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Family Child Care Program Closure in Alabama During the COVID-19 Pandemic

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Family child care (FCC) is uniquely positioned to address challenges with insufficient early care and education supply and access in the United States. FCC programs were steadily declining before COVID-19, and many child care programs, both center- and home-based, were at risk of closure early in the pandemic. This study examines closure among Alabama FCC providers during COVID-19. Specifically, we examine the timing and predictors of FCC providers' closure using discrete time-hazard modeling. We analyze administrative data for the 788 FCC programs licensed in March 2020. Over the following 28 months, FCC closure risk was closely linked with COVID-19 disease spread trends. Providers who participated in child care subsidy or national accreditation had lower closure risk than those who did not. The protective effects of subsidy participation were amplified in lower-opportunity communities. Results have implications for mitigating FCC decline and identifying resources to support FCC providers' continued operation.

Keywords: *child care, child care subsidy, COVID-19, descriptive analysis, early childhood, educational policy, equity, family child care, home-based child care, longitudinal studies, quality improvement, secondary data analysis*

Family child care (FCC), one type of home-based child care, is uniquely positioned to address challenges with early care and education (ECE) supply. Therefore, it is important that state and federal agencies and initiatives support FCC sustainability. Specifically, FCC helps to ensure equitable access to ECE, as it is often one of the only viable options for historically marginalized families who would otherwise struggle to access child care (Henly & Adams, 2018; Malik et al., 2018). FCC is the preferred ECE option for many families, especially for infants and toddlers (Bromer et al., 2021). It is often more affordable and readily available in rural communities than center-based care. Of the nearly 11 million children with working mothers, 40% spend more time in FCC or similar home-based paid caregiving arrangements than in other ECE settings. About one in four children who receive child care subsidies funded through the Child Care and Development Fund (CCDF) program attend FCC (Office of Child Care, 2016).

For over a decade, the number of licensed FCC programs has declined more rapidly than center-based ECE programs (NCECQA, 2020). Little is known about what has been driving this decline and whether it has persisted during the COVID-19 pandemic. Most research on ECE closure during the pandemic has focused on center-based care. However, research conducted before and during COVID-19 indicates that FCC providers face different challenges than centers, indicating a need to study FCC program closure specifically. While the pandemic may have exacerbated factors that influenced FCC decline prepandemic, it may be that pandemic conditions increased the demand for and support available to FCC. To better understand the state of this ECE sector and factors related to its sustainability or possible continued decline, this study explores the timing and predictors of FCC program closure in Alabama during the first two years of the COVID-19 pandemic.

Literature Review

Family Child Care

FCC refers to care for a small group of children in a residential setting, most often the provider's home, licensed or regulated by the state (Child Care Aware of America, 2018). Many states' regulations require FCC providers to be licensed once they care for a certain number of unrelated children. However, regulations vary considerably. For example, 15 states require licensure when providers care for one or two unrelated children, 7 require licensing beginning at six or more, and 3 do not have mandatory FCC licensure (NCECQA, 2020). Many states license FCC as either small—one provider, typically around six children—or large, up to around

12 children with a second adult present. State-to-state variation in defining FCC creates a challenge for drawing broader conclusions and tracking national trends in FCC operation. Therefore, state-specific case studies of FCC are essential and relevant.

FCC is the preferred ECE option for many families, including historically marginalized groups who often face barriers to accessing child care. FCC is frequently used by families who are immigrants, work nontraditional hours, and have low-wage jobs (Liu, 2015; Sandstrom et al., 2019). FCC is often less expensive than center-based care and, therefore, more accessible to low-income families (Child Care Aware of America, 2019). Families can often find an FCC provider who is a cultural and linguistic match more readily than in center-based care (Hill et al., 2021; Vieira & Hill, 2019). This match can benefit child outcomes, especially for dual language learners (Shivers et al., 2016). Rural families are more likely to access and utilize FCC than center-based care (Anderson & Mikesell, 2019). Additionally, some families, especially those with infants and toddlers and children with disabilities, prefer FCC because they want their child to be in a home setting, in a small group, with siblings, and with one trusted, consistent adult (Forry et al., 2013; Hooper & Hallam, 2021b).

