Annenberg Institute
BROWN UNIVERSITY

EdWorkingPaper No. 25-1151

Count Me In? Identifying Factors That Predict Centers' Application to Boston's Mixed-Delivery Universal Pre-K Program

Paola Guerrero-Rosada
University of California, Irvine

Christina Weiland
University of Michigan

Meghan McCormick
Overdeck Foundation

Catherine Snow
Harvard University

Universal prekindergarten (UPK) programs often expand through mixed-delivery systems by offering seats in public schools and community-based centers (CBOs). Although this approach aims to meet varied family needs, little is known about potential systematic differences between CBOs that apply to UPK programs and those that do not. We examined whether applier and nonapplier CBOs differ in capacity, structural quality, and demographic characteristics, using public and administrative data from 223 licensed centers during the first 2 years of Boston UPK expansion. We included a geospatial approach to identify quality variation across neighborhoods. Before accounting for community characteristics, UPK appliers had larger capacity than nonappliers (0.81 SD), were more likely to receive subsidies (35 pp), participate in accountability systems (36 pp), and have national accreditation (39 pp). However, after accounting for community characteristics, only accreditation status differentiated appliers from nonappliers. Consistently, we found distinct patterns of accountability participation, compliance with standards, and accreditation across neighborhoods. Findings illustrated an innovative method to inform the equitable scaling of UPK programs and suggest new directions on potential uses of licensing, monitoring, and accreditation systems.

VERSION: March 2025

Suggested citation: Guerrero-Rosada, Paola, Christina Weiland, Meghan P. McCormick, and Catherine Snow. (2025). Count Me In? Identifying Factors That Predict Centers' Application to Boston's Mixed-Delivery Universal Pre-K Program. (EdWorkingPaper: 25 -1151). Retrieved from Annenberg Institute at Brown University: https://doi.org/10.26300/s943-qx43

Count Me In? Identifying Factors That Predict Centers' Application to Boston's Mixed-Delivery Universal Pre-K Program

Paola Guerrero-Rosada[1]

Christina Weiland[2]

Meghan McCormick[3]

Catherine Snow[4]

[1] University of California - Irvine, [2]University of Michigan, [3] Overdeck Foundation, [4] Harvard Graduate School of Education

Note: The research reported here was conducted as a part of a study funded by the Heising-Simons Foundation and the Foundation for Child Development, and the writing phase was funded by the National Academy of Education (NAEd)-Spencer Dissertation Fellowship.

Declaration of interest: none

Acknowledgements: We would like to thank our colleagues from the Massachusetts Department of Education's Department of Early Education and Care, the Boston Universal Prekindergarten Program, and the National Association for the Education of Young Children for their engagement and cooperation in this study.

Correspondence should be addressed to Paola Guerrero Rosada, University of California - Irvine, 3200 Education Building, Irvine, CA 92697. Email: pguerre@uci.edu.

Abstract

Universal prekindergarten (UPK) programs often expand through mixed-delivery systems by offering seats in public schools and community-based centers (CBOs). Although this approach aims to meet varied family needs, little is known about potential systematic differences between CBOs that apply to UPK programs and those that do not. We examined whether applier and nonapplier CBOs differ in capacity, structural quality, and demographic characteristics, using public and administrative data from 223 licensed centers during the first 2 years of Boston UPK expansion. We included a geospatial approach to identify quality variation across neighborhoods. Before accounting for community characteristics, UPK appliers had larger capacity than nonappliers (0.81 *SD*), were more likely to receive subsidies (35 pp), participate in accountability systems (36 pp), and have national accreditation (39 pp). However, after accounting for community characteristics, only accreditation status differentiated appliers from nonappliers. Consistently, we found distinct patterns of accountability participation, compliance with standards, and accreditation across neighborhoods. Findings illustrated an innovative method to inform the equitable scaling of UPK programs and suggest new directions on potential uses of licensing, monitoring, and accreditation systems.

Count Me In? Identifying Factors That Predict Centers' Application to Boston's Mixed-Delivery Universal Pre-K Program

Most U.S. public prekindergarten (Pre-K) programs use a mixed-delivery approach, serving children through classrooms in school-based and community-based organizations (CBOs; Friedman-Krauss et al., 2021). This approach gives families more options and can help localities expand public Pre-K quickly. When universal Pre-K (UPK) programs are implemented or expanded (i.e., creating new publicly funded Pre-K seats in school- or center-based settings), they attract children who otherwise would have attended other modalities of early care and education (e.g., home-based, family-based, center-based private Pre-K). To meet children and families' needs, UPK programs help disrupt the larger early care and education (ECE) system by incentivizing potential providers to apply for partnership, vetting their potential to offer services, and supporting them in implementing new practices in the successful appliers' classrooms. Eligible providers assess their interest and potential benefits in engaging with a given UPK program, which in turn determines the program's success in reaching their target population.

Despite the importance of this recruitment process, little is known about which organizations select into these mixed-delivery systems. CBOs typically serve proportionately more children from families of minoritized race/ethnicity and from families with low incomes than school-based programs (Crosnoe et al., 2016; Sandstrom & Chaudry, 2012; Schumacher et al., 2001; Weiland, McCormick, et al., 2024). CBOs also retain a smaller proportion of teachers from year to year, making it difficult to sustain highly experienced and trained staff (Shapiro et al., 2019; Weiland et al., 2021). Moreover, CBOs are more likely to serve areas of concentrated disadvantage than school-based programs, which suggests a spatial approach is needed to identify communities with differential access to high- or low-quality services. UPK programs

need to attract a pool of high-quality, center-based providers across the city to avoid the risk of inadvertently increasing opportunity and achievement gaps as early as kindergarten entry. An equitable implementation of UPK programs—ensuring newly funded seats for students from marginalized neighborhoods and communities are high quality—requires understanding how UPK applier centers differ from nonappliers to identify participation barriers and improve the selection of potential providers.

To help address this gap in the literature, we leveraged administrative data from the Licensing Education Analytic Database (LEAD), ratings from the Massachusetts Quality Rating and Improvement System (QRIS), subsidy records from the Child Care Financial Assistance (CCFA) system, records from the National Association for the Education of Young Children (NAEYC), and administrative data from the Boston UPK program to examine differences between applier and nonapplier centers in the Boston area. Specifically, we examined differences in centers' Pre-K capacity, structural quality, and in the demographic characteristics of the communities and children served by the center. We selected Boston as our study setting because the city has been carefully scaling out its nationally recognized, public-school Pre-K model to CBOs since 2013 (Guerrero-Rosada et al., 2021; Weiland, McCormick, et al., 2024). Our findings serve as a case study that highlights the need to understand how CBOs that select into UPK systems differ from those that do not.

Center Selection Into Mixed-Delivery Systems

Although mixed-delivery Pre-K programs are a popular approach for meeting families where they are, systems must balance several important equity issues. For example, CBO teachers and administrators are typically paid less than their public-school counterparts and have lower educational levels (Garver et al., 2023; Reid et al., 2019). Setting-level differences in

classroom learning opportunities and in children's early learning gains tend to favor public schools (McCormick et al., 2022; Peisner-Feinberg et al., 2019; Weiland, McCormick, et al., 2024). Children from families with lower incomes and from minoritized racial/ethnic groups also disproportionately choose center-based programs over school-based programs within mixed-delivery systems (Garver et al., 2023). Accordingly, understanding how CBOs select into mixed-delivery systems and differences between appliers and nonappliers can hold promise for addressing issues of equity in these existing systems.

Our analysis was grounded in two key challenges UPK programs face when recruiting and selecting centers to participate in mixed-delivery systems. The first challenge is that UPK systems need to attract CBOs already offering high-quality services, or those with potential to achieve high quality in the short term, with support. Pre-K programs, especially those offering a high-quality experience, tend to be in high demand and to have higher operational costs (Barnett & Yarosz, 2007). Such programs may have few incentives to accept additional administrative and educational burdens (e.g., participating in childcare subsidy systems, implementing district curricula) of joining the larger UPK system. The benefits of participating (e.g., boost in funding, professional development) must be seen as outweighing the costs.

The second challenge is that the UPK program must be equipped to identify higher quality CBOs across the city to ensure all communities have high-quality options to meet their needs. At present, quality assessments are not available for the full population of centers in many localities. In such cases, localities are generally faced with creating their own criteria based on information provided by applicants or with collecting their own information after centers have already applied. Due to these data constraints, UPK programs have a limited picture of the services available for children in some communities. One possible solution is to use

administrative data commonly available to UPK programs to examine differences in which centers are successfully recruited to apply.

Administrative Data on CBOs

Common administrative data sources for early childhood settings across the United States include licensing data, subsidy data for centers accepting subsidies to ease childcare costs for families, QRIS data, and NAEYC accreditation status. All 50 states have a licensing process for center-based preschool programs (Votruba-Drzal & Dearing, 2017) and subsidy systems tied to the federal Child Care and Development Block Grant (Lynch, 2022). Additionally, 42 states have a QRIS (The Build Initiative, 2023), and the NAEYC assesses and offers accreditation for centers across all states and territories in the United States (NAEYC, n.d.). Further, community characteristics are publicly available from the American Community Survey 5-year estimates (Berkley, 2017). These data could be harnessed to support recruitment of centers into mixed-delivery systems and to understand features of applicant versus nonapplicant centers. Next, we reviewed research on key indicators from each data system, which we examined empirically to identify key predictors of centers' decisions to apply to be part of a growing UPK program.

Capacity

One key variable available in licensing data systems is *capacity*, defined as the number of preschool-aged children the center is approved to serve. Capacity is a key center feature for a very practical reason—increasing access to preschool means offering more seats, a task made easier in centers with more space and staff available. UPK centers must also consider economies of scale; for example, New Jersey pays a higher rate for slots in community-based preschool programs than for public-school programs in their mixed-delivery system due to different operational costs (Garver et al., 2023). Although empirical evidence on the association between

centers' capacity and quality is scarce, a program's licensed capacity depends on their physical facilities; administrative resources to hire and retain staff; and financial resources that determine the size of centers' operations, among other aspects of structural quality.

