COVID-19, Early Care and Education, and Child Development

Elizabeth U. Cascio*
Dartmouth College and National Bureau of Economic Research

October 2021

Abstract

This paper explores the consequences of the COVID-19 pandemic for child development in the United States by way of changes in participation in center-based child care and preschool, or early care and education (ECE). The pandemic appears to have reduced ECE enrollment and exacerbated existing inequalities in ECE participation. However, these effects have varied in timing across demographic groups and in intensity across states. The unique set of forces driving the participation declines – as well as pandemic impacts on ECE quality in addition to quantity – also suggest care in generalizing from pre-pandemic research findings when contemplating the impacts for child development. Prior research is still helpful, however, and it offers frameworks for understanding the drivers of more localized ECE effects and their implications. I conclude with thoughts on the long-standing challenges in ECE that were brought into sharp relief by the pandemic.

* Department of Economics, Dartmouth College, 6106 Rockefeller Center, Hanover, NH 03755-6106. I thank Ashwini Narayanan for excellent research assistance.

1. Introduction

Infants and toddlers today have essentially never known a world without COVID-19; for slightly older children, that world may seem a distant memory. Pandemic-induced closures of schools and child care centers have attracted media and academic attention, but these discussions often quickly return to the implications for parents, rather than for the children themselves. This is especially the case for children under the age of 5. Unlike elementary and secondary education, the care of infants and toddlers simply cannot be delivered remotely or in some hybrid format; the same might also be said for preschool-aged children, even though it has certainly been tried over the course of the pandemic. Young children simply require adult supervision.

This paper concerns how the COVID-19 pandemic may be affecting child development, focusing on potential impacts by way of changes in participation in center-based child care and preschool – what I refer to collectively as early care and education (ECE). Center closures, state regulations affecting capacity, and rising costs from staffing shortages and implementation of safety measures have made ECE out of reach for many families over the past 18 months. At the same time, unemployment, labor market departures to care for school-age children, and safety considerations have also lowered ECE demand. The situation was already fraught: Despite the importance of the earliest years for brain development, the U.S. ECE landscape has historically been characterized by low subsidization and low enrollment rates by international standards and large participation gaps by race, ethnicity, and socioeconomic status (SES) (Cascio, 2021).

A recent comprehensive review of many state and local studies and several smaller-scale national surveys suggests that the pandemic may have exacerbated some gaps in ECE participation (Weiland, et al., 2021). A distinction of this paper is that I rely on large-scale data consistent in their collection across the U.S. These are not the person-level data typically used to estimate ECE enrollment rates, which are not yet available for 2020. Rather, I analyze census tract-level data from the recently released U.S. Database of Childcare Closures during COVID-19 (Lee and Parolin, 2021a). Merging these data to information on pre-pandemic tract population characteristics, I investigate whether small areas with more young children in several demographics experienced larger declines in visits to ECE providers.

The data suggest that the pandemic reduced ECE enrollment and exacerbated existing inequalities in ECE participation. Reductions in visits to ECE providers were particularly pronounced at the start of the pandemic but continued through at least the summer of this year and have been felt most acutely by Latino and Black children. However, these effects have varied in timing across demographic groups and in intensity across states, suggesting they owe to no single driving force. The unique set of forces driving participation declines – as well as pandemic impacts on ECE quality in addition to quantity – also suggest care in drawing inferences about their impacts on child development from pre-pandemic research findings.

Yet, the research base offers frameworks for decisionmakers to understand state and local ECE effects and their implications for child development. These are standard economic and statistical frameworks that structure how economists think about ECE in theory and using data. In addition to describing these frameworks, I conclude with thoughts about the long-standing challenges in ECE that were brought into sharp relief by the pandemic.

2. An Economic Framework

Whether a child participates in ECE is a parental choice. It is at once a consumption decision, about improving a family's well-being in the short term, and an investment decision, about improving a child's well-being over the longer term. Purchasing ECE can improve a family's well-being today because it provides child care; by freeing up the parent who would have been the primary caregiver – typically the mother – to participate in the labor market, family income can rise, expanding the family's scope to purchase other goods and services. ECE is an investment because it yields returns in the future by strengthening the foundation on which later investments in the child's human capital will build.

Families may vary in how much they value these additional consumption possibilities and the child's later life well-being. But variation in parental decisions about ECE participation, at least in the U.S., has historically stemmed more from the costs of accessing ECE in relation to family income. Anticipated out-of-pocket payments to ECE providers are typically not zero and indeed can be quite high. The nearest ECE center may also be far from home, further raising the costs of participation. A mother's potential earnings could well be below these costs combined, in which case paying for ECE would require additional sources of income and be solely about the future return. And other sources of income – earnings of a partner, transfer income – might not be enough both to pay for ECE and still put a roof over a family's head and food on the table. Even if they were sufficient to do so, families may still choose informal or parental care to free up this income for other uses.

In the absence of government intervention, ECE prices would be determined in a marketplace by supply – the marginal willingness of providers to operate – and demand – the marginal willingness of families to pay. Public policies can shift the supply curve, potentially lowering the ECE price (in the case of provider-side subsidization) or raising it (in the case of regulations that raise operating costs), and individual families must always take the resultant price of ECE as given. In the discussion to follow, I therefore consider price – and costs of accessing ECE more generally – to be "supply-side" factors. Remaining factors affecting ECE demand – maternal wage offers, other income, preferences – will be "demand-side" factors.[1]

The next two sections use this economic framework as scaffolding for understanding levels and racial, ethnic, and SES-based gaps in ECE participation both in the immediate pre-pandemic period and during the pandemic itself. Before the onset of COVID-19, the story was largely a supply-side one, as the price of ECE was high relative to income for most families given the modesty of government intervention. Patterns of ECE participation reflect this: overall participation rates were typically higher among children from better-resourced families. The pandemic then lowered ECE participation by affecting both supply (i.e., by increasing operating costs, making it difficult to stay open at a given price) and demand (e.g., by reducing incomes or changing preferences). The effects on a given demographic group thus depend on factors like pre-existing profit margins of ECE providers in areas where it resides and the economic

[1] A separate choice problem concerns the government's decision to intervene in this market. The overriding justification for intervention is the liquidity constraint that families face in making ECE participation decisions for their children. There is a "market failure" because there is a missing market: it is not possible for families to borrow against the future to finance ECE today (Cascio, 2017; U.S. Department of the Treasury, 2021).

incidence of the pandemic for and risk tolerance of that group. The anticipation is that more disadvantaged populations have been more affected, exacerbating existing participation inequalities, and this is indeed what the evidence suggests.

3. The Pre-Pandemic Norm

3.1 Supply-side factors

Even though kindergarten is free for families and offered essentially universally by school districts across the U.S.,[2] ECE is effectively a luxury that most American families cannot afford. Unlike other high-income countries, the U.S. relies heavily on private providers and offers little in the way of government subsidies to offset the costs of private ECE. The subsidies that do exist are also a hodgepodge, varying in their goals (human capital development versus child care or work support), the initiating level of government (federal, state, local), and the ages of children eligible and served. There is thus no ECE or child care "system" in the U.S., but rather a set of largely uncoordinated and potentially duplicative government programs that are still small in the aggregate, relative to both other government programs and spending on ECE elsewhere in the developed world.

Table 1 outlines the major subsidy programs, giving total expenditures and estimated percentages of the child population participating (if available) or of families with age-eligible children, as of the most recently reported pre-pandemic program year.[3] Most extensive are programs delivered directly by state or local government (or by private providers under government contract), which focus on the development of preschool-aged children – Head Start, a federal-local matching grant program dating to the mid-1960s targeting disadvantaged children, and state pre-kindergarten (pre-K) programs, which vary in their eligibility requirements.[4] Still, aggregate enrollment shares in age-eligible populations are low, not exceeding 34% (the state-funded pre-K enrollment rate of 4-year-olds). By contrast, there is only one voucher program, which is means-tested and prioritizes care over education – subsidies through the Child Care and Development Fund (CCDF). Favorable tax treatment of private child care expenditures is even more limited by comparison and offers little in the way of benefits for lower-income families.[5]

---

[2] Public schools are "free" in the sense that families do not need to pay tuition for their children to attend. Yet, families do make financial contributions to local public schools through local property tax payments (which can be capitalized into rents for those who do not own homes) and state income (and sometimes sales) tax payments. An important distinction is that families will pay these taxes across their entire lifetimes, thus spreading out the costs of educating their children. This is how public education has solved the liquidity constraint problem that plagues ECE: through school finance, families are able to borrow against the future to finance their children's education.

[3] This table is an updated version of Table 1 in Cascio (2017).

[4] Some pre-K programs are means-tested or otherwise target disadvantaged populations, like Head Start. Others are universal, in principle available to all children who meet age-eligibility requirements where they are offered (Friedman-Krauss, et al., 2021; Cascio, 2020).

[5] Expenses are only reimbursed *ex post*. Historically, the Child and Dependent Care Tax Credit (CDCTC) was non-refundable, meaning that any difference between the credit and a tax filing unit's federal tax liability could not take the form of an income transfer. (See Cascio (2017) and Maag (2013).) However, the 2021 CDCTC is refundable under provisions of the American Rescue Plan Act of 2021.

Table 1. Major ECEC Programs, by Child Age:
Most Recent Available Pre-Pandemic Year

	Spending[a] (billions of $2020)	% of Child Pop. Served, by Age						% Fams. w/ Kids Served	Eligibility
		0	1	2	3	4	0 to 4		
Direct provision									
State Pre-K	10.50		0.18		6.3	33.8	8.4	-	Varies by state
Head Start	9.95	1.4	1.8	2.4	7.6	12.0	5.1	-	≤ 130% FPL
Tax and subsidy policy									
CCDF Child care Subsidies	10.61	1.8	3.6	4.6	4.9	4.8	4.0	3.5	Varies by state; no more than 85% SMI
CDCTC	3.29	-	-	-	-	-	-	23.7	Earned income>0[c,d]
Dependent Care FSAs[b]	1.24	-	-	-	-	-	-	6.7	Employer must offer[d]

Sources: State-funded pre-K: Friedman-Krauss et al. (2021). Head Start: *https://eclkc.ohs.acf.hhs.gov/about-us/article/head-start-program-facts-fiscal-year-2019*. CCDF Child Care Subsidies: *https://www.acf.hhs.gov/occ/fact-sheet/characteristics-families-served-child-care-and-development-fund-ccdf-based*. CDCTC and Dependent Care FSAs: *https://home.treasury.gov/system/files/131/Estimated-Benefit-fr-CDCTC-and-FSA-for-2020-01142020.pdf*. Population by single year of age: *https://www.census.gov/newsroom/press-kids/2020/population-estimates-detailed.html.* Number of families with children under age 12: *https://www.census.gov/data/tables/2020/demo/families/cps-2020.html*.
Notes: - =not available, FPL=federal poverty level, SMI=state median income, CDCTC=Child and Dependent Care Tax Credit, FSA=Flexible Spending Account. Figures for the CDCTC and Dependent Care FSAs correspond to the 2020 tax year, figures for state-funded pre-K correspond to the 2019-20 academic year, and figures for Head Start and the CCDF correspond to the 2019 fiscal year. Monetary values are inflated to 2020 dollars using the CPI-U. Program-specific enrollment numbers by age were normalized by Census Bureau estimates of population for July 1, 2019, and the number of family beneficiaries was normalized by Census Bureau estimates of the number of families with children under the age of 12. a These are outlays by the federal government (in the case of Head Start, the CDCTC, and dependent care FSAs), by federal and state government (in the case of CCDF child care subsidies), and by state governments (in the case of state-funded pre-K). b Also known as the "child care exclusion" or the "employment exclusion." c For a married couple to be eligible to be able to claim the CDCTC, both parents must be working or looking for work or one parent must be working or looking for work if the other is attending school full time. d Beneficiaries in practice have positive tax liability. This has changed for the 2021 tax year for the CDCTC because the American Rescue Plan Act of 2021 expanded the CDCTC and made it refundable.

