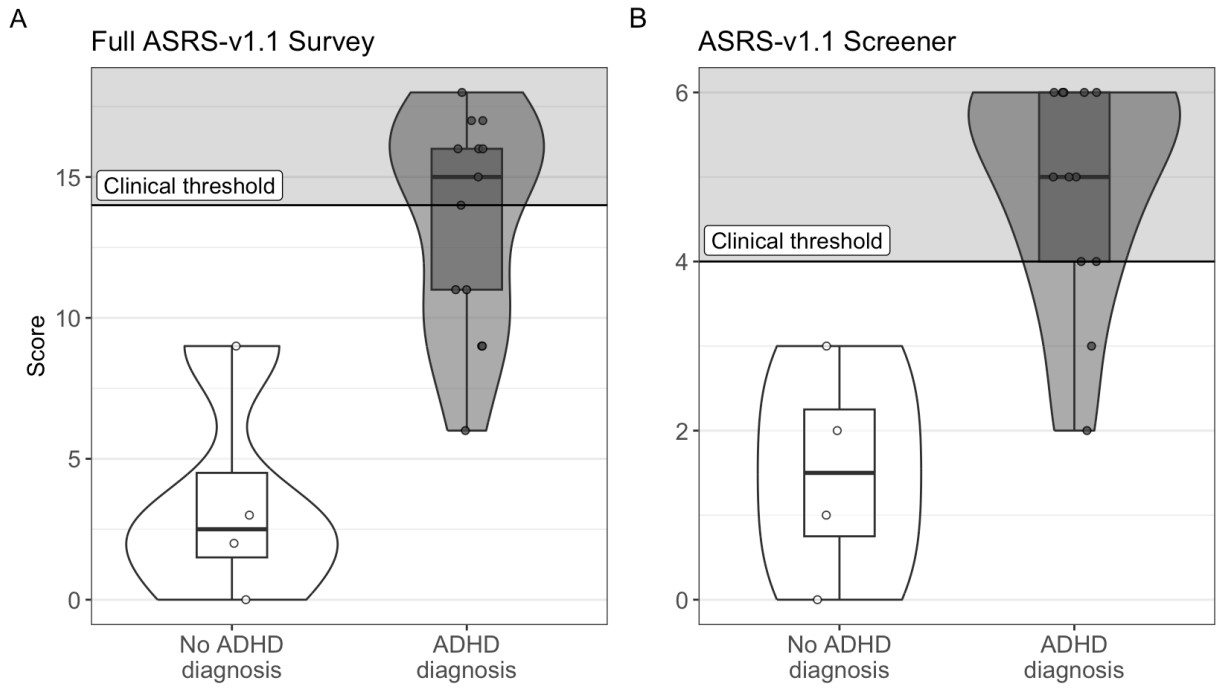

Figure 4.1 Scores on full Adult ADHD Self-Report Scale (ASRS-v1.1) (A) and screener (B) for individuals with and without ADHD (N = 17). Boxplots and kernel density estimates are shown for both groups and scores above clinical thresholds are denoted by darker shading.

4.3.1 Complex and contradictory feelings regarding ADHD

> "For a long time, ADHD was bad, you know. In my mind, ADHD was bad."

Interviews revealed often negative and complicated feelings about ADHD symptoms and about ADHD itself. One participant spoke explicitly about her complex feelings about having ADHD, stating:

> *[T]here's the fun part and then the non-fun part of ADHD. Sometimes you're really fun, sometimes you have energy, and you can chat up the whole room and have the funniest conversations and have the weirdest facts because of past hyperfocus. Then, there's the bad parts of it. You can feel very insecure, you can feel really depressed. Sometimes it's*

> *super common to have depression and anxiety, or sometimes you'll—very commonly—overthink and you'll be stuck in your head.*

All individuals who had an ADHD diagnosis reported a number of negatives associated with the disorder, frequently highlighting problems with focus (n = 9), time management (n = 7), and difficulties with social relationships (n = 6), reflecting common difficulties noted frequently in clinical literature (American Psychiatric Association, 2013; Kwon et al., 2018). Seven individuals, half of the sample diagnosed with ADHD, felt some degree of negativity or shame about the disorder. Thinking back on her time at school, one participant remarked:

> *It [ADHD] really started to bother me because, at the time, I was very focused on grades and was like, "I know I could do better if I was able to put in a little bit more effort." I was very much manifesting [her struggles in school] as, "I'm not able to do it," or "I'm lazy. Why can't I do it?"*

This statement indicates a degree of negative self-image and shame surrounding struggles associated with ADHD. A small number of participants were reticent to talk about their medication use, likely also due to the shame and stigma surrounding ADHD and its treatment (Hallberg et al., 2010; Lebowitz, 2016).

Additionally, two participants found it hard to see any positives to the disorder ("[It's] been harder for me to grasp what the strengths are that are associated with [ADHD] because it is defined in terms of things you lack or things that you struggle with"), while two others believed that the negatives of ADHD outweighed the positives ("[The] negative do kind of outweigh the positives"). Others felt a sense of shame and annoyance when symptoms impacted daily functioning or were apparent to others. Multiple participants described feeling frustrated by their ADHD symptoms, with one participant's remarking on her impulsivity: "I've always been kind

of interrupting-y, kind of annoying. I like it now, but it used to really be—I feel—like, "Why do I do this?"

Finally, women in the sample struggled with ADHD in ways that differed from the men. Two female participants who were diagnosed in adulthood noted separately that ADHD was thought of exclusively as a "boy disease" when they were younger. One participant said about the perception of ADHD growing up:

> *I also grew up in a time when it was "Girls, no, they don't get, it's a boy disease!" I think I wouldn't have had as much support as a kid being diagnosed as I had as an adult, so I'm kind of grateful for that experience [being diagnosed as an adult].*

Another woman who was diagnosed with ADHD as an adult noted a similar perception of ADHD and its impacts on how she felt initially about her diagnosis:

> *I went to a provider nearby and did an assessment and she concluded that I have mild ADHD, but it took me a year to kind of take that seriously. I think there's a part of me that had the stereotype in mind that this has to do– I grew up when ADD and ADHD described hyperactive little boys. I never thought of it as something that could apply to me.*

Notably, all of the women included in the sample were diagnosed as adults, whereas all but one of the diagnosed men were diagnosed in childhood or adolescence. For many of the women in the sample, the decision to seek out a diagnosis was driven by ongoing struggles in college or with work. In contrast, most of the men in the sample described receiving their diagnosis following teacher or parent intervention.

4.3.2 Experiences of ADHD as excess energy with nowhere to go

> "I like that [with ADHD]… I do boost the energy, especially when I'm excited about something."

It was relatively common for diagnosed participants to reference the concept of energy, specifically in the form of movement, when speaking about their experiences with ADHD. The term "energy" related to ADHD in such a way appeared in some sense across five interview participants. Here, it appeared that participants with ADHD saw their inability to be still and focused during certain contexts as an excess of energy, rather than merely a deficit of attention. As such, some participants chose to channel their "excess energy" towards other goals, including via movements both large and small.

Multiple participants noted their preference for using physical movement, such as exercise, pacing, or simply moving around a room, as a coping mechanism or as a way to improve focus and concentration. Some saw their ADHD as a "boost" of energy that both needed to be managed when doing mundane things but was beneficial in other contexts. One participant, a teacher, saw his ADHD as a helpful way to keep kids engaged with his lessons, noting that "having the kind of frantic science teacher who goes on long-winded tangents and suddenly goes 'Wait a minute!' and then runs to the back room, comes back with some chemicals, and does something: that's exactly what students want as science teachers. So, I think for my classroom etiquette, [ADHD is] spot on perfect." Later, this same participant described having to "force" himself to sit down in order to complete paperwork, further highlighting the complex relationship between individuals and their ADHD, as well as the context-dependence of the disorder's benefits and downsides. Similarly, another participant reflected on their experience incorporating movement into their day-to-day work and home life, saying:

> *I think the days where I'm able to keep up a pace, keep going, stay on top of movement, definitely helps keep me engaged. The sitting down and stopping really drags things out—those days are definitely worse.*

This participant, who works as a medical professional, noted that she had to find the "balance" between movement and stillness in order to function optimally due to the nature of her job, which requires her to be both hands-on with patients and on top of her paperwork. Finding balance, however, was difficult, as she enjoyed the days in which she was "moving from room to room" more than the days she was required to be still. Here, she noted that she was "a bit more *energetic* [emphasis added]" on those days and often ended those movement-filled days feeling more accomplished.

A preference for physicality was also shown in other ways. Some participants described deriving enjoyment from doing things with their hands, and some used tasks or hobbies involving their hands as a way to improve focus. These concepts were often paired with describing their ADHD as an excess of energy with nowhere to go. One participant who frequently utilizes fidget toys during meetings noted that:

> *It's like my hands almost always need to be busy… I have no idea why, but my theory is that… my ADHD energy has to go somewhere, and it's via my hands going instead of being up here [gestured to head].*

This is in direct contrast to one participant without ADHD who, when asked if she played with her hands with or without an object in them when seated during meetings, simply said, "No, not really, not too fidgety, I would say." It is notable that many of these hand-based tasks comprised of relatively small movements would not be out-of-place in social contexts where larger movements would. An individual who knits or crochets during a meeting would likely be more

accepted than an individual who paces around the room. Thus, it may be that the ADHD-diagnosed individuals in this sample channel their excess energy into these crafts *because* they are socially acceptable but would otherwise prefer to fidget or pace in less socially acceptable ways. For example, one participant, when reflecting on his history "tinkering or messing around with things," stated:

> *My parents called me [Bob] the Builder because, if there was something, anything in front of me, I would try and take it apart and put it back together, or take things that shouldn't be together and put them together, or keep a roll of Duck Tape that I would constantly make into things. To me, I thought it was just fun, and I was keeping myself busy, but I was doing that all the time, always [emphasis added].*

Furthermore, he described that this behavior was somewhat impairing in that his "tinkering" interfered during schooltime and was perceived negatively by his teachers (although not by his parents, it seems). This was something that he, eventually, learned to harness: "I'm very good at taking a bunch of tiny pieces from everywhere else and synthesize them into something new." Therefore, it may be that the strengths identified by individuals as associated with their ADHD in this sample represent skills that they developed to foster success out of previously maladaptive traits.

In the interviews, excess energy was also conceived of as mental, not just physical. One participant stated that, due to ADHD, he is "able to accomplish a lot with little time at times" and is "able to *hyperfocus* [emphasis added] at times" when it is a subject he enjoys. Hyperfocus is the phenomenon in which an individual is entirely absorbed in a task for an extended period of time, without noticing or reacting to distractions (Ashinoff & Abu-Akel, 2021). Another participant described these periods of hyperfocus as "rabbit holes" that were exceptionally

helpful in her work, and this exact sentiment was again noted by a different participant, who explained: “I have always gone down rabbit holes really well, and… I think can be very beneficial.” Thus, it may be that greater mental energy was beneficial in some ways for some participants in providing them the ability to hyperfocus. However, this excess mental energy was not always perceived of positively. The participant quoted at the beginning of section 4.3.1 referred explicitly to hyperfocus as a “fun” part of ADHD, but also acknowledged the great mental cost that might come with ADHD, notably depression and anxiety, which are commonly comorbid with ADHD (Faraone et al., 2024). Additionally, one participant noted that this ability to focus was context-dependent: “I think my ADHD gives me the ability to focus and execute at a very high-functioning level, but only when conditions are met.”

Finally, excess energy also appeared to manifest across interviews as a heightened ability to take in and process information from the surrounding environment, a process usually quickly accompanied by some action or reaction. This “hyperawareness,” to use a term directly from an interview, has been observed among individuals with ADHD, particularly in the form of increased sensitivity to peripheral stimuli (Panagiotidi et al., 2017). When speaking more broadly about his experience of ADHD, one participant remarked: “I think, to some degree, you’re just hyperaware of the things that are going on around you at all moments.” This hyperawareness extended to include how some participants were able to visualize their body in a space. For example, one participant who had previously taught yoga stated:

> *[Yoga] was something that I think came more easily to me because I almost had a physical sense of it. I could close my eyes and imagine the different positions we had to be in and see the shapes.*

Similarly, when one participant described her experience when skiing:

> *You're constantly assessing the situation: everything around you, and the people around you, and what they're doing. And, if you don't have a brain that can do 100 things at once, you really can't go that fast.*

For others, their hyperawareness was helpful when juggling multiple tasks, with one participant who works in the medical field remarking: "In the right situation, I feel like the ADHD definitely helps with managing a few different things at once and keeping tabs on different things." Another participant likened her skill at multitasking to a "Spidey sense" that was particularly helpful for time-sensitive kitchen tasks, but also noted, in the same sentence, that if you were to ask her to be on time for an event, "it will not happen."

This hyperawareness experienced by participants appeared to lead to benefits in, and, thus, a preference towards dynamic contexts. Participants often felt drawn towards environments that were highly active, frequently preferring to be around others or in contexts with some amount of ambient noise. While not explicitly described by the participants in terms of "energy," many of the ADHD-diagnosed participants enjoyed high energy, busy environments, even preferring them when needing to do work. Across five participants, each individually noted a preference for doing work in public places, such as coffee shops and airport lounges, with one participant introspectively remarking that "something about ambient noise actually works really well for me," and another noting that she "need[ed] things going on… that's how I get work done… I need background noise." This preference, however, was not universal among diagnosed participants, with on participant noting that she could only work effectively in quiet environments, saying, "Noise, especially, really distracts me—it feels like it interrupts my thoughts." Interestingly, one participant noted that, in busy environments:

> *For better or worse, I feel like I see lots of stuff at once. I'm easily distracted by things in my peripheries, but, as a result, I see lots of things that are happening. And, if it's a dangerous situation sometimes, like if a car is coming or if I'm in a public situation, I find myself assessing… "What's everything that can go wrong?"*

Thus, his experience of hyperawareness was complex and context-dependent: while impairing in one setting, it was adaptive in another.

For some in this sample, the experience of ADHD as an excess of energy was often highlighted when in the presence of people without the disorder, often referred to as "neurotypical" people by participants. One participant stated explicitly that "people without ADHD, neurotypical people, can't necessarily keep up." Another participant described interacting with neurotypical individuals as "personally very boring" owing to their propensity to converse in a "very straightforward, very one-thing-at-a-time" manner and felt "a lot more comfortable" with neurodiverse people. In my own experience as a person with ADHD, interviews with other diagnosed individuals tended to flow faster and included greater amounts of detailed information than interviews with non-diagnosed individuals. In particular, participants with ADHD frequently interrupted—both me and themselves—when they had an important point to add, and, in my experience, spoke with a faster cadence than participants without ADHD. It is notable that my own diagnosis of ADHD was not until after the majority of the interviews were performed, so my own diagnostic status was likely not influencing how comfortable individuals felt during interviews.

4.3.3 ADHD and the desire for novelty across multiple domains

> "I feel like sometimes it was just that I got bored, [jobs] got too repetitive, and there wasn't any of that newness to it that was giving me the energy to be supercharged."

The above quote not only references the previously explored idea of energy, but also explicitly ties the ability to have energy (be "supercharged") with "newness." Another key concept common across interviews concerned a preference for novelty in many regards. One participant noted that, while he benefited from highly structured environments, such as the military, he "need[ed] novelty" in order to enjoy life. Novel experiences and settings as well as novel tasks were of great interest to many participants, and some attributed this directly to their ADHD: "ADHD also just makes you so curious about stuff and open to learning new things, at least in my experience… Yeah, I think I would never want to not have ADHD."

A preference for novelty was sometimes cited as being a benefit of ADHD, particularly in the form of spontaneity. One participant said of herself: "I am a very spontaneous person in some ways; I love change" when directly asked if ADHD benefitted her. Additionally, the ability to respond adequately to novel scenarios—to be adaptive or flexible—was referenced across multiple interviews. Alternatively, in some participants, the desire for novelty was labelled instead as "adventurousness" or often involved a preference for somewhat risky hobbies. One participant gleefully described her penchant for injuring herself while doing such activities, which included skiing, snowboarding, weight-lifting, rock-climbing, mountain biking, and hockey. It is notable that most individuals participated in hobbies related to spending time outdoors, such as hiking and skiing, likely owing to the popularity of these activities in the Pacific Northwest, where most of the sample resided. Thus, it may be that the commonality of

adventurousness and risky hobbies across the sample was a result of geographic location, rather than being attributable to ADHD. Additionally, participants without ADHD also appeared to enjoy similarly active hobbies, with one participant noting that she often enjoyed paddle boarding with her dogs. This pattern may indicate that individuals with ADHD are not especially drawn towards these kinds of hobbies more generally.

Participants with ADHD were also drawn towards novel tasks, often preferring a variety of tasks rather than focusing on just one. While multitasking as a strength derived from ADHD was brought up in the previous section, it is notable that diagnosed participants appeared to prefer new, and therefore more interesting, tasks to focus on—although only for a time. For instance, one diagnosed participant remarked: "I'm really passionate about [hobbies] at first; I get all the stuff, get one-fourth of the way into it and then I lose motivation and interest." Notably, her living space, which was visible in the background of the virtual meeting room, reflected this—she showed me a project that was partially-finished on her desk and the many crafting supplies that filled her office drawers. Other diagnosed participants noted that they struggled with mundane, repetitive tasks, often procrastinating starting or finishing them. Some participants were also drawn towards novel environments as well: one participant noted that he didn't like "staying in one place for too long, usually" and would frequently find new places to work or travel to.

Common phrases that participants used to describe themselves often included variations of "adaptable" or "flexible." One participant, who described herself as adventurous, also noted that her ADHD also allowed her to be adaptable:

> *That adaptability is really helpful. I can, you know, jump into a new role in a completely unfamiliar place and find my way in it and not really even be physically uncomfortable,*

not be emotionally uncomfortable at all. I do think that is one of things that makes me most successful in what I do is that.

Furthermore, she saw her ability to be flexible as something that conferred direct benefits to her, allowing her to take on jobs, expand her knowledge, and have a diverse set of experiences. Similarly, another participant described himself as "spontaneous," often "chaotically taking what is put in front of [him]" and running with it in a way that are often helpful both in his job (a physical therapist) and in his personal life. One participant noted that, when speaking with other adults with ADHD about how they deal with high pressure or high stress situations, it was "ironically something that doesn't necessarily bother people with ADHD," and that people with ADHD "tended to like the pressure and thrive in those kinds of environments." Thus, diagnosed participants often not only desired novelty, but also saw themselves as more adept at responding to it.

4.3.4 Cognitive diversity as a key component of ADHD

"[ADHD] helps with seeing things from different perspectives. I'm definitely guilty of getting stuck on one thought, but having lots of different thoughts and reasons could be helpful, more multipolar. The world could benefit from that versus just hegemony."

Across a number of interviews with diagnosed participants, ADHD was described frequently as an ability to think about or see things differently than others without the diagnosis. In other words, to many of the participants, ADHD represented sometimes useful—although sometimes impairing—cognitive diversity. In one interview, the concept of ADHD as a form of cognition different from the prescribed norm was discussed explicitly by the participant:

> *I wonder, sometimes… is [ADHD] a different way of cognitive functioning or something like that?… I think all the time about [how] there are good things about having ADHD. Everybody [with ADHD] can say that they have these strengths, but there's no other disorder that you can say that about.*

While other diagnosed participants did not use as direct language to talk about their experience of ADHD as beneficial diversity of cognition and perspective, this concept was widely reflected across the other interviews, with many participants viewing their capacity for cognitive flexibility, creativity, and their ability to generate novel or previously unthought-of solutions to various problems as benefits conferred by ADHD.

Participants often noted that ADHD seemed to give them the ability to see things from perspectives different from those around them. For example, when asked what she thinks the benefits of ADHD are, one participant stated:

> *I think it just kind of helps with seeing things a slightly different way. I think most people I know that have it—and I interact with—just kind of have a slightly different approach to life and the world and how you interact with it.*

This idea is reflected in a number of other interviews with diagnosed individuals, sometimes referred to as "out-of-the-box" thinking. For example, one participant noted that ADHD was particularly beneficial at work, stating that "[ADHD] helps when you need to think out-of-the-box, or when you need to think of something different, or if we're doing 'think big' sessions," but noted that the greater number of ideas generated did not always consider plausibility.

ADHD was often linked to creativity in the interviews, and diagnosed participants frequently cited their creative ability as attributed to their ADHD. This extended from greater

capacity for artistic creativity, such as crafting hobbies or drawing/painting, to more cerebral creativity, such as novel idea generation and rich storytelling abilities.

The relationship between creativity and ADHD was somewhat complex, however. With some noting that they encountered various ADHD symptom-related issues when they wished to *be* creative. For example, when asked about how her experience being creative and how it related to her ADHD, one participant reflected that:

> *Probably other people think I'm creative, I guess maybe more creative than some people, but I have trouble visualizing finished things in my mind. I'm better off taking something, and I can put them together and make something, but I can't always say, "Okay, I want to make this," and then go to the store and buy all the pieces that I need…*

Other participants noted similar issues, with one participant reflecting that she often picked up and put down creative projects without finishing them, but after buying all the items necessary.

Participants sometimes noted that their ADHD was particularly helpful for problem solving and often cited this in relation to their ability to problem solve in ways others could or did not was beneficial to them in their work. One participant noted that:

> *I would say that problem solving is one of my big strengths, and I really think outside-the-box, and want to try different things, and look at things from every angle.*

Later in the interview, this same participant also noted that:

> *[ADHD makes me] good at problem solving, and I work really well under pressure—I'm really calm when everyone is panicking—and thinking outside-the-box, and I'm really able to view things from lots of different perspectives, and I think I'm a more analytical and deep thinker. You know, I think a lot of that stuff kind of does come from the ADHD. I*

really think that makes me unique, even in my own family and circle of friends. I was thinking about that the other day, would I trade it? I don't think I would.

Here, ADHD was experienced as explicitly beneficial and as something that made her unique among others. Furthermore, creativity was sometimes mentioned in relation to problem solving, with individuals noting that they not only felt that problem solving was a strength of theirs, but also that they were able to problem solve in creative, diverse ways. One participant explicitly called this out as a strength, saying "I would consider myself a creative problem solver." Similarly, another participant noted, "I think [ADHD] makes me a fantastic problem solver—I can get really creative with problem solving." Finally, another participant noted that she was able to not only produce more solutions to problems, but also better able to see which solutions were worthwhile:

I love my ADHD brain. I think it's really creative and helps me see patterns, and I'm good a connecting dots that other people might not immediately connect. That seems to be one of my strengths, and I feel like that's really related to ADHD. Having so many thoughts and ideas coming all at once, you're used to being able to pick out [or] notice what your attention's going to. I don't know, I never thought about it before until recently because, you know, you're used to the way your brain works, so it doesn't seem that interesting or different. So, when other people react to the work that you're doing, and they're like, "Oh, I've never thought about it that way…" It was only a few months ago that I realized that's because they don't have ADHD.

Therefore, in the experience of these participants, ADHD represented beneficial cognitive diversity that allowed for the generation of unique or overlooked perspectives, opinions, and solutions.

The concept of ADHD as being related to increased diversity of thought was also reflected by the interviews themselves. Compared to non-diagnosed participants, diagnosed participants seemed to have a more diversity when expressing their thoughts and answering interview questions—most notably observed by amount of detail offered in responses as well as their nonlinear, but illuminative, storytelling. One participant noted that ADHD was good at giving you a "stockpile of information," a concept that was well reflected in the interviews with diagnosed participants, who often opened up substantially about their personal lives, even when the question did not explicitly call for this kind of detail. While the number of questions differed between the interviews, with the ADHD interviews including more questions than the non-ADHD interviews, the interviews with ADHD-diagnosed participants also tended to be substantially longer, in part due to the long, winding tangents taken by those with ADHD. In contrast, those without ADHD were more succinct in their responses, often not providing the level of detail present in the interviews with ADHD-diagnosed individuals. Figure 4.2 compares responses to the same questions from interviews of one participant with ADHD and one participant without ADHD, showcasing the stark differences between the lengths and types of responses given to the same question. Notably, both participants shared demographic characteristics: both were women in their early thirties and were college-educated. The observable difference in length and detail displayed in Figure 4.2 generally represents differences seen more broadly between diagnosed and non-diagnosed groups.

ADHD diagnosis	No ADHD diagnosis
Interviewer: Can you describe your current job for me? **ID07:** Yes. So, I'm a physical therapist. I work in a hospital, so I'm in an inpatient unit, like acute care. So, a large part of what I'm doing is seeing patients that are deconditioned or injured or weak and falling. A large part of it is focused on mobility, working on getting out of bed, standing, walking, and assessing "Are you safe to go home? Do you need more help before you can get back home" What's the safest place for you to be? What kind of supports do you need? Do you need more home care?" So, that's a lot of what I'm doing. My day-to-day is, you know, I get about eight or nine patients a day for an eight-hour shift and see them each day, either evaluations for new patients or treatments, and then documentation—each visit has a little note. So, then we go sit down at our little computer and write up our notes about what they did with us, how they're doing. So, that's the bulk of what I'm doing. In between, it's coordinating with nurses, doctors—you know, chatting with people going on rounds.	**Interviewer:** Can you describe your current job for me? **ID10:** I am a software engineer. I basically just write code all day and try and figure out either why something isn't working or trying to get something to work.
Interviewer: Can you describe your experience creating and maintaining social relationships? **ID07:** Well, I think that part of things can be very difficult. I very much struggle with the part of maintaining relationships when you're not around people. I definitely struggle with that, always have. Even growing up, it was like the people I was doing sports with every day, or in class with every day, were generally the people I ended up being closest with. So, I definitely find it easier to maintain closer relationships when I see people more frequently in person. I have a very hard time keep up with people when they're not there. Part of it is that I'm focused on what I'm doing, I forget to reach out. The other part of it is I genuinely find it very difficult to call and text people. It's just the writing thing: putting thoughts into words is stressful for me, and it takes more mental energy than I would like it to, you know. It's not just *saying* something. It's *thinking* about what I'm saying, how I'm saying it, how they'll take it, how they text, how I text. All of that weighs on my head, so that's tricky. I think that's the hard part. I think having friends who are better at that has been helpful for me. Or, friends who get it and are like, "Yeah, no worries," versus people who really take offense to that or read more into it and put a lot of weight into that like, "Oh, you didn't answer me a few times—it's intentional and it's malicious." I forgot to mention, I think, the other side of friendships with ADHD. Most of my close friends have ADHD. All of my best and closest relationships are also people that are neurodivergent and that has been really lovely and beautiful to get into more. I think, even when I was younger, before I understood that, I think the people I was drawn to and clicked with more were that kind of person. But, not being together is difficult, but when you are together it's so much easier to maintain a conversation and to exist and talk. I feel like trying to be friends with and talk with and keep up with people who are more neurotypical… it feels like that's when I get into the scripted territory and feeling like I'm masking, trying to be a certain way. Or, I feel like neurotypical people have ways of conversing that are, personally, very boring, like, "We can be so much more interesting than this." It's just very straightforward, very one-thing-at-a-time… So, I think it's just sort of this innate thing [where] I feel a lot more comfortable when I can tell that we're thinking a similar way—there's a lot less pressure. That's been really fun to lean into that and make more friends like that and prioritize that.	**Interviewer:** Can you describe your experience creating and maintaining social relationships? **ID10:** I definitely have a little bit of a hard time with that. A lot of the friends that I've made have been through my husband. I don't text people that often, so they're pretty good about me only responding once in a while. I've always had a bit of an issue with making and keeping friends. I tend to just not contact people unless I have a reason to, like if I want to plan something. I'm not good at the, you know, emotional labor of saying like, "I found this rock and it made me think of you." So, those things don't come naturally to me. Most of my communication happens through Discord or other chat apps. We'll make and plan stuff through Discord mostly in a group chat setting, rather than individually messaging people. It's harder for me to have a one-on-one conversation with people because I have to think of what to say next, but whenever I'm in a group setting or in a group chat, you just kind of build on top of each other, and the silence isn't weird. So, if I'm silent for a little bit, it's okay, and then when I have something to say, I will say it.

Figure 4.2 Interview excerpts from one individual with and one without ADHD.

4.3.4 ADHD, medication usage, and coping mechanisms

> "[The medical provider] told me, in order for her to prescribe Adderall or anything like that, I needed to really jump through a series of hoops… I hear this is really common, but I thought it was funny that she handed me this diagnosis that was like, 'Yeah, you have some profound issues with executive function. Here's a series of hoops you have to jump through to resolve it that requires a high level of executive functioning.'"

Eight individuals reported being currently on medication for ADHD, and there was substantial variability in the types, dosage, and reasons for medication usage. For example, two individuals reported taking their medication at the same time every day, while two others reported using their medication strategically, such as taking it before an important meeting or "taking weekends off." Diagnosed individuals also cited a number of reasons for *not* taking medications, including difficulties accessing prescription drugs, side effects, and issues with insurance or medical providers. Notably, data collection occurred during significant supply shortages in the medications commonly used to address ADHD symptoms (Currie & Malinovskaya, 2026), and some interview participants experienced problems receiving their medication during this period, with one participant even reporting that she changed medications primarily due to this reason.

Those that took medication often noted that it was most useful when combined with other coping mechanisms. For example, one participant remarked, "Even taking the Ritalin, I do still struggle to start things. I still need the pressure of a deadline, but I can make false deadlines for myself and that kind of helps." Most participants who were currently or had ever been on ADHD medication had tried more than one and often described difficulties finding the right medication fit. Meanwhile, other participants described a reluctance to go on ADHD medication due to a

lack of familiarity with the drugs or due to the possible side effects. One participant noted that she was "really hesitant to get on medication" because she "didn't really understand what that looked like, or what sort of medications were available." Instead, her understanding was "that they were all stimulant medications, and that they were highly addictive, controlled substances." Two participants elected not to answer questions about ADHD medication usage at all.

Diagnosed participants also employed a number of non-medication interventions to help mitigate ADHD symptoms. These were often framed as "coping mechanisms" that were developed following years of experience with ADHD-related difficulties. Some participants described using alarms and reminders to keep them on-task or remember things, while others used mindfulness techniques to calm overactive minds. Interestingly, two individuals described that they instead liked to "work with" their ADHD and leaned into the behaviors instead of combating them. One participant said, "As crazy as it sounds, I kind of let my ADHD take me," when she needed to get things done. However, she also followed this statement by clarifying that:

> *I never fully sit down and finish something and then move on to something else and finish it. I kind of do a little bit of everything and then, at the end of the day, as long as everything's done in full, we're good.*

She described this process as "follow[ing] the noodle" of her "spaghetti brain," a picture that symbolizes the non-linear process she used to accomplish her goals. A few other diagnosed participants used discomfort and anxiety as tools to help finish tasks, setting deadlines for themselves when things really needed to get done (although this was also mentioned as a tool used by a participant without ADHD). Finally, five individuals described using exercise as a tool

to mitigate their ADHD symptoms and allow for better focus through the day. One participant noted that:

> *Movement, I found to be helpful [to deal with ADHD symptoms]. Being able to find time to just go out if I'm getting stuck in decision fatigue or there's too many things I can possible be working on, trying to move and be outside [helps]… But physical movement I've found to be helpful.*

However, he went on to temper this observation, noting that exercise can sometimes be distinctly unhelpful at times:

> *Hypothetically, exercise can easily turn into its own hyper-fixation or distraction—I'll exercise and then I don't do any of my tasks I need to do.*

Others who used exercise as a coping mechanism noted that it was useful in "regulating" ADHD symptoms, with one participant noting that, on the days that he did exercise, he felt "so much more focused and so much better" than on the days he did not.

Others coped with their ADHD by fostering community with other neurodiverse individuals. This idea appeared in an earlier section, wherein one diagnosed participant referenced that, in their experience, non-ADHD individuals "can't necessarily keep up." Thus, she preferred to socialize with others who had similar experiences as she did. Later on, this same participant reflected that:

> *Most of my close friends have ADHD. All of my best and closest relationships are also people that are neurodivergent and that has been really lovely and beautiful to get into more. I think, even when I was younger—before I super understood [ADHD]—I think the people I was drawn to and clicked with more were that kind of person.*

A sense of community being helpful in managing ADHD as its associated feelings of shame and distress was also explored by another participant who often described her ADHD as at odds with her ability to function. Here, she stated:

> *I feel like I've surround myself with people who get [ADHD] and know, and I don't have to mask in front of them… They help me with it, but they're also like, "How are you actually feeling?" and so on. My friends have very much helped me with the acceptance part of ADHD. It's like, "Why is it a bad thing?"*

Therefore, this participant began the process of letting go of the shame surrounding the disorder by leaning on others with similar experiences as her.

4.3.6 Integration of observed patterns and generation of themes of strengths derived from ADHD

Interviews were designed to understand experiences of those with and without ADHD; specifically, to identify tasks and contexts in which diagnosed individuals felt their ADHD symptoms were less apparent—or, importantly, contributed to their success. These responses were then compared to those of individuals without ADHD. Codes corresponding to these ADHD-associated strengths as well as observed patterns across interviews were generated during and throughout the analysis process. 258 individual codes were produced during analysis, which were then collapsed into 11 distinct code groups. The most common code groups among participants diagnosed with ADHD are presented in top half of Table 4.4, while the bottom half includes the frequency of those code groups in the participants without ADHD for comparison, when applicable.

