COVID-19 AND SCHOOLS:

THE YEAR IN REVIEW AND A PATH FORWARD

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COVID-19 and Schools: The Year in Review and a Path Forward

In March 2020, K–12 schools across the United States, like schools around the globe, abruptly halted in-person education. This immediate and collective decision was based on the premise that schools would be sources of substantial transmission of SARS-CoV-2, the virus that causes COVID-19, and that closing school buildings could help stop community spread and limit the extent of the COVID-19 pandemic.

In the 15 months since those initial closures, scientists, clinicians, public health experts, educators, and communities have learned much about the epidemiology of COVID-19, the factors contributing to viral spread, and the strategies to mitigate transmission in school settings that allow for safe, in-person learning. Over that time, the ABC Science Collaborative, which includes academic experts throughout the country, partnered with school districts to monitor transmission rates and safety procedures within schools, evaluate ongoing scientific findings regarding COVID-19, understand the implications of new findings, and share insights. Together, we identified strategies to help school leaders use current data to consider the best, safest, and most practical policies to promote attendance in the classroom, where most students learn best. State authorities and local education agencies are using many of these strategies to develop policies and best practices to guide K–12 operations for the 2021–22 school year.

To further assist leaders in these decisions, the ABC Science Collaborative coordinated a comprehensive review of the current scientific literature and available data on COVID-19 transmission and mitigation strategies for K–12 schools. The following summary of current findings provides an informational resource and practical guidance for school leaders and policy makers to consider as they plan a path forward for safely resuming full in-person instruction in the new school year.

ABOUT THE AUTHORS

The ABC Science Collaborative is an initiative that extends across 13 states, connecting scientists and physicians with school and community leaders to help understand the most current and relevant information about COVID-19. The program helps school leaders and state policy makers arrive at informed decisions about returning to school using data from their own communities. The shared goal is to keep students, teachers, school staff, and their local communities healthy and safe. The ABC Science Collaborative is coordinated by the Duke Clinical Research Institute at the Duke University School of Medicine and is funded by a grant from the National Institutes of Health. Learn more at https://abcsciencecollaborative.org/.

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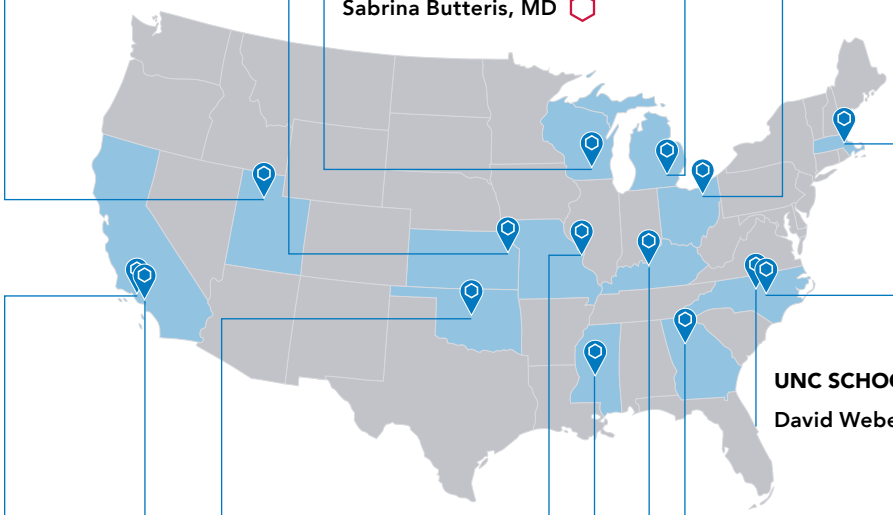

DUKE UNIVERSITY SCHOOL OF MEDICINE
Kanecia Zimmerman, MD
Co-chair, ABC Science Collaborative
Danny Benjamin, MD, PhD
Co-chair, ABC Science Collaborative
Sarah Armstrong, MD
Ibukun Kalu, MD ⬡
Gabriela Maradiaga Manayotti, MD
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Jason G. Newland, MD, MEd ⬡

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Background

IMPACT OF SCHOOL BUILDING CLOSURES ON CHILD HEALTH

The most severe mitigation measure, which current data suggest was likely unnecessary to prevent secondary transmission of SARS-CoV-2 in communities, was widespread halting of in-person education. Even when school buildings reopened, many operated at reduced capacity. Extensive data collected over the course of the pandemic highlights the adverse effects of this public health strategy on child health and well-being; these effects are likely to have long-term consequences into adulthood.

