Observed Mask Use in Kindergarten Through Grade 12 Schools in Georgia—Fall, 2021

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Abstract

BACKGROUND: Universal masking, with additional layered prevention strategies, was an essential tool for limiting the transmission of SARS-CoV-2 and ensuring a safe return to in-person learning for kindergarten through 12th grade (K-12) students and staff. Few studies have examined mask adherence in this setting and none have described types of masks worn or locations of mask adherence. This project sought to assess mask adherence, types worn, and location of mask adherence in K-12 settings.

METHODS: This study used direct in-person observations to measure the proportion of persons wearing masks correctly; type of masks worn; and location of mask adherence in 19 K-12 schools in Georgia.

RESULTS: A total of 16,222 observations were conducted. Among those observed, 85.2% wore masks, with 80.3% wearing the mask correctly. Persons in high school were less likely to wear masks correctly. Correct mask use was most often observed among persons wearing N95-type masks. The prevalence of persons wearing masks correctly in transitional spaces was 5% higher than in congregate spaces.

CONCLUSION: In K-12 schools with a universal masking policy, correct mask adherence was high among individuals. Examining adherence to recommended prevention measures can provide K-12 schools feedback to inform targeted messaging and policies during future disease outbreaks.

Keywords

coronavirus; COVID-19; SARS-CoV-2; prevention strategies; nonpharmaceutical interventions; schools; K-12 schools; mask; mask adherence

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The COVID-19 pandemic has profoundly impacted kindergarten through grade 12 (K-12) schools and caused a loss of in-person learning.[1] Universal masking in the K-12 setting, together with other layered prevention strategies, has proven effective at limiting the transmission of SARS-CoV-2, the virus that causes COVID-19, while allowing students to remain in in-person learning.[2–4] When US K-12 schools opened in fall 2021, the Centers for Disease Control and Prevention (CDC) recommended universal indoor masking for students, staff, faculty, and visitors, regardless of vaccination status. A study conducted in the fall of 2021 examining the association between mask policies and COVID-19 incidence in K-12 schools found school districts with universal mask requirements had 23% lower incidence of COVID-19 among students and staff compared to districts without mask requirements.[3] Despite evidence supporting the effectiveness of mask policies, states and school districts across the nation adopted various mask policies during fall 2021, with 63% of US school districts requiring universal masking, regardless of vaccination status (CDC School Data Team, unpublished data, December 2021).

Adherence to mask policies in K-12 schools has been linked to lower the transmission of SARS-CoV-2, but consistent mask adherence may differ across grade levels, locations within the school, and the individual.[4] Previous studies have demonstrated high mask adherence in K-12 schools when a universal masking policy is in place.[4,5] During spring 2021, 2 North Carolina school districts implemented a 7-week surveillance program to monitor mask adherence within K-12 schools and found mask adherence was high (>80%) across staff and students at all grade levels (elementary, middle, and high school).[4] A 4-week, online, prospective, observational survey in a single school district examined the use of cloth face masks by students in grades pre-K-2 and found among 1000 students and 1048 classroom days, the mean percentage of the school day with appropriate mask usage was 76.9%.[5]

Although wearing a face mask reduces the risk of transmission of SARS-CoV-2, protection efficacy may be compromised if not worn correctly and consistently.[6,7] Additionally, some masks and respirators offer higher levels of protection than others, and some may be harder for students to tolerate or wear consistently.[6,7] Respirators such as nonsurgical N95s give the most protection; KN95s and surgical masks provide the next highest level of protection; and cloth masks provide less protection.[7] While previous studies have evaluated mask adherence in K-12 schools, none have examined types of masks worn.

During fall 2021, CDC collaborated with K-12 schools to assess mask adherence in the school setting. The objectives of the Mask Adherence Study in K-12 Schools (MasK-12) were to use direct in-person observations to assess (a) the proportion of individuals who were wearing masks, (b) the proportion of individuals wearing masks correctly (c) the type of masks worn, and (d) the location of mask use. The findings from MasK-12 may be used

by school administrators and public health officials to inform future school-based masking strategies and guidance.