FCC providers are small business owners in addition to caring for children. This means they must have a broad skillset to be successful and often must navigate many roles simultaneously, such as business owner and teacher (Fernandez et al., 2018; Gerstenblatt et al., 2014; Hooper, 2020; Mimura et al., 2019). Most FCC providers are women, and Black and Latinx women are over-represented (McLean et al., 2021; NSECE Project Team, 2016). Therefore, in addition to the importance of ECE supply and access, supporting FCC sustainability also has implications for women and minority-owned small businesses.

Prepandemic Family Child Care Decline

The number of FCC programs in the United States has been declining for more than a decade (NCECQA, 2015, 2020). Data from the National Association for Regulatory Administration (NARA) Child Care Licensing Study, a nationwide count of licensed ECE programs conducted every three years, show that more than 97,000 FCC programs closed between 2005 and 2017 (NARA, 2017). This represents a decline of 48% in small FCC and 21% in large FCC programs, compared to a 2% increase in center-based child care programs over the same period (NCECQA, 2020).

The National Survey of Early Care and Education (NSECE), a nationally representative study of the supply and demand for ECE in the United States, found that from 2012–2019, the number of listed home-based providers, roughly comparable to licensed FCC, decreased by 25 percent (Datta et al., 2021). Additionally, the number of FCC providers receiving child care subsidy funds declined by 60% from 2006–2015 (Mohan, 2017). This substantial decline in the number of FCC programs and those accepting child care subsidies is a significant concern because of FCC's important role in addressing equitable ECE access.

Bromer and colleagues (2021) conducted a comprehensive literature review identifying three main factors affecting the changing FCC supply: working conditions, business sustainability, and experiences with ECE systems. Work-related stress and business income were the most salient factors for providers' exit from the FCC workforce. However, as the authors note, there remain significant gaps in our understanding of FCC decline.

Very little research directly examines FCC program closure or providers' exit from the field. Most relevant research has examined factors related to providers' job commitment, work engagement, and intent to stay in or exit the field. For example, Weaver (2002) found that psychological well-being and resources—such as social support, the Child and Adult Care Food Program, and equipment loans—were significant predictors of FCC providers' professional commitment. Walker (2002) similarly found FCC providers' intent to remain in the field was significantly correlated with lower stress, higher job satisfaction, lower role overload, and higher income from child care. More recently, Swartz and colleagues (2016) found that providers' intent to exit FCC was predicted by higher stress and lower peer support. While informative, these studies use self-reported provider characteristics and experiences and proxies for FCC decline.

As Bromer and colleagues (2021) observed, most existing research related to FCC decline indirectly examines decline by studying providers' challenges, working conditions, and business practices (e.g., Gerstenblatt et al., 2014; Hurley & Shen, 2016; Werner, 2016). Of the few quantitative studies that directly examine FCC providers' intent to exit or actual exit from the field, most were conducted 10 to 20 years ago (e.g., Deery-Schmitt & Todd, 1995; Walker, 2002; Weaver, 2002).

The existing research indicates that FCC providers' stress, income, job control, social support, and resources related to their intent to exit ECE. However, little recent empirical research has directly examined FCC program closure and its predictors.

Early Care and Education and COVID-19

In Spring 2020, 45 states implemented stay-at-home orders due to COVID-19, leading to widespread closures of ECE programs. As of April 2020, more than half of ECE centers and one-quarter of FCC programs across the country had suspended operations (Ali et al., 2021; Lee & Parolin, 2021; US Department of Health and Human Services, 2020). As states lifted stay-at-home orders and

mandatory closures expired, some programs reopened, but many remained closed. However, ECE program closures were not uniform across states, communities, or program types. Communities with higher percentages of White families experienced the fewest program closures, whereas communities with higher rates of Hispanic families were the most likely to experience closures (Campbell et al., 2020; Lee & Parolin, 2021; Zhang et al., 2022). Programs funded solely by private pay were more likely to close and less likely to reopen than programs that received public funding like subsidies, Head Start, and public Pre-K funds (Campbell et al., 2020; Delap et al., 2021; Weiland et al., 2021).

Most of the published studies and reports on ECE closure throughout the pandemic have documented providers' self-reported operating status via survey, meaning that many of these closures are likely temporary suspensions of operations rather than permanent program closures. However, evidence suggests that some ECE programs, particularly FCC, were at risk of permanent closure. For instance, in June 2020, 40% of FCC providers in Maine reported that the pandemic made them reconsider working in FCC (Williams & Karno, 2022). In a national survey conducted in summer 2021 (NAEYC, 2021), one-third of ECE providers nationally, including over half of those surveyed in Alabama, reported that they were considering leaving or closing their program in the next year.

