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Walden University

College of Health Sciences and Public Policy

This is to certify that the doctoral study by

Imani S. Barnes

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
2025

Abstract

Factors Affecting School Readiness and Level of Distraction Among Black Children During Virtual Learning in the United States

by

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MSPH, Southern New Hampshire University, 2020

BS, South Carolina State University, 2004

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

February 2026

Abstract

The COVID-19 pandemic necessitated an shift to mandatory virtual learning (VL) for kindergarten through grade 12 students, disrupting educational systems globally and exposing systemic inequities. Although researchers had explored health and education disparities separately, they had not adequately examined the intersection of child health, specifically body mass index (BMI) and health-affected ability, with school readiness and level of distraction in VL environments. The purpose of this quantitative, cross-sectional study was to examine associations between BMI, health affected ability, school readiness, and distraction levels among U.S. Black children engaged in VL in the 2020 school year, controlling for gender, age, and parental education level. The socioecological model was the framework utilized. Data from the 2020 National Survey of Children's Health were analyzed using ordinal logistic regression to test four research questions pertaining to (a) BMI in school readiness, (b) BMI and level of distraction, (c) health affected ability and level of distraction, and (d) school readiness and level of distraction. The sample size was 725 participants. Results indicated that higher BMI were associated with lower levels of school readiness and greater levels of distraction. Health-affected ability was a significant predictor of distraction. Children who experienced more health limitations were more likely to report higher levels of distraction. Furthermore, lower school readiness was associated with greater distraction, suggesting that health-related factors and academic preparedness influenced children’s ability to remain engaged during virtual instruction. This study has the potential to reduce health-related academic disparities and promote positive social change in historically underserved youth populations.

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Dedication

First, I would like to thank God for giving me the strength to push through to the end even when I didn't believe I could. I dedicate this to my one and only child, my son, Mr. Malachi Imari Barnes; my beautiful mother, Sherilyn Bell; my late grandmother Rita Crew; my amazing family; and all of my close friends who took this journey with me. I love you all dearly!

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Section 1: Foundation of the Study and Literature Review

The COVID-19 pandemic affected almost all countries globally leaving schools closed and educational systems disrupted. It is an unprecedented event similar to historical events like the Great Depression, 1918 flu pandemic, and the 2008 recession that endangered children's education and health (Benner & Mistry, 2020). Global school closures from COVID-19 affected approximately 1.6 billion scholars in over 200 countries making it the leading disturbance of educational systems in history (Pokhrel & Chhetri, 2021). Approximately 94% of the global student population in schools and universities had to adapt to required virtual learning (VL) with not many other alternatives, making this a new experience for both school leaders and students (Pokhrel & Chhetri, 2021). Massive sociohistorical events have threatened the health and well-being and disturbed the growth and development of children and adolescents where less advantaged, lower socioeconomic status (SES) students are more affected (Benner & Mistry, 2020; Flack et al., 2020).

Emergency school closures endanger healthy development for children in the United States by jeopardizing access to healthy school lunch programs which are provided to more than 35 million children daily (Benner & Mistry, 2020). Furthermore, studies have found prior to the COVID-19 pandemic, students in lower SES experienced greater learning loss and disproportions in school readiness during breaks, exacerbating the inequities (González et al., 2022; Zhang & Storey, 2022).

Background

Although researchers have explored this issue, there is very little or no literature on the in-depth research on the virtual home learning environment and how it has affected the health and academic achievement of low SES students, specifically Black students, as stated by Greenhow et al., (2020). Furthermore, additional research is also necessary to understand how weight gain from long periods of homeschool in low SES homes retain the knowledge from schoolwork and aggravate existing disparities as Franckle et al., (2014) found higher a risk of weight gain amongst children with pre-existing disparities. This research can potentially contribute to positive social change by educating schools, parents, and stakeholders in the United States on how to improve child health and mitigate educational disparities that exist during virtual homeschooling. This research will provide a better understanding of how Black students' health is affected during mandatory virtual homeschool.

Problem Statement

The specific public health research problem that will be addressed through this research is how mandatory VL can affect child health. Specifically, this research will address how a child's body mass index (BMI) exacerbates educational disparities in especially at-risk racial, ethnic, and SES groups such as Black students in 2020 during VL in the United States. Mandatory VL highlighted the systemic disproportions in education and the unique roadblocks for demographics including Black, other minority, and low SES populations (Zhang & Store, 2022). Furthermore, already disproportioned students' overall health is affected exponentially more. Zhang and Store (2022) explained

how the learning shift from teacher to family in historically disadvantaged populations widened the achievement gap compared to their wealthier peers. They found low and working-class families relied more on school issued resources while their wealthier peers had access to better VL technology, resources, and supportive educated parents. Additionally, disadvantaged students also lost access to non-academic resources like school mental health services, free healthy school meals, library and healthcare support (Zhang & Store, 2022). Evidence from similar historical events like the COVID-19 Pandemic such as the Great Recession of 2008 provides insight on how U.S. school districts with more low-income and minority students had decreased student achievement and increased the achievement gap compared to their economically advantaged peers (Shores & Steinberg, 2019).

The healthy food options offered by the U.S. Department of Agricultures (USDA) National School Lunch Program (NSLP) and School Breakfast Program (SBP) are critical federal initiatives aimed at reducing food insecurity and improving nutritional outcomes among children in the United States (USDA, 2021). These programs have provided free or reduced-price meals to millions of students, particularly those from low-income households where in 2019, the NSLP served approximately 29.4 million children daily and the SBP served 14.77 million children daily (FRAC, 2020; USDA, 2021). School ensured nourishment, access to school counselors who provided mental health services, and mandatory physical education that provided regular exercise (Browne et al., 2021). Students who previously experienced learning disruptions as a result of their social determinants including low income, social, and cultural populations, during

mandatory home VL may have also struggled with food insecurity, lack of digital resources, low parental digital literacy, or reduced physical activity (Shinwell & Defeyter, 2017; Bozkurt et. al, 2020).

Black and Hispanic children have a higher risk of inflammation, which increases their BMI and leads to obesity (Townsend et al., 2020). Browne et al., (2021) found an association with being out of school for Black and Hispanic children and weight gain from the lack of ability to uphold a healthy weight. Furthermore, in the United States, 30 million children depend on lunch from the National School Lunch Program and over 14.7 million participate in the National School Breakfast Program providing them healthy food options and access to at least two nutritionally balanced meals a day five days per week (Browne et al., 2021). A recent U.S. study by Patrick et al., (2020) showed how inflation in food cost in 2020 and children being home from school led to food insecurity that increased from March to July 2020 from 32.6% to 36.0% Rundle et al., (2020) described how parents supplemented foods during the inflation period. Parents purchased cheaper, processed, high caloric, non-nutrient dense foods that increase BMI and risk for obesity leading to other problems like depression, isolation, and academic regression. Rundle describes how more than 30 million children a year receive free or reduced school meals. Closing school for even 1 day has reverberating effects; in Philadelphia, PA a 3-day school closure could lead to more than 405,000 missed meals amongst school-aged children. Children in this demographic were also more negatively affected academically than their higher income peers. Shores and Steinberg (2019) described how during the

2008 Great Recession school districts with the most qualifying National School Lunch and Black students had declines in math scores.

The transition from traditional brick and mortar in person school to the VL environment not only affects the children's physical health, but also mental health and well-being. During this time, children were isolated from normal socialization with peers, were called to learn in an unfamiliar learning setting, and no longer had access to federally funded school-based healthcare services (SBHCs). In the United States, SBHCs provide approximately 6.3 million students in 10,629 schools mental, oral, reproductive health, vision services, immunizations, and other services (Love et al., 2019). With schools being closed, these services were unavailable leaving children vulnerable to a myriad of adverse health issues. Jackson et al., (2021) describes how adverse childhood experiences like mandatory school closures have been associated with unfavorable health outcomes in children, that can reduce their school readiness, negatively affecting their academic achievement later in life. There is a gap in research in understanding how long term mandatory VL has affected already disproportionate Black low SES students' health and school readiness. George et al., (2021) found low-SES and Black students trail about 1 to 2 years behind their appropriate level after stressful events like long-term school closures.

Purpose of the Study

Students experienced a major life course event when mandatory VL was enforced in schools nationwide in 2020. The purpose of this quantitative study is to investigate the impact of BMI and health affected ability on school readiness and level of distraction of Black children during virtual homeschool controlled for children's gender, age and parental educational level.

Research Questions and Hypotheses

To address health disparities that arise from students being placed into mandatory virtual home school, stakeholders must better understand the environment and behaviors that exist within their home, community, and cultures. By encouraging physical exercise and physical activity during virtual home school, it gave students and parents tips on controlling weight gain, boosting students' immune systems, and improving mental health (Ruíz-Roso et al., 2020). Not all home situations were set up for children to be healthy or to succeed virtually while participating in mandatory homeschool. This research aims to understand other factors that contributed to a less than adequate home school environment, the effect this environment has to Black children's health, and to help mitigate virtual homeschool educational inequalities that existed for Black children in less privileged schools and communities by addressing the following research questions (RQs) and hypotheses:

RQ1: Is there an association between BMI (BMI percentile) and school readiness among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

$H_0$1: There is no significant association between BMI (BMI percentile) and school readiness among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

H_a1: There is a significant association between BMI (BMI percentile) and school readiness among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

RQ2: Is there an association between BMI and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

$H_0$2: There is no significant association between BMI and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

H_a2: There is a significant association between BMI and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

RQ3: Is there an association between health affected ability and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

$H_0$3: There is no significant association between health affected ability and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

H_a3: There is a significant association between health affected ability and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

RQ4: Is there an association between school readiness and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

$H_0 4$: There is no significant association between school readiness and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

$H_a 4$: There is a significant association between school readiness and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

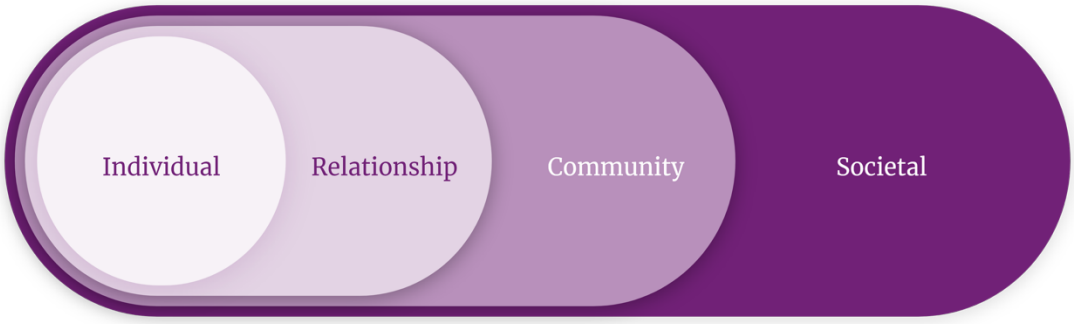
Conceptual Framework

The conceptual framework that ground this study include the socioecological model (SEM), as shown in Figure 1 (CDC, 2019). The original author of this model is psychologist Urie Bronfenbrenner who believed children's development depends on its relationship to the five ecological systems (Guy-Evans, 2020). These five ecosystems in Bronfenbrenner's model are the microsystem, mesosystem, exosystem, macrosystem, and chronosystem. The microsystem or individual level is the direct interactions and engagement the child has with parents/guardians, family, friends, and their local environment (Bronfenbrenner & Morris, 2007). Bronfenbrenner described the mesosystem as the relationships between family and community, school, workplace, and

social networks. Next is the exosystem which refers to the availability of places like libraries, clinics, hospitals, government departments, parks, and other community resources that do not directly influence an individual (Bronfenbrenner & Morris, 2007). The macrosystem encompasses culture, religious beliefs, race, and economic status. Lastly, the chronosystem encompasses policy and sociohistorical influence like the Great Depression or the COVID-19 pandemic (Bronfenbrenner & Morris, 2007).