At the same time as there has historically been little subsidization of ECE participation in the U.S., the price of ECE is high. Even though workers in this sector are often lucky to earn more than the minimum wage, hiring enough staff to ensure adequate staff-to-child ratios and meeting other state licensing requirements – not to mention providing a stimulating and nurturing environment – can make for hefty full-time, full-year sticker prices, just for a provider to stay afloat. As of 2019, the estimated average cost of full-time, full-year care was $16,500 per

child not yet eligible for kindergarten.[6] To put this figure in perspective, also in 2019, an estimated 34.5% (63.5%) of the population under age 18 lived in a family where such a price tag would have accounted for at least 30% (15%) of family income (Fox, 2020).[7] As a result, the child care expenditures the average family incurs in practice are lower, as they substitute toward less expensive family day care or informal care or use ECE less intensively.

Aside from high sticker prices where they operate, ECE providers are also absent in many communities, adding further to the costs of accessing ECE. Approximately 51% of young children live in neighborhoods the Center for American Progress (CAP) has classified as "child care deserts" – census tracts (areas with populations between 2,500 and 8,000) with at least 50 children under age 5 where the ratio of children to child care slots is 3-to-1 or above (Malik and Hamm, 2017; Malik et al., 2018).[8] I come to a similar conclusion based on the data I will use to analyze ECE participation during the pandemic, which include counts of ECE centers by census tract in the months right before the pandemic began (see Section 4). In these data, the average child under 5 in January 2020 resided in a census tract with 0.62 ECE providers – or an estimated 33 to 34 ECE slots – for every 100 children ages 0 to 4.[9]

3.2 Pre-pandemic ECE enrollment

Against this backdrop, it should not be surprising that U.S. enrollment rates in ECE have historically been not just low by international standards but also pulled down the most by populations with lower ability to pay. Among the Organisation for Economic Co-operation and Development (OECD) countries, the U.S. ranks second to last (to Turkey) in the share of 4-year-olds enrolled in pre-primary education (public and private combined), at 64% (Cascio, 2021). ECE participation rates of younger children in the U.S. are lower still. According to the School Enrollment Supplements of the October Current Population Survey (CPS), an authoritative source on school enrollment of the U.S. population ages 3 and over, only 39% of 3-year-olds were enrolled in a public or private preschool or nursery school over 2015 to 2019 (Flood et al., 2020). Calculations from the 2019 Early Childhood Program Participation (ECPP) survey yield an ECE participation rate for 1- to 2-year-olds of approximately 26%.[10]

---

[6] Using the 2019 Early Childhood Program Participation (ECPP) survey, Cui and Natzke (2021) report an average hourly cost of $8.22 for center-based care for children ages 0 to 5 (and not enrolled in kindergarten). Assuming 2000 hours of care a year (40 hours a week for 50 weeks) yields an average annual cost of full-time care of $16,440.

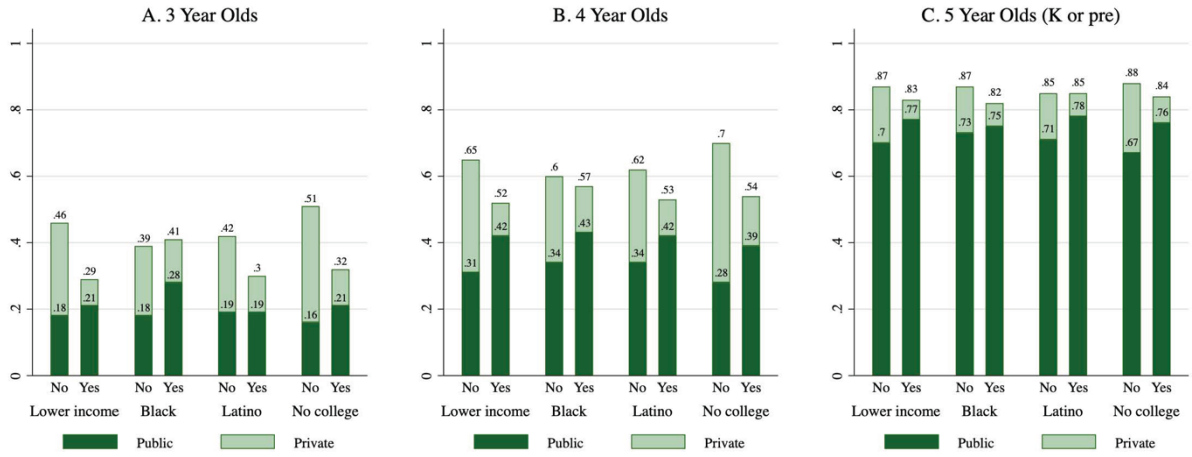
[7] In 2019, 34.5% (63.5%) of the population under age 18 lived in families with incomes below 200% (400%) of the federal poverty level (FPL). In 2019, the FPL for a two-adult, two-child family was $25,926 (Fox, 2020).

[8] CAP has recently updated their methodology for identifying child care deserts so as not to be dependent on census tract boundaries (Malik et al., 2020), taking up the distance-based approach of Davis, Lee, and Sojourner (2019). This paper compares to the original tract-based measure due to current constraints on available data that track changes in use of child care centers during the pandemic.

[9] Population estimates are from the 2015 to 2019 American Community Survey (ACS) (Manson et al., 2021). This calculation assumes that the average ECE provider serves 54 children, as reported in the 2012 National Survey of Early Care and Education (National Survey of Early Care and Education Project Team, 2014).

[10] I arrive at the 26% figure by multiplying the share of 1- to 2-year-olds participating in at least one weekly nonparental care arrangement (0.55) by the share of those children participating in center-based care (0.47). The comparable figure for 3- to 5-year-olds not in kindergarten is 61% (=0.74 x 0.83) (Cui and Natzke, 2021).

Figure 1. ECE Enrollment Rates by Age and Characteristic, 2015-19



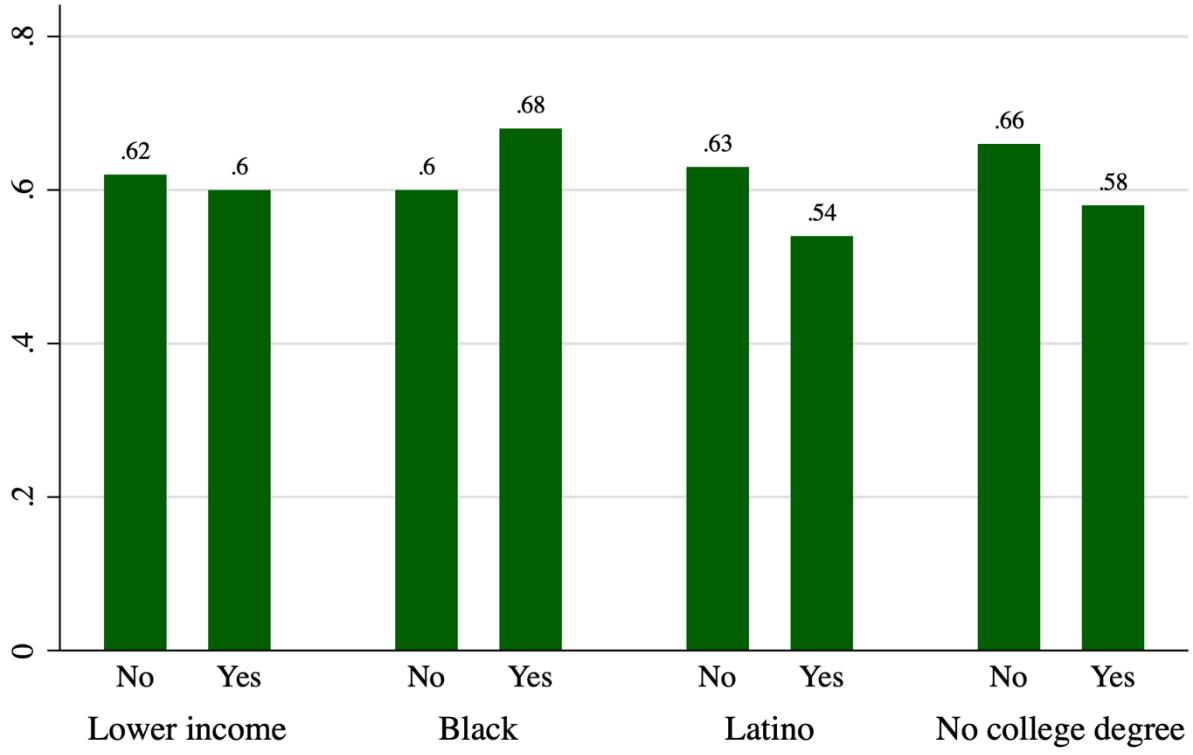
Source: Public use microdata samples from the October Current Population Survey School Enrollment Supplement for 2015-2019 (Flood et al., 2020).
Notes: Author's calculations weighting by final sampling weights and limiting sample to 3-to 5-year-old children residing in the 50 states or Washington, D.C. for whom age and school enrollment are not allocated. Children are defined as lower income if reported annual family income is below $50,000 (roughly 200% of the FPL for this period). Children are coded as having parents with no college degree if all parents present in the household do not have at least a 2-year college degree.

The first two panels of Figure 1 show pre-pandemic ECE enrollment gaps for 3- and 4-year-olds, based on data from the 2015 to 2019 October CPS School Enrollment Supplements. The last panel presents the same statistics for the combined kindergarten/preschool enrollment rate of 5-year-olds, most but not all of whom would have been eligible to attend kindergarten.[11] Children from lower-income families, defined here as having a family income below $50,000 (or roughly 200% of FPL over this period), have lower ECE enrollment rates than their higher-income counterparts. Public enrollment rates, which would include public pre-K and Head Start (Table 1), favor lower-income children, but not by enough to overcome the 20-plus percentage point differences in private enrollment rates. Similar patterns also arise by whether a child is Latino and whether parents have at least a 2-year college degree. These rates and patterns have been roughly stable over the past two decades (Figure A1) and appear as well in the ECPP and other survey data (Cui and Natzke, 2021).[12] By contrast, gaps in combined preschool/ kindergarten enrollment rates across groups of 5-year-olds are smaller, even if private enrollment remains more common among groups with more means.

An important distinction between most 5-year-olds and younger children, as noted above, is that public schooling is free and universal for children who reach age 5 by some state or locally specified date (e.g., September 1). In other words, public schools are available in communities across the country, accessible by school bus even if distant from a child's home, and free once a child is eligible by age. This raises the question: To what extent does the

[11] I focus on combined preschool/kindergarten enrollment rates for 5-year-olds because in states or school districts that require entering kindergartners to be 5 by sometime earlier than October – which is true in most states today (Friedman-Krauss et al., 2021) – some 5-year-olds in October would not be old enough for kindergarten.
[12] There are also gaps in the quality of ECE experienced conditional on enrollment (Flood, et al., 2021).