Data show that school closures have affected multiple facets of child health and well-being.[1] The longitudinal FamilieForSK study (n=442) found significant associations between remote learning, social isolation, and adverse psychological impacts in children, which were more pronounced among older children and adolescents, defined as > 12 years old and/or grade 4 or higher.[2] Students who rely on school meals have experienced food insecurity and nutritional deficiency,[3] and Feeding America projects that 13 million children (1 in 6) in the United States may not have enough to eat, a notable increase from pre-pandemic numbers of 1 in 7 children.[4] Despite this, rates of child obesity are predicted to have risen sharply during school closures. Evidence suggests that in-person school is protective against obesity, as school provides structure, nutrition, and regular physical activity.[5] Recent data show striking increases in the already-high rates of obesity in children and an alarming widening in the disparities gap, with a 2% higher climb in obesity rates among children of color, as compared with pre-pandemic.[6] Children with special educational needs, like those with autism spectrum disorder, experienced a disruption in services needed to achieve optimal development.[7] Among children with a history of a mental health condition, 83% said their condition became worse during school closures, and 26% were unable to access urgent mental healthcare when needed.[8] **Considering the breadth of available data demonstrating limited SARS-CoV-2 in-school transmission with mitigation strategies in place, and the severe impacts of school building closures on child health, school building closures should be the last resort to control spread of infectious diseases such as COVID-19.**

Mitigation Practices for Students and Staff

MASKING GUIDANCE

Available data suggest that properly wearing a face mask (appropriate fit with coverage of chin, nose, and mouth) is effective in limiting in-school transmission of SARS-CoV-2, even with increased population counts in school buildings, poor ventilation, high community transmission, and limited distancing.[9,10,11] With limited in-school transmission of SARS-CoV-2, K–12 schools do not contribute to community transmission. However, instances of SARS-CoV-2 transmission within school buildings have definitively occurred under circumstances of masking non-adherence or during activities when it is difficult to maintain masking adherence, including during mealtimes, sports, and in students with special educational needs and their staff caretakers.[9,12–14] Increased transmission during masking non-adherence was observed during periods of moderate or high community transmission and limited or no vaccine availability. Data in the United States are not yet available to define the risks of unmasked students and staff in K–12 schools in the setting of limited community transmission, vaccination of many adults, and a largely unvaccinated student population.

Data from the United Kingdom early in the pandemic suggested that with extremely low community transmission (less than 10 cases/100,000 people/week), secondary transmission within schools where masking was not required or recommended was minimal.[15] The opposite was seen in Tel Aviv where uncontrolled spread among unmasked students was observed in schools although community spread was believed to be controlled.[16–18] This may be explained by inaccurate measures of community incidence; community incidence as documented by public health agencies depends on testing uptake and may lag behind actual incidence. Therefore, strategies to monitor and quickly mitigate spread within schools or local communities in which individuals are unmasked are necessary to prevent COVID-19 morbidity and mortality, especially in unvaccinated students and adults.

Recent data from several states suggest that among adults who are unvaccinated, rates of hospitalizations and deaths from COVID-19 in May 2021 were similar to rates in late January 2021, when COVID-19 disease was at its peak.[19] Conversely, vaccination has resulted in substantial decreases in hospitalization and death. Thus, high vaccination rates (such as greater than 70 percent) among students and staff within the school or local community will likely be an important metric to ensure sustained, limited community transmission and protection against the acquisition and sequelae of COVID-19. **The combination of high vaccination rates and low community transmission may safely permit transitioning from mandatory masking of students and staff in K–12 schools. Importantly, high vaccination rates in elementary schools cannot currently be achieved because there are no approved vaccines for children younger than age 12.**

Although available data from K–12 schools and other settings clearly demonstrate the efficacy of masking and vaccination in preventing transmission of SARS-CoV-2, some school districts may have limited masking and limited vaccination with the continued presence of virus in the community. Under these circumstances, risk of transmission within school buildings increases and consideration should be given to additional mitigation strategies to prevent within-school transmission of SARS-CoV-2. (See Table 1 on page 14 for other mitigation strategies in masked and partially/unmasked school settings.)