Figure 1

*Socioecological Mode*l



Note. This figure demonstrates the SEM. "*The Socioecological Model: A Framework for Prevention Violence Prevention Resource Guide* (CDC, 2019). Copyright 2019 by the Centers for Disease Control and Prevention. Reprinted with permission.

The socioecological approach covers two main concepts. The first concept emphasizes that behavior has several levels of influence. The second concept focuses on how social environment shapes individual behavior (Salihu et al., 2015). SEM stresses how the change in social environment affects student's health, school readiness, and ability to perform in school. In the same way, the SEM perspective can be used to

understand healthy dietary intake of Black student's that also affect school readiness and achievement (Robinson, 2008).

This study focused on the association between factors that influenced student's health from a socioecological perspective and incorporating SEM concepts into promoting a better quality of life for Black students when put into a VL environment. SEM grants understanding on the individual, relationships, community, and societal factors that affect Black student's during VL. The socioecological approach offers a useful framework for attaining understanding of the multiple factors and barriers that impact dietary and learning behaviors, subsequently providing insight for culturally appropriate prevention strategies (Robinson, 2008). Payne et al. (2015) describes how obesity is multifaceted with not only genetic and biological contributions, but also societal, environmental, and economic factors as obesity grows into an epidemic. Societal norms and having access or the lack thereof to food and space for physical activity is known as the "built environment" (Payne et al., 2015). SEM theorizes how behaviors are shaped by various social and environmental factors which makes it relevant to this study as the home and social environments of students are expected to influence both their health behaviors and academic outcomes during VL.

Nature of the Study

I used a quantitative, cross-sectional research design that supports objective measurement and statistical testing of relationships among variables (Creswell & Creswell, 2018). The independent variables include BMI percentile, health-affected ability, and school readiness, while the dependent variables are school readiness and level

of distraction. Data was drawn from the publicly available 2020 National Survey of Children's Health (NSCH), which collects health and behavioral information on U.S. children. The data was analyzed using logistic regression.

Literature Search Strategy

For this study, the following databases and search engines were used; ERIC, National Survey of Children's Health (NSCH), Walden University library, PubMed, and Google Scholar. The NSCH is a yearly survey designed to provide national and state-level estimates of key measures of child health and well-being, and the child's family, social, and economic context that gives an in depth understanding into school readiness and healthy development. The keywords used to complete the literature review were *College and Career Ready Performance Index (CCRPI), low socioeconomic status and education, state funded schools, school students (K-12), children health, school readiness, distraction, BMI, elementary school disparities, traditional in-school, virtual homeschool, learning*, and *Title 1 schools.* My focus was on peer-reviewed literature between the years of 2016-2021 where I found very few studies on level of distraction and BMI in students.

Literature Review Related to Key Variables and/or Concepts

More than a billion children worldwide experienced the abrupt transition from traditional school to VL during the onset of the COVID-19 pandemic (Black et al., 2021). It is estimated that 56 million K-12 students in the US suddenly transitioned from traditional school consequently having to attend virtual homeschool beginning in April 2020 (Leeb, 2020). As described by Dorn et al. (2020), lower SES students have a worse

probability for high-quality VL, with engagement rates for majority Black and Hispanic schools only at 60% to 70%. Iruka et al. (2020) found that Black girls compared to other girls from different racial groups, “consistently underperform,” but paralleled to their Black male counterparts with comparable risk factors, the girls have better educational success.

Virtual Learning

VL is not a new method of learning for students, but requiring all students on a global scale was new territory for K-12. Moore et al., (2011) defines VL as method of remote learning without being in the traditional physical classroom. Educational disparities amongst low-socioeconomic communities are prevalent issues in the US and were exacerbated from additional factors such as the COVID-19 pandemic and mandatory VL. Van Lancker and Parolin (2020) found the more time school is closed, the more educational disparities, inequalities, and negative mental and physical health results for this population of children. The public health issue of interest are the health behaviors that lead to educational disparities for disadvantaged Black school students that were required to transition from traditional school to the virtual learning environment (VLE). Parolin and Lee (2021) found extreme disparities resulting from virtual schooling for schools that had previously despaired educational performance. Furthermore, Van Lancker and Parolin (2020) show 14% of previously disadvantaged students in the US suffer from food insecurity and depend on school for nutritious foods to eat. A study by Galindo et al. (2017) explains how disadvantaged students perform better when in traditional school rather than homeschool.

Subsequently, when the children are in traditional school settings, healthy meals and snacks provide up to two thirds of their daily nutritional needs (Dunn et al., 2020). The home VL environment leads to some children eating less healthy foods and missing meals leading to fatigue, developmental, mental, physical, and emotional impairments. This study will investigate the socioecological factors that affect the weight and academic performance during mandatory VL for Black children.

School Readiness

When the time comes for a child to enter kindergarten, it is ideal for them to be properly prepared for formal education. The concept of school readiness, as described by Duncan et al., (2018), is the child's preparedness to enter school and succeed, ensuing academic success in subsequent years. It is important for children to have a solid foundation when beginning school. They found high-quality prekindergarten (pre-K) programs improve early literacy skills for children from low-income households who are more at risk for poor school readiness without the foundation of a quality pre-K program. Furthermore, the child's social determinants, demographic factors, whether they participated in preschool or not, and their experiences from preschool are all associated with gaps in school readiness skills. Eddins et al., (2020) explains how for some students, VL at home may lead to a lack of understanding from imprecise and confusing directions, widening the learning gap.

One of the factors in high quality school readiness programs is having a curriculum that involves the promotion of positive socialization, interactions, and stimulating activities between peers and teachers. The children in 2020 who were

entering kindergarten during mandatory VL, did not have a high-quality pre-K program, and lacked the amenities of in-person peer and teacher interactions will be more at risk for slower development of academic skills leading to less cumulative advantages and larger achievement gaps (Duncan et al., 2018).

In addition to preparing the students for virtually taught curriculum, other factors under consideration are the teacher's preparation, teachers' willingness, and ability to deliver lessons virtually. Petko et al., (2018) found that teachers who are skeptical about the efficacy of virtual teaching or lack the proficiency to utilize digital technology may lead to insufficient teacher readiness. These are examples of some of the first- and second-order barriers that lead to impeded implementation efforts. Ertmer (1999) found first-order barriers were out of the teachers control such as the lack of resources, time, training, and assistance. He classified second-order barriers as those more personal to the teacher including teacher's cultural influences, beliefs, and knowledge. Furthermore, student readiness is dependent on teacher readiness, which is largely dependent on school readiness. School readiness incorporates a supportive school board, updated policies, supportive principle and leadership staff, outcome clarity, and strong technological infrastructure (Petko et al., 2018).

School readiness skills that children possess when they enter school impact educational growth and life course outcomes. The children's growth is dependent upon factors including family SES, home environment, the health behaviors of the parent, relationships with teachers, and government policy (Iruka et al., 2020). With a new school setting for students and teachers, the school norm was now not normal. According

to Kuhfeld et al. (2020), teachers across the US reported students spent half as much time engaged in learning following the mandatory school closures compared to prior school years.

As Liou and Rotheram-Fuller (2019) described, the norms, principles, policies, procedures, and expectations, form the school culture that influences children's learning environments. Furthermore, approximately 35% of households with children ages 6 to 17 and an annual income below $30,000 a year lacked access to a WIFI connection at home, compared with just 6% of households earning $75,000 or more a year, disproportionately affecting Black families (Shami-Iyabo, 2020). Moreover, Kuhfeld et al. found roughly 50% of low-income families and 42% of families of color lacked sufficient resources at home to access VL. Yang et al., (2021) describes how higher parental educational attainment is associated with the child's lower BMI. Subsequently, Yang found the students with parents with a high school degree or below were estimated to be three times more likely to be obese by six years old compared with peers with highly educated parents. They found parental educational attainment and educational status is strongly correlated to BMI. These combinations of factors contribute to school readiness for students in a virtual classroom environment.

Body Mass Index and Childhood Obesity

A study completed before mandatory VL by Baxter et al., (2013) examined BMI and student's academic achievement and did not find a substantial relationship between academic performance and BMI, but did find relationships between academic achievement and SES, and academic achievement and race. Baxter concluded that

additional research is necessary to examine academic achievement and childhood obesity in minority populations. However, Elish et al., (2023) did find negative academic achievement associations with course grades for students who developed overweight/obesity, making healthy weight intervention promotions critical for at-risk schools to improve minority student health and achievement. Furthermore, Elish et al., found other socioeconomic factors that impact childhood obesity and academic achievement include low parental income, low parent educational attainment, impoverished neighborhood conditions, and racial inequality. There was a stronger association between student's academic achievement and obesity for those who were not overweight, but became overweight during their study, suggesting health interventions are important for students experiencing weight change. Students that transitioned to VL and gained weight due to some of the factors above were more at-risk for higher learning loss and reduced academic achievement.

Hermassi et al., (2022) describes how there is a positive association between academic achievement and physical fitness making the ability for students to have access to physical fitness in school important to increase cognitive abilities that contribute to healthy psychosocial development. Furthermore, sedentary behaviors like increased screen and leisure time are a health risk that has been associated with negative academic performance. Increased physical exercise was associated with better academic attainment than students who were less physically active.

Pietrobelli et al., 2020 found that student's eating, physical activity, and sleep behaviors negatively changed 3 weeks into virtual homeschool. Student's meals per day,

screen time, and sleep time increased. Unfortunately, along with these increases, the consumption of processed and junk food specifically potato chips and saccharide heavy drinks also increased. It is cheaper to provide these types of foods, and for many low-income households, access to these types of foods is easier. One study found households with children during mandatory VL were under greater stress resulting in food access problems redolent of the Great Recession (Ahn & Norwood, 2021).

Food Insecurity

The transition from nutritious meals provided by the school to then having parents feed their children during the school day affected some families negatively more than others as these meals were less healthy for many low-income students. School districts provided meal distribution points where parents could pick up healthy foods. Jabbari et al. (2021) found that although these pick-up points were provided, many low-income students lacked transportation to get to these food distribution sites leading to food insecurity. Children who lack food and adequate nutrition compared to children who do receive proper nutrition have a considerably greater likelihood of poor health, lesser quality of life, poorer physical function, and struggles in school (Rosenkranz & Dzewaltowski, 2008). Children from low-income households, who are predisposed higher risk for poorer health and lower academic achievement than children from high-income households, may be further deprived by nutrition shortfalls (Dunn et al., 2020).

