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APPENDIXES
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Regional Educational Laboratory Mid-Atlantic
At Mathematica

Supporting Students with Health Conditions in District of Columbia Public Schools

Appendix A. Methods

Appendix B. Supporting analyses

See https://go.usa.gov/xHbA4 for the full report.

Appendix A. Methods

This appendix discusses the study data, sample, methodology, and limitations.

Data sources, samples, and methodology

Data sources. The study team used data from District of Columbia Public Schools (DCPS) administrative records, DCPS standardized testing data, and the DCPS Conditions and Treatments report and linked the data using DCPS student identification codes that match across data sources. Detailed information about each variable examined is in table A1. DCPS administrative records and the Conditions and Treatments report were used for all three research questions. DCPS standardized testing data were used for research question 3 on education outcomes and helped provide context for the findings for research question 1 on prevalence rates of reported health conditions.

Table A1. Data sources and variables

Data source	Variable	Description
Administrative data	Student identifier	Unique numeric code assigned to student by District of Columbia Public Schools (DCPS) for identification purposes
	School identifier	Numeric code assigned to the student's school building
	Ward of residence	Numeric code assigned to the student's ward of residence
	School year	Numeric school year
	Grade	Grade-level code for the school year
	Gender	One-digit code for the student's gender
	Ethnicity	One-digit code specifying whether student is Hispanic
	Race/ethnicity	Numeric indicator(s) for White, non-Hispanic; Black, non-Hispanic; and other
	Economically disadvantaged indicator	A binary indicator (Yes or No) specifying whether a student has any of the following characteristics: • Is eligible for the national school lunch program • Is eligible to receive Temporary Assistance for Needy Families or Supplemental Nutrition Assistance Program benefits • Is identified as homeless in available data on homelessness • Is under the care of Child and Family Services Agency
	Individualized education program indicator	A binary indicator (Yes or No) showing whether student had an individualized education program

	Chronic absences	A binary indicator (Yes or No) showing whether a student was absent more than 18 days during the school year
	Suspensions	A binary indicator (Yes or No) showing whether a student was ever suspended during the school year
	Grade point average for school year	Numeric grade point average on a scale of 0.0–4.0; this variable was missing for most students in grades K–8, so analyses in the current study were limited to grades 9–12
Conditions and Treatments report	Reported health conditions	A binary indicator (Yes or No) showing whether a student had any reported health condition or one of the health conditions of particular interest to DCPS (asthma, attention deficit hyperactive disorder, mental health condition, diabetes, food allergies, anaphylaxis, or intellectual and developmental disabilities or delays); detailed information about the conditions included in "any health condition" and intellectual and developmental disabilities or delays are shown in table A3 later in the appendix.
	504 plan indicator	A binary indicator (Yes or No) showing whether a student participated in a 504 plan; to have such a plan, a student must have a physical or mental impairment that substantially limits one or more major life activities, have a record of such impairment, or have been regarded as having such impairment
Standardized testing data	Proficient on Partnership for Assessment of Readiness for College and Careers (PARCC) math test	Students were considered proficient if they received a performance level score of 4 (met expectations) or 5 (exceeded expectations)
	Proficient on PARCC English language arts/reading test	Students were considered proficient if they received a performance level score of 4 (met expectations) or 5 (exceeded expectations)
Administrative data	School ward	Numeric code assigned to ward of school attended (1–8)
	Grade span	Grade levels served by the school
	Enrollment	Total student enrollment

Source: District of Columbia Public Schools administrative records, District of Columbia Public Schools standardized testing data, and District of Columbia Public Schools Conditions and Treatments report.

For research question 2 on 504 plan and individualized education program (IEP) supports provided to students with reported health conditions, the study team selected variables based on data availability. For research question 3 the study team selected education outcomes, including math and reading proficiency, chronic absenteeism, suspensions, and grade point average (GPA), based on evidence from prior research.

*Population and samples***.** The study population for research question 1 included all 45,410 students in grades K–12 in 114 DCPS schools during the 2018/19 school year. The study sample for research question 2 was the 12,082 students in DCPS schools with a reported health condition. The target population for specific analyses for research question 3 varied according to the outcome, as shown in table A2. For example, the target population for analyses that included students' math and reading proficiency was DCPS students who took the Partnership for Assessment of Readiness for College and Careers (PARCC) math and reading exams, which excludes students in grades K–2 and most high school students. Among eligible students, PARCC math exam data were missing for 2.6 percent of students and PARCC reading exam data were missing for 2.5 percent of students. Similarly, the target population for analyses examining students' GPA is students in grades 9–12, because DCPS administrative data do not include GPA data for most students in grades K–8; data on GPA were missing for 3 percent of students in grades 9–12. In addition, data on ward of residence were missing for 4,859 students (10.7 percent), and data on the economically disadvantaged indicator were missing for 3,013 students (6.6 percent). The missing data rates were below 5 percent for all other outcomes and student characteristic variables.

Table A2. Number and percentage of students with education outcome data

Outcome	Eligible grade spans	Number of students from whom study attempted to collect data	Number of students with data	Percent of students with data
Proficient in math[a]	3–12	23,512	22,892	97.4
Proficient in reading[a]	3–12	23,721	23,137	97.5
Suspended	K–12	45,410	45,410	100.0
Chronically absent	K–12	45,410	45,302	99.8
Grade point average (grades 9–12)[b]	9–12	11,864	11,470	96.7

PARCC is Partnership for Assessment of Readiness for College and Career test.
a. The PARCC exam is administered only to students in grades 3–8 and high school students enrolled in Algebra I, Geometry, and English I and II; students in grades K–2 and all other high school students are thus excluded from the target population for the PARCC outcomes.
b. District of Columbia Public Schools administrative data do not include grade point average data for most students in grades K–8.
Source: District of Columbia Public Schools administrative records and District of Columbia Public Schools standardized testing data.

Methodology. Descriptive research methods were used to identify patterns in the prevalence of health conditions for research question 1. The study team calculated the overall prevalence of any reported health condition across DCPS and the prevalence of conditions of particular interest to DCPS (asthma, attention deficit hyperactive disorder [ADHD], mental health conditions, diabetes, food allergies, anaphylaxis, and intellectual and developmental disabilities or delays [IDDD]). (See table A3 for a list of all health conditions included in "any health condition" and for the conditions included as IDDD.) For comparisons at the ward level (both ward of residence and school ward), the study team conducted *F*-tests to assess whether the distributions across wards differed by more than would be expected by chance. Any significant differences (see tables B3 and B4 in appendix B) are displayed in ward-level maps by prevalence quartiles (see figures B1–B8). The study team also used *F*-tests to determine whether health condition prevalence differed by student characteristics, such as gender, race/ethnicity, economic disadvantage, and grade span.