HAND HYGIENE

Hand hygiene using either soap and water or a waterless alcohol gel (at least 60% alcohol) is a central tenet of infection prevention, is easy and cost-effective, and should be a standard practice to limit spread of infection, including from SARS-CoV-2 and other respiratory viruses, in K–12 schools. Hand hygiene is a proven strategy to prevent the transmission of pathogens by minimizing exposures from hands to hands, hands to mucous membranes, and hands to objects or materials. Hand hygiene should occur before school entry, before eating/drinking, and after toileting activities, and is especially essential before and after mask removal. As mask mandates are lifted, diligence with hand hygiene should remain, particularly given the risk for transmission of other illnesses in K–12 schools.

KEY QUESTIONS

Before modifying local, state, or national mask policies, consider the following:

1. Have schools already successfully returned to full, in-person education?
2. At what levels of vaccination and community incidence is it safe to transition from mandatory masking in K–12 schools? Is community incidence as reported by public health agencies an accurate and current measure of incidence?
3. Is the COVID-19 safety policy easily implemented and enforced? For example, if mask mandates are lifted for those who are vaccinated, how will schools monitor who should and should not be masked? Will schools have consistent access to updated vaccination information for students and staff?
4. How will the absence of mask mandates (or presence of partial mandates) affect those students and families who are already hesitant to return to school buildings and those who are medically fragile, unable to be vaccinated, or live with someone who is at high risk of death from COVID-19 disease but can't receive vaccination?
5. How might existing quarantine policies affect the ability of students and staff to stay in school and participate in extracurricular activities if they are identified as close contacts?
6. If students become infected, what is the risk to local families and the community at large?
7. With emerging more-transmissible variants, are there systems in place to rapidly detect and mitigate spread within schools and the community?
8. Are schools prepared to reinstitute masking, as needed, to mitigate spread and avoid school building closures?

DISTANCING WITHIN CLASSROOMS AND ON SCHOOL BUSES

Initial guidance from the Centers for Disease Control and Prevention (CDC) required 6 feet of distance between people inside or outside of school buildings as part of a layered mitigation strategy based on evidence that viral particles can be transmitted via droplets and small aerosols when in close proximity.

Data from North Carolina and Wisconsin in Fall 2020 confirmed that with strict adherence to appropriate masking, transmission within schools was low in the hybrid model of education, using approximately 6 feet of distance between people.[9,10,20] However, guidance supporting 6 feet of distance between students had significant operational implications; with strict adherence, the guidance functionally limited the number of students who could be present in a classroom at the same time because the majority of schools cannot accommodate such distancing. Later data from North Carolina, Utah, Missouri, and Massachusetts suggested that 3 feet of distance among elementary school students was sufficient to limit COVID-19 spread in an environment with universal masking, even during periods of high community transmission (more than 400 cases/100,000/week) and before vaccines were widely available.[12,21–23]

More recently, data from 100 local education agencies (LEAs) and approximately 14 charter schools in North Carolina (with more than 1 million students and staff) suggested that with adherence to appropriate masking, there was no difference in COVID-19 secondary transmission, defined as transmission after close contact with a confirmed community-acquired case, in students in elementary, middle, and high schools for school districts requiring 6 feet of distance versus those with 3–6 feet of distance or those with less than 3 feet of distance.[24] Additionally, early data from schools, childcare programs, and summer camps support low secondary transmission and reduced contact tracing burden when children were allowed to remain in small groups while learning or playing.[10,21,25–27] **Based on these data, K–12 schools with strict adherence to masking can mitigate COVID-19 spread and full in-person education can be safely implemented.**

Consistent with data about distancing within classrooms, data from LEAs in North Carolina during Spring 2021 suggested that districts permitting 1, 2, or 3 students per bus seat with *adherence to appropriate masking* saw no differences in secondary transmission.[24] **Based on these data, full bus capacity (3 students per seat) can be implemented safely when other mitigation strategies are in place.**