METHODS

Participants

CDC collaborated with K-12 schools and school districts in Georgia that expressed interest in participating from September to December 2021. Eligibility to participate in MasK-12 was based on the school or school district's ability to train individuals to conduct direct in-person observations of students, teachers, staff, and visitors within the school throughout the day. To be considered for project participation, schools were asked to complete an enrollment form that collected school demographics and COVID-19 prevention strategies and policies. Public, private, and charter K-12 schools with various mask policies (eg, mask optional or mask required) were eligible to participate.

Direct in-person observations occurred across 19 K-12 schools within 3 separate school districts. The number of observers was determined by the school district and varied by participating schools within each district. While participating in MasK-12, all schools required universal masking of students, teachers, staff, and visitors. Two of the 3 participating school districts were composed of charter schools, and 1 was a public school district. One charter school district performed observations for 6 weeks and the other for 8 weeks. The participating public school district performed observations for 2 weeks. Observations were conducted in elementary, middle, and high schools.

School group A.—Group A consisted of 11 schools—5 elementary, 5 middle, 1 K-8th, and 1 high school from a public charter network serving a metropolitan school district. Across participating schools, most students identified as black, African American (75–98%), 1–16% identified as Hispanic, 1–9% identified as White, and 0–3% identified as other. Approximately, 27 school administrators and health services staff performed direct in-person observations across all schools within the district over an 8-week period.

School group B.—Group B implemented MasK-12 in 7 out of 23 schools within the same school district in a metropolitan area of Georgia. Of the 7 schools, 4 were middle, and 3 were high schools. The student population across participating schools was 42–84% Black, African American, 3–24% White, 9–43% Hispanic, and 1–10% other. Approximately 13 high school students enrolled in a health science program performed direct in-person observations over a 2-week period.

School group C.—Group C consisted of 1 charter K-8th grade school (referred to as a district for the purposes of this manuscript) located in a metropolitan area of Georgia. Most students (70%) identified as black, African American, 15% identified as White, 5% identified as Hispanic, and the remainder identified as other (10%). Direct in-person observations were completed by approximately nine 8th grade students or staff over a 6-week period.

Instrumentation

Enrollment survey tool.—Once a school or district agreed to participate in the project, and before observations took place, an enrollment link was sent for completion. The enrollment survey tool was developed in REDCap (version 11.0, Vanderbilt University), a secure web application for managing surveys online. The survey captured information on school demographics such as type of school, number of enrolled students, grades, and more. Demographic information was collected at the school level to capture aggregate information about students' race and ethnicity, reduced-price lunch eligibility, and spoken language. The survey also captured information regarding the school masking policy, such as if a mask was required or optional, the locations in which the requirement applied, and whether contact tracing was conducted. Current prevention strategies and contact tracing procedures were also probed during the survey.

Observation survey tool.—Observations were conducted using an electronic or paper survey instrument. Electronic surveys were automatically submitted in REDCap. If observations were recorded on a paper form, entries were submitted in REDCap by the end of each week.

The survey instrument included 10 questions that captured information on time observation was recorded, point of observation (ie, indoors, outdoors, or transportation), where mask observation was collected within the school (eg, classroom, school bus, cafeteria, auditorium, student/teachers' lounge, main office, and more), type of mask worn (ie, surgical, cloth, N95 types, or neck gaiters), what location of the face were covered (ie, nose, mouth, and/or chin), and type of person observed (ie, adult, student, unknown).

Procedure

Schools that were interested in participating in MasK-12 were evaluated by CDC to determine eligibility. An enrollment form was completed once the school site agreed to project participation. CDC staff provided a letter describing the project for distribution to the school community. Parental consent was obtained if schools identified students under 18 as observers. All observers were required to adhere to the school's current mask policy while conducting observations. Additionally, it was recommended that participating observers be fully vaccinated and maintain appropriate physical distancing to reduce the risk of transmission.