Figure 2. Mean ECE Centers per 100 Children Under Age 5 in Census Tract by Tract Population Characteristic, January 2020



Sources: Number of ECE centers by census tract in January 2020: U.S. Database of Childcare Closures during COVID-19 (Lee and Parolin, 2021a). Census tract population of children under age 5 and shares of overall tract population with specific characteristics: 2015-19 ACS tabulations, compiled and distributed by NHGIS (Manson et al., 2021)
Notes: Author's calculations. Census tracts that do not appear in the U.S. Database of Childcare Closures during COVID-19 (Lee and Parolin, 2021a) are assumed to have zero ECE centers. Figures reported are weighted means of the number of ECE Centers per 100 children under age 5 in a census tract, where the weights are estimated populations of children under the age of 5 in each category. Category-specific populations are estimated by multiplying the population of children under age 5 in the tract by the share of the overall tract population in each category. The share of the overall tract population that is lower income is the share with family income below 200% FPL. The share of the overall tract population that has no college degree is the share of adults aged 25 and over without at least a 2-year college degree.

variation in preschool enrollment rates of 3- and 4-year-olds across groups in Figure 1 reflect not just a high price of the private ECE that exists in a community, but a lack of local ECE supply – public or private – altogether?

Malik et al. (2018) find that child care deserts are more common in census tracts that are lower-income or have more Latino children. Figure 2 shows the average number of ECE centers in a census tract in January 2020 (from the data described in Section 4) per 100 children under age 5, weighted by estimated tract populations of children under age 5 with certain characteristics (from the 2015-2019 American Community Survey (ACS) (Manson et al. (2021)). These tract population estimates are potentially noisy because they are based on sample data and because detailed tabulations of ethnic, racial, and other characteristics in narrow age groups are not

available for census tracts and so must be estimated.[13] Yet the pattern of means by characteristic in Figure 2 is qualitatively like that in Figure 1, suggesting that highly localized measures of supply do relate to enrollment. There are fewer ECE centers per capita not just in tracts where I estimate there to be more lower income children (income below 200% FPL) and more Latino children, but also in tracts with more children whose parents do not have college degrees (including 2-year degrees). However, this pattern does not appear for Black children, where there is also less of a difference in ECE participation (Figure 1).

3.3 Demand-side factors as revealed by kindergarten enrollment

The pre-pandemic norm in the U.S. was thus one of low ECE enrollment rates overall and lower ECE enrollment rates for many disadvantaged groups. Supply-side factors – limited direct public provision, high anticipated out-of-pocket expenditures on private ECE, potentially long distances to the nearest provider – arguably play an important role in these patterns, taking the income distribution of families with children as given. But other demand-side factors could also be important. This is suggested by the fact that enrollment rates of 5-year-olds are far from 100% (Figure 1), despite public kindergartens being accessible and free to attend. In most states, children are not legally required to be in school at age 5, so parents can still exercise discretion over their school enrollment, weighing the benefits of starting school on time versus delaying school entry. In a smaller set of states, kindergarten attendance is also not mandatory.

Recent analyses of school enrollment changes during the pandemic have found that public kindergarten enrollment fell significantly during the 2020-21 academic year, even for public schools that continued to operate in person (Dee et al., 2021; Musaddiq, et al. 2021). The exact causes of this decline are unclear. However, the finding implies that some parents of potential kindergartners perceived the benefits of in-person school during 2020-21 – short and longer term – to be lower than the benefits of waiting, especially with the promise of a normal start to the 2021-22 school year. And 2020-21 was far from normal: a variety of safeguards were recommended to prevent the spread of COVID-19 – masking, strict cohorting (i.e., limited to no cross-classroom interactions even within grade), and so on – and parents may have been concerned about safety risks in in-person interactions. The short-term costs of delaying school enrollment may have also declined, since the primary caregivers of more potential kindergartners would have been at home, either due to job loss, labor market exit, or remote work arrangements. Either way, public schools are likely to face challenges going forward due to an unusually large kindergarten cohort this year and/or a lack of school readiness among this year's first graders.

4. COVID-19 Shocks to ECE Participation

Despite the many reports of how hard the ECE sector was hit by the pandemic, we do not know how the pandemic has affected ECE enrollment on a large scale. At the time of writing, 2020 versions of the large-scale microdata that have historically informed our understanding of

[13] I estimate the population of children under 5 in a specific demographic by multiplying the overall population of children under 5 in the tract by the share of the overall tract population in that demographic. (Both figures are from the 2015-2019 ACS (Manson et al. 2021).) Differences are much more muted using county level data (Figure A2).

ECE enrollment has not yet been released to the public. These data include not just the October CPS, but also the ACS.[14]

To explore patterns of ECE participation during the pandemic, I instead rely on a recently released database giving changes in visits to ECE providers by month, relative to the same month in 2019, since January 2020 (Lee and Parolin, 2021a). While the database does not provide changes in visits to individual, geolocated providers, it comes close by providing statistics on changes in visits to small sets of providers within census tracts. Given differences in the demographics of these small geographic areas, I can therefore estimate group differences in exposure to changes in visits to ECE providers, similarly to how I estimated group differences in levels of exposure to ECE providers in January 2020 in Figure 2.

4.1 Data Sources and Key Variables

The U.S. Database of Childcare Closures during COVID-19 (Lee and Parolin, 2021a) is derived from monthly anonymized data on visits to nearly 6.5 million locations across the U.S. by around 40 million cell phone users, collected and distributed by SafeGraph.[15] Categorizing locations by their online descriptions in map applications and websites, SafeGraph has classified over 85,000 locations under NAICS (North American Industry Classification System) code 62441 ("Child Day Care Services") – what I refer to here as ECE providers or ECE centers. This NAICS code is broad, including much of what would typically be considered ECE: child care/day care centers, Head Start and pre-K programs that operate outside of schools, and preschools/nursery schools. However, it does not include Head Start and pre-K programs operating *within* public schools, which would also be considered ECE.[16] Some states rely more heavily than others on public schools to deliver pre-K (Friedman-Krauss, et al., 2021), so this this is a limitation of the analysis to follow.

Lee and Parolin (2021a) provide four monthly ECE visitor statistics at the census tract level from January 2020 forward, all expressed as changes relative to the same month in 2019. The first is the average (percentage point) change in the number of ECE visitors to centers within a tract. While this variable is technically an average, it is close to what is happening for individual providers: for roughly a quarter of all census tracts – and 37% of tracts with any ECE providers – there was only one ECE provider in January 2020, and 78% of tracts with any ECE providers at baseline had no more than three. This information is helpful for understanding the final three visitor statistics in the database – the fractions of centers in a tract experiencing declines in visitor numbers (relative to the same month in 2019) of at least 25, 50, and 75 percentage points. For tracts with only one provider, these are essentially indicator variables for visitor declines at or above various thresholds.

---

[14] Recent release histories suggest the 2020 ACS will not be available until December 2021, and the 2020 October CPS will not be available until February 2022. A benefit of the ACS is that it is a larger dataset. A drawback is that households are interviewed throughout the year and that timing is not disclosed in public-use data, making it more difficult than in the October CPS to know the grade for which a child is eligible.

[15] The data are at https://osf.io/k3t98/. I use data through June 2021, several months after Lee and Parolin (2021b).

[16] For a list of index entries for NAICS code 62441, see https://classcodes.com/lookup/naics-code-624410/. This could be one reason why the number of ECE providers included, at roughly 85,000, is less than the total number of centers reported in other data (i.e., 117,327 ECE centers, according to the U.S. Department of Health and Human Services (2020)). ECE centers must also have an online presence, at least in a mapping application, to be included.

In the analysis below, I create two alternative variables from these three: the share of centers in a tract experiencing declines in visitors of between 25 and 50 percentage points (where pandemic visits are between 50 and 75% of pre-pandemic levels) and the share of centers experiencing visitor declines of between 50 and 75 percentage points (where pandemic visits are between 25 and 50% of pre-pandemic levels). The share of centers experiencing declines in visits of 75 percentage points or greater is thus equivalent to the share with pandemic visits at or below 25% of pre-pandemic levels. Because they are less sensitive to outliers, these variables will be my preferred outcome measures.

There are several caveats on these measures, two of which were pointed out by Lee and Parolin (2021b). First, because visits in the SafeGraph data are derived from cell phone geolocation, cell phones must physically enter ECE centers to be counted as visits. If families scaled back cell phone plans during the pandemic or if pick-up and drop-off locations for ECE providers moved (e.g., to a nearby outdoor location), recorded declines in visits would overstate actual declines in participation. Second, when calculated from tract level data, group exposure to visitor declines will be mismeasured to the extent that families in the group enroll their children in ECE centers outside of the census tract in which they reside.

Two other caveats on the data are relevant for this analysis. First, visitor declines above some threshold, such as 50%, do not necessarily indicate "center closure," despite the database title. There were real ECE closures in the earliest months of the pandemic: a 2020 government audit found half or more of ECE centers closed at least temporarily in 28 states (including Washington, D.C.), and 42 states saw closures for at least a quarter of providers (U.S. Department of Health and Human Services, 2020). Demand-side forces certainly contributed to these closures as the massive layoffs at the start of the pandemic and stay-at-home orders would have reduced both families' financial capacity and need for child care. Indeed, all states except one (Rhode Island) allowed ECE centers to remain open – for the children of essential workers if not all children – and many still closed (U.S. Department of Health and Human Services, 2020).

This is not to say that supply-side factors were unimportant or have not become more important as the pandemic has worn on. In fact, supply-side factors may be key to explaining why providers may be extremely scaled back but not closed. States introduced a variety of safety guidelines to ensure the safety of teachers, caregivers, and children with continued operation. These guidelines, as described in U.S. Department of Health and Human Services (2020), often involved physical distancing, potentially requiring lower child-to-staff ratios in a fixed built environment. ECE providers may be operating "at capacity," but that capacity is limited. Capacity may also be limited in effect by difficulty in finding staff willing to work under these conditions at low wages.