Table 4.4 Code groups from interviews for individuals with and without ADHD (N = 18).

	Frequency[1]	
Code Group	**ADHD diagnosis (n = 14)**	**No ADHD diagnosis (n = 4)**
Negative symptoms associated with ADHD	100% (14)	N/A
Prefers manual tasks and physical movement	92.9% (13)	75.0% (3)
Prefers a variety of tasks or dynamic settings	85.7% (12)	25.0% (1)
Openness to new experiences	78.6% (11)	50.0% (2)
Creativity as a strength	78.6% (11)	25.0% (1)
Problem solving as a strength	71.4% (10)	75.0% (3)
Understanding and connecting with others as a strength	71.4% (10)	25.0% (1)
Ability to see patterns and gain insights that others miss as a strength	71.4% (10)	25.0% (1)
Multitasking as a strength	64.3% (9)	25.0% (1)
Hyperfocus and hyperawareness as strengths	50.0% (7)	0.0% (0)
Negative feelings or shame regarding ADHD diagnosis or symptoms	50.0% (7)	N/A

[1]Frequency refers to the number of times a theme was mentioned at least once in interviews.

As explored in previous sections, participants with ADHD often described their experiences as related to an excess of energy. This theme broadly spanned how individuals described internal feelings, such as feeling like they cannot settle, to how they described their mental state, such as with hyperfocus or hyperawareness. Therefore, it may be the excess energy conferred by ADHD is beneficial in some settings or for some tasks. Considering that some diagnosed participants described channeling this energy to their hands (i.e., “tinkering”), this may be an area where ADHD is experienced as a strength. Furthermore, this excess energy may be beneficial for larger physical movements: individuals with ADHD may possess both the energy to perform such activities as well as the hyperawareness of their body and surroundings, including other people and objects, in order to execute them well. Thus, two areas of strength of ADHD may be (1) *an increased ability to work well with one’s hands on tasks requiring manual*

manipulation, and (2) *better performance in activities involving physical movement due to heightened spatial awareness of one's body and environment*.

Participants diagnosed with ADHD also described a desire for novelty in multiple domains, notably preferring novel settings and experiences. Frequently, participants described themselves as adaptable or flexible, often attributing this trait to ADHD and noting it is a strength of their personalities. This capacity for flexibility may be especially helpful in novel settings where the things encountered are unknown or unpredictable. Combined with a heightened sense of awareness, individuals with ADHD may be better equipped to respond to issues in their immediate area. Thus, another area of strength conferred by ADHD may be *an improved ability to navigate and succeed in active or busy environments*. Finally, this capacity for adaptability and flexibility may be beneficial in contexts where task-varying or juggling multiple tasks is necessary, especially when performing novel or interesting tasks (as many participants noted that motivation mattered substantially in the ability to complete a task). Therefore, a fourth area of strength related to ADHD may be *a proficiency in contexts requiring varied tasks or multitasking*.

Finally, participants diagnosed with ADHD cited their ability to problem solve, see things others miss, and be creative as explicit strengths associated with their ADHD. Broadly, interviews pointed to ADHD as a form of cognitive diversity, with diagnosed participants being rich storytellers as well as highly creative and intuitive. Thus, a fifth strength conferred by ADHD may be *an increased capacity for creativity and problem solving in innovative and diverse ways*—ways that others without ADHD could not.

Therefore, five themes emerged from interview data: (1) an increased ability to work well with one's hands on tasks requiring manual manipulation, (2) better performance in activities

involving physical movement due to heightened spatial awareness of one's body and environment, (3) an improved ability to navigate and succeed in active or busy environments, (4) a proficiency in contexts requiring varied tasks or multitasking, and (5) an increased capacity for creativity and problem solving in innovative and diverse ways. Once the five themes were finalized, interviews were re-analyzed to understand their commonality across individuals with and without ADHD. For brevity, themes were shortened to: (1) fine manipulative skills & tasks, (2) tasks involving physical movements, (3) dynamic, active environments, (4) varied tasks, and (5) problem solving and creativity. Observed frequencies of the five themes across interviews of participants with and without ADHD are presented in Table 4.5 from most to least common in the ADHD-diagnosed participants. Figure 4.3 depicts the relationships between broader observed theoretical concepts and then how they were used to determine areas of strength attributable to ADHD.

Table 4.5 Frequency of areas of strength in individuals with and without an ADHD diagnosis (N = 18).

Areas of strength	**ADHD diagnosis** (n = 14)	**No ADHD diagnosis** (n = 4)
Problem solving & creativity	100.0% (14)	75.0% (3)
Dynamic, active environments	92.9% (13)	25.2% (1)
Tasks involving physical movements	78.6% (11)	50.0% (2)
Fine manipulative skills & tasks	71.4% (10)	0.0% (0)
Varied tasks	57.1% (8)	25.0% (1)

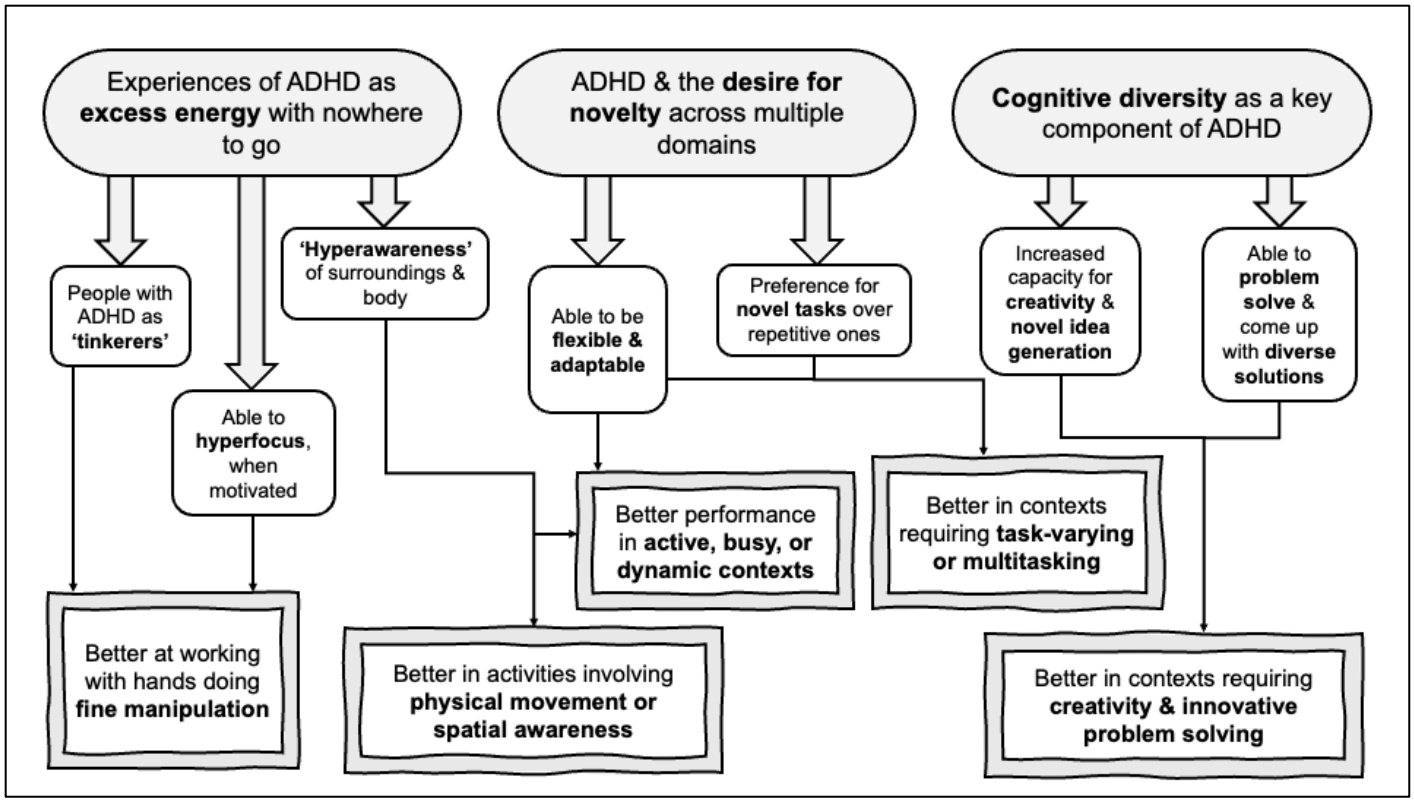

Figure 4.3 Observed theoretical constructs used to determine areas of strength associated with ADHD. Grey ovals represent broad concepts, rounded boxes represent intermediate observed patterns, and boxes outlined in grey represent finalized areas of strength.

4.4 Discussion

> "I don't think I would trade it at all, honestly. And I wonder sometimes… is it a different way of cognitive functioning or something like that?... I think about it all the time—there are good things about ADHD… so it makes it fully hard to wrap your head around it being a disorder when there are good things that come out of it. I think it's more… what society has decided is the norm and how we have to function inside of it that makes it a disorder than it actually being a disorder."

The above quote is one that I believe exemplifies the goal of this dissertation: to reframe ADHD as something context dependent and as something that may be beneficial in some circumstances and for some tasks. Based on the frequency of their appearance as well as their

relative importance compared to other aspects based on my interpretations of interview data, I identified five areas of potential strengths of ADHD to further investigate: (1) tasks involving problem solving and creativity, (2) performance in dynamic, active environments, (3) jobs or tasks involving physical movement, (4) fine manipulative skills, and (5) activities and/or jobs involving varied tasks.

The complicated attitudes towards ADHD observed across interviews reflect a larger truth about the disorder: ADHD is a disorder that is, in some ways, socially-bound and whose impairments are substantially context-dependent. Diagnosed participants often described their symptoms as impairing primarily in specific contexts, such as in school, at work, or during mundane tasks, while describing the same traits as adaptive or advantageous in other contexts. Others saw their ADHD as a deviation from socially-determined norms and expectations and, although the impacts were real, the symptoms often felt arbitrarily labeled as "disordered." This concept is particularly apparent in the final sentence of the quote at the beginning of this section, which appears to attribute the status of ADHD as a defined disorder to this deviation from societal expectations. Furthermore, the concepts expressed across interviews with diagnosed participants frequently mirrored recent findings that environmental fit appears to shape ADHD symptom expression and impairment (Lasky et al., 2016; Sibley et al., 2022, 2024). Diagnosed participants did not uniformly experience ADHD as a consistent deficit across all settings; instead, they experienced ADHD as a collection of traits whose impacts shifted depending on the demands and specifics of their environmental context in that moment.

An increased capacity for problem solving and creativity was identified most often by diagnosed participants as an area of strength attributed to ADHD. Participants with ADHD linked their creative and problem-solving abilities explicitly to the experience of thinking differently

from others without ADHD, referencing their "out-of-the-box" thinking, pattern recognition, and ability to see things others miss as key strengths. These experiences reflect observations from other qualitative literature about the strengths of ADHD, notably research from Sedgwick and colleagues (2019), who identified divergent thinking and creativity as core strengths of the disorder, and research from Schippers and colleagues (2022), who found that individuals with ADHD reported creativity as a positive aspect of the disorder. Furthermore, this experience points to the potential framing of ADHD as important cognitive diversity that is beneficial in certain contexts—a concept that is reflected in some clinical literature regarding ADHD. Notably, children with ADHD appear to exhibit greater cognitive exploration on semantic search tasks (Van den Driessche et al., 2019), indicating that they may employ different cognitive strategies than children without ADHD. These different strategies may manifest as greater creativity, innovation, or problem solving abilities, as expressed by participants in these interviews. Thus, these areas may be strengths associated with ADHD, wherein individuals with ADHD experience benefits, or may be simply less impaired by their ADHD, in these domains.

Diagnosed participants also appeared to identify an affinity for and improved ability to navigate and succeed in dynamic, active, or busy environments as another key strength of their ADHD. This observation is consistent with findings that ADHD symptom remission is associated with increasing environmental demands (Sibley et al., 2024). When participants found themselves busier or more active, they frequently described these contexts as more "intuitive" for them to handle effectively and be successful in. Participants often described that, when in physically and/or cognitively demanding occupations, including the medical, educational, or culinary fields, they experienced their ADHD as an asset to their performance in the dynamic

aspects of their work. One quote from a participant who worked as a teacher is especially evocative of this concept:

> *I'm also in that flow state where I'm just taking in this information and then getting ready to change in any way, shape or form, which is kind of what I like about [ADHD], so I actually don't feel stressed. It's almost like I have so much input that I'm constantly being stimulated, and I think that's why I love [busy] jobs, and that's why I love teaching. There's never a boring moment.*

On the other hand, they also described significant difficulties performing less dynamic tasks, such as paperwork or writing reports, thus reflecting the apparent context-dependence of ADHD-related impairments. As such, ADHD is experienced as beneficial, but only, as one participant put it, "in the right situation."

Two of the five identified themes—better performance in activities involving physical movement and in activities involving fine manipulation—shared a common underlying experience expressed by diagnosed participants. Here, ADHD was experienced as an excess of energy that was then redirected in the form of physical activity or "tinkering," and participants often expressed a preference for these types of activities. In contrast, participants who were not diagnosed never described themselves as fidgety, indicating that they did not often feel the extra energy that participants with ADHD felt. Notably, one of the diagnostic criteria for ADHD references this experience, with the hyperactive-impulsive experience of ADHD described as being "on the go" as if "driven by a motor" (American Psychiatric Association, 2013). Thus, it is not surprising that diagnosed participants experienced ADHD as such, with some likening their excess energy as being "supercharged" or feeling like non-ADHD people "can't necessarily keep up." Notably, the reframing of this as a potential source of strength, rather than merely as a

symptom, offers a new perspective on the ADHD-associated behavior. Furthermore, diagnosed participants' experiences of heighted spatial awareness and the ability to understand their body in space, closely aligns with some research indicating that individuals with ADHD have heightened sensitivities to stimuli in their visual peripheries (Panagiotidi et al., 2017) and atypical (often inefficient) visual scanning , which may both be beneficial in succeeding in a task or hobby requiring distributed rather than focused attention. However, the experiences described by participants are also contrary to substantial clinical evidence that children with ADHD experience increased postural instability and balance control, leading to impairments in the ability to employ postural strategies or motor skills required by a particular task (Christ et al., 2025; Kaiser et al., 2015).

Participants sometimes described a preference for variety that, while sometimes impairing (e.g., leaving projects unfinished), was beneficial in diversifying their skills and experiences. The language used by participants in this regard (e.g., "flexible," "adaptable," and "spontaneous") highlighted their pursuit of novel experiences. ADHD-diagnosed participants also expressed confidence in switching between tasks, or multitasking, effectively, typically in relation to occupational or domestic contexts in which they were juggling multiple responsibilities. However, the benefits of this particular strength, as with others presented here, appear to be highly context-dependent: participants noted that their capacity for multitasking was most beneficial if tasks were novel or interesting, and least beneficial when repetitive tasks required sustained attention. That participants identified switching between varied tasks as a strength of their ADHD is somewhat surprising considering the clinical literature: children with ADHD often show marked deficits in task switching tests when compared to non-ADHD controls (Cepeda et al., 2000), although this association may be mediated by the kinds of task

switching tests being utilized (Luna-Rodriguez et al., 2018). Additionally, tests of multitasking in children with ADHD indicate worsened performance than non-ADHD peers (Ewen et al., 2012). Thus, it may be understandable that only just over half of the participants diagnosed with ADHD reported this as a strength: this may represent an area of substantial heterogeneity in ADHD symptom profiles or, conversely, an area where individuals overestimate their abilities owing to the positive illusory bias.

Finally, diagnosed participants' feelings regarding their ADHD were often contradictory, with many expressing both an appreciation for the disorder and an acknowledgement of how it impacts them negatively at the same time. For example, one participant who explicitly stated, "I kind of prefer my ADHD brain," also went on—just a few seconds later—to describe her difficulties with the disorder: "I will get executive dysfunction where I literally cannot make myself get up…. I know it's because my brain isn't giving me enough dopamine to get started on the task." Another participant who said she "wouldn't trade [ADHD] at all" also reflected earlier in the interview that, even after taking ADHD medication, she still struggled often with symptoms, noting that her ADHD behaviors were often "maladaptive." Thus, the relationship between individuals and their ADHD was complex—a concept most accurately described by one participant: "It's like a superpower or it's like my Kryptonite, depending on the day."

4.4.1 Limitations

Several limitations of this study should be acknowledged. Firstly, the sample size was small (N = 18), although this is not uncommon for qualitative studies. ADHD diagnosis was self-reported and not clinically verified, and the variability of medication type (stimulant or nonstimulant), use, dosage, and dosing strategies introduces additional heterogeneity to the sample. Much of the sample was middle- to upper-class and all individuals interviewed were

currently employed at the time of data collection, limiting the generalizability of these results. Additionally, the sample was predominantly adult women, many of whom were diagnosed in adulthood, which is somewhat common for ADHD women (Faraone et al., 2024). However, given the limited number of studies centered on adult women with ADHD, this may also be a considered a strength of this research. An additional limitation lies in the language surrounding the concept of "strengths." In particular, it is possible that individuals respond similarly when asked about their strengths because of a cultural script rather than observations of themselves. Countless articles exist which proport to provide the "correct" answers when asked about strengths in job interviews (e.g., Malinsky, 2021; Schwartzberg, 2023), and there are popular media representations of the strengths of those with ADHD that the reported strengths here partially correspond with (e.g., Moskowitz, 2024; Nall & Matysiak, 2021). Some participants may be simply repeating commonly suggested strengths, rather than truthfully assessing their own strengths. Finally, these findings cannot confirm whether the proposed areas of strength are definitively areas in which individuals with ADHD perform better than their peers (or simply perform less worse), and these themes should be understood as requiring further empirical and experimental testing. Some of these limitations are addressed by the final research chapter of my dissertation, which used a nationally representative database to understand if individuals with ADHD preferentially select jobs which involve the proposed areas of strength.

4.4.2 Strengths

Despite the limitations of this research, these findings contribute meaningfully to a body of literature that has historically focused on the negative outcomes and deficits surrounding ADHD. With this research, I centered the experiences and perspectives of adults with ADHD, allowing for the identification of strengths of ADHD grounded directly in the words of those

diagnosed. While other qualitative research has asked similar questions regarding the strengths conferred by ADHD, this research contributes novel findings in a number of important ways. In particular, the use of semi-structured interviews allowed participants to describe experiences in their own terms, producing rich qualitative data that both identified strengths associated with the disorder and allowed for contextualization of these strengths. Additionally, women are generally underrepresented in research regarding ADHD (Hinshaw et al., 2022). While it was not intentionally addressed in the study design, this research aids in the goal of addressing this issue: the majority of my participants diagnosed with ADHD were women (8 out of 14; 57%) and most of the full sample were women (11 out of 18; 61%).

4.5 Conclusions

"I have been trying not to just think of ADHD in terms of things I can't do or that I'm bad at or in terms of a pathology."

Based on the collected interview the five themes discussed here may be perceived as areas of strength attributable to ADHD, however, it remains to be seen if they are truly beneficial. Thus, it is necessary to directly test both how common these themes are amongst individuals with ADHD, and how often these traits directly result in benefits to the individual. Current literature testing the empirical benefits of ADHD-associated traits is limited, and some of the studies which have identified adaptive benefits of the phenotype have been called into question (Thagaard et al., 2016). Additionally, one study showed that individuals with ADHD may perceive greater benefits when partaking in risky behaviors (Shoham et al., 2016), aligning with other research that has found that children and adolescents with ADHD may also

overestimate their competence in daily life activities relative to ratings from parents reports (Volz-Sidiropoulou et al., 2016). Therefore, it is necessary to test the five themes identified by this research in a larger sample to understand the generalizability of these strengths, a question which has not yet been answered, to my knowledge. The final chapter of my dissertation will focus on answering a portion of this question, specifically asking if adults diagnosed with ADHD are more likely to hold jobs with characteristics that correspond to these areas of potential strengths.

Future research should aim to empirically test whether ADHD-associated traits confer measurable performance advantages in the proposed areas of strengths (problem solving and creativity, tasks involving physical movements, tasks involving fine manipulative skills, dynamic, active environments, and activities and/or jobs involving varied tasks). In conclusion, identifying the contexts in which ADHD confers benefits, rather than detracts from success, may be helpful in reframing the disorder as naturally occurring behavioral and neurobiological variation, rather than as a pathological deviation from a socially determined norm and may have the potential to alleviate some of the shame and stigma surrounding the disorder. Thus, this study offers a more complete picture of ADHD and points towards specific environmental contexts and tasks in which ADHD may be beneficial, with results that may translatable and useful for future therapeutic interventions.

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Chapter 5. Do those with ADHD hold occupations that work to their strengths? Relationships of ADHD diagnosis with occupational characteristics in Add Health

5.1 Introduction

Around 11% of US children and 6% of US adults have been diagnosed with attention-deficit/hyperactivity disorder, or ADHD (Danielson et al., 2024; Staley et al., 2024). Furthermore, in a study across 10 countries, an estimated 3.5% of workers met the criteria for adult ADHD (Graaf et al., 2008). Thus, ADHD represents an important area where further consideration of its effects, both positive and negative, is warranted.

ADHD is defined by inattention, hyperactivity, and/or impulsivity that impairs function across multiple domains. ADHD diagnoses may involve three presentations or sub-types: predominantly inattentive, predominantly hyperactive-impulsive, or combined (American Psychiatric Association, 2013). Until relatively recently, ADHD was considered to be a disorder of childhood, and diagnostic criteria were targeted towards children. Observable symptoms of ADHD for school-aged children can range from disruptive behaviors in the classroom and emotional dysregulation to disorganization and poor school performance (Nigg, 2013; Nigg et al., 2020). In adults, ADHD may manifest as attentional deficits at work, legal troubles, or difficulties with driving (Faraone et al., 2006; Wilens et al., 2009). ADHD is additionally associated with higher levels of risk-taking behaviors in adolescents and adults (Matthies et al., 2012; Pollak et al., 2019), and adults with ADHD are more likely to have ever been arrested or issued a traffic ticket (Faraone et al., 2006).

Individuals with ADHD often display deficits in executive functioning, a category which typically includes a variety of complex cognitive and behavioral processes used in task management and attainment of some future goal (Martel et al., 2007; Pennington & Ozonoff, 1996). These deficits may have marked impacts on work performance and ability to complete tasks (Nadeau, 2005). As such, ADHD is often linked to higher rates of long-term unemployment (Helgesson et al., 2023), lower yearly individual earnings (Patel et al., 2021), poorer job performance, and lower occupational attainment (Gordon & Fabiano, 2019) than individuals without ADHD.

Considering the substantial genetic basis (~80% heritable) and high prevalence of ADHD, it is argued that ADHD represents an example of evolutionary mismatch (Jensen et al., 1997; Swanepoel et al., 2017; Williams & Taylor, 2005). The concept of evolutionary mismatch suggests that once-adaptive traits or evolutionarily neutral phenotypic variation may become maladaptive in new environments. When applied to behavioral traits, an evolutionary mismatch hypothesis argues that the behaviors that once contributed to fitness in past environments may be harmful to success in modern environments and are therefore categorized as "disordered" (Li et al., 2018). Modern demands of sustained focus and attention have changed substantially in just the last few generations, much faster than genetically constrained human behavioral traits are able to adjust (Gluckman & Hanson, 2006). Although behaviors like learning and attention are very old, contexts such as formal schooling, college, desk jobs, and technology are evolutionary novel, representing inventions of the last few centuries (Gray, 2011; Gurven & Lieberman, 2020). Behaviors such as disorganization and distraction, fidgeting, standing or pacing during inappropriate times, or the inability to settle are only inappropriate within certain contexts (e.g., a classroom or during a meeting). In addition, there is a general consensus that the behaviors

associated with ADHD exist on a continuum wherein diagnostic cut-offs can be arbitrary (Blashfield et al., 2014; Epstein & Loren, 2013; Kraemer et al., 2012). In other words, the behaviors observed to be disruptive or negatively impact functioning, and thus used to justify an ADHD diagnosis, exist in "normal" degrees in all individuals, and an ADHD diagnosis may represent the pathologizing of this behavioral variation.

It is possible that behaviors associated with ADHD may be neutral, or even beneficial, in some contexts, and identification of those contexts may be useful in decreasing negative stigma around the disorder or as a therapeutic intervention. Clinical recommendations for treatment of ADHD in adults suggest that changes in environment (both exclusive of or in combination with therapies and medication) may help alleviate symptoms or reduce the severity of impacted functioning, particularly in regard to occupational environments (Faraone et al., 2024; Wolraich et al., 2019). Consistent with this, the impact of ADHD symptoms may vary across domains, and the degree to which ADHD behaviors impact function is likely context dependent (Lasky et al., 2016). Recent evidence also shows that ADHD can fluctuate across the lifespan with periods where symptoms no longer meet diagnostic criteria, and that these periods of remission may coincide with particular environmental contexts (Sibley et al., 2024).

However, few studies have sought to present the possible benefits or strengths of ADHD, and much of this work has been done using qualitative methods in small samples. Thus, many of these studies do not provide empirical evidence regarding the generalizability of identified themes. In this case, qualitative studies involving interviewing or surveying individuals with ADHD about their experiences are useful in that they provide potential areas of interest for future research. Sedgwick et al. (2019), in a sample of 6 adult men diagnosed with ADHD, showed that self-perceived core strengths and/or advantages of ADHD included divergent

thinking, hyperfocus, creativity, curiosity, bravery, and persistence. Schippers et al. (2022) saw similar results when analyzing open-ended responses from ADHD-diagnosed members of a Dutch organization for people with ADHD, dyslexia, and dyscalculia. From 206 respondents, Schippers et al. found that individuals with ADHD highlighted creativity, being dynamic, flexibility, socio-affective skills, and higher-order cognitive skills as positive aspects and strengths of the disorder.

Some of the above themes are reflected in the previous chapter's research involving interviewing adults with ADHD (Chapter 4). Preliminary results from 18 interviews of individuals diagnosed with ADHD and of those without ADHD show that individuals felt their ADHD contributed to their capacity for creativity and problem solving, their ability to gain insight others miss, and their ability to multitask or navigate busy environments. Additionally, participants with ADHD felt more comfortable in dynamic environments or in contexts which had physical movement, working with their hands, and flexible or varied tasks. Based on these results, I highlighted five core areas in which ADHD may be beneficial: (1) problem solving and creativity, (2) physical movement, (3) fine manipulative tasks, (4) dynamic, active environments, and (5) varied work tasks. However, individuals with ADHD have been observed to overestimate their abilities—a phenomenon known as positive illusory bias (Owens et al., 2007; Prevatt et al., 2012; Volz-Sidiropoulou et al., 2016). Thus, it is necessary to test whether these self-perceptions of strengths are accurate and, if so, how common these ADHD-associated strengths are across larger samples of individuals.

One area in which adults may exercise choice over their environments is via occupation. Thus, it is possible to investigate whether individuals diagnosed with ADHD gravitate towards and persist in jobs in which they are able to utilize any ADHD-derived strengths. Some research

has explored what jobs individuals with ADHD may be more adept at, although the topic remains relatively unexplored (Samosh et al., 2024). For example, a study of ADHD symptoms and self-employment among the STAGE cohort of the Swedish Twin Registry showed that ADHD—and hyperactivity, specifically—was positively associated with self-employment, wherein an individual works as an independent contractor or as the sole proprietor of an entrepreneurial venture rather than working under another individual (Verheul et al., 2016). Another study involving a case study of fourteen entrepreneurs diagnosed with ADHD argued that aspects of the disorder, namely impulsivity and hyperfocus, were major drivers and catalysts for entrepreneurial action and its consequences, although the study also observed a number of negatives associated with the ADHD-associated behaviors, such as increased impulsivity causing anxiety due to thoughtless responses to complex situations (Wiklund et al., 2016). Given evidence that ADHD is context dependent, it is likely that individuals choose jobs that "fit" with their brains, rather than choosing particular broad fields (Lasky et al., 2016). Thus, here I look at job characteristics, rather than job category to try to understand which environments individuals with ADHD appear to prefer, persist in, and/or be selected for.

I argue that individuals are likely more successful in, and therefore more attracted to and likely to get, jobs that involve any of the five areas isolated from the previous chapter's interviews. Thus, these five areas were used to inform Occupational Information Network (O*NET) items of interest in order to test this hypothesis. I expected that individuals with ADHD may gravitate towards roles that involve the items listed in Table 5.1, which displays the 22 initial O*NET items of interest and the associated hypothesized "core area," numbered 1 through 5. In other words, I predicted that individuals diagnosed with ADHD will be more likely to hold jobs which reported higher need for one or more of these characteristics.

*Table 5.1 22 O*NET items chosen and the hypothesized area associated.*

Name	Description	Area
Fluency of Ideas	The ability to come up with a number of ideas about a topic (the number of ideas is important, not their quality, correctness, or creativity).	1
Originality[1]	The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.	1
Problem Sensitivity	The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing that there is a problem.	1
Inductive Reasoning	The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).	1
Category Flexibility	The ability to generate or use different sets of rules for combining or grouping things in different ways.	1, 4, 5
Spatial Orientation	The ability to know your location in relation to the environment or to know where other objects are in relation to you.	2, 4
Visualization	The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.	3
Time Sharing	The ability to shift back and forth between two or more activities or sources of information (such as speech, sounds, touch, or other sources).	4, 5
Manual Dexterity	The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.	3
Finger Dexterity	The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.	3
Multilimb Coordination	The ability to coordinate two or more limbs (for example, two arms, two legs, or one leg and one arm) while sitting, standing, or lying down. It does not involve performing the activities while the whole body is in motion.	2
Response Orientation	The ability to choose quickly between two or more movements in response to two or more different signals (lights, sounds, pictures). It includes the speed with which the correct response is started with the hand, foot, or other body part.	2, 4
Stress Tolerance	Job requires accepting criticism and dealing calmly and effectively with high-stress situations.	4
Adaptability[1]	Job requires being open to change (positive or negative) and to considerable variety in the workplace.	4, 5
Innovation[1]	Job requires creativity and alternative thinking to develop new ideas for and answers to work-related problems.	1
Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.	1
Active Learning	Understanding the implications of new information for both current and future problem-solving and decision-making.	1
Complex Problem Solving[1]	Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.	1
Making Decisions & Solving Problems	Analyzing information and evaluating results to choose the best solution and solve problems.	1
Thinking Creatively[1]	Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions.	1
Performing General Physical Activities	Performing general physical activities includes doing activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling materials.	2, 4
Handling & Moving Objects	Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.	2, 3, 4

[1]Items expected to show the largest effect size. Areas: (1) Problem solving & creativity, (2) Physical movement; (3) Fine, manipulative tasks, (4) Dynamic, active environments; and (5) Varied work tasks.

Of the O*NET items selected for the planned analyses, I expected five to show the largest effect size based on a review of the literature and the results of previous interviews: Originality, Adaptability, Innovation, Complex Problem Solving, and Thinking Creatively. Originality, which is defined by O*NET as "the ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem." Related to Originality are Thinking Creatively, defined as "developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions," and Innovation, defined as requiring "creativity and alternative thinking to develop new ideas for and answers to work-related problems." I expected high values in these three items to be strongly associated with ADHD due to previous observations that adults with ADHD generate more original ideas in a work context (Boot et al., 2020). Additionally, children with ADHD have been shown to exhibit greater creativity than their peers (Shaw & Brown, 1991). I also expected ADHD to be associated with higher values in the Complex Problem Solving item, defined as "identifying complex problems and reviewing related information to develop and evaluate options and implement solutions," in part due to observations from my own qualitative interviews as well as evidence from the literature that individuals with ADHD may be more adept at coming up with a variety of solutions to a problem (White, 2020; White & Shah, 2011). Finally, I also expected that individuals with ADHD may be more likely to hold jobs which score highly in Adaptability, defined as requiring "being open to change (positive or negative) and to considerable variety in the workplace," as individuals in qualitative interviews reported that a key strength attributable to their ADHD was the ability to remain flexible and adaptable at work and in other areas of life, reflecting patterns observed in the literature (Schippers et al., 2022). I expected the association between ADHD and these five items to be strongest over other O*NET items included in Table

5.1 as they more directly match my interpretation of the literature and the results from previous interviews.

This study aimed to characterize the relationship between ADHD and occupational characteristics in US adults in an effort to understand if individuals with ADHD hold particular jobs or jobs with particular characteristics that align with key strengths associated with ADHD highlighted in the interviews explored in the previous chapter. In adherence with principles of Open Science, research plans were preregistered prior to performing any analyses (see Methods). Finally, this research adds to scholarly research highlighting the positives of ADHD, which may help to alleviate feelings of shame surrounding the diagnosis and provide a translational model for future research about neurodivergence (Fleischmann & Fleischmann, 2012; Schippers et al., 2022).

5.2 Methods

5.2.1 Preregistration

A general preregistration was uploaded to Open Science Framework (OSF) prior to access to datasets and is available here: https://osf.io/p4zag/. Following access to datasets, an additional preregistration was generated which included a more detailed description of analyses and model designs. There were no deviations in the second pre-registration from the initial one. The second pre-registration included more detailed model designs based on discussion with collaborators familiar with the data. The second preregistration also narrowed the hypotheses to only consider ADHD diagnosis and not polygenic scores. Any differences between the preregistrations and the analyses presented here are explicitly noted.