Before conducting surveillance, observers underwent training provided by CDC. A combination of real-time and pre-recorded virtual training was used. Observers were trained to recognize what constitutes observable spaces, what constitutes a mask, and what was considered appropriate mask usage. Observable locations included congregational spaces such as the classrooms, auditoria, libraries, and gymnasia; transitional spaces included cafeteria lines, teachers' lounges, school entrances, main offices, hallways/stairs, and common areas. Mask types included surgical masks, N95 types (including KN95 and KF94), cloth, and neck gaiters. Appropriate mask use was proper coverage of the nose, mouth, and chin. The proper mask use and mask type analyses were restricted to those observed wearing a mask. Analyses exploring the percent of people wearing a mask on nose, mask

on mouth, and mask on chin were restricted to only those wearing a mask. Observers were also trained to collect and document data appropriately. Once training was completed, an observer training quiz was administered via REDCap to assess comprehension. A score of 80% or more was considered passing.

Observations were recorded on K-12 school sites using the electronic or paper survey. All data captured on the paper survey was entered into REDCap within 48 hours of observation. Observers conducted a minimum of 100 observations per week at each school site or approximately 2 hours of observations per week. Observers were asked to collect observations on every third person across various locations, such as in the classroom, cafeteria line, hallway, and more. Locations selected were visited at different times on various days of the week to avoid bias. Schools submitted all collected observations to CDC each week.

Data Analysis

All analyzes were performed using SAS (version 9.4; SAS Institute, Cary, North Carolina). Two charter schools ranging from K-8th grade were removed from the final analysis to maintain grade stratification integrity. Descriptive statistics were used to describe proper mask use, adherence, mask type, and location at 3 school types (elementary, middle school, and high school). Log-binomial models were used to estimate the adjusted prevalence, prevalence ratio (PR), and associated 95% confidence intervals (CIs). To account for variability between schools, a Generalized Estimate Equations (GEE) model, which defines *schools* as clusters, was used. Secondary analysis examined the relationship between incorrect mask wear and school type, mask type, and location. The distinction between adult, student, or people with unknown status was not captured on the electronic survey tool in REDcap; therefore, analyses were not conducted to explore differences between adults and students.

RESULTS

A total of 16,222 persons were observed across 19 schools in Georgia. Over half (52.7%) of the observations took place at middle schools, 28.3% took place at elementary schools, and 12.0% at high schools (Table 1). Seven percent (7.0%) of observations occurred at K-8th schools. Most individuals were observed in transitional spaces with 34.1% observed in hallways/stairs and 25.5% at the school entrance (Table 1). Eighteen percent (18.0%) of the observations occurred within classrooms (Table 1).

Most (85.2%) observed persons wore masks, with 80.3% of them wearing masks correctly —covering the nose, mouth, and chin. When comparing mask adherence and correct mask use across school type, 84.8% of persons observed in elementary schools wore masks, with 82.8% of them wearing masks correctly; 85.4% of persons observed in middle schools wore masks, with 82.5% of them wearing masks correctly; and 85.4% of persons observed in high schools wore masks, with 64.3% of them wearing masks correctly (Table 1). Among observed persons wearing a mask, surgical (65.3%) and cloth (27.0%) masks were the most worn (Table 1). Prevalence and prevalence rate (PR) were used to assess associations of correct mask use with school type, mask type, and location within the school (Table 2). The

prevalence of persons who wore masks correctly in high schools (64.3%) (PR=0.78, 95% CI 0.62–0.97) was significantly smaller than the prevalence of persons who wore masks correctly in elementary schools (82.8%). No significant difference was observed between the prevalence of persons who wore masks correctly in elementary and middle schools (PR=0.98, 95% CI 0.75–1.27). When the prevalence of correct mask use by mask type was examined, the prevalence of wearing an N95-type mask (93.4%) or neck gaiter (92.2%) correctly was significantly higher than wearing a cloth mask correctly (74.9%) (PR=1.25, 95% CI 1.09–1.43) and (PR=1.23, 95% CI 1.11–1.37), respectively. The prevalence of wearing a surgical mask correctly (79.7%) was significantly higher than wearing a cloth mask correctly (PR=1.06, 95% CI 1.00–1.13). The prevalence of people in transitional spaces wearing masks correctly (80.8%) was significantly higher than those who wore masks correctly in congregational spaces (75.8%) (PR=0.94, 95% CI 0.89–0.99).

