

Examining Early Literacy Skills in the Wake of COVID-19 Spring 2020 School Disruptions:

**VIRGINIA FALL 2020 STATEWIDE SCREENING
FINDINGS AND IMPLICATIONS**

Anita McGinty, Allison Gray,
Ann Partee, Walter Herring,
and Jim Soland

May 2021



About PALS

The Phonological Awareness Literacy Screener (PALS) is the state-provided screening tool for the Virginia Early Intervention Reading Initiative (EIRI). EIRI allocates funds to help participating school divisions identify children in need of additional instruction and to provide early intervention services to students with diagnosed needs. School divisions are required to screen students in kindergarten through third grade either with an assessment approved by the Virginia Department of Education or with PALS. All but one school division in the state chooses to administer PALS.

PALS measures students' development in early reading skills. The assessment is administered by the child's classroom teacher in a one-on-one setting, with the exception of several subtasks which are administered in small groups.

Disclaimer

This research was prepared using data provided under a contract with the Virginia Department of Education (VDOE). The content does not necessarily reflect the views or policies of the VDOE, the Board of Education, or the Commonwealth of Virginia. Consequently, the VDOE, the Virginia Board of Education, and the Commonwealth of Virginia are not responsible for the research brief's content or any loss suffered due to the use of such content. Moreover, the mention of any trade names, commercial products or organizations in this research brief is not an endorsement of any of these entities by the VDOE, the Virginia Board of Education, or the Commonwealth of Virginia.

SUMMARY

This report summarizes statewide literacy screening data collected in Fall 2020 in Virginia. The PALS literacy screener was administered to 64,013 kindergartners and 71,712 first graders in Virginia, representing over 90% of students enrolled in divisions administering the PALS assessment in these grades during the Fall of 2020.

Results from statewide screening show:

- Over one quarter of kindergarten and first grade students were identified as being considerably behind in early literacy skills at the beginning of the 2020-2021 school year.
- There was a 10% point increase in the proportion of students considerably behind in early literacy skills from Fall 2019 to Fall 2020.

- The increase in students considerably behind in early literacy skills from 2019 to 2020 was most pronounced among students who identify as Black, Hispanic, economically disadvantaged, and English learner. These patterns point to systemic inequities that lie at the root of educational disparity and raise concerns that such disparities may have been exacerbated in the wake of Spring 2020 school disruptions.

Implications: The increase in kindergarten and first grade students considerably behind in early literacy in Fall 2020 raises a warning about long-term challenges in literacy achievement in the coming years. These data emphasize the importance of organizing resources to support the youngest students in the public education system from an equity lens.

On March 16, 2020 Virginia school buildings closed by executive order in response to the SARS-CoV-2 (i.e., COVID-19) global health pandemic,¹ resulting in a rapid shift to virtual instruction for the remainder of the 2019-2020 school year. The situation facing Virginia's students and families was echoed around the nation as over 124,000 schools physically closed for 55.1 million students and families.²

These initial school disruptions in Spring 2020, paired with ongoing changes to the school experiences for many across the 2020-2021 school year, elevate

concerns about the instructional opportunities that are available to students during the pandemic. As educational leaders and policymakers seek to determine priorities for education recovery efforts, student data are critical to this decision-making process.

In recent months, literacy screening data have been leveraged to understand the impact of COVID-19 school disruptions on student reading achievement prior to third grade. Across the U.S., over half the states mandate literacy screening as a means of early identification for reading difficulties and disabilities and as a method of supporting all students' reading success. The literacy skills that children develop across the preschool and early elementary school years are critical to their successful, long-term academic outcomes. Literacy screening offers an important window into student learning prior to state standardized testing (typically first administered in third grade) and an opportunity to understand how the COVID-19 pandemic may have impacted the early reading development of the youngest students in the K-12 system.

Three national studies have used data from screeners of early literacy to examine potential learning setbacks in the reading skill development of students prior to third grade. These studies offer mixed evidence and are limited by systematic shifts in literacy screening participation during Fall 2020, as well as a lack of visibility into other local shifts, such as enrollment changes within schools or school divisions. For example, data from a widely used screening and progress monitoring tool in literacy (STAR Early Literacy; STAR Reading) found few differences between students' Fall 2020 literacy performance and expectations established from previous cohorts.³ Notably, in grades 1-3 there was no evidence of learning setbacks, with findings demonstrating that students performed *ahead* of expectations in Fall 2020. The authors emphasized that testing did not occur consistently within or across localities, so some students may have received substantially more instruction than others before testing. In contrast, a report using DIBELS screening data on approximately 400,000 kindergarten – 5th grade students across forty states found large increases in the number students at risk in early reading skills from 2019-2020 to 2020-2021, particularly among kindergarten and first grade students.⁴ These data included significantly more students who identify as Black and Hispanic/Latinx, and fewer students who are White, and less representation from suburban and rural schools than would be

expected in a nationally representative sample. A third study took a different approach, examining *within* student change across multiple years on a measure of oral reading fluency for students in grades 1-4.⁵ This study found evidence of negative COVID-related disruptions, primarily in Grades 2 and 3. While this study provides a rigorous look at learning in relation to the pandemic's onset, its sample was also limited to a select set of divisions and students who could be followed across time.⁵

The current report offers a unique set of information on young students' literacy skills at the start of the 2020-2021 school year. In Virginia, a legislatively-mandated system of literacy screening and early intervention has been in place since 1997. A common literacy screener, the Phonological Awareness Literacy Screener (PALS-K, PALS 1-3), is used to assess approximately 148,000 kindergarten and first grade students annually across 978 schools across the state. This represents all but one school division in the state (i.e., 131 out of 132 school divisions) and includes over 90% of all students enrolled in public school across those divisions. Under the Early Intervention Reading Initiative (EIRI) legislative mandate,⁶ school divisions receive state funds in support of early intervention for students designated significantly behind in early reading skills, based on their PALS assessment.

Virginia's PALS literacy screening data from Fall 2020 creates a remarkably complete (i.e., proportion of students assessed)—and historically comparable—picture of kindergarten and first grade students entering Virginia public schools in Fall 2020. These data present a unique opportunity to examine the extent to which our youngest learners, those starting kindergarten and first grade in Fall 2020, compare to previous cohorts of children in their literacy related skills. This is particularly important in the wake of prolonged disruption to typical school services. Virginia's longitudinal and historic records linking kindergarten and first grade screening data to third grade outcomes also offer unique data that can help project the risk of longer-term difficulties in third grade reading achievement. These long-term analyses are ongoing (see Appendix C for a description of the work in progress). We expect this report to be the first in a series on Virginia's data. The intent of this report is to provide data that are actionable at the state and local levels and are also relevant to the national conversation on students' learning amidst the COVID-19 pandemic.

This report seeks to answer two key questions:

1. Are the early reading skills of incoming kindergarten and first grade students different in Fall 2020 compared to Fall 2019?
2. Do differences in early reading skills between 2019 and 2020 vary by students' demographic characteristics?