Subsidies

Childcare subsidy data systems can identify whether a CBO accepts any subsidies to enroll preschool-aged children and, if so, the number of children gaining access to the program using a subsidy. These data may be valuable to a UPK program for several reasons. The first is that subsidy receipt may be a quality signal. Centers that enroll children with subsidies have lower quality ratings compared to centers that do not accept subsidies (Jones-Branch et al., 2004). However, these data should be handled carefully, as ratings may be biased due to potential associations between neighborhood affluence and center quality (Bassok & Galdo, 2016; Hatfield et al., 2015). Subsidy receipt data may also provide a signal that the center serves economically marginalized children and families whom a locality may want to prioritize for access to UPK. Finally, subsidy receipt data may also indicate that the center has capacity to manage different funding streams, which could be an important structural feature because UPK would add to the administrative load faced by a participating center.

Licensing Standards

States have made significant investments in licensing standards and systems to ensure safe environments for young children. To be licensed, centers generally need to meet a set of standards for their physical environment, administration, operations, personnel, and community engagement (Gallagher et al., 1999). These standards are features tracked in state administrative data that could be leveraged in mixed-delivery systems, given all centers are assessed regularly for compliance with state standards. Empirical research on licensing standards has shown more

stringent state regulations increase the quality of services (Gallagher et al., 1999; Hotz & Xiao, 2011; NAEYC, 2010), especially in higher income areas (Hotz & Xiao, 2011). Additionally, UPK programs can leverage centers' licensing data to identify areas of low compliance and inform strategies to increase availability of high-quality seats in particular communities.

Quality Rating and Improvement Systems

As mentioned earlier, 42 states have a QRIS, meant to incentivize programs to improve their quality—often via financial incentives (Thomson et al., 2020; Tout et al., 2009). In all, about one third of centers in the United States participated in QRIS in 2012 (Jenkins et al., 2021). There is more extensive literature on QRIS systems than other kinds of typically available administrative data; however, there is no consistent evidence that participating in QRIS improves children's math, pre-reading, language, and social skills (Sabol et al., 2013).

QRISs with mandatory participation seem to lead to improvements in centers' process quality scores in some cases (Bassok et al., 2019). In others, scores appear to increase via improvements in structural characteristics such as child and health screenings and director qualifications (Gomez et al., 2022). In North Carolina, programs that received state and federal funding had higher scores in total licensing points (i.e., their QRIS metric), whereas centers nested in communities with higher levels of concentrated disadvantage were more likely to be of lower quality. In other words, centers with a greater concentration of federal funding located in affluent communities had higher quality (Hatfield et al., 2015).

Importantly, QRIS data need to be examined carefully due to centers' self-selection into these systems when participation is voluntary. For voluntary QRISs, there exists consistent evidence of differential participation across communities, generally linked to funding incentives. Nationally representative data showed participation in QRIS is higher among centers that blend

funding, are accredited by NAEYC, and serve communities with high poverty rates and lower proportions of Black residents (Jenkins et al., 2021). Centers that participate in QRIS and, subsequently, the center's rating levels, are data UPK programs could access; however, the mixed evidence and differential engagement across communities mean these data should be handled carefully.

NAEYC Accreditation Status

Accreditation data from NAEYC are available for centers nationwide. The accreditation process entails centers' self-assessment, direct observations, and guided improvement across 10 areas of quality: relationships with children, curriculum, teaching approaches, child assessment, nutrition and health, staff qualifications, relationship with children's families, relationship with the community, physical environment, and program leadership and management. Families, directors, and teachers participate in the process. Although centers are assessed in reference to the same standards, they receive individualized support based on resource availability, location, and other potential differentiating factors. Once achieved, centers hold accreditation status for 5 years, with yearly reports on quality required and eligibility for renewal (NAEYC, n.d.). Descriptive studies have found local policies and state regulations relate to centers' likelihood of pursuing and obtaining NAEYC accreditation; for example, more stringent quality indicators in state regulations are associated with the number of programs involved in the NAEYC accreditation process (Apple, 2006), suggesting that centers self-assess their likelihood of obtaining accreditation based on feedback they receive from monitoring or accountability systems.

NAEYC accreditation can also affect center quality through centers' organizational climate, work conditions, or staff selection. A study examining differences in the quality of work

experiences for staff in accredited versus nonaccredited centers across 33 states, found staff in accredited centers reported higher scores in domains such as professional growth, innovativeness, goal consensus, and clarity (Jorde Bloom, 1996). There is also correlational evidence that accredited centers have lower staff turnover and pay staff higher salaries than nonaccredited centers (Whitebook et al., 2004). Moreover, experimental evidence has suggested that NAEYC-accredited providers are more likely to interview job applicants with specific early education work experience, higher education levels, and other professional credentials, whereas QRIS participants are not (Boyd-Swan & Herbst, 2020).

NAEYC accreditation is also hypothesized to increase classroom quality and thereby improve children's outcomes. However, empirical evidence remains limited and correlational. In a prior study of Boston Pre-K in public schools, undertaking NAEYC accreditation cost an estimated $5,000 per classroom per year and took 3 years to complete on average. In a sample of 119 Boston Pre-K and Kindergarten classrooms, undertaking accreditation was inconsistently associated with higher classroom quality and with higher child vocabulary gains (Weiland et al., 2021). These findings are consistent with evidence showing that programs can obtain NAEYC accreditation, yet fall short of meeting guidelines for developmentally appropriate curriculum as measured by a widely used instrument of structural quality (i.e., ECERS-R; Zan, 2005).

Community and Child Characteristics

Community characteristics are another important piece of data to consider. Prior research has shown that center-based Pre-K classrooms serving lower income and high-minority communities, on average, are rated as having lower process quality than center-based classrooms serving more affluent communities (Bassok & Galdo, 2016). In particular, CLASS Emotional Support and Instructional Support scores were lower (*SD* = 0.59 and *SD* = 0.30, respectively) in

communities in the highest quartile of percentage of poverty compared with communities in the lowest quartile. Conversely, centers located in communities with the highest economic poverty rates employed teachers with approximately 2 more years of experience than centers in more affluent communities; moreover, centers in communities with a higher proportion of Black residents had lower child-to-adult ratios than centers in predominantly White communities. These findings are consistent with evidence from the New York UPK program, in which centers serving majority Black children scored 0.51 *SD* lower on the ECERS than providers serving majority White children, even among providers located in the same census tract. These differences were small and not statistically significant when comparing centers serving majority White children to centers serving majority Hispanic and Asian students (Latham et al., 2021).

In North Carolina, centers nested in communities with higher levels of concentrated disadvantage were more likely to be of lower quality, whereas centers receiving federal and state subsidy funds (including Head Start) have tended to receive a boost on licensing points in the North Carolina Tiered QRIS (Hatfield et al., 2015). UPK programs can and do use community characteristics to decide which communities to target in Pre-K expansion and monitor quality across communities from an equity perspective. For example, Chicago had success in increasing equity of access in its expansion via prioritizing neighborhoods with lower incomes and higher unemployment (Ehrlich et al., 2020). DC similarly prioritized neighborhoods (i.e., wards) with lower incomes in the rollout of its UPK program for 3-year-olds (Greenberg et al., 2020).

Center Location

Geospatial analyses are a potential and actionable approach to depicting and modeling variation at different clustering levels (e.g., census tracts, neighborhoods, zip codes) above and beyond average variation among groups (Cobb, 2020). A particular application of interest in our

study was using spatial tools to identify whether quality indicators showed statistically significant levels of clustering at low and high levels of quality. For example, Schultz (2014) analyzed 199 public elementary schools in St. Louis to identify clustering of high-quality teachers and found highly qualified teachers were clustered in schools located in neighborhoods with lower levels of concentrated poverty and students of color. UPK programs can use a geospatial approach to identify and address clusters of quality and access disparities.

Mixed-Delivery UPK Expansion in Boston

The Boston UPK program began in 2005, offering free public Pre-K to 4-year-old children regardless of their background characteristics in school-based settings. Research has shown it has unusually high instructional quality and positive impacts on children's math, language, literacy, executive function, and socioemotional skills at kindergarten entry (Chaudry et al., 2021; Weiland & Yoshikawa, 2013). In 2012, Boston Public Schools (BPS) began a scale-out pilot initiative with 11 CBO partners in particularly disadvantaged neighborhoods. In 2016, Boston built on this work through the federal Preschool Expansion Grant (PEG) in Massachusetts, which funded 15 additional classrooms in 12 centers (Checkoway et al., 2019). In April 2019, the program scaled out to additional CBOs and increased capacity to serve all age-eligible students, making Boston UPK a mixed-delivery system. The Boston UPK vision is to ensure equitable access to a free school day (i.e., 6.5 hours per day, 180 days per year) in classrooms with adequate teacher-to-child ratios (i.e., maximum 2:22 in school-based classrooms and 2:20 in center-based classrooms) in safe and age-appropriate environments. These centers are supported to offer comprehensive health and family engagement services and to sustain or adopt high-quality practices, including the implementation of the *Focus on Early Learning* curriculum (Boston Public Schools, 2019). The Boston UPK program also offered centers a

substantial pay boost for UPK teachers, which placed them at the starting point of the BPS teacher pay scale (Guerrero-Rosada et al., 2021). UPK centers with funded seats received about $11,000 per seat in the 1st year (i.e., 2019–2020).

In our study years (i.e., 2018 - 2021, a call for centers to participate in the UPK program was disseminated each year through several mechanisms, including the Boston Department of Early Education social networks, website, and via email to all potential applicants—namely licensed centers in the Boston area. To apply during the first 2 years of Boston UPK (i.e., 2019 and 2020), centers needed evidence that they were a state-licensed program with a physical location and capacity to serve eligible children in a 4-year-old-only classroom.[1] The application also required centers to submit information about their organizational capacity and business model, financial documentation, enrollment history, staff processes and supports, and ability to align with Boston UPK quality requirements. During the application process, center leaders and staff were invited to Q&A sessions where formal expectations for centers were shared in written materials and discussed with participants. In addition to implementing components of the Boston UPK program, some of these expectations included solving any licensing noncompliance issues during the 1st year of program participation and working toward obtaining a 3+ level in the Massachusetts QRIS (i.e., attaining moderate levels of quality as measured by self-assessments and vetted by a technical visit, among other criteria) and being NAEYC accredited before finishing their first funding cycle in their 3rd year as partner providers.

