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The Risk Of Severe COVID-19 Within Households Of School Employees And School-Age Children

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ABSTRACT Across the United States, school districts are grappling with questions of whether and how to reopen and keep open elementary and secondary schools in the 2020–21 academic year. Using household data from before the pandemic (2014–17), we examined how often people who have health conditions placing them at risk for severe coronavirus disease 2019 (COVID-19) were connected to schools, either as employees or by living in the same households as school employees or school-age children. Between 42.0 percent and 51.4 percent of all school employees met the Centers for Disease Control and Prevention's (CDC's) definition of having or potentially having increased risk for severe COVID-19. Among all adults with CDC-defined risk factors for severe COVID-19, between 33.9 million and 44.2 million had direct or within-household connections to schools.

School districts across the United States are grappling with questions of whether and how to reopen or keep open elementary and secondary schools in the 2020–21 academic year.[1] Keeping schools closed and relying on distance learning will have serious learning, social, nutritional, and health consequences for children, especially those in low-income families.[2] There will also be impacts on parental employment and the overall economy. Reopening schools potentially increases the risk for coronavirus disease 2019 (COVID-19) exposure among teachers, other school employees, students, and their household members.[3]

To better understand the potential health impacts of reopening, we examined how often people at risk for severe COVID-19 were connected to schools, either as employees or by living in the same households as school employees or school-age children. Our results highlight the public health challenge that arises when the risk of school-related exposure is coupled with the potential for within-household transmission.

Study Data And Methods

DATA SOURCE Data were from the Medical Expenditure Panel Survey (MEPS), a household survey of the civilian noninstitutionalized population sponsored by the Agency for Healthcare Research and Quality.[4] MEPS is the only nationally representative survey that provides detailed health, socioeconomic, and employment information for all household members, making it a unique resource for studying household connections among employment, schooling, and the risk of severe COVID-19.[5] Pooling MEPS data from 2014 to 2017 yielded a sample of 122,393 positively weighted observations, including 95,830 adults ages eighteen and older. Estimates were weighted to be nationally representative, and standard errors and significance tests were adjusted to reflect the complex design of MEPS.

STUDY POPULATION Using four-digit census occupation and industry codes, we categorized 3,194 employees in the elementary and secondary education industry as follows: teachers and teacher assistants (a category that includes special education, substitute teachers, kindergarten teachers, and prekindergarten teachers in elementary schools) and other teachers and

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instructors (sample size = 1,979), administrators and other high-skill support staff (those in business, science, and arts occupations) (sample size = 434), and low-skill support staff (all remaining occupations) (sample size = 781).

We categorized children according to their ages as of August 31 of each year as follows: elementary school (including kindergarten) (ages 5–10), middle school (ages 11–13), and high school (ages 14–17). Race and ethnicity were defined for respondents whose single reported race was White, Black, or Asian and for respondents of Hispanic ethnicity (any race). Results for Asian school employees are not shown because of small sample sizes.

Following Centers for Disease Control and Prevention (CDC) guidance,[6] we classified people as being at increased risk for severe COVID-19 if they had obesity (body mass index of 30 kg/m^2 or greater), were age sixty-five or older, or had any of the following treated conditions: diabetes, cancer (other than nonmelanoma skin cancers), emphysema or other chronic obstructive pulmonary disease, kidney disease, or coronary heart disease.[5] Also following CDC guidance, we added a broader group that includes factors that might lead to increased risk, adding current smoking, treated asthma, and treated high blood pressure to the risk factors in the CDC's main definition.

LIMITATIONS This study had several limitations. Our analysis examined only the civilian noninstitutionalized population, thereby excluding hard-hit populations in nursing, long-term care, and correctional facilities. Although approximately 3 percent of school-age children were home schooled before the pandemic, our analysis examined all school-age children. Our data predate the pandemic and therefore do not measure any changes in employment, school attendance, or household composition that may have occurred in response to it.