Second, exposure to changes in *visits* to ECE providers is not the same thing as a change in ECE *participation*. That is, just because a particular demographic group is more concentrated in tracts that experienced relatively large reductions in visits to ECE providers does not mean that demographic itself experienced the decline. A compounding factor is that the demographic measures at the tract level are noisy, as already noted. When ECE enrollment measures are available, it will therefore be important to revisit the patterns described below to the extent possible. Still, the database allows for calculation of more granular statistics than possible with

survey data. With monthly data, for example, I can detect demographic variation in the amount of exposure to reduced ECE enrollment that would be obscured in annual enrollment snapshots. And given the geographic coverage of the database, I can explore racial, ethnic, and SES gaps in exposure to ECE visit declines within individual states, which provides useful information for policymakers but is not possible to calculate with precision using survey data.[17]

4.2 Overall Trends in ECE Visits During the Pandemic

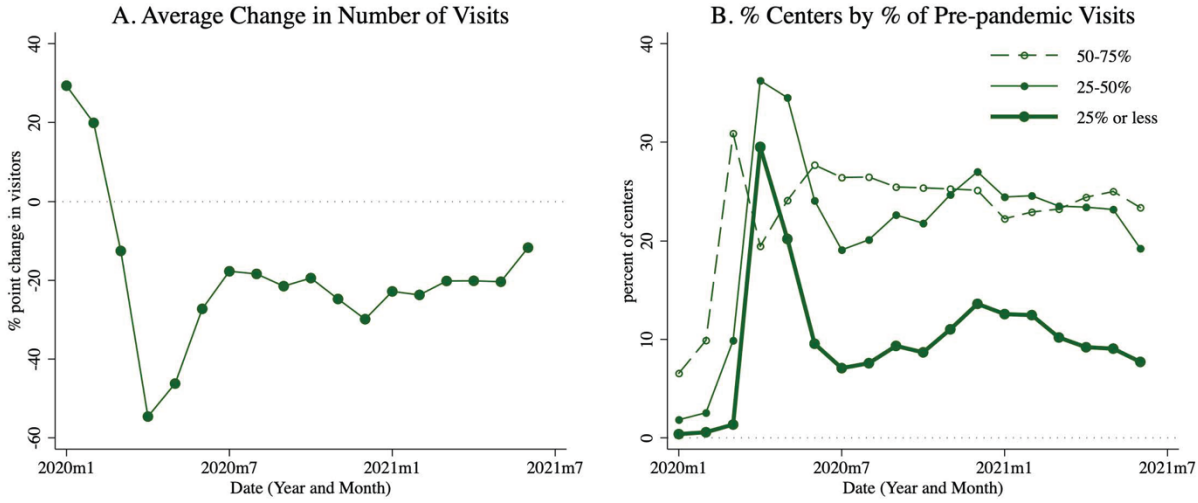
Figure 3 Panel A shows trends in the first measure – the (average) percentage change in the number of visitors to the ECE provider(s) in a census tract. So that the figures represent the average young child's experience, I give more weight to visitor changes in tracts with higher pre-pandemic populations of children under age 5. The figure exhibits the familiar V-shaped pattern seen in other high-frequency data on economic activity during the early months of the pandemic (e.g., Chetty et al., 2020; Albanesi and Kim, 2021): ECE providers experienced sharp declines in the number of visits between March and April 2020, then converged to a new steady state between May and July before dipping again (albeit not as dramatically) during the winter 2020 COVID-19 surge. In addition, children continued to be affected as late as June 2021, the most recent month with data reported; at that time, visits to ECE providers remained on average more than 10 percentage points below their June 2019 levels.

Exposure to declines in ECE visits in certain ranges mirror these patterns, as shown in Figure 3 Panel B. In April 2020, the average child under 5 lived in a tract where 66% of ECE centers were operating at 50% or less of their April 2019 capacity, if capacity is indeed captured by the number of visitors. That is, at the peak of visitor declines in these data (where these figures are most positive), well over half of ECE providers appear to have been providing services to half or less of their clientele one year prior. By the summer of 2020, around 30% of ECE centers remained similarly scaled back. As noted, visitor declines at this time could well indicate real center closures (U.S. Department of Health and Human Services, 2020).[18] But fast forward to June 2021, and ECE providers still did not have the same number of visitors they did in June 2019: only about half of ECE providers in the average child's tract had visits at or above 75% of pre-pandemic levels, 27% of providers continued to have visits down by 50% or more, and nearly 8% of ECE providers remained extremely impacted, with visits at or below 25% of their June 2019 level. It thus appears that use of ECE centers remains lower than it was in 2019.

Again, "visits" to ECE providers are not equivalent to ECE participation. Even if they were, there is not enough information in ECE participation or enrollment data alone to know the relative weight to give to supply- versus demand-side factors. Regardless, the June 2021 figures look improved relative to those for January through May of this year, providing some hint of a move toward normalcy. At that time, the outlook was starting to seem rosier: there was hope that vaccination rates would continue to rise, new case rates and death rates were declining, and the Delta variant had not yet begun to spread. As more months of data become available, we will

[17] It is not possible to consider gaps in ECE participation at the state level in the (still quite useful and informative) small-scale national surveys of ECE participation during the pandemic (e.g., Barnett, Jung, and Nores, 2020).
[18] Consistent with closures, child care employment follows a similar pattern, as documented by the Center for the Study of Child Care Employment: *https://cscce.berkeley.edu/child-care-sector-jobs-bls-analysis/*.

Figure 3. Change in Visits to ECE Centers During COVID-19
Relative to Same Month in 2019, Tract Level Data



Sources: Statistics on the change in visits to ECE centers by census tract: U.S. Database of Childcare Closures during COVID-19 (Lee and Parolin, 2021a). Population of children under age 5 and shares of overall population with specific characteristics: 2015-19 ACS tabulations compiled and distributed by NHGIS (Manson et al., 2021).
Notes: Author's calculations. Figures reported are weighted means at the national level of variables in the tract-level data, where the weight is the 2015-19 ACS estimate of the tract population under age 5.

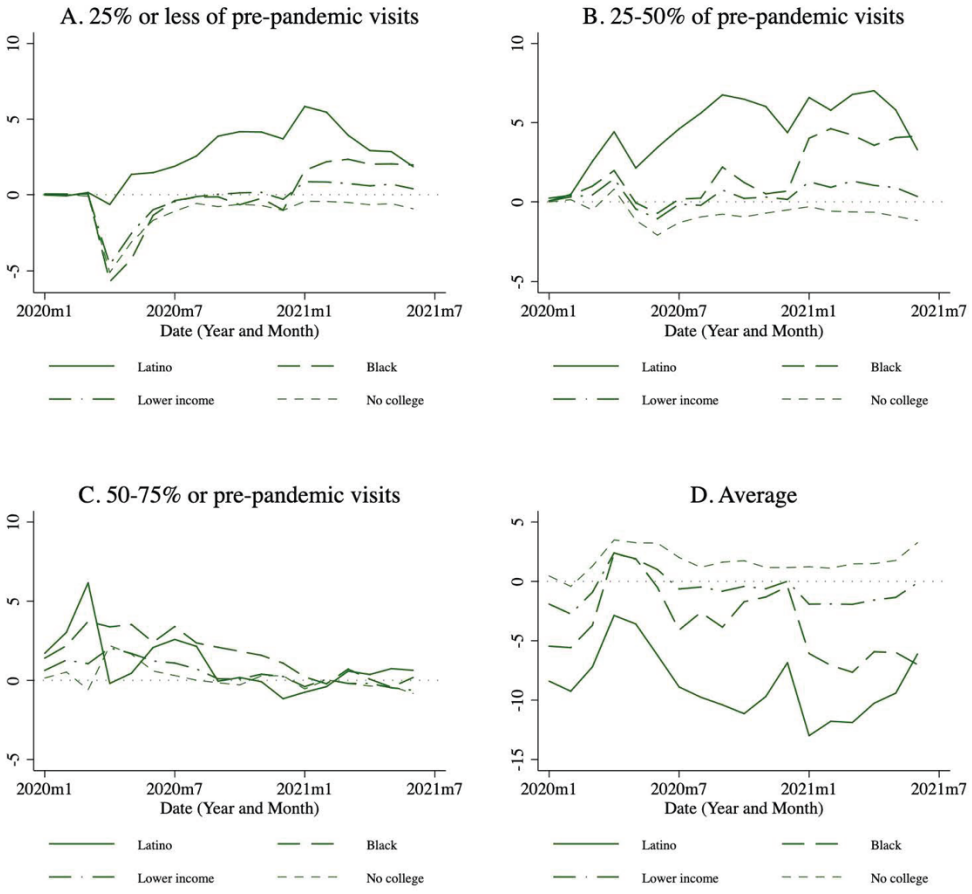
be able to assess whether this apparent move back toward pre-pandemic levels of ECE participation continued.

4.3 National Variation by Demographic

Figure 4 Panel A presents estimated national trends in SES, racial, and ethnic gaps in exposure to extreme declines in visits to ECE providers relative to pre-pandemic levels (visits at 25% or less of pre-pandemic levels). To arrive at these gaps, I recalculated the relevant series in Figure 3 Panel B twice, weighting first by the population of a group of interest (e.g., children in families with incomes below 200% FPL), then by the remainder of the population (e.g., children in families with incomes at or above 200% FPL) (see Figure A3). Figure 4 Panel A then gives the difference these weighted averages across the two groups, month by month.[19] To continue with the example, a gap in exposure for lower-income children (dash and dot line) emerged in April 2020 but was initially more favorable to lower-income children. That is, lower-income children were *less* exposed to center closures during the early months of the pandemic, making this gap negative. This is consistent with reports that Head Start centers, which target lower-

[19] Figure A4 does the same but based on county level data. Estimates of county populations of Black and Latino children under age 5 as of 2019 are available, as are 2015-19 ACS estimates of the share of families in a county with children under age 5 with family incomes at or below the FPL. A drawback is that distance to centers does matter for ECE participation (Davis, Lee, and Sojourner, 2019), and so centers per capita at the county level is a blunter measure of the centers to which any given child would be exposed. Accordingly, while the patterns shown in Figure A4 are qualitatively similar to those shown in Figure 4, the exposure gaps across groups are smaller in magnitude.

Figure 4. Gaps in Exposure to Declines in ECE Visitors
Relative to Same Month in 2019, Tract Level Data



Sources: See Figure 3 sources.
Notes: Author's calculations. Figures reported are differences in weighted means at the national level of variables in the tract-level data. The first mean is weighted by the population in that demographic, estimated from the tract population under age 5 and the share of the overall tract population in that demographic in 2015-19. The second mean is weighted by the estimated population not in that demographic, calculated analogously. For the differences plotted in Panel A, these weighted means are plotted in Figure A3.

income children (Table 1), were more likely to remain open than private ECE providers at the start of the pandemic (Weiland et al., 2021), After a period of relative parity in exposure over the remainder of 2020, however, lower-income children became more exposed to significant declines in visits to ECE providers during 2021.

The remaining lines in Figure 4 Panel A correspond to other demographic differences – by ethnicity (Latino children, solid line), by race (Black children, long dash line), and by parental

education (no college degree, short dash line).[20] Like lower-income children, Black children and children from families with less-educated parents were less exposed to center closures in the first months of the pandemic. But there was an increase in the relative exposure of Black children to extreme declines in ECE visits at the start of 2021. By June 2021, the Black/non-Black gap in exposure was in fact the largest of all groups considered. Nevertheless, the census tracts in which Latino children under 5 reside appear to have been hit relatively hard by extreme declines in ECE visits throughout the pandemic: the Latino/non-Latino gap is positive – meaning more exposure of Latino children to ECE visitor declines – for all months from May 2020 forward.

The remaining panels of Figure 4 show the same series for the three other measures considered in Figure 3. A similar pattern emerges for visits in the 25 to 50% range of pre-pandemic levels (Panel B): Latino children are relatively more exposed throughout the pandemic, and a substantial gap for Black children emerges in 2021. On the other hand, all groups under consideration were relatively more exposed to visitor levels in the 50 to 75% range of pre-pandemic levels in the early days of the pandemic; by June 2021, however, there are essentially no gaps in exposure to ECE visitor declines at this level (Panel C). Gaps in the average declines in ECE visitors to which different groups were exposed (Panel D) reflect these observations, with the large impacts on Latino children throughout the pandemic and an emergent impact on Black children this year.