FCC providers' challenges throughout the pandemic resemble the factors that prepandemic studies found were associated with permanent FCC program closure, such as access to resources and providers' psychological well-being. Several studies have found that conditions related to the pandemic had adverse effects on FCC providers' emotional well-being and have increased their workload, stress, and isolation (Delap et al., 2021; Nagasawa & Tarrant, 2020; Porter et al., 2020; Smith et al., 2021; Williams & Karno, 2022).

Though ECE providers across settings experienced these challenges, some may have impacted FCC providers more severely. Any additional program operating responsibilities, such as symptom screening and increased cleaning, fell solely on the FCC provider rather than being shared across program staff. FCC providers also experienced high stress related to virus exposure for themselves and their families, given they operate their programs within their homes and are less likely to have access to health benefits (Gallagher & Huddleston-Casas, 2020; Mimura et al., 2019).

Implementing COVID-19 precautions increased operating costs, while temporary closures and reduced enrollment decreased program revenue for ECE programs (Delap et al., 2021; Porter et al., 2020; Williams & Karno, 2022). Some evidence suggests FCC programs were particularly financially vulnerable. Workman and Jessen-Howard (2020) estimated that the actual cost of meeting pandemic-era enhanced health and safety guidelines equaled a 70% increase in operating expenses for FCC versus a 47% increase for centers. Qualitative data reinforce this (e.g., Delap et al., 2021). Additionally, FCC providers were less likely than other ECE programs to access financial supports, such as grants and Paycheck Protection Program loans, due to a lack of administrative capacity, not having established banking relationships, and fear of repayment and tax implications (NAEYC, 2020; Smith et al., 2021; US Chamber of Commerce Foundation, 2020; Weiland et al., 2021). They were more likely to take on personal debt to keep their programs operating (NAEYC, 2021).

However, there is evidence that home-based programs were protected from some challenges that center-based programs faced. For example, given that FCC providers have small group sizes, they were largely unaffected by restrictions on class sizes. Research from several states indicates fewer temporary closures and smaller reductions in enrollment among home-based programs than among centers (CA CCRR Network, 2021; Daro & Gallagher, 2020; Delap et al., 2021; Porter et al., 2020; Zhang et al., 2022).

Although very little published research has examined permanent FCC closure throughout the pandemic, one report by the California Child Care Resource & Referral (CCR&R) Network (2021) tracked licensing data from January 2020 to January 2021. The authors found that the number of FCC licenses decreased by 14% during this period. Tracking licensing data allows for a more accurate account of permanent program closures. However, examining net changes in FCC licenses, capturing some providers exiting while new providers enter, cannot isolate factors associated with permanent FCC closures. In other words, the California CCR&R Network (2021) report contributes to the body of research documenting the FCC decline but does not contribute to our understanding of what is driving the decline. The present study addresses this by using administrative data to track the licensing status of all FCC programs licensed as of March 2020 and examine provider- and community-level factors associated with closure over the following two-year period.

There is some evidence that families' preferences related to child care changed during COVID-19. For example, an Alabama survey of working families conducted in summer 2020 found that although only 11% of responding parents reported using any home-based child care, 40% reported that home-based child care was the only type of child care they were comfortable using at the time of the survey (Hooper et al., 2020). However, the overall demand for child care during the pandemic seems to have remained high, especially relative to the decreased supply, with many families desiring child care even if they were working remotely (e.g., Yamoah et al., 2023).

Alabama Context

The current study used data from Alabama, where FCC providers must be licensed if they care for one or more unrelated children, if care is away from the child's home, and if they operate for more than four hours per day. Small FCC (family day care homes) can serve up to six children, whereas group FCC (group day care homes) can serve up to 12 children with an assistant caregiver. FCC programs, both small and group, comprise approximately 30% of licensed child care programs in the state.

Though the number of FCC programs in Alabama had been declining at a slightly slower rate than nationally prepandemic—20% vs. 22%, respectively (NARA, 2017)—FCC plays a vital role in meeting Alabama families' ECE needs. Groups who often have difficulty accessing ECE and prefer FCC are overrepresented among Alabama's population. Specifically, 41% of Alabama's population lives in rural areas compared to 19% nationally (US Census Bureau, 2016). Among Alabama children under six years old in working families, an estimated 42% have parents working nontraditional hours; only two states, Mississippi and Nevada, have higher percentages (Schilder et al., 2021).