Table A3. Health conditions included in any reported health conditions and in Intellectual and developmental disabilities or delays

Health conditions included	
Any reported hearth condition	
Acanthosis nigricans	Hyperinsulinemia
Achondroplasia	Hyperopia
Acquired immune deficiency	Hypertension
Attention deficit hyperactivity disorder	Hyperthyroid disorder or Hyperthyroidism
Adrenal disorder	Hypoglycemic
Allergic reactions: animal, aspirin, bee sting, drug, environmental, insects, latex, other, penicillin, seasonal, unknown etiology	Hypotension
Amblyopia	Hypothyroidism
Anaphylaxis	Intellectual and developmental disabilities or delays
Anemia: aplastic, iron deficiency, other, sickle cell	Idiopathic thrombocytopenic purpura
Aortic valve disease	Incontinence
Arteriovenous malformation	Insulin pump
Arthritis	Irritable bowel syndrome
Arthrogryposis	Juvenile rheumatoid arthritis
Asthma	Kidney disease or kidney missing/removed/transplant
Astigmatism	Klinefelter syndrome
Bicuspid valve disorder (leakage of the aortic valve)	Lactose intolerance
Blindness	Leg long bone tumor
Brain tumor	Leukemia
Bronchiectasis	Liver transplant

Health conditions included	
Bronchopulmonary dysplasia	Lupus/systemic lupus erythematosus
Cancer	Lyme disease
Cardiac surgery	Lymphoma
Cardiovascular disorder	Malabsorption syndrome
Cataract	Malnutrition
Catheterization	Marfan syndrome
Cholesterol elevated	Medically fragile
Chronic otitis media	Menorrhagia
Chronic pancreatitis	Mental health conditions
Chromosomal abnormality	Metabolic disorder
Cleft lip or palate	Mitral valve disease
Club feet	Molluscum contagiosum
Central nervous system disease	Multiple sclerosis
Colitis: Ulcerative	Murmur
Color deficiency	Mute
Colostomy	Myopia
Concussion: diagnosed, follow-up, history, mild, moderate, severe	Narcolepsy
Congenital heart disease	Nephritis
Cystic fibrosis	Nephrotic syndrome
Cystic kidney disease	Neurofibromatosis
Deaf, deafness	Neurogenic bladder
Deformity	Obesity
Diabetes	Osgood-Schlatter disease
Ear congenital defect, structural problems	Osteogenesis imperfecta
Eating disorder	Other-bone cartilage disorder
Eczema	Paraplegic
Encopresis	Pituitary disorder
Enuresis	Psoriasis
Femoral anteversion	Ptosis eyelid
Food allergies	Pulmonary valve disease
G6PD deficiency	Reactive airway disease
Gastroesophageal reflux	Recurrent headaches
Genetic Tourette’s syndrome	Refractive error
Gingivitis	Scoliosis
Glaucoma	Seizure disorder
Glycogen storage disease 1A	Short gut
G-tube or button	Sickle cell anemia (genetic), disease, or trait
Hairy tongue	Sleep apnea
Head injury	Sleep disorder
Hearing loss or impairment: mild, severe	Spinal curvature
Heart disease	Thalassemia
Heart transplant	Thyroid disorder
Hemiplegia	Tracheotomy or tracheotomy care
Hemoglobinopathies	Transplant liver
Hemophilia	Tremors
Hepatitis	Tuberculosis
Hernia	Vision impairment: mild, severe, or unspecified
HIV positive	Von Willebrand Disease
Hormonal imbalance	X-link recessive
Hydrocephalus	

Health conditions included	
Intellectual and developmental disabilities or delays	
Asperger syndrome	Neurocutaneous syndrome
Autism or autism spectrum disorder	Other developmental delays
Cerebral palsy	Prader-Willi syndrome
Cohen syndrome	Prenatal exposures
Cornelia de Lange syndrome	Rett syndrome
Dandy-Walker syndrome	Schizencephaly
Down syndrome	Soto syndrome
Fetal alcohol syndrome or effect	Specific reading disorder
Fragile X syndrome	Speech and language impairments or delays
Intellectual disabilities: mild, moderate, profound, or severe	Spina bifida
Microcephaly	Traumatic brain injuries
Motor delay	Turner syndrome
Muscular dystrophy	

Source: District of Columbia Public Schools Conditions and Treatments report.

For research question 2 the study team used *F*-tests to determine whether support through a 504 plan or an IEP differed by student characteristics, such as gender, race/ethnicity, economic disadvantage, and grade span. Because support might differ by health condition, findings are reported by condition for students with one of the three most prevalent health conditions of particular interest to DCPS: asthma, ADHD, and food allergies. The results are presented as raw descriptive data, without any controls or fixed effects.

For research question 3 the study team used regression analyses to compare education outcomes of students with and those without a reported health condition and for students with and those without one of the three most prevalent health conditions of particular interest to DCPS (asthma, ADHD, and food allergies). The main findings are presented as raw descriptive data. Sensitivity analyses that control for student characteristics and include school fixed effects were used to investigate unexpected findings, given that students are clustered within schools. For this research question the study team also used regression analyses to examine differences in education outcomes between students with and those without a reported health condition within specific student groups, such as girls and boys. Finally, the study team used difference-in-differences regressions to compare raw ward-level differences between students with and students without a health condition against the average differences across all other wards of residence or school wards.

Limitations

This study had several limitations. First, student-level data on reported health conditions provided by DCPS are based on physicians' diagnoses, conditions recorded by school nurses, and information from 504 plans and IEPs. Research has revealed inequities in physician and nurse diagnosis and reporting, finding underdiagnoses for some conditions for economically disadvantaged students and racial/ethnic minority students (Chokshi et al., 2015; Thakur et al., 2017). The study's data do not enable distinguishing between inequities in diagnoses and actual differences in prevalence.

Second, differences in the severity of reported health conditions could influence the likelihood that students will be identified or receive support for their condition. Students with more severe forms of a condition might be more likely to be identified than students with less severe forms, who might be able to manage their health condition without support from the school. And in many cases schools find out about students' health conditions primarily through 504 plans or IEPs. Thus, it might be difficult to identify students who have a health condition and who receive no accommodations. To determine whether there was complete overlap between students that the study data identified as having a health condition and those identified as receiving support, the two groups were compared. Among students with a reported health condition, only 28 percent received support through a 504 plan or an IEP.

Third, this study's prevalence rates are lower than those in the National Survey of Children's Health (NSCH) database for the District of Columbia (Child and Adolescent Health Measurement Initiative, 2018). These differences could reflect differences in measurement and categorization, but they could also suggest that health conditions are underreported (by parents) to DCPS or perhaps are underdiagnosed by school nurses and other DCPS staff. The study team compared prevalence rates in order to flag any differences that might call into question the quality of the data used in the study. Whereas the NSCH database shows that 38 percent of children (ages 0–17) in the District of Columbia had a reported health condition in 2017–18, this study found a prevalence rate of 27 percent for DCPS students in 2018/19. When NSCH data are limited to school-age children, the NSCH health condition prevalence rates are even higher, ranging from 43 percent among children ages 6–11 to 57 percent among children ages 12–17. The DCPS data classifies students in K–12 based on current health conditions that were identified by medical professionals, reported to schools, or supported by a 504 plan or an IEP within the school year. The health conditions included in the NSCH database are based on parents' recollection and not independently verified by medical professionals. The NSCH database also excludes conditions such as blood disorders, cystic fibrosis, and genetic or inherited conditions, which were included in the current study's definition of "any health condition."

Fourth, the data available for the current study could not be used to measure the severity of reported health conditions. Therefore, it is unclear whether any differences in 504 plan and IEP support are based on the severity of the condition or on some other factor. The study also did not examine average number of visits to the school nurse or whether students received support through the school health center, because these data were not consistently tracked or available across schools.

Fifth, the study's correlational design means that it cannot determine cause and effect. Finding an association between a health condition and an education outcome, even when statistically significant, does not mean that the health condition caused the outcome, and it should not be interpreted as such. The study's findings reveal only the strength of the associations between specific health conditions and outcomes. These associations can be used to pinpoint potential inequities for DCPS to further explore.