Food insecurity has been associated with lower intakes of fruits and vegetables and an increase of cheaper and more convenient sugary and processed foods leading to obesity. Rosenkranz and Dzewaltowski (2008) found food-insecure teens, young

children, Mexican American children, Black children, and youth living below the poverty level, have an increased risk of obesity and were more likely to be above 85th percentile in BMI. Family structure also contributed to the home food environment. Single parents versus a two-parent household, or households with several children was also a factor in nutritional outcomes for students during mandatory VL.

According to the CDC's 2017–2020 US national data, obesity prevalence among children aged 2–19 years was 26.2% for Hispanic children, 24.8% for Black children, 16.6% for White children, and 9.0% for Asian children (CDC, 2021). The data also indicated higher obesity prevalence among children from lower-income households compared with those from higher-income households. Additionally, poverty and food insecurity disproportionality increase the risk of childhood obesity for low-income and minority groups (Council on community pediatrics, & committee on nutrition, 2015). These risks are exacerbated by environmental barriers in low-income communities like food desserts, lack of availability to nutrient-rich foods, and full-service grocery stores, which promote unhealthy eating behaviors and food-insecure households (Council on community pediatrics, & committee on nutrition, 2015). Gaps remain in ensuring equitable access to nutrition education, consistent meal availability, and the promotion of sustainable, healthy eating behaviors for children in the mandatory VLE. Addressing these systemic challenges requires a multistakeholder and multifaceted intervention approach, including policy reform, increased funding for community health initiatives, and enhanced education on nutrition and physical activity (Gundersen & Ziliak, 2015).

Transition to Virtual Learning

The COVID-19 pandemic caused schools K-12 to transition from traditional in-person school to virtual school via electronic technology in 2020. Web based learning was delivered electronically leaving untrained parents the responsibility of co-teaching despite their education level or familiarity to technology (Black et al., 2021). These challenges were compounded by pre-existing disparities in educational resources and support systems. Recommendations from The American Academy of Pediatrics advised stakeholders to return to traditional school as early as possible to avoid aggravating existing educational disparities for high-risk populations (Black et al., 2021).

Furthermore, differences in students learning behaviors, home environment, internet access, and parental support increased disparities in student success and academic achievement (Black et al., 2021). A study found students with limited parental support, especially in low-income households, faced greater difficulties in adjusting to the demands of VL (Van Lancker & Parolin, 2020). The shift to VL not only exposed existing inequities but also highlighted the need for specific interventions to support Black children and their families.

Academic Distraction

Academic distraction emerged as a significant challenge during the transition to VL, particularly among Black children in underserved communities. Dontre (2021) found students multitasking and increasingly distracted as classes transitioned to VL due to the lack of teacher supervision and the wide range of online distractions. Academic procrastination characterized by Hong et al., (2021) as the habitual postponement of

schoolwork has led to an increase of pathological internet use (PIU) and problematic mobile phone use (PMPU). Hong et al., (2021) further explains how these behaviors often favor short-term rewards over long-term goals, leading them to lose focus on academic tasks and engage in enjoyable online activities, such as social media, and games for immediate psychological gratification.

The Council on Community Pediatrics, & Committee on Nutrition (2015) described how food insecurity has also been linked to academic distraction for children of all ages from the link between lower cognitive abilities, dysregulated behavior, and emotional distress. Furthermore, they found food insecurity amongst kindergarten students is a predictor for lower academic achievement in math and reading over the next four years (Council on Community Pediatrics, & Committee on Nutrition, 2015).

Additionally, VL created an environment where many students struggled to establish routines, contributing to increased distraction. Walters et al. (2022) found that students reported challenges in understanding assignments, staying engaged during lessons, and maintaining focus, often opting for leisure activities over academic responsibilities. The absence of structured school environments also eliminated critical support systems, such as access to school counselors and peer interactions, both of which are essential for emotional regulation and sustained academic performance (Rundle et al., 2020). The rise of sedentary behaviors during VL, including extended screen time and reduced physical activity, also contributed to academic distraction. Hermassi et al. (2022) emphasized that physical fitness is positively correlated with academic performance, while increased sedentary behaviors negatively impact attention spans and cognitive

function. As Black children faced compounded challenges, their ability to academically succeed in VL settings was significantly compromised.

Urban Versus Rural Differences in Virtual Learning

Hariyati et al. (2021) describe how urban areas are more successful on learning processes like the transition to VL than rural areas because of the environmental ability. Rural areas have minimal facility to upgrade the WIFI and internet infrastructure. Likewise, a more recent issue of digital disparities and digital equity now exist for lower SES and minority communities (Maxwell et al., 2021). Parents from these socioeconomic groups have been found to have less time due to having to work and be less technologically advanced to support their child in the virtual classroom at home (Maxwell et al., 2021).

Additionally, as reliance on technology in the classroom increased from 2019 to 2020, the lack of access to that technology and access to the internet put a major roadblock in place for children from low-income and underprivileged communities (Shami-Iyabo, 2020). The absence of minimum essential connectivity a student needs to accomplish their schoolwork at home is the “homework gap”—, creating a digital divide between upper- and lower-income groups, and a larger gap in technology inequities. In 2020, Shami-Iyabo found 70% of school assignments were given online and over 12 million children lacked internet access.

Children living in urban communities with less opportunity for space to perform physical activity during mandatory home schooling experienced more sedentary behavior (Rundle et al., 2020). Furthermore, Rundle et al., describes how the transition to

mandatory home school affected all children, but had a larger impact on urban children with a lack of safe and accessible outdoor spaces.

South Carolina's Department of Education, where 15% of the people lived in rural populations, introduced "Grab-n-Go" meal pick up locations that provided 5 days of meals (Dunn et al., 2020). More urban school districts in Michigan and New York set up meal deliveries to neighborhoods and school bus stops. Services like these are imperative for children who depend on school for their daily nutrition. A study by Dush (2020) found adolescents in rural and urban homes living in poverty, with single parents that have low educational attainment, and are racial and ethnic minorities, experience more food insecurity that exacerbates over time.

Virtual Learning and Mental Health

Prior to mandatory VL, Henderson et al., (2020) found child mental health issues had a high prevalence across the US with 3.2% 3 to 17 years diagnosed with depression, 7.1% with anxiety, and 7.4% with behavioral problems. During mandatory VL, there were also other national events like civil unrest and police shootings that may have affected students' overall health and ability for academic achievement. Kuhfeld et al. (2020) described how adverse police events amongst Blacks like George Floyd in Minneapolis and Jacob Blake in Kenosha have negative effects on students' achievement in those local schools. Subsequently, Kuhfeld found social unrest resulting from adverse police events could further aggravate the academic achievement declines for students of color.

Iruka et al. (2020) explains how school readiness, and pre-academic skills are imperative for children to obtain key proficiencies during preschool and kindergarten. Being abruptly transitioned to VL at such a critical point in their academic journey introduced a roadblock for many stakeholders on how to continue to deliver lessons to obtain these key proficiencies. Many other stressors developed from the transition for some families like food insecurity that created stress, depression, and anxiety for parents and students (Council on Community Pediatrics, & Committee on Nutrition, 2015). Tang et al. (2021) found that quarantined people had a higher risk of developing long term posttraumatic stress symptoms and a higher prevalence of psychological symptoms. Furthermore, 30% of children in high impact zones affected by H1N1 exemplified posttraumatic stress disorder, while anxiety, depression, and stress were common in children that transitioned to mandatory home VL during the COVID-19 quarantine (Tang et al., 2021). Walters et al. (2022) found that the VL learning environment presented significant challenges for students 15 to 19 years due to lack of focus, easy access to distractions online rather than participating in class, misunderstanding assignments, and sleeping during class. Students also reported missing the school environment, social interaction with their peers, and the structure which helped them complete assignments. Furthermore, Walters et al. found students lacked motivation to study because of decreased concentration and poor learning environments which significantly impacted the child's mental health and well-being.

School Meal Programs During the COVID-19 Pandemic

The Household Pulse Survey conducted by the United States Census Bureau collected data to measure household experiences during the COVID-19 pandemic. The survey done for 2019 through 2020 found a total of 26,000,644 children qualified for free or reduced lunch (U.S. Census Bureau, 2023). California had the nation's highest, 3,648,170 students that qualified. In 2020, 38.3 million people, with 12 million being children, lived in a home with food insecurity (Dush, 2020).

School closures due to COVID-19 in the US began on February 27, 2020 in Washington state (Zviedrite et al., 2021). By March 30, 2020, there was the first nationwide public-school closure for K-12 where all US public school districts were closed except one. These closures necessitated mitigation strategies to address learning disruptions and maintain access to vital nutrition through school meal programs. As school districts organized these mitigation efforts, food insecurity surged, and reliance on processed high calorie foods increased the risk for obesity and unhealthy weight gain (Rundle et al., 2020). For example, in Philadelphia, school closure for just 3 days equated to approximately 405,000 missed meals (Rundle et al., 2020). When planning to extend the school meal program, stakeholders had to consider Black and Hispanic adults are twice as likely as White adults to experience food insecurity (Dush, 2020).

According to The Council on Community Pediatrics, & Committee on Nutrition (2015), 84% of food-insecure households with children had at least one working parent. Programs such as the Supplemental Nutrition Assistance Program (SNAP) or free or reduced-price school meals are critical in addressing nutritional disparities.

Unfortunately, the pandemic's impact revealed gaps in accessibility and availability, particularly for marginalized populations who relied heavily on these resources. Stakeholders had to innovate, such as creating grab-and-go meal services and school bus delivery systems, but often, these measures were not able to reach all families in need. Significantly disrupted access to essential school-based meal programs, exacerbating food insecurity and increasing reliance on unhealthy food options, which contributed to weight gain and obesity among vulnerable children. These challenges highlighted systemic inequities in food access and nutrition for low-income families, particularly among Black and Hispanic populations. Addressing these disparities requires comprehensive policies that ensure consistent access to healthy, affordable food for all children, even during periods of crisis. As schools remain a cornerstone for providing daily nutrition, enhancing the resilience of food assistance programs and addressing barriers to access are critical steps toward reducing food insecurity and its long-term health impacts.

The transition from traditional school to the home VLE significantly disrupted access to essential school-based meal programs, exacerbating food insecurity and increasing reliance on unhealthy food options, which contributed to weight gain and childhood obesity among children in vulnerable communities. These challenges highlighted systemic inequities in food access and nutrition for low-income families, particularly among Black and Hispanic populations.

Definitions

The following are pertinent terms and definitions relevant to this research.

Adverse childhood experiences: childhood exposure to different forms of abuse and household dysfunction, including psychological abuse, physical abuse, sexual abuse, substance abuse, mental illness, domestic violence, and criminal behavior (Hinesley & Krist, 2020).

At-risk student: A student who is at risk for academic, behavioral, and emotional difficulties that result from factors like challenging family situations, learning problems, or socioeconomic disadvantage (Waterman, 2009).

Body-mass index (BMI): the proportion of body fat mass to total body mass, usually expressed as a percentage (% body fat; Telford et al., 2021).

COVID-19: an acute disease in humans caused by coronavirus. The disease was originally found in China in 2019 and became a global pandemic in 2020 (World Health Organization, n.d.).