There are several reasons why our estimates likely undercount the true prevalence of people meeting the CDC guidelines for increased risk. We did not include liver disease because we were unable to distinguish between chronic and acute cases. We also did not include the following conditions: pregnancy; immunocompromised states resulting from solid organ transplant, blood or bone marrow transplant, immune deficiencies, HIV, use of corticosteroids, or use of other immune-weakening medicines; cerebrovascular disease, cardiomyopathies, and heart failure (unless associated with coronary heart disease); sickle cell disease; cystic fibrosis; neurologic conditions such as dementia; and thalassemia. Many of these omitted categories are rare, and in some cases they overlap with CDC risk factors that we included (especially age and obesity). In addition, although we included kidney disease as a CDC risk factor, we did not present separate estimates of its prevalence. Kidney disease is undercounted in MEPS, perhaps because it often is a secondary condition associated with high blood pressure, diabetes, or other conditions.

MEPS contains self-reported data on conditions and treatments. Self-reporting is known to undercount condition prevalence.[7,8] A recent study[9] found that in 2015–16 self-reported height and weight resulted in an undercount of obesity, the most prevalent of the CDC risk factors, by 3.7 percentage points (averaged across men and women). Note, however, that some people with unobserved obesity may have been classified as having increased risk based on other risk factors, such as diabetes, hypertension, or being age sixty-five or older.

Study Results

SCHOOL EMPLOYEES Substantial percentages of adults had risk factors associated with severe COVID-19 (exhibit 1 and online appendix exhibit 1).[10] Compared with nonworking adults (a group that includes many seniors), workers had a lower prevalence of most risk factors and were less likely to meet CDC criteria for increased risk. Using the main CDC definition, 42.0 percent of school employees were at increased risk for severe COVID-19. Among school employees, low-skill support staff were more likely to be at increased risk (58.2 percent) compared with teachers and teacher assistants (37.8 percent) or administrators and high-skill support staff (39.1 percent). Obesity was the primary factor causing school employees to be in the main CDC increased-risk group, whereas high blood pressure also played an important role regarding the broader CDC definition. Among school employees, men were more likely than women and Blacks were more likely than Whites to be at increased risk.

Exhibit 2 examines the health risks of school employees and household members, reflecting the possibility of within-household transmission (see also appendix exhibit 2).[10] Overall, 63.2 percent of school employees lived in households with at least one adult (either the employee or an adult living in the same household) who met the main CDC definition of increased risk. The household-level results in exhibit 2 are substantially larger than the estimates of school employees' own health risks in exhibit 1. We nevertheless observed many of the same patterns across occupation, age, and race and ethnicity. More than 70 percent of low-skill school employees, school employees ages fifty and older, and Black school employees lived in households that contained at

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EXHIBIT 1

Prevalence of COVID-19 health risks among all US adults by employment status and among school employees by selected occupation and socioeconomic characteristics, 2014–17

	Sample size	Population (millions)	Obesity (%)	Diabetes (%)	High blood pressure (%)	Age 65 or older (%)	Meets main CDC definition (%)	Meets broader CDC definition (%)
All adults	95,830	248.0	31.4	9.6	24.0	20.3	49.7	61.0
Nonworkers	38,142	90.8	31.5	15.9***	37.7***	44.6***	67.4***	75.8***
Workers[a]	57,688	157.3	31.4	6.0	16.0	6.3	39.4	52.4
School employees	3,194	9.9	33.8	5.4	16.8	6.2	42.0	51.4
Teachers and teacher assistants[a]	1,979	6.5	30.8	4.3	14.6	5.3	37.8	47.2
Administration and high-skill support staff	434	1.4	32.0	3.5	14.7	3.6	39.1	46.5
Low-skill support staff	781	2.0	45.1***	10.2***	25.6***	11.1***	58.2***	68.8***
Sex								
Men[a]	761	2.5	39.0	7.6	21.9	7.3	47.2	54.6
Women	2,433	7.5	32.1**	4.7**	15.1***	5.9	40.3**	50.3
Age, years								
18–49[a]	1,945	6.2	32.2	2.2	6.8	0.0	34.2	42.1
50+	1,249	3.8	36.5	10.7***	33.3***	16.5	54.9***	66.7***
Family income as percent of FPL								
<100%	167	0.3	33.9	9.1	19.2	2.7	39.0	54.3
100%–199%	373	0.7	35.8	7.4	18.7	8.8	44.7	52.4
200%–399%	1,034	2.9	38.4**	4.7	15.0	5.7	45.4	54.2
≥400%[a]	1,620	6.0	31.4	5.3	17.3	6.3	40.3	49.8
Race/ethnicity								
White non-Hispanic[a]	1,786	7.3	31.7	4.4	15.9	6.3	40.5	50.2
Black non-Hispanic	562	1.0	51.8***	10.0***	28.2***	7.0	59.5***	68.3***
Hispanic	622	1.1	36.4	6.2	11.6**	5.1	40.7	48.2