Finally, this study used data from a single school year (2018/19) rather than tracking student outcomes across several years to understand possible long-term associations between health conditions and outcomes or changes in prevalence across time. The decision to focus on one school year was made because the content and quality of the data on health conditions and support vary from year to year as the collection and tracking of data improve over time. The health conditions and support data from the most recently completed school year at the time of the study (2018/19) were the most complete and accurate. Comparisons with previous years would be problematic because any differences could be attributed to differences in data collection and tracking rather than actual changes in prevalence. Although the findings are sufficient to answer questions about the prevalence of health conditions and associations with education outcomes during one school year, the findings do not provide evidence of long-term associations between variables. Therefore, results should be interpreted as applicable only to the 2018/19 school year.

References

Child and Adolescent Health Measurement Initiative. (2018). *2017-2018 National Survey of Children's Health (NSCH) data query.* Data Resource Center for Child and Adolescent Health. Retrieved June 18, 2020 from http://www.childhealthdata.org.

Chokshi, N. Y., Patel, D., & Davis, C. M. (2015). Long-term increase in epinephrine availability associated with school nurse training in food allergy. *Journal of Allergy and Clinical Immunology*: *In Practice, 3*(1), 128–130.

Thakur, N., Barcelo, N. E., Borrell, L. N., Singh, S., Eng, C., Davis, A., et al. (2017). Perceived discrimination associated with asthma and related outcomes in minority youth: The GALA II and SAGE II studies. *Chest, 151*(4), 804–812.

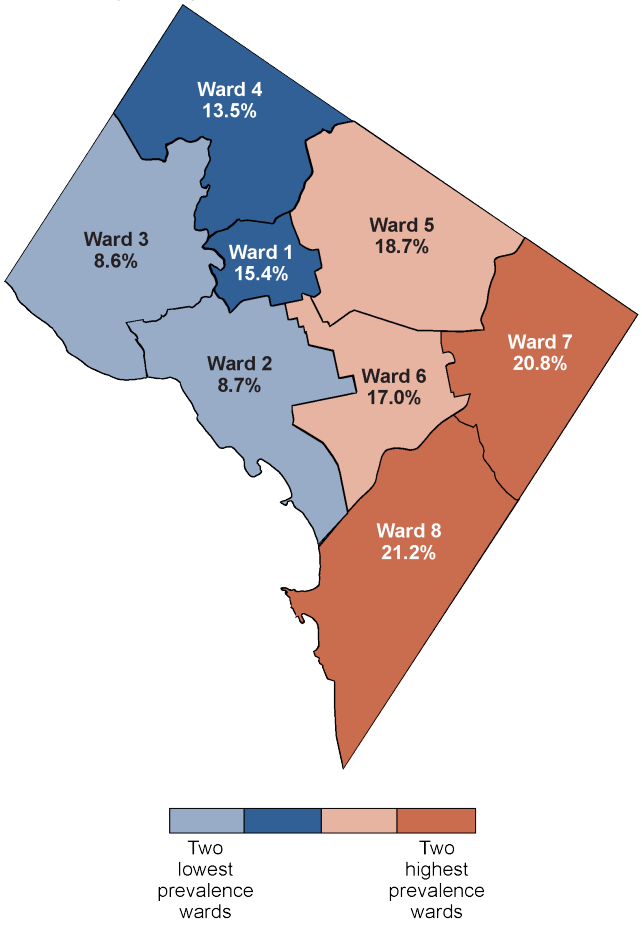
Appendix B. Supporting analyses

This appendix provides additional detailed results of analyses of prevalence rates by ward of residence, school ward, school, and health condition. It also provides education outcomes by student characteristics, ward of residence, school ward, and health condition.

Prevalence rates, including the minimum, median, and maximum prevalence among wards of residence, school wards, and schools are presented in figures B1–B8 and tables B1–B4. In general, variation in prevalence levels was similar for wards of residence and school wards (tables B1 and B2). However, the prevalence of some conditions of interest, including asthma, attention deficit hyperactivity disorder, food allergies, and intellectual and developmental disabilities or delays, varied significantly across students' wards of residence and school wards, with some wards having higher or lower rates than others (figures B1-B8 and tables B3 and B4).

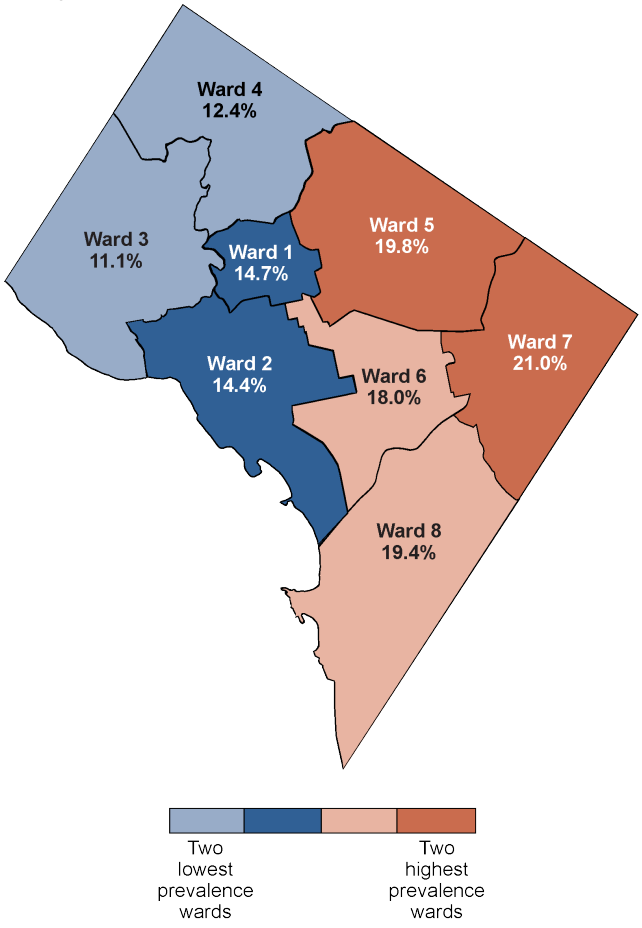
Prevalence rates of the three most prevalent reported health conditions by ward of residence, school ward, and school

Figure B1. Prevalence of asthma among District of Columbia Public Schools students, by ward of residence, 2018/19



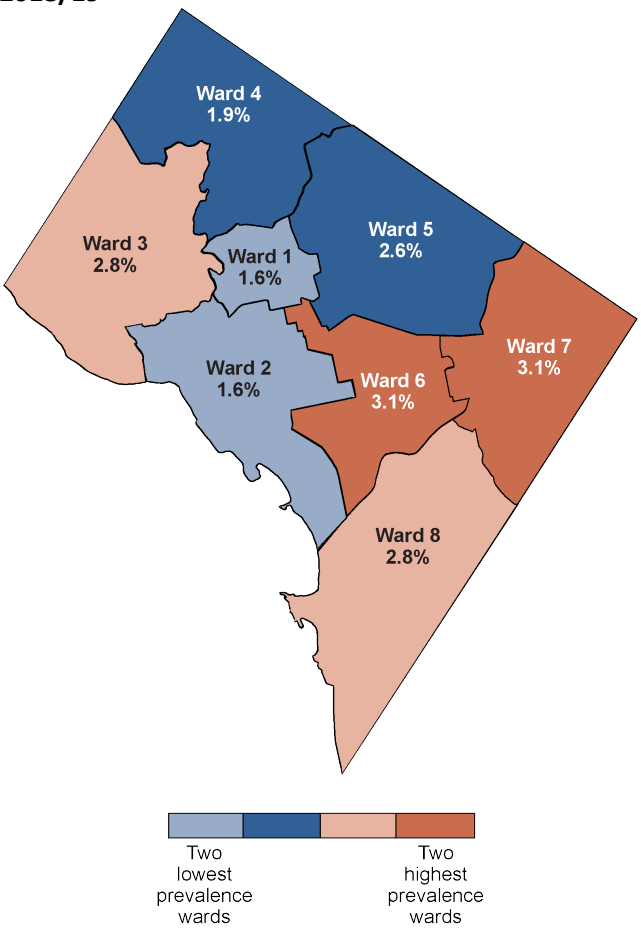
Note: An *F*-test used to assess differences in ward-by-ward distributions was statistically significant at the $p < .05$ level.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Figure B2. Prevalence of asthma among District of Columbia Public Schools students, by school ward, 2018/19