5.2.2 Description of data

5.2.2.1 The National Longitudinal Study of Adolescent to Adult Health (Add Health)

The National Longitudinal Study of Adolescent to Adult Health (Add Health) is a nationally representative, longitudinal study of United States adolescents. This study enrolled adolescents in 7th through 12th grade beginning in 1994, and subsequent data collection waves followed individuals into college and adulthood. Currently, a total of six waves of data collection have been completed, with Wave VI collecting data between 2022 and 2025. More details about the design of Add Health can be found in Harris (2013).

For the analyses, I used reported ADHD diagnosis from Wave IV (collected in 2008) when participants were 24 to 32 years old. In this wave, 5.2% (of 15,701 individuals) reported having received an ADHD diagnosis. Job titles for current and previous jobs are available through Add Health as Census job codes. I used participants' current job information collected during Wave V (2016-2018) when individuals were 33 to 43 years old in order to assign job characteristic data. Additional covariates used from Add Health included: age, sex, census region, highest education level, self-reported race/ethnicity from Wave I (coded as Hispanic, non-Hispanic white, non-Hispanic black, Native American, Asian/Pacific Islander, and Other), family financial status, and highest parental education level. Sex, census region, highest education level, and self-reported race/ethnicity were considered individual-level covariates for these analyses, while family financial status and highest parental education level were considered family-level covariates. Age was recorded in years. For the purposes of this analysis, sex was only available as dichotomized as "male" and "female," although we recognize that these categories may not accurately reflect gendered experiences (DuBois & Shattuck-Heidorn, 2021). Census regions were coded as "South," "Midwest," West," and "Northeast." Highest education level (sometimes just referred to as "education level" here) was made of 16 categories: (1) 8th

grade or less, (2) some high school, (3) obtained GED, (4) obtained high school diploma, (5) some vocational or technical training, (6) some community college, (7) completed vocational or technical training, (8) some college, (9) associate or junior college degree, (10) completed college (bachelor's degree), (11) some graduate school, (12) completed a master's degree, (13) some graduate training beyond master's degree, (14) completed a doctoral degree, (15) some post baccalaureate professional education, and (16) completed post baccalaureate professional degree. As the individuals in Add Health had been recruited using a stratified school design with first wave enrollment occurring in Grades 7 through 12, no individuals in the sample had never been to school, and all individuals included in the subsequent waves had at least completed 8th grade (Harris, 2013). The variable "family financial status" involved retrospective ratings by respondents about whether their family while growing up was "a lot better off," "somewhat better off," "same as average," "somewhat worse off," or "a lot worse off" than other families in their area. The variable "highest parental education level" was constructed by taking the highest education level listed between each parent. Possible categories included: (1) 8th grade or less, (2) more than 8th grade, but did not graduate, (3) went to a business, trade, or vocational school instead of high school, (4) obtained GED, (5) high school graduate, (6) went to a business, trade, or vocational school after high school, (7) some college, (8) completed college, (9) professional training beyond college, and (10) never went to school. Following the removal of all individuals missing data for any of the included covariates, the final sample size consisted of 7,255 individuals.

*5.2.2.2 Occupational Information Network (O*NET)*

Worker abilities, styles, values, and activities of interest—referred to here as "job characteristics" for the purposes of brevity—specific to each occupation were isolated from the

Occupational Information Network, or O*NET based on previously collected interview data. O*NET is a comprehensive system which describes occupations and the knowledge, skills, abilities, activities, and tasks necessary for those occupations (Peterson et al., 2001). For O*NET Skills, Work Activities, and Abilities items, numeric "Levels" of each item for each occupation were computed via questionnaires administered to individuals at those jobs, who reported the level of each item necessary to perform their job as well as the importance of each item to the performance of their job. Responses were on a Likert scale, and final value was obtained by averaging responses across respondents in the job. I used "Level" values for these items, as I am interested in the defining characteristics of each job rather than perceived importance, although Level and Importance values are highly correlated with one another (Handel, 2016). O*NET Work Styles items, including Stress Tolerance, Innovation, and Adaptability, involve personality traits that are relevant to occupations. Here, an "Impact" value was computed by asking workers how beneficial or detrimental a particular Work Style item was for job performance on a 7-point rating scale (with -3 corresponding to detrimental and 3 corresponding to beneficial) (Putka et al., 2025). For analyses, I used the O*NET 30.1 Database, available for use under a Creative Commons license and found at: https://www.onetcenter.org/.

5.2.3 Statistical analyses

All results reported are in line with data security requirements from Add Health. Study design and analyses were approved by the University of Washington Human Subjects Division (IRB ID: STUDY00024520) and Add Health (ID 041225002) prior to access to the data. All analyses were performed in R version 4.4.1 (R Core Team, 2024). All results presented here were approved before export by Add Health in accordance with their security procedures.

A pairwise correlation matrix was generated using only O*NET data for O*NET items of interest to understand relationships between the items prior to combining of O*NET and Add Health datasets. Pairwise correlations were computed for all 894 occupations included in the O*NET 30.1 database prior to the merging of the O*NET and Add Health databases. Correlation results are shown in Figure 5.1. Following merging of O*NET and Add Health datasets, pairwise correlations were once again generated (Figure 5.2). Here, I observed a similar pattern of correlations as are seen in Figure 5.1, although some correlation estimates changed slightly, likely due to the decrease in the number of independent job titles in the final sample (316 job titles from the 894 total included in the O*NET database).

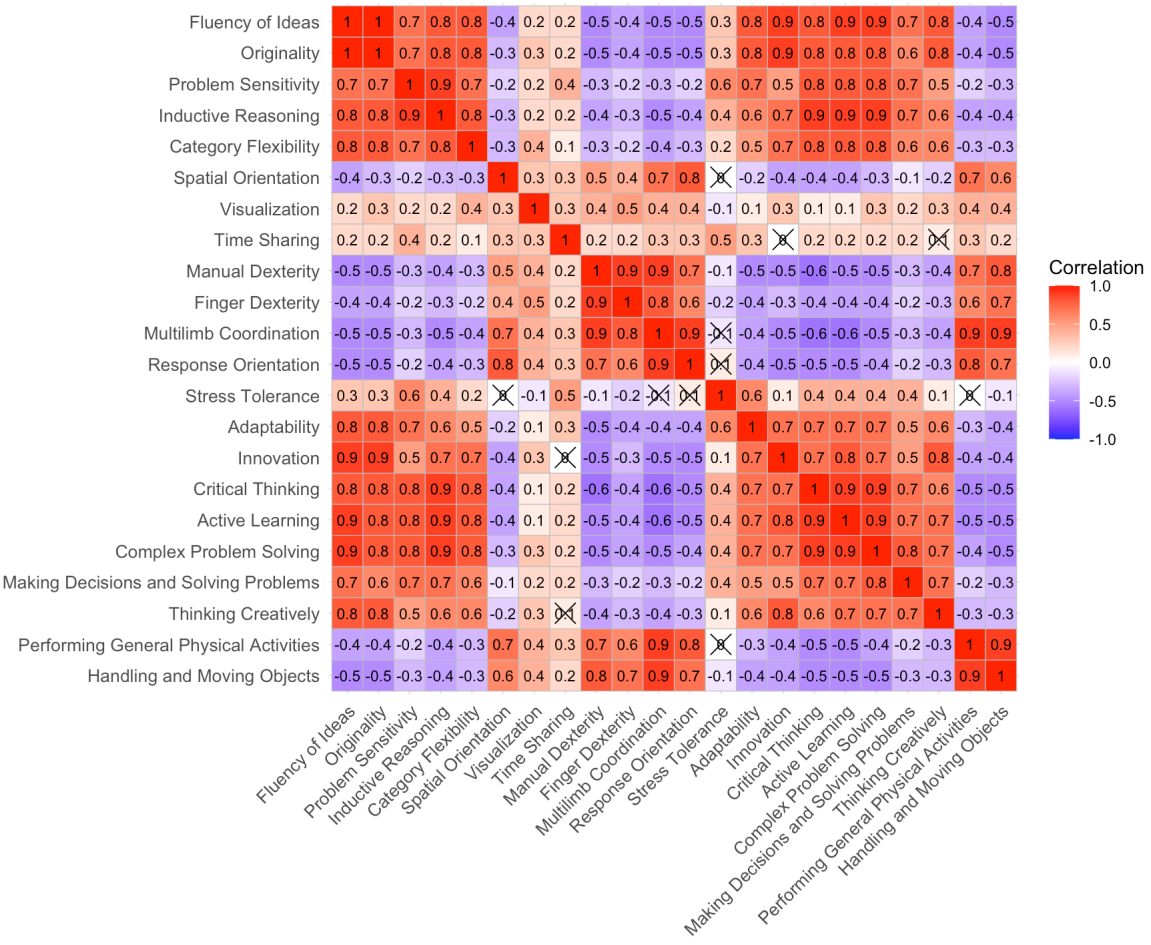

*Figure 5.1 Pairwise comparison matrix of O*NET items across all jobs (n = 894) in the O*NET 30.1 database. Non-significant correlations ($p \geq 0.05$) are marked with an "X."*

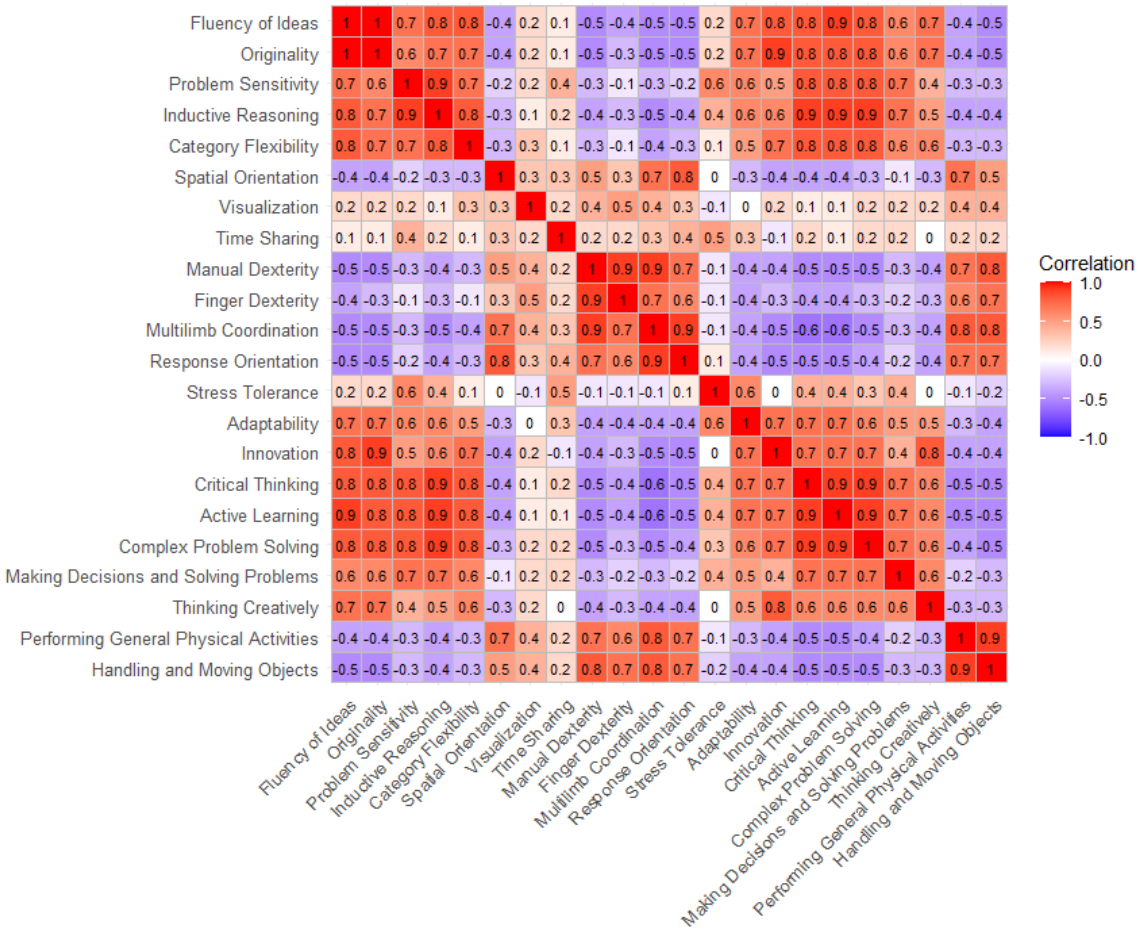

*Figure 5.2 Pairwise comparison matrix of O*NET items following merging of Add Health and O*NET databases (n = 316).All correlations were significant (p < 0.05).*

Each occupation had one value ("Level" or "Impact") for each of the 22 items listed in Table 5.1. Pairwise correlations for O*NET items were also assessed following merging of datasets. Given the high correlations observed between O*NET items, I expected many of the O*NET items of interest to be highly related to one another. However, as the primary goal of this research was to understand specific differences in job characteristics held by individuals with and without an ADHD diagnosis, I did not utilize factor analysis. Thus, selected O*NET items were included as separate outcomes, with the exception of Fluency of Ideas, which was perfectly correlated (r = 1) with Originality in both the full O*NET database and when running the

correlations only in the final merged dataset. Therefore, this variable was re-labeled Fluency of Ideas/Originality and only used once.

Multiple model designs are used to understand how the addition of covariates effect outcome variable coefficients. In a deviation from the second preregistration, models were re-named for clarity. Base models involve only age (measured in years), and ADHD diagnosis (yes/no) predicting O*NET item Level values. Models with individual-level variables ("Base + Individual-level") additionally add sex, education level, census region, and self-reported race. Finally, models with both individual- and family-level variables ("Base + Individual- & Family-level") include all the variables as in the Base + Individual-level model as well as highest parental education level and childhood socioeconomic status as additional covariates. The outcome variables include Level or Impact values for job characteristics and worker abilities and skills obtained from O*NET. All models are multiple linear regressions. Model equations are available in Supplementary Figure C.1. A Bonferroni correction was used to address multiple testing issues. This correction was calculated by dividing 0.05, the desired α, by the number of tests (21), yielding a significance threshold of 0.0024.

5.3 Results

Descriptive statistics of categorical variables are presented in Table 5.2. In the total sample of 7,255 individuals, 274, or 3.8%, of individuals had reported a diagnosis of ADHD (Figure 5.3). The majority of individuals diagnosed with ADHD in the sample were male (68%, n = 187). However, across the full sample, individuals were majority female (55%). About half of the sample had at least completed college and obtained a bachelor's degree or more (50%), however, over half of the sample with a diagnosis of ADHD never obtained a bachelor's degree

(66%), instead many of the individuals diagnosed with ADHD held an associate's or junior college degree (25%) or held a high school diploma or GED (14%), with only 34% of this group having obtained at least a bachelor's degree. In comparison, 33% of the sample of individuals without an ADHD diagnosis completed college or some graduate school, and 17% went on to obtain a master's degree or higher. Most individuals in the sample listed their race/ethnicity as non-Hispanic white (62%), with an even higher portion of the ADHD sample doing so (83%) . 71 of the 274 (26%) individuals who reported an ADHD diagnosis rated their family's financial status as below average, and a similar percentage of individuals without an ADHD diagnosis (27%) also rated their family's financial status as below average. There was a notable difference in educational level attainments between the samples with ADHD and without ADHD: a lower percentage of individuals with ADHD (34%) had completed at least college with a bachelor's degree as compared to individuals without ADHD (51%). This is in line with expectations, as individuals with ADHD are less likely to graduate both high school (Barbaresi et al., 2007) and college (Hechtman et al., 2016; Henning et al., 2022) than their peers. Finally, 47% of individuals with a reported ADHD diagnosis had a parent who had at least completed college, compared to 39% of individuals without an ADHD diagnosis. Figure 5.4 depicts comparisons of each categorical variable parsed by ADHD diagnosis.

Table 5.2 Descriptive statistics for categorical variables (N = 7,255).

	Variable		Count (Percent of total sample)
Individual-level variables	Sex (F)		3,962 (55%)
	Education Level	8th grade or less	4 (<0.1%)
		Some high school	109 (1.5%)
		Obtained high school diploma	577 (8.0%)
		Completed a GED	166 (2.3%)
		Some vocational or technical training	145 (2.0%)
		Some community college	568 (7.8%)
		Completed vocational or technical training	372 (5.1%)
		Associate or junior college degree	988 (14%)
		Some college	698 (9.6%)
		Completed college (bachelor's degree)	2,077 (29%)
		Some graduate school	317 (4.4%)
		Completed master's degree	747 (10%)
		Some graduate training beyond Master's	71 (1.0%)
		Completed a doctoral degree	96 (1.3%)
		Some post baccalaureate professional education	70 (1.0%)
		Completed post baccalaureate professional degree	250 (3.4%)
	Census Region	South	2,840 (39%)
		Midwest	1,811 (25%)
		West	1,759 (24%)
		Northeast	845 (12%)
	Self-reported Race/Ethnicity	Non-Hispanic white	4,515 (62%)
		Non-Hispanic black	1,171 (16%)
		Hispanic	1,029 (14%)
		Asian	483 (6.7%)
		Native American	19 (0.3%)
		Other	38 (0.5%)
Family-level variables	Highest Parental Education Level	8th grade or less	189 (2.6%)
		More than 8th grade, but did not graduate high school	380 (5.2%)
		Went to a business, trade, or vocational school instead of high school	32 (0.4%)
		High school graduate	1,570 (22%)
		Completed a GED	287 (4.0%)
		Went to a business, trade, or vocational school after high school	488 (6.7%)
		Some college	1,077 (15%)
		Graduated from college	1,777 (24%)
		Professional training beyond college	1,088 (15%)
		Never went to school	367 (5.1%)
	Family Financial Status	A lot better off	417 (5.7%)
		Somewhat better off	1,371 (19%)
		Same as average	3,514 (48%)
		Somewhat worse off	1,588 (22%)
		A lot worse off	365 (5.0%)

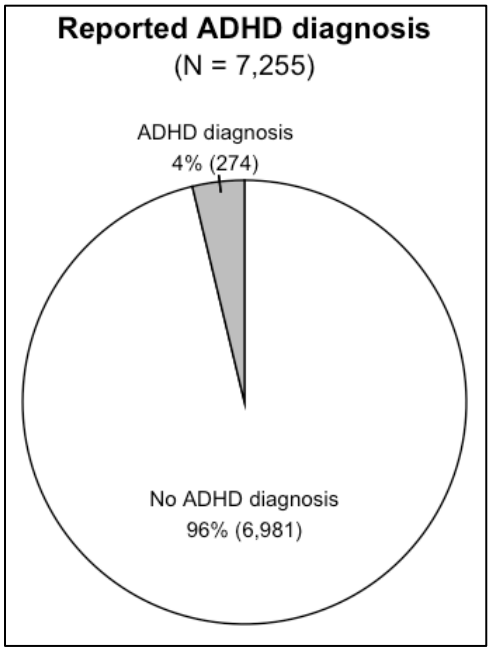

Figure 5.3 Pie chart depicting percentage of reported ADHD diagnosis. Counts are in parentheses.

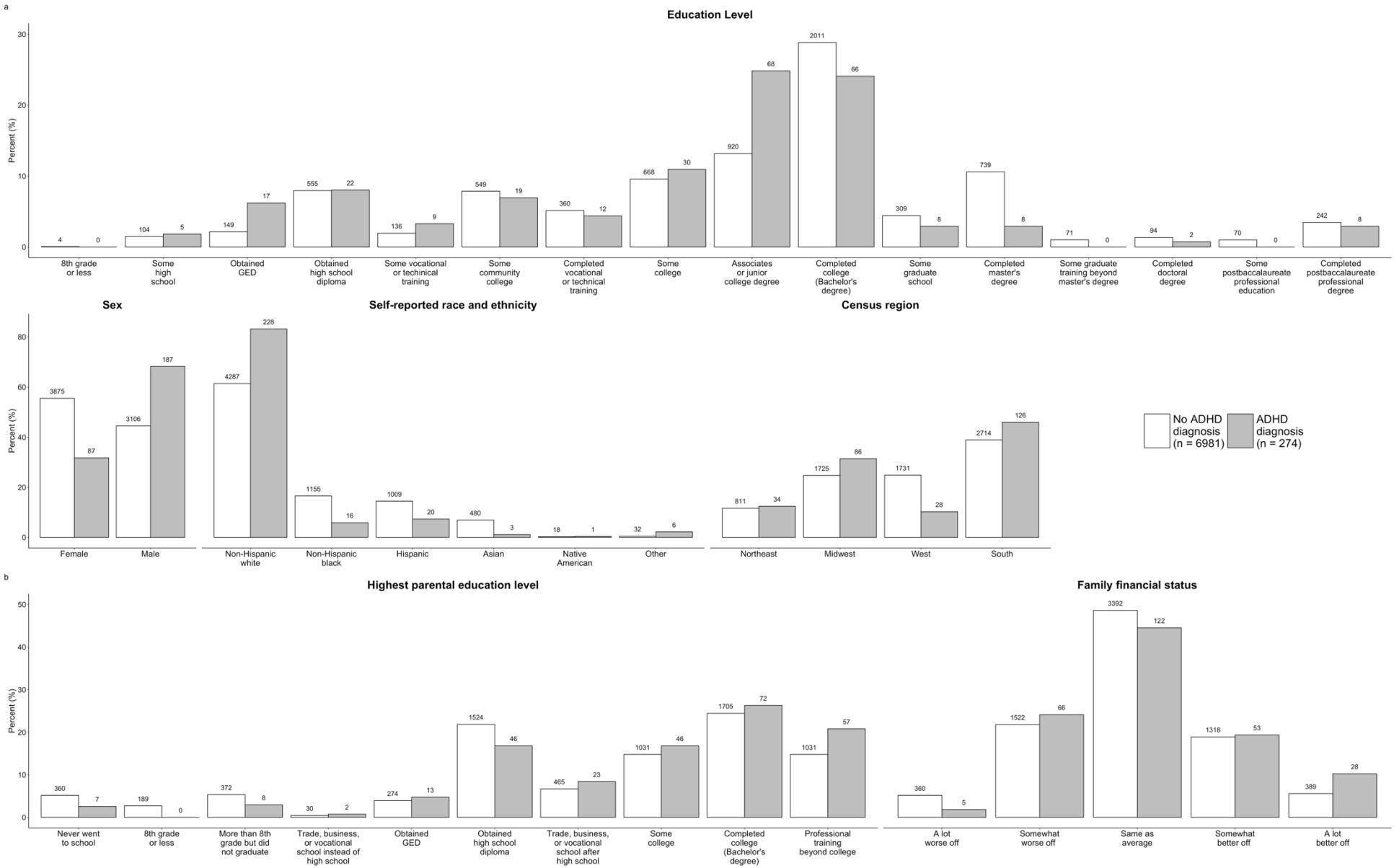

Figure 5.4 Descriptive statistics for categorical variables parsed by ADHD diagnosis. Y-axes are percentages and count data is available for (a) education level, sex, self-reported race and ethnicity, and census region, as well as for (b) highest parental education level and family financial status.

Descriptive statistics for continuous variables for the total sample are presented in Table 5.3, and mean values for continuous variables parsed by ADHD diagnosis can be seen in Figure 5.5. Mean ages for all individuals in the full sample as well as for individuals with and without an ADHD diagnosis was 37.4 years. The youngest individuals in the sample were 33 years old, while the oldest were 43 years old. Means for most O*NET items tend to be slightly lower for the sample of individuals diagnosed with ADHD as compared to the sample without an ADHD diagnosis. Exceptions to this included O*NET items such as Spatial Orientation, Visualization, Innovation, Complex Problem Solving, and Handling & Moving Objects, wherein the means for individuals diagnosed with ADHD were slightly higher or equal to the means for individuals without an ADHD diagnosis.

Table 5.3 Descriptive statistics for continuous variables (N = 7,255).

	Variable	Mean	(SD)
Age (years)		37.4	(1.86)
Age at ADHD diagnosis (years)[1]		13.7	(7.18)
O*NET items	Originality	3.08	(0.62)
	Problem Sensitivity	3.88	(0.65)
	Inductive Reasoning	3.71	(0.63)
	Category Flexibility	3.33	(0.45)
	Spatial Orientation	0.49	(0.73)
	Visualization	2.67	(0.59)
	Time Sharing	2.58	(0.38)
	Manual Dexterity	1.62	(1.15)
	Finger Dexterity	2.07	(0.89)
	Multilimb Coordination	1.37	(1.23)
	Response Orientation	0.91	(1.00)
	Stress Tolerance[2]	1.81	(0.63)
	Adaptability[2]	1.57	(0.62)
	Innovation[2]	0.91	(0.82)
	Critical Thinking	3.81	(0.53)
	Active Learning	3.52	(0.65)
	Complex Problem Solving	3.37	(0.60)
	Making Decisions & Solving Problems	4.69	(0.88)
	Thinking Creatively	3.96	(0.89)
	Performing General Physical Activities	2.56	(1.36)
	Handling & Moving Objects	2.97	(1.50)

N = 7,255. SD = standard deviation. Ranges for O*NET items are 0 to 7, unless otherwise specified. [1]N = 274. [2]Range of item value is -3 to 3.

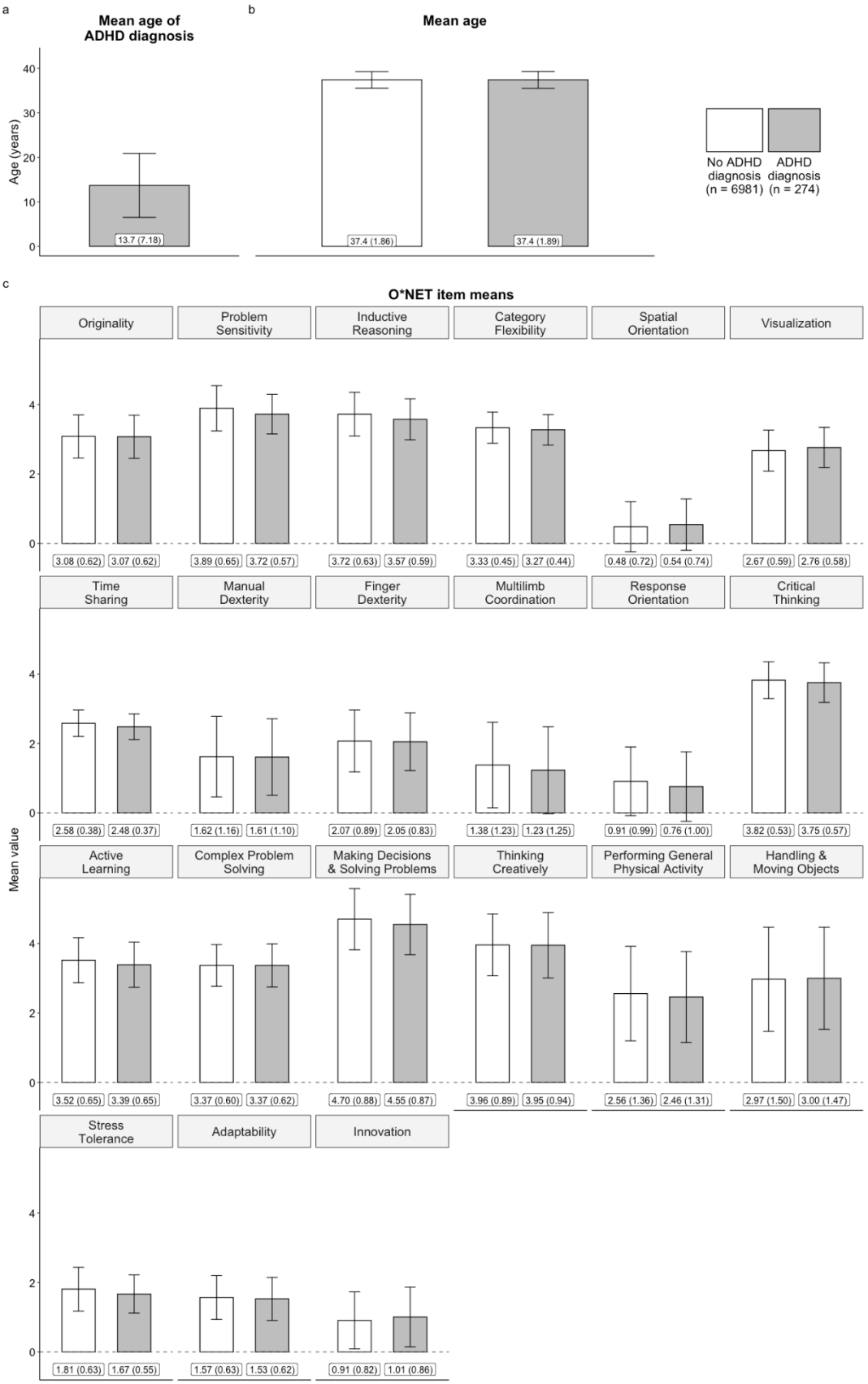

*Figure 5.5 Means and standard deviations for continuous variables for groups with and without an ADHD diagnosis. Means and standard deviations (error bars) are present for age at ADHD diagnosis (a), age (b), and O*NET items (c) on bar plots.*

ADHD diagnosis was largely associated with mean lower values for O*NET items Time Sharing, Active Learning, Inductive Reasoning, Problem Sensitivity, and Stress Tolerance, signifying that individuals with ADHD were less likely to perceive these skills as important to job performance than people without ADHD (Table 5.4). Notably, O*NET items such as Adaptability, Complex Problem Solving, and Critical Thinking were not significant in any model, contrary to expectations. ADHD diagnosis was significantly negatively associated ($p < 0.0024$) with Time Sharing, Stress Tolerance, and Problem Sensitivity values across all three model designs. Figure 5.6 displays combined violin and box plots for O*NET items Innovation and Visualization as well as all O*NET items for which a Bonferroni corrected significant negative association with ADHD diagnosis was observed. Base, Base + Individual-level, and Base + Individual- & Family-level model results for O*NET items Innovation, Visualization, Time Sharing, Performing General Physical Activity, Active Learning, Inductive Reasoning, Stress Tolerance, Multilimb Coordination, Response Orientation, and Problem Sensitivity are available in Appendix C (Supplementary Tables C.1–C.10).

*Table 5.4 Model estimates for ADHD diagnosis predicting values of O*NET items of interest.*

Model:	**Base**		**Base + Individual-level**		**Base + Individual- & Family-level**	
	Estimate	p-value	Estimate	p-value	Estimate	p-value
Innovation[1]	*0.100*	*0.047*	0.090	0.059	0.078	0.104
Visualization	*0.090*	*0.013*	0.008	0.826	0.006	0.865
Spatial Orientation	0.060	0.179	-0.065	0.122	-0.062	0.143
Handling & Moving Objects	0.028	0.759	*-0.178*	*0.047*	-0.158	0.078
Complex Problem Solving[1]	0.000	0.997	0.025	0.471	0.016	0.633
Thinking Creatively[1]	-0.003	0.957	0.002	0.971	-0.005	0.923
Originality[1]	-0.016	0.678	0.005	0.884	-0.005	0.898
Manual Dexterity	-0.018	0.799	*-0.157*	*0.023*	*-0.141*	*0.042*
Finger Dexterity	-0.021	0.700	*-0.108*	*0.045*	-0.098	0.070
Adaptability[1]	-0.038	0.320	-0.026	0.471	-0.030	0.409
Category Flexibility	*-0.059*	*0.030*	-0.033	0.188	-0.033	0.185
Critical Thinking	-0.063	0.053	-0.019	0.528	-0.026	0.374
Time Sharing	**-0.097**	**<0.001**	**-0.100**	**<0.001**	**-0.099**	**<0.001**
Performing General Physical Activity	-0.104	0.213	**-0.264**	**0.001**	**-0.250**	**0.002**
Active Learning	**-0.135**	**<0.001**	*-0.080*	*0.026*	*-0.084*	*0.019*
Inductive Reasoning	**-0.145**	**<0.001**	*-0.096*	*0.005*	*-0.099*	*0.004*
Stress Tolerance	**-0.146**	**<0.001**	**-0.120**	**0.001**	**-0.123**	**0.001**
Multilimb Coordination	-0.147	0.054	**-0.288**	**<0.001**	**-0.275**	**<0.001**
Making Decisions & Solving Problems	*-0.153*	*0.004*	-0.097	0.051	*-0.110*	*0.028*
Response Orientation	*-0.155*	*0.011*	**-0.278**	**<0.001**	**-0.267**	**<0.001**
Problem Sensitivity	**-0.175**	**<0.001**	**-0.135**	**<0.001**	**-0.135**	**<0.001**

Bonferroni corrected statistically significant ($p < 0.0024$) estimates are highlighted in dark grey and bolded. Estimates with p-values < 0.05 are italicized and in light grey. [1]O*NET item expected to be most strongly positively associated with ADHD diagnosis. Variables organized in descending order based on estimate in Base model.