The Sample

Data for this brief were collected as a part of [state-mandated](#) screening in Virginia. Data were collected across a testing window that ran from July 15 – November 15, 2020.

In Fall 2020, 64,013 kindergarten students and 71,712 first grade students were assessed with the PALS measures. This reflects over 90% of all students enrolled in kindergarten and first grade within divisions administering the PALS assessment, an average level of representation consistent with historic trends. It is worth noting, however, that there were enrollment changes in divisions administering PALS across 2019 and 2020. Compared to Fall 2019, there was an 18% decrease in the number of kindergarten students assessed with PALS and a 3% increase in the number of first graders assessed in Fall 2020, resulting in approximately 12,000 fewer students in the Fall 2020 sample.^{7,8}

Although the overall number of kindergarten and first grade students was lower in Fall 2020, the composition of the cohorts was similar, with the percent of students representing varied racial, ethnic, and socio-economic categories shifting around 1% point between 2019 and 2020 (see Table A2 in Appendix A). The only exception was that the kindergarten Fall 2020 cohort had approximately 3% points fewer White students compared to the kindergarten Fall 2019 cohort.

Data Collection

Teachers primarily assessed students in a 1:1 testing session that lasted about 20-30 minutes, consistent with testing protocols from previous years. However, in Fall 2020, unlike previous years, that 1:1 setting occurred in two different

modalities: in-person (with social distance and safety protocols in place) or remote, through a video conferencing mechanism that connected the student and teacher in an assessment session. Training and adapted materials were made available to local leaders, schools, and teachers to support remote administration. Users from 86 divisions, or 66% of those administering PALS, downloaded these materials before or during the fall testing window.

Across all kindergarten and first grade students, 55.7% of state data were collected through remote administration methods in Fall 2020. The prevalence of a remote testing approach to data collection varied by geography. For example, 70% of the divisions using primarily in-person assessment methods ($n = 60$) were rural. In contrast, the school divisions that used primarily remote administration methods ($n = 28$) were urban (30%) and suburban (30%). School divisions using a combination of remote and in-person administration methods ($n = 28$) were 40% rural, 26% suburban, 19% urban, and 16% towns. See Figure A1 in Appendix A.

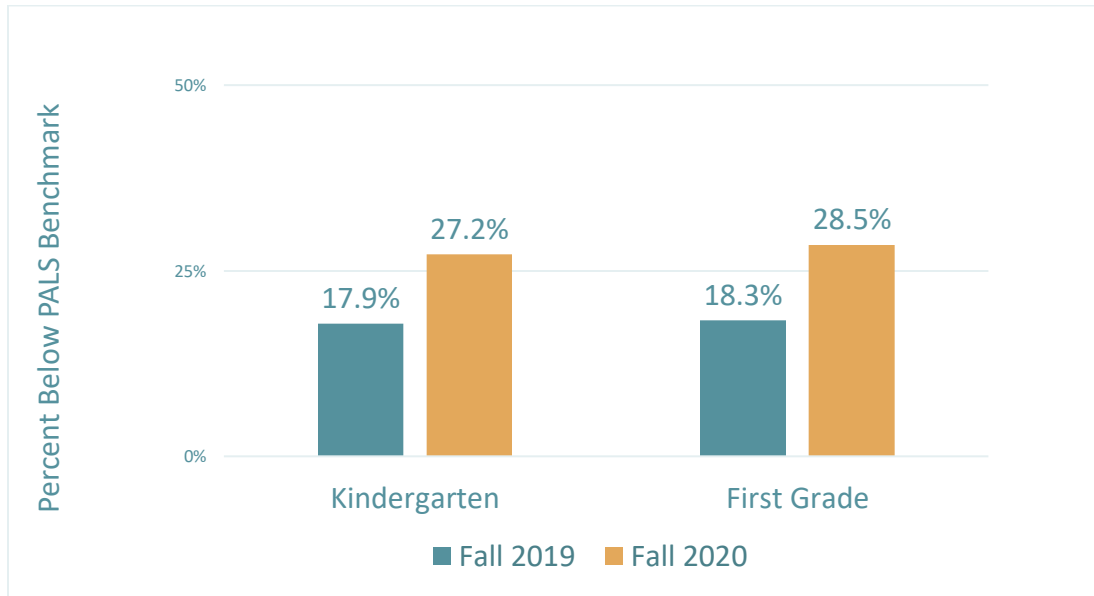
Remote administration was more frequently used to screen kindergarten students who identified as Black, Hispanic, and English learner, compared to students who identified as White. These patterns are partially explained by school division enrollment, as students identifying as Black and English learner were more likely to attend divisions using remote assessment methods (see Table A1 in Appendix A). Despite these varied assessment methods, as well as other shifts in testing procedures that were analyzed (e.g., including a lengthened testing window and a reduction of certain test items), our findings (presented in next section) remained robust. Appendix A provides more information on the validity of the remote administration method and differences in the sample of test-takers between 2019 and 2020.

Findings

Finding 1. PALS data from Fall 2020 show that over one quarter of kindergarten and first grade students began this school year considerably behind in early reading skills (i.e., “below the benchmark”), putting them at high-risk for future reading difficulties. In absolute numbers, 37,894 kindergarten and first grade students scored below the benchmark in early reading skills, identifying them as

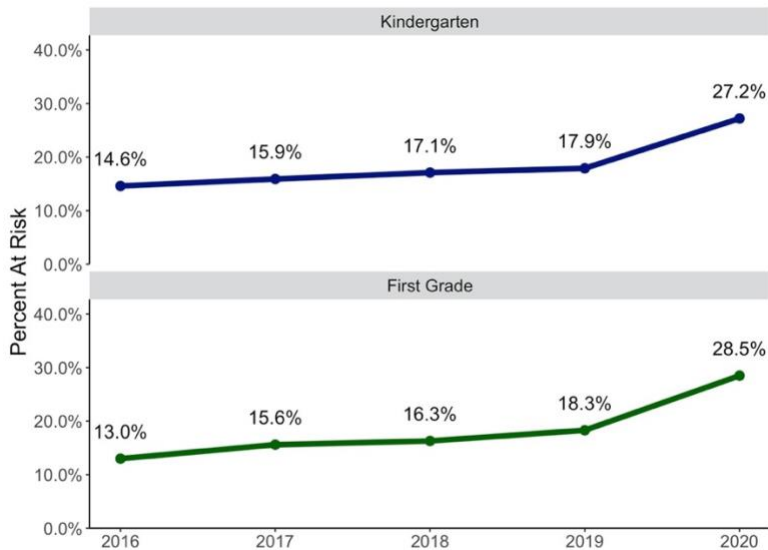
in need for supplemental reading intervention services. This reflects a 10% point increase in the identification rate for each grade and translates to 11,000 more kindergarten and first grade students considered at-risk for future reading difficulties in Fall 2020 compared to Fall 2019 (see Figure 1).