Child care and COVID-19 in Alabama. Most pandemic-related orders issued to ECE providers in Alabama had little direct effect on FCC. For instance, from March through May 2020, child care facilities were limited to having fewer than 12 children in a room, higher than most FCC programs' licensed capacity. Though Alabama was one of 33 states that allowed child care programs to remain open, it had one of the highest rates of temporary closures, with only 12% of ECE programs open and serving children at the end of March 2020 (AL Department of Human Resources, 2020).

In August 2020 and May 2021, the state agency overseeing child care offered two stabilization grants, which incentivized child care programs to reopen and remain open. The stabilization grants awarded providers $300 per child in fall 2020 and $500 per child in summer 2021. Funds could be used for any program operating costs. To receive funding, providers had to be licensed, apply, and agree to remain open for a full year after receiving each grant.

Alabama was not one of the 20 states that awarded child care subsidy funding through Child Care Development Fund (CCDF) to ECE providers who had not previously participated in the subsidy program. As a result, much of the state's pandemic-related financial assistance was available only to providers already serving subsidy-eligible children. These subsidy-participating providers received 125% of the normal subsidy rate for children of essential workers from May 2020 through June 2021; they received full-time rather than part-time rates for school-aged children while public schools were closed in the spring of 2020. From April to August 2020, all subsidy-participating providers received weekly "sustainability payments" at 50% of the regular pay rate for subsidized children. These were paid on top of the regular subsidy rate if providers were open and serving children. Additionally, Alabama's CCDF Lead Agency temporarily loosened or suspended certain attendance policies, meaning that provider subsidy payments remained more stable.

Given the importance of FCC in meeting families' ECE needs, the prepandemic decline in FCC, and the concerns about ECE program closure due to COVID-19, this study sought to address four research questions:

1. How did the FCC closure risk change during the COVID-19 pandemic, and how does this trend relate to COVID-19 disease spread rates?
2. What is the association between provider-level characteristics and FCC closure risk, controlling for the community-level differences? Does the association vary across time?
3. What is the association between community-level characteristics and FCC closure risk, controlling for the provider-level differences? Does the association vary across time?
4. Does the association between provider-level characteristics and FCC closure risk vary according to the level of community-level characteristics?

We hypothesized that because of the additional financial support offered to subsidy-accepting providers, FCC providers accepting subsidies would have a lower closure risk. We also hypothesized lower closure risk for providers living in higher-opportunity communities, as they may have greater access to resources, and higher closure risk when COVID-19 disease spread rates were also high.

Method

Sample

The sample for this study included all Alabama FCC providers, small and group, who were licensed as of March 1, 2020—788 providers. We obtained licensing data at 13 time points over 28 months, from March 2020 to June 2022. We excluded FCC programs that opened after March 2020 in our analysis. Therefore, our analysis reflects the closure decisions of the population of FCC providers licensed in March 2020 rather than the overall FCC supply during these 28 months. Table 1 shows the demographic statistics for the sample. Approximately two-thirds (66%) were small FCC, and 68% accepted subsidies. Most (84.3%) lived in a community classified as urban.

Measures

We used state administrative data for child care licensing and child care subsidy and additional secondary data sources

TABLE 1
Demographic Characteristics of Family Child Care Providers Licensed in March 2020 and Their Communities

	All (N = 788)			Open, Never Closed (n = 410)			Ever Closed (n = 378)		
Variable	Percent	Mean	*SD*	Percent	Mean	*SD*	Percent	Mean	*SD*
Provider type									
Small FCC	65.4%			62.0%			69.0%		
Group FCC	34.6%			38.0%			31.0%		
Accepts subsidy	65.2%			74.6%			55.0%		
Nationally accredited	10.3%			13.9%			6.3%		
Urban/rural									
Urban	84.3%			81.7%			87.0%		
Suburban	8.9%			11.5%			6.1%		
Rural	6.6%			6.6%			6.6%		
COI composite		43.9	27.7		44.7	27.5		43.1	28.0
Community licensed child care capacity		111.0	115.5		110.9	113.0		111.0	118.4

Note: COI composite = Child Opportunity Index composite score (the weighted average of three domains: education, social and economic, health and environment). The COI composite score ranges from 0 to 100, with higher scores indicating communities with higher opportunities for children.

related to community characteristics. We created a combined dataset, matching providers using a common identification number. Measures are described in the following sections.