Center applications were assessed by the Boston UPK team to verify minimal requirements and schedule a needs assessment. The assessment served to identify center-level

[1] This last requirement changed for the 3rd year of the program in 2021, when centers could apply to offer Pre-K seats in mixed-age classrooms for 3- and 4-year old children (we only include the first 2 years of implementation in the current study).

scopes of work and assign different levels of funding support. Some of the commitments required for Boston UPK participation were to ensure lead teachers had at least a bachelor's degree and that leadership and instructional staff could participate in ongoing professional development and coaching on curriculum; financial management; comprehensive services; and family engagement, technology, and use of data to inform instruction. The program opened additional UPK seats and partnered with new centers in 2020 and 2021 to meet the demand for high-quality Pre-K for all Boston families who would like a seat for their 4-year-old children.

Present Study

In this paper, we first add to the current literature on equitable access to early education by identifying whether there are systematic distinguishing features of centers that applied to partner with Boston UPK among the population of licensed centers and among the subset of centers receiving subsidies. Second, we use geographical information systems (GIS) to explore variation in quality across neighborhoods and census block groups. Specifically, we examine the following research questions:

1. Do centers applying to Boston UPK differ from nonappliers in their capacity, structural quality, or the demographic characteristics of the communities in which they are located?
2. To what extent do these selection patterns vary in the subgroup of centers receiving childcare subsidies?
3. Do proxies of structural quality from Boston applier and nonapplier community-based centers vary across census block groups and neighborhoods?

Method

Participants and Setting

Our sample included the total population of Boston licensed early care and education centers in the 2018–2019 school year ($N = 223$). Of these centers, 32 applied for Boston UPK supports across the 2019–2020 (UPK Year 1 [Y1]; $N = 28$ centers) and 2020–2021 (UPK Year 2 [Y2]; $N = 4$ additional centers) school years. In total, 28 centers were accepted to Boston UPK during its first 2 years of implementation (Y1 = 26, Y2 = 2). The four remaining centers reapplied and were awarded funding during the 3rd and 4th years of the program. We excluded from analyses two providers in private school-based programs that applied to receive Boston UPK funding because we could not access their administrative records.

Procedures

The Institutional Review Boards at the lead and partner organizations for this study approved the human subjects plan before the commencement of study activities and the secondary data analysis. We used administrative data from the first 2 years of the Boston UPK program (i.e., 2019 and 2020) and LEAD data from the Massachusetts Department of Early Education and Care (Massachusetts-EEC) for the 2018–2019 school year. Additionally, we used item-level data from licensing visits by Massachusetts EEC, including visits conducted between 2017 and 2022. We used an indicator of whether centers were NAEYC accredited between 2014 and 2021. To obtain demographic information about the communities and children served by centers, we accessed public data from 2019 American Community Survey 5-year estimates at the census block group level and data at the child level from the Massachusetts CCFA system.

Measures

UPK Application Status

We used Boston UPK administrative data to create a binary indicator for whether the center applied to UPK versus did not, based on the population of centers licensed by the Massachusetts-EEC.

Center Addresses and Licensed Capacity

We obtained center addresses, total approved number of seats for each age level (i.e., infants, toddlers, Pre-K, and Pre-K in mixed-age classrooms), and total seats licensed to the center for the 2018–2019 school year from the LEAD data.

Center Subsidy Receipt Status

We used data from the CCFA system to construct a binary indicator of whether the center received subsidies for at least one enrolled child or not.

Center Structural Quality

NAEYC Accreditation Status. We created an indicator of whether the center was NAEYC accredited by September 1st of the 2019, 2020, or 2021 school years using records provided by NAEYC.

QRIS Participation and Rating. We also included an indicator of whether the center participated in the Massachusetts QRIS and whether it was rated at Level 3 or 4 across four quality levels currently in the system. To be rated at the first two levels in the Massachusetts QRIS, centers self-report characteristics across several domains, including curriculum and learning, learning environments, workforce development and qualifications, family and community engagement, leadership, and management. Ratings at Levels 3 or 4 require verification by the Massachusetts-EEC (Mass.gov, n.d.). Details on the application, scoring

process, and level requirements are available in online supplementary materials (see Appendix A).

Compliance With Licensing Standards. We identified centers' percentages of assessed state standards on which each center was rated as compliant based on Massachusetts-EEC Department Licensing Standards: administration, interactions among adults and children, curriculum and progress reports, physical facility requirements, family involvement, educator qualifications and professional development, ratios, group sizes and supervision of children, health and safety, nutrition and food service, and transportation (Franklin et al., 2003). These regulations apply to all programs providing nonresidential services to children younger than 14 years old, regardless of the care setting and the ages of the children served. Programs receive scheduled visits to determine their level of compliance with regulations after they submit extensive documentation demonstrating their programs meet current regulations (Massachusetts Department of Education, n.d.). We used data from each center's previous assessment visit between April 18, 2017, and July 28, 2022, to calculate their compliance for each factor. Then, we aggregated across factors to obtain the center's average compliance. Our measure of compliance was not completed in all cases by the first round of applications to Boston UPK in 2019, a limitation to which we return in the discussion section.

Demographic Characteristics of Children and Communities Served by the Center

Characteristics of Children Receiving Subsidies. We used data from the CCFA system to identify the characteristics of children receiving subsidies served by each center, including children's subsidy eligibility factors (e.g., income, transitional assistance, housing); age, race and ethnicity; primary language spoken at home; eligibility for transportation; homeless status; and family monthly income.

Demographic Characteristics of the Community at the Center Location. For community-level demographics, we used data from the 5-year estimates of the 2019 American Community Survey. Specifically, we obtained block-group counts of children younger than 5 years; estimated median income in dollars for the previous 12 months; race composition (i.e., percentage of African American, Asian or Asian American, White, and other/two or more races); ethnicity (percentage of Hispanic or Latino population); percentage of the population speaking a language other than English at home; and percentage of the population with a bachelor's degree or higher. Because we did not have access to the demographic characteristics of enrolled children who do not receive CCFA subsidies, we used these measures to identify the demographic characteristics of the communities (i.e., census block groups) where appliers and nonappliers are located and identify potential demographic differences for the full population of centers.

Analytical Approach

To address our first research question (i.e., Do centers applying to Boston UPK differ from nonappliers in their capacity, structural quality, or the demographic characteristics of the communities in which they are located?), we first estimated unconditional differences for appliers and nonappliers using *t* tests. Then, we estimated linear probability models following Equation 1:

$$Applied_{jkz} = \beta_{jkz} + \varphi_{jkz} + \delta_{jk} + \lambda_k + \rho_k + (\varepsilon_{jkz} + \gamma_{kz} + \mu_z) \quad (1),$$

where subscripts j, k, and z represent the center, census block group, and neighborhood where the center is located, respectively. $Applied_{jkz}$ is an indicator of whether the program applied to serve as a Boston UPK center during the 2019–2020 or 2020–2021 school years. φ_{jkz} is a vector for centers' capacity to operate a classroom serving 4-year-olds exclusively and receive funding for subsidized seats. δ_{jkz} is a vector for centers' structural quality, which we

proxied with centers' average percentages of compliance with licensing standards and an indicator of whether the center participates in the Massachusetts QRIS. λ_{kz} is a vector for the demographic composition of the census block group, including counts of total children under 5 years; population race and ethnicity, with White as the reference group; median estimated income in the last year; percentage of population speaking a language other than English at home; and the percentage of population who completed a bachelor's degree or higher.

We included random intercepts for census block groups (γ_{kz}) and neighborhoods (μ_z), and a residual error term for centers (ε_{jkz}). We selected probit as our function based on evidence that it yields a better model fit in nested models with samples of small and moderate size (Hahn & Soyer, 2005). However, we estimated logistic models as a robustness check (see Appendix A, Tables A1 and A2). To address Research Question 2 (i.e., To what extent do these selection patterns vary in the subgroup of centers receiving childcare subsidies?), we restricted our models to centers receiving subsidies and replaced λ_{kz} (from Equation 1) with a vector of demographic characteristics of children served by the center (σ_{jkz}), at the center level. These characteristics included race and ethnicity (with White as the reference group), monthly total family income, and percentage of children speaking a language other than English at home. For all our models for Research Questions 1 and 2, we entered predictors in conceptual blocks (capacity, quality, and children demographic characteristics) to assess magnitude and statistical significance of each factor, and then we tested all factors jointly.

To answer Research Question 3 (i.e., Do proxies of structural quality from Boston applier and nonapplier community-based centers vary across census block groups and neighborhoods?), we aggregated centers' quality indicators to the census block group and neighborhood levels using the Arc-GIS Pro "summarize within" feature to describe geographical variation and

conducted hotspot analysis to identify statistically significant differences: in (a) QRIS participation, (b) compliance with standards, and (c) NAEYC accreditation status across the city by census block groups. We used the optimized hotspot analysis tool, which estimated an optimal fixed distance band based on average distance to nine nearest census block groups. We extended this analysis by replicating Equation 1 using spatial autoregressive models (SAR). SAR models are an extension of linear regression that accounts for spatial patterns in the dependent variable, among independent variables, and/or in models' residuals when observations are nested in geographical areas or have a spatial representation (Ver Hoef et al., 2018). We used this approach to examine whether predictors of applications to Boston UPK—as examined in Research Questions (RQs) 1 and 2—are particular to some neighborhoods or reflect interdependence among applicant centers.

Results

RQ1: Do Community-Based Organizations Applying to Boston UPK Differ From Nonappliers in Their Capacity, Structural Quality, and Community Demographic Characteristics?