Figure 1. Students at High-Risk for Reading Difficulties: Fall 2019 versus Fall 2020



Looking at PALS data from a historic lens shows the unprecedented nature of this increase. Figure 2 shows that across the past few years there has been a slight upward trend in the percent of students flagged as being below benchmark in early reading skills at kindergarten and first grade entry. However, the increase observed between 2019 and 2020 is substantial. This shift is five times that of any single year change since 1997 (Figure 2 illustrates the pattern just across the past five years). It is important to note that the increase in students behind in early reading skills is evident despite the fact that approximately 12,000 fewer students were assessed in Fall 2020 compared to Fall 2019, primarily as a result of enrollment differences.

Figure 2: Students at High-Risk for Reading Difficulties: 2016-2020



Finding 2. The increase in students considerably behind in early reading from 2019 to 2020 was most pronounced among students who identify as Black, Hispanic, economically disadvantaged, and English learner (Figures 3a, 3b).

These trends point to systemic inequities that lie at the root of educational disparity and raise concerns that such disparities may have been exacerbated in the wake of Spring 2020 school disruptions.

The disaggregated kindergarten data from 2019 provide evidence that, even prior to COVID-19, inequities existed in children’s opportunity to develop early reading skills. However, Figure 3a also shows that these inequities are larger in 2020. When comparing Fall 2019 to Fall 2020, the proportion of White kindergarten students with early reading difficulties increased by 7.4% points. When making this same comparison for Black kindergarten students, the increase was 8.8% points; for Hispanic kindergarten students, the increase was 14.2% points. For English learners, the proportion of kindergarten students with early reading difficulties increased by 12.4% points, and for students coming from economically disadvantaged homes the proportion of kindergarten students considerably behind in early reading rose by 11% points from 2019 to 2020. The patterns seen among kindergarten students were less pronounced, though evident, in first grade, with one exception. For first grade students coming from homes that are economically disadvantaged, the proportion of

students considerably behind in early reading rose dramatically, by 14.8% points, from 2019 to 2020.

Figure 3a. Kindergarten Students at High-Risk for Reading Difficulties: Fall 2019 versus Fall 2020, by Student Group

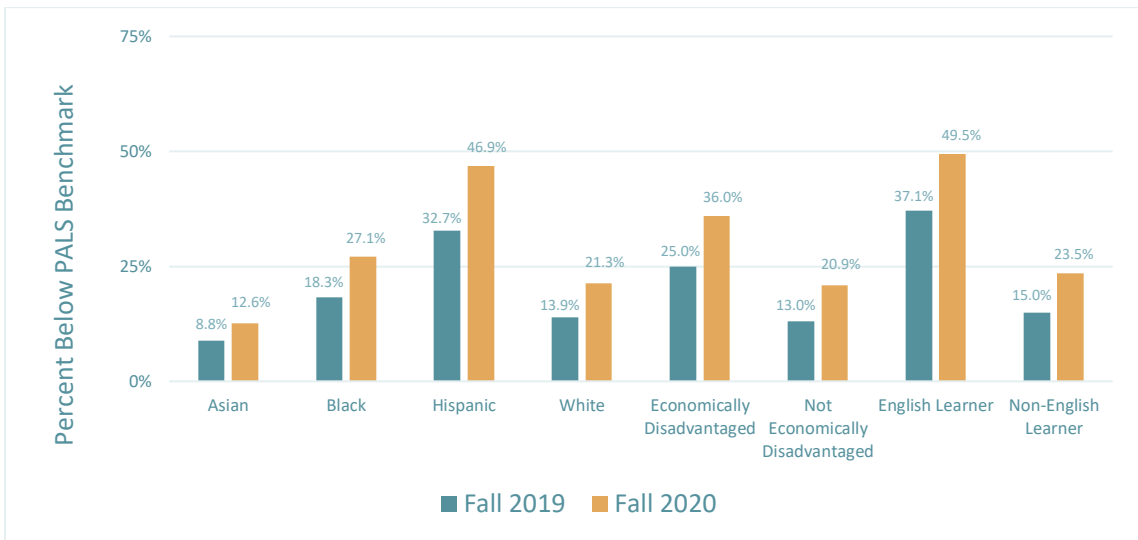
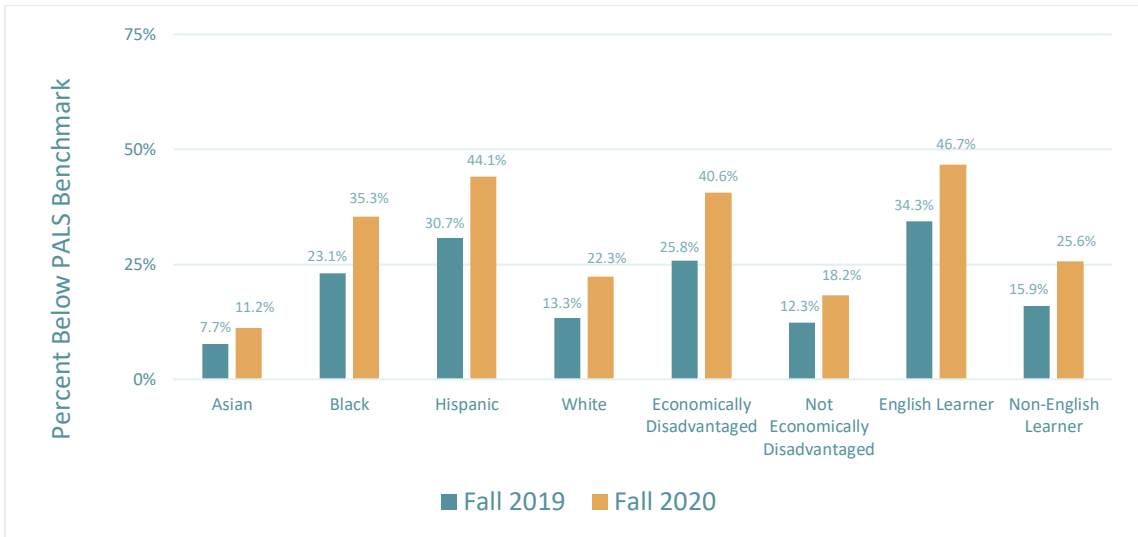


Figure 3b. First Grade Students at High-Risk for Reading Difficulties: Fall 2019 versus Fall 2020, by Student Group



Discussion and Implications

This report adds to a growing number of studies that seek to examine student learning amidst a global health pandemic. These data offer a fairly robust baseline of information on kindergarten and first grade students in Virginia in Fall 2020 that is largely comparable to historic cohorts.

Our report focuses on the youngest students in the K-12 public education system because of the importance of these years to long-term reading success and academic trajectories. Children's reading skill development is incredibly stable even prior to school, with 80% of first grade reading attributable to underlying skills observed in preschool and kindergarten.⁹ First grade reading abilities in turn predict reading outcomes in fifth grade.¹⁰ Thus, understanding kindergarten and first grade students' literacy skills post-school disruptions in Spring 2020, in comparison to historic trends, can both inform the field about the immediate challenges schools face and offer data that can point to potential future challenges that may come, in the absence of a robust educational response.