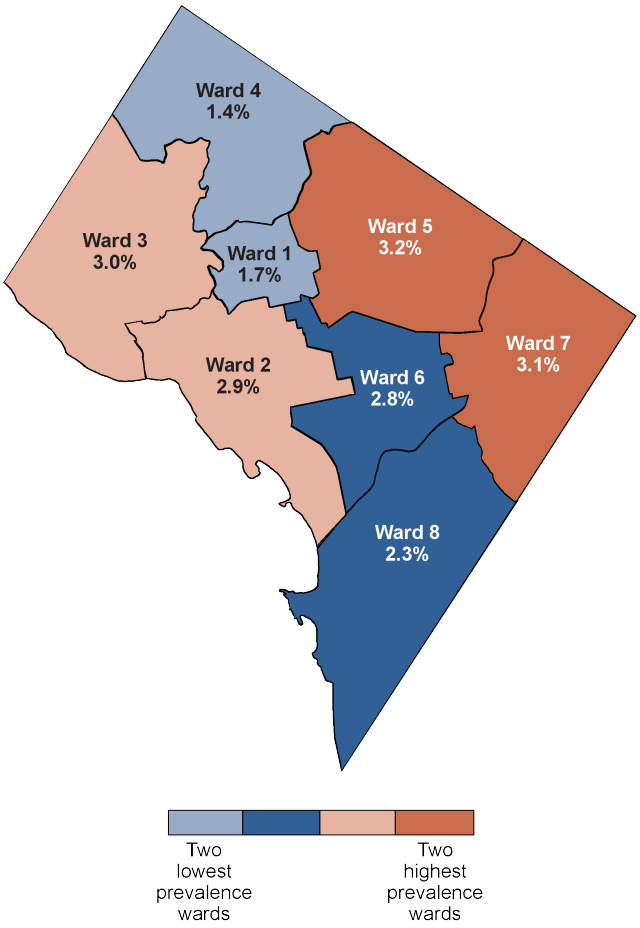
Note: An *F*-test used to assess differences in ward-by-ward distributions was statistically significant at the $p < .05$ level.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Figure B3. Prevalence of attention deficit hyperactivity disorder among District of Columbia Public Schools students, by ward of residence, 2018/19



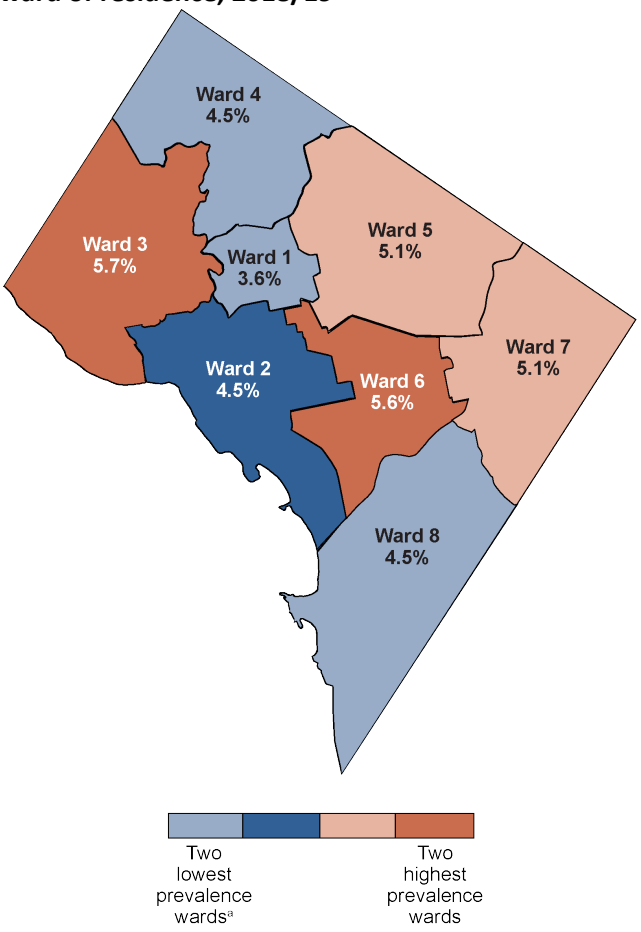
Note: An *F*-test used to assess differences in ward-by-ward distributions was statistically significant at the $p < .05$ level.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Figure B4. Prevalence of attention deficit hyperactivity disorder among District of Columbia Public Schools students, by school ward, 2018/19



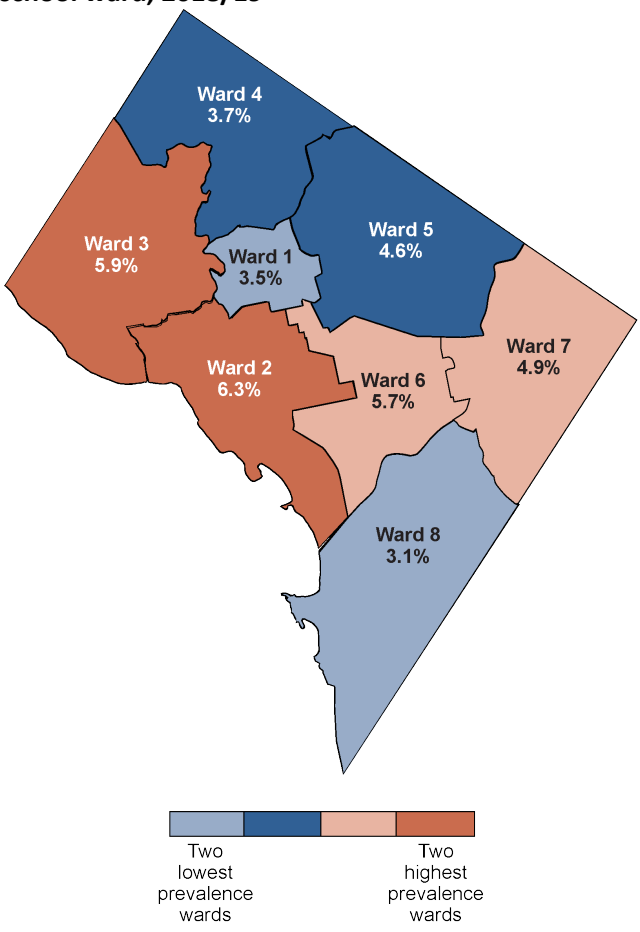
Note: An *F*-test used to assess differences in ward-by-ward distributions was statistically significant at the $p < .05$ level.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Figure B5. Prevalence of food allergies among District of Columbia Public Schools students, by ward of residence, 2018/19