ATHLETICS

Based on data from 13 LEAs in North Carolina and data from Georgia[13] and Florida,[14,28] participation in indoor sports, such as wrestling and basketball, accounted for a substantial amount of secondary transmission among high school students and staff (up to 75% of high school secondary transmission in North Carolina[12]). It is unclear whether transmission occurred during practice, games, or other team events where there was non-adherence to masking. SARS-CoV-2 transmission among those participating in athletics at K–12, collegiate, and professional levels has resulted in missed practices and games as well as early termination of seasons. This SARS-CoV-2 transmission among athletes has highlighted specific concerns about the effects of COVID-19 on athletes.[29]

Data are clear that athletics can be high-risk environments. However, surprisingly low transmission has been observed in outdoor, high-contact sports such as football. Similarly, low transmission was observed in states with strict adherence to masking during play of indoor sports as well as in states with frequent screening testing in place for athletes.[30] These data suggest that with specific, dedicated strategies during athletics, successful prevention of SARS-CoV-2 transmission is possible. **Now that vaccines are available, vaccination is likely the most helpful, long-lasting, and cost-effective strategy to prevent SARS-CoV-2 transmission among student athletes and staff.** Incentivizing vaccination of athletes through lifting the requirements for masking during athletic events, quarantine, and COVID-19 testing in vaccinated collegiate teams has resulted in near-universal vaccination among collegiate athletes at some universities.

VACCINATION

In clinical trials and according to evidence from Israel and among healthcare personnel, vaccination with mRNA vaccines is known to be 90% to 97% effective in preventing symptomatic COVID-19 and close to 98% effective in preventing severe COVID-19 clinical outcomes including hospitalization or death.[31–34]

New data from Israel and among healthcare personnel demonstrated that mRNA COVID-19 vaccines are also 75% to 92% effective in preventing asymptomatic infection.[35,36] Vaccination trials in adolescents have demonstrated markedly high protection against COVID-19.[37] **Based on these data, vaccination among eligible students and staff will assist in reducing in-school COVID-19 transmission this fall.**

Mitigation Practices for the School Environment

DEEP CLEANING

The SARS-CoV-2 virus is transmitted primarily through respiratory droplets. To date, there have been only three possible reports of SARS-CoV-2 infection through the sharing of objects.[38-40] None of these instances occurred within school buildings. Standard cleaning practices coupled with diligent hand hygiene are sufficient to maintain the safety of the K–12 school environment, including spaces used for afterschool or aftercare and objects (e.g., books) that may be shared between people.

VENTILATION

In the setting of strict adherence to masking, school districts that rarely made changes to ventilation were nevertheless successful in preventing transmission of SARS-CoV-2 among students and staff.[12] **In the absence of masking, ventilation may become more important *but should not be considered a substitute for masking.*** According to one study based on survey data from schools, the incidence of COVID-19 was 39% lower among schools implementing one or more strategies to improve classroom ventilation compared to schools that did not implement ventilation changes. Among schools that implemented ventilation changes to dilute or to dilute and filter airborne particles, the incidence of COVID-19 was 35% and 48% lower, respectively, compared to incidence among schools not implementing ventilation changes.[13] A range of cost-effective options have been recommended to potentially improve ventilation, including opening windows or adding air purifiers; however, human data on the effectiveness of each of these strategies to reduce SARS-CoV-2 transmission do not currently exist.[41]

POST-EXPOSURE QUARANTINE

Throughout the COVID-19 pandemic, quarantine has been used to limit further spread when a person comes into close contact (defined as less than 6 feet for a total of 15 minutes) with an infected person.[42] Quarantine has been modified or deferred within healthcare settings when both parties are masked or if a masked healthcare provider cares for an infected patient. Healthcare has provided evidence that continued work by asymptomatic and masked personnel is not associated with transmission in healthcare settings.

Under most quarantine policies used in K–12 schools throughout the 2020–2021 school year, the impact of quarantine on school operations and attendance was substantial. Data from LEAs in North Carolina, Wisconsin, Nebraska, Utah, and Missouri demonstrate that for every primary case within schools 4–10 students/staff are identified as close contacts and required to quarantine.[10,12,21,22] This practice resulted in hundreds of thousands of missed days of school and work despite a secondary transmission rate of less than 1% when both parties were masked.