The increase in the proportion of kindergarten and first grade students considerably behind in early literacy skills in Fall 2020, as compared to Fall 2019, is a warning signal that requires attention. Students at kindergarten entry falling below the PALS benchmark have difficulty identifying words that rhyme, typically know fewer than 12 alphabet letter names, know fewer than 5 letter sounds, and cannot connect the sounds in a word and the letter that represents the sound. Students falling below the PALS benchmark in first grade have difficulty providing the corresponding sound for individual letters, reading simple CVC words (e.g., dog), and reading a short and simple passage of text with accuracy. Previous studies have shown that difficulties in these reading skill areas in kindergarten and first grade are an indication that these students are at high risk for reading difficulties, in the long term, if they are provided evidence based instruction.

The societal and community inequities that have been exacerbated by COVID-19 are relevant context for interpreting the findings of this report.¹¹ All children grow in the context of their daily experiences, which include not only school, but the families, neighborhood, and community in which they live. Opportunities for

learning, sense of safety, the provision of basic needs (e.g., food), experiences of trauma, racism, and availability and capacity of adults are among the factors that relate to cognitive and social development and positive outcomes for young learners.¹² The findings in this report point to an inequitable impact of school disruption on racially/ethnically minoritized students and economically disadvantaged students. It is important to interpret these data in the context of inequitable conditions of opportunity, support, and educational resources available for these students and their families, *in addition to the challenge of disrupted schooling* that all students faced. Although these data cannot disentangle the specific impact of community, family, and schooling disruptions on student learning, systematic differences in learning outcomes that fall along racial, ethnic, and economic lines point to students' unmet learning needs *and* are indicative of broader systemic challenges that must be addressed in tandem with students' educational opportunities.

Importantly, these data offer visibility into student learning within the context of a widely accepted model for intervention. The scientific evidence behind prevention-oriented reading instruction and early intervention offers a guide for a relevant educational response. The importance of organizing resources and support to the youngest learners in the public education system, from three-years-old through third grade, as a means of offsetting the long-term impacts of COVID-19 is unequivocally supported by science.

Even as schools seek to address the impact of COVID-19 on student learning, teachers continue to work with a lack of visibility into students' daily learning, and many students continue to have fragmented connections to the school system. Although this report provides an initial baseline of students for the 2020-2021 school year, we expect to continue to build a focus on students' learning needs and developmental trajectories across the school year following the mandatory spring testing window in Virginia.

Endnotes

¹ Commonwealth of Virginia. (2020, March 13). *Governor Northam orders all Virginia K-12 schools closed for minimum of two weeks* [Press release]. <https://www.governor.virginia.gov/newsroom/all-releases/2020/march/headline-854442-en.html>

Commonwealth of Virginia. (2020, March 23). *Governor Northam orders statewide closure of certain non-essential businesses, K-12 schools* [Press release]. <https://www.governor.virginia.gov/newsroom/all-releases/2020/march/headline-855292-en.html>

² EducationWeek. (2020, March 6). *Map: Coronavirus and school closures in 2019-2020*. <https://www.edweek.org/leadership/map-coronavirus-and-school-closures-in-2019-2020/2020/03>

³ Renaissance Learning. (2020). *How kids are performing: Tracking the impact of COVID-19 on reading and mathematics achievement*. <https://renaissance.widen.net/s/wmjtlxkhbm>

⁴ Amplify. (2021, February). *COVID-19 means more students not learning to read*. https://amplify.com/wp-content/uploads/2021/02/Amplify-mCLASS_MOY-COVID-Learning-Loss-Research-Brief_022421.pdf

⁵ Domingue, B. W., Hough, H. J., Lang, D., & Yeatman, J. (2021, March). *Changing patterns of growth in oral reading fluency during the COVID-19 pandemic*. Policy Analysis for California Education (PACE). https://edpolicyinca.org/sites/default/files/2021-03/wp_domingue_mar21-0.pdf

⁶ Virginia Department of Education (VDOE). (n.d.). *Early Intervention Reading Initiative (EIRI)*. https://www.doe.virginia.gov/instruction/english/elementary/reading/early_intervention_reading.shtml

⁷ Fall of first grade is traditionally not a mandatory PALS testing window, however, the VDOE mandated that all first graders be assessed with PALS in Fall 2020 due to COVID-19. Thus, the number of first grade students assessed with PALS increased from Fall 2019 to Fall 2020. More information about this mandate can be found here:

http://www.doe.virginia.gov/administrators/superintendents_memos/2020/214-20.docx

⁸ Bassok, D., & Shapiro, A. (2021, February). *Understanding COVID-19-era enrollment drops among early-grade public school students*. Brown Center Chalkboard. <https://www.brookings.edu/blog/brown-center-chalkboard/2021/02/22/understanding-covid-19-era-enrollment-drops-among-early-grade-public-school-students/>

Korman, H. T. N., O'Keefe, B., & Repka, M. (2020, October 21). *Missing in the margins: Estimating the scale of the COVID-19 attendance crisis*. Bellwether Education Partners. <https://bellwethereducation.org/publication/missing-margins-estimating-scale-covid-19-attendance-crisis>

⁹ Lonigan, C. J., Burgess, S. R., & Anthony, J. L. (2000). Development of emergent literacy and early reading skills in preschool children: Evidence from a latent-variable longitudinal study. *Developmental Psychology*, 36(5), 596-613. <https://doi.org/10.1037/0012-1649.36.5.596>

¹⁰ Fuchs, D., Compton, D. L., Fuchs, L. S., Bryant, V. J., Hamlett, C. L., & Lambert, W. (2012). First grade cognitive abilities as long-term predictors of reading comprehension and disability status. *Journal of Learning Disabilities*, 45(3), 217-231. <https://doi.org/10.1177/0022219412442154>

¹¹ van Dorn, A., Cooney, R. E., & Sabin, M. L. (2020, April 18). COVID-19 exacerbating inequalities in the US. *The Lancet*, 395(10232), 1243-1244. <https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2930893-X>

¹² Institute of Medicine and National Research Council. (2000). *From neurons to neighborhoods: The science of early childhood development*. The National Academies Press. <https://doi.org/10.17226/9824>

Appendix A: PALS Administration Details

In this appendix, we outline additional information regarding PALS administration in the 2020 school year and ways in which it differed from administration in prior school years. We describe the adjustments we made and additional analyses we conducted to ensure that the comparisons we make between Fall 2019 and Fall 2020 are not simply the result of differences in administrative details between the two years but rather reflect a true decrease in students' literacy skills in kindergarten and first grade in the wake of the COVID-19 pandemic.

Fall 2020 PALS Sample and Variable Definitions

The PALS Kindergarten assessment was mandatory in 131 out of the 132 school divisions in the state during Fall 2020. Traditionally, the fall of first grade is not a mandatory testing window for PALS, though all 131 divisions tested at least one first grade student in Fall 2019. In 2020, PALS testing was required in the fall of first grade.