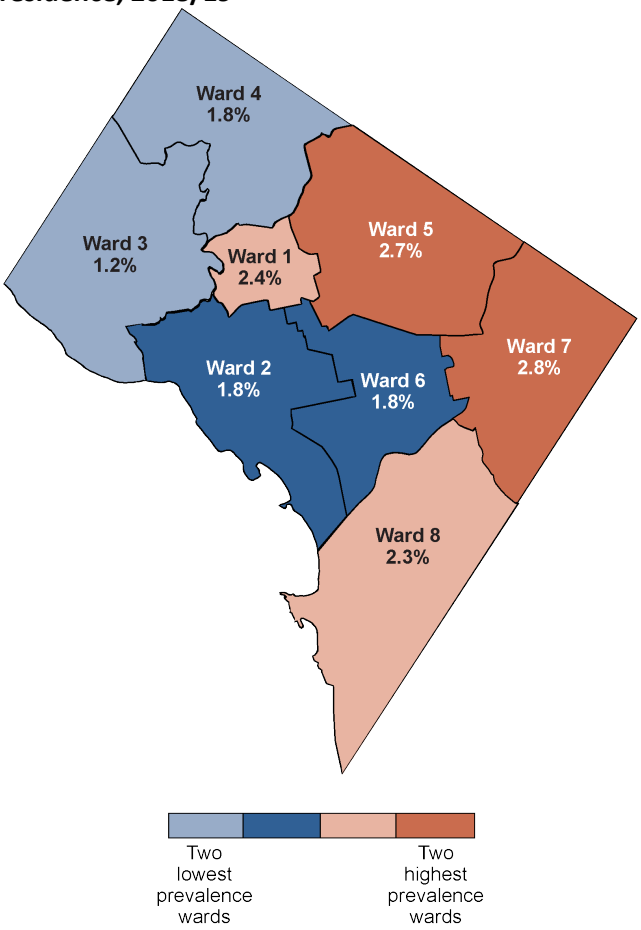
Note: An *F*-test used to assess differences in ward-by-ward distributions was statistically significant at the $p < .05$ level.
a. Wards 4 and 8 had similar prevalence in food allergies, prior to rounding; as a result, they were grouped together into the lowest prevalence category, along with Ward 1. Therefore, the second-to-lowest prevalence category has just one ward (Ward 2).
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Figure B6. Prevalence of food allergies among District of Columbia Public Schools students, by school ward, 2018/19



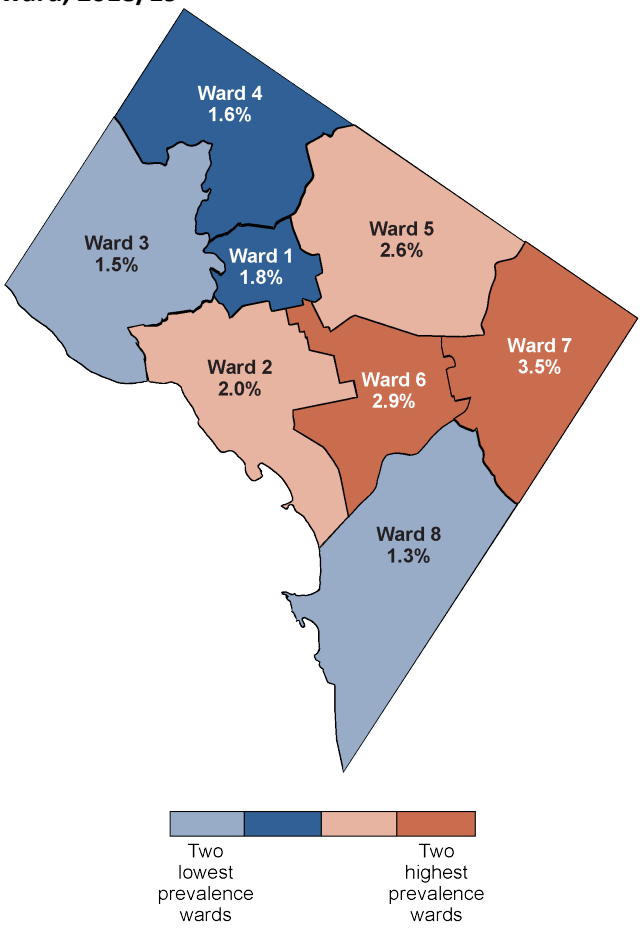
Note: An *F*-test used to assess differences in ward-by-ward distributions was statistically significant at the $p < .05$ level.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Figure B7. Prevalence of intellectual and developmental disabilities or delays among District of Columbia Public Schools students, by ward of residence, 2018/19



Note: An *F*-test used to assess differences in ward-by-ward distributions was statistically significant at the $p < .05$ level.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Figure B8. Prevalence of intellectual and developmental disabilities or delays among District of Columbia Public Schools students, by school ward, 2018/19



Note: An *F*-test used to assess differences in ward-by-ward distributions was statistically significant at the $p < .05$ level.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Table B1. Prevalence of reported health conditions in District of Columbia Public Schools, districtwide and by ward of residence, school ward, and school, 2018/19 (percent)

	Districtwide		Ward of residence		School ward		School	
Health condition	Overall prevalence (%)	Overall number of students	Average among lowest prevalence wards	Average among highest prevalence wards	Average among lowest prevalence wards	Average among highest prevalence wards	Average among lowest prevalence schools	Average among highest prevalence schools
Any health condition	26.6	12,082	20.9	31.5	21.3	31.2	15.3	40.5
Condition of particular interest								
Asthma	16.0	7,269	8.7	20.9	11.7	20.4	7.5	25.3
Attention deficit hyperactive disorder	2.5	1,119	1.6	3.1	1.5	3.2	0.4	5.7
Mental health condition	0.4	177	0.3	0.6	0.3	0.6	0.0	1.1
Diabetes	0.2	101	0.1	0.3	0.1	0.4	0.0	0.7
Food allergies	4.6	2,091	4.2	5.7	3.3	6.1	1.7	7.9
Anaphylaxis	0.2	113	0.1	0.3	0.2	0.3	0.0	0.8
Intellectual and developmental disability or delay	2.1	933	1.5	2.8	1.4	3.2	0.2	8.4

Note: Lowest prevalence wards or schools are wards or schools with the lowest percent of students with health conditions. Highest prevalence wards or schools are wards or schools with the highest percent of students with health conditions. Wards are categorized into four groups from lowest to highest prevalence, with two wards in each group; schools are categorized into five groups from lowest to highest prevalence, with equal numbers of schools in each group.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Table B2. Minimum, median, and maximum prevalence of reported health conditions in District of Columbia Public Schools, by ward of residence, school ward, and school, 2018/19 (percent)

	Ward of residence			School ward			School		
Health condition	Minimum	Median	Maximum	Minimum	Median	Maximum	Minimum	Median	Maximum
Any health condition	18.3	26.9	32.2	19.4	27.6	32.3	0.2	26.6	93.2[a]
Condition of particular interest									
Asthma	8.6	16.2	21.2	11.1	16.3	21.0	0.2	17.8	36.4
Attention deficit hyperactive disorder	1.6	2.7	3.1	1.4	2.8	3.2	0.0	1.8	13.6
Mental health condition	0.3	0.4	0.7	0.3	0.4	0.6	0.0	0.2	2.7
Diabetes	0.1	0.2	0.3	0.1	0.2	0.4	0.0	0.00	1.3
Food allergies	3.6	4.8	5.7	3.1	4.8	6.3	0.0	4.3	11.2
Anaphylaxis	0.1	0.2	0.3	0.7	0.3	0.4	0.0	0.2	1.3
Intellectual and developmental disability or delay	1.2	2.0	2.8	1.3	1.9	3.5	0.0	1.8	65.9

a. Removing one school that serves primarily students with low-incidence disabilities reduces the school-level maximum percentage of students with any health condition (last column) from 93.2 percent to 43.5 percent.

Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Table B3. Prevalence of reported health conditions in District of Columbia Public Schools, by student ward of residence, 2018/19

Health condition	*p*-value from *F*-test	Ward 1		Ward 2		Ward 3		Ward 4		Ward 5		Ward 6		Ward 7		Ward 8	
		Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number
Any health condition	<.01	24.7	1,032	18.3	174	25.2	1,177	23.6	1,763	29.5	1,361	28.5	1,197	32.2	2,083	30.7	2,459
Condition of particular interest																	
Asthma	<.01	15.4	643	8.7	83	8.6	403	13.5	1,008	18.7	862	17.0	715	20.8	1,345	21.2	1,698
Attention deficit hyperactive disorder	<.01	1.6	68	1.6	15	2.8	130	1.9	145	2.6	119	3.1	131	3.1	199	2.8	224
Mental health condition	.06	0.3	13	0.3	3	0.7	31	0.3	23	0.5	24	0.5	20	0.4	23	0.3	28
Diabetes	.16	0.2	7	0.1	1	0.1	4	0.3	22	0.3	14	0.2	9	0.3	19	0.2	14
Food allergies	<.01	3.6	150	4.5	43	5.7	267	4.5	336	5.1	237	5.6	235	5.1	327	4.5	361
Anaphylaxis	.61	0.2	9	0.1	1	0.2	8	0.3	25	0.3	14	0.2	9	0.3	20	0.3	21
Intellectual and developmental disability or delay	<.01	2.4	102	1.8	17	1.2	57	1.8	132	2.7	124	1.8	75	2.8	182	2.3	181
At least one condition of particular interest	<.01	20.8	870	14.6	139	16.6	776	19.3	1,441	24.9	1,147	23.8	1,000	27.2	1,759	26.6	2,133
More than one condition of particular interest	<.01	2.7	111	2.4	23	2.5	115	2.9	219	4.9	224	4.1	172	5.1	327	4.4	351

Note: An *F*-test was used to assess differences in the prevalence of each health condition across wards. Findings were considered statistically significant at the $p < .05$ level.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Table B4. Prevalence of reported health conditions in District of Columbia Public Schools, by school ward, 2018/19

Health condition	*p*-value from *F*-test	Ward 1		Ward 2		Ward 3		Ward 4		Ward 5		Ward 6		Ward 7		Ward 8	
		Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number
Any health condition	<.01	23.2	1,183	28.0	842	27.2	1,993	19.4	1,482	29.9	1,307	30.2	1,925	32.3	1,528	26.7	1,822
Condition of particular interest																	
Asthma	<.01	14.7	750	14.4	433	11.1	815	12.4	945	19.8	865	18.0	1,146	21.0	992	19.4	1,323
Attention deficit hyperactive disorder	<.01	1.7	85	2.9	86	3.0	217	1.4	109	3.2	141	2.8	177	3.1	147	2.3	157
Mental health condition	.06	0.5	25	0.6	18	0.5	36	0.3	25	0.5	21	0.3	22	0.3	13	0.2	17
Diabetes	.08	0.1	5	0.4	13	0.2	12	0.2	16	0.3	13	0.3	17	0.2	11	0.2	14
Food allergies	<.01	3.5	178	6.3	188	5.9	433	3.7	286	4.6	203	5.7	361	4.9	232	3.1	210
Anaphylaxis	.44	0.3	15	0.3	8	0.2	14	0.2	18	0.4	16	0.3	16	0.3	15	0.2	11
Intellectual and developmental disability or delay	<.01	1.8	94	2.0	59	1.5	112	1.6	120	2.6	112	2.9	182	3.5	167	1.3	87
At least one condition of particular interest	<.01	19.6	1,003	22.3	671	18.9	1,390	16.9	1,295	25.6	1,118	25.0	1,598	27.7	1,309	23.2	1,586
More than one condition of particular interest	<.01	2.5	127	4.1	123	3.1	229	2.6	199	5.1	224	4.6	296	5.1	243	3.1	210

Note: An *F*-test was used to assess differences in the prevalence of each health condition across wards. Findings were considered statistically significant at the $p < .05$ level.
Source: Authors' analysis based on data from District of Columbia Public Schools administrative records and District of Columbia Public Schools Conditions and Treatments report.

Education outcomes of students with reported health conditions by student characteristics

Descriptive analyses by student background characteristics suggest that students with health conditions generally fared worse on education outcomes compared with students without health conditions, regardless of gender, race/ethnicity, economic status, or school attendance within or outside their ward of residence (table B5).

Table B5. Comparison of education outcomes for District of Columbia Public Schools students with and those without reported health conditions, by student characteristics, 2018/19

Student characteristic	Proficient in math[a] (%)		Proficient in reading[a] (%)		Chronically absent (%)		Suspended (%)		Mean grade point average (grades 9–12)	
	With condition	Without condition	With condition	Without condition	With condition	Without condition	With condition	Without condition	With condition[b]	Without condition
Gender										
Female	28.6*	32.5	44.1	45.8	32.5*	27.5	8.6*	6.1	2.8*	2.7
Male	25.4*	31.7	30.4*	35.6	32.1*	28.1	12.9*	8.3	2.4*	2.3
Race/ethnicity										
Black, non-Hispanic	15.3*	18.6	24.8*	28.4	39.5*	37.0	14.3*	11.3	2.4*	2.3
Hispanic	34.2*	30.2	41.1*	37.6	20.8*	23.0	4.8*	3.1	2.7*	2.5
White, non-Hispanic	76.3*	80.4	85.4	87.1	11.2*	6.7	2.3*	0.9	3.7	3.7
Other	60.2	63.7	76.2	66.9	13.3*	8.4	3.9*	0.6	3.6	3.4
Economically disadvantaged										
Yes	16.7*	20.6	23.9*	27.1	38.0*	35.8	13.5*	9.7	2.3*	2.3
No	58.7*	65.8	73.6*	78.1	14.3*	9.3	2.7*	1.8	3.4	3.5
Attends school in ward of residence										
Yes	28.1*	34.0	34.2*	39.3	29.3*	25.1	11.1*	7.5	2.5*	2.4
No	27.1*	31.8	41.4*	45.8	35.5*	33.8	9.8*	7.2	2.7*	2.6
Grade span										
K–5	32.9*	40.7	32.6*	39.9	17.9*	12.8	5.3*	2.7	na	na
6–8	23.8*	26.6	40.0*	44.3	29.1*	23.8	19.8*	16.7	na	na
9–12	16.1	17.9	39.0	38.6	64.6	62.8	14.7*	11.6	2.6*	2.5

* Significant at $p < .05$.

na is not applicable because grade point average findings are restricted to students in grades 9–12

a. Students are considered to be proficient if they receive a performance level score of 4 (met expectations) or 5 (exceeded expectations) on the Partnership for Assessment of Readiness for College and Career test in math or reading.

b. Sensitivity analyses used to investigate unexpected findings revealed that the differences in this column are no longer statistically significant after other student characteristics were adjusted for and school fixed effects were added to the model.

Note: This table presents raw descriptive data with no adjustments for student characteristics. Asterisks indicate a significant difference in education outcomes between students with a given student characteristic, such as female students with a health condition compared with female students without a health condition. Significant differences that favor students without a health condition are shaded in red. Significant differences that favor students with a health condition are shaded in blue.

Source: Authors' analysis based on data from District of Columbia Public Schools administrative records, District of Columbia Public Schools standardized testing data, and District of Columbia Public Schools Conditions and Treatments report.