As shown in Table 1, UPK appliers had a larger total capacity (*SD* = 0.81) than nonappliers, on average, reflecting the larger number of seats for 4-year-old children they can accommodate (*SD* = 0.76, equivalent to 26 seats, $p < .000$). There were no other differences in licensed seats for younger children. Appliers were 35 percentage points (pp) more likely to receive subsidies ($p < .000$); 36 pp more likely to participate in the Massachusetts QRIS ($p < .000$); and 39 pp more likely to be NAEYC accredited ($p < .000$), consistently with the QRIS model of incentivizing participation through subsidy reimbursements and the Boston UPK goal of partnering with providers that are or can be NAEYC accredited within 3 years—before

finishing their first funding cycle. Among participant centers in the Massachusetts QRIS, UPK appliers were 17 pp more likely to be rated as Level 3 or 4 (i.e., the two highest levels in the system). There were no differences in centers' compliance with licensing standards by UPK application status, our proxy for structural quality available at the population level. Notably, centers do not self-select into the licensing process as they do for QRIS and NAEYC accreditation. When compared to all centers, Boston UPK appliers were located in communities with a larger proportion of people of color (Black $SD = 0.50$, $p < .05$; Other race $SD = 0.52$, $p < .05$), a larger proportion of people who speak a language other than English ($SD = 0.86$, $p < .000$), a smaller proportion of White ($SD = –0.75$, $p < .000$) and college-educated people ($SD = 0.66$, $p < .01$), and lower median income ($SD = 0.45$, $p < .05$) than nonappliers (see Table 1).

Once we adjusted by the demographic characteristics of communities at the center location in our linear probability models, UPK applier and nonapplier centers only differed in their likelihood to receive subsidies and to be NAEYC accredited (see Table 2). The change in magnitude and statistical significance of the coefficient representing centers' probability of receiving subsidies once we accounted for the demographic composition at the census block group suggested a selection pattern based on the characteristics of communities at the center location. In other words, centers receiving subsidies in communities with average lower incomes and a higher proportion of Black and multilingual families were more likely to apply for Boston UPK. Considering Boston UPK centers were also more likely to be NAEYC accredited, new funded seats have expanded equitable access to the Boston Public Schools Pre-K model through high-quality centers in these communities.

RQ2: Do Boston UPK Appliers Differ From Nonappliers Receiving Subsidies in Their Capacity, Structural Quality, and the Demographic Characteristics of the Children They Serve?

Before estimating differences among Boston UPK appliers and nonappliers receiving subsidies, we compared recipients and nonrecipients (see Appendix B). In short, centers receiving subsidies in Boston did not differ from those not receiving subsidies in capacity, probability of being NAEYC accredited, nor the demographic composition of their census block groups except for the percentage of habitants with a college degree or a higher level of education ($b = –0.39$, $p < .000$). However, centers receiving subsidies were more likely to participate in QRIS (58 pp, $p < .000$) and were less compliant with licensing standards (–8 pp, $p < .05$). We return to these differences in the discussion section.

When comparisons were restricted to the subset of centers receiving subsidies, UPK appliers served a higher proportion of children between 3 and 4 years (9.35 pp, $p < .05$), and more children eligible for transportation ($SD = 0.55$, $p < .05$) than nonappliers (see Table 3). There were no differences in the subsidy eligibility factors nor demographic characteristics of children enrolled in applier and nonapplier centers.

Once we accounted for associations between capacity, quality, and demographic characteristics of enrolled children in a joint model, UPK appliers and nonappliers were statistically identical in their capacity; QRIS participation status; and the demographic characteristics of enrolled children with subsidies, except that appliers were 25 pp more likely ($p < .01$) to be NAEYC accredited (see Table 4).

RQ3: Do Proxies of Structural Quality of Boston Centers Vary Across Census Block Groups and Neighborhoods?

As shown in Table 2 and described previously, UPK applier centers were more likely than nonappliers to participate in the Massachusetts QRIS and be NAEYC accredited before applying to UPK, but were similar in their compliance with licensing standards from 2019 to 2022. We examined these indicators of quality in a geospatial framework and found all varied widely across the different neighborhoods where UPK centers might be needed. In Figure 1, the size of the circles represents the proportion of UPK centers in the census block group. Panel A shows the variation in the average compliance with licensing standards across Boston. Panels B, C, and D show hotspots of QRIS participation, average compliance, and NAEYC accreditation across the city, namely areas with statistically significant concentrations of centers compared to other census block groups.

Hotspots with statistically significantly higher QRIS participation were in two neighborhoods with an average annual income of $79,987 and average subsidy eligibility of 78.5% (i.e., Roxbury and Mattapan), suggesting centers in these areas are incentivized to compete for subsidized seats. Consistently with the spatial pattern shown in QRIS participation, there is also a hotspot with a statistically significantly higher number of NAEYC-accredited centers located in a centralized neighborhood (i.e., Roxbury). Given total compliance with license standards is expected for centers' operation, and most centers attain more than 90% in this measure, variability was limited at high levels of compliance. Still, this measure was discriminative of centers with low compliance in the full population and among UPK centers. Centers in the East Boston area (56% Hispanic on average, range 17%–74%; 66% of residents speak a language other than English, range 29%–88%) had statistically significantly lower

compliance than the rest of the city, indicating this area needs focalized efforts to expand high-quality services. This finding is important from an equitable implementation perspective because centers in this area serve a majority of Spanish-speaking families.

Results from our regression models examining the predictors of centers' application to Boston UPK in a geospatial framework are presented in Table 5. Consistent with results presented in Research Questions 1 and 2, centers' capacity and accreditation status were the main predictors of applications to Boston UPK regardless of centers' locations (see Model 4, main effects). However, there were spatial effects in centers' compliance with licensing standards ($b = 5.89$, $p < .05$) and the percentage of residents who are Asian ($b = 0.12$, $p < .01$), Hispanic ($b = 0.11$, $p < .05$), and speak a language other than English ($b = –0.18$, $p < .001$) in Boston neighborhoods. In other words, UPK appliers tend to be near other centers with high compliance scores and serve areas with more Hispanic and Asian residents, and they are less likely to be in areas with a larger share of multilingual families. Some of these results reflected focused efforts to increase access to the BPS Pre-K model across communities less likely to enroll in school-based settings; however, the negative association between the percentage of residents who speak a language other than English and centers' application status merits further examination.

Robustness Checks

We replicated our models using logistic regression to assess consistency of our estimates when using a different functional form (see Appendix A). Multilevel logistic and linear probability models yielded consistent results; however, our multilevel linear probability models with the full population of centers (see Table 2) suggested a statistically significant difference on centers' subsidy status that was only marginal in our multilevel logistic models (see Appendix A,

Table A1). All other coefficients were consistent in magnitude, direction, and statistical significance.

Discussion

Despite the ubiquity of mixed-delivery Pre-K systems, there is no research on which centers participate in these systems and which do not, nor on how localities might incorporate administrative data to inform center recruitment and selection processes. Understanding how centers select into mixed-delivery systems is necessary to reduce an important risk for Pre-K expansion programs: unintendedly making seats available in settings with lower quality than those children would have accessed otherwise, which would have important implications for children's kindergarten readiness and future achievement. We found that in the Boston context, UPK applier centers were more likely to be NAEYC accredited, participate in QRIS, receive subsidies, and be located in communities with average lower incomes and a higher proportion of Black and multilingual families compared with nonappliers. Once we accounted for the demographic characteristics of communities where centers were located, most of these differences were no longer statistically significant except for centers' NAEYC accreditation status, which suggests evidence of an equitable expansion process. However, geospatial analyses show that QRIS participation, NAEYC accreditation, and compliance with licensing standards varied significantly across neighborhoods, with hotspots of high participation (QRIS), high-quality (NAEYC), and low quality (compliance) located in two different sets of neighborhoods. Next, we detail implications of our findings for UPK programs in turn and discuss the limitations of this research.

Differences Between Applier and Nonapplier CBOs

Accurately identifying high-quality centers with the capacity and administrative readiness to engage with UPK programs is necessary for an equitable implementation and to ensure an adequate return on the investment of public dollars in the expansion process. This identification is challenging without reliable quality measures available at the population-level. We identified potential uses for three quality proxies available for large-scale systems: compliance information, QRIS participation, and NAEYC accreditation.

Licensing data allowed us to identify compliance with quality standards across all Boston centers. Although applier and nonapplier centers did not differ systematically, compliance rates did differ across communities. To our knowledge, no research has focused on measurement properties of licensing data, potentially due to its reduced variability. We hypothesized that items reflecting the presence of a curriculum and quality of interactions would have greater variability and better discriminative properties, and we aimed to weigh these factors accordingly to differentiate centers' readiness to participate in UPK programs. Although the data we had available did not support this analysis, UPK programs could explore synergistic efforts with licensing systems to include relevant and informative indicators of instructional quality that could be assessed through current installed capacity (e.g., leveraging visits from state licensing personnel to assess additional features of developmentally appropriate practices and instructional quality) in state licensing systems, with the goal of obtaining more discriminative quality measures at the population level.

Compared to all Boston centers, UPK appliers were more likely to receive subsidies and participate in QRISs. Both these differentials disappeared once our models accounted for community characteristics, suggesting that subsidy receipt and QRIS participation are

simultaneously related to centers' UPK application status. A potential explanation for this pattern is that subsidy rates are likely a higher and more stable revenue source for programs when compared to market rates for centers accessible to low-income communities. Additionally, providers receiving subsidies typically have administrative structures necessary to leverage additional funding sources. Our results are consistent with research showing centers located within communities with high concentrations of poverty were more likely to participate in QRIS than centers in moderate- or low-poverty communities, perhaps because public funding incentives are linked to QRIS participation and ratings (Jenkins et al., 2021). In QRIS systems with mandatory participation, such as Georgia and North Carolina, findings have been consistent that classrooms in low-income and high-minority communities are rated significantly lower on their quality (Bassok et al., 2016; Hatfield et al., 2015). For UPK programs, QRIS with mandatory participation can help identify highly rated centers, especially when the systems conduct formal quality assessments with observational measures –as illustrated in the Georgia mixed-delivery UPK system (Bassok et al., 2016).

Importantly, when centers self-select into QRIS, ratings are only indicative of variation among the subset of participant centers. On the contrary, participation offers population-level information about a program's readiness to engage with an additional funding stream. For voluntary QRIS, there is consistent evidence of differential participation across communities, generally linked to funding incentives. Nationally representative data showed participation in QRIS is higher among centers that blend funding, are accredited by NAEYC, and serve communities with high poverty rates and lower proportions of Black residents (Jenkins et al., 2021). In sum, whether a center participates in QRIS and if so, the center's rating level are data

UPK programs could access, though the mixed evidence and differential engagement across communities means these data should be handled carefully.