Childhood obesity: a chronic condition where the child's BMI is above the healthy weight for their sex, age, and height equal to or greater than the 95th percentile (Ramana et al., 2024).

Public school: a tax- free supported school controlled by a local governmental authority (Merriam-Webster, n.d.).

Low socioeconomic status: a description of a person/people based on their education, income, and type of job. Also called SES and ranked low, medium, and high (NCI, n.d.).

School-based health care services: programs that provide preventive services, early diagnosis, treatment, risk assessments, vaccinations, and more., school-based clinics

improve healthcare access for children with limited access to health care services (Zwiebel & Thompson, 2022).

School readiness: the readiness of the child, the school's readiness for the children, and the capability of the family and community to support the best possible early child development (Williams et al., 2019).

Traditional learning environment: face-to-face learning for students in school.

Virtual learning (VL): web-based schooling delivered to students physically separated from their teachers (Black et al., 2021).

Assumptions

In conducting this research, I assumed that parents and caregivers accurately reported students' home learning behaviors, physical activity levels, and dietary patterns during the period of VL. Similarly, it is assumed that educators provided unbiased and truthful insights into the challenges and outcomes of VLEs. Furthermore, this study assumes that the SEM, as applied in this research, effectively captures the multilayered influences of individual, relational, community, and societal factors on Black students' health and educational outcomes. Last, I assumed that the VL experiences of Black children across different states and school districts during the pandemic were broadly comparable. This included assumptions about the uniformity of challenges related to technology access, parental support, and socioeconomic conditions (Kuhfeld et al., 2020).

Scope and Delimitations

This study addresses the multifaceted impact of the transition from traditional school to mandatory home VL during the COVID-19 pandemic on Black children's

health and academic outcomes. The focus was chosen because existing disparities in access to school resources, such as technology, nutritious meals, and physical activity opportunities, were exacerbated during mandatory VL, disproportionately affecting minority and low-SES populations. This ensures that the research captures the unique challenges faced by these vulnerable communities, providing critical insights into systemic inequities.

Study Boundaries

The boundaries of this study are defined by the included and excluded populations and the theories guiding the investigation. The population includes Black children aged 5–18 across the US. Excluded populations include children from, other racial/ethnic groups, and non-Black minority groups. The study also excludes populations from non-urban areas where access to resources may differ. The SEM provides the most appropriate theoretical framework for this study, emphasizing the interplay between individual behaviors and systemic factors. However, other behavioral and psychological models are not examined, as they are outside the scope of this research.

Generalizability

While this study's findings are primarily focused on Black children, its implications may extend to other marginalized populations facing similar systemic barriers. By defining these boundaries and addressing internal and external validity concerns, this study aims to contribute meaningful, targeted insights while acknowledging its limitations in generalizability.

Limitations

This research had several limitations as it is a quantitative study relying heavily on secondary data with minimal peer reviewed studies available on this specific subject. First, external validity is constrained by the specific focus on Black children and generalizing other racial or ethnic groups. Second, BMI may not fully capture all aspects of physical health, and standardized test scores may not reflect the holistic aspects of school readiness or achievement. Third, there are ethical limitations and barriers for research involving children. Lastly, potential confounder variables, such as parental involvement, access to additional learning resources, or regional differences in VL implementation, may also influence the outcomes. Biases in this study include selection bias and self-reporting bias. Selection bias could arise from focusing exclusively on Black children. Self-reporting bias is a concern for data collected from parents and educators, as responses may be influenced or there may be recall inaccuracies. By acknowledging the limited generalizability of the findings, this study highlights the need for further research in diverse socioeconomic and cultural contexts.

Significance

This study may advance knowledge in the fields of public health and education by exploring the intersection between mandatory VL, health outcomes, and academic readiness among Black children. The research builds upon existing literature by providing a detailed analysis of how systemic inequities in home schooling, nutrition, access to digital resources, and physical activity exacerbate disparities during times of crisis, such as the COVID-19 pandemic. Specifically, it contributes to understanding the

relationship between BMI, school readiness, and academic performance, emphasizing the compounding effects of systemic barriers on minority populations. By addressing this gap, the study provides a foundation for future research into mitigating these disparities.

The findings of this study have the potential to inform both educational and public health practices. For policymakers, the study highlights the importance of equitable access to essential services, such as nutritious school meals, school medical services, and digital learning resources, especially during emergency transitions to VL environments. The research supports the development of policies that prioritize marginalized communities, such as expanding the NSLP and SBP which are critical at reducing food insecurity and supporting investments in digital equity initiatives. For school boards, educators, public health practitioners, and stakeholders, the study underscores the need for targeted interventions to address the physical and academic well-being of vulnerable student populations during extended periods of disruption.

Implications for Social Change

This study can contribute to positive social change by educating students, teachers, school administrators, policymakers, and other stakeholders on how to improve child health and mitigate educational disparities that exist during virtual homeschooling for marginalized groups. Furthermore, this study promotes health and educational equity by identifying actionable strategies to reduce health and education disparities among Black students. Understanding how social and environmental factors influence children's educational success in the home VL environment will provide valuable insights for managing future mandatory school transitions more effectively. By highlighting the

systemic barriers faced by Black children during VL, this research advocates for a more inclusive and equitable approach to education and public health planning.

Summary and Conclusions

The impact of mandatory VL on the health and educational outcomes of Black children exacerbated disparities, disproportionately impacting low-SES and minority populations. Studies also highlighted the importance of physical activity and nutrition in promoting both academic success and overall well-being. Mandatory VL disrupted access to vital resources such as school-based health services, nutritious meals, and in-person instruction, further widening inequities for low-SES and Black students (Zhang & Storey, 2022).

The literature review underlines the critical role that school readiness plays in academic success and the compounding effects of childhood obesity on cognitive and physical health (Duncan et al., 2018; Townsend et al., 2020). Moreover, that food insecurity, limited access to technology, and reduced physical activity during VL led to significant BMI increases and subsequent health challenges for vulnerable populations (Rundle et al., 2020; Rosenkranz & Dzewaltowski, 2008). Additionally, factors such as parental education, digital literacy, and environmental barriers in urban versus rural communities further impacted students' readiness and ability to succeed in a VLE (Hariyati et al., 2021; Yang et al., 2021). This research can extend knowledge in public health and education by providing evidence-based insights into the barriers that contribute to health and educational disparities during major disruptions like the COVID-19 pandemic. This research will not only enhance our understanding of the challenges

faced by Black children during mandatory VL, but also offer recommendations for improving health, educational equity, and reducing educational disparities. Such findings are necessary for informing policies aimed at strengthening school meal programs, promoting digital equity, and ensuring targeted interventions to support marginalized populations during future disruptions.

The literature review has several interconnected themes regarding the impacts of systemic inequities on education and health outcomes. Key findings indicate that disparities in SES, access to digital resources, ability for physical activity, and nutrition significantly affect school readiness and academic performance. The COVID-19 pandemic exacerbated these disparities, disproportionately impacting low-SES and minority populations. Studies also highlight the importance of physical activity and nutrition in promoting both academic success and overall well-being.

This study provides a focused analysis of how the abrupt transition to mandatory VL affected the health and academic achievement of Black children. It extends existing knowledge by examining the interplay between BMI, school readiness, and systemic inequities in a home VLE among Black children during mandatory VL. It employs the SEM framework to analyze how individual, relational, community, and societal factors collectively influence outcomes. By focusing on the intersection of health and education disparities, this research extends knowledge in public health and education disciplines, providing insights for mitigating inequities during similar crises in the future. This offers evidence-based recommendations for policymakers, educators, public health practitioners, and other stakeholders emphasizing the importance of addressing and

improving systemic barriers to promote equity and well-being in marginalized communities.

Section 2: Research Design and Data Collection

The abrupt transition from traditional brick-and-mortar school to VL home school in 2019 to 2020 for K-12 students was a major life course event. The purpose of this quantitative study is to investigate the impact of childhood obesity measured in BMI on school readiness and academic achievement of Black children during mandatory VL (2020) controlled for children's gender, age and parental educational level, and state. Section 2 includes sections devoted to the research design and rationale, methodology, population, sampling and data collection procedures, instrumentation and operationalization of constructs, threats to validity, and ethical procedures. The section concludes with a summary.

Research Design and Rationale

The variables include BMI and health-affected ability as the independent variables (IV), with school readiness and level of distraction serving as the dependent variables (DV) and gender, age, parents' education level, and state as control variables. RQ1 the IV is BMI and the DV is school readiness. RQ2 the IV is BMI and the DV is level of distraction. RQ3 the IV is health affected ability and the DV is level of distraction. RQ4, the IV is school readiness and the DV is level of distraction. A quantitative research design was chosen to explore the relationships among these variables, using secondary data resources from national surveys and CDC. Statistical methods, including regression analysis, were used to measure variables, analyze patterns, and control for confounding factors. The research design aligned with the objectives and

RQs to better examine the systemic inequities and barriers impacting Black children during mandatory VL in 2020.

Methodology

Population

The data source used for this quantitative analysis is from the 2020 National Survey of Children's Health (NSCH) that samples households with children (CAHMI, 2021). The target population for this study comprised Black children aged 5 to 18 across the United States who were enrolled in VL during the academic year. This population was selected due to the disproportionate impact of systemic barriers on the health and educational outcomes of Black children during the COVID-19 pandemic. The estimated size of the target population includes approximately 7.4 million Black students enrolled in K-12 education nationwide (National Center for Education Statistics, 2020).

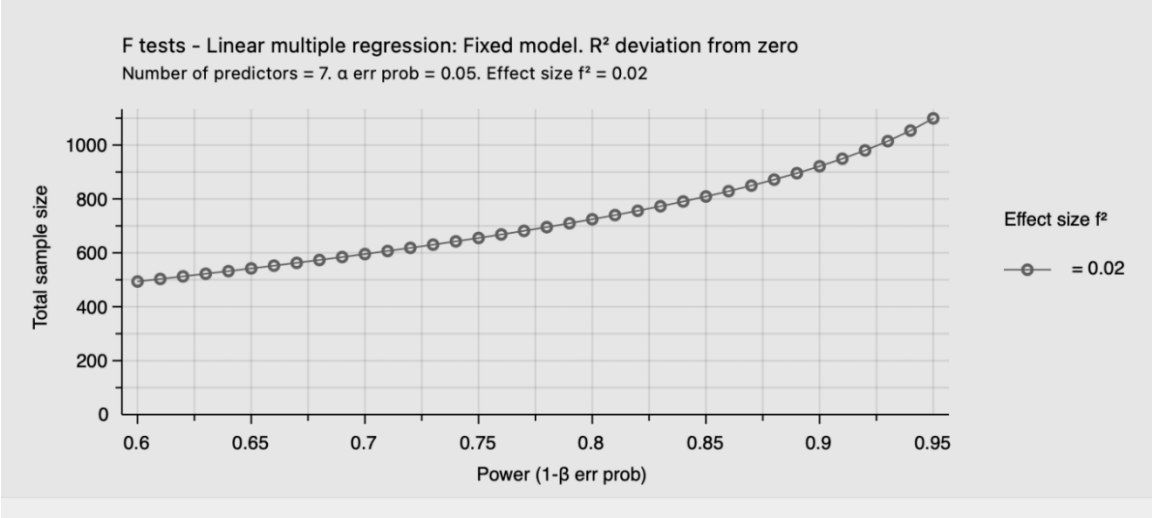
The inclusion criteria for this study were Black students between the ages of 5 and 18 who were enrolled in K-12 education and engaged in VL during the 2020 academic year. The data used was accessed from publicly available national data sets and retrieved through official research portals, eliminating the need for additional permissions. The NSCH and CDC are recognized for their data reliability and rigorous validation protocols, ensuring the quality of the information used in this research (U.S. Census Bureau, 2023). This data set was chosen because of its comprehensive scope and focus on key health and education-related variables, which provided insights into the disparities experienced by Black children during VL.