Our 2020 PALS sample contains all students who completed the fall PALS assessment in kindergarten and first grade via standard administration. Standard administration includes allowable practices such as multiple testing sessions or repeating instructions, while nonstandard administration occurs when a student's Individualized Education Plan (IEP) allows exemption from formal screening but the teacher uses the PALS assessment as an informal tool for examining student literacy skills. Students with incomplete assessments or assessments done in a nonstandard way were removed from the sample. Students could be given PALS either in person or remotely, and all statewide analyses include both methods of administration (more details provided below).

To conduct the subgroup analyses, students' results from the PALS assessments were linked to information from VDOE Student Record Collection demographics. PALS scores are tied to VDOE demographics via the Student Testing Identifier. There are often about 1% of PALS students per grade who do not have a matching VDOE record due to differences in timing of data collection. This fall there were 1,230 kindergarten students and 617 first grade students who had PALS scores but no matching record in the VDOE Student Record Collection.

Student demographic variables are defined as follows:

- The race/ethnicity variable used is the "Federal Race/Ethnicity Code" that combines the Ethnicity Flag (Hispanic Yes/No) and the "Race as Reported" variable.
- The English Learner (EL) variable originally contained 4 levels: 1) Identified as EL and receives EL Services, 2) Identified as EL but has refused EL Services, 3) Identified as formerly EL for each of the four years after exiting EL Services, and 4) Temporarily identified as EL (Presumptive EL until formally screened in person). For these analyses, all categories were collapsed into an EL Yes/No flag. Given that these analyses are focused on kindergarten and first grade students, we were not concerned with the small

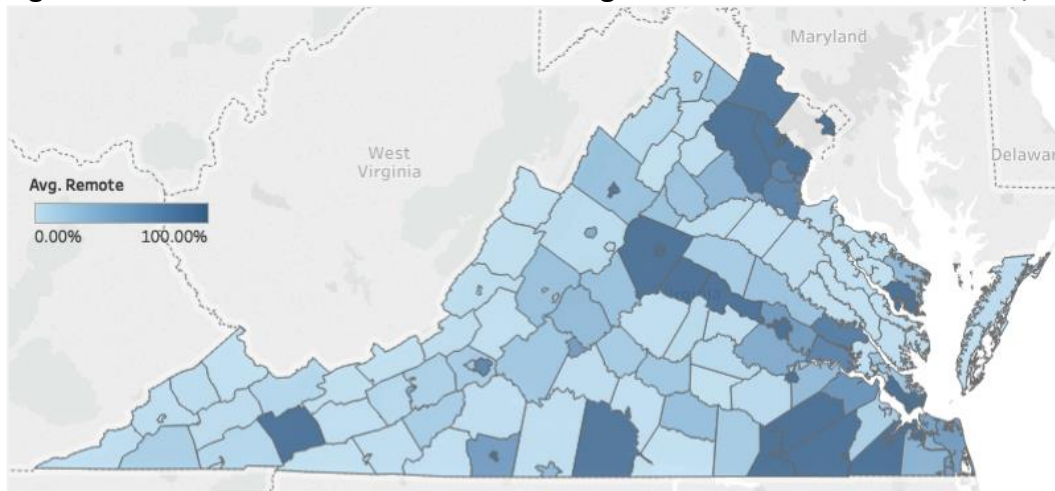
number of students (N = 2 in kindergarten and N = 808 in first grade) who are classified as formerly EL.

- Economically disadvantaged students are identified with a Yes/No flag. Students are identified as disadvantaged if they 1) are eligible for Free/Reduced meals, 2) receive TANF, or 3) are eligible for Medicaid.

Differences in Administration in 2020

There were several key differences in the manner in which PALS was administered in the fall of 2020 compared to prior years. First, and most obviously, many students took the PALS assessment remotely in 2020 (see Figure A1).

Figure A1. Administration Method for Kindergarten and First Grade Students, by Division



In initial descriptive analyses, we divided divisions into three categories: Remote, In-Person, and Mixed Administration per grade. Remote divisions' assessments were 90%+ remote. In-Person divisions' assessments were 10% or less remote. Mixed Administration divisions' assessments were 10-90% remote. These divisions tended to split among geographical categories and had different demographic compositions from each other. However, divisions, for the most part, fell into the same administration category when considering their kindergarten assessments and first grade assessments separately. Given the same patterns across grades, we combined kindergarten and first grade to create one sample. Table A1 below documents differences in student demographics in our kindergarten and first grade combined sample based on divisions' PALS administration classification.

Table A1: Student Demographics by PALS Administration

	In-Person	Mixed	Remote
Race/Ethnicity			
Asian	1.1% (314)	4.3% (2499)	9.1% (4537)
Black	12.0% (3412)	25.0% (14354)	26.9% (13413)
White	68.1% (19381)	47.3% (27178)	32.3% (16074)
Hispanic	10.2% (2897)	13.6% (7814)	23.3% (11611)
Other	7.0% (1985)	8.4% (4799)	7.2% (3610)
No Record	1.7% (475)	1.4% (813)	1.1% (559)
Total	100.0% (28464)	100.0% (57457)	100.0% (49804)
Economically Disadvantaged Status			
Yes	44.5% (12672)	41.5% (23610)	41.4% (20614)
No	53.8 (15317)	57.5% (33034)	57.5% (28631)
No Record	1.7% (475)	1.4% (813)	1.1% (559)
Total	100.0% (28464)	100.0% (57457)	100.0% (49804)
English Learner Status			
Yes	5.6% (1599)	7.5% (4326)	23.0% (11470)
No	92.7% (26390)	91.1% (52318)	75.8% (37775)
No Record	1.7% (475)	1.4% (813)	1.1% (559)
Total	100.0% (28464)	100.0% (57457)	100.0% (49804)

In addition to changes in the mode of administration, the specific PALS tasks that students completed during Fall 2020 differed from prior years. Specifically, for students given the PALS Kindergarten assessment, the “Concept of Word” (COW) tasks were optional in 2020. Therefore, 95% of students did not have a task score, COW word list, that is typically included in the calculation of the PALS Summed Score. This task’s benchmark score is 0 and thus there is no expectation that the task will contribute any points to a student’s Summed Score. For comparison, fall scores from 2019 were recalculated without any COW word list task scores, and only an additional 144 students out of 77,987 total students fell below the benchmark due to the loss of points. Therefore, all descriptive statistics from 2019 reflect the Summed Score that includes the COW word list task.

Finally, there were some differences in the sample of students taking the PALS assessment between 2019 and 2020 (see Tables A2 and A3). Sample differences were most pronounced for kindergarten students as evidenced by a decrease of 18%, however, neither grade level saw substantial differences by race/ethnicity, economically disadvantaged status, or English learner status across years.

