

## OBSERVATION: BRIEF RESEARCH REPORT

## Risk for Severe COVID-19 Illness Among Teachers and Adults Living With School-Aged Children

**Background:** Schools provide critical educational and health benefits to children, and reopening them facilitates parents', particularly mothers', return to work (1). Although children rarely have severe coronavirus disease 2019 (COVID-19) illness, they can transmit infection (2).

**Objective:** To determine the prevalence of risk factors for severe COVID-19 illness among teachers and adults living with school-aged children.

**Methods and Findings:** We analyzed nationally representative data from the 2018 National Health Interview Survey. We used the Centers for Disease Control and Prevention's criteria (3) to define "definite" and "possible" risk factors for severe COVID-19 illness, including differing severities of obe-

esity, and tabulated their prevalence among 3 groups: employed adults other than teachers, adults employed as teachers, and adults living with school-aged (aged 5 to 17 years) children. We assessed differences in the prevalence of definite or possible risk factors among adults living with children according to the children's ages (5 to 10 years vs. 11 to 17 years), race/ethnicity, and family income using bivariate logistic regressions. Analyses were done with STATA/SE, version 16.1 (StataCorp), using weights and procedures that accounted for the survey's complex design.

The National Health Interview Survey sample included 14 097 adults representative of 150.3 million U.S. nonteacher workers; 592 adults representative of 5.8 million primary, secondary, and special education teachers; and 5682 adults representative of 69.7 million adults living with school-aged children.

Among teachers, 39.8% (weighted  $n = 2.32$  million [95% CI, 1.98 to 2.66 million]) had definite and 50.6% (weighted  $n = 2.95$  million) had definite or possible risk factors for severe

**Table 1.** Risk Factors for Severe COVID-19 Illness Among Teachers\* and Adults Living in a Household With School-Aged Children

Condition Indicating Increased Risk†	National Estimate (in Thousands) of Nonteacher Workers (95% CI), n‡	Percentage of All Nonteacher Workers (95% CI)	National Estimate (in Thousands) of Teachers (95% CI), n‡	Percentage of All Teachers (95% CI)	National Estimate (in Thousands) of Adults Living With School-Aged Children (95% CI), n‡	Percentage of Adults Living With School-Aged Children (95% CI)
<b>Definite risk factors</b>						
Cancer	1318.8 (1051.3-1586.3)	0.9 (0.7-1.1)	43.7 (0-90.3)	0.7 (0.3-2.2)	632.6 (435.7-829.4)	0.9 (0.7-1.2)
Serious heart condition	10 746.9 (9938.5-11 555.3)	7.2 (6.7-7.7)	465.2 (326.4-603.9)	8.0 (6.0-10.6)	4667.9 (4119.4-5216.4)	6.7 (6.0-7.5)
COPD	5281.3 (4697.4-5865.2)	3.5 (3.2-3.9)	182.9 (93.2-272.7)	3.1 (1.9-5.1)	2464.2 (2035.6-2892.7)	3.5 (3.0-4.2)
<b>Obesity</b>						
BMI $\geq 30$ kg/m <sup>2</sup>	44 772.3 (42 716.5-46 828.0)	30.7 (29.6-31.8)	1577.8 (1296.2-1859.3)	27.9 (23.7-32.5)	22 126.6 (20 695.6-23 557.5)	32.8 (31.2-34.5)
BMI $\geq 35$ kg/m <sup>2</sup>	18 231.8 (17 010.7-19 452.8)	12.5 (11.8-13.3)	651.0 (482.3-819.7)	11.5 (9.0-14.7)	9040.9 (8184.1-9897.7)	13.4 (12.3-14.6)
BMI $\geq 40$ kg/m <sup>2</sup>	6964.7 (6275.3-7654.0)	4.8 (4.3-5.3)	234.9 (126.9-342.9)	4.2 (2.6-6.5)	3542.8 (3032.2-4053.5)	5.3 (4.6-6.0)
Type 2 diabetes	8643.6 (7922.4-9364.7)	5.8 (5.3-6.2)	337.0 (195.3-478.7)	5.8 (3.8-8.7)	4843.9 (4235.4-5452.5)	6.9 (6.2-7.8)
Any of the above	57 992.7 (55 645.2-60 340.1)	38.6 (37.5-39.7)	2176.3 (1846.9-2505.6)	37.3 (32.8-42.1)	27 968.1 (26 393.2-29 543.0)	40.1 (38.5-41.7)
Age >64 y	8586.0 (7950.1-9222.0)	5.7 (5.3-6.1)	322.7 (207.5-437.9)	5.5 (3.9-7.8)	2501.4 (2121.7-2881.1)	3.6 (3.1-4.2)
Any definite risk factor	62 204.8 (59 764.5-64 645.0)	41.4 (40.3-42.5)	2318.8 (1982.3-2655.3)	39.8 (35.2-44.6)	28 613.1 (27 030.1-30 196.2)	41.0 (39.4-42.7)
<b>Possible risk factors</b>						
Asthma (moderate/severe)	4394.7 (3835.3-4954.1)	2.9 (2.6-3.3)	280.4 (151.9-408.8)	4.8 (3.1-7.5)	2329.1 (1882.8-2775.4)	3.3 (2.8-4.0)
Cerebrovascular disease	1462.2 (1174.0-1750.5)	1.0 (0.8-1.2)	46.8 (5.6-88.0)	0.8 (0.3-1.9)	849.6 (622.1-1077.0)	1.2 (0.9-1.6)
Hypertension	28 150.6 (26 771.3-29 529.9)	18.7 (18.0-19.5)	960.7 (749.0-1172.4)	16.5 (13.4-20.2)	11 771.9 (10 814.4-12 729.5)	16.9 (15.7-18.1)
Dementia	21.1 (0-48.8)	0.0 (0.0-0.1)	0 (NA)	0 (NA)	117.7 (19.6-215.8)	0.2 (0.1-0.4)
Liver disease	2057.9 (1725.2-2390.6)	1.4 (1.2-1.6)	89.3 (20.3-158.2)	1.5 (0.7-3.3)	1451.1 (1112.7-1789.5)	2.1 (1.7-2.6)
Pregnancy	1245.2 (973.6-1516.9)	0.8 (0.7-1.0)	95.2 (20.7-169.8)	1.6 (0.8-3.5)	721.1 (525.0-917.2)	1.0 (0.8-1.4)
Smoking	20 642.2 (19 389.7-21 894.7)	13.7 (13.0-14.5)	282.0 (158.7-405.3)	4.8 (3.1-7.4)	9209.4 (8304.6-10 114.1)	13.2 (12.1-14.5)
Type 1 diabetes	504.1 (282.7-725.4)	0.3 (0.2-0.5)	23.1 (0-51.5)	0.4 (0.1-1.4)	260.4 (130.1-390.8)	0.4 (0.2-0.6)
Any definite or possible risk factor	83 899.3 (81 003.8-86 794.9)	55.8 (54.6-57.0)	2947.6 (2575.5-3319.7)	50.6 (45.9-55.3)	37 658.9 (35 729.8-39 588.0)	54.0 (52.2-55.8)
No risk factors	66 403.8 (63 541.0-69 266.7)	44.2 (43.0-45.4)	2880.5 (2475.4-3285.5)	49.4 (44.7-54.1)	32 081.5 (30 108.3-34 054.6)	46.0 (44.2-47.8)