Education outcomes for students with and those without a reported health condition by ward of residence and school ward

Ward-level differences in education outcomes between students with and those without a reported health condition are similar to the average differences of all other wards combined, with some distinctions by student ward of residence and school ward. Tables B6a through B7c compare ward-level differences in education outcomes between students with and those without asthma, attention deficit hyperactivity disorder (ADHD), or food allergies. These findings are based on difference-in-differences regressions that compare individual ward-level differences between students with and without health conditions to average differences across all other wards. Because the study team made many comparisons across conditions, wards, and outcomes, some of the differences could be attributable to random chance. The discussion here therefore focuses on wards in which differences demonstrate some consistency and highlights wards of residence or school wards for which there are three or more statistically significant differences (in the same direction) from the average difference among all other wards of residence or school wards combined.

Within wards of residence, differences between students with and students without asthma, ADHD, or food allergies are similar to average differences across all other wards combined on most education outcomes, with some exceptions. For example:

- In **Ward 1** differences in math proficiency, chronic absenteeism, and suspensions between students with and those without **asthma** are significantly smaller than the average difference across all other wards of residence combined (table B6a).
- In **Ward 7** differences in math proficiency, reading proficiency, and chronic absenteeism between students with and those without **asthma** are significantly smaller than the average difference across all other wards of residence combined. Differences in GPA are significantly larger and favor students with asthma over those without asthma, which is the opposite direction of the average association across other wards (see table B6a).
- In **Ward 8** differences in math proficiency, reading proficiency, chronic absenteeism, and suspensions between students with and those without **asthma** are significantly smaller than the average difference across all other wards of residence combined. Differences in grade point average (GPA) are significantly larger and favor students with asthma over those without asthma, which is the opposite direction of the average association across other wards (see table B6a).
- These findings suggest that having **asthma** and residing in **Wards 1, 7, and 8** is not as strongly associated with negative education outcomes as it is in other wards of residence. These three wards of residence (along with Ward 5) are among the four wards with the highest percentage of economically disadvantaged students and the lowest percentage of students who are proficient in math and reading (see table 2 in the main report). So the small differences in education outcomes between students with and those without asthma may be related to overall low student performance and other challenges students face in these wards.
- In **Ward 4** differences in reading proficiency, suspensions, and GPA between students with and those without **ADHD** are significantly smaller than the average difference across all other wards of residence combined (table B6b).
- Among students with **food allergies,** there are no wards of residence with three or more statistically significant differences from the average across all other wards combined (table B6c).

At the school ward level, differences between students with and those without asthma, ADHD, or food allergies are also similar to the average differences across all other wards combined on most education outcomes, with some exceptions across wards. For example:

- In schools in **Ward 3** differences in math proficiency, reading proficiency, chronic absenteeism, and GPA between students with and those without **asthma** are significantly larger than the average difference between students across all other school wards combined (table B7a). These findings indicate that students with asthma who attend school in Ward 3 are less likely to be proficient in math and reading, more likely to be chronically absent, and are more likely to have lower GPAs than students without asthma who attend school in Ward 3.
- In schools in **Ward 8** differences in math proficiency, reading proficiency, and chronic absenteeism between students with and those without **asthma** are significantly smaller than the average difference across all other school wards combined (see table B7a). Ward 8 is also the only ward in which students with asthma have much higher GPAs than those without asthma. These findings suggest that having asthma in Ward 8 is not as strongly associated with negative education outcomes as it is in other wards. Schools in Ward 8 also have the lowest percentage of students proficient in math and reading (see table 2 in the main report), so the small differences in education outcomes between students with and those without asthma might be related to overall low student performance in these wards.
- There are no school wards with at least three differences in education outcomes between students with and those without **ADHD** that are significantly different than the average difference across all other school wards combined (see table B7b).
- In schools in **Ward 5**, differences in math proficiency, chronic absenteeism, and suspensions between students with and those without **food allergies** are significantly larger than the average difference across all other school wards combined (table B7c). These findings indicate that students with **food allergies** who attend school in **Ward 5** are less likely to be proficient in math, more likely to be chronically absent, and more likely to be suspended than students without food allergies. This could indicate that students with food allergies who attend school in this ward could use additional support.

Table B6a. Comparison of education outcomes for students with and those without asthma: Differences in each ward of residence compared with differences across all other wards of residence, 2018/19

Ward of residence	Difference between students with and those without asthma				
	Proficient in math[a] (%)	Proficient in reading[a] (%)	Chronically absent (%)	Suspended (%)	Mean grade point average (grades 9–12)
All wards	–9.67	–9.83	7.09	4.25	–0.01
Ward 1	–1.76*	–8.65	3.28*	1.12*	–0.01
Ward 2	–11.85	–12.96	6.72	1.88	–0.17
Ward 3	–7.85	–4.25	6.02	0.42*	–0.13
Ward 4	–6.82	–5.23*	4.16	1.34*	0.05
Ward 5	–3.89*	–4.31*	6.29	3.55	–0.11
Ward 6	–17.14*	–14.03	6.56	5.94	–0.08
Ward 7	0.07*	–1.48*	2.26*	3.67	0.16*
Ward 8	–2.66*	–0.84*	–1.03*	1.91*	0.27*

* Significant at $p < .05$.

Note: Asterisks indicate a significant difference between the difference in a particular ward of residence compared with the average difference across all other wards of residence combined (excluding the focal ward) based on difference-in-differences regressions that compared raw ward-level differences between students with and those without asthma. Differences that are significantly larger than the average difference across all other wards and that favor students without asthma are shaded in red. Differences that are significantly larger than the average difference across all other wards and that favor students with asthma are shaded in blue. Differences that are significantly smaller than the average difference across all other wards are shaded in green.

a. Students are considered to be proficient if they receive a performance level score of 4 (met expectations) or 5 (exceeded expectations) on the Partnership for Assessment of Readiness for College and Career test in math or reading.

Source: Authors' analysis based on data from District of Columbia Public Schools administrative records, District of Columbia Public Schools standardized testing data, and District of Columbia Public Schools Conditions and Treatments report.

Table B6b. Comparison of education outcomes for students with and those without attention deficit hyperactivity disorder: Differences in each ward of residence compared with differences across all other wards of residence, 2018/19

	Difference between students with and those without attention deficit hyperactivity disorder				
Ward of residence	Proficient in math[a] (%)	Proficient in reading[a] (%)	Chronically absent (%)	Suspended (%)	Mean grade point average (grades 9–12)
All wards	–13.00	–14.09	15.43	17.33	–0.27
Ward 1	–24.62	–19.21	17.95	15.26	–0.11
Ward 2	–22.66	–16.29	12.52	–1.93*	–0.56
Ward 3	–29.74*	–21.30	16.19	7.05*	–0.50
Ward 4	–7.27	–3.08*	15.84	11.69*	0.10*
Ward 5	–15.15	–19.53	15.64	20.89	–0.66*
Ward 6	–15.05	–17.21	21.60	18.01	–0.43
Ward 7	–9.59	–16.69	15.91	22.26*	–0.48*
Ward 8	–7.10	–12.01	3.92*	17.09	–0.31

* Significant at $p < .05$.

Note: Asterisks indicate a significant difference between the difference in a particular ward of residence compared with the average difference across all other wards of residence combined (excluding the focal ward) based on difference-in-differences regressions that compared raw ward-level differences between students with and those without attention deficit hyperactive disorder (ADHD). Differences that are significantly larger than the average difference across all other wards and that favor students without ADHD are shaded in red. Differences that are significantly smaller than the average difference across all other wards are shaded in green.

a. Students are considered to be proficient if they receive a performance level score of 4 (met expectations) or 5 (exceeded expectations) on the Partnership for Assessment of Readiness for College and Career test in math or reading.