SOURCE Authors' calculations using data from the Medical Expenditure Panel Survey, 2014–17. **NOTES** "Meets main/broader CDC definition" refers to definitions of health conditions placing people at increased risk for severe COVID-19. School employees are those working in elementary or secondary education. Estimates by race/ethnicity exclude Asian non-Hispanics as well as people with mixed or other race/ethnicity because of small sample sizes. Health indicators included in the main CDC definition of increased risk are obesity (body mass index of 30 kg/m^2 or more); diabetes (if treated with oral or injectable medication); and any of the following conditions (if linked to current-year treatment): emphysema or other chronic obstructive pulmonary disease, cancer (other than nonmelanoma skin cancers), coronary heart disease, or kidney disease. The broader CDC definition also includes current smoking, high blood pressure (if being treated with prescription medicine), and asthma (if linked to current-year treatment). Standard errors and risk factors not shown in this exhibit are in appendix exhibit 1 (see note 10 in text). Statistical significance is reported for results relative to reference groups. CDC is Centers for Disease Control and Prevention. FPL is federal poverty level. [a]Reference category. **$p < 0.05$ ***$p < 0.01$

least one adult with increased risk, based on the main CDC definition.

SCHOOL-AGE CHILDREN Children, especially at younger ages, are less likely than adults to become severely ill or transmit infection if exposed to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2); nevertheless, exposure to infected children can place vulnerable adults at risk.[11,12] Exhibit 3 shows that 58.7 percent of school-age children lived in households with at least one adult meeting the main CDC definition of increased risk (see also appendix exhibit 3).[10] Again, the primary health risk was obesity, which affected adults in the households of 53.6 percent of all school-age children. High blood pressure and smoking (shown in the appendix)[10] were also risk factors with high prevalence.

High school–age children were more likely than elementary school–age children to live with adults with increased risk. Although it is not surprising that the health issues of parents and other household members would increase as they and their children get older, this finding takes on special importance in the context of COVID-19, insofar as transmission risks also increase with child age.[11] The risk of adult exposure may therefore be greatest when the risk of severe illness is also greatest. Among high school–age children, the percentage living with increased-risk adults in the same household was 62.1 percent versus 55.7 percent among children ages 5–9. Exhibit 3 also shows that Black and Hispanic children were more likely than White children to live in households with increased-risk adults. In contrast, Asian children were less likely than White children to live in households with increased-risk adults.

POTENTIAL SCHOOL-RELATED EXPOSURE OF ADULTS WITH INCREASED RISK Exhibit 4 examines how often adults, especially those at in-

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EXHIBIT 2

Prevalence of COVID-19 health risks among school employees and their adult household members, by employee occupation and selected socioeconomic characteristics, 2014–17

			Share of school employees living in households in which at least 1 adult (school employee included) has COVID-19-related risk factors (%)					
Characteristics	**Sample size**	**Population (millions)**	**At least 1 adult has obesity**	**At least 1 adult has diabetes**	**At least 1 adult has high blood pressure**	**At least 1 adult is age 65 or older**	**At least 1 adult meets main CDC definition**	**At least 1 adult meets broader CDC definition**
School employees	3,194	9.9	52.5	11.8	31.4	12.6	63.2	71.9
Teachers and teacher assistants[a]	1,979	6.5	48.5	10.2	27.6	10.7	59.7	68.9
Administration and high-skill support staff	434	1.4	52.7	8.7	25.6	9.0	59.8	69.0
Low-skill support staff	781	2.0	65.5***	19.6***	48.2***	21.2***	77.0***	83.8***
Sex								
Men[a]	761	2.5	54.4	14.8	32.1	12.1	65.2	72.6
Women	2,433	7.5	51.8	10.9	31.2	12.7	62.5	71.7
Age, years								
18–49[a]	1,945	6.2	51.2	7.4	18.3	4.0	56.1	64.4
50+	1,249	3.8	54.6	19.2***	53.0***	26.6***	74.8***	84.3***
Family income as percent of FPL								
<100%	167	0.3	45.9	13.5	26.5	7.7	55.1	67.2
100%–199%	373	0.7	52.1	14.9	32.8	19.4	64.4	70.1
200%–399%	1,034	2.9	54.9	11.3	30.1	10.2	64.2	72.0
≥400%[a]	1,620	6.0	51.7	11.7	32.1	13.0	62.9	72.3
Race/ethnicity								
White non-Hispanic[a]	1,786	7.3	50.7	10.3	29.7	11.6	61.6	70.7
Black non-Hispanic	562	1.0	64.3***	15.9**	45.4***	14.4	73.6***	82.0***
Hispanic	622	1.1	58.7**	15.5**	28.7	14.1	66.7	74.5