4.4 State Variation by Demographic

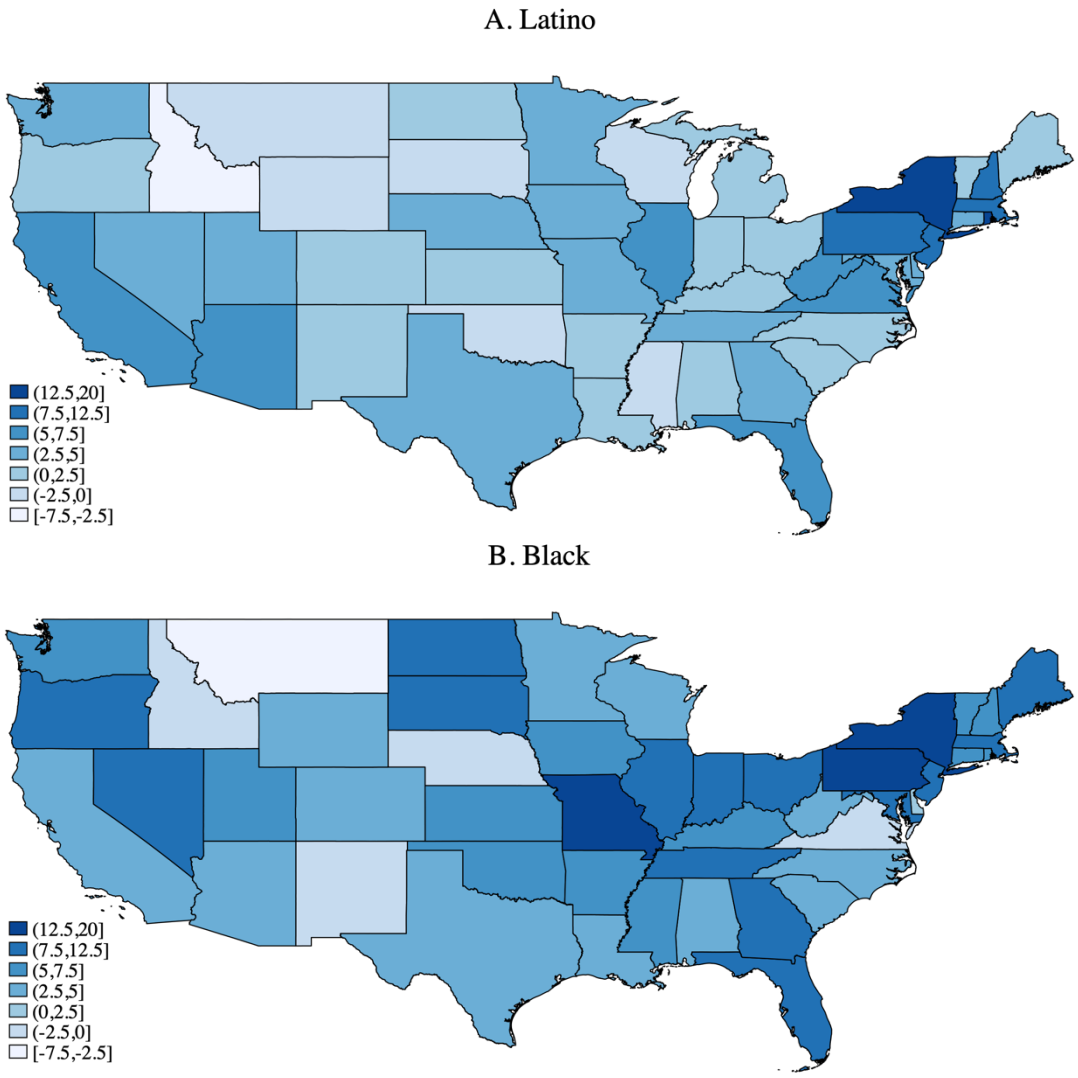
As the pandemic has lingered, the incidence of ECE impacts thus appears to have shifted toward groups that had relatively low ECE enrollment rates beforehand (such as lower-income children) and groups disadvantaged in later educational experiences (such as Black children). And Latino children appear to have been relatively exposed to ECE center closures throughout the pandemic. However, these impacts were not necessarily evenly felt across the country. The circumstances faced by given demographic – the fragility of existing private ECE, access to public ECE, the economic shocks of the pandemic, and so on – may have differed across locations in ways that affect how much inequality has risen these past 18 months.

Figure 5 illustrates the geographic distribution of the four gaps in exposure to declines in ECE visits – for Latino children (Panel A), Black children (Panel B), lower-income children (Panel C), and children whose parents are not college educated (Panel D). To construct state-level gaps, I limit attention to the six months of tract-level data from 2021 and focus on the share of centers with 50% or fewer visitors relative to the same months in 2019. Then, instead of calculating group differences in exposure at the *national* level month by month (as in Figure 4), I calculate group differences in exposure at the *state* level across the first six months of 2021 combined. Throughout, the scale remains constant; thus, the typically darker shading in the first two maps reflects the earlier findings that Latino and Black children have been the most negatively impacted nationally this year.

[20] Lee and Parolin (2021b) perform a similar exercise but using more dated tract-level characteristics and without visualizing the differences across groups in the same way as I do here. They also do not show state heterogeneity.

Figure 5. Gaps in Exposure to Declines in ECE Visitors, by State

1st Half of 2021 Relative to 1st Half of 2019, Tract Level Data

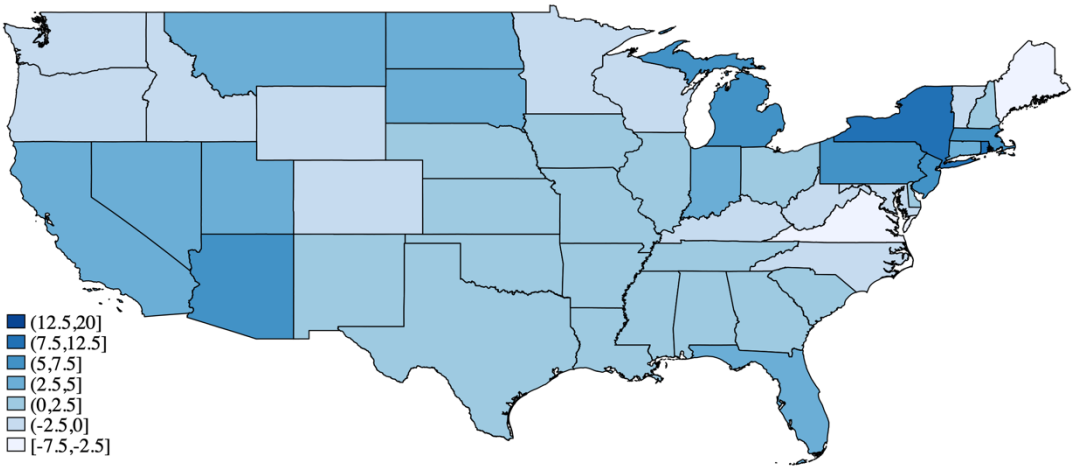


Sources: See Figure 3 sources.
Notes: Author's calculations. Figures reported are differences in weighted means at the state level of variables in the tract-level data. The first mean is weighted by the population in that demographic, estimated from the tract population under age 5 and the share of the overall tract population in that demographic in 2015-19. The second mean is weighted by the estimated population not in that demographic, calculated analogously. Means are taken across January through June of 2021.

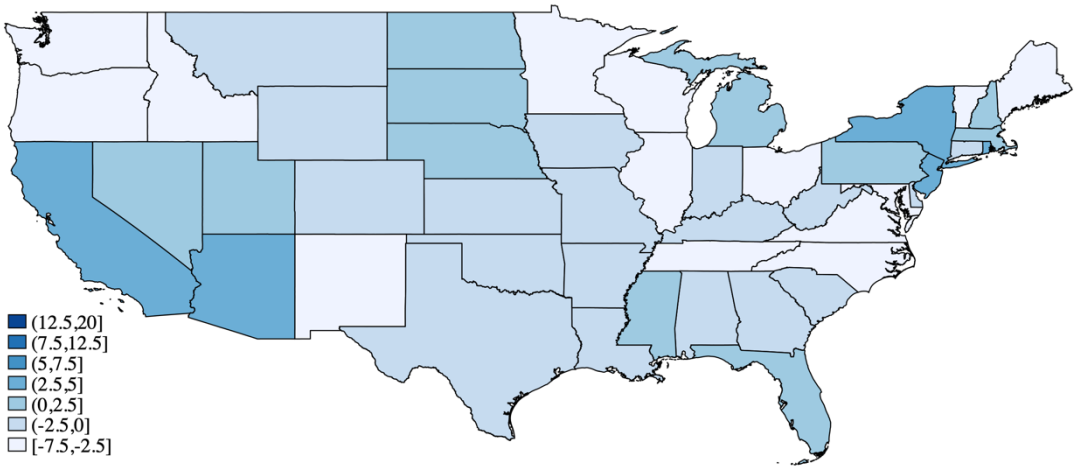
For each of the four gaps, the maps show a great deal of heterogeneity across states, with some states experiencing little to no increases (or even decreases) in ECE inequality, and other states experiencing quite large increases. Some of correlation coefficients between the gaps in

Figure 5. Gaps in Exposure to Declines in ECE Visitors, by State (cont'd)
1st Half of 2021 Relative to 1st Half of 2019, Tract Level Data

C. Lower Income



D. No College



Sources: See Figure 3 sources.
Notes: Author's calculations. Figures reported are differences in weighted means at the state level of variables in the tract-level data. The first mean is weighted by the population in that demographic, estimated from the tract population under age 5 and the share of the overall tract population in that demographic in 2015-19. The second mean is weighted by the estimated population not in that demographic, calculated analogously. Means are taken across January through June of 2021.

the state-level data are also not particularly high. Correspondingly, while some states, like New York, do stand out as experiencing relatively large increases in ECE inequality on multiple dimensions, others exhibit much larger increases in inequality only for one demographic. Other states in the Northeast – Pennsylvania especially, but also New Jersey, Rhode Island, and Massachusetts – exhibit a similar albeit less extreme pattern as New York. Yet other states rank

highly on inequality on one dimension only, like Indiana, Missouri, Ohio, and Tennessee (Black/non-Black) and Virginia and West Virginia (Latino/non-Latino).

These findings suggest that no single factor has driven increases in ECE inequality during the pandemic, and that local economic conditions – both broadly and in the ECE sector – matter. It is beyond the scope of this paper to explore the factors on a state-by-state basis, but the economic framework used throughout provides a useful way to organize our thoughts about these differences. On the supply side, important considerations might include thinner operating margins for private ECE centers and/or a lack of public ECE options in the neighborhoods in which populations of color reside, especially in situations where these populations are highly residentially segregated. On the demand side, the pandemic is known to have disproportionately affected low wage workers (e.g., Chetty et al., 2020), so the ECE effects for a given demographic will likely reflect its economic stature in a particular place. Mothers who also had elementary-age children (especially those with lower levels of education) were more likely to have been drawn out of the labor force over past year and a half (Heggeness, 2020; Goldin, 2021), as there is no ready child care backup for public schools. School closures affecting a given demographic group therefore likely matter as well. Finally, preferences for ECE participation under pandemic conditions matter, too, and could vary across locations.

Knowledge of the factors that have driven the ECE participation declines is critical for understanding which types of interventions may lift participation as we emerge from the pandemic. For example, if these declines have come largely from cost increases and/or reductions in family income, finding ways to lower costs – either by subsidizing ECE providers or families – may be relatively helpful in boosting participation going forward. If, however, they have been driven by voluntary withdrawals from ECE centers, subsidies may be less useful. More important in this case may be delivering improvements in quality that encourage participation.