BMI = body mass index; COPD = chronic obstructive pulmonary disease; COVID-19 = coronavirus disease 2019; NA = not applicable.

\* Teachers included employed persons whose occupation was "primary, secondary, and special education school teachers."

† Definite and possible risk factors for poor COVID-19 outcomes were defined according to Centers for Disease Control and Prevention guidelines (3). However, no reliable indicators of chronic kidney disease, immunocompromise, sickle cell disease, thalassemia, cystic fibrosis, or pulmonary fibrosis were available. Cancer = any cancer diagnosed within the past 2 y, excluding nonmelanoma skin cancer. Serious heart condition = ever told they had angina pectoris or coronary heart disease or a heart condition/disease or a heart attack. COPD = told they had chronic bronchitis in the past 12 mo or ever told they had COPD or ever told they had emphysema. Obesity = BMI  $>30$  kg/m<sup>2</sup>. Type 2 diabetes = ever told they had diabetes and not included in type 1 diabetes group (see below). Moderate/severe asthma = had an asthma attack in the past 12 mo or had an emergency department visit for asthma in the past 12 mo or used  $>3$  canisters or disks of inhalers in the past 3 mo or hospitalized for asthma in the past 12 mo. Cerebrovascular disease = ever told they had a stroke. Hypertension = ever had hypertension on  $>2$  visits. Dementia = had difficulty thinking or remembering and main reason was dementia or Alzheimer disease. Liver disease = ever told they had chronic liver condition or told they had liver condition in the past 12 mo. Pregnancy = pregnant at time of interview. Smoker = current smoker. Type 1 diabetes = ever told they had diabetes and diabetes onset before age 18 y and using insulin.

‡ Estimates are based on the National Health Interview Survey sample, which included 14 097 adults representative of 150.3 million nonteacher workers, 592 adults representative of 5.8 million teachers, and 5682 adults representative of 69.7 million adults living with school-aged children.

**Table 2.** Increased Risk for Severe COVID-19 Illness Among Adults Living in a Household With School-Aged Children, by Children's Age, Children's Race/Ethnicity, and Family Income ( $n = 5682$ )

Characteristic	Adults With Definite or Possible Risk Factor, weighted $n$ (thousands) (%)	Difference in Prevalence of Any Definite or Possible Risk Factor (95% CI), percentage points*
<b>Children's age†</b>		
5-10 y	12 422.1 (54.1)	Reference
11-17 y	25 236.8 (53.9)	-0.2 (-3.6 to 3.2)
<b>Children's race/ethnicity‡</b>		
White, non-Hispanic	19 187.1 (54.7)	Reference
Asian/other	2757.2 (43.3)	-11.4 (-17.5 to -5.3)
Hispanic	9954.3 (52.8)	-1.9 (-6.3 to 2.5)
Black	5760.3 (60.8)	6.0 (1.2 to 10.9)
<b>Family income§</b>		
\$0 to <\$35 000	7481.4 (63.3)	18.4 (14.0 to 22.7)
\$35 000 to <\$75 000	10 749.9 (60.6)	15.7 (11.8 to 19.6)
\$75 000 to <\$100 000	4264.2 (56.8)	11.8 (6.3 to 17.3)
≥\$100 000	12 048.3 (44.9)	Reference

COVID-19 = coronavirus disease 2019.