SOURCE Authors' calculations using data from the Medical Expenditure Panel Survey, 2014–17. **NOTES** "Meets main/broader CDC definition" refers to definitions of health conditions placing people at increased risk for severe COVID-19. School employees are those working in elementary or secondary education. Estimates by race/ethnicity exclude Asian non-Hispanics as well as people with mixed or other race/ethnicity because of small sample sizes. Health indicators included in the main CDC definition and broader CDC definition are in the notes to exhibit 1. Standard errors and risk factors not shown in the exhibit are in appendix exhibit 2 (see note 10 in text). Statistical significance is reported for results relative to reference groups. CDC is Centers for Disease Control and Prevention. FPL is federal poverty level. [a]Reference category. **$p < 0.05$ ***$p < 0.01$

creased risk, lived in households with at least one school employee or school-age child. Overall, 4.0 percent of all adults were school employees, and another 4.2 percent of adults lived in households with at least one school employee (for a combined share of 8.2 percent). Adding in households with school-age children, 35.2 percent of all adults had a direct or within-household connection to schools. Using the main CDC definition of increased risk, 3.4 percent of increased-risk adults were school employees, and another 3.3 percent lived in households with at least one school employee (for a combined 6.7 percent). Factoring in households with school-age children, we found that 27.5 percent or 33.9 million of the 123.2 million increased-risk adults had a direct or within-household connection to schools. Using the broader CDC definition, 29.2 percent or 44.2 million of the 151.3 million adults with increased risk had a direct or within-household connection to schools (see appendix exhibit 4).[10]

Among adults meeting the main CDC definition of increased risk, those with family incomes of at least 400 percent of the federal poverty level were most likely to live in households with at least one school employee, whereas adults with incomes below 100 percent of the federal poverty level were most likely to live in households with school-age children. Among adults meeting the main CDC definition of increased risk, Whites had lower rates of direct or within-household school connections (22.4 percent) than did Blacks (34.1 percent) or Hispanics (44.3 percent). These differences were primarily driven by the frequencies of having at least one school-age child in the household. Asian adults with increased risk were less likely than Whites to work in schools or live with school employees, but they were more likely to live in households with school-age children.

MULTIPLE RISK FACTORS Having multiple risk factors increases the likelihood of severe COVID-19.[6,13] Exhibit 5 examines school employees and

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EXHIBIT 3

Presence of adults with COVID-19 health risks in households of school-age children, by school level and selected socioeconomic characteristics, 2014–17

Child characteristics	Sample size	Population (millions)	Share of school-age children living in households in which at least 1 adult member has COVID-19-related risk factors (%): At least 1 adult has obesity	At least 1 adult has diabetes	At least 1 adult has high blood pressure	At least 1 adult is age 65 or older	At least 1 adult meets main CDC definition	At least 1 adult meets broader CDC definition
All school-age children	26,509	53.9	53.6	11.3	24.0	5.6	58.7	71.0
School level								
Elementary school[a]	12,546	24.4	51.4	9.0	19.3	4.7	55.7	67.6
Middle school	6,068	12.4	55.0**	11.7***	25.2***	5.7	60.2***	71.9***
High school	7,895	17.1	55.7***	14.2***	29.7***	6.8***	62.1***	75.2***
Sex								
Boys[a]	13,663	27.5	53.4	11.5	23.7	5.4	58.8	70.8
Girls	12,846	26.4	53.9	11.1	24.2	5.8	58.7	71.3
Family income as percent of FPL								
<100%	8,412	9.7	55.5***	12.7***	21.1**	5.5**	60.8***	75.7***
100%–199%	6,821	11.5	57.9***	13.3***	23.7	6.6***	63.2***	75.9***
200%–399%	6,686	16.4	55.5***	10.9	24.6	6.6***	60.7***	72.5***
≥400%[a]	4,579	16.2	47.6	9.3	25.1	4.0	52.3	63.1
Race/ethnicity								
White non-Hispanic[a]	7,436	26.8	51.0	8.9	23.8	4.2	55.8	69.5
Black non-Hispanic	5,188	7.6	62.8***	14.0***	32.4***	6.8***	67.3***	79.8***
Asian non-Hispanic	1,469	2.7	21.7***	12.2	24.7	10.7***	35.2***	52.0***
Hispanic	10,923	13.3	60.3***	12.8***	19.2***	5.9***	64.6***	72.2