5. What are Implications for Children?

5.1 Previous Research Findings

There is a large literature on the impacts of child development (rather than child care) focused ECE in the U.S., much of it relying on other, pre-pandemic shocks to a family's ECE choice problem as a source of variation in ECE participation.[21] These shocks include differences across otherwise similar children in ECE eligibility – largely for public programs – that stem from program eligibility rules tied to age or income.[22] They also include expansions in the supply of public ECE programs, like Head Start, which generate differences in ECE access

[21] A challenge is to isolate the effects of ECE participation from the effects of other participant characteristics that might affect child well-being. This can be done with an experiment, where the researcher assigns ECE participation randomly, or using policy variation, which can generate "as good as random" variation in ECE participation.
[22] For example, a series of studies compare children who "just barely make" versus "just barely miss" eligibility for pre-K, given their birthday and the date by which enter pre-kindergartners must be 4 years old (e.g., Gormley and Gayer, 2005; Weiland and Yoshikawa, 2013; Cascio, 2021). Children who "just barely miss" eligibility one year are eligible for pre-K the next, so a limitation of this approach is the inability to examine longer-term outcomes.

across families with similar ECE demand.[23] This literature, recently reviewed in Cascio (2021), has typically found that ECE participants start school stronger academically (first type of studies) and attain more education, are more likely to work and less likely to receive public assistance or engage in crime, and have higher earnings as adults (second type of studies). Likewise, a recent study taking advantage of admissions lotteries for Boston's pre-K program in the late 1990s found that pre-K attendance boosted high school graduation and college-going (Gray-Lobe, Pathak, and Walters, 2021).

Such findings suggest substantial private (to the child) and societal losses from declines in ECE participation of disadvantaged children during the pandemic. However, we should be cautious in generalization. One reason is that these studies focus on public ECE programs that target child development, but such programs appear to have been relatively robust, at least during the early stages of the pandemic (Weiland et al., 2021). ECE enrollment losses have arguably come at least in part from the private sector and from programs where the primary goal is to provide child care. Convincing studies of the developmental impacts of child care in the U.S. are sparser and the findings not as positive, especially for disadvantaged children.[24],[25] Given that disadvantaged children already experience lower-quality ECE (Flood et al., 2021), these studies thus suggest that the losses to children – from the decline in ECE enrollment during the pandemic, not due to the pandemic *per se* – may not be as extreme as feared. Still, it is difficult to know without data on the pre-pandemic quality of centers that scaled back the most.

In addition, ECE quality was directly affected by the pandemic as well,[26] and has thus not been held constant as parents have made decisions about ECE participation. This is another reason to be cautious in generalizing from existing findings: whereas the drivers of participation variation in the literature have typically been changes in ECE costs across families with similar demand for ECE services of fixed quality, pandemic-induced variation in ECE participation has come not just from cost shocks, but also demand shocks owing to ECE quality downgrades, even in centers where ensuring quality was already a struggle. It is possible that some children who did not participate in ECE during the pandemic could have been made better off by this choice.

An additional implication is that, even for children who continued to participate in ECE, that experience may have been less beneficial than it would have been in the absence of the pandemic. In other words, the development of children who remained in ECE – not just those who exited – was arguably negatively affected by the pandemic, too. It is therefore useful to shift the focus toward trying to understand the effects of the pandemic for all children, not just those ECE participation changed as a result.

---

[23] Recent studies have used variation from the establishment of Head Start centers to estimate the longer-term effects of Head Start (e.g., Thompson, 2018; Johnson and Jackson, 2019; Barr and Gibbs, 2019; Bailey, Sun, and Timpe, 2020; Anders, Barr, and Smith, 2020). See Cascio (2021) for a description of these research findings.

[24] CCDF child care subsidies may lower test performance of children with single mothers, at least in the short term, possibly due to poor quality of the centers accepting these subsidies (Herbst and Tekin, 2010, 2016).

[25] A similar empirical regularity appears in the literature outside of the U.S.: ECE with a child development orientation tends to deliver more positive outcomes for children than ECE with a child care orientation. See Cascio (2015) for a discussion of universal ECE in an international context.

[26] Even if group sizes were smaller, other pandemic operating guidelines for ECE centers may have reduced the amount and quality of time that caregivers and children spent together (see Weiland et al (2021)).

5.2 An Empirical Framework

Even if existing research findings are challenging to generalize to the pandemic, the underlying framework that economists have used to rationalize these and other empirical findings is useful for conceptualizing the effects of the pandemic for all children. In brief, ECE is beneficial for children when it substitutes for lower-quality (e.g., home-based) care, and the gains from ECE are larger the bigger the gap in quality between the ECE program and the "counterfactual," or what it substitutes for.[27] By targeting disadvantaged children with relatively high-quality care, many public ECE programs, like Head Start, can generate large benefits for children. On the other hand, child care programs may be lower quality – even lower quality than what they substitute for – at least along dimensions that matter for child development. By the same token, reductions in the quality of programs available to a given group also lower the benefits of enrollment.

The broad message is that how children spent their time matters for their development. And the pandemic shocked how children spent their time: even for children whose ECE participation status did not change, the quality of the care that they received – in ECE or at home or in an informal care setting – may have changed. The aggregate effect of the pandemic on child development can in fact be decomposed into an effect experienced by all children regardless of ECE participation, an effect due to reduced benefits from ECE participation, and an effect due to reduced ECE participation.[28] The relative importance of each individual effect for the aggregate will depend on not just how much ECE participation declined – which I attempted to estimate above – but also on how much the quality of both ECE and the alternative changed as a result of the pandemic. These quality changes can vary across demographic groups and locations and would be valuable information for decisionmakers to gather to predict impacts of the pandemic on child development.

Understanding the implications of pandemic for child development, and the role of ECE therein, is thus complex. Just like the enrollment declines themselves, these implications depend on local circumstances, this time those that govern the quality of the time that young children spend with adults. A robust recovery for ECE may therefore involve not only facilitating participation in ways that respect the causes of the participation declines, but also supporting ECE providers in delivering higher-quality services.

6. Looking Forward

This paper has used recently released, high-frequency data to estimate how ECE participation was affected during the pandemic and attempted think through the implications for child development. There is a state of the world where declines in ECE participation will not have large negative ramifications for child development, even if the pandemic itself is damaging

[27] These ideas are articulated in Cascio and Schanzenbach (2014). This is a straightforward application of the Rubin Causal Model (Holland, 1986): Treatment effects depend fundamentally on "potential outcomes" – the counterfactual – not just the treatment itself.

[28] To see this, let $\bar{Y}_t$ be the average value of some developmental outcome for young children in period *t*, and $\bar{P}_t$ be the ECE participation rate at time *t*. Suppose further that $\bar{Y}_t = \beta_{0t} + \beta_{1t}\bar{P}_t$. Then the change in average outcomes due to the pandemic is given by $\bar{Y}_{post} - \bar{Y}_{pre} = (\beta_{0post} - \beta_{0pre}) + (\beta_{1post} - \beta_{1pre})\bar{P}_{post} + \beta_{1pre}(\bar{P}_{post} - \bar{P}_{pre})$.

to all children. But this is arguably due to failings of the existing ECE "system," not because high-quality ECE is not itself a worthwhile investment. Existing research certainly suggests that it is. However, the center-based child care settings experienced by many disadvantaged children, even before the pandemic (Flood et al., 2021), were not conducive to child development, despite the best intentions of caregivers who are poorly paid and may lack adequate training. And the pandemic has made it even harder for ECE providers to deliver high-quality services.

The American Rescue Plan Act (ARPA) of 2021 included $39 billion to shore up the child care sector (e.g., by supporting providers in offering higher wages to workers) and to support families in accessing ECE in the short-term (e.g., by lowering out-of-pocket costs). This is a substantial investment – indeed more than annual government spending on ECE prior to the pandemic (Table 1) – and so presents an opportunity that would have otherwise been absent. I have attempted to provide some guidance on how use of these funds might be optimized by giving decisionmakers frameworks for understanding the drivers of local participation declines and their implications for children.

But ARPA funds are about COVID-19 relief, not moving ECE – and the economy – beyond where it was before the pandemic. The past 18 months have truly laid bare the long-standing challenges in ECE – severe inequalities in access, razor-thin operating margins, and a care and education workforce at the bottom of the earnings distribution. At the same time, however, it has put into perhaps even sharper relief the value of providing access to high-quality care and education. School closures and remote learning have driven some mothers of school-aged children out of the workforce (Heggeness, 2020), stalling the economic recovery. If the gains from time spent in kindergarten (Fitzpatrick, Grissmer, and Hastedt, 2011) and universal preschool (Cascio 2020) are any indication, the short-term learning losses from children not being in school are also likely to be substantial. And models suggest that school-aged children's learning may have been affected in ways that could have lasting impacts for an entire generation (Fuchs-Schündeln et al., 2020; Agostinelli et al., 2020).

Thus, an alternative –and policy relevant – question is: What gains to the economy – now and into the future – are left behind by not investing in 4-year-olds (and younger children) the way in which we invest in 5-year-olds (and older children)? The Biden Administration's American Families Plan included $200 billion in funding for ECE, and so could present an opportunity to start funding ECE on the same basis with public education. For political reasons, however, various funding streams under that plan – including that for ECE – have become folded into a Budget Reconciliation bill that is currently stalled in Congress. Should this bill pass in some form, my hope is that this paper has outlined issues that may have not otherwise considered in the discretionary allocation of these funds.

7. References

Agostinelli, Francesco, Matthias Doepke, Giuseppe Sorrenti, and Fabrizio Zilibotti. 2020. "When the Great Equalizer Shuts Down: Schools, Peers, and Parents in Pandemic Times." NBER Working Paper 28264. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w28264

Albanesi, Stefania and Jiyeon Kim. 2021. "Effects of the COVID-19 Recession on the US Labor Market: Occupation, Family, and Gender." *The Journal of Economic Perspectives* 35(3): 3-24. https://doi.org/10.1257/jep.35.3.3

Anders, John, Andrew Barr, and Alex Smith. 2019. "The Effect of Early Childhood Education on Adult Criminality: Evidence from the 1960s through the 1990s." Mimeo. http://people.tamu.edu/~abarr/main2d_12_9_2019.pdf

Bailey, M.J., Sun, S., Timpe, B., 2020. "Prep School for Poor Kids: The Long-Run Impacts of Head Start on Human Capital and Economic Self-Sufficiency." NBER Working Paper 28268. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w28268

Barnett, W. Steven, Kwanghee Jung, and Milagros Nores. 2020. *Young children's home learning and preschool participation experiences during the pandemic. NIEER 2020 Preschool Learning Activities Survey: Technical report and selected findings.* New Brunswick, NJ: National Institute for Early Education Research. Research. https://nieer.org/wp-content/uploads/2020/11/NIEER_Tech_Rpt_July2020_Young_Childrens_Home_Learning_and_Preschool_Participation_Experiences_During_the_Pandemic-AUG2020.pdf

Barr, Andrew and Chloe R. Gibbs. 2019. "Breaking the Cycle? Intergenerational Effects of an Anti-Poverty Program in Early Childhood." EdWorkingPaper No. 19-141. Providence, RI: Annenberg Institute at Brown University. http://www.edworkingpapers.com/ai19-141

Cascio, Elizabeth U. and Diane Schanzenbach. 2014. "Expanding Preschool Access for Disadvantaged Children." Proposal 1 in *Policies to Address Poverty in America*, eds. Melissa S. Kearney and Benjamin H. Harris. Washington, D.C.: The Hamilton Project, 19-28, June. https://www.brookings.edu/research/expanding-preschool-access-for-disadvantaged-children/

Cascio, Elizabeth U. 2015. "The Promises and Pitfalls of Universal Early Education." *IZA World of Labor* 116. https://wol.iza.org/articles/promises-and-pitfalls-of-universal-early-education

Cascio, Elizabeth U. 2017. "Public Investments in Child care." In *The 51%: Driving Growth through Women's Economic Participation*, eds. Diane Whitmore Schanzenbach and Ryan Nunn. Washington, D.C.: The Hamilton Project, 123-142, October. http://www.hamiltonproject.org/assets/files/public_investments_child_care_cascio.pdf

Cascio, Elizabeth U. 2020. "Does Universal Preschool Hit the Target? Program Access and Preschool Impacts." *Journal of Human Resources*, forthcoming. http://jhr.uwpress.org/content/early/2021/01/04/jhr.58.3.0220-10728R1.abstract

Cascio, Elizabeth U. 2021. "Early Childhood Education in the United States: What, When, Where, Who, How, and Why." NBER Working Paper 28722. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w28722

Chetty, Raj, John N. Friedman, Nathaniel Hendren, Michael Stepner, and the Opportunity Insights Team. 2020. "The Economic Impacts of COVID-19: Evidence from a New Public Database Built Using Private Sector Data." NBER Working Paper 27431. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w27431

Cui, Jaishan, and Luke Natzke. 2021. *Early Childhood Program Participation: 2019*. NCES 2020-075REV. Washington, D.C: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2020075REV

Davis, Elizabeth E., Won F. Lee, and Aaron Sojourner. 2019. "Family-centered measures of access to early care and education," *Early Childhood Research Quarterly* 47 (2) (2019): 472–486. https://www.sciencedirect.com/science/article/pii/S0885200618300851?via=ihub.