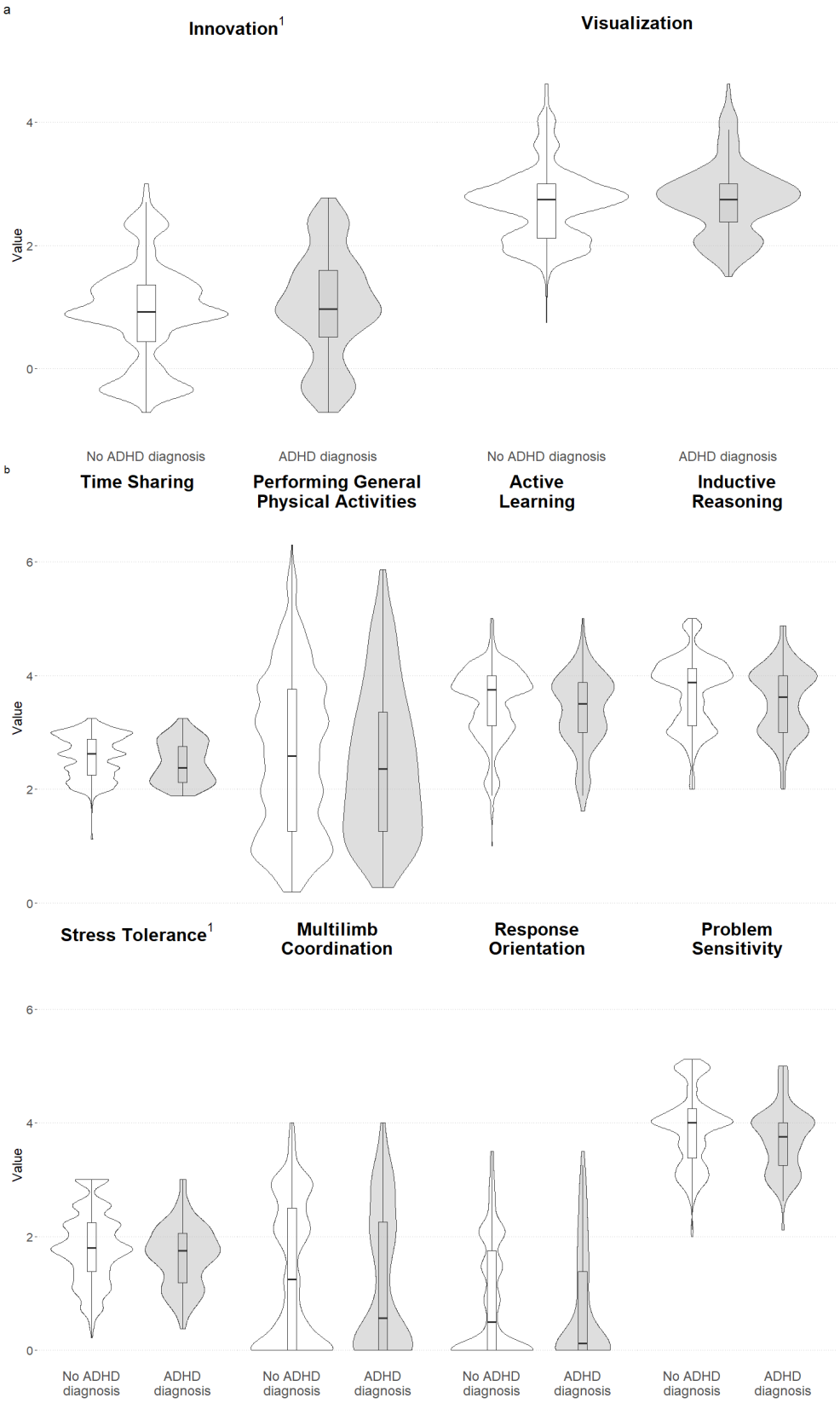

*Figure 5.6 Violin plots depicting kernel density estimates with box plots for Bonferroni-significant ($p < 0.0024$) O*NET items. Individuals who reported an ADHD diagnosis are in grey, and individuals without an ADHD diagnosis are in white.*

When comparing between model designs for estimates of the effect of ADHD diagnosis on O*NET item values, while most items generally showed decreasing estimates and increasing p-values when additional covariates were added, other O*NET items showed the opposite effect, wherein p-values decreased and beta coefficients increased in either one model or across both models. Performing General Physical Activity, which had a non-significant beta coefficient of -0.104 in the Base model, which doubled and reached nominal significance in the Base + Individual-level (-0.264; $p = 0.001$) and Base + Individual- & Family-level models (-0.250; $p = 0.002$). Additionally, Multilimb Coordination, which was non-significant in the Base model (-0.147; $p = 0.054$), became significant and saw a near doubling of its beta coefficient in the Base + Individual-level model (-0.288; $p < 0.001$), but a slight decrease in its beta coefficient in the Base + Individual- & Family-level model (-0.275; $p < 0.001$). Similarly, Response Orientation, which was not significant with a Bonferroni correction in the Base model (-0.155; $p = 0.011$), also became significant and saw a near doubling of its beta coefficient (-0.278, $p < 0.001$) in the Base + Individual-level model, then a slight decrease in the beta coefficient in the Base + Individual- & Family-level model (-0.267; $p < 0.001$). Visual representations of beta coefficients with 95% confidence intervals are shown as forest plots in Figure 5.7. Notably, this figure shows that many of the beta coefficients remain similar across models, or become more negative, with only Complex Problem Solving becoming slightly more positive in subsequent models.

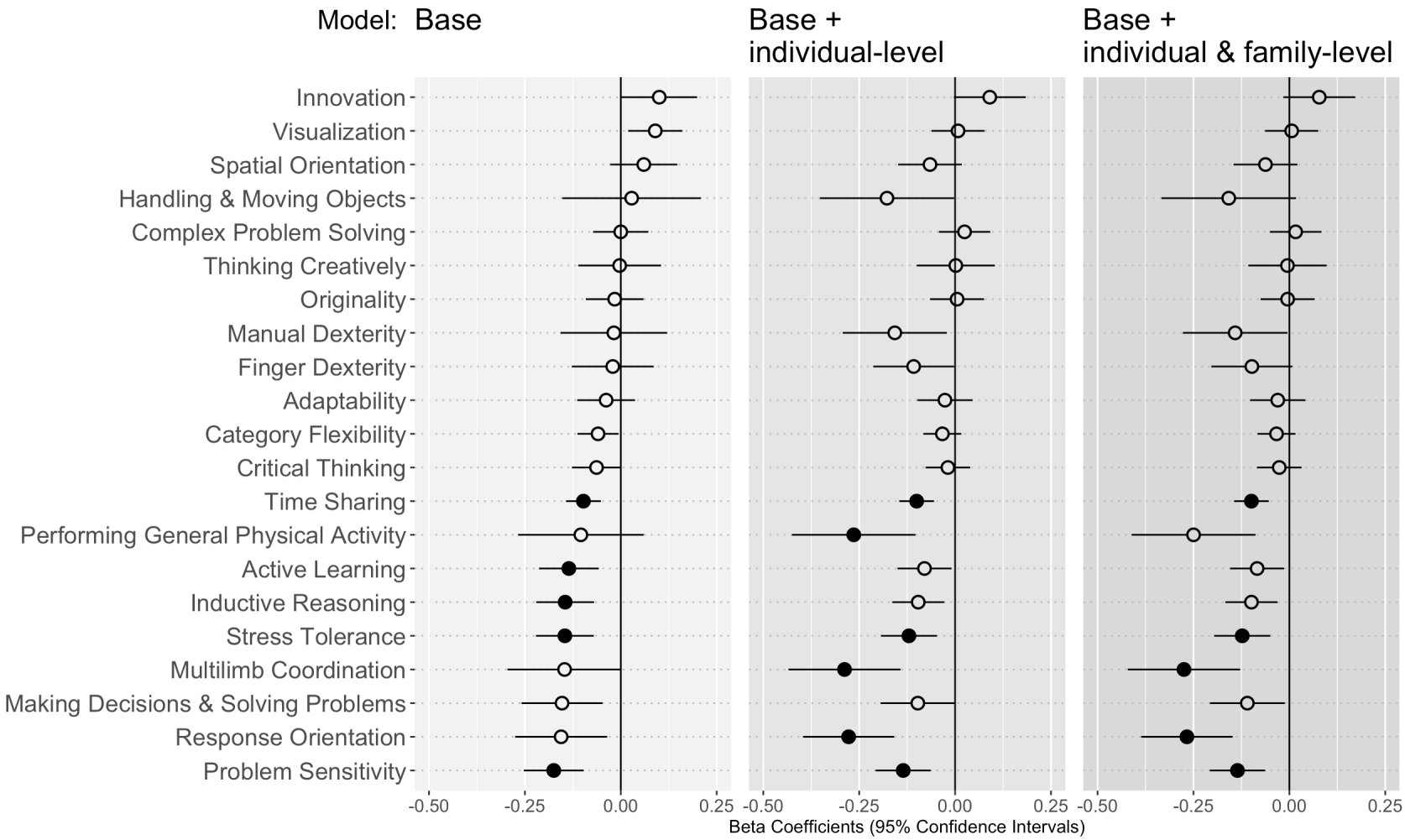

*Figure 5.7 Forest plots of all model estimates with 95% confidence intervals (error bars). O*NET items are listed on the left and in descending order of beta coefficient value from the Base model. Bonferroni-significant beta coefficients ($p < 0.0024$) are designated by filled in dots.*

Interestingly, ADHD diagnosis was significantly associated with a moderate increase in Levels for two O*NET items, Innovation (0.100; p = 0.047) and Visualization (0.090; p = 0.013), but only in the Base model. This finding did not reach significance when the Bonferroni correction was applied. Innovation is defined as requiring "creativity and alternative thinking to develop new ideas for and answers to work-related problems," while Visualization is defined as "the ability to imagine how something will look after it is moved around or when its parts are moved or rearranged." Visualization of Impact of Level values for these two O*NET items shows little difference between the group diagnosed with ADHD and the group without ADHD (Figure 5.6a). However, a slight difference is observable between groups for Innovation, with the ADHD-diagnosed group having a slightly higher median Impact value and a wider distribution above the median than the group without ADHD. In contrast, the distributions for Visualization appear relatively similar.

Other than Innovation, no other O*NET item that was initially predicted to be strongly positively associated with ADHD diagnosis (Complex Problem Solving, Thinking Creatively, Adaptability) was observed to be (Figure 5.8). Although none of these items showed significant negative associations with ADHD diagnosis, all four had estimates very close to zero and high p-values (Table 5.4).

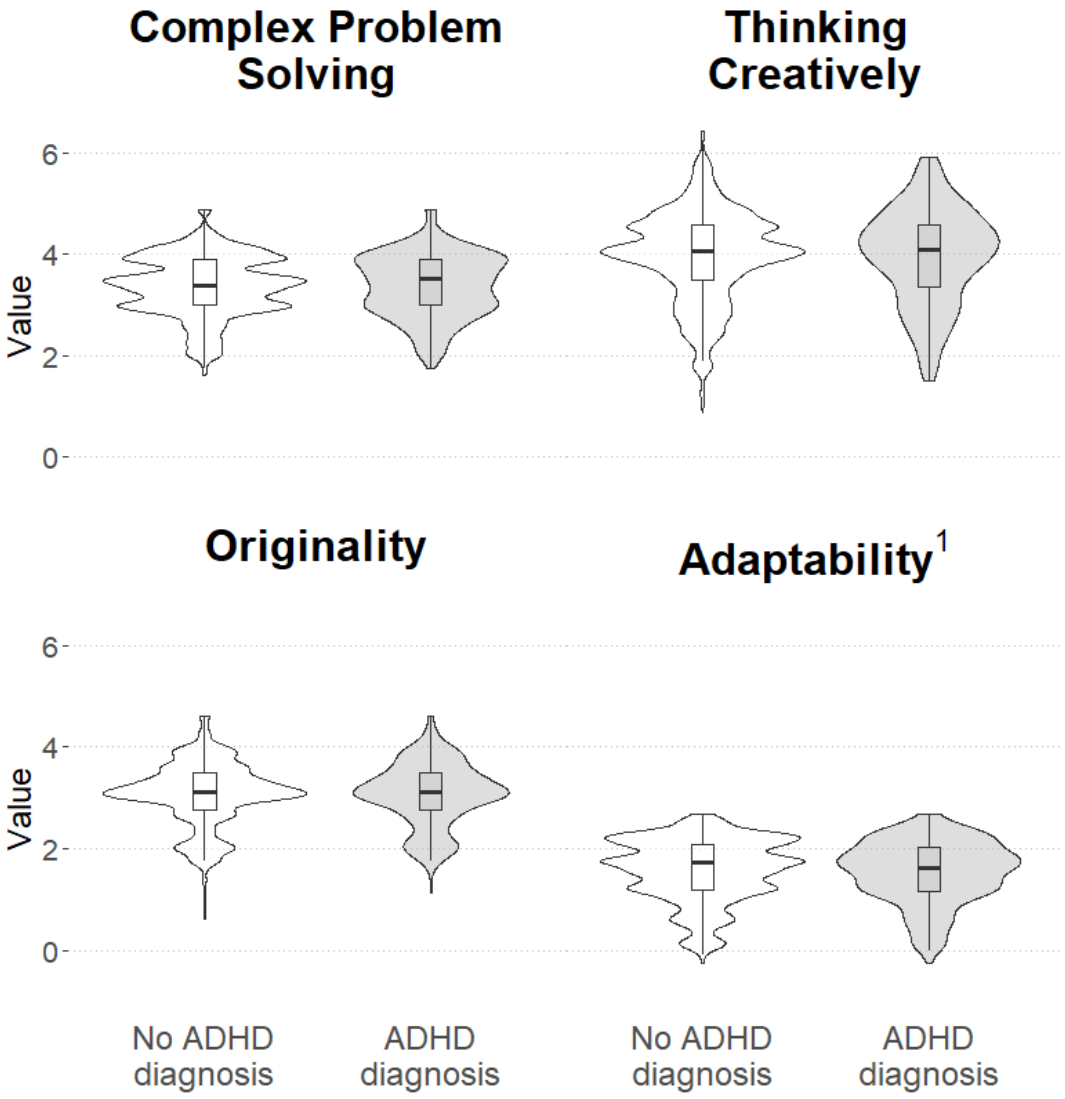

*Figure 5.8 Violin plots depicting kernel density estimates overlayed with box plots for four O*NET items. Individuals who reported an ADHD diagnosis are in grey, and individuals without an ADHD diagnosis are in white.*

For Innovation, an increase of 0.100 corresponded to a 0.12 increase in standard deviations. The increase for Visualization was similar, with the increase of 0.090 corresponding to an increase of 0.15 standard deviations. Thus, in this sample, individuals with ADHD were more likely to hold jobs wherein these two skills were considered more necessary. However, it is

notable that this association did not retain significance following the addition of other individual-level and family-level covariates.

In the Base + Individual-level model (Supplementary Table C.1) for Innovation, being male and having completed a master's degree and a doctoral degree were significantly associated with an increase in Impact value: being male corresponded with a standard deviation 0.25 increase in Impact value (0.207; $p < 0.001$), while completion of a master's degree was associated with an increase of 0.19 standard deviations (0.154; $p < 0.001$), and completion of a doctoral degree was associated with an increase of 0.33 standard deviations (0.269; $p = 0.001$). Across both the Base + Individual-level and Base + Individual- & Family-level models for Innovation, education levels below completion of a master's degree generally were significantly associated with lower Impact values. Additionally, residing in the West census region was also significantly associated with a minor decrease in Impact value in both the Base + Individual-level (-0.078; $p = 0.001$) and Base + Individual- & Family-level models (-0.088; $p < 0.001$). Self-reported racial and ethnicity categories of Hispanic and non-Hispanic black were significantly associated with slight decreases Impact values, with estimates being -0.097 ($p < 0.001$) and -0.162 ($p < 0.001$), respectively. This association likely reflects known patterns of racial and ethnic discrimination in the availability and accessibility of certain job types, and does not suggest any differences in the ability to innovate (Brown & Lent, 2020; Fryer et al., 2013). Also negatively associated with Innovation Impact value was if either parents' highest education level was graduating high school (-0.089; $p = 0.001$). Intriguingly, a reported family financial status of "a lot worse off" was also significantly associated with an increase of 0.131 ($p = 0.002$) in Impact value for Innovation, corresponding to an increase of 0.16 standard deviations.

For the O*NET item Visualization, significant predictors of increased Level value across both Base + Individual-level and Base + Individual- & Family-level models included being male and completion of vocational or technical training (Supplementary Table C.2). Being male was associated with an increase of 0.287—nearly half a standard deviation (0.49 SD; $p < 0.001$)—in the Base + Individual-level model, and an increase of 0.48 standard deviations (0.281; $p < 0.001$) in the Base + Individual- & Family-level model. Completion of vocational or technical training was associated with a comparatively much smaller increase Level value in both models: 0.097, or 0.16 standard deviations ($p = 0.002$), and 0.110, or 0.19 standard deviations ($p = 0.001$), respectively. Negatively associated with Visualization Level values were most educational levels, although many were not significant. Notably, completion of some college (-0.163; $p < 0.001$) and some community college (-0.189; $p < 0.001$) were significantly associated with lower Level values compared to the outgroup (completed college). Finally, the self-reported racial and ethnicity categories of Hispanic (-0.068; $p = 0.001$) and non-Hispanic black (-0.063; $p = 0.001$) were significantly associated with slight decreases (compared to out group of non-Hispanic white) in Level values for Visualization in the Base + Individual-level model. As stated previously, this likely reflects racial disparities in job availability accessibility, rather than being indicative of differences in skills or ability (Brown & Lent, 2020; Fryer et al., 2013).

For most O*NET items, an education level below a completed bachelor's degree was typically associated with a decrease in O*NET item Level or Impact values, while most education levels post college, including the completion of a master's or doctoral degree or post baccalaureate professional training were positively associated with slight increases in O*NET item values (Table 5.5). For example, this is observable in the models for the O*NET item Problem Sensitivity, defined as "the ability to tell when something is wrong or is likely to go

wrong." Here, having not completed college or having completed only vocational or technical training was significantly associated with decreased Level values in both Base + Individual-level and Base + Individual- & Family-level models (Supplementary Table C.10). However, having completed some post baccalaureate professional education was significantly associated with an increase of 0.74 standard deviations in Level value in the Base + Individual-level model (0.478; $p < 0.001$) and an increase of 0.73 standard deviations in Level value in the Base + Individual- & Family-level model (0.472; $p < 0.001$). This pattern did not hold for all O*NET items—particularly those involving physical movement. For example, the O*NET item Performing General Physical Activity is defined as "doing activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling materials," For this item, having an education level between some high school and an associate or junior college degree was significantly positively associated (with the exception of the category "some community college") with a higher value for the item in both the Base + Individual-level and Base + Individual- & Family-level models (Supplementary Table C.4). Conversely, having completed a master's degree was significantly associated with a decrease of 0.16 standard deviations in Level value (-0.218; $p < 0.001$).

*Table 5.5 Significant beta estimates for highest education levels predicting values of all O*NET items.*

	Innovation	Visualization	Spatial Orientation	Handling & Moving Objects	Complex Problem Solving	Thinking Creatively	Originality	Manual Dexterity	Finger Dexterity	Adaptability	Category Flexibility	Critical Thinking	Time Sharing	Performing General Physical Activities	Active Learning	Inductive Reasoning	Stress Tolerance	Multilimb Coordination	Making Decisions & Solving Problems	Response Orientation	Problem Sensitivity
8th grade or less	-1.4				-1.4	-2.1	-1.3			-0.9	-0.8	-1.5			-1.5	-1.5			-2.2		-1.2
	-1.3				-1.4	-2.0	-1.3			-0.9	-0.8	-1.5			-1.5	-1.5			-2.2		-1.2
Some high school	-0.7		0.6	1.5	-0.7	-0.9	-0.7	1.0	0.5	-0.6	-0.6	-0.7		1.0	-0.9	-0.9	-0.4	1.0	-1.1	0.5	-0.7
	-0.7		0.6	1.5	-0.7	-0.9	-0.6	1.0	0.5	-0.6	-0.6	-0.7		1.0	-0.9	-0.9	-0.4	1.0	-1.1	0.5	-0.7
Completed a GED	-0.7		0.4	1.0	-0.6	-0.7	-0.6	0.7	0.4	-0.6	-0.5	-0.6	-0.1	0.7	-0.8	-0.7	-0.4	0.7	-0.9	0.4	-0.7
	-0.7		0.4	1.0	-0.6	-0.7	-0.6	0.7	0.4	-0.6	-0.4	-0.6	-0.1	0.7	-0.8	-0.7	-0.4	0.7	-0.9	0.4	-0.7
Obtained high school diploma	-0.6		0.5	1.0	-0.5	-0.7	-0.5	0.6	0.4	-0.5	-0.4	-0.5		0.7	-0.7	-0.6	-0.3	0.7	-0.8	0.4	-0.6
	-0.6		0.5	1.0	-0.5	-0.7	-0.5	0.6	0.4	-0.5	-0.4	-0.5		0.7	-0.6	-0.6	-0.3	0.7	-0.8	0.3	-0.6
Some vocational/ technical training	-0.5		0.4	1.1	-0.5	-0.6	-0.4	0.8	0.5	-0.4	-0.3	-0.4		0.8	-0.6	-0.6	-0.3	0.8	-0.6	0.4	-0.5
	-0.5		0.4	1.1	-0.5	-0.5	-0.4	0.8	0.5	-0.4	-0.3	-0.4		0.8	-0.6	-0.6	-0.3	0.8	-0.6	0.4	-0.5
Some community college	-0.5	-0.2	0.2	0.4	-0.4	-0.6	-0.4	0.3	0.1	-0.4	-0.3	-0.3	-0.1		-0.5	-0.5	-0.3	0.2	-0.6		-0.5
	-0.5	-0.2	0.2	0.4	-0.4	-0.6	-0.4	0.3		-0.4	-0.3	-0.3	-0.1		-0.5	-0.5	-0.3		-0.6		-0.5
Completed vocational/ technical training	-0.4	0.1	0.3	0.9	-0.4	-0.4	-0.3	0.7	0.5	-0.3	-0.3	-0.4		0.7	-0.5	-0.5	-0.2	0.6	-0.5	0.2	-0.4
	-0.3	0.1	0.3	0.9	-0.4	-0.4	-0.3	0.7	0.5	-0.3	-0.3	-0.3		0.7	-0.5	-0.5	-0.2	0.6	-0.5	0.2	-0.4
Some college	-0.4	-0.2	0.2	0.3	-0.3	-0.5	-0.3	0.2		-0.3	-0.3	-0.3	-0.1		-0.4	-0.4	-0.2	0.2	-0.5		-0.4
	-0.4	-0.2	0.2	0.3	-0.3	-0.5	-0.3	0.2		-0.3	-0.3	-0.3	-0.1		-0.4	-0.4	-0.2	0.2	-0.5		-0.4
Associate or junior college degree	-0.1		0.1	0.6	-0.2	-0.2	-0.2	0.5	0.3			-0.1	0.1	0.5	-0.1	-0.1	-0.1	0.4	-0.1	0.4	
	-0.1		0.1	0.6	-0.1	-0.1	-0.2	0.5	0.3			-0.1	0.1	0.4	-0.1	-0.1	-0.1	0.4	-0.1	0.3	
Some graduate school	-0.2																			0.2	
	-0.2																			0.2	
Completed master's degree	0.2			-0.3	0.1	0.2	0.2	-0.3	-0.2			0.1		-0.2			-0.1	-0.2		-0.2	
	0.1			-0.3	0.1	0.2	0.2	-0.2	-0.2			0.1		-0.2			-0.1	-0.2		-0.2	
Some graduate training beyond master's degree			-0.2						-0.4							0.2					
			-0.1						-0.3							0.2					
Completed doctoral degree	0.3				0.2						0.2	0.2				0.3	-0.2				
											0.2	0.2				0.3	-0.2				
Some postbaccalaureate professional education										0.3	0.2	0.2	0.2	0.5	0.3	0.3	0.6	0.5	0.5	0.5	0.5
				0.6					0.3	0.3	0.2	0.2	0.2	0.6	0.3	0.3	0.6	0.5	0.5	0.6	0.5
Completed postbaccalaureate professional degree					0.2		0.2				0.3	0.4	0.2		0.3	0.3	0.3		0.5		0.3
					0.2		0.2				0.3	0.3	0.2		0.3	0.3	0.3		0.5		0.3

Variables (other than ADHD diagnosis) that were not significant ($p \geq 0.0024$) in any model for any O*NET item were excluded. First value is Base + Individual-level model estimate; second value in grey is Base + Individual- & Family-level model estimate. Beta estimates are reported to the first decimal only. Reference category was "completed college."

Individual-level covariates included in the Base + Individual-level and Base + Individual- & Family-level models were also associated with O*NET item values in various ways. Age was not significantly associated with any changes in Level or Impact values for any O*NET items. Being male was observed to be significantly associated with increases in Level or Impact values in both models for 12 O*NET items, and with decreases in Level or Impact values for two items, Time Sharing and Stress Tolerance (Table 5.6). A self-reported race and ethnicity of non-Hispanic black was significantly associated with lower Level or Impact values in one or both models for 14 O*NET items, and a self-reported race and ethnicity of Hispanic was significantly associated with decreases in Level or Impact values for four items, but only in the Base + Individual-level models (Table 5.6). A self-reported race and ethnicity that fell under "Other" was significantly associated with Level value for only one item, Category Flexibility, where it was associated with a decrease of 0.2 in Level value ($p < 0.001$) in both the Base + Individual-level and Base + Individual- & Family-level models (Table 5.6). Some regions were also significantly associated with O*NET item Level or Impact values for various O*NET items. Being located in the Northeast region associated with decreases in Level or Impact values for 10 items in one or both models. Being located in the Midwest was negatively associated with Level values for six items in one or both models (Table 5.6), but positively associated Level values for Performing General Physical Activities in the Base + Individual-level model (0.1; $p = 0.002$) and for Multilimb Coordination in the Base + Individual-level model (0.1; $p = 0.002$) and in the Base + Individual- & Family-level model (0.1; $p = 0.002$).

*Table 5.6 Significant beta estimates for individual-level covariates predicting O*NET item values.*

		Innovation	Visualization	Spatial Orientation	Handling & Moving Objects	Complex Problem Solving	Thinking Creatively	Originality	Manual Dexterity	Adaptability	Category Flexibility	Critical Thinking	Time Sharing	Performing General Physical Activity	Active Learning	Inductive Reasoning	Stress Tolerance	Multilimb Coordination	Making Decisions & Solving Problems	Response Orientation	Problem Sensitivity
Sex (Female)		0.2	0.3	0.4	0.2	0.1	0.2	0.1			0.04	0.1	-0.03	0.1			-0.1		0.1	0.2	
		0.2	0.3	0.4	0.2	0.1	0.2	0.1			0.04	0.1	-0.03	0.2			-0.1		0.1	0.2	
Region	Northeast								-0.1	-0.1	-0.1		-0.1	-0.2	-0.1	-0.1			-0.1	-0.1	-0.1
										-0.1	-0.1		-0.1	-0.2	-0.1	-0.1			-0.1	-0.1	-0.1
	Midwest				0.1						-0.04	-0.1		0.1	-0.1	-0.1		0.1			
											-0.04	-0.1			-0.1	-0.1		0.1			
	West	-0.1																			
		-0.1																			
Self-reported race/ethnicity	Non-Hispanic black	-0.2	-0.1			-0.1	-0.1	-0.1		-0.1	-0.1	-0.1	-0.04		-0.1	-0.1	-0.1		-0.1		-0.1
		-0.2				-0.1	-0.1	-0.1		-0.1	-0.1	-0.1			-0.1	-0.1			-0.1		-0.1
	Hispanic	-0.1	-0.1											-0.2				-0.2			
	Other										-0.2										
											-0.2										

Variables (other than ADHD diagnosis) that were not significant ($p \geq 0.0024$) in any model for any O*NET item were excluded. O*NET items where included individual-level variables were not significant were also excluded. First value is Base + Individual-level model estimate; second value in grey is Base + Individual- & Family-level model estimate. Beta estimates are reported to the first decimal only unless value was too close to 0. Reference categories were female (sex), South (Census region), and non-Hispanic white (self-reported race/ethnicity).

Family-level covariates, including family financial status and highest parental education level, were rarely associated with O*NET item values: family financial status was significantly associated with values of only five O*NET items, and highest parental education level was associated with values for only three O*NET items (Table 5.7). Having parents whose highest education level was that of a high school graduate was significantly associated with a slight decrease in Impact value for Innovation (-0.1; $p = 0.001$), and with slight decreases in Level values for Complex Problem Solving (-0.1; $p < 0.001$) and Originality (-0.1; $p < 0.001$). Conversely, having a parent who attained professional training beyond college led to a slight increase in Level value for Originality (0.1; $p = 0.002$). Supplementary Figure C.2 shows violin and box plots for each parental education level for these O*NET items.

*Table 5.7 Significant beta estimates for family-level covariates predicting O*NET item values.*

		Innovation	Visualization	Complex Problem Solving	Thinking Creatively	Originality
Highest Parental Education Level	High school graduate	-0.1		-0.1		-0.1
	Professional training beyond college					0.1
Family financial status	A lot better off		-0.1			
	A lot worse off	0.1		0.1	0.2	0.1

Variables (other than ADHD diagnosis) that were not significant ($p \geq 0.0024$) in any model for any O*NET item were excluded. O*NET items where family-level variables were not significant were also excluded. Reference categories were "completed college" (highest parental education level) and "same as average" (family financial status).

Interestingly, having a family financial status of "a lot worse off" was associated with increases in Impact or Level values for Innovation (0.1; $p = 0.002$). Additionally, this relationship

was also observed for O*NET items Complex Problem Solving (0.1; $p < 0.001$), Originality (0.1; $p = 0.002$), and Thinking Creatively (0.2; $p < 0.001$), while a family financial status of "a lot better off" was associated with a slight decrease in Level value for Visualization (-0.1; $p = 0.001$). Supplementary Figure C.3 shows violin and box plots of family financial status categories for Innovation, Originality, Thinking Creatively, and Visualization.

There was some variation in the jobs held by individuals in Add Health, with 316 independent job titles across the 7,255 individuals in the sample. The most common occupations across the full sample were Loss Prevention Managers and Regulatory Affairs Managers, with 302 individuals employed for each, followed by various nursing occupations, including Acute Care Nurses, Advanced Practice Psychiatric Nurses, Clinical Nurse Specialists, Critical Care Nurses, and Registered Nurses, all of which had 227 individuals employed in each. Out of the 274 individuals in the sample diagnosed with ADHD, the most common occupation was First-Line Supervisors of Retail Sales Workers, with 10 ADHD-diagnosed individuals falling into this category. Comparatively, the most common occupations for individuals without ADHD were: Loss Prevention Managers (n = 296) and Regulatory Affairs Managers (n = 296), followed by the nursing occupations. Values for the five O*NET items predicted to be most associated with ADHD (Innovation, Originality, Adaptability, Complex Problem Solving, and Thinking Creatively) plus Visualization for the most common jobs for individuals with and without an ADHD diagnosis are presented in Table 5.8. Job descriptions and Standard Occupation Classification (SOC) system Major Group categories for each occupation are available in Supplementary Table C.11.

Table 5.8 Most common jobs for individuals with and without an ADHD diagnosis.

	Percent (Count)		Innovation	Originality	Adaptability	Complex Problem Solving	Thinking Creatively	Visualization
	ADHD	No ADHD						
O*NET-SOC Job Title	n = 274	n = 6,981	*[-0.7–3.0]*	*[0.6–4.6]*	*[-0.3–2.7]*	*[1.6–4.9]*	*[0.9 –6.4]*	*[0.8–4.6]*
First-Line Supervisors of Retail Sales Workers	3.6% (10)	2.4% (166)	0.87	**3.12**	**1.72**	**3.50**	2.89	**2.75**
Computer Systems Engineers/Architects	3.3% (9)	0.7% (52)	**2.48**	**3.88**	**2.34**	**4.00**	**4.33**	**3.12**
Customer Service Representatives	3.3% (9)	2.0% (140)	-0.34	2.62	1.14	3.00	2.45	2.12
Document Management Specialists	3.3% (9)	0.7% (52)	0.89	3.00	1.22	**3.62**	3.60	**2.88**
Geographic Information Systems Technologists & Technicians	3.3% (9)	0.7% (52)	**1.80**	3.00	**1.58**	3.25	**5.06**	**3.25**
Information Security Engineers	3.3% (9)	0.7% (52)	**2.36**	**3.38**	**2.05**	**3.75**	**4.32**	2.62
Information Technology Project Managers	3.3% (9)	0.7% (52)	**1.58**	**3.25**	**2.30**	**4.00**	**5.05**	**3.00**
Web Administrators	3.3% (9)	0.7% (52)	**1.63**	**3.25**	**1.83**	**3.88**	**5.65**	**2.88**
Loss Prevention Managers	2.2% (6)	4.2% (296)	0.75	**3.62**	1.54	**3.88**	**4.10**	**2.75**
Regulatory Affairs Managers	2.2% (6)	4.2% (296)	0.87	**3.12**	**1.75**	3.25	**4.52**	1.88
First-Line Supervisors of Office & Administrative Support Workers	1.1% (3)	1.6% (114)	0.87	**3.38**	1.51	3.25	3.81	2.62
Acute Care Nurses	0.7% (2)	3.2% (225)	**1.10**	3.00	**2.26**	**3.50**	**4.16**	**2.88**
Advanced Practice Psychiatric Nurses	0.7% (2)	3.2% (225)	**1.36**	**3.25**	**2.09**	**3.50**	**4.91**	2.25
Clinical Nurse Specialists	0.7% (2)	3.2% (225)	**1.47**	**3.38**	**2.17**	**4.12**	**4.57**	**2.75**
Critical Care Nurses	0.7% (2)	3.2% (225)	**0.92**	**3.25**	**2.51**	**3.38**	3.93	**2.88**
Registered Nurses	0.7% (2)	3.2% (225)	**1.20**	**3.12**	**2.25**	**3.38**	**4.05**	**3.12**

N = 2,755. Values for Innovation & Adaptability are Impact values, which can range from -3 to 3; all other items are Level values, which can range from 0 to 7. Calculated ranges for the sample are provided in brackets. Values above mean for sample are bolded.