Differences in incorrect mask-wearing were examined by school type, location within the school, and mask type among persons who were observed wearing a mask. Persons observed in the high school setting were significantly less likely to have the mask covering the nose (56.0%) (PR=0.79, 95% CI 0.68–0.92) than persons observed in elementary (70.7%) and middle schools (70.2%) (PR=.99, 95% CI 0.87–1.14) (Table 3). Similarly, persons wearing N95-type masks and neck gaiters were significantly more likely to wear their masks covering their mouth (98.8% and 97.1%) (PR=1.10, 95% CI 1.04–1.15 and PR=1.08, 95% CI 1.03–1.13) and chin (99.4% and 98.5%) (PR=1.02, 95% CI 1.00–1.03 and PR=1.01, 95% CI 0.99–1.02).

DISCUSSION

To our knowledge, this study is one of the first to explore types of masks worn and school campus locations where masks were worn in the K-12 school setting during the COVID-19 pandemic. Mask-12 provides a methodology schools can use to assess the implementation of prevention strategies, such as mask use, within school settings. Having measures to evaluate the effectiveness of prevention policies can help identify problems with the implementation of prevention strategies that could potentially lead to severe health impacts from diseases such as COVID-19, which can help prevent disease transmission, allowing for safe in-person learning.[8]

Mask-12 demonstrated that K-12 schools with universal masking policies had high correct mask adherence among students. A mask must cover the nose, mouth, and chin to be considered worn correctly.[8,9] During this project, the CDC recommended that students, teachers, staff, and visitors wear well-fitting masks indoors correctly and consistently. While overall adherence was high, low adherence to correct mask use was observed in high school and congregational spaces, where there is potentially an increased risk of transmission of SARS-CoV-2 due to length of exposure. High correct mask adherence was observed in persons who wore N95-type masks. Although neck gaiters offer very little protection against COVID-19 and are not recommended,[10] our measure of correct mask use was found to be significantly higher in persons who wore neck gaiters (PR=1.23, 95% CI 1.11–1.37) compared to cloth masks.

MASCUP, a similar study conducted in 2021, observed mask use among 17,622 persons at 6 colleges and universities in the United States. Observations were conducted at indoor and outdoor locations.[11] Like MasK-12, observed persons in colleges and universities strongly adhered to masking compliance. Correct mask use was also found to be highest among persons who wore N95-type masks (96.8%).[11] However, incorrect mask use was 11% to 20% lower among those observed in MASCUP (4% to 15%),[11] compared to persons observed wearing a mask in MasK-12 (15% to 35%). In MASCUP, high correct mask adherence was observed among persons wearing cloth masks (92.2%) compared to neck gaiters (86.8%) and in indoor spaces compared to outdoor locations.[11]

As seen in both Mask-12 and MASCUP, mask adherence can vary based on the type of mask worn and the location. Since this project, CDC has updated guidance to recommend preventive actions based on COVID-19 Community Levels (low, medium, or high). Indoor mask use in spaces including K-12 schools is still recommended when the COVID—19 Community Level is high. This project demonstrates the benefit of conducting studies on the implementation of prevention strategies in K-12 schools during an infectious disease outbreak to help keep schools safely open for in-person learning.

IMPLICATIONS FOR SCHOOL HEALTH POLICY, PRACTICES, AND EQUITY

Schools can use MasK-12 as a model, not just for COVID-19, but as a framework to understand prevention strategy implementation in current and future short- and long-term emergencies. Data gathered from collected observations can help to inform administrators, teachers, staff, students, and parents about the effectiveness of the school's current mitigation strategies, identify gaps, and reframe school preparedness policies.

Although most individuals (85.2%) observed within K-12 schools were adherent to masking, the remaining individuals (14.7%) who were not could raise concerns. School and system-wide messaging that promotes, models, and reinforces mask adherence and correct mask use to students, teachers, staff, and visitors, could be important, especially when COVID-19 community levels are high and universal indoor masking is still recommended. In addition to persistent messaging, signage in multiple locations throughout the school may serve as a reminder to wear face coverings and the importance of wearing them correctly.