Source: Authors' analysis based on data from District of Columbia Public Schools administrative records, District of Columbia Public Schools standardized testing data, and District of Columbia Public Schools Conditions and Treatments report.

Table B6c. Comparison of education outcomes for students with and those without food allergies: Differences in each ward of residence compared with differences across all other wards of residence, 2018/19

	Difference between students with and those without food allergies				
Ward of residence	Proficient in math[a] (%)	Proficient in reading[a] (%)	Chronically absent (%)	Suspended (%)	Mean grade point average (grades 9–12)
All wards	2.14	6.62	–0.24	0.47	0.17
Ward 1	0.21	4.13	–3.93	–1.64	0.07
Ward 2	8.12	25.01	6.90	0.46	0.06
Ward 3	4.66	4.07	0.11	–0.91	0.14
Ward 4	3.56	7.22	–1.16	1.01	0.15
Ward 5	0.76	4.61	2.05	2.01	0.17
Ward 6	–0.26	6.11	–0.75	2.26	–0.10
Ward 7	0.95	6.08	–2.35	0.67	0.24
Ward 8	–1.53	5.15	–0.75	–2.56*	0.23

* Significant difference (at $p < .05$) between the difference in a particular ward of residence compared with the average difference across all other wards of residence combined (excluding the focal ward) based on difference-in-differences regressions that compared raw ward-level differences between students with and those without food allergies. The difference that is significantly larger than the average difference across all other wards and that favors students with food allergies is shaded in blue.

a. Students are considered to be proficient if they receive a performance level score of 4 (met expectations) or 5 (exceeded expectations) on the Partnership for Assessment of Readiness for College and Career test in math or reading.

Source: Authors' analysis based on data from District of Columbia Public Schools administrative records, District of Columbia Public Schools standardized testing data, and District of Columbia Public Schools Conditions and Treatments report.

Table B7a. Comparison of education outcomes for students with and those without asthma: Differences in each school ward compared with differences across all other school wards, 2018/19

School ward	Difference between students with and those without asthma				
	Proficient in math[a] (%)	Proficient in reading[a] (%)	Chronically absent (%)	Suspended (%)	Mean grade point average (grades 9–12)
All wards	–9.67	–9.83	7.09	4.25	–0.01
Ward 1	1.68*	–2.21*	4.46	2.57	0.00
Ward 2	–9.06	–9.55	7.91	1.17*	–0.16
Ward 3	–14.55*	–10.73*	9.19*	1.59*	–0.23*
Ward 4	–5.98	–4.46*	3.76*	3.64	0.09
Ward 5	–0.46*	–2.77*	8.65	3.42	–0.05
Ward 6	–10.51	–10.00	5.52	3.43	0.05
Ward 7	–1.89*	–2.10*	4.78	5.08	0.01
Ward 8	–1.53*	0.42*	–1.13*	3.01	0.37*

* Significant at $p < .05$.

Note: Asterisks indicate a significant difference between the difference in a particular school ward compared with the average difference across all other school wards combined (excluding the focal ward) based on difference-in-differences regressions that compared raw ward-level differences between students with and those without asthma. Differences that are significantly larger than the average difference across all other wards and that favor students without asthma are shaded in red. Differences that are significantly larger than the average difference across all other wards and that favor students with asthma are shaded in blue. Differences that are significantly smaller than the average difference across all other wards are shaded in green.

a. Students are considered to be proficient if they receive a performance level score of 4 (met expectations) or 5 (exceeded expectations) on the Partnership for Assessment of Readiness for College and Career test in math or reading.

Source: Authors' analysis based on data from District of Columbia Public Schools administrative records, District of Columbia Public Schools standardized testing data, and District of Columbia Public Schools Conditions and Treatments report.

Table B7b. Comparison of education outcomes for students with and those without attention deficit hyperactivity disorder: Differences in each school ward compared with differences across all other school wards, 2018/19

School ward	Difference between students with and those without attention deficit hyperactivity disorder				
	Proficient in math[a] (%)	Proficient in reading[a] (%)	Chronically absent (%)	Suspended (%)	Mean grade point average (grades 9–12)
All wards	–13.10	–14.09	15.43	17.33	–0.27
Ward 1	–28.96*	–19.10	20.66	19.87	–0.70*
Ward 2	–9.19	–12.19	18.87	8.48*	–0.14
Ward 3	–25.30*	–18.91	14.98	9.38*	–0.26
Ward 4	–11.25	–13.01	21.83	19.38	–0.20
Ward 5	–8.56	–14.62	15.08	19.82	–0.53*
Ward 6	–8.36	–15.92	13.99	17.77	–0.50
Ward 7	–8.23	–12.12	22.60*	25.80*	–0.35
Ward 8	–5.71	–9.68	2.31*	17.81	–0.19

* Significant at $p < .05$.

Note: Asterisks indicate a significant difference between the difference in a particular school ward compared with the average difference across all other school wards combined (excluding the focal ward) based on difference-in-differences regressions that compared raw ward-level differences between students with and those without attention deficit hyperactive disorder (ADHD). Differences that are significantly larger than the average difference across all other wards and that favor students without ADHD are shaded in red. Differences that are significantly smaller than the average difference across all other wards are shaded in green.

a. Students are considered to be proficient if they receive a performance level score of 4 (met expectations) or 5 (exceeded expectations) on the Partnership for Assessment of Readiness for College and Career test in math or reading.

Source: Authors' analysis based on data from District of Columbia Public Schools administrative records, District of Columbia Public Schools standardized testing data, and District of Columbia Public Schools Conditions and Treatments report.

Table B7c. Comparison of education outcomes for students with and those without food allergies: Differences in each school ward compared with differences across all other school wards, by school ward, 2018/19

School ward	Difference between students with and those without food allergies				
	Proficient in math[a] (%)	Proficient in reading[a] (%)	Chronically absent (%)	Suspended (%)	Mean grade point average (grades 9–12)
All wards	2.14	6.62	–0.24	0.47	0.17
Ward 1	–0.06	8.82	5.28	1.58	–0.04
Ward 2	–6.35	1.48	11.08*	–0.10	–0.10
Ward 3	0.03	0.77	0.90	–0.11	–0.10*
Ward 4	4.68	4.87	0.41	3.06	0.29
Ward 5	–9.32*	–1.52	7.36*	4.50*	0.10
Ward 6	4.47	6.46	–3.09	1.34	–0.03
Ward 7	0.09	2.67	1.43	–0.36	–0.02
Ward 8	0.97	7.37	–2.78	–0.98	0.45*

* Significant at $p < .05$.

Note: Asterisks indicate a significant difference between the difference in a particular school ward compared with the average difference across all other school wards combined (excluding the focal ward) based on difference-in-differences regressions that compared raw ward-level differences between students with and those without food allergies. Differences that are significantly larger than the average difference across all other wards and that favor students without food allergies are shaded in red. Differences that are significantly larger than the average difference across all other wards and that favor students with food allergies are shaded in blue. Differences that are significantly smaller than the average difference across all other wards are shaded in green.

a. Students are considered to be proficient if they receive a performance level score of 4 (met expectations) or 5 (exceeded expectations) on the Partnership for Assessment of Readiness for College and Career test in math or reading.

Source: Authors' analysis based on data from District of Columbia Public Schools administrative records, District of Columbia Public Schools standardized testing data, and District of Columbia Public Schools Conditions and Treatments report.