Strikingly, many of the job titles associated with Innovation and Visualization also have Level or Impact (in the case of Adaptability and Innovation) values above the mean for the five O*NET items I had previously suggested would be highly associated with ADHD diagnosis (Table 5.6). The top ten job titles with the highest Impact values for Innovation included job titles such as Video Game Designer, Fine Artists (Including Painters, Sculptors, and Illustrators), Poets, Lyricists, and Creative Writers, Choreographers, Special Effects Artists and Animators, Music Directors and Composers, Writers and Authors, Computer and Information Research Scientists, Commercial and Industrial Designers, and Nanosystems Engineers. For Visualization, the top ten job titles with the highest Level values included: Architects (Except Landscape and Naval), Robotics Engineers, Set and Exhibit Designers, Air Traffic Controllers, Construction Managers, Coaches and Scouts, Architectural and Engineering Managers, Landscape Architects, Physicists, and, similar to Innovation, Fine Artists (Including Painters, Sculptors, and Illustrators). Descriptions for each job in Table 5.9 as well as the Standard Occupation Classification Major Group classification is available in Supplementary Table C.12. In some cases, the jobs with the highest Impact or Level values for Innovation and Visualization, respectively, also had values at least two standard deviations above the mean, denoted in Table 5.9 in grey. This may indicate that my assumptions prior to data analysis were somewhat correct, as many of the jobs with high values in Innovation and Visualization also appear to have high values for Originality, Adaptability, Innovation (in the case of Visualization), Complex Problem Solving, and Thinking Creatively. This pattern is not as readily observed for the other 15 O*NET items (Supplementary Tables C.13 & C.14).

*Table 5.9 Top ten O*NET SOC Job Titles with high values in Innovation and Visualization and their associated values in O*NET items of Originality, Adaptability, Complex Problem Solving, Thinking Creatively, Innovation, and Visualization.*

	Originality	Adaptability[1]	Complex Problem Solving	Thinking Creatively	Innovation[1]	Visualization
Jobs with high values in Innovation	**Values**					
Actual Range:	*[0.6–4.6]*	*[-0.3–2.7]*	*[1.6–4.9]*	*[0.9 –6.4]*	*[-0.7–3.0]*	*[0.8–4.6]*
Video Game Designer	**4.12**	**2.30**	**3.88**	**6.40**	**3.00**	**3.75**
Fine Artists, Including Painters, Sculptors, & Illustrators	**4.62**	**1.29**	2.88	**5.82**	**3.00**	**4.25**
Poets, Lyricists, and Creative Writers	**4.50**	0.71	3.25	**6.43**	**3.00**	**2.75**
Choreographers	**4.25**	**2.34**	3.00	**6.29**	**2.89**	**3.75**
Special Effects Artists & Animators	**4.00**	**1.90**	3.25	**5.51**	**2.86**	**4.00**
Music Directors & Composers	**4.12**	**2.09**	3.12	**5.61**	**2.86**	2.25
Writers and Authors	**3.88**	**1.75**	3.00	**4.51**	**2.85**	2.50
Computer & Information Research Scientists	**4.38**	**2.30**	**4.38**	**6.11**	**2.83**	**3.62**
Commercial & Industrial Designers	**4.38**	**1.94**	**3.88**	**4.87**	**2.80**	**4.25**
Nanosystems Engineers	**4.38**	**2.30**	**4.12**	**5.81**	**2.77**	**3.88**
Jobs with high values in Visualization	**Values**					
Architects, Except Landscape & Naval	**4.25**	1.44	**4.25**	**5.52**	**2.51**	**4.75**
Robotics Engineers	**4.62**	**2.05**	**4.12**	**5.90**	**2.55**	**4.62**
Set & Exhibit Designers	**3.88**	**2.17**	**3.88**	**6.19**	**2.70**	**4.50**
Air Traffic Controllers	**3.50**	**2.17**	**4.50**	**5.05**	-0.68	**4.50**
Construction Managers	**3.25**	**2.09**	**4.12**	3.79	**1.28**	**4.38**
Coaches & Scouts	**3.88**	**1.61**	**3.88**	3.92	**1.60**	**4.25**
Architectural & Engineering Managers	**4.00**	**1.75**	**4.25**	**5.18**	**2.33**	**4.25**
Landscape Architects	**4.00**	**1.72**	**4.00**	**5.40**	**2.45**	**4.25**
Physicists	**5.25**	1.35	**4.88**	**6.20**	**2.61**	**4.25**
Fine Artists, Including Painters, Sculptors, & Illustrators	**4.62**	1.29	2.88	**5.82**	**3.00**	**4.25**

Values are from full O*NET 30.1 database. Values above the sample mean are bolded. Values also 2 standard deviations from the mean are highlighted in dark grey. [1]These items have Impact values that could range from -3 to 3. All other items have Level values that could range from 0 to 7. Actual computed ranges are presented in brackets. As these jobs were isolated based on their Innovation and Visualization values, those sections have been highlighted in light grey, respectively.

5.4 Discussion

5.4.1 Summary of results

Many of the results presented here do not align with prior expectations. I predicted that higher values in the 21 selected O*NET items (Table 5.1) would be associated with history of ADHD diagnosis in the Add Health cohort. Instead, 8 of the 21 O*NET items were significantly ($p < 0.0024$) negatively associated with reported ADHD diagnosis and 11 of the O*NET items showed non-significant negative or neutral relationships with ADHD diagnosis. Additionally, I isolated five O*NET items, Originality, Adaptability, Innovation, Complex Problem Solving, and Thinking Creatively, that I hypothesized would be most likely to be positively associated with ADHD diagnosis based on interpretations of previously analyzed interview data (Chapter 4) and other qualitative analyses (Boot et al., 2020; Schippers et al., 2022; Shaw & Brown, 1991; White, 2020). This expectation was largely proven incorrect, with Originality, Adaptability, Complex Problem Solving, and Thinking Creatively all showing non-significant negative or near-zero associations with ADHD diagnosis. There was no support four of the five hypothesized areas of strength associated with ADHD (physical movement, fine, manipulative tasks, dynamic active environments, and varied work tasks) identified in the previous chapter. Unexpectedly, there was actually evidence against some of these areas, with O*NET items involving physical movement and dynamic environments, such as Performing General Physical Activity, Multilimb Coordination, Stress Tolerance, and Response Orientation, and an O*NET item associated with varied tasks, Time Sharing, being significantly negatively associated with ADHD diagnosis. These results indicate that previous assumptions based on interview data from Chapter 4 were erroneous, possibly by the effect of the positive illusory bias, which may have led individuals to overestimate their abilities in certain domains (Prevatt et al., 2012). However, the disparity

between the results presented in the previous chapter and those found in the present analyses may also be due to differences in the data itself; the previous chapter's interviews asked individuals to evaluate their strengths, while O*NET surveyed workers regarding the necessity of certain skills in completing a particular job. The difference here may be substantial: what individuals perceive as their strength may not be same as the skills necessary to do their work.

5.4.2 ADHD diagnosis was positively associated with greater Innovation and Visualization values, but not significantly

Interestingly, the O*NET items Innovation (which was expected to have a positive association with ADHD diagnosis) and Visualization were positively associated with reported ADHD diagnosis, although this was not significant following the application of a Bonferroni correction to correct for multiple testing. Nonetheless, these results point to the potential association of ADHD with these two characteristics, and these associations are worth exploring further.

The observed positive relationship between ADHD diagnosis and Innovation in the Base model, while not significant when a Bonferroni correction is applied, is somewhat in line with prior expectations. Having reported an ADHD diagnosis was associated with a modest increase in Impact value (0.100; $p = 0.047$). However, that the effect of ADHD diagnosis on Innovation Impact value diminished across subsequent models may indicate that the observed association in the Base model was coincidental. Lending support to the result, however, is the fact that the O*NET definition of Innovation—"job requires creativity and alternative thinking to develop new ideas for and answers to work-related problems"—aligns well with information provided by interview participants presented in the previous chapter. For example, all 14 individuals diagnosed with ADHD indicated that their ability to problem solve and their creativity were key

strengths associated with ADHD. Additionally, 10 out of the 14 individuals diagnosed with ADHD remarked that they had the ability to gain insights or see patterns that others had missed or had not thought of, which may contribute positively towards innovation and generation of new ideas. Therefore, while not Bonferroni-significant, the finding that ADHD diagnosis was associated with an increase in Innovation Impact value is in line with the qualitative research presented here, as well as with other qualitative literature (Schippers et al., 2022; Sedgwick et al., 2019).

Innovation was also highly positively correlated ($p < 0.05$) in both the full O*NET database (Figure 5.1) and after merging with Add Health data (Figure 5.2) with the other O*NET items that were predicted to be associated with ADHD diagnosis, such as Originality (correlation of 0.9 in both), Thinking Creatively (correlation of 0.8 in both), Complex Problem Solving (correlation of 0.7 in both), and Adaptability (correlation of 0.7 in both). Given that estimates for the four items other than Innovation were not significant but hovering around 0, it may be that they are positively associated with ADHD in some way, but that these relationships are unable to be detected using this dataset or these methods.

Similar to Innovation, a positive relationship, while not Bonferroni-significant, was observed between ADHD diagnosis and Visualization. Here, reported ADHD diagnosis was associated with a 0.090 increase in Level value ($p = 0.013$) in the Base model. Across subsequent models this association disappeared, with estimates approaching zero and large increases in p-values, suggesting that the observed association may have been spurious, or, more likely, that the relationship between ADHD diagnosis and other variables included in the models exhibit more complex relationships than is adequately captured in this model design. For example, the effect of ADHD diagnosis on job characteristics may be mediated by educational level, which may also

be effected by ADHD diagnosis. Nevertheless, the positive association between ADHD diagnosis and Visualization Level value remains interesting as it was indirectly featured in the interview data collected for the previous chapter. O*NET defines Visualization as "the ability to imagine how something will look after it is moved around or when its parts are moved or rearranged." Participants in the previous chapter's research mentioned various hobbies which would require this particular ability. For example, one participant's hobby involved the use of a 3D printer to construct small figurines. This hobby not only requires substantial creativity in the design and decoration of these figurines, but also requires an individual to visualize an end goal in order to properly construct the 3D printed model without running into errors, which can be a technically challenging process (Kwon & Hwang, 2025). Other participants also named hobbies such as painting, knitting, and even leatherwork, all of which require careful planning and maneuvering in order to achieve a desired final product. Unlike Innovation, however, Visualization was only moderately positively correlated with other O*NET items, with its strongest correlation in both the full O*NET database (Figure 5.1) and following the merging of the databases (Figure 5.2) being with Finger Dexterity (0.5; $p < 0.05$). This aligns well with the anecdotal interview data above, as hobbies such as knitting, painting, and leatherwork would require substantial finger dexterity.

In order to understand what jobs may be associated with high Impact values in Innovation and high Level values for Visualization, I turned to the full O*NET database. Many of these jobs were highly creative in nature, such as Fine Artists, Poets, Lyricists, and Creative Writers, Choreographer, Special Effects Artists and Animators, and Set and Exhibit Designers, and many also likely consist of considerable problem solving, especially in the case of engineers, research scientists, and managers, in line with one of the predicted areas of strength of ADHD: problem

solving & creativity. This mirrors some of the experiences of those interviewed in the previous chapter (Chapter 4). In particular, many of the individuals in the previous chapter (8 out of 14) who were diagnosed with ADHD also participated in creative hobbies, even if their work was not in a creative field. One participant remarked, “That’s always been kind of a theme in my life, I just want to create stuff,” about the desire to pursue creative hobbies outside of work. Such hobbies may also be an area where adults can exercise autonomy over their environmental contexts and may represent an area where they can choose to partake in tasks that “work” with their ADHD, rather than against it.

Despite some overlap, the jobs listed in Tables 5.8 and 5.9 only somewhat reflect the currently held positions of those that individuals who were interviewed in Chapter 4 held, and Table 5.8 matches the interview data the least. Only one individual diagnosed with ADHD who was interviewed worked as a manager at a retail store, although another ADHD-diagnosed individual was a manager at a software engineering company. Two other individuals, one diagnosed with ADHD and one not, held positions that required substantial amounts of analyzing data, similar to what computer and information research scientists likely do. The other 14 individuals (13 diagnosed with ADHD, 1 not diagnosed) included in the previous chapter currently held jobs which did not appear in either table. That the most common jobs for individuals with ADHD in the final sample included a number of computer- and math-based occupations is interesting and directly contradicts a recent finding in a similar analysis. Voloudakis and colleagues (2025), in an analysis of the relationship between neuropsychiatric polygenic scores (PGS)—a measure of genetic risk for a disorder or trait—and professional job categories, observed that while neuropsychiatric PGS were generally poor predictors of job category ADHD PGS were significantly associated with professional categories such as cleaning

and maintenance, food prep and serving, production/manufacturing, construction and extraction, installation and maintenance, protective services, transportation, and personal care. Additionally, this analysis found that individuals with higher ADHD PGS were less likely to be found in professional categories such as architecture and engineering, computers and math, business and finance, education, healthcare practitioners, science, and legal, somewhat at odds with those jobs listed in Tables 5.8 and 5.9. However, the authors noted that these associations were significantly mediated by education level, which aligns well with the observation that education levels were often significantly correlated with O*NET Level or Impact values (Table 5.5).

5.4.3 Individuals diagnosed with ADHD appeared to be less likely to hold jobs with some O*NET characteristics, contrary to prior expectations

ADHD diagnosis was associated with decreases in values in at least one of the three model designs for some O*NET items, including Time Sharing, Performing General Physical Activities, Active Learning, Inductive Reasoning, Stress Tolerance, Multilimb Coordination, Response Orientation, and Problem Sensitivity. Thus, it appears that individuals diagnosed with ADHD in this sample were *less* likely to hold jobs which required these particular characteristics, in a departure from the predictions based on the previous chapter's results. This result may be due to a number of reasons, most notably that individuals may not hold jobs that utilize their self-perceived strengths. Anecdotally, follow-up with previously interviewed participants regarding these results led to some contradictions: one participant noted that they did struggle with Time Sharing, or switching back and forth between different activities, even though they had declared multitasking as a strength of theirs during the interview. Therefore, it may also be that individuals in the previous chapter did not accurately assess their strengths.

5.4.4 Differences in education level were highly predictive of O*NET item values

Generally, across the Base + Individual-level and Base + Individual- & Family-level models, educational level, more so than other covariates, tended to be greatly associated with O*NET item values, with lower levels of educational achievement typically showing a negative relationship with Level or Impact values. However, for O*NET items centered around physical movement or interactions with the physical environment (rather than predominantly mental tasks), the association between increasing level of education and O*NET item values was negative, with higher education levels predicting lower Level values for those items and lower education levels predicting increase in Level values. This pattern was observed for O*NET items like Spatial Orientation, Handling & Moving Objects, Manual Dexterity, Finger Dexterity, Performing General Physical Activity, Multilimb Coordination, and Response Orientation (see Table 5.5). This may be due to the types of jobs available—and desirable—to those with higher education degrees, which tend to be jobs that are less physically demanding and may instead be more mentally demanding, and to those without those degrees, which are often more physically demanding (Monden, 2005; Schreuder et al., 2008).

5.4.5 Family-level variables were not predictive of O*NET item Level or Impact values, except in rare cases

Highest parental education level and family financial status as a child were rarely predictive of O*NET item Level or Impact values, contrary to expectations. The addition of the variables to models resulted in minimal changes to estimates, suggesting that these variables did not have much impact on the kinds of jobs being held by individuals.

However, when family financial status was found to be significantly associated with O*NET item Level or Impact values, it was in an unexpected manner. For example, for the

O*NET item of Innovation, being "a lot worse off" financially during childhood corresponded with an increase in Impact value (Supplementary Table C.1). A similar association was also observed in O*NET items Complex Problem Solving, Originality, and Thinking Creatively (see Table 5.7), where a reported family financial status of "a lot worse off" was significantly associated with slight increases in the values of these items. These particular O*NET items all involve the use of creative skills—including Complex Problem Solving (Davidson & Sternberg, 2003). Thus, association between lower relative family financial status and increased values in these items was particularly interesting, as some research has suggested that children's performance on measures of creativity increases as socioeconomic status increases (Castillo-Vergara et al., 2018). However, these results suggest that individuals whose childhood socioeconomic status may have been relatively low ended up in jobs in which require more innovation, problem solving, and creativity than some of their more well-off peers.

This result may point to a different argument: resilience. Resilience, as a concept, represents the ability to successfully adapt in the face of stress and adversity (Wu et al., 2013). Thus, individuals who grew up socioeconomically disadvantaged may obtain some skills that are beneficial later in life. While some have previously argued that individuals with ADHD may represent a particularly resilient group due to the ability to overcome challenges associated with the disorder in order to achieve success (Wilmshurst et al., 2011), other evidence suggests the opposite, with ADHD individuals seemingly less resilient than others (Regalla et al., 2019). Some studies have sought to identify the factors that influence or mediate resilience in children with ADHD, with results that point to a combination of factors, including emotional, financial, and academic supports, that help create resilience in ADHD children (Dvorsky & Becker, 2025;

Dvorsky & Langberg, 2016; Jia et al., 2021; Ray et al., 2017). Whether these proposed interventions for promoting resilience translate into success in adulthood are understudied.

5.4.6 Limitations

It is important to acknowledge several limitations of the current study. Firstly, there was a substantial amount of missing data in the Add Health datasets, and even more when the Add Health and O*NET datasets were combined. For example, Add Health utilized Census occupation codes for Wave V, while O*NET utilizes O*NET-specific Standard Occupation Classification (SOC) codes. While a link is available to translate Census occupation codes to O*NET SOC codes, some codes had no direct match and therefore were excluded from the sample, potentially biasing the remaining sample towards certain job types. Additionally, in Wave V, 775 individuals who had previously reported an ADHD diagnosis during Wave IV of Add Health were present in the dataset, making up about 6% of the total sample. After removing all missingness from the dataset for the variables of interest, the number of individuals with an ADHD diagnosis was reduced to 274, or about 4% of the final sample population of 7,255 individuals. Notably, the total sample size in Wave V was 12,300, meaning the final sample population involved a removal of more than half of the individuals initially present. This degree of missingness, and the removal of individuals with missing data, may have additionally biased the data. In particular, individuals who did not report a current job were not included in these analyses. As individuals with ADHD tend to suffer from greater unemployment (Faraone et al., 2021), this may have systematically excluded individuals with more severe ADHD symptoms. Unemployment additionally impacts different job categories, as employment opportunities may vary across fields (Núñez & Livanos, 2010), leading to an underrepresentation individuals in certain fields in the final sample.

Another limitation of this study lies in the use of self-reported ADHD diagnosis. This variable does not provide any insight into symptom severity, symptom fluctuations, or medication usage by the individuals in the sample, all of which may impact which jobs they apply to, are selected for, and persist or succeed in. The percent of individuals in the final sample with a reported ADHD diagnosis, 3.8%, is lower than the reported number of adults diagnosed with ADHD in 2023, which was 6%. However, this number is in line with estimates of ADHD prevalence in adulthood from around the time of data collection, which hovered around 2.5% (Popit et al., 2024). It is also of note that the majority of individuals in the sample who reported an ADHD diagnosis were male, with 187 males (68%) and 87 females (32%). This is a departure from the expected gender ratio of ADHD prevalence in adulthood, which tends to be around 1:1 Considering that the average age of diagnosis in the sample was 13.7 years old, this likely reflects well-established trends of greater diagnosis among boys in adolescence, wherein the diagnosis rate of boys to girls is around 2:1 (Faraone et al., 2024).

Finally, this study is limited in that it looks only at most recent job as of Wave V. This may be problematic for a number of issues: namely, that ADHD diagnosis is from Wave IV (collected in 2008). In the eight to ten year gap between Wave IV and Wave V data collections, there may have been additional diagnosis of ADHD, or individuals may have gone into symptom remission, which may affect job choice (Sibley et al., 2022). Additionally, by looking only at job during Wave V, my ability to look at job choice, retention, or success becomes limited, as individuals may hold jobs for variable amounts of time (i.e., they quit or were fired from the reported job quickly after data collection) and may be variably successful or satisfied in those jobs (i.e., how well the job “fits” with the person and how well they do in the job are not ascertainable with this data).

Notably, ADHD diagnosis was not significantly associated with any increases in O*NET item Level or Impact values but was, however, associated with decreases in values for Time Sharing, Performing General Physical Activity, Active Learning, Inductive Reasoning, Stress Tolerance, Multilimb Coordination, Response Orientation, and Problem Sensitivity in at least one of the models. Therefore, based on the results presented above, I cannot conclude that the observed positive association between ADHD diagnosis and O*NET items Innovation and Visualization are robust, although they are worth exploring further.

5.5 Conclusion

The results presented in this chapter suggest that the relationship between ADHD and occupational characteristics is more nuanced and difficult to detect than initially hypothesized, or, conversely, that the hypothesis ADHD diagnosis would be positively associated with the selected O*NET items was largely incorrect. Therefore, critical re-evaluation of this hypothesis is warranted. While most associations between ADHD diagnosis and the 21 isolated O*NET items of interest were either negative or null, the positive associations between ADHD diagnosis with Innovation and Visualization, although not significant after correction for multiple testing, is promising. Those associations provide partial support for the qualitative picture of ADHD strengths described in Chapter 4, particularly for the identified strength of problem solving and creativity. Notably, however, no support was provided for any of the other areas of strength.

These results may suggest that current environments are more broadly mismatched with ADHD phenotypes than expected. Additionally, it may be that ADHD was not as beneficial in past environments. Considering that ADHD diagnosis was significantly associated with decreases in many of the O*NET items, it may be that the strengths individuals identified during

interviews were not honest depictions of their *actual* strengths, which aligns with research suggesting a positive illusionary bias in individuals with ADHD. While the results presented did not reflect expectations based on an evolutionary mismatch hypothesis for ADHD, it remains important to explore the potential benefits of the disorder and identify the contexts in which ADHD phenotypes may be advantageous or, at least, less disadvantageous.

Future research should prioritize the use of larger samples of adults with ADHD with richer occupational data, including longitudinal measures of job changes and success within careers in order to better test whether individuals with ADHD are drawn to or thrive in occupations that emphasize creativity, problem solving, physical movement, dynamic environments, and task variety.

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Chapter 6. Conclusions and future directions

This dissertation aimed to assess the hypothesis that attention-deficit/hyperactivity disorder (ADHD) is a disorder caused by a mismatch between previously adaptive (or neutral) neurobiological/behavioral variation with current environmental contexts. In this dissertation, I drew on multiple sources of evidence using a mixed methods approach, and each chapter sought to build on the results of the last in order to examine whether ADHD might confer benefits in particular contexts. This chapter provides an overview of the results of each study presented in this dissertation which are then synthesized into overarching conclusions regarding the ability of these studies to address the research aims of this body of work. Finally, I conclude this dissertation by looking towards the future by presenting potential avenues of further exploration and inquiry in this area of research, building on the knowledge and expertise gained over the course of my graduate career.

6.1 The ADHD-associated DRD4 gene and its effects on nutrition status, economic status, and schooling in Samburu adolescents of Kenya: a replication study

Chapter 3 explored the effects of an ADHD-associated allele, the 7-repeat (7R) allele of the gene encoding the dopamine D4 receptor (*DRD4*), in a sample of 161 adolescents residing in two communities of a Northern Kenyan semi-nomadic, pastoralist group, the Samburu. The analyses presented in this chapter did not replicate the previously observed associations between the 7R allele and nutritional status in Ariaal men, finding no significant associations between 7R allele presence and most nutritional measures, with the exception of hemoglobin concentration. Notably, this failure to replicate the associations observed in Ariaal men was also seen in a

previous replication in a sample of settled Rendille children, which saw no association between 7R and nutritional status. A positive association between 7R and hemoglobin concentration in the sample of Samburu adolescents may reflect the allele's positive effect on acquiring iron-rich foods. However, low hemoglobin concentration can also be due to general immune response to infections, poor iron absorption, and other causes, complicating this narrative. Contrary to preregistered hypotheses, neither sex nor community significantly modified the effect of 7R on any nutritional measure, despite expectations that boys' greater participation in hunting and the lowland community's greater mobility would mirror the nomadic-versus-settled nutritional pattern seen in Ariaal men. However, the direction of the community interaction was consistent with expectations. Presence of a 7R allele showed a positive but non-significant association ($p = 0.08$) with economic success, proxied by a culturally-relevant measure. This finding, despite not reaching significance is especially compelling because it is consistent with previous findings among Rendille children wherein 7R was associated with greater household economic status. Thus, these results suggest that the allele may benefit household economic outcomes through parental or adolescent behaviors. These results suggest that the original findings of 7R allele's nutritional benefits among mobile Ariaal men and the allele's associations with worsened nutrition in settled Ariaal men were spurious. Alternatively, these results suggest that any benefits of the 7R allele may only emerge in adulthood, as both replications involved younger populations where behaviors associated with the 7R allele may not yet translate into better nutritional outcomes.

However, a limitation of this analysis was that it focuses on the benefits of one ADHD-associated allele, which is not enough to definitively determine what benefits the phenotype overall may confer. Thus, this chapter demonstrated the need for a more nuanced look into the

potential benefits of ADHD, as the focus on the effects of a single gene that likely exerts only a modest effect on behavior is insufficient to capture the full range of ways ADHD may be beneficial.

6.2 "I love my ADHD brain": Exploring experiences of adults diagnosed with attention-deficit/hyperactivity disorder (ADHD) through semi-structured interviews

Chapter 4 explored the potential benefits of ADHD more broadly by utilizing semi-structured interviews to understand the experiences and perceived strengths of 14 adults with and 4 without ADHD. This chapter evolved as a direct response to the limitations of the previous chapter, and the desire to more specifically identify the modern contexts in which ADHD may be beneficial. Among ADHD-diagnosed participants, the most frequent areas of strength association with ADHD that were highlighted during interviews were the capacity for creativity, openness to new experiences, problem solving abilities, being able to understand and connect with others, and the ability to see patterns others miss. Preferences for dynamic settings and manual/physical tasks were also highly common. These concepts were reported considerably less often in the non-ADHD group, and the strength of creativity and the preference for variety/dynamic settings were significantly positively correlated with ADHD diagnosis. Notably, several participants described their ADHD symptoms as highly context-dependent, describing ADHD as both a "superpower" and "Kryptonite depending on the day." Final analysis and interpretation of interview data using a grounded theory approach grouped related emergent themes into five distinct areas in which individuals with ADHD may experience benefits: (1) contexts involving problem solving & creativity, (2) contexts involving physical movement, (3) contexts involving fine manipulative

tasks, (4) contexts involving dynamic, active environments, and (5) contexts involving varied task structures.

This chapter contributes meaningfully to a body of literature that has historically focused on the negative outcomes and deficits surrounding ADHD by centering the experiences and perspectives of adults with ADHD, offering a more complete picture of the disorder and pointing towards specific environmental contexts and tasks in which ADHD may be beneficial, with results that may be translatable to future therapeutic interventions. However, given the propensity for individuals with ADHD to overestimate their abilities, known as the positive illusory bias, it became necessary to empirically test these findings. Thus, these findings were then used to inform the hypotheses for my final chapter, wherein I tested whether individuals with ADHD tend to gravitate towards jobs which require one or more of those five areas.

6.3 Do those with ADHD hold occupations that work to their strengths? Relationships of ADHD diagnosis with occupational characteristics in Add Health

Chapter 5 tested the previous chapter's findings using ADHD diagnosis and occupational data from a nationally-representative, longitudinal dataset, the National Longitudinal Study of Adolescent to Adult Health (Add Health) and the Occupational Information Network (O*NET). In this preregistered analysis, I selected 21 O*NET items that I expected to be positively associated with ADHD diagnosis based on the five areas of strength identified above. Following exclusion of individuals with missing data, the final dataset included 7,255 individuals.

The findings in this chapter suggested that there is a more complex relationship between ADHD and occupational characteristics than initially expected. Although the majority of associations between ADHD diagnosis and the 21 O*NET items of interest were negative or

null, the positive association of ADHD diagnosis with Innovation and Visualization (while not significant after correcting for multiple testing) offered some support for the qualitative strengths identified in Chapter 4. In particular, these two O*NET items may corroborate the idea of creativity and problem solving as key strengths associated with ADHD. However, it is notable that the other areas of strength identified in the previous chapter were overall not supported by these results, indicating that they may not be contexts in which ADHD *actually* confers benefits.

Interpretation of this chapter's results may more broadly indicate that there is a greater mismatch between current environments and ADHD than expected, and additionally raises the possibility that ADHD conferred less benefits in past environments than initially predicted, or that ADHD may have provided no benefit whatsoever. Additionally, the observation of significant negative associations between ADHD diagnosis and some of the selected job characteristics calls into question if the strengths participants described in interviews reflect genuine abilities or reflect a positive illusory bias. Despite falling short of the predictions derived from the previous chapter's interview data and current qualitative literature centered on the possible benefits of ADHD, Nonetheless, these findings emphasize the importance of continuing to investigate if potential benefits of ADHD exist and if there are contexts in which it is advantageous—or, conversely, in refuting popular claims about ADHD's advantages.

6.4 Summary conclusions

This dissertation work represents a novel, interdisciplinary effort to explore the conditions under which ADHD may confer benefits. Drawing on a mixed-methods framework that integrates approaches from biological and sociocultural anthropology, demography, and

genetics, I recognize the positive dimensions of a condition most commonly framed as an obstacle to achievement.

Together, these three studies show that, while ADHD may confer modest benefits in certain contexts, as evidenced by the findings among Samburu adolescents and in the Add Health cohort, many of the self-perceived strengths that individuals associated with their "ADHD brains" did not hold up to further testing. It is apparent across all three studies that context matters, but it is difficult to detect differences, and, thus, where ADHD is beneficial, due to the complexity of the contexts explored here. Given that many of the proposed hypotheses across the three studies went unsupported by the data, it is also likely that the notion of ADHD as potentially beneficial is largely false. However, the failure of these studies to provide evidence for this claim does not mean that individuals with ADHD do not develop specific compensatory mechanisms that are helpful in other areas of life. Thus, ADHD may not confer general benefits that are observable across individuals, as only those individuals who build and utilize these mechanisms experience benefits. Therefore, it is important for future work to disentangle meaningful benefits conferred by ADHD phenotypes themselves, and the benefits stemming from behavioral modifications made *in response to* difficulties experiences due to ADHD.

Broadly, this dissertation serves as additional criticism of some of the current clinical approaches toward ADHD. In postulating ADHD as a mismatch between individual phenotypes and the modern environment, my dissertation moves away from the traditional disease model in psychology or the multiple-deficit model, which posits that ADHD is characterized by deficits in multiple cognitive areas and caused by a number of factors. Instead, the three studies presented here argue for a model of ADHD that looks more closely at the interactions between the individual, their neurobiological and behavioral phenotypes, and the environment in which they

exist to understand why impairments occur and identify potential benefits. My approach more closely resembles the framework common to positive psychology, which primarily focuses on positive aspects of mental health to promote resilience and overall well-being. Given, however, that the results of the three studies presented here overwhelmingly do not support the hypothesis that ADHD confers meaningful benefits, it is possible that traditional frameworks hold true in this regard; ADHD may indeed be a disorder which is characterized by deficits in various cognitive areas that must be addressed in order to achieve unimpaired functioning and rarely possesses any positive aspects.

The research presented here does not refute all critiques of current clinical approaches. The qualitative work presented in Chapter 4 highlighted the highly complex, variable nature of ADHD experiences across and within individuals, in agreement with the growing consensus that ADHD represents a context-dependent, dimensional disorder in which associated traits are observed to exist in subclinical levels across all individuals. However, current diagnostic criteria continue to frame ADHD in distinctly categorical ways, and the overt reliance on the diagnostic thresholds presented in the *DSM* to define psychiatric disorders reflects a reticence to adopt frameworks that encompass the complex, variable, and, sometimes, positive aspects associated with many psychiatric disorders. In order to promote the well-being of those with ADHD, it may be most advantageous to propose a combined framework which both highlights the dimensionality of ADHD and adopts strengths-based therapeutic approaches and also acknowledges the utility and effectiveness of treatments developed under the disease model.