More research is needed on the optimal funding and reimbursement mechanisms that UPK programs can implement to attract high-quality providers that may be reluctant to engage with state subsidies and QRIS systems. In particular, UPK programs may benefit from understanding whether and how the business model of nonsubsidized centers can accommodate or incorporate UPK-related practices such as implementing an evidence-based curriculum, sustaining a professional development model with job-embedded coaching, and securing adequate working conditions for teachers—including reduced ratios, dedicated time for planning, and adequate compensation (Bassok, Magouirk, et al., 2021; Bassok, Markowitz, et al., 2021; Weiland, 2016). Understanding how to sustainably incorporate these practices into centers' operational and financial model is important so that UPK can support centers to become fully independent after their funding cycle ends. A future direction for research in equitable implementation of UPK programs is examining how subsidy recipients differ from their unsubsidized counterparts in aspects of their operation that relate to their decision of receiving subsidies, such as their financial, operational model, and administrative staff capacity (Herbst, 2023). Research has shown that centers that enroll children with subsidies have lower quality ratings than centers that do not accept subsidies (Jones-Branch et al., 2004). For an equitable implementation, UPK programs need to address the associations between neighborhood affluence, centers' subsidy receipt status, and center quality.

We did observe differences in the NAEYC accreditation status of applier vs. nonapplier centers for the population of centers and for the subset of centers receiving subsidies, consistently with a programmatic preference for accredited partners that was communicated to

centers during recruitment phases. NAEYC accredited centers are potentially good partners for UPK programs due to improved organizational climate, work conditions, and better staff selection processes (Boyd-Swan & Herbst, 2020; Jorde Bloom, 1996); which in turn is associated with lower staff turnover and better compensation policies (Whitebook et al., 2004). These elements of structural quality are key for an equitable expansion of UPK programs, considering the chronic turnover in early education centers (Bassok, Markowitz, et al., 2021).

Although NAEYC accreditation is an impartial third-party endorsement of high-quality services, other high-quality programs that are positioned through sources different than accreditation, such as experience, brand name, and word-of-mouth, might be less incentivized to undertake the rigorous and demanding NAEYC accreditation process (Xiao, 2010). For example, the nationally recognized Boston Pre-K Program estimated that supporting schools to achieve and sustain NAEYC accreditation costs roughly $5,000 per classroom per year in coaching, materials, and structural adaptations; and takes 3 years to complete, on average. (Weiland et al., 2021).

Finally, more research is needed to identify how NAEYC accreditation relates to observational quality measures and to what extent predicts children's academic and developmental gains. Currently, UPK programs that decide to use NAEYC accreditation as an indicator for recruitment would need to carefully assess programs' instructional quality, considering evidence that assessment of curriculum standards might fall short in this system (Zan, 2005).

Differences Between Subsidized Applier and Nonapplier CBOs

Among centers receiving subsidies, QRIS participation is the differential factor. These findings suggest that QRIS ratings may conflate information about the demand for subsidized

services in some communities, consistent with prior research showing that income and racial disparities are linked to QRIS participation (Gomez et al., 2022; Jenkins et al., 2021). Although Boston UPK appliers were in communities with a higher proportion of people of color, higher linguistic diversity, and lower income in comparison with nonappliers, we found no statistically significant differences between the demographic characteristics of children attending UPK applier centers and children attending nonapplier centers. Future research will benefit from examining the demographic composition of Boston UPK appliers and nonappliers.

Variation Across Census Block Groups and Neighborhoods

Finally, regarding our third research question, we used a geospatial approach to identify areas with a higher need for funding and quality improvement support. Research has already used mapping tools to monitor equitable access to high-performing teachers in elementary schools (Schultz, 2014) and applications to Boston Pre-K at the study level (Shapiro et al., 2019). In our approach, geospatial analysis showed areas with statistically significant concentrations of NAEYC-accredited centers, higher QRIS participation rates, and lower compliance with licensing standards. These results offer actionable directions for UPK programs.

Evidence has shown that regulatory and accountability interventions have differential effects on centers based on their location (Bassok et al., 2019; Hotz & Xiao, 2011). Increasing the stringency of licensing standards in regulatory systems can help increase the quality of services across sites, although with risks of increased closures in low-income communities where some centers would have fewer resources to meet higher requirements (Gallagher et al., 1999; Hotz & Xiao, 2011). Consistently, our quality proxy calculated from licensing data proved useful in identifying communities where the majority of centers have statistically significantly lower compliance (i.e., proxying lower structural quality) in comparison with other areas of the city.

UPK programs can identify areas where they need to focalize improvement efforts by closely supporting centers and conducting differential recruitment approaches.

Monitoring and accountability systems are also sensitive to geospatial patterns. Evidence from North Carolina shows that the effects of QRIS incentives appear concentrated in communities with higher levels of competition from other ECE providers (Bassok et al., 2019). To our knowledge, no studies have analyzed geospatial patterns for early education accredited centers. In Boston, we found three statistically significant hotspots of centers with accreditation and its UPK program has successfully attracted centers in one of those hotspots. UPK programs aiming to identify providers with operational and financial readiness to engage with blended funding streams can leverage geospatial analysis and identify areas with higher accreditation and QRIS participation rates.

We extended mapping methods by modeling spatial patterns in a regression framework, which allowed us to identify main associations across Boston and spatial associations that might be particular to centers within some geographic units (Ver Hoef et al., 2018). Using mapping and modeling tools simultaneously is a methodological contribution of this paper that UPK programs can replicate to identify whether spatial patterns reflect programmatic decisions or, on the contrary, provide signals of inequitable access to services during UPK expansion. Consistently with evidence of an equitable program expansion, our results show increased participation of centers serving Asian and Hispanic communities, and communities where the majority of residents speak a language other than English. An important advantage of expanding UPK programs through mixed-delivery systems is meeting families' needs in relation to their cultural and linguistic fit with providers, work and summer schedules, and care needs across different age ranges (Weiland, Guerrero-Rosada, et al., 2024). Although prioritizing expansion in historically

marginalized communities that are less likely to attend school-based settings is consistent with an equitable approach, a good practice for programs that observe spatial patterns linked to racial, ethnic, or socioeconomic characteristics of communities is to carefully monitor quality with observational measures to decrease the risks of facing a two-tier system problem.

Limitations

Our study had several important limitations. First, we did not have access to demographic information for nonsubsidized children in either applier or nonapplier centers. Currently, centers are not required to report demographic information for children who do not receive state or district subsidies, which limits important information to assess potential disparities in access to high-quality settings. We addressed this limitation by using census data to account for the demographic characteristics of communities at the centers' location, but this proxy is insufficient to make inferences about the characteristics of children who attend applier and nonapplier centers. A second limitation was we did not obtain access to data on the overall demographic composition of enrolled children in the centers, which limited our capacity to assess whether there was socioeconomic, racial, or ethnic segregation, an important aspect of an equitable UPK implementation.

Third, we could not restrict the time span of our compliance measure to licensing visits conducted strictly before the Boston UPK rollout due to characteristics of the data system. Our data included visits spanning 2017–2022, 2 years after the rollout of Boston UPK. The risk of this overlap is that centers' measures of compliance with licensing standards conflate with Boston UPK supports. However, only licensed centers were eligible to apply to Boston UPK, and it is unlikely that Boston UPK supports were related to nonappliers' compliance. Additionally, we were unable to assess whether there are compliance patterns in Boston that

connect to assigned licensors, considering there might be individual differences in how they apply and assess standards. Whether such individual differences affect the early education market in some neighborhoods more than others is a new direction for the field.

Conclusion

Despite these limitations, this paper has three actionable main takeaways. First, centers' financial and operational models are important predictors of application to the Boston UPK program. More research on barriers specific to nonsubsidized centers is needed to better understand their role in UPK programs and the overarching early education system. Second, accreditation status is an important quality proxy for UPK programs, but barriers to accreditation in low-income communities can affect programs' equitable implementation. Our findings illuminate the importance of monitoring quality at the population level using measures not linked to subsidy incentives. Third, using neighborhood-centered approaches is a promising strategy to identify and address potential quality disparities during the scale-up process of UPK programs and differentiate intended and unintended patterns of application to decrease the risks of facing a two-tier system problem.

References

Apple, P. L. (2006). A developmental approach to early childhood program quality improvement: The relation between state regulation and NAEYC accreditation. *Early Education and Development*, *17*(4), 535–552. https://doi.org/10.1207/s15566935eed1704_2

Barnett, W. S., & Yarosz, D. J. (2007). *Who goes to preschool and why does it matter?* [Policy brief]. National Institute for Early Education Research. https://nieer.org/research-library/who-goes-preschool-why-does-it-matter

Bassok, D., Dee, T. S., & Latham, S. (2019). The effects of accountability incentives in early childhood education. *Journal of Policy Analysis and Management, 38*(4), 838–866. https://doi.org/10.1002/pam.22149

Bassok, D., & Galdo, E. (2016). Inequality in preschool quality? Community-level disparities in access to high-quality learning environments. *Early Education and Development*, *27*(1), 128–144. https://doi.org/10.1080/10409289.2015.1057463

Bassok, D., Magouirk, P., & Markowitz, A. J. (2021). Systemwide quality improvement in early childhood education: Evidence from Louisiana. *AERA Open*, *7*. https://doi.org/10.1177/23328584211011610

Bassok, D., Markowitz, A. J., Bellows, L., & Sadowski, K. (2021). New evidence on teacher turnover in early childhood. *Educational Evaluation and Policy Analysis*, *43*(1), 172–180. https://doi.org/10.3102/0162373720985340

Berkley, J. (2017). *Using American community survey estimates and margins of error.* U.S. Census Bureau. https://www.census.gov/content/dam/Census/programs-surveys/acs/guidance/training-presentations/20170419_MOE.pdf