Sampling Procedures

Following the guidance on Cohen (1988), I used a medium effect size (Cohen's f2=0.02f^2 = 0.02f2=0.02), alpha level of 0.05, and power level of 0.80 for regression analysis (see Figure 2). The sample size was calculated using G*Power 3.1, a statistical software for power analysis (Faul et al., 2007). The results indicated that the minimum required sample size was approximately 725 participants to achieve adequate power. The available sample size exceeds this minimum threshold, further strengthening the reliability of the findings.

Figure 2

Power Analysis for Sample Size Calculation



Operationalization of Variables

Table 1 describes the demographic variables examined in this study. The understanding of age, race, sex, parental education level, and state will give population descriptives. Table 2 describes the variables necessary to operationalize the RQs. The

variables are level of distraction, BMI, health affected ability, and confident student is ready for school to examine associations between child health indicators and academic outcomes during VL among Black children in the US. For RQ1, the independent variable is BMI percentile, and the dependent variable is school readiness. RQ2 also uses BMI as the independent variable but examines its relationship with level of distraction as the dependent variable. RQ3 investigates the association between health-affected ability, as the independent variable, and level of distraction as the dependent variable. Lastly, RQ4 has school readiness as the independent variable and level of distraction as the dependent variable. All four RQs use gender, age, and parents' education level, and state as control variables.

Table 1

Demographic Variables of Interest

Name	Definition	Variable
Age	How old is this child	SC_AGE_YEARS (0-18)
Race	Race of selected child	SC_RACE_R – What is this child's race? What is this child's race? 1 = White alone 2 = Black or African American alone 3 = American Indian or Alaska Native alone 4 = Asian alone 5 = Native Hawaiian and Other Pacific Islander alone 7 = Two or More Races
Sex	Sex of selected child	SC_SEX – What is this child's sex? 1 = Male 2 = Female
Parental education level	Highest level of education among reported adults	HIGRADE_TVIS 1 = Less than high school

		2 = High school (including vocational, trade, or business school) 3 = Some college or Associate Degree 4 = College degree or higher

Table 2

Operational Variables of Interest

Name	Definition	Variable
Age	How old is this child	SC_AGE_YEARS (0-18)
Level of distraction	How often easily distracted	DISTRACTED 1 = Always 2 = Most of the time 3 = About half the time 4 = Sometimes 5 = Never
Confident ready for school	How confident are you that this child is ready to be in school?	CONFIDENT What is this child's race? 1 = Completely confident 2 = Mostly confident 3 = Somewhat confident 4 = Not at all confident
Health affected ability	Health affected ability - How often	HCABILITY 1 = This child does not have any health conditions 2 = Never 3 = Sometimes 4 = Usually 5 = Always
BMI	BMI, percentile	BMICLASS 1 = Less than the 5th percentile 2 = 5th percentile to less than the 85th percentile 3 = 85th percentile to less than the 95th percentile 4 = Equal to or greater than the 95th percentile

Note. BMI = body mass index.

Data Analysis Plan

The data analysis for this study was conducted using IBM SPSS version 28 statistical software (IBM Corp, 2021). The RQs examined the associations between BMI, school readiness, health affected ability, and level of distraction among Black children during VL in 2020. Linear regression analysis was used to test the hypotheses, as this method allows for examining the strength and direction of associations between the independent and dependent variables. Data cleaning included removing duplicate cases, out-of-range values, and recoding categorical variables as necessary. A complete case analysis was done to exclude students from the analysis if any value is missing from one of the variables.

Research Questions and Hypotheses

RQ1: Is there an association between BMI (BMI percentile) and school readiness among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

$H_0$1: There is no significant association between BMI (BMI percentile) and school readiness among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

H_a1: There is a significant association between BMI (BMI percentile) and school readiness among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

RQ2: Is there an association between BMI and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

$H_0$2: There is no significant association between BMI and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

H_a2: There is a significant association between BMI and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

RQ3: Is there an association between health affected ability and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

$H_0$3: There is no significant association between health affected ability and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

H_a3: There is a significant association between health affected ability and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

RQ4: Is there an association between school readiness and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

$H_0$4: There is no significant association between school readiness and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

H_a4: There is a significant association between school readiness and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level.

Statistical Tests

In this study, four hypotheses were tested using separate regression models. RQ1 asks if there is an association between BMI and school readiness. Here, school readiness is the dependent variable which has 4 levels of confidence and is ordinal. BMI is the independent variable with 4 levels of confidence and is also ordinal categorical. To test the association, ordinal logistic regression was used. This analytical test was used to see if BMI was a predictor of higher or lower school readiness. RQ2 asked if there was an association between BMI and level of distraction. Level of distraction is the dependent variable with 5 levels of confidence and BMI is the independent variable. To test the association, ordinal logistic regression was used. It analyzed if BMI is associated with the odds of the student being less or more distracted during VL. In RQ3, the dependent variable is level of distraction, and the independent variable is health affected ability. Both are measured with 5 levels of confidence and will be best tested with ordinal logistic regression as well. This analyzed if students with more frequent health conditions affect level of distraction than those with less health issues. Lastly, RQ4 asks if there is an association between school readiness and level of distraction during VL. School

readiness in the independent variable, while level of distraction is the dependent variable. To test the association, ordinal logistic regression will also be used. This will test whether the student's readiness for school is associated to how frequently the child is distracted.

Threats to Validity

A potential threat to external validity in this study is the specificity of the study sample, as it is limited to Black children in the US who participated in VL during the 2020 academic year. This may reduce generalizability to students of other racial and ethnic backgrounds or those in traditional classroom settings. As described by Creswell and Creswell (2018), selection-treatment interaction may be a concern as parents who opted into the survey may differ systematically from those who did not, introducing bias into how generalizable the results are beyond the study sample. Subsequently, these threats were mitigated by using a nationally representative data set. The 2020 National Survey of Children's Health (NSCH) utilizes complex sampling strategies to reflect the broader US child population which enhances external validity (U.S. Census Bureau, 2020).

Internal validity may be threatened by unmeasured confounding variables, such as household internet quality, the availability of school resources at home, or parental involvement and availability during VL. Due to the single time point design, maturation and history effects are less of a concern. However, selection bias could affect outcomes if families with more extreme experiences during the pandemic were more likely to respond. These threats are partially addressed by including control variables (child age, gender, and parental education) in the analysis and relying on the NSCH's validated

survey measures and large sample size to reduce random error (U.S. Census Bureau, 2020). This data set was publicly available and fully de-identified ensuring anonymity. Furthermore, this study uses secondary data from a federal survey with no direct interactions with participants, reducing ethical risks. There is no conflict of interest with the data set source, further safeguarding ethical integrity.

In this study, I employed a quantitative, cross-sectional research design. It examined the association between BMI, health-affected ability, and academic outcomes, specifically school readiness and level of distraction among Black children in the US during 2020 mandatory VL. The analysis used secondary data from the nationally recognized 2020 NSCH survey. The target population included Black children aged 5 to 18 engaged in K-12 VL during the 2020 COVID-19 pandemic. Variables included BMI percentile and health-affected ability as independent variables; school readiness and level of distraction as dependent variables; and gender, age, parental education, and state as covariates. Regression analysis was utilized, and sample size adequacy was confirmed via a priori power analysis using G*Power 3.1 (Faul et al., 2007). Ethical standards such as data de-identification and confidentiality were upheld throughout the research process. This methodological approach ensured statistical validity while addressing the study's aim to understand systemic inequities in health and education during virtual schooling.

Ethical Procedures

The data set used in this study was the 2020 National Survey of Children's Health (NSCH), a publicly available secondary data set provided by the US Census Bureau. This data set did not contain personally identifiable information, and all identifiers were

removed by the data provider prior to public dissemination (US Census Bureau, 2021). As such, the data set was fully de-identified before access and no re-identification was attempted during this study.

No direct contact was made with participants and no interventions were implemented. Therefore, the study posed no risk to individuals. The data set is classified as public use data, and there were no conflicts of interest related to data research or affiliations to the researcher.

Summary

This study employed a quantitative, cross-sectional design to examine associations between BMI, health-affected ability, school readiness, and level of distraction among US Black children engaged in VL during the 2020 school year. Data was derived from the 2020 National Survey of Children's Health, a publicly available, de-identified data set. Ordinal logistic regression analysis was conducted to test for four research questions while controlling for age, gender, parental education, and state. Ethical standards were maintained through the use of a secondary anonymized data set, minimizing risk to participants. Threats to internal and external validity were mitigated by the nationally representative sample and control variables used in the analysis. Section 3 presents the results of the data analysis, including descriptive statistics, model summaries, and interpretations of the findings in relation to each research question.

Section 3: Presentation of the Results and Findings

Introduction

In this quantitative study, I used secondary data to explore associations between BMI, health-affected ability, school readiness, and level of distraction among Black children during mandatory VL in the United States in 2020. Using the SEM as the conceptual framework, I investigated how multiple layers of influence interacted to affect cognitive and academic behaviors in a VLE. I explored how BMI associated with school performance and attention during mandatory VL. Furthermore, the study examines the extent to which health limitations may impair engagement in VL. The inclusion of school readiness and health-affected ability as predictors allows for a more comprehensive understanding of both physical and perceived functional readiness for academic engagement during an unprecedented educational shift. Each question was tested using ordinal logistic regression and controlled for the child's gender, age, and parents' education level. Section 3 includes the results of this study. Using secondary data from the National Survey of Children's Health (NSCH), the section begins with an overview of the data set, sample demographics, and the analytic strategy, which applied ordinal logistic regression models. The results are then organized by RQs.

RQ1 tested the association between BMI and school readiness, finding that higher BMI percentiles were significantly associated with lower odds of being school-ready. RQ2 examined BMI and level of distraction, revealing that children with higher BMI scores were more likely to be distracted. RQ3 explored health-affected ability and distraction, indicating that children with more frequent health limitations experienced

greater levels of distraction. Finally, RQ4 investigated school readiness and distraction, showing that children rated as less school-ready were also more likely to report higher distraction levels. Across all models, age emerged as a consistent factor, with older children generally more likely to experience distraction, while gender effects were not significant.

Section 3 concludes with a summary that highlights these key findings, noting that while effect sizes were modest, the associations were statistically significant. These results suggest that health-related variables such as BMI and functional ability have meaningful, though subtle, impacts on academic readiness and attention among Black children in VL environments.

Research Questions

RQ1: Is there an association between BMI (BMI percentile) and school readiness among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

RQ2: Is there an association between BMI and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

RQ3: Is there an association between health affected ability and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

RQ4: Is there an association between school readiness and level of distraction among Black children during virtual home school (2020) in the US, controlling for gender, age, parents' education level?