School districts in Ohio, Wisconsin, and Missouri have successfully implemented modified quarantine, which permits asymptomatic, exposed, student and staff classroom contacts to remain in the in-person instruction setting as long as index case and exposed contacts were masked during contact.[10,22] Similarly, evidence from studies in Utah and Missouri support modified quarantine as safe and effective at facilitating continued in-person instructional activities by asymptomatic school students and staff.[21,22] Under some circumstances, implementation of modified quarantine has also helped to encourage masking when local practices or policy would otherwise lift masking mandates. **Based on these data, modified quarantine policies that eliminate quarantine for those appropriately masked in schools should be implemented to promote in-person education.** Importantly, modified quarantine practices are limited to asymptomatic individuals in the classroom; exposed individuals should continue to quarantine for all other extracurricular activities at school and activities within the community setting.

TESTING

SARS-CoV-2 screening testing

No existing data support the need for screening testing to ensure safe, in-person education when masking is in place. However, some districts have implemented SARS-CoV-2 screening testing to varying degrees. With strict adherence to masking, districts with screening testing in Utah and without screening testing in North Carolina demonstrated success in limiting SARS-CoV-2 transmission.[9,30] Screening testing may be beneficial for early identification of SARS-CoV-2 infected student athletes who may expose unvaccinated or unmasked athletes during play, or for early identification under other circumstances in which masking may be difficult (e.g., students with disabilities). In addition, screening testing may improve confidence in returning to the school environment, and when compulsory, may encourage adherence to masking and behavior modification outside of school hours; however, these potential benefits are not yet proven.

If implemented, the goals of screening testing should be clearly identified and communicated; limitations of testing methods (e.g., antigen vs. molecular [polymerase chain reaction, or PCR]) should be understood; and consideration should be given to risks and benefits of testing and test results (e.g., true vs. false positives) for the school population as well as for individuals.

SARS-CoV-2 symptomatic testing and testing after exposure

Access to testing is essential for students and staff who are symptomatic or exposed to a person with COVID-19. Importantly, in addition to limiting the spread of SARS-CoV-2, masking mandates have helped limit the spread of viruses such as respiratory syncytial virus, enterovirus, and influenza. As masking mandates are lifted, there has been an expected increase in the occurrence of these common respiratory viruses.[43] Because COVID-19 has overlapping symptoms with many other respiratory viruses, differentiation between COVID-19 and other viruses will be more difficult if testing is not available. Access to testing after SARS-COV-2 exposure is necessary to limit the duration of quarantine and ensure unvaccinated students and staff can return to in-person school as quickly as possible.

LIMITING ATTENDANCE OF SICK STUDENTS AND STAFF

An important facet of infection control measures throughout the 2020–2021 school year has been to exclude symptomatic students and staff from the school environment. **It is essential to continue this culture of a "symptom-free" in-person environment, particularly as schools transition away from mandatory masking practices.** Schools and policy makers should consider the implementation of policies (e.g., paid sick leave) and availability of resources (e.g., widespread broadband access) to encourage these practices while limiting negative monetary and educational consequences (e.g., missed school and work days).

Key Takeaways for School Leaders and Policy Makers

The data-driven findings obtained over the last 15 months can inform the path forward to safely resuming in-person instruction in the 2021–22 school year. Quantitative and qualitative data confirm that in-person instruction is desperately needed for the health and well-being of most students and families.

In order to support the continued safety of students and staff via low in-school transmission of SARS-CoV-2, the following are suggested based on available data:

1. Encourage vaccination. Vaccination among eligible students and staff reduces COVID-19 transmission in schools. The combination of high vaccination rates (greater than 70%) and low community transmission may safely permit transitioning from mandatory masking of all students and staff in K–12 schools.

2. Adhere to proper masking. Proper masking is the most effective mitigation strategy to prevent secondary transmission in schools when COVID-19 is circulating and vaccination is unavailable or there is insufficient uptake.

3. Modify quarantine. Modified quarantine policies that eliminate quarantine for those appropriately masked should be implemented to promote in-person education.

4. Use in-school transmission rates as a metric. In-school transmission, as opposed to community transmission, should be used as the primary indicator of the ability of schools to keep students and staff safe.

5. Physical distancing should not be the limiting factor for determining in-person instruction when appropriate adherence to masking is present.