Limitations

There were some limitations that emerged of this project. First, we did not explore variations among adults and students given the distinction (ie, adult, student, or unknown status) among observed persons was not inputted in the electronic survey tool. However, both adults and students were required to follow the same masking policy for their respective school district. Second, the project did not examine the relationship between cases of COVID-19 in the schools or communities and the directly observed use of masks. Adherence or non-adherence to mask use could have potentially been an indicator of low or high case rates within a participating school, which could suggest a need to modify prevention policies. Third, all of the schools that participated in MasK-12 had universal mask requirements in place for students, teachers, staff, and visitors on school grounds, limiting our ability to explore differences between schools with and without universal requirements. Lastly, the

charter schools collected data for 6 and 8 weeks, compared to the public school district that collected data for 2 weeks.

Conclusion

This project evaluated mask adherence and correct mask use among individuals within 3 K-12 school districts in Georgia. Although current mask guidance has changed in that CDC recommends universal indoor mask use when COVID-19 community levels are high, mask use remains an effective mitigation strategy that can be used in schools to limit the transmission of SARS-CoV-2.[8] In areas where schools are recommended or encouraged to use masks, conducting observational projects such as this could allow school leadership and local health authorities to receive masking data and allow for real-time monitoring and feedback around mask adherence at school sites. The findings from this project have the potential to inform national efforts to improve mask adherence, and the use of other nonpharmaceutical interventions to prevent infectious diseases in the K-12 school setting in the future.

Acknowledgments

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Table 1.

Descriptive Statistics for Overall Mask Use, Correct Mask Use, Mask Type, and Where Masks Were Worn by School Type (n = 16,222)

Description	Overall, N (%)	School Type, N (%)		
		Elementary	Middle	High School
Mask use				
Yes	12,810 (85.2)	3890 (84.8)	7263 (85.4)	1657 (85.4)
No	2202 (14.7)	697 (15.2)	1236 (14.5)	269 (13.9)
Unknown	18 (0.1)	1 (0.0)	3 (0.0)	3 (0.0)
Proper mask use [†]				
Yes	10,280 (80.3)	3221 (82.8)	5994 (82.5)	1065 (64.3)
No	2530 (19.8)	669 (17.2)	1269 (17.5)	592 (35.7)
Mask on nose [†]				
Yes	10,360 (80.9)	3241 (83.3)	6041 (83.2)	1078 (65.1)
No	2450 (19.1)	649 (16.7)	1222 (16.8)	579 (34.9)
Mask on mouth [†]				
Yes	11,785 (92.0)	3646 (93.7)	6744 (92.9)	1395 (84.2)
No	1025 (8.0)	244 (6.3)	519 (7.2)	262 (15.8)
Mask on chin [†]				
Yes	12,541 (97.9)	3814 (98.1)	7137 (98.3)	1590 (96.0)
No	269 (2.1)	76 (2.0)	126 (1.7)	67 (4.0)
Mask type [†]				
Cloth mask	3457 (27.0)	988 (25.4)	1965 (27.1)	504 (30.4)
N95	721 (5.6)	292 (7.5)	329 (4.5)	100 (6.0)
Neck gaiter	193 (1.5)	46 (1.2)	131 (1.8)	16 (1.0)
Other	5 (0.0)	0 (0.0)	1 (0.0)	4 (0.2)
Surgical mask	8368 (65.3)	2545 (65.4)	4792 (66.0)	1031 (62.2)
Missing	66 (0.5)	20 (0.5)	45 (0.6)	2 (0.1)
Location [‡]				
Auditorium	40 (0.3)	0 (0.0)	40 (0.5)	0 (0.0)
Cafeteria line	2018 (13.4)	580 (12.6)	1153 (13.6)	285 (14.7)
Classroom	2702 (18.0)	1233 (26.9)	1364 (16.0)	105 (5.4)
Common areas	554 (3.7)	6 (0.1)	116 (1.2)	432 (22.3)
Gymnasium	156 (1.0)	19 (0.4)	137 (1.4)	0 (0.0)
Hallway/stairs	5124 (34.1)	1642 (35.8)	3149 (37.0)	333 (17.2)
Library/MC/CL	78 (0.5)	28 (0.6)	50 (0.5)	0 (0.0)
Main office	362 (2.4)	40 (0.9)	302 (3.1)	20 (1.0)
School entrance	3835 (25.5)	1000 (21.8)	2070 (24.4)	765 (39.4)
Teacher lounge	141 (0.9)	40 (0.9)	101 (1.0)	0 (0.0)
Unknown	20 (0.1)	0 (0.0)	20 (0.2)	0 (0.0)