Accessing the Data Set for Secondary Analysis

The data used in this study were from the 2020 National Survey of Children's Health (NSCH), a nationally representative, cross-sectional survey administered annually by the U.S. Census Bureau and sponsored by the Health Resources and Services Administration's Maternal and Child Health Bureau (HRSA MCHB). Data collection for the 2020 cycle took place from June 2020 to January 2021, during the peak of the COVID-19 pandemic, which offered a unique opportunity to explore child health and educational outcomes in the context of widespread remote learning (U.S. Census Bureau, 2021). The NSCH uses an address-based sampling frame and collects data through a combination of web and paper-based self-administered questionnaires. For the 2020 cycle, the weighted overall household response rate was approximately 42.4%, which is consistent with response rates from other large national health surveys (HRSA MCHB, 2021).

There were no major discrepancies between the planned use of the data set and its actual application in this study. The analytic sample was limited to Black or African American children aged 5 to 18 who participated in VL in 2020. The sample included cases with responses for variables BMI percentile, school readiness, level of distraction, and health affected ability to ensure valid statistical modeling.

Table 3 shows the descriptive analysis of the final sample showing a mean child age of approximately 11.7 years with a balanced distribution across sexes. Most children lived in households where at least one adult had completed high school or higher education. The geographic spread of the sample covered multiple US states, aligning with the national scope of the NSCH. These demographic characteristics reflect the broader Black child population in the US and enhance the external validity of the findings by increasing the generalizability of the results to similar populations (U.S. Census Bureau, 2021).

I conducted basic univariate analyses. Variables such as child age, sex, and household education level were assessed for variability, independence, and distribution characteristics. None of these covariates exhibited extreme skewness or collinearity with outcome or predictor variables. These findings supported their inclusion in the final ordinal logistic regression models as control variables to account for potential confounding.

Table 3

Descriptive Analysis of Participant Demographics

Variable	*n*	%
Gender		
Male	1,659	51.8
Female	1,545	48.2
Child's age (in years)		
5	2,279	5.6
6	1,999	4.9

7	2,135	5.2
8	2,096	5.1
9	2,152	5.3
10	2,297	5.6
11	2,418	5.9
12	2,485	6.1
13	2,696	6.6
14	2,745	6.8
15	3,017	7.5
16	3,298	8.2
17	3,298	8.2
Parents' educational level		
Less than high school	157	4.9
High school (including vocational/trade/business)	685	21.4
More than high school	2,362	73.7

Note. $N = 3,204$. Percentages reflect proportions of the total sample. Age categories represent children aged 5–17 years; gender categories include male and female participants.

Results

Descriptive Statistics of the Sample

The analytic sample included 3,204 valid cases of Black children in the US whose data were available from the 2020 National Survey of Children's Health shown in Table 3 (NSCH; U.S. Census Bureau, 2020). Of these, 51.8% (n = 1,659) were male and 48.2% (n = 1,545) were female.

Parental education was categorized into three groups. The majority of children (73.7%, n = 2,362) had parents with more than a high school education, while 21.4% (n = 685) had parents whose highest level of education was high school, and only 4.9% (n = 157) had parents with less than a high school education. These descriptive characteristics reflect a relatively balanced gender distribution and a highly educated adult sample. However, there were low frequencies of some confidence categories.

Ordinal Logistic Regression Results for Research Question 1

RQ1 examined whether there was an association between BMI percentile and school readiness among Black children during VL in 2020 in the US. Controlling for gender, age, and parental education level, an ordinal logistic regression was conducted. The null hypothesis (H_{01}) stated that there would be no statistically significant association between BMI and school readiness, while the alternative hypothesis (H_{a1}) proposed that such an association would exist. Table 4 presents the descriptive statistics for RQ1. The results in Table 5 from the ordinal regression indicated that BMI was a statistically significant predictor of school readiness, with a negative regression coefficient (B = −0.011, SE = .001, Wald = 74.715, p <0.001).

This suggests that higher BMI percentiles were associated with slightly lower odds of being rated as more school-ready. Additionally, age in years was also a statistically significant predictor (B = −0.082, SE = 0.011, Wald = 58.414, p < 0.001), with older children being slightly less likely to be rated as school-ready possibly due to age-related differences in survey item applicability. Parental education level showed partial significance. Compared to children whose parents had a graduate degree, those

whose parents had some college experience had higher odds of school readiness (B = 0.239, SE = 0.099, Wald = 5.840, p = 0.016). However, the comparison for parents with a high school education or less did not reach statistical significance (B = 0.321, SE = 0.187, Wald = 2.941, p = 0.086). Gender (coded as male vs. female) was not a significant predictor in the model (B = 0.104, SE = 0.080, Wald = 1.679, p = 0.195), indicating no meaningful difference in school readiness scores between boys and girls.

The model demonstrated an acceptable fit, with chi-square statistic ($\chi^2(5) = 92.341$, $p < 0.001$), showing that the final model provided a significantly better fit than the intercept-only model. The Pearson ($\chi^2 = 6531.783$, df = 1975, $p < 0.001$) and Deviance tests ($\chi^2 = 4726.320$, df = 1975, $p < 0.001$), were both statistically significant. Furthermore, the results in Table 5 revealed that BMI percentile (B = -0.011, $p < 0.001$) was a statistically significant predictor of school readiness. Moreover, it suggests that higher BMI percentiles were associated with lower odds of being in a higher school readiness category.

In summary, the null hypothesis for RQ1 was rejected. BMI percentile was found to be significantly associated with school readiness among Black children, controlling for age, gender, and parental education. Although the effect size was small, the result was statistically meaningful, indicating that as BMI increased, children were slightly less likely to be perceived as school-ready.

Table 4

Descriptive Statistics for Research Question 1 Variables

Variable	*n*	%

Confident ready for school		
Completely confident	322.0	10.0
Mostly confident	83.0	2.6
Somewhat confident	36.0	1.1
Not at all confident	13.0	0.4
Child's sex		
Male	1,659.0	51.8
Female	1,545.0	48.2
Highest level parental education		
Less than high school	157.0	4.9
High school (vocational, trade, or business school)	685.0	21.4
More than high school	2,362.0	73.7
Total	3,204.0	100.0

Note. N = 3,204. Percentages reflect proportions of the total sample.

Table 5

Ordinal Logistic Regression Analysis Examining Association Between Body Mass Index and School Readiness for Research Question 1

Variable	Estimate	*SE*	Wald/χ^2	*df*	*p*
Final vs intercept			92.341	5	<0.001
School readiness					
Completely confident	-3.278	0.161	414.233	1	< 0.001
Mostly confident	-3.015	0.159	361.28	1	< 0.001
Somewhat confident	-2.915	0.158	341.237	1	< 0.001

Not at all confident	-2.88	0.158	334.37	1	< 0.001
Age	-0.082	0.011	58.414	1	< 0.001
BMI	-0.011	0.001	74.175	1	< 0.001
Gender	0.104	0.08	1.679	1	0.195
Highest parental education					
Less than high school	0.321	0.187	2.941	1	0.086
High school (vocational, trade, or business school)	0.239	0.099	5.84	1	0.016
More than high school	0.00 [a]				

Note. A 95% confidence interval was used for all parameter estimates. The level of statistical probability for all significance tests was set at $p < .05$.

[a] Parameters were set to 0 because they represent reference categories against which other groups were compared.

Ordinal Logistic Regression Results for Research Question 2

RQ2 examined whether there was an association between BMI and level of distraction among Black children during virtual home school in 2020, while controlling for gender, age, and parental education level. The null hypothesis (H_{02}) stated that there would be no significant association between BMI and level of distraction, whereas the alternative hypothesis (H_{a2}) proposed that such an association would exist. An ordinal logistic regression was conducted, with distraction measured on a five-point ordinal scale

ranging from “always distracted” to “never distracted” in Table 6. Both the Pearson χ^2 ($\chi^2(2305) = 6828.53$, $p < 0.001$) and Deviance χ^2 ($\chi^2(2305) = 4765.61$, $p < 0.001$) were significant. Pseudo-R^2 values to evaluate the overall effect size suggested that the overall effect was modest (Cox & Snell $R^2 = 0.028$; Nagelkerke $R^2 = 0.033$; McFadden $R^2 = 0.015$). This indicated the model accounted for a relatively small proportion of the variance in the outcome variable. The results in Table 7 from the ordinal regression indicated that BMI was a statistically significant predictor of distraction. Higher BMI was associated with lower odds of being in a higher (less distracted) category (B = –0.011, SE = 0.001, Wald = 72.88, $p < 0.001$, 95% CI [–0.013, –0.008]), corresponding to an odds ratio of 0.989 (95% CI [0.987, 0.992]). This indicates that each one-unit increase in BMI class was associated with a 1.1% decrease in the odds of being reported as less distracted. Age was also significant (B = –0.082, SE = 0.011, Wald = 58.58, $p < 0.001$, 95% CI [–0.103, –0.061]), with older children more likely to be distracted. Sex was not significant (B = 0.114, SE = 0.080, Wald = 2.02, $p = 0.156$). Parental education showed mixed effects. Children of parents with only a high school education had higher odds of being less distracted compared to those whose parents had more than high school education (B = 0.224, SE = 0.099, Wald = 5.14, $p = 0.023$, OR = 1.25, 95% CI [1.03, 1.52]), while less than high school education did not reach significance ($p = 0.108$).

In summary, BMI was significantly and negatively associated with level of distraction during VL. Children with higher BMI scores were more likely to experience greater distraction, and older children also demonstrated higher distraction levels. Although effect sizes were small, the null hypothesis was rejected in favor of the

alternative, supporting the conclusion that BMI was significantly associated with level of distraction among Black children in the study sample.

Table 6

Descriptive Statistics for Research Question 2 Variables

Variable	*n*	%
How often easily distracted		
Always	39	1.2
Most of the time	70	2.2
About half the time	90	2.8
Sometimes	226	7.1
Never	28	0.9
Sex of selected child		
Male	1659.0	51.8
Female	1545.0	48.2
Highest level of education among reported adults		
Less than high school	157.0	4.9
High school (including vocational, trade, or business school)	685.0	21.4
More than high school	2362.0	73.7

Note. $N = 3{,}204$. Percentages reflect proportions of the total sample.

Table 7

Ordinal Logistic Regression Between Body Mass Index and Level of Distraction for Research Question 2

Variable	Estimate	SE	Wald/χ^2	*df*	*p*
Level of distraction					

Always	-5.488	0.221	616.304		
Most of the time	-4.486	0.180	608.269	1	< 0.001
About half the time	-3.800	0.167	511.471	1	< 0.001
Sometimes	-2.953	0.158	349.895	1	< 0.001
Never	-2.097	0.157	334.837	1	< 0.001
Age	-0.082	0.011	58.414	1	< 0.001
BMI	-0.011	0.001	74.175	1	< 0.001
Gender	-0.114	0.080	1.679	1	0.156
Parental education level					
Less than high school	0.301	0.187	2.587	1	0.108
High school (vocational, trade, or business school)	0.224	0.099	5.140	1	0.023
More than high school	0.00 [a]				

Note. A 95% confidence interval was used for all parameter estimates. The level of statistical probability for all significance tests was set at $p < .05$. BMI = body mass index.