SOURCE Authors' calculations using data from the Medical Expenditure Panel Survey (MEPS), 2014–17. **NOTES** "Meets main/broader CDC definition" refers to definitions of health conditions placing people at increased risk for severe COVID-19. School level based on age as of August 31 of MEPS year: elementary: ages 5–10; middle school: ages 11–13; and high school: ages 14–17. Estimates by race/ethnicity exclude people with mixed or other race/ethnicity. Health indicators included in the main CDC definition and broader CDC definition are in the notes to exhibit 1. Standard errors and risk factors not shown in the exhibit are in appendix exhibit 3 (see note 10 in text). Statistical significance is reported for results relative to reference groups. CDC is Centers for Disease Control and Prevention. FPL is federal poverty level. [a]Reference category. $^{**}p < 0.05$ $^{***}p < 0.01$

EXHIBIT 4

Percent of adults with connections to schools, either as school employees or by living with school employees or school-age children: all adults and adults meeting the main Centers for Disease Control and Prevention (CDC) definition of increased risk, by poverty level and race/ethnicity, 2014–17

	Sample size	Population (millions)	School employees (%)	Living in households containing school employees (%)	Living in households containing school-age children (%)	Living in households containing school employees or school-age children (%)
All adults	95,830	248.0	4.0	8.2	30.1	35.2
Meets main CDC definition	48,124	123.2	3.4	6.7	23.2	27.5
Family income as percent of FPL						
<100%	9,068	14.7	0.7***	1.6***	31.0***	31.8***
100%–199%	10,975	23.2	1.4***	3.0***	27.0***	28.8***
200%–399%	14,238	35.6	3.6***	6.7***	26.8***	30.3***
≥400%[a]	13,830	49.6	4.9	9.8	16.4	23.6
Race/ethnicity						
White non-Hispanic[a]	22,106	82.2	3.6	6.9	17.7	22.4
Black non-Hispanic	10,014	15.8	3.9	6.9	29.9***	34.1***
Asian non-Hispanic	2,146	4.0	1.3***	4.2**	22.5***	26.0
Hispanic	12,514	17.6	2.5***	5.7**	41.0***	44.3***

SOURCE Authors' calculations using data from the Medical Expenditure Panel Survey, 2014–17. **NOTES** School employees are those working in elementary or secondary education. School-age children are those ages 5–17 as of August 31 of the survey year. Estimates by race/ethnicity exclude people with mixed or other race/ethnicity. Health indicators included in the main CDC definition (referring to increased risk of severe COVID-19) are in the notes to exhibit 1. Standard errors and results based on the broader CDC definition (see the notes to exhibit 1) are in appendix exhibit 4 (see note 10 in text). Statistical significance is reported for results relative to reference groups. FPL is federal poverty level. [a]Reference category. $^{**}p < 0.05$ $^{***}p < 0.01$

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EXHIBIT 5

Number of COVID-19 health risks among adult household members of school employees and school-age children, by main and broader Centers for Disease Control and Prevention (CDC) definitions of increased risk for severe COVID-19, 2014–17

			Living in households with at least 1 adult having specified number of conditions associated with severe COVID-19:		
	Sample size	Population (millions)	1 condition (%)	2 conditions (%)	3 or more conditions (%)
School employees					
Living in households in which at least 1 adult meets main CDC definition	2,070	6.3	47.6	30.2	22.1
Living in households in which at least 1 adult meets broader CDC definition	2,356	7.1	53.3	27.2	19.4
School-age children					
Living in households in which at least 1 adult meets main CDC definition	16,321	31.6	50.6	31.7	17.7
Living in households in which at least 1 adult meets broader CDC definition	19,248	38.2	58.2	27.2	14.6