[†]The proper mask use, mask type, mask on nose, mask on mouth, and mask on chin analyses were restricted to those individuals who were wearing a mask, n = 12,810.

[‡]Location analyses included all observed individuals, n = 15,030.

Table 2.

Number of Persons Observed Wearing a Mask by Grade and Mask Type

Characteristic Level	Mask Use				Proper Mask Use[†]			
	Prevalence (%)	PR	95% CI	P-value	Prevalence (%)	PR	95% CI	P-value
School type								
Elementary	84.8	REF			82.8	REF		
Middle	86.1	1.02	0.88, 1.17	.83	80.9	0.98	0.75, 1.27	.86
High school	86.0	1.01	0.89, 1.16	.83	64.3	0.78	0.62, 0.97	.024
Location								
Congregational	89.9	1.07	1.04, 1.10	<.0001	75.8	0.94	0.89, 0.99	.011
Transitional	84.2	REF			80.8	REF		
Mask type								
Cloth					74.9	REF		
N95					93.4	1.25	1.09, 1.43	.0014
Neck gaiter					92.2	1.23	1.11, 1.37	<.0001
Surgical					79.7	1.06	1.00, 1.13	.046

PR, Prevalence Ratio; CI Confidence Interval.

[†]The proper mask use and mask type analyses were restricted to the mask use groups, n = 13,893.

Table 3.

School Type, Location Within the School, and Mask Type Characteristics by Area of the Face Covered by the Mask of Persons Observed Wearing a Mask

Characteristic Level	Mask on Nose (yes)[†]				Mask on Mouth (yes)[†]				Mask on Chin (yes)[†]			
	Prevalence (%)	PR	95% CI	P-value	Prevalence (%)	PR	95% CI	P-value	Prevalence (%)	PR	95% CI	P-value
School type												
Elementary	70.7	REF	—	—	79.5	REF	—	—	83.2	REF	—	—
Middle	70.2	0.99	0.87, 1.14	.92	79.3	1.00	0.93, 1.07	.95	84.3	1.01	0.89, 1.15	.83
High school	56.0	0.79	0.68, 0.92	.003	72.4	0.91	0.79, 1.05	.19	82.6	0.99	0.87, 1.13	.91
Location												
Congregational	68.5	1.0	0.95, 1.05	.95	81.3	1.05	1.01, 1.08	.005	88.4	1.08	1.05, 1.11	<.0001
Transitional	68.6	REF	—	—	77.5	REF	—	—	82.1	REF	—	—
Mask type												
Cloth	75.5	REF	—	—	90.2	REF	—	—	97.9	REF	—	—
N95	93.6	1.24	1.08, 1.42	.002	98.8	1.10	1.04, 1.15	.0002	99.4	1.02	1.00, 1.03	.005
Neck gaiter	93.7	1.24	1.12, 1.37	<.0001	97.1	1.08	1.03, 1.13	.001	98.5	1.01	0.99, 1.02	.40
Surgical	80.4	1.06	1.00, 1.13	.040	91.4	1.01	0.99, 1.03	.18	97.5	1.00	0.99, 1.00	.33

PR, Prevalence Ratio; CI, Confidence Interval.

[†] Mask on nose, mask on mouth, and mask on chin were restricted to only wearing a mask, n = 13,893.