[a] Parameters were set to 0 because they represent reference categories against which other groups were compared.

Ordinal Regression Results for Research Question 3

RQ3 examined whether there was an association between health-affected ability and level of distraction among Black children during virtual home school in 2020, while controlling for gender, age, and parental education level. The null hypothesis (H_{03}) stated that there would be no significant association between health-affected ability and level of distraction, whereas the alternative hypothesis (H_{a3}) proposed that such an association

would exist. An ordinal regression was conducted to determine whether children whose health affected their ability to learn were more likely to experience higher levels of distraction measured on a five-point ordinal scale below in Table 8. Results showed in Table 9 that the model was statistically significant overall, $\chi^2(4) = 15.08$, $p = 0.005$. Both the Pearson χ^2 ($\chi^2(2572) = 9128.12$, $p < 0.001$) and Deviance χ^2 ($\chi^2(2572) = 5027.88$, $p < 0.001$) tests were statistically significant. Pseudo-R^2 values (Cox & Snell $R^2 = 0.005$; Nagelkerke $R^2 = 0.006$; McFadden $R^2 = 0.002$) indicated a very small proportion of explained variance in distraction levels.

Health-affected ability was not a significant predictor of distraction, B = 3.463E-5, $p < 0.001$, 95% CI, indicating that it had no meaningful association with their distraction level. This suggest that health limitations did not significantly impact the odds of being reported as more or less distracted during VL. Age was significant (B = –0.028, SE = 0.008, Wald = 12.41, $p < 0.001$, 95% CI, suggesting older children were less likely to be reported as distracted compared to younger children. However, gender (B = –0.112, $p = 0.162$) and parental education level (B = –0.123, $p = 0.086$) were not statistically significant predictors. In summary, the null hypothesis was not rejected. After controlling for demographic factors there was no significant association between health affected ability and level of distraction. Although age showed a small association with distraction, health related limitations did not predict differences in attention.

Table 8

Descriptive Statistics for Research Question 3 Variables

Variable	*n*	%

How often easily distracted		
Always	39	1.2
Most of the time	70	2.2
About half the time	90	2.8
Sometimes	226	7.1
Never	28	0.9
Health affected ability- How often		
No health conditions	2051	64
Never affected by health conditions	632	19.7
Sometimes affected	383	12
Usually affected	55	1.7
Always affected	54	1.7
Sex of selected child		
Male	1659.0	51.8
Female	1545.0	48.2
Parental educational level		
Less than high school	157.0	4.9
High school/general equivalency diploma	685.0	21.4
College or higher	1384	43.2

Note. N = 3,204. Percentage values reflect proportions of the total sample.

Table 9

Ordinal Logistic Regression Between Health-Affected Ability and Level of Distraction for Research Question 3

Variable	Estimate	*SE*	Wald/χ^2	*df*	*p*
Level of distraction					

Always	-5.177	0.293	311.780	1	< 0.001
Most of the time	-4.131	0.264	185.600	1	< 0.001
About half the time	-3.504	0.255	188.112	1	< 0.001
Sometimes	-2.679	0.250	114.986	1	<0.001
Never	-2.607	0.250	109.154	1	< 0.001
Age	-.028	.008	12.414	1	< 0.001
Health affected ability	3.463E-5*	0.004	0.000	1	0.994
Gender	-0.114	0.080	2.017	1	0.156
Parental educational level	-.123	.072	2.945	1	0.086

Note. A 95% confidence interval was used for all parameter estimates. The level of statistical probability for all significance tests was set at $p < .05$. *3.463E–5 = 0.00003463.

Ordinal Logistic Regression Results for Research Question 4

RQ4 examined whether there was an association between school readiness and level of distraction among Black children during virtual home school in 2020, while controlling for gender, age, and parental education level. The null hypothesis (H_{04}) stated that there would be no significant association between school readiness and level of distraction, whereas the alternative hypothesis (H_{a4}) proposed that such an association would exist. An ordinal logistic regression was performed to evaluate school readiness related to the frequency of distraction during VL.

The model was statistically significant ($\chi^2(9) = 4656.23$, $p < 0.001$). The model fit indicated excellent explanatory power, with Cox and Snell $R^2 = 0.766$, Nagelkerke $R^2 = 0.898$, and McFadden $R^2 = 0.758$. Table 10 shows that school readiness was a significant

predictor of distraction levels. Children rated as not at all confident in their school readiness (B = –29.29, SE = 1.34, Wald = 476.42, $p < 0.001$), somewhat confident (B = –28.48, SE = 1.28, Wald = 494.98, $p < 0.001$), mostly confident (B = –28.25, SE = 1.26, Wald = 503.80, $p < 0.001$), and completely confident (B = –27.47, SE = 1.24, Wald = 487.82, $p < 0.001$) all had significantly lower odds of being reported as more distracted. These results indicated that higher school readiness was associated with lower distraction levels. In contrast, age (B = –0.015, p = .826), sex (B = 0.125, p = 0.444), and parental education levels (B = 0.124, p = 0.408) were not statistically significant covariates indicating that the demographic variables did not meaningfully contribute to explaining variance in children's distraction once school readiness was accounted for.

In summary, the results suggested that school readiness was the primary factor associated with lower reported levels of distraction during VL. Children who were more confident in their school readiness were less likely to experience frequent distraction, underscoring the importance of academic assurance in maintaining focus during remote instruction. Therefore, the null hypothesis (H_{04}) is rejected, and the alternative hypothesis is supported confirming that school readiness was significantly associated with distraction levels among Black children during VL in 2020.

Table 10

Ordinal Logistic Regression Between School Readiness and Level of Distraction for Research Question 4

Variable	Estimate	*SE*	Wald/χ^2	*df*	*p*
Level of distraction					
Always	29.744	1.362	477.188	1	< 0.001
Most of the time	-28.480	1.355	608.269	1	< 0.001
About half the time	-27.534	1.354	413.690	1	< 0.001
Sometimes	-24.586	1.348	335.073	1	<0.001
Never	-22.448	1.267	313.691	1	< 0.001
Age	-0.015	0.70	0.49	1	0.826
Gender	0.125	0.164	0.587	1	0.444
Parental educational level	0.124	0.150	0.685	1	0.408
Completely confident	-27.474	1.244	487.818	1	< 0.001
Mostly confident	-28.254	1.259	503.797	1	< 0.001
Somewhat confident	-28.475	1.342	476.424	1	< 0.001
Not confident	-29.288	1.342	476.424	1	< 0.001

Note. A 95% confidence interval was used for all parameter estimates. The level of statistical probability for all significance tests was set at $p < .05$.

No post-hoc analyses were conducted beyond the main ordinal logistic regression models, and no additional statistical tests beyond those specified in the RQs and hypotheses. Each of the four hypotheses were tested with regression, and the results were presented in relation to the predefined variables (BMI, school readiness, health-affected ability, and distraction), with covariates included for age, gender, and parental education. The study design focused strictly on answering the four primary RQs. Model fit statistics, pseudo R^2 values, and odds ratios were reported, and found no evidence of exploratory post-hoc analyses or newly emerged hypotheses tested after the primary models.

Summary

The findings of this study addressed four RQs examining the associations between BMI, health-affected ability, school readiness, and level of distraction among Black children during mandatory VL in 2020. Results for RQ1 indicated that BMI percentile was significantly associated with school readiness, with higher BMI scores linked to lower odds of being rated as ready for school. This suggest that physical health may play a critical role in children's preparedness for academic success. RQ2 revealed that higher BMI was associated with greater distraction, suggesting that higher BMI may influence children's ability to remain attentive in a virtual setting. These findings indicate that weight status may have behavioral and cognitive implications in learning environments. RQ3 showed that health-affected ability was significantly related to distraction, indicating that children experiencing more frequent health limitations were more likely to struggle with maintaining focus. Finally, RQ4 demonstrated that lower levels of school readiness corresponded with higher levels of distraction, highlighting the link between academic preparedness and attention levels. Across these models, age consistently emerged as a significant predictor, while gender was not statistically significant.

These findings provide evidence that school readiness and health factors collectively play a role in the academic experiences of Black children in VLEs. The consistent pattern across models supports the rejection of the null hypotheses for each RQ and provides empirical validation for the hypothesized relationships. Although effect sizes were modest, the statistically significant associations suggest that both BMI and

health conditions play a meaningful role in predicting academic outcomes, particularly distraction and school readiness. The results highlight the systemic inequities faced by children during mandatory VL and underscore the importance of addressing health, nutrition, and readiness factors in education policy and practice. In Section 4, I build on these findings by interpreting their implications for theory, practice, and future research. I also provide recommendations for policy and intervention strategies aimed at mitigating disparities and fostering both educational and health equity among Black children in times of crisis learning environments.

Section 4: Application to Professional Practice and Implications for Social Change

In this study, I employed a quantitative, cross-sectional design using ordinal logistic regression to analyze data from the 2020 National Survey of Children's Health. The research focused on Black students aged 5–18 who were engaged in mandatory VL during the 2020 school year, examining associations among BMI, school readiness, health-affected ability, and level of distraction. Using the SEM as the guiding framework, this study analyzed the interplay between individual health conditions and surrounding contextual factors in determining student's academic readiness and attentional engagement in the VLE. This research was motivated by concerns about educational and health disparities exacerbated by the abrupt transition from traditional brick and mortar schools to mandatory home VL in 2020. The goal of this study was to illuminate how health and societal related factors may contribute to inequities in VL outcomes for Black students.

Key Findings

The analysis revealed several significant but subtle relationships among the key variables. BMI was significantly associated with both school readiness and distraction levels, with higher BMI percentiles linked to lower odds of being school ready and a greater likelihood of distraction during VL. Health affected ability also showed a significant association with distraction. Children who experience more frequent health related limitations tended to report higher distraction levels. Likewise, school readiness was a significant predictor of distraction, as children rated less ready for school exhibited greater distraction. Across all models, age emerged as a consistent predictor (older

children were generally more prone to distraction), whereas gender was not significantly related to the outcomes. Although these associations were statistically significant, their effect sizes were modest. Together, these findings suggest that factors like BMI and health related functional ability have a measurable impact on academic readiness and attention. This sets the stage for a broader discussion on their implications in the context of educational equity and health during abrupt transitions to VL and emergency learning situations like in the 2020 school year.

Interpretation of the Findings

Body Mass Index

The findings of this study confirm and extend prior literature regarding the relationship between BMI and academic outcomes. Consistent with Elish et al. (2023), who found that overweight and obesity negatively influenced course grades, this study demonstrated that higher BMI percentiles were significantly associated with both lower school readiness and higher levels of distraction among black children during VL. While Baxter et al. (2013) did not identify strong connections between BMI and academic achievement, this study demonstrated measurable effects of BMI on academic achievement among minority children navigating mandatory virtual education. Furthermore, the findings align with Hermassi et al. (2022), who identified positive relationships between physical fitness and academic performance, suggesting that the absence of school-based fitness opportunities during the 2020 school year may have exacerbated BMI related challenges. Additionally, the documented shifts in student's health behaviors during the 2020 school year such as poorer diet and increased sedentary

activity (Pietrobelli et al., 2020), help explain the stronger associations observed in this study.