Table A2: Kindergarten Sample, by Student Demographics, 2019 vs. 2020

	2019	2020	% Change
Race/Ethnicity			
Asian	5.1% (3974)	5.1% (3257)	-18.04%
Black	22.2% (17326)	22.9% (14686)	-15.24%
White	48.7% (37958)	45.8% (29294)	-22.83%
Hispanic	15.6% (12203)	16.6% (10597)	-13.16%
Other	7.4% (5775)	7.7% (4949)	-14.30%
No Record	1.0% (751)	1.9% (1230)	63.78%
Total	100.0% (77987)	100.0% (64013)	-17.92%
Economically Disadvantaged Status			
Yes	38.9% (30342)	38.2% (24431)	-19.48%
No	60.1% (46894)	59.9% (38352)	-18.22%
No Record	1.0% (751)	1.9% (1230)	63.78%
Total	100.0% (77987)	100.0% (64013)	-17.92%
English Learner Status			
Yes	11.9% (9285)	12.4% (7916)	-14.74%
No	87.1% (67951)	85.7% (54867)	-19.3%
No Record	1.0% (751)	1.9% (1230)	63.8%
Total	100.0% (77987)	100.0% (64013)	-17.92%

Table A3: First Grade Sample, by Student Demographics, 2019 vs. 2020

	2019	2020	% Change
Race/Ethnicity			
Asian	4.8% (3376)	5.7% (4093)	21.24%
Black	23.9% (16711)	23.0% (16493)	-1.30%
White	47.9% (33469)	46.5% (33339)	-0.39%
Hispanic	15.5% (10863)	16.4% (11725)	7.94%
Other	7.3% (5112)	7.6% (5445)	6.51%
No Record	0.6% (386)	0.9% (617)	59.84%
Total	100.0% (69917)	100.0% (71712)	2.57%
Economically Disadvantaged Status			
Yes	44.1% (30852)	45.3% (32465)	5.20%
No	55.3% (38679)	53.9% (38630)	-0.10%
No Record	0.6% (386)	0.9% (617)	59.80%
Total	100.0% (69917)	100.0% (71712)	2.57%
English Learner Status			
Yes	12.7% (8885)	13.2% (9479)	6.69%
No	86.7% (60646)	85.9% (61616)	1.60%
No Record	0.6% (386)	0.9% (617)	59.84%
Total	100.0% (69917)	100.0% (71712)	2.57%

Validity of Remote Administration

One might be concerned that the differences in students' skills in the fall of kindergarten and first grade that we observe for the 2020 cohort relative to prior years simply reflect differences in the mode in which the assessment was administered. That is, one would not want to interpret mean differences in test scores between two timepoints substantively if those differences were actually due to how the measure functioned between remote and in-person test takers. For example, if students taking the remote version of the test found certain items easier compared to in-person test takers even when being compared only to students with the same true score in early literacy, then bias could be driving differences in scores.

To help mitigate such concerns, we conducted measurement invariance analyses to determine if the test was functioning differently for in-person versus remote test takers. Measurement invariance suggests that a construct is being measured consistently across groups, timepoints, or some combination of the two.¹ The methods often proceed by systematically constraining the factor structure (configural), loadings (weak), thresholds (strong), and residuals (strict) across groups/timepoints, then examining whether there is a decrement in model fit. In our context, we examined whether the construct is being measured consistently for students who took the test in-person versus remotely. Failures of measurement invariance could constitute evidence that bias due to the mode of delivery, not true differences in early literacy, is driving observed differences in test scores.

Table A4 presents these results. In this table, we compare model fit for the configural model relative to the strong model. To examine measurement invariance, we used a criterion of Δ Root Mean Squared Error (Δ RMSEA) of .01 (i.e., changes in RMSEA at or below .01 between models suggest measurement invariance holds). All analyses were conducted in Mplus Version 8 using a weighted least squares means- and variance-adjusted (WLSMV) estimator.

¹ Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika*, 58, 525–543. <https://doi.org/10.1007/BF02294825>

Table A4: Fit Statistics Comparing Models Imposing Configural Versus Strong Invariance

	Configural	Strong
<hr/>		
Alphabet (26 items)		
RMSEA	0.024	0.024
Delta		0.000
<hr/>		
Beg. Sound (10 items)		
RMSEA	0.031	0.030
Delta		0.001
<hr/>		
Letter Sounds (26 items)		
RMSEA	0.046	0.045
Delta		0.001
<hr/>		
Rhyme (10 items)		
RMSEA	0.078	0.075
Delta		0.003
<hr/>		
Spelling (30 items)		
RMSEA	0.030	0.029
Delta		0.001

As the table shows, based on the Δ RMSEA criterion, there is little evidence of failures of measurement invariance. While these results cannot rule out potential sources of bias by mode of administration, they provide evidence that measurement model parameters seem fairly consistent by mode of administration in the sample being studied. One should note that these analyses are preliminary and ongoing, which means comparisons of scores for in-person versus remote testing should be interpreted with caution.

Appendix B: Additional Descriptive Statistics

In this appendix, we provide additional descriptive statistics from our sample not shown in the main body of this report. These figures give a more comprehensive look at trends in students who score below benchmark in 2019 and 2020 as well as additional information on the proportion of students who took the PALS assessment remotely versus in-person in Fall 2020 by student subgroups.

Proportion of Students Below Benchmark

In Fall 2019, there were 77,987 kindergarten students who completed PALS, and 17.9% of those students fell below the benchmark. In Fall 2020, there were 64,013 kindergarten students who completed PALS, and 27.2% of those students fell below the benchmark.

In Fall 2019, there were 69,917 first grade students who completed PALS, and 18.3% of those students fell below the benchmark. In Fall 2020, there were 71,712 first grade students who completed PALS, and 28.5% of those students fell below the benchmark.

Tables B1 through B3 below show differences in below benchmark (BB) rate across various subgroups for the combined kindergarten and first grade sample. The 2020 results include students' scores from both the in-person and remote PALS administration methods.

Table B1: Combined K and 1st Grade Below Benchmark Rates by Race/Ethnicity, 2019 vs. 2020

	2019			2020		
	Total	# BB	% BB	Total	# BB	% BB
Asian	7350	610	8.3%	7350	871	11.9%
Black	34037	7032	20.7%	31179	9795	31.4%
White	71427	9732	13.6%	62633	13653	21.8%
Hispanic	23066	7337	31.8%	22322	10141	45.4%
Other	10887	1642	15.1%	10394	2588	24.9%
No record	1137	347	30.5%	1847	839	45.4%

Table B2: Combined K and 1st Grade Below Benchmark Rates by Economically Disadvantaged Status, 2019 vs. 2020

	2019			2020		
	Total	BB	%BB	Total	BB	%BB
Economically Disadvantaged	61194	15538	25.4%	56896	21995	38.7%
Not Economically Disadvantaged	85573	10815	12.6%	76982	15053	19.6%
No record	1137	347	30.5%	1847	839	45.4%

Table B3: Combined K and 1st Grade Below Benchmark Rates by English Learner (EL) Status, 2019 vs. 2020

	2019			2020		
	Total	BB	%BB	Total	BB	%BB
EL	18170	6493	35.7%	4266	2415	56.6%
Not EL	128597	19860	15.4%	54837	15200	27.7%
No record	1137	347	30.5%	1022	465	45.5%

Remote Assessment

As mentioned in Appendix A, some students took the PALS in-person as in years past while many other students took the assessment remotely during Fall 2020. In Tables B4 through B9, we report the proportion of students who took the PALS in-person versus the proportion who took the PALS remotely by race/ethnicity, economically disadvantaged status, and EL status to better document who took the assessment in which format. We report results separately for kindergarten and first grade.