The three papers presented in this dissertation attempted to support my overreaching goal of reframing of ADHD as naturally occurring behavioral and neurobiological variation rather than a pathological deviation from a socially-determined norm. However, the results presented in

this dissertation suggest caution towards fully adopting an evolutionary mismatch hypothesis; based on these results, the benefits conferred by ADHD appear to be modest and only beneficial in very specific domains, and any benefits, such as an increased proclivity towards innovation, creativity, and visualization, may be constrained or mediated by other factors like educational attainment. Finally, the combined results of these three studies also appear to indicate that modern environments are more broadly mismatched than expected. Therefore, it may be that very little benefits are conferred by ADHD in any currently-existing contexts, or, conversely, that no benefits are associated with ADHD whatsoever. Nonetheless, the possibility of ADHD as a product of evolutionary mismatch remains an important research area, as identifying the domains in which ADHD confers benefits or is less impairing may alleviate some of the shame and stigma surrounding the disorder and provide potential avenues for therapeutic interventions based on modifications to the environment of an individual.

6.5 Future directions

Current literature testing the empirical benefits of ADHD-associated traits is limited, emphasizing the need to directly test both how common proposed positives of ADHD are experienced by individuals and how often these traits directly result in tangible benefits. Therefore, my future directions will prioritize testing the hypotheses presented more rigorously while continuing to utilize a mixed methods approach.

The inability to replicate prior findings of benefits associated with the ADHD-associated *DRD4* 7R in Chapter 3 indicates the need for further testing of these hypotheses, particularly using samples that more directly replicate that of the original study (e.g., a sample of adult men or a sample from a population with a greater distinction between nomadic/mobile and settled/less

mobile groups). These hypotheses may also benefit from being expanded to test for ADHD-associated behaviors more directly by modifying existing symptom rating scales or neuropsychiatric tests to be applicable (and meaningful) outside of WEIRD (Western, Educated, Industrialized, Rich, and Democratic) populations. As we know that ADHD is associated with poor educational and occupational outcomes, it may be most informative to look towards populations where success is attained differently. Additionally, future studies may more readily identify contexts in which ADHD is beneficial by expanding the scope of these inquiries using cross-population comparisons, looking at differences in ADHD phenotypes and their relationship to success across various environments and subsistence strategies.

Future research may also focus on expanding qualitative literature about the potential benefits of ADHD to focus more specifically on individuals in certain job roles in response to the combined results of Chapters 4 and 5. Recruitment of participants could pay particular attention to those jobs most associated with higher values for the O*NET items of Innovation and Visualization to understand if individuals with ADHD truly experience benefits in those areas as compared to their non-ADHD coworkers, helping to test whether the observed associations were spurious. Additionally, presenting the results of Chapter 5 to participants with and without ADHD may prompt individuals to be more introspective regarding their strengths and weaknesses and potentially reduce the impact of positive illusory bias.

In an attempt to expand the research presented in Chapter 5, I plan to utilize longitudinal occupational history data from both Add Health and another longitudinal study, the Health and Retirement Study (HRS), to understand job choice and success across time. For example, I can ask whether individuals are more likely to end up in the jobs which require the O*NET items I selected in Chapter 5 as they age and are more able to exert autonomy over their employment.

Additionally, using longitudinal data, I can ask if individuals tend to persist longer, and are therefore more successful, in the jobs which require those O*NET items. If combined with measures of job satisfaction—data which is available for HRS participants—this question may be expanded to include whether or not individuals with ADHD are *happier* in jobs which require the selected O*NET items.

Alternatively, there may be contexts or jobs characteristics that *buffer* individuals with ADHD from the negative occupational and economic outcomes associated with the disorder (e.g., higher unemployment, lower income), even if such contexts do not entirely nullify negative outcomes when compared to non-ADHD peers. In other words, individuals with ADHD in these contexts may still have worse outcomes when compared to individuals without ADHD, but better (or, simply, less bad) outcomes when compared to individuals with ADHD outside these contexts. There is also likely variability within individuals with ADHD in the same contexts wherein individuals with less severe ADHD (i.e., those who score lower on symptom scales) may also see "less bad" outcomes as compared to those with more severe ADHD. To test these hypotheses, my future research would feature continuous measures of ADHD symptoms, combined with longitudinal data on socioeconomic/occupational outcomes and job characteristics and environment, such as the data included in O*NET and/or in the U.S. Bureau of Labor Statistics Occupational Requirements Survey (ORS), a national survey that identifies the necessary education or experience, cognitive requirements, physical demands, and environmental conditions for around 480 distinct job titles. Identification of the job contexts or characteristics in which ADHD is less negatively impactful would be broadly beneficial to individuals with ADHD by providing translatable results that could pave avenues towards

comparatively greater success, reducing the disparities in occupational and economic outcomes between adults with and without ADHD.

In future analyses, I plan to strengthen my analyses by using ADHD polygenic score (PGS) data. As a brief reminder, polygenic scores are calculated measure of genetic risk for a disorder or trait based on the genetic makeup of an individual. PGS are particularly useful as an instrumental variable in analyses as a method to disentangle ADHD from confounders that may affect diagnosis rates. Additionally, ADHD PGS capture variation in ADHD propensities that do not necessarily reach diagnostic thresholds, providing an opportunity to look at subclinical phenotypes. As such, ADHD PGS would be an informative predictor in looking at variation between ADHD-diagnosed individuals, as higher ADHD PGS predict more ADHD symptoms. Consequently, it is also possible to look at the other end of the spectrum; lower ADHD PGS is associated with lower risk for ADHD, and the higher end of the "low" range may represent subclinical ADHD where benefits from ADHD-associated behaviors are experienced without those behaviors contributing to functional impairment. An analysis that includes only ADHD PGS from non-diagnosed individuals (i.e., excludes individuals with a history of ADHD diagnosis from analyses) would be able to characterize the effects of subclinical ADHD phenotypes on socioeconomic and occupational outcomes.

An approach which utilizes ADHD PGS may allow for the ability to look at gene – environment (GxE) interactions between ADHD PGS and environmental contexts. Given the context-dependent nature of ADHD, it would be informative to see if the interaction between ADHD and individual contexts better predicts particular outcomes than ADHD diagnosis alone. For example, I could more directly test the areas of strength presented in Chapter 4 or the findings from Chapter 5 by testing if the effect of ADHD-associated genes on occupational

success is modified by job characteristics. Additionally, I could test whether or not the effect of ADHD-associated genes on ADHD symptom ratings are modified by the number of environmental demands, as it appears that ADHD symptom remission is associated with greater reported demands. Testing this hypothesis using ADHD PGS would provide evidence for a possible causal relationship where more demands decrease ADHD symptoms, rather than the reverse, wherein individuals are able to take on more demands with decreased symptom burden. Finally, ADHD PGS could be informative for understanding how early life conditions impact the later life outcomes associated with ADHD. Doing so may provide information on protective elements that buffer ADHD individuals from the negative outcomes associated with the disorder later in life, such as the increased risk for cardiovascular disease as well as cognitive decline and neurodegenerative diseases.

My future research may also expand the scope of my work to look across the lifespan to investigate the ways ADHD impacts aging. ADHD has been linked to Alzheimer's Disease and neurodegenerative diseases in later years and, therefore, may share underlying causal mechanisms implicated in general cognitive decline. Investigation of these possible mechanisms may inform therapeutics or treatment modalities for the prevention of such conditions. Additionally, ADHD has been associated with a number of negative health outcomes as well as with an increased risk for morbidity and mortality. Research exploring the causal pathways underlying these associations remains in its infancy; thus, this domain represents a worthwhile area of further exploration. Future research may investigate the relationships between ADHD, chronic stress, and aging-related cognitive decline, seek to identify protective factors against the development of cardiometabolic diseases, and/or understand if ADHD may contribute to the

development of these aging-related diseases via its associations with shorter telomeres (although current evidence of the relationship between ADHD and telomere length is mixed).

Ultimately, I hope to pursue work that will continue to argue the main hypothesis proposed by this dissertation: that ADHD represents naturally-occurring neurobiological and behavioral variation, rather than a purely pathological deficit, that may confer advantages in some contexts. My future research will build on the knowledge I have gained during the development of this work and will emphasize an interdisciplinary, mixed methods approach. In doing so, I hope to offer a more empirically grounded understanding of the disorder based on the voices and experiences of individuals most affected that yields meaningful therapeutic and social interventions and allows neurodiverse individuals to thrive.

Chapter 7. Appendices

A Appendix A: Chapter 3 Supplementary Materials

A.1 Chapter 3 Supplementary Tables

Table A.1. DRD4 allele and genotype frequencies.

	All				Highland				Lowland			
	n	**Obs. %**			**n**	**Obs. %**			**n**	**Obs. %**		
Allele												
2	6	1.9			3	1.5			3	2.3		
3	14	4.3			9	4.6			5	3.9		
4	223	69.3			131	67.5			92	71.9		
5	5	1.6			3	1.5			2	1.6		
6	1	0.3			1	0.5			0	0.0		
7	70	21.7			46	23.7			24	18.8		
8	2	0.6			1	0.5			1	0.8		
9	1	0.3			0	0.0			1	0.8		
Total	322	100.0			194	99.8			128	100.0		
Genotype Classification[1]	**n**	**Obs. %**	**Exp. %**	**(Obs. – Exp.)**	**n**	**Obs. %**	**Exp. %**	**(Obs. – Exp.)**	**n**	**Obs. %**	**Exp. %**	**(Obs. – Exp.)**
2/2	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.1	-0.1
2/3	0	0.0	0.2	-0.2	0	0.0	0.1	-0.1	0	0.0	0.2	-0.2
2/4	3	1.9	2.6	-0.7	2	2.1	2.1	0.0	1	1.6	3.4	-1.8
2/5	1	0.6	0.1	0.5	1	1.0	0.0	1.0	0	0.0	0.1	-0.1
2/7	2	1.2	0.8	0.4	0	0.0	0.7	-0.7	2	3.1	0.9	2.2
3/3	2	1.2	0.2	1.0	2	2.1	0.2	1.9	0	0.0	0.2	-0.2
3/4	8	5.0	6.0	-1.0	4	4.1	6.3	-2.2	4	6.3	5.6	0.7
3/5	1	0.6	0.1	0.5	0	0.0	0.1	-0.1	1	1.6	0.1	1.5
3/7	1	0.6	1.9	-1.3	1	1.0	2.2	-1.2	0	0.0	1.5	-1.5
3/8	0	0.0	0.1	-0.1	0	0.0	0.0	0.0	0	0.0	0.1	-0.1
3/9	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.1	-0.1
4/4	78	48.4	48.0	0.4	45	46.4	45.6	0.8	33	51.6	51.7	-0.1
4/5	2	1.2	2.2	-1.0	1	1.0	2.1	-1.1	1	1.6	2.2	-0.6
4/6	1	0.6	0.4	0.2	1	1.0	0.7	0.3	0	0.0	0.0	0.0
4/7	52	32.3	30.1	2.2	32	33.0	32.0	1.0	20	31.3	27.0	4.3
4/8	1	0.6	0.9	-0.3	1	1.0	0.7	0.3	0	0.0	1.1	-1.1
4/9	0	0.0	0.4	-0.4	0	0.0	0.0	0.0	0	0.0	1.1	-1.1
5/7	1	0.6	0.7	-0.1	1	1.0	0.7	0.3	0	0.0	0.6	-0.6
6/7	0	0.0	0.1	-0.1	0	0.0	0.2	-0.2	0	0.0	0.0	0.0
7/7	7	4.3	4.7	-0.4	6	6.2	5.6	0.6	1	1.6	3.5	-1.9
7/8	0	0.0	0.3	-0.3	0	0.0	0.2	-0.2	0	0.0	0.3	-0.3
7/9	0	0.0	0.2	-0.2	0	0.0	0.0	0.0	0	0.0	0.3	-0.3
8/9	1	0.6	0.0	0.6	0	0.0	0.0	0.0	1	1.6	0.0	1.6
Total	161	100.0	100.0	0.0	97	100.0	99.5	0.5	64	100.0	100.1	-0.1
7+	63	39.1			40	41.2			23	35.9		
7-	98	60.9			57	58.8			41	64.1		

[1]Genotypes that were both not observed or expected were excluded from the table.

Table A.2. Model descriptions for each model, including whether restricted or expanded and table number.

Model	Description	Type	Table
1	Prediction of BMI-for-age with inclusion of 7R allele presence-by-Community interaction term	Restricted	3.3
2	Prediction of BMI-for-age with inclusion of 7R allele presence-by-Community interaction term	Expanded	3.3
3	Prediction of Height-for-age Z-score (HAZ) with inclusion of 7R allele presence-by-Community interaction term	Restricted	3.3
4	Prediction of Height-for-age Z-score (HAZ) with inclusion of 7R allele presence-by-Community interaction term	Expanded	3.3
5	Prediction of Arm muscle plus bone area with inclusion of 7R allele presence-by-Community interaction term	Restricted	3.3
6	Prediction of Arm muscle plus bone area with inclusion of 7R allele presence-by-Community interaction term	Expanded	3.3
7	Prediction of hemoglobin concentration with inclusion of 7R allele presence-by-Community interaction term	Restricted	3.3
8	Prediction of hemoglobin concentration with inclusion of 7R allele presence-by-Community interaction term	Expanded	3.3
9	Prediction of BMI-for-age with inclusion of 7R allele presence-by-Sex interaction term	Restricted	3.4
10	Prediction of BMI-for-age with inclusion of 7R allele presence-by-Sex interaction term	Expanded	3.4
11	Prediction of Height-for-age Z-score (HAZ) with inclusion of 7R allele presence-by-Sex interaction term	Restricted	3.4
12	Prediction of Height-for-age Z-score (HAZ) with inclusion of 7R allele presence-by-Sex interaction term	Expanded	3.4
13	Prediction of Arm muscle plus bone area with inclusion of 7R allele presence-by-Sex interaction term	Restricted	3.4
14	Prediction of Arm muscle plus bone area with inclusion of 7R allele presence-by-Sex interaction term	Expanded	3.4
15	Prediction of hemoglobin concentration with inclusion of 7R allele presence-by-Sex interaction term	Restricted	3.4
16	Prediction of hemoglobin concentration with inclusion of 7R allele presence-by-Sex interaction term	Expanded	3.4
17	Prediction of tropical livestock units (TLU)		3.5
18	Prediction of years in school		3.6
19	Prediction of number of repeated grades		3.6
20	Prediction of BMI-for-age with inclusion of 7R allele presence-by-Community interaction term and log-transformed TLUs in place of raw TLUs	Expanded	A.5
21	Prediction of Height-for-age Z-score (HAZ) with inclusion of 7R allele presence-by-Community interaction term and log-transformed TLUs in place of raw TLUs	Expanded	A.5
22	Prediction of Arm muscle plus bone area with inclusion of 7R allele presence-by-Community interaction term and log-transformed TLUs in place of raw TLUs	Expanded	A.5
23	Prediction of hemoglobin concentration with inclusion of 7R allele presence-by-Community interaction term and log-transformed TLUs in place of raw TLUs	Expanded	A.5
24	Prediction of BMI-for-age with inclusion of 7R allele presence-by-Sex interaction term and log-transformed TLUs in place of raw TLUs	Expanded	A.6
25	Prediction of Height-for-age Z-score (HAZ) with inclusion of 7R allele presence-by-Sex interaction term and log-transformed TLUs in place of raw TLUs	Expanded	A.6
26	Prediction of Arm muscle plus bone area with inclusion of 7R allele presence-by-Sex interaction term and log-transformed TLUs in place of raw TLUs	Expanded	A.6
27	Prediction of hemoglobin concentration with inclusion of 7R allele presence-by-Sex interaction term and log-transformed TLUs in place of raw TLUs	Expanded	A.6
28	Prediction of hemoglobin concentration without inclusion of any interaction term	Restricted	A.7
29	Prediction of hemoglobin concentration without inclusion of any interaction term	Expanded	A.7
30	Prediction of log-transformed TLUs		A.10
31	Prediction of TLUs with inclusion of 7R allele presence-by-Community interaction term		A.11
32	Prediction of log-transformed TLUs with inclusion of 7R presence-by-Community interaction term		A.12
33	Prediction of number of repeated grades with inclusion of years in school as covariate		A.13

Table A.3. Descriptive statistics of categorical variables.

Variable			Total Sample (N = 161)	Highland (N = 97)	Lowland (N = 64)
	7R allele presence	*All*	39% (63)	41% (40)	36% (23)
		Boys	38% (30)	38% (18)	40% (12)
		Girls	40% (33)	45% (22)	32% (11)
	Sex	*Girls*	52% (83)	51% (49)	53% (34)
Maternal marital status	1st polygynous wife	*All*	25% (40)	22% (21)	30% (19)
		Boys	22% (17)	15% (7)	33% (10)
		Girls	28% (23)	29% (14)	26% (9)
	2nd+ polygynous wife	*All*	21% (34)	18% (17)	30% (19)
		Boys	23% (18)	19% (9)	30% (9)
		Girls	19% (16)	16% (8)	24% (8)
	Monogamous wife	*All*	25% (40)	32% (31)	14% (9)
		Boys	28% (22)	40% (19)	10% (3)
		Girls	22% (18)	24% (12)	18% (6)
	Other	*All*	29% (47)	29% (28)	27% (17)
		Boys	27% (21)	27% (13)	27% (8)
		Girls	31% (26)	31% (15)	32% (11)
Father age-set	Lmooli	*All*	26% (42)	24% (23)	30% (19)
		Boys	28% (22)	23% (11)	37% (11)
		Girls	24% (20)	24% (12)	24% (8)
	Lkiroro	*All*	42% (68)	44% (43)	39% (25)
		Boys	45% (35)	46% (22)	43% (13)
		Girls	40% (33)	43% (21)	35% (12)
	Lkishili	*All*	22% (36)	23% (22)	22% (14)
		Boys	19% (15)	25% (12)	10% (3)
		Girls	25% (21)	20% (10)	32% (11)
	Lkimaniki	*All*	8% (13)	7% (7)	9% (6)
		Boys	6% (5)	4% (2)	10% (3)
		Girls	10% (8)	10% (5)	9% (3)
	Lmekuri	*All*	1% (2)	2% (2)	0% (0)
		Boys	1% (1)	2% (1)	0% (0)
		Girls	1% (1)	2% (1)	0% (0)

Statistics are percentages and counts in parentheses.

Table A.4. Descriptive statistics of continuous variables.

Variable		Total Sample (N = 161)		Highland (N = 97)		Lowland (N = 64)	
		Mean	SD[1]	Mean	SD[1]	Mean	SD[1]
Age (years)	*All*	14.3	3.1	13.0	2.3	16.3	3.0
	Boys	14.3	3.1	12.8	2.3	16.7	2.8
	Girls	14.3	3.0	13.2	2.3	15.9	3.2
Height (cm)	*All*	152.1	14.1	147.4	13.5	159.2	12.0
	Boys	151.7	15.5	146.2	14.6	160.5	12.9
	Girls	152.4	12.8	148.5	12.4	158.1	11.3
Weight (kg)	*All*	35.4	10.2	32.1	9.3	40.4	9.5
	Boys	34.7	11.3	30.7	9.3	41.0	11.5
	Girls	36.1	9.0	33.5	9.2	39.8	7.4
BMI-for-age Z-score	*All*	-2.5	1.1	-2.5	1.1	-2.5	1.2
	Boys	-2.9	1.1	-2.8	0.9	-2.9	1.4
	Girls	-2.1	1.0	-2.2	1.1	-2.1	0.9
Height-for-age Z-score (HAZ)	*All*	-0.9	1.1	-0.9	1.1	-0.8	1.3
	Boys	-1.2	1.0	-1.1	1.1	-1.4	0.9
	Girls	-0.6	1.2	-0.8	1.1	-0.3	1.3
Arm muscle plus bone area (AMPBA)	*All*	22.1	6.5	20.8	6.0	24.0	6.7
	Boys	21.3	7.1	19.1	5.0	24.7	8.6
	Girls	22.8	5.7	22.4	6.5	23.4	4.4
Hemoglobin concentration (g/dL)	*All*	12.5	1.7	12.9	1.4	12.0	1.9
	Boys	12.8	1.9	12.8	1.5	12.9	1.4
	Girls	12.3	1.5	13.0	1.4	11.3	2.0
Number of wives in the household	*All*	2.0	1.0	1.8	1.0	2.3	1.0
	Boys	1.9	1.1	1.8	1.1	2.2	0.9
	Girls	2.0	0.9	1.8	0.8	2.3	1.0
Number of siblings	*All*	5.4	1.9	5.6	1.9	5.3	2.0
	Boys	5.3	2.1	5.5	1.9	4.9	2.4
	Girls	5.6	1.8	5.6	2.0	5.6	1.5
Tropical livestock units (TLU)	*All*	21.1	28.8	11.3	15.5	36.1	36.9
	Boys	19.8	26.1	11.5	18.3	33.0	31.2
	Girls	22.4	31.9	11.0	12.4	38.9	41.5
Log-transformed TLU [log(TLU + 1)]	*All*	2.4	1.2	2.0	1.0	3.1	1.1
	Boys	2.3	1.2	1.9	1.1	3.0	1.1
	Girls	2.5	1.2	2.1	1.0	3.1	1.2
Years in school	*All*	5.7	3.4	6.4	2.8	4.7	4.1
	Boys	6.3	3.4	6.2	3.2	6.3	3.9
	Girls	5.1	3.4	6.6	2.3	3.2	3.7
Number of repeated grades	*All*	2.4	1.7	3.0	1.4	1.5	1.6
	Boys	2.7	1.7	3.1	1.6	2.0	1.6
	Girls	2.1	1.7	2.9	1.2	1.1	1.5

[1]SD = Standard deviation.

Table A.5. Regression models predicting effect of 7R allele on nutritional variables with log-transformed tropical livestock units [log(TLU + 1)] added to model.

		BMI-for-age		**Height-for-age (HAZ)**		**Arm muscle plus bone area**		**Hemoglobin Conc.**	
Model:		20		21		22		23	
		β	*p*	β	*p*	β	*p*	β	*p*
7R allele presence		-0.27	0.23	-0.03	0.9	-0.15	0.14	0.57	0.11
7R allele presence-by-Community		0.54	0.15	-0.03	0.94	2.75	0.12	0.31	0.58
Community (Highland = 0)		-0.27	0.30	-0.01	0.98	-2.18	0.11	**-1.05**	**0.02**
Sex (F = 0)		**-0.74**	**<0.001**	**-0.54**	**0.005**	*-1.62*	*0.06*	**0.59**	**0.03**
Age[1]						**1.36**	**<0.001**	0.00	0.99
Number of siblings		0.06	0.26	0.05	0.37	0.10	0.68	-0.10	0.19
Maternal Wife Status	2^{nd}+ polygynous wife	0.46	0.11	0.10	0.74	1.38	0.29	-0.30	0.46
	Monogamous wife	0.01	0.96	-0.03	0.92	-0.71	0.58	-0.17	0.68
	Other	0.09	0.71	0.01	0.96	0.2	0.87	-0.03	0.94
log(TLU + 1)		0.05	0.64	0.12	0.28	-0.28	0.55	0.31	0.58

Statistically significant values ($p < 0.05$) are bolded. P-values < 0.1 are italicized. All models are multiple linear regressions; N = 146 (BMI-for-age, HAZ), N = 157 (Arm muscle plus bone area, Hemoglobin concentration). Reference category is in parentheses. [1]Age not included in BMI-for-age or HAZ models.

Table A.6. Regression models predicting effect of 7R allele on nutritional variables with log(TLU + 1) added to model.

		BMI-for-age		**Height-for-age (HAZ)**		**Arm muscle plus bone area**		**Hemoglobin Conc.**	
Model:		24		25		26		27	
		β	p	β	p	β	p	β	p
7R allele presence		-0.34	0.20	-0.11	0.69	0.43	0.73	**0.97**	**0.01**
7R allele presence-by-Sex		0.50	0.18	0.15	0.71	1.00	0.57	-0.56	0.31
Community (Highland = 0)		-0.04	0.83	-0.02	0.93	-1.01	0.38	**-0.91**	**0.01**
Sex (F = 0)		**-0.96**	**<0.001**	**-0.61**	**0.02**	*-1.95*	*0.08*	**0.83**	**0.02**
Age[1]						**1.34**	**<0.001**	0.00	0.95
Number of siblings		0.05	0.30	0.05	0.38	0.08	0.73	-0.09	0.21
Maternal Wife Status	2nd+ polygynous wife	*0.48*	*0.09*	0.10	0.74	1.43	0.28	-0.29	0.48
	Monogamous wife	0.13	0.64	-0.01	0.97	-0.47	0.72	-0.22	0.59
	Other	0.15	0.56	0.03	0.92	0.26	0.83	-0.09	0.81
log(TLU + 1)		0.04	0.67	0.15	0.71	-0.33	0.48	0.07	0.63

Statistically significant values ($p < 0.05$) are bolded. P-values < 0.1 are italicized. All models are multiple linear regressions; N = 146 (BMI-for-age, HAZ), N = 157 (Arm muscle plus bone area, Hemoglobin concentration). Reference category is in parentheses. [1]Age not included in BMI-for-age or HAZ models.

Table A.7. Post hoc regression models predicting effect of 7R allele on nutritional variables.

		Hemoglobin Conc.			
	Model:	28		29	
		β	p	β	p
7R allele presence		**0.71**	**0.01**	**0.72**	**0.01**
Community (Highland = 0)		**-0.84**	**0.01**	**-0.79**	**0.02**
Sex (F = 0)		**0.59**	**0.02**	**0.59**	**0.03**
Age		0.00	0.97	0.00	0.99
Number of siblings		-0.09	0.22	-0.08	0.28
Maternal Wife Status	2^{nd}+ polygynous wife	-0.26	0.51	-0.23	0.58
	Monogamous wife	-0.21	0.59	-0.25	0.53
	Other	-0.08	0.83	-0.11	0.76
Tropical livestock units (TLU)				0.00	0.62

Statistically significant values ($p < 0.05$) are bolded. P-values < 0.1 are italicized. All models are multiple linear regressions; Model 28 represents restricted model; Model 29 includes TLU and represents expanded model. N = 157.

Table A.8. 83.4% confidence intervals for hemoglobin concentration models.

	Model:	7		8		15		16		28		29	
		8.30%	91.70%	8.30%	91.70%	8.30%	91.70%	8.30%	91.70%	8.30%	91.70%	8.30%	91.70%
7R allele presence		0.11	1.08	0.12	1.10	0.45	1.53	0.44	1.53	0.32	1.09	0.33	1.11
7R allele presence-by-Sex						-1.33	0.20	-1.32	0.23				
7R allele presence-by-Community		-0.48	1.06	-0.50	1.05								
Community (Highland = 0)		-1.51	-0.41	-1.48	-0.32	-1.29	-0.40	-1.27	-0.32	-1.29	-0.39	-1.26	-0.31
Sex (F = 0)		0.21	0.95	0.21	0.95	0.34	1.30	0.32	1.29	0.22	0.96	0.22	0.96
Age		-0.07	0.07	-0.07	0.07	-0.07	0.07	-0.07	0.07	-0.07	0.07	-0.07	0.07
Number of siblings		-0.18	0.01	-0.18	0.02	-0.18	0.01	-0.18	0.02	-0.19	0.01	-0.18	0.02
Maternal Wife Status	2^{nd}+ polygynous wife	-0.83	0.29	-0.81	0.34	-0.82	0.31	-0.80	0.35	-0.82	0.30	-0.80	0.35
	Monogamous wife	-0.77	0.31	-0.81	0.29	-0.82	0.27	-0.86	0.25	-0.75	0.33	-0.79	0.30
	Other	-0.58	0.43	-0.62	0.41	-0.65	0.37	-0.68	0.36	-0.58	0.42	-0.62	0.40
Tropical livestock units (TLU)				-0.50	1.05			-0.01	0.01			-0.01	0.00

All models are multiple linear regressions; N = 157.

Table A.9. Standard errors for hemoglobin concentration models.

		Model:	7	8	15	16	28	29
					Standard Errors			
7R allele presence			0.35	0.35	0.39	0.39	0.28	0.28
7R allele presence-by-Sex					0.55	0.56		
7R allele presence-by-Community			0.55	0.56				
Community (Highland = 0)			0.39	0.42	0.32	0.34	0.32	0.34
Sex (F = 0)			0.27	0.27	0.35	0.35	0.26	0.27
Age			0.05	0.05	0.05	0.05	0.05	0.05
Number of siblings			0.07	0.07	0.07	0.07	0.07	0.07
Maternal Wife Status	2^{nd}+ polygynous wife		0.40	0.41	0.40	0.41	0.40	0.41
	Monogamous wife		0.39	0.40	0.39	0.40	0.39	0.39
	Other		0.36	0.37	0.37	0.37	0.36	0.37
Tropical livestock units (TLU)				0.01		0.01		0.01

All models are multiple linear regressions; N = 157.

Table A.10. Regression model (Model 30) predicting effect of 7R allele presence on log-transformed tropical livestock units [log(TLU + 1)].

	β	p
7R allele presence	*0.30*	*0.05*
Community (Highland = 0)	**0.78**	**<0.001**
Father age-set	0.01	0.91
Number of wives in household	**0.57**	**<0.001**

Statically significant values (p < 0.05) are bolded. P-values < 0.1 are italicized. N = 156.

Table A.11. Regression model (Model 31) predicting effect of 7R allele presence on tropical livestock units (TLU).

	β	p
7R allele presence	*9.27*	*0.06*
7R allele presence-by-Community	-6.33	0.41
Community (Highland = 0)	**19.67**	**<0.001**
Father age-set	-0.59	0.78
Number of wives in household	**14.55**	**<0.001**

Statically significant values (p < 0.05) are bolded. P-values < 0.1 are italicized. N = 156.

Table A.12. Regression model (Model 32) predicting effect of 7R allele presence on log-transformed tropical livestock units [log(TLU + 1)] with inclusion of a 7R allele presence-by-Community interaction term.

	β	p
7R allele presence	*0.38*	*0.05*
7R allele presence-by-Community	-0.20	0.52
Community (Highland = 0)	**0.86**	**<0.001**
Father age-set	0.01	0.91
Number of wives in household	**0.57**	**<0.001**

Statically significant values ($p < 0.05$) are bolded. P-values < 0.1 are italicized. N = 156.

Table A.13. Regression models predicting effect of 7R allele presence on number of grades repeated while controlling for years in school (Model 33).

	Number of repeated grades	
	β	p
7R allele presence	-0.04	0.80
Community (Highland = 0)	-0.17	0.39
Age	**-0.17**	**<0.001**
Sex (F = 0)	0.01	0.51
Number of siblings	0.02	0.60
Tropical livestock units (TLU)	0.00	0.33
Years in school	**0.36**	**<0.001**

Statistically significant values ($p < 0.05$) are bolded. All models are multiple linear regressions. N = 157.

A.2 Chapter 3 Supplementary Figures

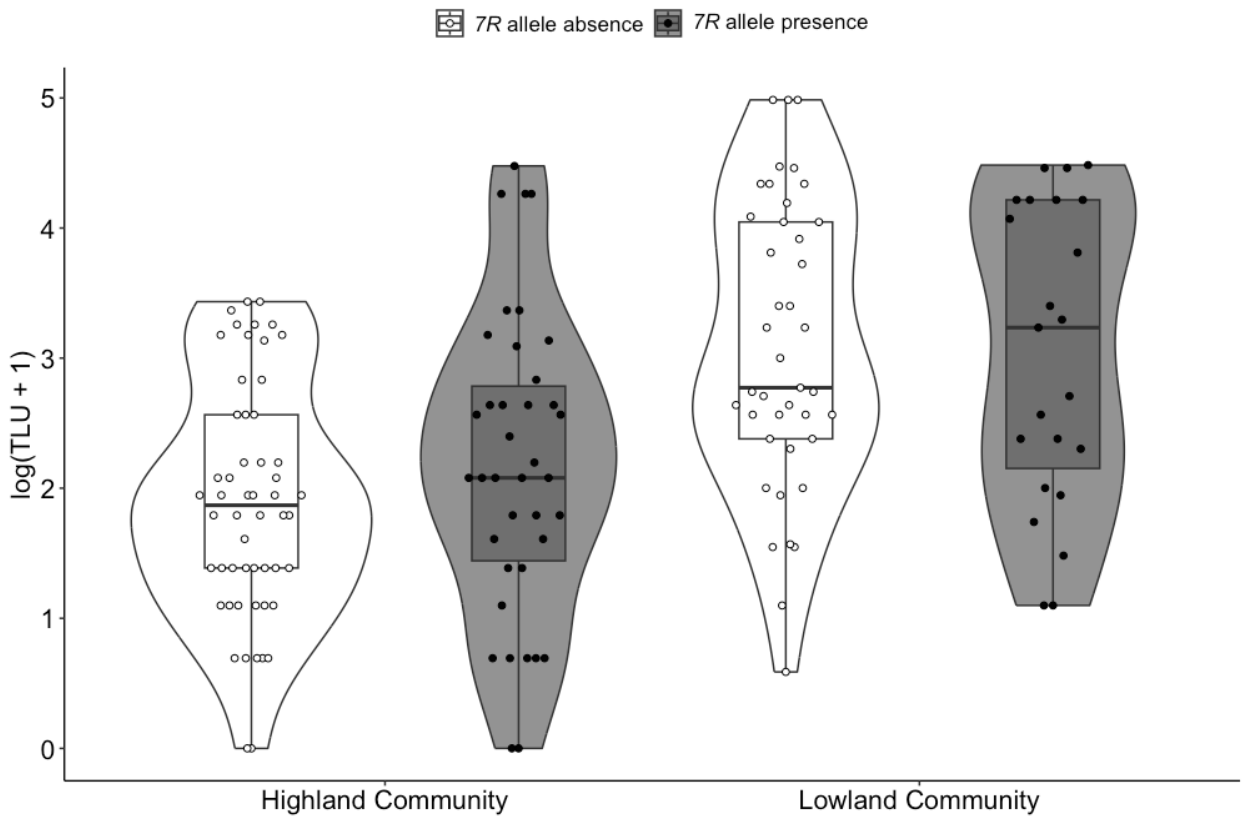

Figure A.1. Comparison of log-transformed tropical livestock units [log(TLU + 1)] for Samburu households of adolescents with and without a 7R allele separated by community. Violin plots depicting log-transformed tropical livestock units (TLU) for highland and lowland households of Samburu adolescents with a 7R allele (grey with black dots) and without a 7R allele (white with open dots).