Program closure (y_{it}). For our outcome variable, we created a dichotomous operating status variable indicating if a provider i appeared on the licensing list at each month of administrative data we obtained (t).

Throughout the paper, *closure* refers to a provider no longer appearing on the list of licensed programs. It does not refer to short-term disruptions in operation or temporarily not serving children. Closure, or exit from licensure, can be active or passive. An active closure occurs when providers contact the state child care licensing agency to share that they are closing or if the licensing agency terminates their license prior to the expiration date. Passive closure occurs when a provider's license, valid for two years, expires without renewal. FCC providers who let their license expire may disappear from the licensing list after a grace period and reappear when they successfully renew their license. Therefore, we use *closure* as synonymous with an exit from licensing. Closure here likely includes passive and active closures, as these cannot be distinguished in the administrative data.

Using FCC licensing status, we constructed survival data, which allows the examination of *whether* and *when* a given event occurred (Singer & Willett, 2003). The event of primary interest was the first closure by a given FCC provider. Although a provider may have exited and reentered licensing during our time period, we focus on first closure because most providers who closed did not return (86% of 378 providers). Also, time to first closure has implications for gauging how tenacious providers were against the impact of COVID-19.

The time scale of closure was recorded in discrete-time intervals, with many FCC providers sharing the same time-to-event values. Even though closure can occur at any time during the month, suggesting a continuous underlying time-to-event process, we had data for only 13 of 28 months. Given the data constraints, it was necessary to model the process using discrete time intervals. We defined the discrete time intervals between the available recorded months, $(t-1,t]$, using the 13 months denoted as $t = 1,2,\ldots,13$ respectively. The time interval represents a standard partition of time, in which each interval starts from the end of the previous recorded month $t-1$ and ends at the concluding month t.

COVID-19 disease spread (x_{1it}). We included the Disease Spread Index (DSI) component of the Pandemic Vulnerability Index 12.4 as a time-varying predictor. The DSI indicates the fraction of total COVID-19 cases in a county over the last 14 days (Marvel et al., 2021). Values range from 0 to 1; 0 indicates that there have been no new infections in the last 14 days, and 1 indicates exponential growth in new infections. We obtained monthly DSI measures for our time period.

Subsidy participation (x_{2i}). We calculated whether FCC providers participated in the subsidy program using several administrative data variables. These included (1) they were serving at least one child receiving subsidy in March 2020; (2) they appeared on a May 2020 list of providers eligible to enroll children in the subsidy program, meaning they had

completed the paperwork to serve subsidized children; and (3) the subsidy data included a date indicating when they became active in the subsidy program. Through discussion with the state agency overseeing subsidy and because of data collection and reporting limitations, we determined that using this combination of variables would provide the most comprehensive list of subsidy-accepting FCC programs. If any of these three variables indicated that providers were subsidy-accepting, we considered them participating in the subsidy program.

National accreditation (x_{3i}). The child care licensing data file included a variable noting whether providers were accredited by the National Association for Family Child Care (NAFCC). We cross-checked this variable with the accredited provider list on NAFCC's website. If there were any discrepancies, we used what was on the NAFCC website, which was determined to be more up-to-date. We created a dichotomous variable indicating accreditation.

Program type (x_{4i}). Using the child care licensing data, we created a variable indicating program type as of March 2020: FCC (licensed to serve up to 6 children) and group FCC home (licensed to serve up to 12 children with an assistant).

Community characteristics

Child Opportunity Index (x_{5i}). We used the Child Opportunity Index 2.0 (COI; Noelke et al., 2020) to measure community socioeconomic conditions. The COI is a composite measure of neighborhood conditions in the United States, focused on indicators that positively facilitate children's health and development. The COI 2.0 uses census data from 2015 and includes 29 indicators related to education, health and environment, and social and economic conditions. Noelke and colleagues (2020) provide a detailed description of the index construction and indicator weighting. Per author recommendations, we used the state-normed COI score. COI is measured at the census tract level; values range from 1 (lowest opportunity) to 100 (highest opportunity).

Urban density (x_{6i}, x_{7i}). We calculated the urban density of providers' census tracts by utilizing the 2010 Rural-Urban Commuting Area (RUCA) codes developed by the US Census Bureau. These codes classify census tracts into ten categories based on the degree of urbanization and the extent of connections to urban areas. We created three main categories: urban (1–4, representing tracts located in the core of large urban areas and those adjacent to them), suburban (5–7, representing tracts located in the outer parts of large urban areas and those adjacent to smaller urban areas), and rural (8–10, representing tracts located in rural areas and those adjacent to them). We created two dummy variables to indicate whether the provider is in a suburban (x_{6i}) or rural (x_{7i}) area, with urban being the reference category.