Boston Public Schools. (2019). *Boston PreK. High-Quality, Accessible Public Prekindergarten.* https://www.bostonpublicschools.org/students-families/universal-pre-k-boston/about

Boyd-Swan, C., & Herbst, C. M. (2020). Influence of quality credentialing programs on teacher characteristics in center-based early care and education settings. *Early Childhood Research Quarterly*, *51*, 352–365. https://doi.org/10.1016/j.ecresq.2019.12.013

The Build Initiative. (2023). *Quality rating and improvement systems.* Quality Compendium. https://qualitycompendium.org/create-a-report

Chaudry, A., Morrissey, T., Weiland, C., & Yoshikawa, H. (2021). *Cradle to kindergarten: A new plan to combat inequality* (2nd ed.). Russell Sage Foundation. https://doi.org/10.7758/9781610449069

Checkoway, A., Hofer, K., Goodson, B., & de Mars, M. (2019). *Massachusetts Preschool Expansion Report (PEG): Year 4 final evaluation report.* Abt Associates. https://www.abtglobal.com/insights/publications/report/massachusetts-preschool-expansion-grant-peg-impact-evaluation-report

Cobb, C. D. (2020). Geospatial analysis: A new window into educational equity, access, and opportunity. *Review of Research in Education*, *44*(1), 97–129. https://doi.org/10.3102/0091732x20907362

Crosnoe, R., Benner, A. D., & Davis-Kean, P. (2016). Preschool enrollment, classroom instruction, elementary school context, and the reading achievement of children from low-income families. In G. Kao & H. Park (Eds.), *Research in the sociology of education* (Vol. 19, pp. 19–47). Emerald Group Publishing. https://doi.org/10.1108/S1479-353920150000019003

Ehrlich, S. B., Connors, M. C., Stein, A. G., Francis, J., Easton, J. Q., Kabourek, S. E., & Farrar, I. C. (2020). *Closer to home: More equitable pre-k access and enrollment in Chicago research report* (ED612485). ERIC. https://files.eric.ed.gov/fulltext/ED612485.pdf

Franklin, S. P., Lamana, A., & Van Thiel, L. (2003). *Early childhood program standards for three- and four-year olds* (ED481492). ERIC. https://files.eric.ed.gov/fulltext/ED481492.pdf

Friedman-Krauss, A. H., Barnett, W. S., Garver, K. A., Hodges, K. S., Weisenfeld, G. G., & Gardiner, B. A. (2021). *The state of preschool 2020: State preschool yearbook*. National Institute for Early Education Research. https://nieer.org/state-preschool-yearbook-2020

Gallagher, J. J., Rooney, R., & Campbell, S. (1999). Child care licensing regulations and child care quality in four states. *Early Childhood Research Quarterly*, *14*(3), 313–333. https://doi.org/10.1016/S0885-2006(99)00015-0

Garver, K., Weisenfeld, G. G., Connors-Tadros, L., Hodges, K., Melnick, H., & Placencia, S. (2023). *State preschool in a mixed delivery system: Lessons from five states*. Learning Policy Institute. https://doi.org/10.54300/387.446

Gomez, C. J., Whitaker, A. A., & Cannon, J. S. (2022). Do early care and education programs improve when enrolled in quality rating and improvement systems? Longitudinal evidence from one system. *Early Education and Development*, *34*(5), 1236–1253. https://doi.org/10.1080/10409289.2022.2105624

Greenberg, E., Luetmer, G., Chien, C., & Monarrez, T. (2020). *Who wins the preschool lottery? Applicants and application patterns in DC public prekindergarten* [Research report]. Urban Institute. https://www.urban.org/research/publication/who-wins-preschool-lottery-applicants-and-application-patterns-dc-public-prekindergarten

Guerrero-Rosada, P., Weiland, C., Taylor, A., Penfold, L., Snow, C. E., Sachs, J., & McCormick, M. (2021). *Effects of COVID-19 on early childhood education centers: Descriptive evidence from Boston's universal prekindergarten initiative*. Gerald R. Ford School of Public Policy, University of Michigan, Education Policy Initiative. https://edpolicy.umich.edu/research/epi-policy-briefs/effects-covid-19-early-childhood-education-centers

Hahn, E. D., & Soyer, R. (2005). Probit and logit models: Differences in the multivariate realm. *The Journal of the Royal Statistical Society*, *67*, 1–12.

Hatfield, B. E., Lower, J. K., Cassidy, D. J., & Faldowski, R. A. (2015). Inequities in access to quality early care and education: Associations with funding and community context. *Early Childhood Research Quarterly*, *30*, 316–326. https://doi.org/10.1016/j.ecresq.2014.01.001

Herbst, C. M. (2023). Child care in the United States: Markets, policy, and evidence. *Journal of Policy Analysis and Management*, *42*(1), 255–304. https://doi.org/10.1002/pam.22436

Hotz, V. J., & Xiao, M. (2011). The impact of regulations on the supply and quality of care in child care markets. *American Economic Review*, *101*(5), 1775–1805. https://doi.org/10.1257/aer.101.5.1775

Jenkins, J. M., Duer, J. K., & Connors, M. (2021). Who participates in quality rating and improvement systems? *Early Childhood Research Quarterly*, *54*, 219–227. https://doi.org/10.1016/j.ecresq.2020.09.005

Jones-Branch, J. A., Torquati, J. C., Raikes, H., & Pope Edwards, C. (2004). Child care subsidy and quality. *Early Education & Development*, *15*(3), 327–342. https://doi.org/10.1207/s15566935eed1503_5

Jorde Bloom, P. (1996). The quality of work life in NAEYC accredited and nonaccredited early childhood programs. *Early Education and Development*, *7*(4), 301–317. https://doi.org/10.1207/s15566935eed0704_1

Latham, S., Corcoran, S. P., Sattin-Bajaj, C., & Jennings, J. L. (2021). Racial disparities in Pre-K quality: Evidence from New York City's universal Pre-K program. *Educational Researcher*, *50*(9). https://doi.org/10.3102/0013189X211028214

Lynch, K. E. (2022). *The Child Care and Development Block Grant: In brief* [Research brief]. Congressional Research Service. https://crsreports.congress.gov/product/pdf/R/R47312

Massachusetts Department of Education. (n.d.). *Child care program licensing*. Retrieved April 16, 2023, from https://www.mass.gov/child-care-program-licensing

Mass.gov. (n.d.). *Learn about the Massachusetts Quality Rating and Improvement System (QRIS).* Retrieved April 16, 2023, from https://www.mass.gov/service-details/learn-about-the-massachusetts-quality-rating-and-improvement-system-qris

McCormick, M. P., Mattera, S. K., Maier, M. F., Xia, S., Jacob, R., & Morris, P. A. (2022). Different settings, different patterns of impacts: Effects of a Pre-K math intervention in a mixed-delivery system. *Early Childhood Research Quarterly, 58*, 136–154. https://doi.org/10.1016/j.ecresq.2021.08.005

National Association for the Education of Young Children. (2010). *Best practices of accreditation facilitation projects: A framework for program quality improvement using NAEYC early childhood program standards and accreditation criteria*. https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/accreditation/early-learning/AFPBestPractices.pdf

Peisner-Feinberg, E., Van Manen, K., Mokrova, I., & Burchinal, M. (2019). *Children's outcomes through second grade: Findings from Year 4 of Georgia's Pre-K Longitudinal Study.* FPG Child Development Institute. http://files.eric.ed.gov/fulltext/ED598162.pdf

Reid, J. L., Melvin, S. A., Kagan, S. L., & Brooks-Gunn, J. (2019). Building a unified system for universal Pre-K: The case of New York City. *Children and Youth Services Review*, *100*, 191–205. https://doi.org/10.1016/j.childyouth.2019.02.030

Sabol, T. J., Soliday Hong, S. L., Pianta, R. C., & Burchinal, M. R. (2013). Can rating pre-K programs predict children's learning? *Science*, *341*, 845–846. https://doi.org/10.1126/science.1233517

Sandstrom, H., & Chaudry, A. (2012). 'You have to choose your childcare to fit your work': Childcare decision-making among low-income working families. *Journal of Children and Poverty*, *18*(2), 89–119. https://doi.org/10.1080/10796126.2012.710480

Schultz, L. M. (2014). Inequitable dispersion: Mapping the distribution of highly qualified teachers in St. Louis metropolitan elementary schools. *Education Policy Analysis Archives*, *22*(90), Article 90. https://doi.org/10.14507/epaa.v22n90.2014

Schumacher, R., Greenberg, M., & Lombardi, J. (2001). *State initiatives to promote early learning: Next steps in coordinating subsidized child care, Head Start, and state prekindergarten. Full report* (ED454947). ERIC. http://files.eric.ed.gov/fulltext/ED454947.pdf

Shapiro, A., Martin, E., Weiland, C., & Unterman, R. (2019). If you offer it, will they come? Patterns of application and enrollment behavior in a universal prekindergarten context. *AERA Open*, *5*(2). https://doi.org/10.1177/2332858419848442

Thomson, D., Cantrell, E., Guerra, G., Gooze, R., & Tout, K. (2020). *Conceptualizing and measuring access to early care and education*. Administration for Children and Families, U.S. Department of Health and Human Services. https://www.acf.hhs.gov/sites/default/files/documents/opre/conceptualizing_and_measuring_access_508_final.pdf

Tout, K., Zaslow, M., Halle, T., & Forry, N. (2009). *Issues for the next decade of quality rating and improvement systems* [Issue brief]. Child Trends. https://www.acf.hhs.gov/sites/default/files/opre/next_decade.pdf

Ver Hoef, J. M., Peterson, E. E., Hooten, M. B., Hanks, E. M., & Fortin, M. J. (2018). Spatial autoregressive models for statistical inference from ecological data. *Ecological Monographs, 88*(1), 36–59. https://doi.org/10.1002/ecm.1283

Votruba-Drzal, E., & Dearing, E. (Eds.). (2017). *The Wiley handbook of early childhood development programs, practices, and policies*. Wiley Blackwell.