SOURCE Authors' calculations using data from the Medical Expenditure Panel Survey, 2014–17. **NOTES** School employees are those working in elementary or secondary education. School-age children are those ages 5–17 as of August 31 of the survey year. For school employees, adult in household meeting CDC definition of increased risk could be the employee themselves. Health indicators included in the main CDC definition and broader CDC definition are in the notes to exhibit 1. Household categories are mutually exclusive, classified according to the adult in the household with the greatest number of conditions. Standard errors are in appendix exhibit 5 (see note 10 in text).

school-age children living in households with increased-risk adults (from exhibits 2 and 3) to show how often adults in the household had multiple risk factors (standard errors are in appendix exhibit 5).[10] To construct these estimates, we counted all CDC risk factors associated with either the main or broader CDC definition. Among school employees in households containing adults with increased risk (based on the main CDC definition), 30.2 percent lived in households containing adults with two risk factors and 22.1 percent lived in households containing adults with three or more risk factors, meaning that approximately half (52.3 percent) lived in households containing adults with multiple risk factors. Among school-age children living with increased-risk adults (based on the main CDC definition), 31.7 percent and 17.7 percent lived with adults with two risk factors and three or more risk factors, respectively, so that here again approximately half (49.4 percent) of school-age children living with increased-risk adults lived with adults having multiple risk factors.

We also estimated how often adults with multiple risk factors had connections to schools, either as school employees or by living with either school employees or school-age children. Among adults meeting the main CDC definition of increased risk, 25.7 percent (9.7 million) of those with two risk factors and 14.4 percent (5.2 million) of those with three or more risk factors either worked at schools or lived in households with school employees or school-age children, for a total of nearly fifteen million adults (appendix exhibit 6).[10]

Discussion

Between 42.0 percent and 51.4 percent of all school employees met the CDC definition for being at increased risk for severe COVID-19, depending on whether we used the main or a broader CDC definition of increased risk. These results align closely with the 43 percent of teachers who reported having a physical condition that makes them vulnerable to COVID-19 in a recent nationally representative Education Week Research Center survey.[14] We also found that many school employees and school-age children lived in households with people with increased risk. Overall, between 63.2 percent and 71.9 percent of school employees and between 58.7 percent and 71.0 percent of school-age children lived in households with at least one increased-risk adult, depending on the CDC definition used. These findings regarding potential within-household transmission take on greater import in light of random testing evidence that living with a household member diagnosed with COVID-19 was associated with a fifteenfold increase in testing positive for SARS-CoV-2.[15]

Given the magnitude of these results, it is not surprising to read about teachers, other school employees, and even students who say they are uncomfortable with in-person schooling, especially in cases where protections are viewed as inadequate.[16] The Americans with Disabilities Act mandates accommodations for increased-risk employees, and many school districts are allowing at least some increased-risk employees to work at home or receive other protective accommodations.[14,17] The act does not, however, cover accommodations for healthy employees

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seeking to protect at-risk family members, and it remains to be seen whether school districts will provide accommodations in these cases.[14,17,18]

Overall, we found that 35.2 percent of all adults in the US had a within-household connection to elementary or secondary schools, either because they were school employees or because they lived with a school employee or school-age child. This percentage is smaller for adults with increased risk, who were less likely to live with children. Nevertheless, between 33.9 million and 44.2 million increased-risk adults, depending on which CDC definition was used, had direct or within-household connections to schools. Even when we restricted the analysis to adults with multiple risk factors, we continued to find a high prevalence of school connections. Among adults with two or more risk factors, nearly fifteen million either worked as school employees or lived in households with school employees or school-age children.

Our analysis finds large numbers of adults who have increased risk for severe COVID-19 and who have a direct or within-household connection to schools. It is important to bear in mind that school reopening represents only one of many possible pathways for exposure to SARS-CoV-2. People can face exposure risks in their jobs and communities even if schools remain closed. It is also important to note that by focusing on direct or within-household connections to schools, we may have understated the potential impact of school reopening on other adults in the community who have increased risk.

Our estimates are substantially higher than recent estimates showing that one-quarter of all teachers and other instructors met CDC criteria for being at increased risk for severe COVID-19[19] and that 3.3 million seniors lived in households with at least one school-age child.[20] Our findings are more comprehensive because we included all school employees and all members of the household and because we used more recent CDC guidelines for defining increased risk, which lowered body mass index thresholds and added high blood pressure (in the broader CDC definition). Our estimates of increased-risk adults with school connections are more closely aligned with contemporaneous research by Adam Gaffney and colleagues,[21] although by using MEPS data we were able to include health risks for all school employees and all household members, leading us to find higher numbers of increased-risk adults with connections to schools.