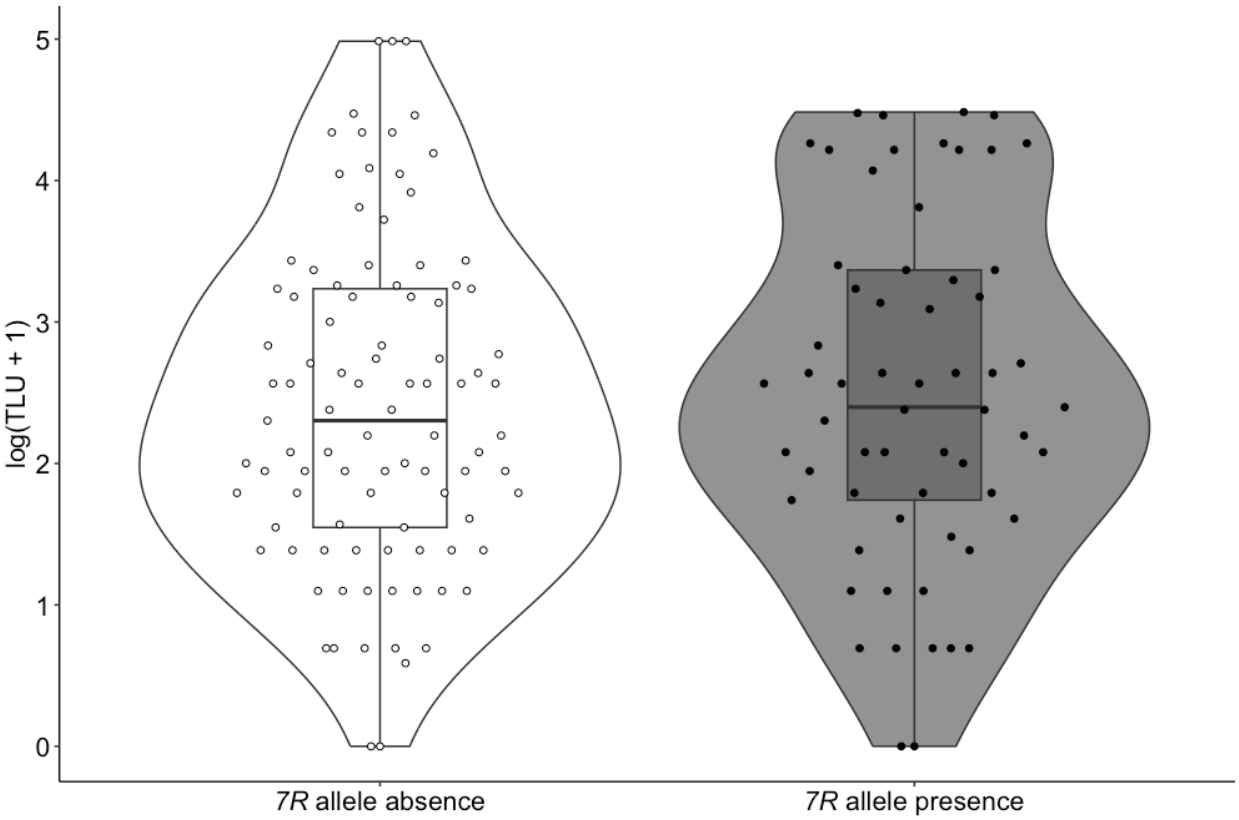

Figure A.2. Comparison of log-transformed tropical livestock units [log(TLU + 1)] for Samburu households of adolescents with and without a 7R allele. Violin plots depicting log-transformed tropical livestock units (TLU) for Samburu adolescents with a 7R allele (grey) and without a 7R allele (white).

B Appendix B: Chapter 4 Supplementary Materials

B.1 ADHD Interview Guidelines

Bolded questions represent main points; highlighted sections are questions that were deemed most important following a round of data analysis in August 2025.

As part of this study, I am looking to understand the strengths of ADHD. To do so, I am looking to understand and compare the experiences of those with ADHD and those without ADHD. If you are uncomfortable with a question, you are not required to answer. You may also halt participation in this study at any time. Before we begin, do you give consent for the recording of this interview?

If you're comfortable doing so, would you be willing to share your history of ADHD diagnosis?

⇒ Were you diagnosed in childhood? Adulthood?
⇒ Did a parent, teacher, or partner recommend diagnosis?
⇒ Did you personally seek a diagnosis after noticing symptoms?
⇒ Were you diagnosed with Inattentive, Hyperactive/Impulsive, or Combined ADHD?

Are you on any medication to help with management of symptoms?

⇒ How has this changed your experience with ADHD?
⇒ I have heard from other adults with ADHD that they sometimes use their medication strategically (e.g., before a meeting or project, when they know they need to focus, etc.), do you do anything similar?

What impact does ADHD have on your daily life?

Have you ever noticed periods in your life where your ADHD has felt less apparent or negatively impactful?

⇒ If yes, can you describe what your life was like at that time?
  - When were those periods?
  - What were you doing (e.g., job, etc.) at the time?
  - How busy were you?

⇒ What about those periods where your ADHD felt more apparent or more impairing?
  - When were those periods?
  - What were you doing at the time?
  - How busy were you?

Can you describe your current job?

⇒ What drew you to this job?
⇒ How structured or unstructured is your typical workday?
  - How does this affect your focus or productivity?
  - Do you work under strict oversight, or do you have more autonomy to make decisions? Do you enjoy this/does it work well for you?

⇒ What tasks do you typically do at this job?
⇒ Which tasks take up most of your time?
⇒ Which tasks do you find most enjoyable, easy, or challenging?
⇒ How do you plan, organize, and remember your tasks or deadlines (e.g., reminders, apps, lists, memory)?
⇒ Probe: Do you often need to problem-solve or think creatively at your job? Do you think ADHD impacts (positively or negatively) your ability to do so?
⇒ Does living with ADHD influence your enjoyment of your job?

Can you describe your past jobs?
⇒ Can you explain why you left your previous jobs?

Which of your jobs, past or current, did you enjoy the most? Or feel most productive in?
⇒ Did any of your jobs, past or current, work well with your ADHD? (*If "yes"*: Why?)
⇒ Do you like working with others, or alone?
⇒ Do you like work environments that have a lot of moving parts or are dynamic?
⇒ Do you like work environments that require doing a variety of tasks?

With regard to both your current and past jobs (*or in college*), what environments help you to get work done?
⇒ Do you often change locations while working?
⇒ Do you notice any difference in your ability to concentrate when allowed to work from different locations?
  ⇒ Does your work allow you to spend time outside? How often do you work outside?

Do you enjoy engaging in activities (such as hobbies or work tasks) that require your hands or body?
⇒ If a simple "yes": can you describe what things you like to do?
⇒ Do you find it easier to concentrate when you are doing something with your hands or moving around?

Can you describe your current hobbies (that you haven't mentioned)?
⇒ What hobbies have you liked to do in the past?
⇒ Probe about any outdoor hobbies: Would you describe yourself as "adventurous"?
⇒ Probe about any "risky" hobbies: Can you tell me a bit more about why you enjoy participating in this hobby?
⇒ Do you play any sports?
  ⇒ Can you describe what kind of sports you currently play?
  ⇒ Did you participate in sports in the past? What was your experience like?

What environments do you feel most productive in (for work or hobbies, or both)?
Are there other activities, in work or otherwise, that you haven't mentioned where you feel very confident about doing well in? (Probe: Why?)

<u>Only ask if there is time, otherwise skip section:</u> Where have you lived throughout your life?
⇒ Can you describe these places? Were they urban, suburban, rural?
⇒ Can you describe what drew you to these places? (Did you like the proximity to nature, open spaces, city/town centers?)
⇒ Can you describe what motivated you to move?

Can you describe your experiences with ADHD and how it may affect your social relationships?
Are there ways in which you feel that your ADHD benefits you (or key strengths you derive from your ADHD)?

B.2 Non-ADHD Interview Guidelines

Before you ask anything: Before we begin, you indicated previously that you are not diagnosed with ADHD, is this accurate?

<u>If no</u>: Go to other interview guidelines!

As part of this study, I am looking to understand the strengths of ADHD. To do so, I am looking to understand and compare the experiences of those with ADHD and those without ADHD. If you are uncomfortable with a question, you are not required to answer, and you may halt participation in this study at any time. Before we begin, do you give consent for the recording of this interview?

Can you describe your current job for me?
- ⇒ What drew you to this job?
- ⇒ What tasks do you typically do at this job?
- ⇒ Do you often need to problem solve or think creatively at your job? Probe: Do you enjoy doing so?

Can you describe your past jobs?
- ⇒ Can you explain why you left your previous jobs?

Which of your jobs, past or current, did you enjoy the most? Or feel most productive in?
With regard to both your current and past jobs (*or in college*), what environments help you to get work done?
- ⇒ Do you often change locations while working?
- ⇒ Do you notice any difference in your ability to complete work (or concentrate) when allowed to work from different locations?
  - ⇒ Does your work allow you to spend time outside? How often do you find yourself working outside?

Do you enjoy doing things (like hobbies or work tasks) with your hands or body?
- ⇒ If a simple "yes": Can you describe what things you like to do?
- ⇒ Do you find it easier to concentrate when you are doing something with your hands or moving around?

Can you describe your current hobbies (that you haven't mentioned)?
- ⇒ What hobbies have you liked to do in the past?
- ⇒ Probe about any outdoor hobbies: Would you describe yourself as "adventurous"?
- ⇒ Probe about any "risky" hobbies: Can you tell me a bit more about why you like to participate in this hobby?

Do you play any sports?
- ⇒ Can you describe what kind of sports you currently play?
- ⇒ Did you participate in sports in the past? What was your experience like?

Are there activities (for work or for fun) that you feel very confident about doing well in? (probe: why?)

What environments, work or otherwise, do you feel most productive in?

Where have you lived throughout your life?
- ⇒ Can you describe these places? Were they urban, suburban, rural?
- ⇒ Can you describe what drew you to these places? (Did you like the proximity to nature, open spaces, city or town centers [*can edit or add based on topics discussed during interview*]?)
- ⇒ Can you describe what motivated you to move?

Can you describe your experience creating and maintaining social relationships?

⇒ Do you experience any challenges when trying to keep in touch with friends you do not see regularly?

What do you see as your key strengths?

Do Not Skip: **"Do you have a partner, spouse, or roommate with ADHD who is already signed up for this study?"**

If YES: **Would you be willing to talk a little bit about this person and their experiences?**

If individual is acting as informant:

What is their name?

Can you tell me about your relationship with [ADHD participant]? (probe: How long have you known them? Do you currently, or did you at one time, live together? How long?)

What strengths do you think [name of partner/roommate/friend] has? (probe about any shared strengths or anything notable)

⇒ What difficulties do they encounter because of their ADHD? (probe: specific symptoms, common hurdles)

⇒ Are there periods where you observe that their ADHD is better? Worse?

- If yes (for either): When do you notice this? In what context?

Do you think there are any strengths derived from their ADHD? Are there any areas they excel in because of their ADHD?

Finally, would you be willing to fill out a version of an ADHD symptom screener meant to understand the symptoms of this person?

C Appendix C: Chapter 5 Supplementary Material

C.1 Chapter 5 Supplementary Tables

*Table C.1. Model results for all model designs for O*NET item Innovation.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	***p***	**Estimate**	***p***	**Estimate**	***p***
ADHD diagnosis (No)		*0.100*	*0.047*	0.090	0.059	0.078	0.104
Age		*-0.014*	*0.006*	*-0.010*	*0.049*	-0.009	0.054
Sex (female)				**0.207**	**<0.001**	**0.200**	**<0.001**
Highest Education Level (Completed college)	8th grade or less			**-1.399**	**<0.001**	**-1.332**	**0.001**
	Some high school			**-0.728**	**<0.001**	**-0.671**	**<0.001**
	Obtained high school diploma			**-0.639**	**<0.001**	**-0.595**	**<0.001**
	Completed a GED			**-0.709**	**<0.001**	**-0.667**	**<0.001**
	Some vocational or technical training			**-0.493**	**<0.001**	**-0.463**	**<0.001**
	Some community college			**-0.509**	**<0.001**	**-0.473**	**<0.001**
	Completed vocational or technical training			**-0.353**	**<0.001**	**-0.321**	**<0.001**
	Associate or junior college degree			**-0.131**	**<0.001**	**-0.105**	**<0.001**
	Some college			**-0.444**	**<0.001**	**-0.425**	**<0.001**
	Some graduate school			**-0.154**	**0.001**	**-0.155**	**0.001**
	Complete master's degree			**0.154**	**<0.001**	**0.135**	**<0.001**
	Some graduate training beyond master's degree			0.086	0.352	0.056	0.543
	Completed a doctoral degree			**0.269**	**0.001**	*0.234*	*0.003*
	Some post baccalaureate professional education			0.100	0.282	0.060	0.519
	Completed post baccalaureate professional degree			0.032	0.536	0.015	0.774
Census Region (South)	West			**-0.078**	**0.001**	**-0.088**	**<0.001**
	Midwest			*-0.070*	*0.003*	*-0.071*	*0.003*
	Northeast			-0.034	0.271	-0.038	0.216
Self-reported race/ethnicity (non-Hispanic white)	Asian			0.008	0.836	0.016	0.683
	Hispanic			**-0.097**	**<0.001**	*-0.075*	*0.009*
	Native American			-0.203	0.249	-0.194	0.270
	Non-Hispanic Black			**-0.162**	**<0.001**	**-0.156**	**<0.001**
	Other			*-0.280*	*0.025*	*-0.283*	*0.023*
Highest parental education level (Completed college)	8th grade or less					-0.057	0.354
	More than 8th grade, but did not graduate high school					*-0.126*	*0.005*
	Went to a business, trade, or vocational school after high school					0.110	0.423
	High school graduate					**-0.089**	**0.001**
	Completed a GED					-0.055	0.269
	Went to a business, trade, or vocational school after college					0.001	0.979
	Some college					-0.022	0.463
	Professional training beyond college					*0.063*	*0.035*
	Never went to school					*-0.090*	*0.045*
Family financial status (Average)	A lot better off					-0.055	0.172
	Somewhat better off					*0.063*	*0.011*
	Somewhat worse off					0.004	0.876
	A lot worse off					**0.131**	**0.002**

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

*Table C.2. Model results for all model designs for O*NET item Visualization.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	***p***	**Estimate**	***p***	**Estimate**	***p***
ADHD diagnosis (No)		*0.090*	*0.013*	0.008	0.826	0.006	0.865
Age		-0.003	0.490	*-0.007*	*0.040*	-0.007	0.050
Sex (female)				**0.287**	**<0.001**	**0.281**	**<0.001**
Highest Education Level (Completed college)	8th grade or less			-0.412	0.145	-0.351	0.215
	Some high school			-0.076	0.171	-0.038	0.496
	Obtained high school diploma			-0.051	0.059	-0.028	0.310
	Completed a GED			*-0.091*	*0.046*	-0.066	0.154
	Some vocational or technical training			0.048	0.329	0.064	0.192
	Some community college			**-0.189**	**<0.001**	**-0.174**	**<0.001**
	Completed vocational or technical training			**0.097**	**0.002**	**0.110**	**0.001**
	Associate or junior college degree			0.022	0.327	0.031	0.167
	Some college			**-0.163**	**<0.001**	**-0.155**	**<0.001**
	Some graduate school			-0.051	0.139	-0.054	0.116
	Complete master's degree			0.008	0.748	0.001	0.973
	Some graduate training beyond master's degree			*-0.137*	*0.045*	*-0.146*	*0.032*
	Completed a doctoral degree			0.088	0.134	0.077	0.193
	Some post baccalaureate professional education			0.045	0.516	0.032	0.643
	Completed post baccalaureate professional degree			-0.046	0.224	-0.050	0.192
Census Region (South)	West			*-0.040*	*0.026*	*-0.046*	*0.012*
	Midwest			-0.004	0.799	-0.007	0.692
	Northeast			*-0.065*	*0.004*	*-0.067*	*0.003*
Self-reported race/ethnicity (non-Hispanic white)	Asian			-0.001	0.967	0.008	0.776
	Hispanic			**-0.068**	**0.001**	*-0.050*	*0.018*
	Native American			-0.110	0.396	-0.108	0.405
	Non-Hispanic Black			**-0.063**	**0.001**	*-0.057*	*0.003*
	Other			-0.084	0.360	-0.085	0.358
Highest parental education level (Completed college)	8th grade or less					-0.067	0.142
	More than 8th grade, but did not graduate high school					*-0.092*	*0.006*
	Went to a business, trade, or vocational school after high school					-0.047	0.645
	High school graduate					*-0.036*	*0.079*
	Completed a GED					-0.036	0.326
	Went to a business, trade, or vocational school after college					-0.012	0.693
	Some college					-0.007	0.759
	Professional training beyond college					0.011	0.628
	Never went to school					*-0.082*	*0.014*
Family financial status (Average)	A lot better off					**-0.095**	**0.001**
	Somewhat better off					0.016	0.388
	Somewhat worse off					-0.008	0.644
	A lot worse off					0.047	0.139

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

*Table C.3. Model results for all model designs for O*NET item Time Sharing.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	**p**	**Estimate**	**p**	**Estimate**	**p**
ADHD diagnosis (No)		**-0.097**	**<0.001**	**-0.100**	**<0.001**	**-0.099**	**<0.001**
Age		-0.003	0.189	-0.002	0.484	-0.002	0.406
Sex (female)				**-0.031**	**<0.001**	**-0.032**	**<0.001**
Highest Education Level (Completed college)	8th grade or less			-0.172	0.354	-0.172	0.353
	Some high school			-0.059	0.105	-0.057	0.124
	Obtained high school diploma			-0.023	0.180	-0.022	0.219
	Completed a GED			**-0.115**	**<0.001**	**-0.116**	**<0.001**
	Some vocational or technical training			-0.024	0.460	-0.022	0.502
	Some community college			**-0.116**	**<0.001**	**-0.117**	**<0.001**
	Completed vocational or technical training			0.033	0.118	0.032	0.127
	Associate or junior college degree			**0.084**	**<0.001**	**0.081**	**<0.001**
	Some college			**-0.061**	**<0.001**	**-0.063**	**<0.001**
	Some graduate school			*0.053*	*0.018*	*0.051*	*0.022*
	Complete master's degree			-0.014	0.380	-0.015	0.351
	Some graduate training beyond master's degree			-0.019	0.677	-0.024	0.585
	Completed a doctoral degree			-0.014	0.711	-0.015	0.704
	Some post baccalaureate professional education			**0.238**	**<0.001**	**0.239**	**<0.001**
	Completed post baccalaureate professional degree			**0.170**	**<0.001**	**0.168**	**<0.001**
Census Region (South)	West			-0.014	0.253	-0.014	0.225
	Midwest			0.002	0.887	0.000	0.999
	Northeast			**-0.067**	**<0.001**	**-0.067**	**<0.001**
Self-reported race/ethnicity (non-Hispanic white)	Asian			-0.002	0.917	0.004	0.852
	Hispanic			*-0.029*	*0.027*	-0.022	0.118
	Native American			-0.009	0.913	-0.013	0.883
	Non-Hispanic Black			**-0.038**	**0.002**	*-0.035*	*0.006*
	Other			0.025	0.674	0.019	0.758
Highest parental education level (Completed college)	8th grade or less					-0.040	0.185
	More than 8th grade, but did not graduate high school					*0.053*	*0.014*
	Went to a business, trade, or vocational school after high school					-0.128	0.054
	High school graduate					0.017	0.212
	Completed a GED					0.034	0.153
	Went to a business, trade, or vocational school after college					0.022	0.260
	Some college					*0.043*	*0.003*
	Professional training beyond college					*0.035*	*0.017*
	Never went to school					-0.004	0.862
Family financial status (Average)	A lot better off					*-0.057*	*0.004*
	Somewhat better off					-0.006	0.616
	Somewhat worse off					0.011	0.334
	A lot worse off					-0.016	0.449

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

*Table C.4. Model results for all model designs for O*NET item Performing General Physical Activity.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	**p**	**Estimate**	**p**	**Estimate**	**p**
ADHD diagnosis (No)		-0.104	0.213	**-0.264**	**0.001**	**-0.250**	**0.002**
Age		0.009	0.319	-0.001	0.865	-0.001	0.864
Sex (female)				**0.144**	**<0.001**	**0.145**	**<0.001**
Highest Education Level (Completed college)	8th grade or less			1.009	0.125	1.030	0.118
	Some high school			**1.021**	**<0.001**	**1.005**	**<0.001**
	Obtained high school diploma			**0.692**	**<0.001**	**0.670**	**<0.001**
	Completed a GED			**0.715**	**<0.001**	**0.701**	**<0.001**
	Some vocational or technical training			**0.804**	**<0.001**	**0.800**	**<0.001**
	Some community college			*0.145*	*0.020*	0.122	0.055
	Completed vocational or technical training			**0.734**	**<0.001**	**0.709**	**<0.001**
	Associate or junior college degree			**0.448**	**<0.001**	**0.424**	**<0.001**
	Some college			*0.160*	*0.006*	*0.147*	*0.012*
	Some graduate school			*0.229*	*0.004*	*0.224*	*0.005*
	Complete master's degree			**-0.218**	**<0.001**	**-0.204**	**<0.001**
	Some graduate training beyond master's degree			-0.229	0.150	-0.212	0.183
	Completed a doctoral degree			-0.194	0.159	-0.164	0.236
	Some post baccalaureate professional education			**0.544**	**0.001**	**0.579**	**<0.001**
	Completed post baccalaureate professional degree			-0.060	0.498	**-0.045**	**0.610**
Census Region (South)	West			0.008	0.857	0.013	0.768
	Midwest			**0.124**	**0.002**	*0.121*	*0.003*
	Northeast			**-0.166**	**0.002**	**-0.163**	**0.002**
Self-reported race/ethnicity (non-Hispanic white)	Asian			-0.105	0.115	-0.094	0.163
	Hispanic			**-0.150**	**0.001**	*-0.139*	*0.005*
	Native American			0.052	0.863	0.048	0.873
	Non-Hispanic Black			-0.023	0.602	-0.019	0.677
	Other			-0.069	0.749	-0.072	0.738
Highest parental education level (Completed college)	8th grade or less					-0.080	0.450
	More than 8th grade, but did not graduate high school					0.083	0.285
	Went to a business, trade, or vocational school after high school					*-0.587*	*0.013*
	High school graduate					0.090	0.059
	Completed a GED					0.120	0.160
	Went to a business, trade, or vocational school after college					0.045	0.510
	Some college					0.073	0.156
	Professional training beyond college					-0.011	0.835
	Never went to school					0.037	0.636
Family financial status (Average)	A lot better off					-0.128	0.063
	Somewhat better off					-0.064	0.137
	Somewhat worse off					-0.034	0.400
	A lot worse off					-0.144	0.050

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

*Table C.5. Model results for all model designs for O*NET item Active Learning.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	**p**	**Estimate**	**p**	**Estimate**	**p**
ADHD diagnosis (No)		**-0.135**	**0.001**	*-0.080*	*0.026*	*-0.084*	*0.019*
Age		*-0.012*	*0.003*	-0.004	0.328	-0.004	0.283
Sex (female)				-0.011	0.437	-0.013	0.346
Highest Education Level (Completed college)	8th grade or less			**-1.477**	**<0.001**	**-1.465**	**<0.001**
	Some high school			**-0.904**	**<0.001**	**-0.877**	**<0.001**
	Obtained high school diploma			**-0.658**	**<0.001**	**-0.639**	**<0.001**
	Completed a GED			**-0.769**	**<0.001**	**-0.758**	**<0.001**
	Some vocational or technical training			**-0.605**	**<0.001**	**-0.594**	**<0.001**
	Some community college			**-0.498**	**<0.001**	**-0.484**	**<0.001**
	Completed vocational or technical training			**-0.480**	**<0.001**	**-0.466**	**<0.001**
	Associate or junior college degree			**-0.114**	**<0.001**	**-0.105**	**<0.001**
	Some college			**-0.397**	**<0.001**	**-0.390**	**<0.001**
	Some graduate school			0.025	0.467	0.024	0.492
	Complete master's degree			*0.074*	*0.003*	*0.066*	*0.008*
	Some graduate training beyond master's degree			0.090	0.197	0.073	0.294
	Completed a doctoral degree			*0.170*	*0.005*	*0.157*	*0.009*
	Some post baccalaureate professional education			**0.300**	**<0.001**	**0.283**	**<0.001**
	Completed post baccalaureate professional degree			**0.263**	**<0.001**	**0.256**	**<0.001**
Census Region (South)	West			*-0.049*	*0.008*	*-0.053*	*0.004*
	Midwest			**-0.070**	**<0.001**	**-0.071**	**<0.001**
	Northeast			**-0.096**	**<0.001**	**-0.096**	**<0.001**
Self-reported race/ethnicity (non-Hispanic white)	Asian			0.021	0.474	0.031	0.294
	Hispanic			-0.017	0.403	-0.004	0.842
	Native American			-0.217	0.101	-0.212	0.108
	Non-Hispanic Black			**-0.124**	**<0.001**	**-0.117**	**<0.001**
	Other			-0.174	0.064	-0.182	0.053
Highest parental education level (Completed college)	8th grade or less					-0.049	0.291
	More than 8th grade, but did not graduate high school					-0.005	0.892
	Went to a business, trade, or vocational school after high school					0.084	0.415
	High school graduate					*-0.053*	*0.010*
	Completed a GED					0.033	0.369
	Went to a business, trade, or vocational school after college					0.013	0.669
	Some college					0.016	0.479
	Professional training beyond college					0.041	0.068
	Never went to school					*-0.077*	*0.022*
Family financial status (Average)	A lot better off					*-0.063*	*0.038*
	Somewhat better off					0.004	0.828
	Somewhat worse off					0.004	0.809
	A lot worse off					*0.090*	*0.005*

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

*Table C.6. Model results for all model designs for O*NET item Inductive Reasoning.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	**p**	**Estimate**	**p**	**Estimate**	**p**
ADHD diagnosis (No)		**-0.145**	**0.000**	*-0.096*	*0.005*	*-0.099*	*0.004*
Age		-0.005	0.163	0.001	0.809	0.001	0.838
Sex (female)				*0.040*	*0.003*	*0.038*	*0.004*
Highest Education Level (Completed college)	8th grade or less			**-1.467**	**<0.001**	**-1.446**	**<0.001**
	Some high school			**-0.899**	**<0.001**	**-0.876**	**<0.001**
	Obtained high school diploma			**-0.636**	**<0.001**	**-0.621**	**<0.001**
	Completed a GED			**-0.693**	**<0.001**	**-0.684**	**<0.001**
	Some vocational or technical training			**-0.562**	**<0.001**	**-0.553**	**<0.001**
	Some community college			**-0.491**	**<0.001**	**-0.481**	**<0.001**
	Completed vocational or technical training			**-0.479**	**<0.001**	**-0.470**	**<0.001**
	Associate or junior college degree			**-0.086**	**<0.001**	**-0.081**	**<0.001**
	Some college			**-0.414**	**<0.001**	**-0.409**	**<0.001**
	Some graduate school			0.061	0.070	0.059	0.080
	Complete master's degree			*0.071*	*0.003*	*0.067*	*0.005*
	Some graduate training beyond master's degree			**0.222**	**0.001**	**0.213**	**0.001**
	Completed a doctoral degree			**0.283**	**<0.001**	**0.276**	**<0.001**
	Some post baccalaureate professional education			**0.332**	**<0.001**	**0.323**	**<0.001**
	Completed post baccalaureate professional degree			**0.281**	**<0.001**	**0.279**	**<0.001**
Census Region (South)	West			-0.028	0.119	-0.031	0.079
	Midwest			**-0.055**	**0.001**	**-0.055**	**0.001**
	Northeast			**-0.103**	**<0.001**	**-0.103**	**<0.001**
Self-reported race/ethnicity (non-Hispanic white)	Asian			0.035	0.215	0.043	0.130
	Hispanic			0.002	0.924	0.013	0.532
	Native American			-0.194	0.127	-0.190	0.136
	Non-Hispanic Black			**-0.081**	**<0.001**	**-0.076**	**<0.001**
	Other			*-0.205*	*0.023*	*-0.207*	*0.022*
Highest parental education level (Completed college)	8th grade or less					-0.043	0.337
	More than 8th grade, but did not graduate high school					-0.032	0.321
	Went to a business, trade, or vocational school after high school					0.013	0.899
	High school graduate					*-0.045*	*0.023*
	Completed a GED					0.022	0.535
	Went to a business, trade, or vocational school after college					-0.002	0.954
	Some college					0.004	0.851
	Professional training beyond college					0.013	0.561
	Never went to school					*-0.069*	*0.034*
Family financial status (Average)	A lot better off					-0.041	0.155
	Somewhat better off					-0.010	0.561
	Somewhat worse off					-0.006	0.717
	A lot worse off					*0.063*	*0.040*

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

*Table C.7. Model results for all model designs for O*NET item Stress Tolerance.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	**p**	**Estimate**	**p**	**Estimate**	**p**
ADHD diagnosis (No)		**-0.146**	**0.000**	**-0.120**	**0.001**	**-0.123**	**0.001**
Age		-0.007	0.061	-0.001	0.783	-0.001	0.723
Sex (female)				**-0.096**	**<0.001**	**-0.094**	**<0.001**
Highest Education Level (Completed college)	8th grade or less			*-0.618*	*0.038*	*-0.631*	*0.035*
	Some high school			**-0.415**	**<0.001**	**-0.422**	**<0.001**
	Obtained high school diploma			**-0.315**	**<0.001**	**-0.317**	**<0.001**
	Completed a GED			**-0.381**	**<0.001**	**-0.390**	**<0.001**
	Some vocational or technical training			**-0.295**	**<0.001**	**-0.293**	**<0.001**
	Some community college			**-0.268**	**<0.001**	**-0.270**	**<0.001**
	Completed vocational or technical training			**-0.242**	**<0.001**	**-0.243**	**<0.001**
	Associate or junior college degree			**0.097**	**<0.001**	**0.095**	**<0.001**
	Some college			**-0.202**	**<0.001**	**-0.204**	**<0.001**
	Some graduate school			*0.107*	*0.003*	*0.106*	*0.003*
	Complete master's degree			**-0.077**	**0.002**	**-0.079**	**0.002**
	Some graduate training beyond master's degree			0.031	0.667	0.021	0.768
	Completed a doctoral degree			**-0.197**	**0.002**	**-0.199**	**0.001**
	Some post baccalaureate professional education			**0.562**	**<0.001**	**0.560**	**<0.001**
	Completed post baccalaureate professional degree			**0.344**	**<0.001**	**0.340**	**<0.001**
Census Region (South)	West			-0.007	0.712	-0.005	0.777
	Midwest			-0.013	0.491	-0.012	0.529
	Northeast			*-0.069*	*0.004*	*-0.067*	*0.005*
Self-reported race/ethnicity (non-Hispanic white)	Asian			-0.005	0.873	-0.003	0.928
	Hispanic			-0.018	0.405	-0.010	0.655
	Native American			0.030	0.825	0.033	0.811
	Non-Hispanic Black			**-0.063**	**0.002**	*-0.060*	*0.003*
	Other			-0.034	0.728	-0.040	0.678
Highest parental education level (Completed college)	8th grade or less					-0.054	0.265
	More than 8th grade, but did not graduate high school					*0.071*	*0.044*
	Went to a business, trade, or vocational school after high school					-0.088	0.411
	High school graduate					0.009	0.674
	Completed a GED					*0.100*	*0.010*
	Went to a business, trade, or vocational school after college					0.038	0.223
	Some college					0.038	0.108
	Professional training beyond college					*0.049*	*0.038*
	Never went to school					0.036	0.306
Family financial status (Average)	A lot better off					-0.003	0.933
	Somewhat better off					-0.007	0.719
	Somewhat worse off					0.013	0.473
	A lot worse off					-0.004	0.893