Weiland, C. (2016). Launching Preschool 2.0: A road map to high-quality public programs at scale. *Behavioral Science & Policy*, *2*(1), 37–46. https://doi.org/10.1353/bsp.2016.0005

Weiland, C., Guerrero-Rosada, P., Taylor, A., Penfold, L., Kushner, R., Snow, C., Xia, Y., McCormick, M. (2024). *Scaling high-quality: An implementation study of Boston's Universal Pre-K expansion to community-based programs* [Manuscript submitted for publication].

Weiland, C., McCormick, M., Duer, J., Friedman-Krauss, A., Pralica, M., Xia, S., Nores, M., & Mattera, S. (2024). The mixed-delivery pre-K opportunity gap? Differences in demographics, quality, and children's gains in community-based versus public school programs across five large-scale systems. *Early Childhood Research Quarterly, 68*, 247–259. https://doi.org/10.1016/j.ecresq.2024.05.004

Weiland, C., Sachs, J., McCormick, M., Hsueh, J., & Snow, C. (2021). Fast-response research to answer practice and policy questions. *The Future of Children*, *31*(1), 75–96. https://doi.org/10.1353/foc.2021.0009

Weiland, C., & Yoshikawa, H. (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

Whitebook, M., Sakai, L. M., & Howes, C. (2004). Improving and sustaining center quality: The role of NAEYC accreditation and staff stability. *Early Education and Development*, *15*(3), 305–326. https://doi.org/10.1207/s15566935eed1503_4

Xiao, M. (2010). Is quality accreditation effective? Evidence from the childcare market. *International Journal of Industrial Organization, 28*, 708–721. http://dx.doi.org/10.1016/j.ijindorg.2010.04.004

Zan, B. (2005). NAEYC accreditation and high quality preschool curriculum. *Early Education and Development, 16*(1), 85–104. https://doi.org/10.1207/s15566935eed1601_6

Table 1. Centers' Baseline Capacity, Quality, and Demographics at Their Location by Application Status

Characteristic	Nonappliers ($N = 191$)		UPK appliers ($N = 32$)		
	M or %	*SD*	*M* or %	*SD*	Difference
Capacity					
Total licensed capacity	57.00	41.14	90.34	51.75	33.34***
Infant (birth–15 months)	5.06	7.21	6.12	7.90	1.05
Toddler (15 months–33 months)	9.16	12.78	10.55	12.20	1.39
Pre-K (33 months–Kindergarten)	32.88	33.48	59.21	34.85	26.33***
Pre-K in mixed-age classrooms	2.02	6.94	1.13	6.36	-0.87
Receives EEC subsidies	52.36	--	87.50	--	35.14***
Quality					
In QRIS	51.83	--	87.50	--	35.67***
QRIS 3+ (127 QRIS participants)	8.08	--	25.00	--	16.91*
Average licensing compliance	94.36	5.54	95.11	4.04	0.07
Administration	89.02	11.38	88.35	12.20	-0.07
Staff and ratios	95.98	13.07	99.42	3.09	0.34
Facilities	93.43	12.25	94.79	9.66	1.36
Health and safety	85.75	16.03	85.71	14.03	-0.00
Nutrition	98.39	6.53	98.21	9.45	-0.02
Interactions	98.98	7.96	99.42	3.09	0.04
Curriculum	99.46	4.39	100.00	0.00	0.05
NAEYC accreditation	19.89	--	59.38	--	39.48***
Demographics at the centers' location					
Children under 5 years	68.97	61.84	88.29	83.87	19.31
% Black or African American	22.36	26.94	36.49	29.36	14.13*
% Asian or Asian American	10.63	12.25	14.20	21.09	3.56
% Other or mixed	12.12	11.00	15.92	12.07	3.80
% Hispanic or Latino	19.32	17.24	24.42	19.18	5.10
% White	54.88	27.17	33.39	28.22	-21.50***
Median income dollars	82,238.50	46,611.78	59,707.58	47,411.48	-22,530.91*
% Speak a language other than English	36.03	16.67	50.19	21.77	14.16***
% College degree +	52.55	26.47	34.68	21.94	-17.87**

Note. ***$p < .001$, **$p < .01$, *$p < .05$. We excluded two licensing factors only assessed for a small number of centers (i.e., transportation $N = 117$ and family involvement $N = 56$). UPK nonappliers are distributed across 173 census block groups, and appliers are distributed across 173. Only 10 block groups (out of 201 in Boston) have both appliers and nonappliers.

Table 2. Linear Probability Models Predicting Application to Boston UPK – Full Population

	Center applied to Boston UPK			
Predictors	(1)	(2)	(3)	(4)
Center's capacity				
Total Pre-K capacity	0.00*			0.00
	(0.00)			(0.00)
Receives subsidies	0.13**			0.05*
	(0.04)			(0.04)
Proxies of structural quality				
Participates in QRIS		0.10**		0.01
		(0.04)		(0.04)
Average compliance with standards		0.17		0.21
		(0.26)		(0.24)
NAEYC accredited		0.24***		0.20*
		(0.07)		(0.08)
Community characteristics at the center location				
Children under 5 years old			0.00	0.00
			(0.00)	(0.00)
% Asian			0.00	0.00
			(0.00)	(0.00)
% Black or African American			0.00	0.00
			(0.00)	(0.00)
% Hispanic or Latino			-0.00	-0.00
			(0.00)	(0.00)
% Other and mixed			0.00	0.00
			(0.00)	(0.00)
Estimate median household income in the past 12 months			0.00	0.00
			(0.00)	(0.00)
% Speak other languages			0.00	0.00
			(0.00)	(0.00)
% Bachelor's degree or higher			-0.00~	-0.00
			(0.00)	(0.00)
Constant	-0.03	-0.15	0.06	-0.20
	(0.06)	(0.25)	(0.15)	(0.32)
Observations	192	192	192	192
Neighborhoods	15	15	15	15

Note. ***$p < .001$, **$p < .01$, *$p < .05$. Robust standard errors are in parentheses

Table 3. Characteristics of Children Served by Non-UPK and UPK Centers During the 2018–2019 School Year, in Centers Receiving Subsidies

	Non-UPK (N = 100)		UPK (N = 28)		Difference
Characteristic	*M* or %	*SD*	*M* or %	*SD*	
Children served by centers					
Enrolled children receiving subsidies	27.58	23.30	66.41	46.87	38.83***
Enrolled children eligible for transportation	7.44	13.47	14.89	25.88	7.45*
Enrolled children with homeless status	0.84	4.14	2.53	7.02	1.69
Children's age by September 1, 2018	3.98	1.97	3.57	1.31	-0.41
% Children under 1 year	5.99	9.93	6.45	6.60	0.46
% Children between 1 and 2 years	14.00	15.09	13.23	13.23	-0.76
% Children between 2 and 3 years	18.85	15.19	19.83	9.25	0.09
% Children between 3 and 4 years	20.59	17.21	29.94	15.32	9.35*
% Children between 4 and 5 years	16.12	16.96	16.27	10.57	0.14
Female	48.47	16.42	51.09	6.52	2.61
Subsidies payments and eligibility					
Monthly total family income	2349.30	648.83	2296.87	439.40	-52.43
Total dollar amount billed by the provider	882.20	278.38	969.72	174.08	87.52
Dollar amount of subsidies received	887.48	282.90	979.59	180.50	92.10
DCF (Department of Children and Families)	12.49	17.94	9.94	9.24	-2.54
DHCD (Department of Housing and Community)	1.61	6.75	5.12	14.04	3.51
DTA (Department of Transitional Assistance)	15.69	16.18	9.99	6.77	-5.70
DTA-PT	7.92	12.38	4.53	4.53	-3.38
DTA-T	5.05	5.54	3.47	3.59	-1.15
Income eligible	57.23	25.81	66.94	16.83	9.70
Children's race/ethnicity					
% Asian or Asian American	16.92	13.02	15.44	9.51	-1.48
% Black or African American	29.71	29.71	29.22	11.88	0.49
% Hispanic or Latino	22.82	19.72	26.42	18.89	3.59
% Two or more races and other	11.05	8.56	13.06	9.46	2.00
% White	19.49	14.03	15.85	6.95	-3.63
Language spoken at home					
% Chinese	1.00	5.38	4.22	16.99	3.22
% English	84.31	18.74	79.15	20.00	-5.14
% Spanish	11.27	15.22	12.50	12.67	1.22
% Other languages	1.69	3.83	3.59	6.12	1.86~

Note. ***$p < .001$, **$p < .01$, *$p < .05$.

Table 4. Linear Probability Models Predicting Application to Boston UPK Among Centers Receiving Child Care Subsidies

	Center applied to UPK			
Predictors	(1)	(2)	(3)	(4)
Center's capacity				
Total Pre-K capacity	0.00			0.00
	(0.00)			(0.00)
Proxies of structural quality				
Participates in QRIS		0.13*		0.08
		(0.06)		(0.11)
Average compliance with standards		0.58		0.34
		(0.44)		(0.62)
NAEYC accredited		0.24**		0.25**
		(0.07)		(0.08)
Demographic characteristics of enrolled children receiving subsidies				
Family monthly income			-0.00	-0.00
			(0.00)	(0.00)
% Asian or Asian American			0.37	0.08
			(0.31)	(0.38)
% Black or African American			0.29	0.06
			(0.22)	(0.43)
% Hispanic or Latino/a			0.42	0.18
			(0.47)	(0.54)
% Other and mixed			1.05***	0.82
			(0.30)	(0.60)
% Speaks English at home			-0.20	-0.06
			(0.25)	(0.24)
Constant	0.13	-0.51	0.19	-0.27
	(0.08)	(0.47)	(0.36)	(0.66)
Observations	121	121	121	121
Neighborhood	15	15	15	15

Note. ***$p < .001$, **$p < .01$, *$p < .05$. Robust standard errors are in parentheses.