Table B4 shows that the majority of Black, Hispanic, and Asian kindergarten students were assessed remotely.

Table B4: In-Person vs. Remote Administration Rates By Race/Ethnicity - Kindergarten

	In-Person	Remote
Asian	18.7% (609)	81.3% (2648)
Black	35.3% (5182)	64.7% (9504)
White	62.6% (18330)	37.4% (10964)
Hispanic	36.1% (3826)	63.9% (6771)
Other	46.8% (2316)	53.2% (2633)
No record	55.4% (682)	44.6% (548)

Table B5 shows that there were no major differences in PALS administration type by economically disadvantaged status for kindergarten students.

Table B5: In-Person vs. Remote Administration Rates By Economically Disadvantaged Status - Kindergarten

	In-Person	Remote
Economically Disadvantaged	47.6% (11640)	52.4% (12791)
Not Economically Disadvantaged	48.6% (18623)	51.4% (19729)
No record	55.4% (682)	44.6% (548)

Table B6 shows that the majority of English Learner (EL) kindergarten students were assessed remotely.

**Table B6: In-Person vs. Remote Administration Rates
By EL Status - Kindergarten**

	In-Person	Remote
EL	26.7% (2115)	73.3% (5801)
Not EL	51.3% (28148)	48.7% (26719)
No record	55.4% (682)	44.6% (548)

Table B7 demonstrates that the majority of Black, Hispanic, and Asian first grade students were assessed remotely.

**Table B7: In-Person vs. Remote Administration Rates by
Race/Ethnicity - First Grade**

	In-Person	Remote
Asian	14.4% (590)	85.6% (3503)
Black	26.3% (4342)	73.7% (12151)
White	54.9% (18311)	45.1% (15028)
Hispanic	29.5% (3456)	70.5% (8269)
Other	39.3% (2141)	60.7% (3304)
No record	55.1% (340)	44.9% (277)

In Table B8, we see that there were no major differences in PALS administration type by economically disadvantaged status for first grade students.

**Table B8: In-Person vs. Remote Administration Rates by Economically
Disadvantaged Status - First Grade**

	In-Person	Remote
Economically Disadvantaged	40.6% (13185)	59.4% (19280)
Not Economically Disadvantaged	40.5% (15655)	59.5% (22975)
No record	55.1% (340)	44.9% (277)

Finally, Table B9 shows that the majority of EL first grade students were assessed remotely.

**Table B9: In-Person vs. Remote Administration
Rates by EL Status - First Grade**

	In-Person	Remote
EL	22.7% (2151)	77.3% (7328)
Not EL	43.3% (26689)	56.7% (34927)
No record	55.1% (340)	44.9% (277)

Appendix C: Work in Progress: Projecting the Increase in SOL Below Proficiency Rate for the 2020 Kindergarten Cohort

Description of Methodology

Logistic Regression Model

To predict whether kindergarten students reach proficiency standards on their third grade Standards of Learning (SOL) reading assessment, we employ a logistic regression model using historic data from the 2014 and 2015 cohorts of kindergarten students. Logistic regression is a widely used method for predicting binary outcomes such as SOL proficiency and allows us to easily integrate multiple predictors in our model.² The historic cohorts of data allow us to model the relationship between students' literacy skills in kindergarten (as measured by PALS) and their future proficiency on the SOL in order to make predictions for the 2020 cohort of kindergartners based on their PALS results.

The model we employ is specified as follows:

$$\ln\left(\frac{p}{1-p}\right) = \alpha + \beta(PALSK) + \gamma'(Race') + \theta(EL) + \lambda(Disadvantaged) + \mu'(PALSK * Race') + \rho(PALSK * Disadvantaged) + \varepsilon$$

Where p represents the probability that a child reaches proficiency on their SOL in third grade, $PALSK$ represents the child's sum score on the PALS in kindergarten, $Race'$ represents a vector of indicator variables for the child's race, EL represents an indicator variable for whether the child is identified as an English learner (EL), and $Disadvantaged$ represents an indicator variable for whether the child is identified as economically disadvantaged.³ Though we have a limited number of covariates available apart from a child's score on the PALS assessment, we include them here because they can improve the accuracy of our predictions.

Assessing Model Accuracy

In order to assess the accuracy of this model in predicting students' third grade reading outcomes, we randomly divide observations in the historic data from the 2014 and 2015 cohorts ($n=130,744$) into two groups. We assign 80% of the observations to the "training" dataset ($n=104,596$), while the remaining 20% are assigned to the "test" data ($n=26,148$). We next fit the logistic equation modeled above on the larger training dataset to estimate the model parameters. We can then apply these parameters to the smaller "test" dataset to predict each observation in the test data's third grade reading proficiency. The idea here is to assess

² For a recent example, see Conradi Smith, K., Amendum, S. J., & Jang, B. G. (2020). Predicting performance on a 3rd grade high-stakes reading assessment. *Reading & Writing Quarterly*, 36(4), 365–378.

<https://doi.org/10.1080/10573569.2019.1649612>

³ VDOE defines economic disadvantage as any student who meets one of the following conditions: (1) is eligible for Free/Reduced Meals, (2) receives TANF, (3) is eligible for Medicaid, or (4) is identified as a migrant or experiencing homelessness.

the performance of our model when applied to previously unseen data to ensure that the model is generalizable and not “overfit.”

With these outcomes estimated in the test data, we can compare the predicted outcomes to the actual third grade proficiency of students in the held-out test datasets. This exercise reveals that our model predicts students’ reading proficiency with 72% accuracy. This figure is roughly commensurate with the accuracy of recent work which aims to predict third grade reading outcomes using data from a kindergarten screener.⁴

Predicting Reading Outcomes

To estimate the increase in the proportion of students likely to fall below proficiency on the SOL in third grade from the 2020 cohort, we apply the results from the model above to the 2018, 2019, and 2020 cohorts. The general approach is to compare the proportion of students we would expect to fall below proficiency in a “typical” year (i.e., 2018 and 2019) and the proportion that we expect to fall below proficiency from the 2020 cohort whose kindergarten PALS scores were influenced by the COVID pandemic.