Dee, Thomas, Elizabeth Huffaker, Cheryl Phillips, and Eric Sagara. "The Revealed Preferences for School Reopening: Evidence from Public-School Disenrollment." NBER Working Paper 29156. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w29156

Fitzpatrick, Maria D., David Grissmer, and Sarah Hastedt. 2011. "What a difference a day makes: Estimating daily learning gains during kindergarten and first grade using a natural experiment." *Economics of Education Review* 30: 269-279. https://doi.org/10.1016/j.econedurev.2010.09.004

Flood, Sarah, Joel F.S. McMurry, Aaron Sojourner, and Matthew J. Wiswall. "Inequality in Early Care Experienced by U.S. Children." NBER Working Paper 29249. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w29249

Flood, Sarah, Miriam King, Renae Rodgers, Steven Ruggles and J. Robert Warren. 2020. *Integrated Public Use Microdata Series, Current Population Survey: Version 8.0* [dataset]. Minneapolis, MN: IPUMS. https://doi.org/10.18128/D030.V8.0

Fox, Liana. 2020. "The Supplemental Poverty Measure: 2019." *Current Population Reports* P60-272. U.S. Census Bureau, Washington, D.C. https://www.census.gov/library/publications/2020/demo/p60-272.html

Friedman-Krauss, Allison H., W. Steven Barnett, Karin A. Garver, Katherine S. Hodges, G.G. Weisenfeld, and Beth Ann Gardiner. 2021. *The State of Preschool 2020: State Preschool Yearbook*. New Brunswick, NJ: National Institute for Early Education Research. https://nieer.org/wp-content/uploads/2021/08/YB2020_Full_Report_080521.pdf

Fuchs-Schündeln, Nicola, Dirk Krueger, Alexander Ludwig, and Irina Popova. 2020. "The Long-Term Distributional and Welfare Effects of Covid-19 School Closures." NBER Working Paper 27773. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w27773

Goldin, Claudia. 2021. "Assessing Five Statements about the Economic Impact of COVID-19 on Women." White Paper, June. https://www.nber.org/sites/default/files/2021-06/GOLDIN_SEANWhitePaper.pdf

Gormley, William T. and Ted Gayer. 2005. "Promoting School Readiness in Oklahoma: An Evaluation of Tulsa's Pre-K Program." *Journal of Human Resources* 40(3): 533-558. https://doi.org/10.3368/jhr.XL.3.533

Gray-Lobe Guthrie, Parag A. Pathak, and Christopher R. Walters. 2021. "Long-Term Effects of Universal Preschool in Boston." NBER Working Paper 28756. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w28756

Heggeness, Misty L. 2020. "Estimating the Immediate Impact of the COVID-19 Shock on Parental Attachment to the Labor Market and the Double Bind of Mothers." *Review of Economics of the Household* 18: 1053-1078. https://link.springer.com/article/10.1007%2Fs11150-020-09514-x

Herbst, Chris M. and Erdal Tekin. 2010. "Child care subsidies and child development." *Economics of Education Review* 29: 618-638. http://ideas.repec.org/a/eee/ecoedu/v29y2010i4p618-638.html

Herbst, Chris M. and Erdal Tekin. 2016. "The Impact of Child Care Subsidies on Child Well Being: Evidence from Geographic Variation in the Distance to Social Service Agencies." Journal of Policy Analysis and Management 35(1): 94-116. https://doi.org/10.1002/pam.21860

Holland, Paul W. 1986. "Statistics and Causal Inference." *Journal of the American Statistical Association* 81(396): 945-960. https://www.jstor.org/stable/2289064

Johnson, Rucker C. and C. Kirabo Jackson. 2019. "Reducing Inequality through Dynamic Complementarity: Evidence from Head Start and Public School Spending." *American Economic Journal: Economic Policy* 11(4): 310-349. https://doi.org/10.1257/pol.20180510

Lee, Emma K. and Zachary Parolin. 2021a. "The Care Burden During COVID-19: A National Database of Child Care Closures in the United States." OSF Preprints. May 14. osf.io/t5d3q.

Lee, Emma K. and Zachary Parolin. 2021b. "The Care Burden During COVID-19: A National Database of Child Care Closures in the United States." *Socius: Sociological Research for a Dynamic World* 7: 1–10. https://journals.sagepub.com/doi/10.1177/23780231211032028

Maag, Elaine. 2013. "Child Related Benefits in the Federal Income Tax." Perspectives on Low-Income Working Families Brief 27. Washington, D.C.: Urban Institute.

Malik, Rasheed and Katie Hamm. 2017. "Mapping America's Child Care Deserts." Washington, D.C.: Center for American Progress. https://www.americanprogress.org/issues/early-childhood/reports/2017/08/30/437988/mapping-americas-child-care-deserts/

Malik, Rasheed, Katie Hamm, Leila Schochet, Cristina Novoa, Simon Workman, and Steven Jessen-Howard. 2018. "America's Child Care Deserts in 2018." Washington, D.C.: Center for American Progress. https://www.americanprogress.org/issues/early-childhood/reports/2018/12/06/461643/americas-child-care-deserts-2018/

Malik, Rasheed, Won F. Lee, Aaron Sojourner, and Elizabeth E. Davis. 2020a. "Measuring Child Care Supply Using the Enhanced Two-Stage Floating Catchment Area Method." Washington, D.C.: Center for American Progress. at https://cdn.americanprogress.org/content/uploads/2020/06/18081719/Child-Care-Deserts-Methodology.pdf

Malik, Rasheed, Katie Hamm, Won F. Lee, Elizabeth E. Davis, and Aaron Sojourner. 2020b. "The Coronavirus Will Make Child Care Deserts Worse and Exacerbate Inequality." Washington, D.C.: Center for American Progress. https://www.americanprogress.org/issues/early-childhood/reports/2020/06/22/486433/coronavirus-will-make-child-care-deserts-worse-exacerbate-inequality/

Manson, Steven, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. https://doi.org/10.18128/D050.V16.0

Musaddiq, Tareena, Kevin Stange, Andrew Bacher-Hicks, and Joshua Goodman. 2021. "The Pandemic's Effect on Demand for Public Schools, Homeschool, and Private Schools. NBER Working Paper 29262. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w29262

National Survey of Early Care and Education Project Team (2014). *Characteristics of Center-based Early Care and Education Programs: Initial Findings from the National Survey of*

Early Care and Education (NSECE). OPRE Report #2014-73a. Washington DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. https://www.acf.hhs.gov/sites/default/files/documents/opre/characteristics_of_cb_ece_programs_111014.pdf

Thompson, Owen. 2018. "Head start's long-run impact: Evidence from the program's introduction." *Journal of Human Resources*, 53(4), 1100–1139. https://doi.org/10.3368/jhr.53.4.0216-7735R1.

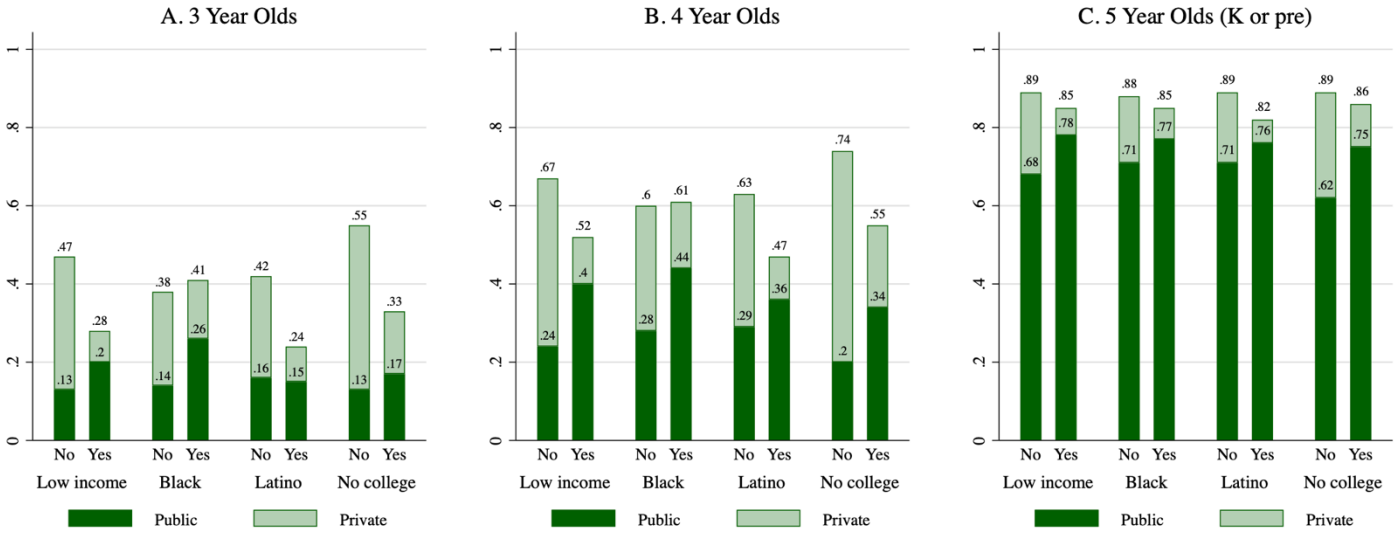
U.S. Department of Health and Human Services. 2020. *National snapshot of state agency approaches to child care during the COVID-19 pandemic*. Report No. A-07-20-06092. Washington, D.C.: U.S. Department of Health and Human Services, Office of Inspector General, Office of Audit Services. https://oig.hhs.gov/oas/reports/region7/72006092.pdf.