Figure 1 Distribution of Quality Through Three Different Indicators: Participation in QRIS, Compliance With Standards, and NAEYC Accreditation

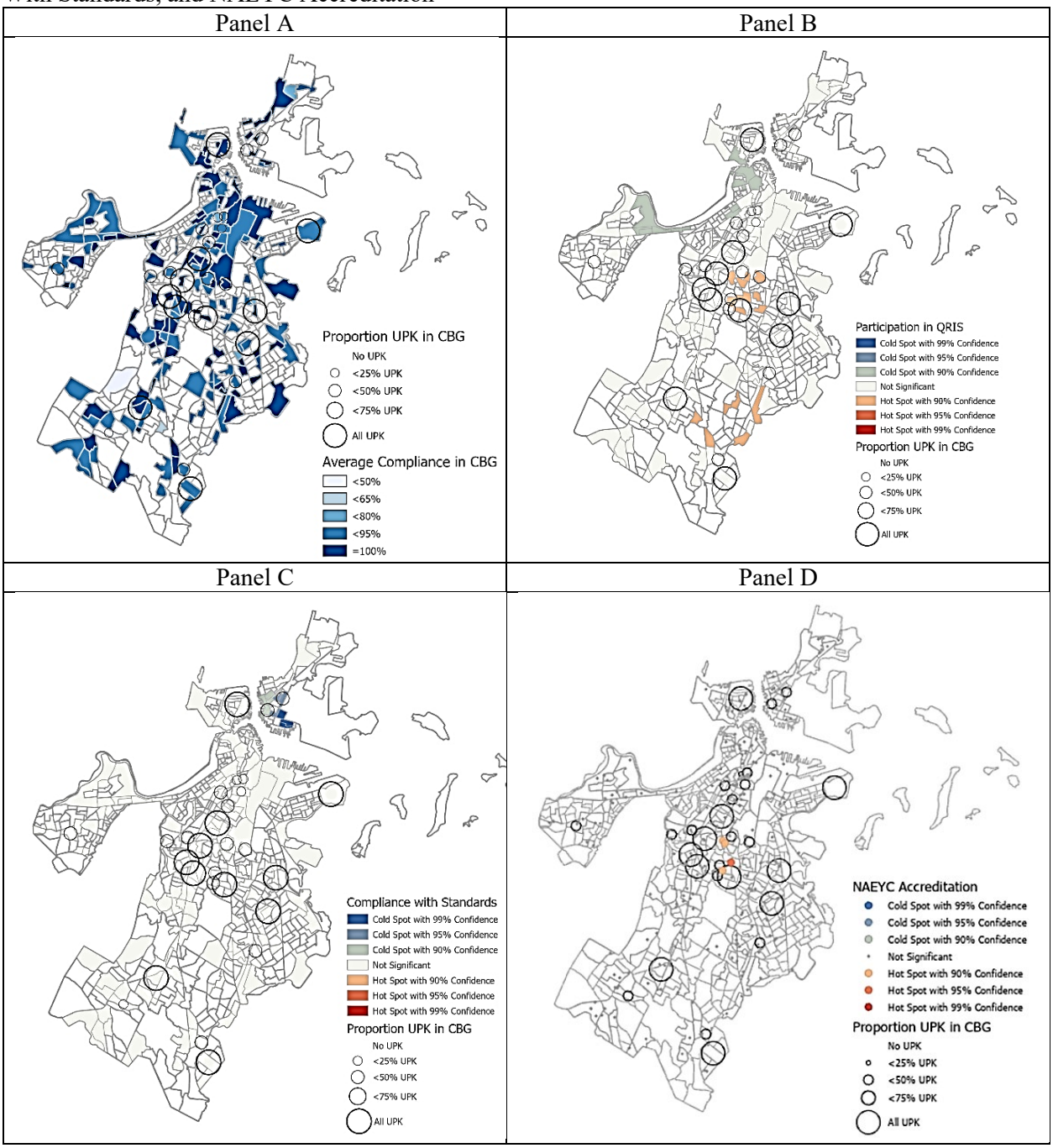

Table 5. Spatial Regression Models Predicting Application to Boston UPK – Full Population

	Center applied to Boston UPK							
	(1)		(2)		(3)		(4)	
Predictors	Main	Spatial	Main	Spatial	Main	Spatial	Main	Spatial
Center's capacity								
Total Pre-K capacity	0.00**	-0.00					0.01**	-0.01~
	(0.00)	(0.00)					(0.00)	(0.00)
Receives subsidies	0.12*	0.78*					0.02	0.01
	(0.05)	(0.32)					(0.06)	(0.63)
Proxies of structural quality								
Participates in QRIS			0.11*	0.43			0.06	0.85
			(0.05)	(0.34)			(0.06)	(0.75)
Average compliance with standards			0.01	-0.42			-0.11	5.89**
			(0.44)	(0.27)			(0.42)	(1.95)
NAEYC accredited			0.23***	0.54***			0.12*	0.56
			(0.05)	(0.05)			(0.05)	(0.42)
Community characteristics at the center location								
Children under 5 years old					0.00	-0.00	0.00	0.00
					(0.00)	(0.00)	(0.00)	(0.04)
% Asian					-0.00	0.13***	0.00	0.12**
					(0.00)	(0.03)	(0.00)	(0.04)
% Black or African American					0.00	0.02*	0.00	-0.02
					(0.00)	(0.00)	(0.00)	(0.02)
% Hispanic or Latino					-0.00	0.12**	-0.01	0.11*
					(0.00)	(0.05)	(0.00)	(0.05)
% Other and mixed					0.00	0.02	0.00	-0.01
					(0.00)	(0.04)	(0.00)	(0.04)
Median household income in the past 12 months					0.00	-0.00*	0.00	-0.00***
					(0.00)	(0.00)	(0.00)	(0.00)
% Speak other languages					0.00	-0.14***	0.00	-0.18***
					(0.00)	(0.03)	(0.00)	(0.00)
% Bachelor's degree or higher					-0.01*	0.03**	-0.00	-0.01
					(0.00)	(0.01)	(0.01)	(0.02)
Constant	-0.15~	-0.46	-0.03	0.10	0.23	-0.01	-0.16	-0.20
	(0.08)	(0.38)	(0.41)	(0.84)	(0.19)	(0.45)	(0.45)	(0.38)
Observations	192		192		192		192	

Note. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$ Robust standard errors are in parentheses

Appendix A

Table A1. Logit Models Predicting Application to Boston UPK – Full Population

	Center applied to Boston UPK			
Predictors	(1)	(2)	(3)	(4)
Center's capacity				
Total Pre-K capacity	0.02~			0.01
	(0.01)			(0.01)
Receives subsidies	1.40*			0.70~
	(0.04)			(0.42)
Proxies of structural quality				
Participates in QRIS		1.23		0.40
		(0.63)		(0.52)
Average compliance with standards		1.73		1.32
		(3.02)		(2.82)
NAEYC accredited		1.84***		1.67**
		(0.09)		(0.50)
Community characteristics at the center location				
Children under 5 years old			0.00	0.00~
			(0.00)	(0.02)
% Asian			0.02	0.01
			(0.02)	(0.02)
% Black or African American			0.00	0.00
			(0.01)	(0.01)
% Hispanic or Latino			-0.02	-0.01
			(0.02)	(0.02)
% Other and mixed			0.02	-0.00
			(0.03)	(0.03)
Estimate median household income in the past 12 months			0.00	0.00
			(0.00)	(0.00)
% Speak other languages			0.01	0.02
			(0.01)	(0.02)
% Bachelor's degree or higher			-0.05**	-0.02*
			(0.02)	(0.01)
Constant	-3.57	-5.23	-2.31	-5.54*
	(2.74)	(3.21)	(1.57)	(2.62)
Observations	192	192	192	192
Neighborhoods	15	15	15	15

Note. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$ Robust standard errors are in parentheses

Table A2. Logit Models Predicting Application to Boston UPK Among Centers Receiving Child Care Subsidies

	Center applied to UPK			
Predictors	(1)	(2)	(3)	(4)
Center's capacity				
Total Pre-K capacity	0.01			0.00
	(0.01)			(0.01)
Proxies of structural quality				
Participates in QRIS		1.43		1.01
		(1.08)		(0.74)
Average compliance with standards		05.09		2.51
		(4.72)		(3.64)
NAEYC accredited		1.44**		1.54**
		(0.14)		(0.55)
Demographic characteristics of enrolled children receiving subsidies				
Family monthly income			-0.00	-0.00
			(0.00)	(0.00)
% Asian or Asian American			2.70~	1.26
			(1.63)	(1.39)
% Black or African American			1.94	0.54
			(2.16)	(2.69)
% Hispanic or Latino/a			3.64	2.16
			(2.94)	(2.74)
% Other and mixed			6.05	6.00
			(2.43)	(2.77)
% Speaks English at home			-0.39	-0.37
			(1.23)	(1.25)
Constant	-1.80	-14.35	-2.87	-5.72
	(0.01)	(48.27)	(2.05)	(4.87)
Observations	121	121	121	121
Neighborhood	15	15	15	15

Note. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$. Robust standard errors are in parentheses.

Appendix B

Table 1B. Taxonomy of Linear Probability Models of Subsidy Receipt Status Among Boston Centers

	Center receiving subsidies in 2019			
Predictors	(1)	(2)	(3)	(4)
Center's capacity				
Capacity	0.00			-0.00
	(0.00)			(0.00)
Proxies of structural quality				
Participates in QRIS		0.68***		0.58***
		(0.05)		(0.07)
Average Compliance with Licensing Standards		-0.98**		-0.83*
		(0.37)		(0.38)
NAEYC accredited		-0.01		-0.02
		(0.06)		(0.08)
Community characteristics at the center location				
Children under 5YO			0.00**	0.00
			(0.00)	(0.00)
% Asian			0.01	0.00
			(0.00)	(0.00)
% Black or African American			-0.00	-0.00
			(0.00)	(0.00)
% Hispanic or Latino			0.00	0.00
			(0.00)	(0.00)
% Other and mixed			0.00	0.00
			(0.01)	(0.00)
Estimate median household income in the past 12 months			0.00	0.00
			(0.00)	(0.00)
% Speak other languages			-0.01*	-0.01
			(0.00)	(0.00)
% Bachelor's degree or higher			-0.01***	-0.01***
			(0.00)	(0.00)
Constant	0.52***	1.11**	1.20***	1.49***
	(0.10)	(0.35)	(0.20)	(0.33)
Observations	193	193	193	193
Neighborhoods	16	16	16	16

Note. Robust standard errors are in parentheses. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$