Our analysis highlights the greater health risk of lower-skill compared with higher-skill school employees. Our analysis also highlights the potential implications of well-known racial/ethnic and socioeconomic disparities in COVID-19 outcomes for reopening schools.[5] We found substantial differences in potential exposure between Black and White school workers. In addition, we found that Black and Hispanic adults with increased risk were substantially more likely than White adults with increased risk to live in households with school-age children.

Conclusion

Sound decision making with regard to reopening schools in the United States and keeping them open requires careful assessment of a wide array of potential benefits and costs. Prudent application of the strategies recommended by the CDC,[22] the American Academy of Pediatrics,[23] and the National Academies of Sciences, Engineering, and Medicine[24] can help mitigate risks. We can also learn from the experience of other countries that have reopened schools.[25] Factors affecting decisions to open elementary schools might be different from those affecting decisions to open secondary schools, given emerging research on how COVID-19 is spread and the age-dependent developmental impacts of distance learning. For many school districts, decisions over whether and how to reopen schools will likely be revisited throughout the school year, depending on local infection rates; evolving research on the effectiveness of preventive measures used by schools; and the effectiveness of local public health measures, such as the use of masks, testing, social distancing, self-quarantining, and eventually vaccinations. Against this backdrop, evidence regarding the health risks of adults with connections to schools is one piece of the puzzle. ■

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NOTES

1 Sharfstein JM, Morphew CC. The urgency and challenge of opening K–12 schools in the fall of 2020. JAMA. 2020;324(2):133–4.

2 Rubin R. School superintendents confront COVID-19—"there are no good options for next year." JAMA. 2020;324(6):534–6.

3 Faden R, Collins M. Let's be honest about the ethical trade-offs of reopening schools. Education Week [serial on the Internet]. 2020 May 8 [cited 2020 Sep 22]. Available from: https://www.edweek.org/ew/articles/2020/05/08/lets-be-honest-about-the-ethical-trade-offs.html

4 Agency for Healthcare Research and Quality. MEPS HC-201: 2017 full year consolidated data file [Internet]. Rockville (MD): AHRQ; 2019 Aug [cited 2020 Sep 22]. Available from: https://meps.ahrq.gov/mepsweb/data_stats/download_data_files_detail.jsp?cboPufNumber=HC-201

5 Selden TM, Berdahl TA. COVID-19 and racial/ethnic disparities in health risk, employment, and household composition. Health Aff (Millwood). 2020;39(9):1624–32.

6 Centers for Disease Control and Prevention. People at increased risk and other people who need to take extra precautions [Internet]. Atlanta (GA): CDC; 2020 Jul 17 [last updated 2020 Sep 11; cited 2020 Sep 22]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/index.html

7 Kim EJ, Kim T, Conigliaro J, Liebschutz JM, Paasche-Orlow MK, Hanchate AD. Racial and ethnic disparities in diagnosis of chronic medical conditions in the USA. J Gen Intern Med. 2018;33(7):1116–23.

8 Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of obesity and severe obesity among adults: United States, 2017–2018 [Internet]. Hyattsville (MD): National Center for Health Statistics; 2020 Feb [cited 2020 Sep 22]. (Data Brief No. 360). Available from: https://www.cdc.gov/nchs/data/databriefs/db360-h.pdf

9 Flegal KM, Ogden CL, Fryar C, Afful J, Klein R, Huang DT. Comparisons of self-reported and measured height and weight, BMI, and obesity prevalence from national surveys: 1999–2016. Obesity (Silver Spring). 2019; 27(10):1711–9.

10 To access the appendix, click on the Details tab of the article online.

11 Park YJ, Choe YJ, Park O, Park SY, Kim Y-M, Kim J, et al. Contact tracing during coronavirus disease outbreak, South Korea, 2020. Emerg Infect Dis. 2020;26(10):2465–8.