U.S. Department of the Treasury. 2021. *The Economics of Child Care Supply in the United States*. Washington, D.C.: U.S. Department of the Treasury. https://home.treasury.gov/system/files/136/The-Economics-of-Child care-Supply-09-14-final.pdf

Weiland, Christina, Erica Greenberg, Daphna Bassok, Anna Markowitz, Paola Guerrero Rosada, Grace Luetmer, Rachel Abenavoli, Celia Gomez, Anna Johnson, Brenda Jones-Harden, Michelle Maier, Meghan McCormick, Pamela Morris, Milagros Nores, Deborah Phillips, and Catherine Snow. 2021. *Historic Crisis, Historic Opportunity: Using Evidence to Mitigate the Effectds of the COVID-19 Crisis on Young Children and Early Care and Education Programs*. Ann Arbor, MI: University of Michigan and Washington, D.C.: Urban Institute. https://edpolicy.umich.edu/files/EPI-UI-Covid%20Synthesis%20Brief%20June%202021.pdf

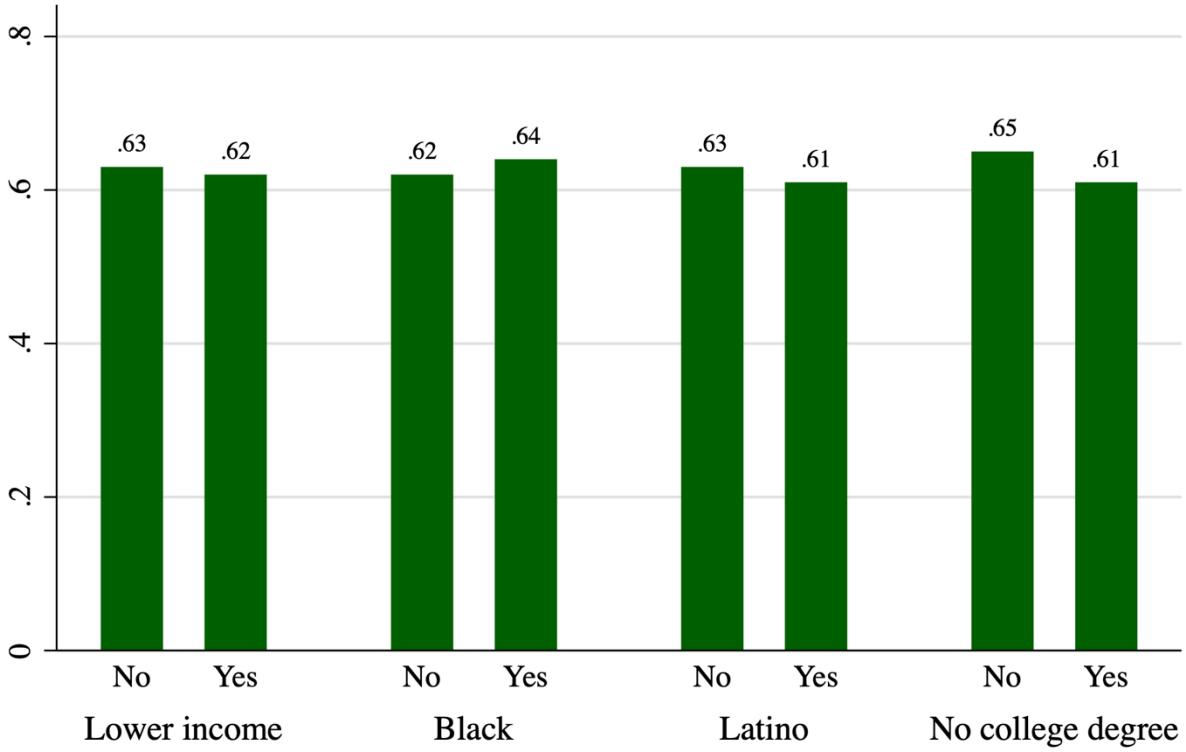
Weiland, Christina and Hirokazu Yoshikawa. 2013. "Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills." *Child Development* 84(6): 2112-2130. https://doi.org/10.1111/cdev.12099

Figure A1. ECE Enrollment Rates by Age and Characteristic, 2000-04



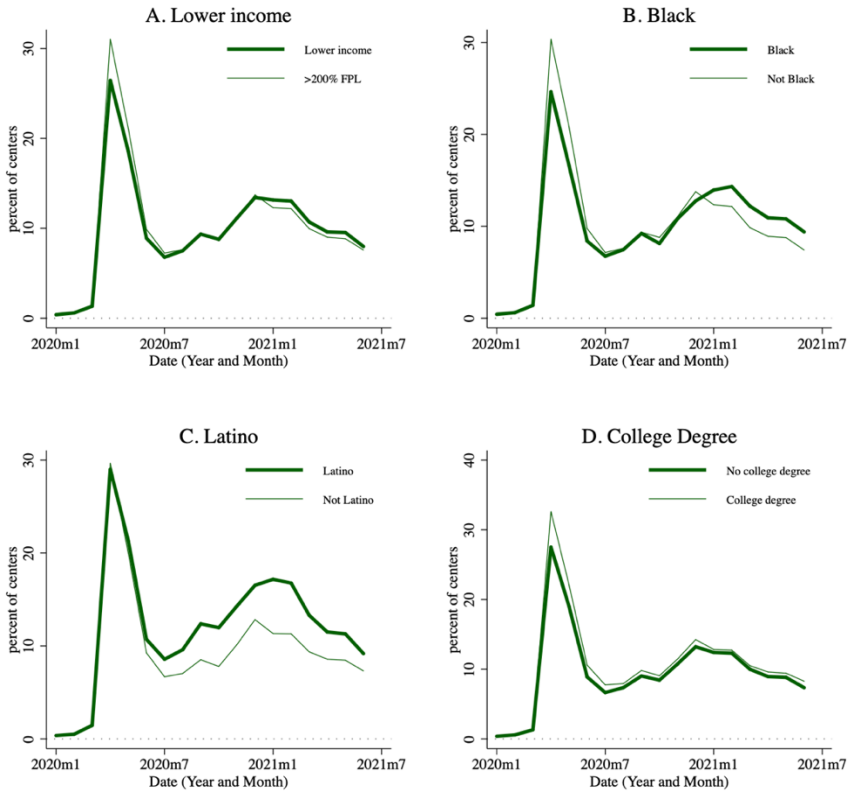
Source: Public use microdata samples from the October Current Population Survey School Enrollment Supplement for 2000-2004 (Flood et al., 2020).
Notes: Author's calculations weighting by final sampling weights and limiting sample to 3-to 5-year-old children residing in the 50 states or Washington, D.C. for whom age and school enrollment are not allocated. Children are defined as lower income if reported annual family income is below $35,000 (roughly 200% of the FPL for this period). Children are coded as having parents with no college degree if all parents present in the household do not have at least a 2-year college degree.

Figure A2. Mean ECE Centers per 100 Children Under Age 5 in County
by County Population Characteristic, January 2020



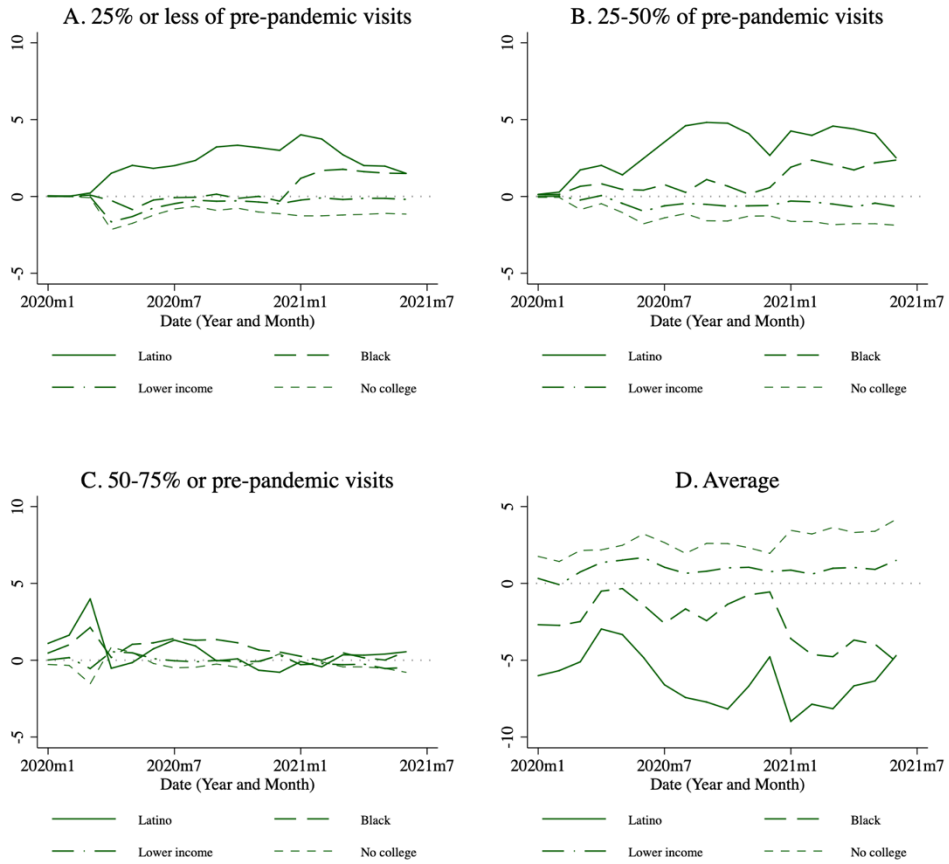
Sources: Number of ECE centers by county in January 2020: U.S. Database of Childcare Closures during COVID-19 (Lee and Parolin, 2021a). Estimated county population of children under age 5 by race and ethnicity as of July 1, 2019: *https://www.census.gov/newsroom/press-kids/2020/population-estimates-detailed.html.* Share of families in county with children under age 5 who also have income below the FPL and share of adults ages 25 and over with at least a two-year college degree: 2015-19 ACS tabulations, compiled and distributed by NHGIS (Manson et al., 2021).
Notes: Author's calculations. Counties that do not appear in the U.S. Database of Childcare Closures during COVID-19 (Lee and Parolin, 2021a) are assumed to have zero ECE centers. Figures reported are weighted means of the number of ECE Centers per 100 children under age 5 in a county, where the weights are (estimated) populations of children under the age of 5 in each category. Category-specific populations are already estimated by race and ethnicity by the Census Bureau and by child poverty (families) in the Census tabulations compiled and distributed by Manson et al. (2021). The share of children in the county whose parents do not have college degrees is approximated by multiplying the population of children under age 5 in the county by the share of the county's adult population with no (2-year or higher) college degree.

Figure A3. % of ECE Centers with Visitors 25% of Less of Pre-Pandemic Levels
Relative to Same Month in 2019, Tract Level Data



Sources: Statistics on the change in visits to ECE centers by census tract: U.S. Database of Childcare Closures during COVID-19 (Lee and Parolin, 2021a). Population of children under age 5 and shares of overall population with specific characteristics: 2015-19 ACS tabulations compiled and distributed by NHGIS (Manson et al., 2021).
Notes: Author's calculations. Figures reported are weighted means at the national level of the share of centers operating at 25% or less of pre-pandemic capacity in the tract-level data. The first set of weighted means (thick line) is weighted by the population in that demographic, estimated from the tract population under age 5 and the share of the overall tract population in that demographic in 2015-19. The second set of weighted means (thin line) is weighted by the estimated population not in that demographic, calculated analogously.

Figure A4. Gaps in Exposure to Declines in ECE Visitors
Relative to Same Month in 2019, County Level Data



Sources: See notes to Figure A2.
Notes: Author's calculations. Figures reported are differences in weighted means at the national level of variables in the tract-level data. The first mean is weighted by the county population in that demographic. The second mean is weighted by the estimated county population not in that demographic.