Number of licensed child care slots (x_{8i}). We obtained state administrative data reflecting the child care landscape as of March 1, 2020, which included both FCC and center-based programs. We used this dataset to calculate the aggregate capacity of center and FCC providers within a given census tract.

Data Analysis

Discrete-time hazard and survival probability. We built analytic models based on the *discrete-time hazard.* The discrete-time hazard for a given time interval was defined as the conditional probability of a provider experiencing closure in that interval, given that a provider had not previously experienced closure. The life table presented in Table 2 shows the required information to estimate these hazards. Let $N_{at\,risk}$ represent the number of FCC providers that remained licensed (or at risk of closure) at the end of the previous time $t-1$ and N_{closed} represent the number of providers who closed during the time interval $(t-1,t]$. Then, the discrete-time hazard in time t can be estimated as the proportion of each time's risk set that experiences closure by the end of that period—that is, $\hat{h}_t = N_{closed} / N_{at\,risk}$.

While the hazard indicates the unique risk of closure associated with each time, the discrete-time survival probability S_t cumulates these period-specific risks to assess the probability of not experiencing the closure by time t. From the last column of Table 2, for example, we can see that the estimated survival probability of remaining licensed in June 2022 was 0.520 ($t=13$), meaning 52% of FCC providers licensed in March 2020 never experienced closure.

Statistical models

RQ1. A model for marginal hazards. A binary event indicator y_{ti} was created for the closure occurring at the time interval $(t-1,t]$ for FCC provider i. The event indicator had a value of 1 if closure happened during that time interval and 0 if closure had not occurred by the end of that time interval. Once closure occurred, or a provider was *censored*, the remaining event indicators were coded as missing. By defining the event history origin as March 2020, we aim to analyze the particular closure risk FCC providers experienced in response to the pandemic.

By defining the binary variable y_{ti} taking the values 0 and 1, the estimated hazard $\hat{h}_t$ can be obtained as the proportion of 1s observed each time interval. We can estimate the proportions as predicted probabilities by using a generalized linear regression model with a link function $g(\cdot)$ and dummy variables for each time interval:

TABLE 2
Life Table Describing the Number of Months to Closure From the Onset of the COVID-19 Pandemic

t	Time Interval	Month-Year	$N_{at\,risk}$	N_{closed}	$N_{censored}$	$\hat{h}_t$ Hazard Prob.	$\hat{S}_t$ Survival Prob.
1	1	Mar-2020	788				
2	(1,2]	Apr-2020	788	27	0	0.034	0.966
3	(2,3]	Jul-2020	761	146	0	0.192	0.780
4	(3,4]	Oct-2020	615	22	0	0.036	0.753
5	(4,5]	Jan-2021	593	54	0	0.091	0.684
6	(5,6]	Feb-2021	539	17	0	0.032	0.662
7	(6,7]	Mar-2021	522	3	0	0.006	0.659
8	(7,8]	Apr-2021	519	4	0	0.008	0.654
9	(8,9]	May-2021	515	9	0	0.017	0.642
10	(9,10]	Jun-2021	506	9	0	0.018	0.631
11	(10,11]	Jul-2021	497	9	0	0.018	0.619
12	(11,12]	Mar-2022	488	57	0	0.117	0.547
13	(12,13]	Jun-2022	431	21	410	0.049	0.520

Note: Time interval, $(t-1,t]$, reflects a standard partition of time in which each interval *excludes* the previous time $t-1$ and *includes* the concluding month t; $N_{at\,risk}$ = number of FCC providers remained open at the end of the previous time $t-1$; N_{closed} = number of FCC providers closed during the time interval $(t-1,t]$; $N_{censored}$ = number of FCC providers censored at the end of the time period t; $\hat{h}_t$ = estimated hazard probability, or proportion of FCC providers at the beginning of the time interval $(t-1,t]$ who closed by the end of that period; $\hat{S}_t$ = estimated survival probability, or proportion of all FCC providers still remained open at the end of the time period t.