6. Implement masking or vaccination in athletics. Indoor athletics can more safely occur with strict adherence to masking or high levels of vaccination. Outdoor and non-contact activities are lower risk compared to indoor and high-contact activities.

7. Continue standard cleaning practices. Deep cleaning of objects is not required.

8. Increase ventilation in unmasked environment. Ventilation is more important in the unmasked environment when COVID-19 is circulating and vaccination is unavailable or there is insufficient uptake.

9. Provide access to symptomatic testing and testing after exposure. Symptomatic students and staff should be tested promptly, and students and staff who have been exposed to COVID-19 cases whether unvaccinated or unmasked should be tested at 5–7 days after exposure. This will promote earlier re-entry to school buildings after a negative COVID-19 test.

STANDARD PRACTICES

The following standard health practices should be followed to ensure the health and safety of students and staff in schools, both during and outside of the COVID-19 pandemic:

Maintain diligent and sustained hand hygiene. Educate students and staff on the importance of this mitigation tactic.

Maintain a culture of limiting symptomatic students and staff in school buildings, particularly in the unmasked environment. Symptomatic students and staff should consult with a physician, as needed.

Table 1. Other mitigation strategies in masked and partially/unmasked school settings

	ENVIRONMENT	
	Fully Masked	Partially Masked* or Unmasked
Diligent hand hygiene	Essential	Essential
Limiting sick students and staff within school buildings	Important. Masking has demonstrated efficacy in limiting the spread of multiple common respiratory viruses; however, sick children and staff should not attend until they have a negative COVID-19 test. Strategies such as temperature screening have not demonstrated benefit over costs (monetary and manpower) for prevention of SARS-CoV-2 transmission.	Essential
Quarantine of exposed contacts	• Modified quarantine (close contacts continue to attend school) for fully masked exposures along with monitoring for symptoms • Shortened quarantine with evidence of a negative test • No quarantine if fully vaccinated	• Insufficient data to support modified quarantine in the partially masked environment • Shortened quarantine with evidence of a negative test • No quarantine if fully vaccinated
Screening testing	No current evidence of additive benefit to prevent secondary transmission	Could be considered to promote early identification of cases
Symptomatic testing	Essential	Essential
In-school transmission as measure to inform school policy/ degree of mitigating measures employed	Essential — can be monitored via case reporting and contact tracing and should be performed by local public health department in concert with the school district	Essential — can be monitored via case reporting and contact tracing and should be performed by local public health department in concert with the school district
Community transmission/ COVID-19 activity	Should not determine mode of learning (in-person vs. virtual)	Should be considered to guide escalation of mitigating measures. If levels cross the identified threshold, **universal masking should be employed prior to implementing virtual learning.**

*Partially masked could include masking only of students and not staff or masking only of those who are unvaccinated.

Table continues on following page.

Table 1. Other mitigation strategies in masked and partially/unmasked school settings (continued)

	ENVIRONMENT	
	Fully Masked	Partially Masked* or Unmasked
Vaccination rates (school and community)	Should be considered in order to transition from mandated masking among teachers and students	Important for sustaining low rates of community transmission and reducing risk of spread when SARS-CoV-2 is circulating within the community
Distancing	No distancing requirement necessary	Should be considered with known community transmission of SARS-CoV-2 if masking is not re-implemented
Cohorting	Less pertinent in the setting of masking	Should be considered with known community transmission if masking is not re-implemented
Ventilation	Less pertinent in the setting of masking	Increases in ventilation via improved indoor circulation of outdoor air or increased outdoor activity should be considered in the unmasked environment when SARS-CoV-2 is circulating within the community.

*Partially masked could include masking only of students and not staff or masking only of those who are unvaccinated.

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Learn more at **abcsciencecollaborative.org**

The ABC Science Collaborative is an initiative that extends across 13 states, connecting scientists and physicians with school and community leaders to help understand the most current and relevant information about COVID-19. The program helps school leaders and state policy makers arrive at informed decisions about returning to school using data from their own communities. Our shared goal is to keep students, teachers, and their local communities healthy and safe. ABC Science Collaborative is coordinated by the Duke Clinical Research Institute at the Duke University School of Medicine and is funded by a grant from the National Institutes of Health.