\* Bivariate logistic regressions; STATA's (StataCorp) margins command was used to calculate percentage point differences and CIs.

† A mutually exclusive variable was created to classify households by children's age. Adults were classified as exposed to children aged 5 to 10 y if the household included only children in this age group; adults were classified as exposed to children aged 11 to 17 y even if they were also exposed to younger children.

‡ A mutually exclusive 4-category variable was created to classify households by children's race/ethnicity: ≥1 non-Hispanic White child (and no child of other race/ethnicity); ≥1 Asian/other child (and no Black or Hispanic child); ≥1 Hispanic child (and no Black child); or ≥1 Black child.

§ A total of 5278 persons were included for the family income analysis; 404 had missing values for family income.

COVID-19 illness (Table 1). Although only 0.7% had cancer, 27.9% had a body mass index (BMI) of 30 kg/m<sup>2</sup> or greater, 4.2% had a BMI of 40 kg/m<sup>2</sup> or greater, and 8.0% had a cardiac condition. The prevalence of most risk factors was similar among nonteacher workers, although more were smokers; 41.4% had any definite risk factors, and 55.8% had definite or possible risk factors.

Among the 69.74 million adults living with school-aged children, 41.0% (weighted  $n = 28.61$  million [CI, 27.03 to 30.20 million]) had definite and 54.0% (weighted  $n = 37.7$  million) had definite or possible risk factors, including 2.50 million who were older than 64 years, 4.67 million with heart disease, 4.84 million with type 2 diabetes, and more than 600 000 with cancer.

The prevalence of risk factors was similar among adults living with younger versus older children (Table 2). Adults living with children in low-income households were more likely to be at risk than those in higher-income households, as were those residing with Black children; adults living with Asian children or children of other races/ethnicities were at lowest risk.

**Discussion:** About 40 million U.S. adults who work or live with school-aged children have definite or possible risk factors for severe COVID-19 illness, a number that excludes 4.4 million nonteachers working at schools and 1.6 million day care workers (Himmelstein DU. Unpublished data). Adults liv-

ing with Black children and those living with children in low-income households are at especially high risk; teachers' risk seems similar to that of other working adults.

By mid-March 2020, 107 nations had closed schools to help contain the COVID-19 outbreak (4); many that have suppressed the virus are now reopening them. In-person instruction is preferable for children's educational and social development, and school closures may adversely affect children's mental health, food security, and safety (1). Moreover, children rarely develop severe COVID-19 disease. However, as our findings indicate, school leaders must weigh these undoubted benefits against the risk to the adults who care for children, particularly older children who commonly transmit the infection (younger children are about one third as likely to cause household spread) (2). Both the risks and benefits of schools reopening are likely larger for poor and Black families.

Our study has limitations. We could not identify school personnel other than teachers or day care workers in the National Health Interview Survey, nor could we identify some conditions identified as risk factors for severe COVID-19 illness, such as chronic kidney disease or thalassemia. Hence, our estimate of the number of adults at risk is likely too low. Our study data predated the COVID-19 pandemic, although substantial shifts in disease prevalence seem unlikely. Finally, different risk factors and different levels of obesity carry different levels of risk for severe COVID-19 illness (for example, a BMI ≥45 kg/m<sup>2</sup> more than quintupled the risk for COVID-19-related death, whereas a BMI of 30 to 34 kg/m<sup>2</sup> increased it by 26%) (5).

Our findings underscore the need for careful consideration of and preparation for school reopenings this fall. The resumption of face-to-face instruction is critical for children's development, health, and welfare. However, without adequate safeguards, reopening schools could put millions of vulnerable adults at risk for severe COVID-19 illness.

Adam W. Gaffney, MD, MPH

Cambridge Health Alliance/Harvard Medical School  
Boston, Massachusetts

David Himmelstein, MD

Steffie Woolhandler, MD, MPH

City University of New York at Hunter College  
New York, New York

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**Reproducible Research Statement:** Study protocol: Not available. Statistical code: Available from Dr. Gaffney (e-mail, [agaffney@gmail.com](mailto:agaffney@gmail.com)). Data set: Available at [www.cdc.gov/nchs/nhis/nhis\\_2018\\_data\\_release.htm](http://www.cdc.gov/nchs/nhis/nhis_2018_data_release.htm).

**Corresponding Author:** Adam Gaffney, MD, Cambridge Health Alliance, 1493 Cambridge Street, Cambridge, MA 02139; e-mail, [agaffney@challiance.org](mailto:agaffney@challiance.org).

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