To do so, we use the results from the model fitting procedure using the training data outlined above to predict whether each child in the 2018, 2019, and 2020 cohort will reach proficiency standards on the SOL. To do so, we calculate the probability that students in each cohort from 2018 to 2020 will reach proficiency based on the logistic regression model parameters estimated from the training dataset. Students with a 50% or greater probability of reaching proficiency are predicted to be proficient in third grade while those with a less than 50% probability of reaching proficiency are predicted to be not proficient. With these predictions, we can calculate the overall proportion of students in each of these recent cohorts who we would expect to fall below proficiency standards. There are a several important considerations to keep in mind regarding this approach:

First, the relationship that we estimate from our logistic model is based only on the subset of kindergarten students who remain in our sample long enough to take an SOL. Many students in these historic data drop out of the sample between kindergarten and third grade because they move out of Virginia, move into a private school, or otherwise do not take an SOL. Similarly, many students in the 2018, 2019, and 2020 cohorts of kindergarteners will also not ultimately take the SOL. We have no way of knowing which students from these more recent cohorts will ultimately take the SOL, and so we make projections based on all students who take a kindergarten PALS assessment. Assuming that the general characteristics of students leaving Virginia public schools prior to third grade do not differ considerably from year to year, the relative differences we project across different cohorts of kindergartners should be relatively unaffected by this attrition.

⁴ Harding, J. F., Herrmann, M. A., Hanno, E. S., & Ross, C. (2019). Using Kindergarten Entry Assessments to Measure Whether Philadelphia’s Students Are On-Track for Reading Proficiently. In *Regional Educational Laboratory Mid-Atlantic*. Regional Educational Laboratory Mid-Atlantic. <https://eric.ed.gov/?id=ED599402>

Second, the projections we make below are based on the relationship between PALS scores and third grade SOL results from cohorts of kindergarteners who did not have their early elementary school experiences disrupted by COVID-19. This means that the predictions we make here assume that the relationships between the variables included in our model (e.g., the relationship between students' PALS scores at kindergarten entry and their third grade proficiency) remain constant. Of course, we have good reason to believe that the disruptions caused by COVID-19 have considerably changed the relationship between kindergarten scores and third grade results for students in the 2018-2020 cohorts and that certain subgroups will be differentially impacted by these disruptions. In this respect, the results we present here might be framed as a best-case-scenario in which students learn at the same rate between kindergarten and third grade as they did prior to COVID.

Third, the projections we make for the 2020 cohort also reflect differences in the PALS-taking population of children in 2020 relative to 2018 and 2019. We know, for example, that children in the 2020 cohort were more likely to be EL than children in prior cohorts. If EL children are less likely to reach proficiency in third grade than non-EL children, our model will project a slightly larger proportion of children to reach proficiency than in years past based on this change in the demographics of our sample alone. If a large number of non-EL children were to re-enter Virginia public schools after kindergarten but before third grade such that the composition of the 2020 cohort more closely resembled that of prior cohorts, the estimate we present here could slightly overstate the increase in children projected to fall below proficiency in third grade.

Last, we acknowledge that many students in the 2020 cohort of kindergarteners took the PALS assessment remotely rather than in-person. Our analysis treats results from the in-person and remote PALS equivalently. Preliminary analyses suggests that we have no reason to suspect that the assessment performed differently when administered remotely, and so we feel comfortable making projections based on the remote assessment.

Results

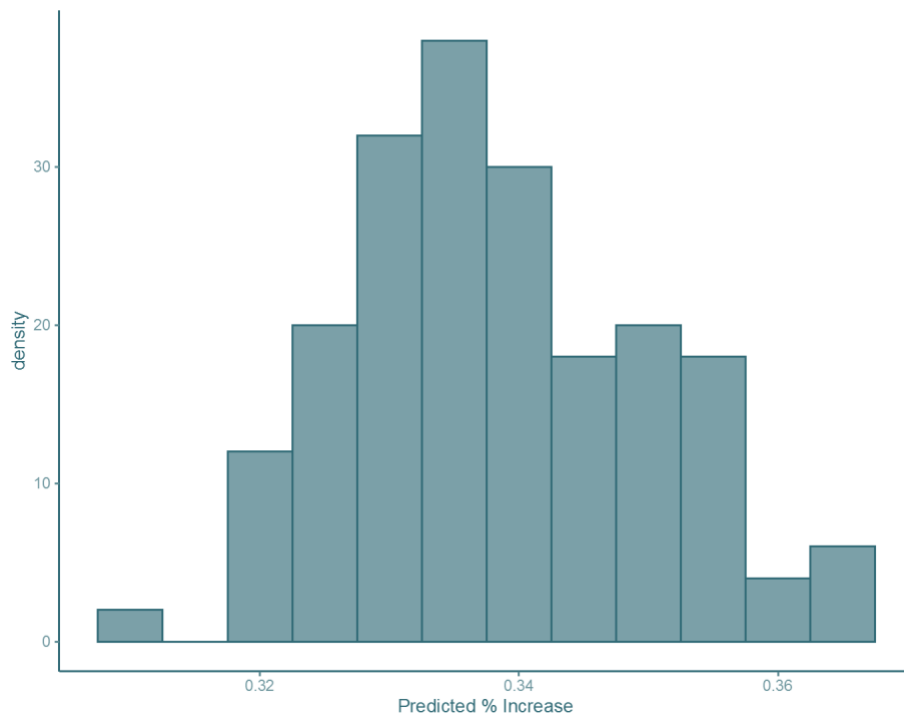
With these caveats in mind, we now compare the proportion of students that we would predict to fall below proficiency standards on their third grade SOL based on their kindergarten PALS results from a typical year (2018 and 2019) to projections for the 2020 cohort whose kindergarten scores reflected the impact of the COVID pandemic.

Based on our fitted model, we would predict that around 30% of students in the 2018 and 2019 cohorts of kindergarten to fall below proficiency standards in third grade (under "normal" circumstances). Extending this same model to the 2020 cohort of kindergartens, the proportion of students we predict to fall below proficiency in third grade increases to 40%.

This represents a troubling ten percentage point or 34% increase in the proportion of students that are predicted to fall below proficiency on their third grade reading exam relative to the baseline absent intensive interventions. Running this same analysis many times on random

subsamples of the data (called “bootstrapping” in statistical parlance) confirms that we would expect between a 32% and 36% increase in the proportion of students falling below proficiency relative to what would have been expected in prior years (with the caveats listed above in mind). Figure C1 below displays the distribution of these bootstrapped predictions.

Figure C1: Distribution of Bootstrapped Predictions of the Percent Increase in Students Falling Below Proficiency on the Third Grade SOL



Although logistic regressions are widely used to make predictions like those we make here, there are a multitude of other techniques we could use to make our projections. To test whether these predictions would be similar if we employed more flexible (but more complex and opaquer) predictive modeling techniques, we made a separate set of predictions using a machine learning technique called “random forests.” The random forest was implemented using the “rf” function in R with the number of predictors included in each “tree” of the forest determined through a five-fold cross-validation procedure. The results of this analysis suggest a similar (though slightly smaller) increase in the proportion of students predicted to fall below proficiency status (33%).