12 Mandavilli A. Older children spread the coronavirus just as much as adults, large study finds. New York Times [serial on the Internet]. 2020 Jul 18 [last updated 2020 Jul 30; cited 2020 Sep 22]. Available from: https://www.nytimes.com/2020/07/18/health/coronavirus-children-schools.html

13 McClung N. Epidemiology of individuals at increased risk of COVID-19 disease [Internet]. Presentation at: Advisory Committee on Immunization Practices Meeting; 2020 Aug 26 [cited 2020 Sep 22]. Available from: https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2020-08/COVID-05-McLung.pdf

14 Will M. Teachers with COVID-19 health risks: who gets to stay home? Education Week [serial on the Internet]. 2020 Aug 18 [last updated 2020 Aug 19; cited 2020 Sep 22]. Available from: https://www.edweek.org/ew/articles/2020/08/18/teachers-with-covid-19-health-risks-who-gets.html

15 Menachemi N, Yiannoutsos CT, Dixon BE, Duszynski TJ, Fadel WF, Wools-Kaloustian KK, et al. Population point prevalence of SARS-CoV-2 infection based on a statewide random sample—Indiana, April 25–29, 2020. MMWR Morb Mortal Wkly Rep. 2020;69(29):960–4.

16 Goldstein D, Shapiro E. "I don't want to go back": many teachers are fearful and angry over pressure to return. New York Times [serial on the Internet]. 2020 Jul 11 [last updated 2020 Aug 13; cited 2020 Sep 22]. Available from: https://www.nytimes.com/2020/07/11/us/virus-teachers-classrooms.html

17 Equal Employment Opportunity Commission. What you should know about COVID-19 and the ADA, the Rehabilitation Act, and other EEO laws [Internet]. Washington (DC): EEOC; 2020 Jul 17 [last updated 2020 Sep 8; cited 2020 Sep 22]. Available from: https://www.eeoc.gov/wysk/what-you-should-know-about-covid-19-and-ada-rehabilitation-act-and-other-eeo-laws

18 American Federation of Teachers. Know your rights: reasonable accommodations during the COVID-19 pandemic [Internet]. Washington (DC): AFT; [cited 2020 Sep 22]. Available from: https://www.aft.org/sites/default/files/covid19_knowyourrights_ada.pdf

19 Claxton G, Levitt L, Garfield R, Kamal R, Neuman T, Kates J, et al. How many teachers are at risk of serious illness if infected with coronavirus? [Internet]. San Francisco (CA): Henry J. Kaiser Family Foundation; 2020 Jul 10 [cited 2020 Sep 22]. Available from: https://www.kff.org/coronavirus-covid-19/issue-brief/how-many-teachers-are-at-risk-of-serious-illness-if-infected-with-coronavirus/

20 Rae M, Neuman T, Kates J, Michaud J, Artiga S, Claxton G, et al. Millions of seniors live in households with school-age children [Internet]. San Francisco (CA): Henry J. Kaiser Family Foundation; 2020 Jul 16 [cited 2020 Sep 22]. Available from: https://www.kff.org/coronavirus-covid-19/issue-brief/millions-of-seniors-live-in-households-with-school-age-children/

21 Gaffney AW, Himmelstein D, Woolhandler S. Risk for severe COVID-19 illness among teachers and adults living with school-aged children. Ann Intern Med. 2020. [Epub ahead of print].

22 Centers for Disease Control and Prevention. Operating schools during COVID-19: CDC's considerations [Internet]. Atlanta (GA): CDC; 2020 May 19 [last updated 2020 Sep 1; cited 2020 Sep 22]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/schools.html

23 American Academy of Pediatrics. COVID-19 planning considerations: guidance for school re-entry [Internet]. Itasca (IL): AAP; 2020 Jun 25 [last updated 2020 Aug 19; cited 2020 Sep 22]. Available from: https://services.aap.org/en/pages/2019-novel-coronavirus-covid-19-infections/clinical-guidance/covid-19-planning-considerations-return-to-in-person-education-in-schools/

24 National Academies of Sciences, Engineering, and Medicine. Reopening K–12 schools during the COVID-19 pandemic: prioritizing health, equity, and communities. Washington (DC): National Academies Press; 2020.

25 Das LT, Abramson EL, Kaushal R. Reopening US schools in the era of COVID-19: practical guidance from other nations. JAMA Health Forum [serial on the Internet]. 2020 Jun 30 [accessed 2020 Sep 22]. Available from: https://jamanetwork.com/channels/health-forum/fullarticle/2767982

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