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

*Table C.8. Model results for all model designs for O*NET item Multilimb Coordination.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	**p**	**Estimate**	**p**	**Estimate**	**p**
ADHD diagnosis (No)		-0.147	0.054	**-0.288**	**<0.001**	**-0.275**	**<0.001**
Age		0.004	0.614	-0.004	0.615	-0.003	0.653
Sex (female)				*0.074*	*0.010*	*0.075*	*0.010*
Highest Education Level (Completed college)	8th grade or less			*1.505*	*0.012*	*1.551*	*0.010*
	Some high school			**1.033**	**<0.001**	**1.019**	**<0.001**
	Obtained high school diploma			**0.728**	**<0.001**	**0.705**	**<0.001**
	Completed a GED			**0.722**	**<0.001**	**0.707**	**<0.001**
	Some vocational or technical training			**0.753**	**<0.001**	**0.748**	**<0.001**
	Some community college			**0.187**	**0.001**	*0.163*	*0.005*
	Completed vocational or technical training			**0.627**	**<0.001**	**0.600**	**<0.001**
	Associate or junior college degree			**0.441**	**<0.001**	**0.418**	**<0.001**
	Some college			**0.193**	**<0.001**	**0.180**	**0.001**
	Some graduate school			*0.185*	*0.010*	*0.181*	*0.012*
	Complete master's degree			**-0.199**	**<0.001**	**-0.185**	**<0.001**
	Some graduate training beyond master's degree			-0.222	0.124	-0.203	0.161
	Completed a doctoral degree			0.037	0.765	0.070	0.573
	Some post baccalaureate professional education			**0.470**	**0.001**	**0.505**	**0.001**
	Completed post baccalaureate professional degree			0.079	0.325	0.097	0.228
Census Region (South)	West			0.017	0.657	0.023	0.552
	Midwest			**0.115**	**0.002**	**0.113**	**0.002**
	Northeast			*-0.132*	*0.005*	*-0.129*	*0.007*
Self-reported race/ethnicity (non-Hispanic white)	Asian			-0.105	0.084	-0.094	0.125
	Hispanic			**-0.146**	**0.001**	*-0.133*	*0.003*
	Native American			0.082	0.766	0.081	0.767
	Non-Hispanic Black			-0.028	0.496	-0.024	0.559
	Other			0.061	0.754	0.065	0.737
Highest parental education level (Completed college)	8th grade or less					-0.094	0.331
	More than 8th grade, but did not graduate high school					0.024	0.732
	Went to a business, trade, or vocational school after high school					*-0.491*	*0.022*
	High school graduate					*0.101*	*0.019*
	Completed a GED					0.108	0.164
	Went to a business, trade, or vocational school after college					0.052	0.400
	Some college					0.065	0.162
	Professional training beyond college					-0.026	0.579
	Never went to school					0.040	0.571
Family financial status (Average)	A lot better off					-0.102	0.104
	Somewhat better off					-0.064	0.099
	Somewhat worse off					-0.029	0.432
	A lot worse off					-0.130	0.051

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

*Table C.9. Model results for all model designs for O*NET item Response Orientation.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	**p**	**Estimate**	**p**	**Estimate**	**p**
ADHD diagnosis (No)		*-0.155*	*0.011*	**-0.278**	**<0.001**	**-0.267**	**<0.001**
Age		0.007	0.261	0.000	0.969	0.001	0.901
Sex (female)				**0.146**	**<0.001**	**0.147**	**<0.001**
Highest Education Level (Completed college)	8th grade or less			0.469	0.334	0.516	0.289
	Some high school			**0.501**	**<0.001**	**0.487**	**<0.001**
	Obtained high school diploma			**0.353**	**<0.001**	**0.331**	**<0.001**
	Completed a GED			**0.418**	**<0.001**	**0.401**	**<0.001**
	Some vocational or technical training			**0.420**	**<0.001**	**0.415**	**<0.001**
	Some community college			0.014	0.766	-0.007	0.882
	Completed vocational or technical training			**0.227**	**<0.001**	**0.203**	**<0.001**
	Associate or junior college degree			**0.363**	**<0.001**	**0.342**	**<0.001**
	Some college			0.020	0.641	0.010	0.809
	Some graduate school			**0.204**	**<0.001**	**0.201**	**0.001**
	Complete master's degree			**-0.185**	**<0.001**	**-0.171**	**<0.001**
	Some graduate training beyond master's degree			-0.123	0.296	-0.103	0.381
	Completed a doctoral degree			*-0.236*	*0.020*	*-0.201*	*0.048*
	Some post baccalaureate professional education			**0.530**	**<0.001**	**0.559**	**<0.001**
	Completed post baccalaureate professional degree			0.081	0.213	0.099	0.128
Census Region (South)	West			0.019	0.543	0.025	0.423
	Midwest			*0.082*	*0.006*	**0.083**	**0.006**
	Northeast			**-0.141**	**<0.001**	**-0.136**	**<0.001**
Self-reported race/ethnicity (non-Hispanic white)	Asian			-0.093	0.058	-0.086	0.085
	Hispanic			*-0.068*	*0.048*	-0.057	0.119
	Native American			0.031	0.889	0.039	0.861
	Non-Hispanic Black			-0.011	0.732	-0.008	0.799
	Other			0.092	0.561	0.101	0.525
Highest parental education level (Completed college)	8th grade or less					-0.080	0.309
	More than 8th grade, but did not graduate high school					-0.017	0.763
	Went to a business, trade, or vocational school after high school					*-0.360*	*0.039*
	High school graduate					*0.079*	*0.025*
	Completed a GED					0.120	0.056
	Went to a business, trade, or vocational school after college					0.054	0.279
	Some college					0.057	0.134
	Professional training beyond college					-0.028	0.470
	Never went to school					0.073	0.203
Family financial status (Average)	A lot better off					-0.063	0.218
	Somewhat better off					*-0.078*	*0.013*
	Somewhat worse off					-0.043	0.146
	A lot worse off					-0.102	0.061

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

*Table C.10. Model results for all model designs for O*NET item Problem Sensitivity.*

Model:		Base		Base + Individual-level		Base + Individual- & Family-level	
Term		**Estimate**	**p**	**Estimate**	**p**	**Estimate**	**p**
ADHD diagnosis (No)		**-0.175**	**<0.001**	**-0.135**	**<0.001**	**-0.135**	**<0.001**
Age		*-0.011*	*0.006*	-0.004	0.328	-0.004	0.297
Sex (female)				-0.034	0.018	*-0.034*	*0.016*
Highest Education Level (Completed college)	8th grade or less			**-1.200**	**<0.001**	**-1.194**	**<0.001**
	Some high school			**-0.735**	**<0.001**	**-0.722**	**<0.001**
	Obtained high school diploma			**-0.557**	**<0.001**	**-0.550**	**<0.001**
	Completed a GED			**-0.666**	**<0.001**	**-0.667**	**<0.001**
	Some vocational or technical training			**-0.520**	**<0.001**	**-0.516**	**<0.001**
	Some community college			**-0.473**	**<0.001**	**-0.470**	**<0.001**
	Completed vocational or technical training			**-0.426**	**<0.001**	**-0.423**	**<0.001**
	Associate or junior college degree			0.017	0.447	0.017	0.455
	Some college			**-0.387**	**<0.001**	**-0.385**	**<0.001**
	Some graduate school			*0.090*	*0.012*	*0.089*	*0.013*
	Complete master's degree			0.009	0.713	0.007	0.769
	Some graduate training beyond master's degree			0.030	0.672	0.021	0.765
	Completed a doctoral degree			*0.132*	*0.032*	*0.131*	*0.033*
	Some post baccalaureate professional education			**0.478**	**<0.001**	**0.472**	**<0.001**
	Completed post baccalaureate professional degree			**0.272**	**<0.001**	**0.272**	**<0.001**
Census Region (South)	West			*-0.046*	*0.016*	*-0.047*	*0.013*
	Midwest			-0.034	0.062	*-0.034*	*0.063*
	Northeast			**-0.126**	**<0.001**	**-0.123**	**<0.001**
Self-reported race/ethnicity (non-Hispanic white)	Asian			0.045	0.130	0.055	0.069
	Hispanic			-0.017	0.412	-0.006	0.787
	Native American			-0.071	0.603	-0.065	0.633
	Non-Hispanic Black			**-0.103**	**<0.001**	**-0.097**	**<0.001**
	Other			*-0.199*	*0.038*	*-0.205*	*0.033*
Highest parental education level (Completed college)	8th grade or less					-0.060	0.206
	More than 8th grade, but did not graduate high school					0.021	0.550
	Went to a business, trade, or vocational school after high school					-0.032	0.758
	High school graduate					-0.024	0.249
	Completed a GED					0.072	0.059
	Went to a business, trade, or vocational school after college					0.030	0.326
	Some college					0.033	0.157
	Professional training beyond college					0.021	0.358
	Never went to school					-0.038	0.272
Family financial status (Average)	A lot better off					-0.057	0.065
	Somewhat better off					-0.013	0.502
	Somewhat worse off					-0.002	0.919
	A lot worse off					0.054	0.102

Statistically significant ($p < 0.0024$) estimates are bolded. Estimates with p-values < 0.05 are italicized. Reference category is in parentheses.

Table C.11. Job descriptions and Standard Occupation Classification (SOC) Major Group categories for most common occupations in sample.

O*NET-SOC Job Title	SOC Major Group	O*NET Description of Job
First-Line Supervisors of Retail Sales Workers	Sales & Related Occupations	Directly supervise & coordinate activities of retail sales workers in an establishment or department. Duties may include management functions, such as purchasing, budgeting, accounting, & personnel work, in addition to supervisory duties.
Computer Systems Engineers/Architects	Computer & Mathematical Occupations	Design & develop solutions to complex applications problems, system administration issues, or network concerns. Perform systems management & integration functions.
Customer Service Representatives	Office & Administrative Support Occupations	Interact with customers to provide basic or scripted information in response to routine inquiries about products & services. May handle & resolve general complaints. Excludes individuals whose duties are primarily installation, sales, repair, & technical support.
Document Management Specialists	Computer & Mathematical Occupations	Implement & administer enterprise-wide document management systems & related procedures that allow organizations to capture, store, retrieve, share, & destroy electronic records & documents.
Geographic Information Systems Technologists & Technicians	Computer & Mathematical Occupations	Assist scientists or related professionals in building, maintaining, modifying, or using geographic information systems (GIS) databases. May also perform some custom application development or provide user support.
Information Security Engineers	Computer & Mathematical Occupations	Develop & oversee the implementation of information security procedures & policies. Build, maintain & upgrade security technology, such as firewalls, for the safe use of computer networks & the transmission & retrieval of information. Design & implement appropriate security controls to identify vulnerabilities & protect digital files & electronic infrastructures. Monitor & respond to computer security breaches, viruses, & intrusions, & perform forensic investigation. May oversee the assessment of information security systems.
Information Technology Project Managers	Computer & Mathematical Occupations	Plan, initiate, & manage information technology (IT) projects. Lead & guide the work of technical staff. Serve as liaison between business & technical aspects of projects. Plan project stages & assess business implications for each stage. Monitor progress to assure deadlines, standards, & cost targets are met.
Web Administrators	Computer & Mathematical Occupations	Manage web environment design, deployment, development & maintenance activities. Perform testing & quality assurance of web sites & web applications.
Loss Prevention Managers	Management Occupations	Plan & direct policies, procedures, or systems to prevent the loss of assets. Determine risk exposure or potential liability & develop risk control measures.
Regulatory Affairs Managers	Management Occupations	Plan, direct, or coordinate production activities of an organization to ensure compliance with regulations & standard operating procedures.
Acute Care Nurses	Healthcare Practitioners & Technical Occupations	Provide advanced nursing care for patients with acute conditions such as heart attacks, respiratory distress syndrome, or shock. May care for pre- & post-operative patients or perform advanced, invasive diagnostic or therapeutic procedures.
Advanced Practice Psychiatric Nurses	Healthcare Practitioners & Technical Occupations	Assess, diagnose, & treat individuals & families with mental health or substance use disorders or the potential for such disorders. Apply therapeutic activities, including the prescription of medication, per state regulations, & the administration of psychotherapy.
Clinical Nurse Specialists	Healthcare Practitioners & Technical Occupations	Direct nursing staff in the provision of patient care in a clinical practice setting, such as a hospital, hospice, clinic, or home. Ensure adherence to established clinical policies, protocols, regulations, & standards.
Critical Care Nurses	Healthcare Practitioners & Technical Occupations	Provide specialized nursing care for patients in critical or coronary care units.
Registered Nurses	Healthcare Practitioners & Technical Occupations	Assess patient health problems & needs, develop & implement nursing care plans, & maintain medical records. Administer nursing care to ill, injured, convalescent, or disabled patients. May advise patients on health maintenance & disease prevention or provide case management. Licensing or registration required.
First-Line Supervisors of Office & Administrative Support Workers	Office & Administrative Support Occupations	Directly supervise & coordinate the activities of clerical & administrative support workers.

SOC system information is available through the U.S. Bureau of Labor Statistics (bls.gov/soc/).

*Table C.12. Job descriptions and SOC Major Group categories for top ten O*NET SOC job titles with high values in Innovation and Visualization.*

O*NET Job Title	Item	SOC Major Group	O*NET Job Description
Video Game Designer	Innovation	Computer & Mathematical Occupations	Design core features of video games. Specify innovative game and role-play mechanics, story lines, & character biographies. Create & maintain design documentation. Guide & collaborate with production staff to produce games as designed.
Fine Artists, Including Painters, Sculptors, & Illustrators	Innovation; Visualization	Arts, Design, Entertainment, Sports, & Media Occupations	Create original artwork using any of a wide variety of media & techniques.
Poets, Lyricists, & Creative Writers	Innovation	Arts, Design, Entertainment, Sports, & Media Occupations	Create original written works, such as scripts, essays, prose, poetry or song lyrics, for publication or performance.
Choreographers	Innovation	Arts, Design, Entertainment, Sports, & Media Occupations	Create new dance routines. Rehearse performance of routines. May direct & stage presentations.
Special Effects Artists & Animators	Innovation	Arts, Design, Entertainment, Sports, & Media Occupations	Create special effects or animations using film, video, computers, or other electronic tools & media for use in products, such as computer games, movies, music videos, & commercials.
Music Directors & Composers	Innovation	Arts, Design, Entertainment, Sports, & Media Occupations	Conduct, direct, plan, & lead instrumental or vocal performances by musical artists or groups, such as orchestras, bands, choirs, & glee clubs; or create original works of music.
Writers & Authors	Innovation	Arts, Design, Entertainment, Sports, & Media Occupations	Originate and prepare written material, such as scripts, stories, advertisements, & other material.
Computer & Information Research Scientists	Innovation	Computer & Mathematical Occupations	Conduct research into fundamental computer & information science as theorists, designers, or inventors. Develop solutions to problems in the field of computer hardware & software.
Commercial & Industrial Designers	Innovation	Arts, Design, Entertainment, Sports, & Media Occupations	Design & develop manufactured products, such as cars, home appliances, & children's toys. Combine artistic talent with research on product use, marketing, & materials to create the most functional & appealing design.
Nanosystems Engineers	Innovation	Architecture & Engineering Occupations	Design, develop, or supervise the production of materials, devices, or systems of unique molecular or macromolecular composition, applying principles of nanoscale physics & electrical, chemical, or biological engineering.
Architects, Except Landscape & Naval	Visualization	Architecture & Engineering Occupations	Plan & design structures, such as private residences, office buildings, theaters, factories, & other structural property.
Robotics Engineers	Visualization	Architecture & Engineering Occupations	Research, design, develop, or test robotic applications.
Set & Exhibit Designers	Visualization	Arts, Design, Entertainment, Sports, & Media Occupations	Design special exhibits & sets for film, video, television, & theater productions. May study scripts, confer with directors, & conduct research to determine appropriate architectural styles.
Air Traffic Controllers	Visualization	Transportation & Material Moving Occupations	Control air traffic on & within vicinity of airport, and movement of air traffic between altitude sectors and control centers, according to established procedures & policies. Authorize, regulate, & control commercial airline flights according to government or company regulations to expedite & ensure flight safety.
Construction Managers	Visualization	Management Occupations	Plan, direct, or coordinate, usually through subordinate supervisory personnel, activities concerned with the construction and maintenance of structures, facilities, and systems. Participate in the conceptual development of a construction project & oversee its organization, scheduling, budgeting, and implementation. Includes managers in specialized construction fields, such as carpentry or plumbing.
Coaches & Scouts	Visualization	Arts, Design, Entertainment, Sports, & Media Occupations	Instruct or coach groups or individuals in the fundamentals of sports for the primary purpose of competition. Demonstrate techniques & methods of participation. May evaluate athletes' strengths & weaknesses as possible recruits or to improve the athletes' technique to prepare them for competition. Those required to hold teaching certifications should be reported in the appropriate teaching category.
Architectural & Engineering Managers	Visualization	Management Occupations	Plan, direct, or coordinate activities in such fields as architecture & engineering or research & development in these fields.
Landscape Architects	Visualization	Architecture & Engineering Occupations	Plan & design land areas for projects such as parks & other recreational facilities, airports, highways, hospitals, schools, land subdivisions, & commercial, industrial, and residential sites.
Physicists	Visualization	Life, Physical, & Social Science Occupations	Conduct research into physical phenomena, develop theories on the basis of observation and experiments, & devise methods to apply physical laws and theories.

SOC = Standard Occupation Classification. SOC system information is available through the U.S. Bureau of Labor Statistics (bls.gov/soc/).

*Table C.13. Top ten O*NET SOC Job Titles with high values in Innovation and their associated values for O*NET items not included in Table 5.6.*

	Problem Sensitivity	Inductive Reasoning	Category Flexibility	Spatial Orientation	Time Sharing	Manual Dexterity	Finger Dexterity	Multilimb Coordination	Response Orientation	Stress Tolerance[1]	Critical Thinking	Active Learning	Making Decisions & Solving Problems	Performing General Physical Activities	Handling & Moving Objects
Range:	*[2.0–5.1]*	*[2.0–5.0]*	*[1.9–5.0]*	*[0.0–3.1]*	*[1.1–3.3]*	*[0.0–4.0]*	*[0.0–4.3]*	*[0.0–4.0]*	*[0.0–3.5]*	*[0.2–3.0]*	*[2.0–5.0]*	*[1.0–5.0]*	*[2.0–6.3]*	*[0.2–6.3]*	*[0.1–6.6]*
Video Game Designers	**3.88**	**4.00**	**3.38**	0.00	**2.62**	**2.00**	**2.38**	0.00	0.00	1.43	**3.88**	**3.62**	**5.35**	0.35	0.65
Fine Artists, Including Painters, Sculptors, & Illustrators	3.00	3.00	3.25	0.00	2.00	**3.62**	**3.25**	**2.38**	**1.38**	0.44	3.25	3.38	3.67	**2.86**	**3.46**
Poets, Lyricists & Creative Writers	3.50	3.50	3.00	0.00	1.12	**1.62**	**2.25**	0.00	0.00	0.68	3.75	**3.75**	4.30	0.82	1.43
Choreographers	3.75	3.12	3.00	**2.50**	**2.88**	**1.62**	1.62	**3.50**	**1.88**	1.64	3.38	3.25	**5.24**	**6.14**	**3.10**
Special Effects Artists & Animators	3.50	3.38	**3.62**	0.00	2.38	**2.25**	**2.62**	0.50	0.50	1.19	3.75	3.38	3.47	0.81	1.74
Music Directors & Composers	3.38	3.38	**3.62**	0.62	**2.62**	**2.25**	**2.12**	**2.62**	0.88	1.80	3.75	3.38	4.66	2.48	2.06
Writers & Authors	3.38	3.50	3.00	0.38	2.00	0.12	0.50	0.25	0.12	1.09	**4.00**	3.25	4.63	0.35	0.72
Computer & Information Research Scientists	**4.25**	**4.62**	**4.38**	0.00	2.12	**1.62**	**2.88**	0.00	0.12	0.97	**4.25**	**4.88**	**5.85**	1.28	1.63
Commercial & Industrial Designers	**3.88**	**3.88**	**3.88**	0.38	2.38	**1.75**	**2.75**	0.12	0.00	0.97	**4.00**	**4.00**	4.11	1.44	2.42
Nanosystems Engineers	**4.38**	**4.88**	**4.75**	0.00	2.25	**2.62**	**2.88**	**1.75**	0.00	1.07	**4.88**	**4.88**	**5.14**	2.38	**3.38**

SOC = Standard occupation classification. Values are from the full O*NET 30.1 database. Values above the mean are bolded. Values also 2 standard deviations from the mean are highlighted in dark grey. [1]These items have Impact values that could range from -3 to 3. All other items have Level values that could range from 0 to 7. Actual computed ranges are presented in brackets.

*Table C.14. Top ten O*NET SOC Job Titles with high values in Visualization and their associated values for O*NET items not included in Table 5.6.*

	Problem Sensitivity	Inductive Reasoning	Category Flexibility	Spatial Orientation	Time Sharing	Manual Dexterity	Finger Dexterity	Multilimb Coordination	Response Orientation	Stress Tolerance[1]	Critical Thinking	Active Learning	Making Decisions & Solving Problems	Performing General Physical Activities	Handling & Moving Objects
Range:	*[2.0–5.1]*	*[2.0–5.0]*	*[1.9–5.0]*	*[0.0–3.1]*	*[1.1–3.3]*	*[0.0–4.0]*	*[0.0–4.3]*	*[0.0–4.0]*	*[0.0–3.5]*	*[0.2–3.0]*	*[2.0–5.0]*	*[1.0–5.0]*	*[2.0–6.3]*	*[0.2–6.3]*	*[0.1–6.6]*
Architects, Except Landscape & Naval	**4.62**	**4.12**	**4.25**	**1.75**	**2.75**	**1.75**	**2.38**	1.12	0.00	1.43	**4.50**	**4.12**	**5.40**	2.29	2.76
Robotics Engineers	**4.50**	**4.50**	**3.88**	**1.00**	**2.88**	**3.00**	**3.62**	**2.38**	**1.38**	1.02	**4.62**	**4.50**	**5.03**	**2.60**	**3.77**
Set & Exhibit Designers	**3.88**	3.50	**3.50**	**1.75**	**2.75**	**2.75**	**2.88**	1.50	0.88	1.43	3.75	3.12	**4.90**	**2.81**	**3.30**
Air Traffic Controllers	**4.62**	**4.00**	**4.00**	**1.00**	**5.62**	**2.00**	**3.00**	0.38	0.88	**3.00**	**4.12**	**3.75**	**6.25**	0.77	1.47
Construction Managers	**4.25**	**4.12**	**3.88**	**2.00**	**3.12**	1.25	1.50	**1.75**	0.62	**2.21**	**4.38**	**4.00**	**5.05**	**4.20**	**4.65**
Coaches & Scouts	**4.00**	**4.00**	**3.88**	**1.38**	**3.00**	**1.88**	1.88	**1.88**	0.00	**2.21**	**4.00**	**4.00**	3.84	**3.99**	**3.83**
Architectural & Engineering Managers	**4.12**	**4.25**	**3.88**	**0.50**	**2.62**	**1.88**	**2.25**	0.75	0.00	1.80	**4.25**	**3.88**	5.78	2.12	2.32
Landscape Architects	**4.00**	**3.75**	**4.00**	**1.00**	**2.75**	**1.62**	1.88	0.62	0.00	1.14	**3.88**	**3.88**	**5.00**	2.10	1.95
Physicists	**4.88**	**5.50**	**5.12**	0.25	**2.88**	0.00	2.00	0.00	0.00	0.95	**4.88**	**5.50**	**5.88**	1.47	2.53
Fine Artists, Including Painters, Sculptors, & Illustrators	3.00	3.00	3.25	0.00	2.00	**3.62**	**3.25**	**2.38**	**1.38**	0.44	3.25	3.38	3.67	**2.86**	**3.46**

SOC = Standard occupation classification. Values are from the full O*NET 30.1 database. Values above the mean are bolded. Values also 2 standard deviations from the mean are highlighted in green. [1]These items have Impact values that could range from -3 to 3. All other items have Level values that could range from 0 to 7. Actual computed ranges are presented in brackets.

C.2 Chapter 5 Supplementary Figures

Base Model:

$$\textbf{O*NET item Level or Impact value} = \beta_0 + \beta_1(\text{ADHD diagnosis}) + \beta_2(\text{age})$$

Base + Individual-level Variables Model:

$$\textbf{O*NET item Level or Impact value} = \beta_0 + \beta_1(\text{ADHD diagnosis}) + \beta_2(\text{age}) + \beta_3(\text{sex}) + \beta_4(\text{highest education level}) + \beta_5(\text{census region}) + \beta_6(\text{self-reported race/ethnicity})$$

Base + Individual- & Family-level Variables Model:

Figure C.1. Model equations for all models. Individual-level variables are highlighted in yellow, and family-level variables are highlighted in green.

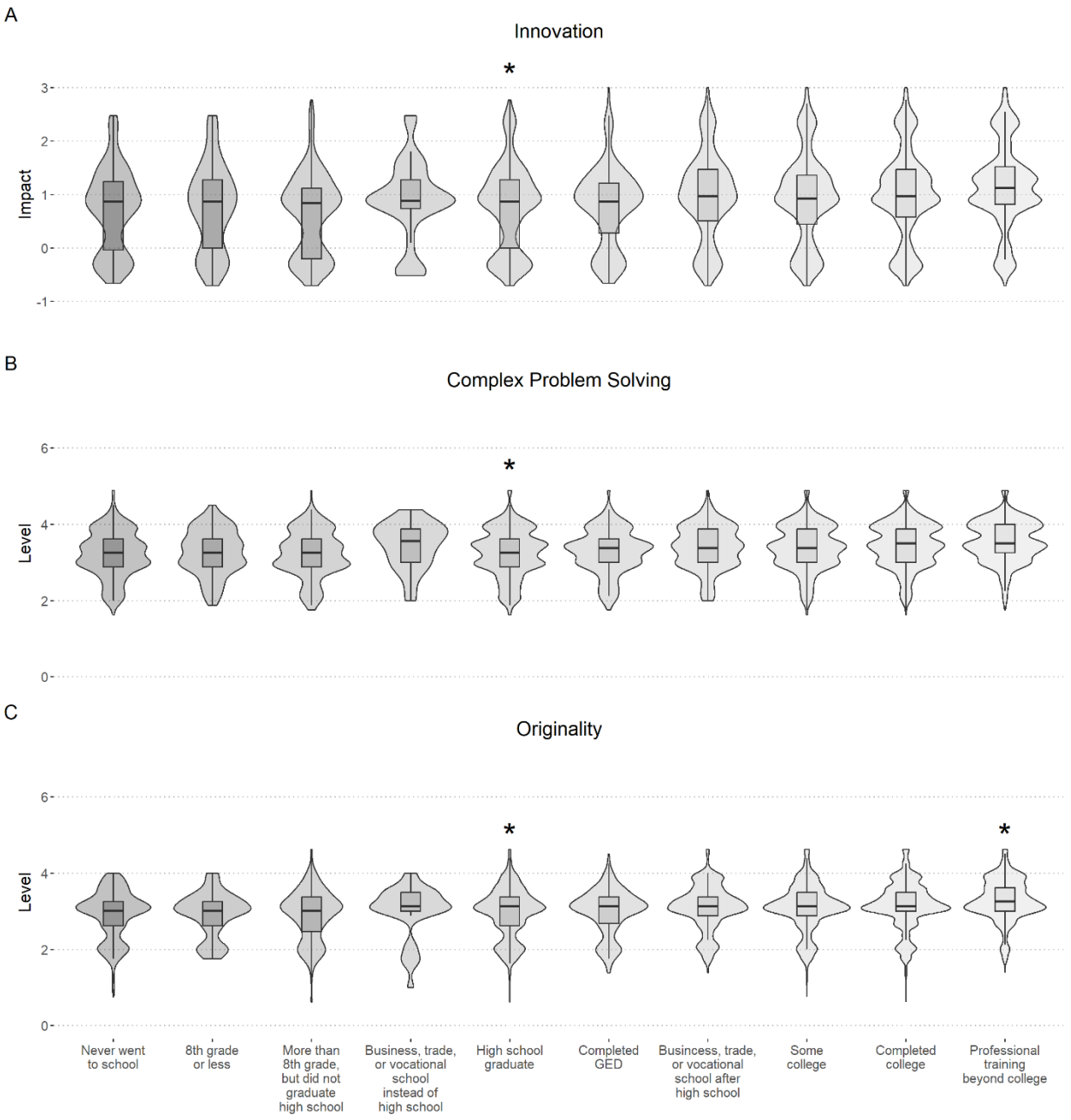

Figure C.2. Violin plots depicting kernel density estimates overlayed with box plots for parental education level categories for Innovation (A), Complex Problem Solving (B), and Originality (C). Bonferroni-significant ($p < 0.0024$) categories are noted with an asterisk.

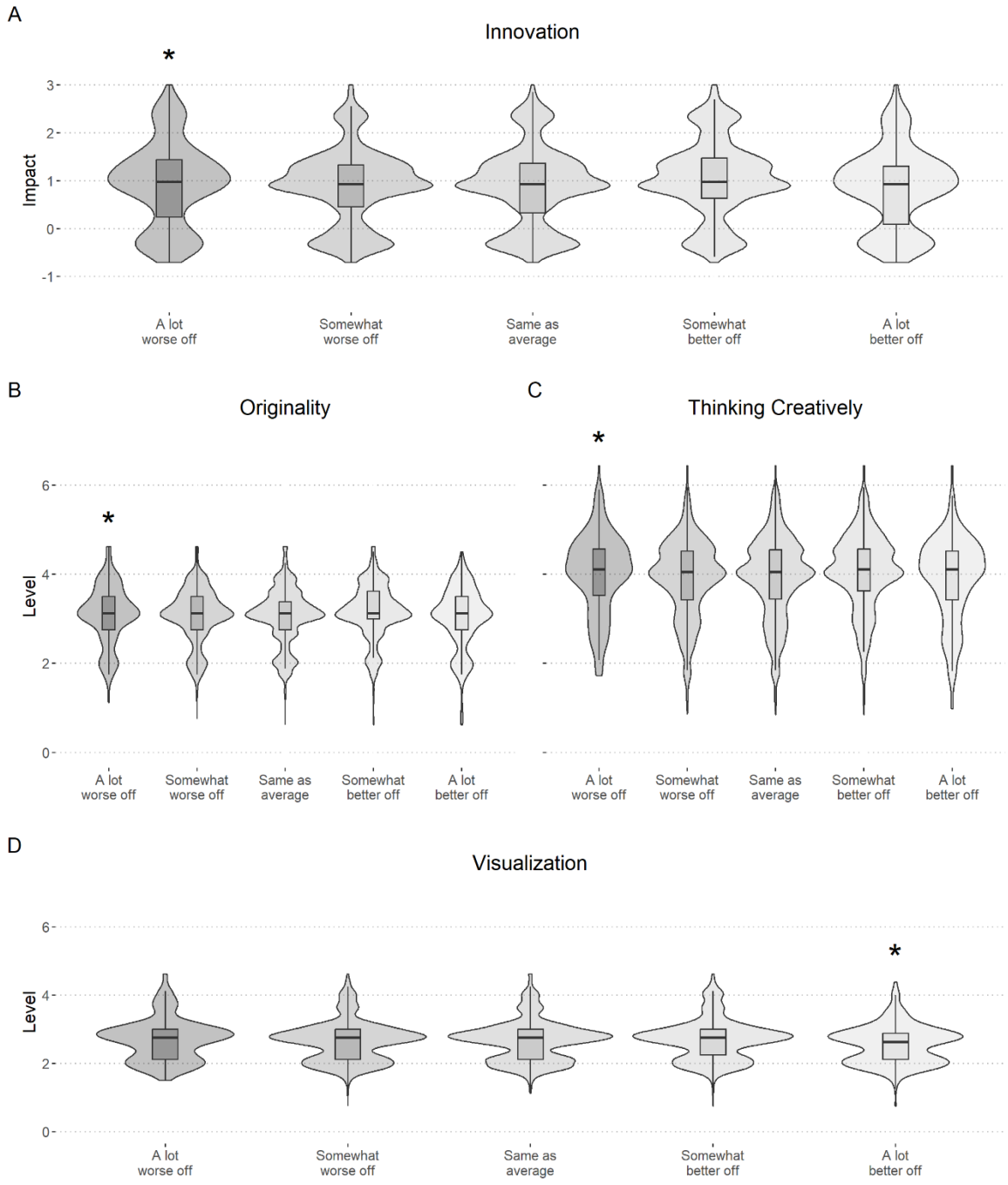

Figure C.3. Violin plots depicting kernel density estimates overlayed with box plots for family financial status categories for Innovation (A), Originality (B), Thinking Creatively (C), and Visualization (D). Bonferroni-significant ($p < 0.0024$) categories are noted with an asterisk.