School Readiness

This study's results confirmed the importance of school readiness and shaping academic outcomes, as predicted by Duncan et al. (2018). Finding that lower school readiness predicted higher distractions levels during VL resonates with Eddins et al. (2020), who warned that imprecise online instruction would widen readiness gaps. Furthermore, Iruka et al. (2020) highlighted demographic and social determinants of readiness by showing how these disparities translated directly into attentional challenges in the VLE. Similarly, the absence of in person peer and teacher interactions previously identified by Duncan et al. (2018) as key drivers of readiness compounded the negative outcomes observed for Black children in the VL environment. The findings also align with Petko et al. (2018), who emphasized the role of school and teacher readiness in student learning, reinforcing that child readiness cannot be disentangled from broader system level preparedness. In confirming these connections, this study underscores the multi layered vulnerabilities faced by Black children who began or continued school without foundational readiness during mandatory VL in the 2020 school year.

Effect of Health on Virtual Learning Aptitude

This study contributes new evidence to an area with limited empirical focus by showing that students with greater health affected ability limitations were significantly more distracted during VL. This finding confirms broader public health research linking health conditions to educational challenges (Rosenkranz & Dzewaltowski, 2008; Council

on Community Pediatrics & Committee on Nutrition, 2015). It also extends Dunn et al. (2020), who reported that nutrition and health impairments affect cognitive and emotional outcomes, by demonstrating specific impacts on distraction and a pandemic learning context. Furthermore, these findings resonate with Van Lancker and Parolin (2020) who noted that school closures exacerbate inequalities in health and education for disadvantaged groups. By quantifying the relationship between health affected ability and distraction, this study adds to the literature by showing how functional health limitations, when combined with disrupted school services, translate into measurable academic performance barriers for Black children.

Academic Distraction

Lastly, the study results confirm the literature that identifies distraction as a significant barrier to learning in VL environments. The finding that distraction was significantly predicted by BMI, school readiness, and health affected ability aligns with Dontre (2021), who described increased multitasking and diminished supervision as sources of the lack of attention online. Similarly, Walters et al. (2022) found that students struggled to focus, often opting for non-educational online activities, a pattern consistent with this study's results. This study also aligns with Hong et al. (2021) who linked distraction to problematic internet and cell phone use, by showing that distraction also interacts with students' health and readiness levels. Furthermore, the study findings confirm Hermassi et al. (2022), who tied sedentary behavior to reduced attention, highlighting how limited physical outlets during the 2020 school year exacerbated challenges for Black children. Together, the results reinforce the literature that academic

distraction during VL is not only an individual behavior but also a function of health, preparedness, and environmental constraints.

Theoretical Findings

Interpreting the findings through Bronfenbrenner's SEM shows the interplay of individual, interpersonal, community, and societal factors in shaping Black students' academic outcomes during mandatory VL. The associations between higher BMI, lower school readiness, and greater academic distraction illustrate SEM's, premise that health is not just an individual characteristic but is also influenced by broader contextual forces including nutrition access, opportunities for physical activity, and the built environment (Payne et al., 2015). Similarly, the significant relationship between health affected ability and distraction reflects how chronic conditions at the micro system level interact with exosystem level barriers to constrain engagement in learning (Bronfenbrenner & Morris, 2007). The strong predictive role of school readiness on distraction highlights the importance of mesosystem interactions. These findings affirm SEM's relevance for understanding how the students' health measures and systemic inequities converge to influence academic readiness and attentional outcomes for Black children during mandatory VL. These interpretations remain appropriately bounded by the scope of the data and associations observed.

Limitations of the Study

Several limitations should be considered when interpreting the findings of this study. First, the use of secondary data from the 2020 National Survey of Children's Health (NSCH) limits the ability to control how variables were originally conceptualized,

measure, and reported. The data set was not designed specifically to address the RQs in this study, and certain constructs such as school readiness and distraction were measured through parent reported items which may introduce reporting bias or reduce construct validity (U.S. Census Bureau, 2021). While ordinal logistic regression provided robust estimates of associations, unmeasured confounding factors, such as household internet quality, parental involvement, or local and state school policies, may have influenced the outcomes, thereby affecting internal validity. Reliability was strengthened by the NSCH's standardized survey design and large nationality representative sample, however missing data and exclusion of incomplete cases may have introduced selection bias. Finally, generalizability is constrained by the study's focus on Black students engaged in VL during the 2020 school year. While this focus provides critical insights into an underserved population, the findings may not extend to other racial or ethnic groups, traditional school environments, or other school years. Collectively, these limitations underscore the importance of continued research using designs tailored to keep exploring these relationships.

Recommendations for Further Research

Based on the strengths and limitations of this study, I offer several recommendations for future research. First, because this study relied on secondary data from the NSCH, future researchers should employ longitudinal designs to better understand how BMI, school readiness, health affected ability, and distraction interact over time. Such designs would help establish causal pathways that could not be inferred in the present study. Second, given that parent reported measures were used for key

constructs, future research could include multiinformant data sources such as teacher assessments or direct child evaluations to strengthen validity and reliability. Third, to address the limited generalizability of these findings beyond Black children engaged in mandatory VL, future studies should examine comparative samples across diverse racial, socioeconomic, and geographic groups. This would determine whether the patterns observed in this study are unique to Black children during an extreme learning transition event or reflect broader trends across populations and learning environments.

Additionally, because this study confirmed that health and educational readiness factors jointly influence academic outcomes, future research could integrate a mixed method approach to capture the lived experiences behind the quantitative associations. Qualitative insights from students, parents, and teachers could contextualize the statistical findings and provide richer understandings of the barriers to readiness and attention in the VL environment. Furthermore, future studies could explore the role of structural factors, such as internet access and food security, to expand on the socioecological framing used in this study. Finally, consistent with gaps identified in the literature review, there is a need for intervention-based research that evaluates programs aimed at improving nutrition, physical activity, and school readiness, particularly in underserved communities. Such work would extend the study's contributions by testing strategies that mitigate disparities and enhance both health and educational outcomes without exceeding the boundaries of the present study.

Implications for Professional Practice and Social Change

The findings of this study carry important implications for professional practice in both public health and education. For stakeholders, the results highlight the need to incorporate health related considerations such as nutrition and BMI into strategies aimed at improving academic readiness and reducing distraction when there is mandatory transition into home VL environments. Teachers, administrators, and school boards may benefit from professional development that emphasizes how health and educational readiness factors intersect to influence student engagement, particularly for Black children disproportionately affected by systemic inequalities.

From a methodological perspective, this study underscores the value of integrating socioecological frameworks into educational practice as these allow professionals to address student needs holistically across individual, family, community, and policy levels. Theoretically, the results affirm the relevance of Bronfenbrenner ‘s SEM as a guiding lens for understanding how overlapping systems shape children's educational outcomes in times of crisis learning. Empirically, the study reinforces the importance of using representative data sources like the NSCH to inform practice, while also acknowledging the need for complementary local data to tailor interventions to community specific contexts. Collectively, these implications encourage professionals to adopt evidence based multilevel approaches that simultaneously address health disparities and educational inequalities, therefore strengthening both school readiness and attentional outcomes for underserved populations.

Positive Social Change

The findings of this study have meaningful potential to contribute to positive social change at multiple levels including the individual, family, organizational, and societal/policy levels. At the individual level, the results highlight how BMI, school readiness, and health affected ability intersect to influence academic attention and outcomes for Black children. By demonstrating that both physical health and readiness factors predict distraction, this study underscores the need for interventions that strengthen children's health behaviors, foster developmental preparedness, and promote intentional skills. Such evidence can empower stakeholders to prioritize balanced nutrition, physical activity, and early learning supports that foster holistic well-being in academic success.

At the family level, the findings reinforce the importance of parental and caregiver engagement in supporting both health and educational outcomes. Families play a critical role in managing children's daily routines, nutrition, and learning environments, particularly in times of disruption such as the 2020 school year. This study suggests that empowering parents with resources for health promotion, digital literacy, strong internet resources, and structured home learning environments can mitigate some of the barriers to focus and readiness that emerged during virtual schooling. In addition, by clarifying the link between health affected ability and distraction, the study provides families with evidence to advocate for school based and community-based supports tailored to the needs of children with health limitations.

At the organizational level, school districts, and community organizations can use these findings to design and implement programs that address the dual challenges of health and academic preparedness. For example, schools may enhance meal programs to ensure consistent access to nutritious food, while also strengthening readiness focus initiatives such as early childhood education programs, tutoring, and social emotional learning supports. School boards and administrators can also leverage these results to advocate for teacher training and technology resources that better address distraction in virtual classrooms. Community organizations, including local health departments and nonprofits, may similarly use these findings to build cross sector partnerships that integrate educational and health services.

At the societal and policy level, this study adds evidence to ongoing conversations about educational equity and health disparities. By highlighting how BMI and health related factors predict school readiness and distraction, the findings provide policymakers with justification for addressing systemic inequalities in nutrition, health care access, and educational opportunities for Black children. Policies that expand school readiness program strengthen food security initiatives and improve health care access for underserved families can directly address the barriers identified in this study. Moreover, the application of the SEM underscores the importance of multilevel policy solutions that integrate health and education sectors, rather than treating them as separate domains. In doing so, this research offers a data-driven foundation for policies that not only support academic achievement but also advance broader goals of public health equity.

Altogether, the potential for positive social change rests in the study's contribution to understanding how interconnected health and educational factors shape the experiences of Black students in the home VLE. While the implications remain bounded by the cross-sectional and secondary nature of the data, the findings nonetheless provide actionable evidence to inform stakeholders in reducing disparities and fostering environments that promote both health and learning. By bridging the gap between health behaviors and educational outcomes, this study supports a vision of social change that prioritizes equity, resilience, and opportunity.

Conclusion

The findings of this study emphasize the interconnectedness of health and education for Black children during the unprecedented shift to mandatory VL in 2020. BMI, health affected ability, and school readiness emerged as significant predictors of children's level of distraction and academic engagement, underscoring the ways in which systemic inequalities and health access and educational opportunities converged to shape outcomes. Specifically, higher BMI percentiles were associated with lower school readiness and increased distraction, while children with more frequent health limitations also reported greater distraction. School readiness itself proved to be a critical determinant of focus and performance, demonstrating that academic success cannot be isolated from the broader health and social context in which children live.

The key essence of this study is that advancing educational equity requires simultaneously addressing child health disparities, food insecurity, and digital inequities. Ecological model highlights that children's development is influenced not only by

individual and family factors but also by community structures and societal systems that either buffer or exacerbate disadvantage. Equitable access to nutritious meals, school-based health services, physical activity opportunities, and digital resources must be prioritized to support the holistic development of Black children. By integrating health and education policy, schools and communities can create resilient systems that safeguard vulnerable students during times of crisis education and beyond.

Ultimately, this research contributes evidence that promoting HealthEquity is inseparable from promoting educational equity. Stakeholders must act collaboratively to reduce disparities that hinder black children's readiness to learn and ability to thrive. In doing so, society can not only mitigate the negative effects of emergencies such as the COVID-19 pandemic but also foster sustainable, positive social change that ensures all children are healthy, engaged, and prepared to succeed academically and socially.

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