$$g\left(h_{ti}\right) \equiv g\left(\Pr\left(y_{ti}=1 \mid \mathbf{d}_{ti}\right)\right) = \alpha_1 d_{1ti} + \cdots + \alpha_{13} d_{13,ti}$$

where h_{ti} is a hazard of the closure occurring at the time interval $(t-1,t)$ for FCC provider i and $\boldsymbol{d}_{ti} = \left(d_{1ti},\ldots,d_{13,ti}\right)$ is a vector containing all the time dummy variables for provider i. By utilizing dummy variables for different time intervals, we can avoid making assumptions about the functional form, such as linear or polynomial, of the relationship between the event's likelihood and the passage of time. The predicted probabilities, $\Pr\left(y_{ti}=1 \mid \mathbf{d}_{ti}\right)$, obtained from this model correspond to estimated marginal hazards $\hat{h}_t$ presented in Table 2 (Muthen & Masyn, 2005; Rabe-Hesketh & Skrondal, 2022). In this model, the complementary log-log function, $\text{cloglog}\left(h_{ti}\right) = \ln\left\{-\ln\left(1-h_{ti}\right)\right\}$, is used as the link function $g(\cdot)$, and the intercept is omitted. Therefore, the exponentiated coefficients of the time dummy variables, $\exp\left(\alpha_t\right)$, are equivalent to the estimated marginal hazards $\hat{h}_t$. The estimated coefficients α_t the first part of Research Question (RQ) 1, which pertains to the evolution of closure risk over time.

In the following model specification, we aimed to examine the relationship between changes in the risk of FCC closure and the COVID-19 DSI (x_{1ti}), as per the second part of RQ 1. We did this by parameterizing the general association between these variables. Instead of utilizing a system of time interval indicators ($\mathbf{d}_{ti}$), we regressed $g(h_{ti})$ on our key time-varying predictor x_{1ti}, as x_{1ti} and $\mathbf{d}_{ti}$ are highly correlated. Since the impact of COVID-19 disease spread on FCC closure may not be instantaneous, we investigated the association with one-month and two-month lagged versions of x_{1ti}, specifically lag-1 ($x_{1,t-1,i}$) and lag-2 ($x_{1,t-2,i}$), and their associations with the discrete-time hazards. The exponentiated regression coefficients of x_{1ti}, $x_{1,t-1,i}$, and $x_{1,t-2,i}$ serve as a measure of the hazard ratio, indicating the proportional change in the risk of FCC closure for a unit increase in the DSI.

RQ 2-4. A model for conditional hazards. To answer RQs 2, 3, and 4, we specify a generalized linear model with seven time-constant covariates $\mathbf{x}_{ij} = (x_{2ij},\ldots,x_{8ij})'$ and county-level fixed effects λ_j added to the dummy variables for time intervals, $\mathbf{d}_{tij} = (d_{1ij},\ldots,d_{13,ij})'$,

$$\begin{aligned} g(h_{tij}) &= g\left(\Pr(y_{tij=1} \mid \mathbf{d}_{tij}, \mathbf{x}_{ij}, \lambda_j)\right) \\ &= (\alpha_1 d_{1ij} + \ldots + \alpha_{13} d_{13,ij}) + \sum_{k=2}^{4} \beta_k x_{kij} \\ &\quad + \sum_{p=5}^{8} \gamma_p x_{pij} + \lambda_j . \end{aligned}$$

where h_{tij} is now a conditional hazard of closing at time interval $(t-1,t]$ for provider i in county j given the fixed effects of time, provider and community characteristics, and county. The link function $g(\cdot)$ again utilizes the complementary log-log function. By including λ_j, this model implicitly controls for all county-level characteristics, whether observed or unobserved, because county is held constant in the comparison. As a result, the parameters of interest, α_t, β_k, and γ_p, all pertain to within-county comparisons.

First, α_t now represents the change of the baseline risk of FCC closure over time when the covariates $\mathbf{x}_{ij}$ are set to zero. Second, β_k represents the within-county effects of provider characteristics, including subsidy participation (x_{2ij}), national accreditation (x_{3ij}), and program type (x_{4ij}). For example, the exponentiated regression coefficient β_2 can be interpreted as the *hazard ratio* between providers who accept subsidies and those who do not within the same county, while controlling for the community characteristics of their census tracts. This hazard ratio estimated from $\exp(\beta_k)$ helps to answer RQ 2.

Third, γ_p summarizes the within-county effects of the three community-level characteristics, COI (x_{5ij}), urban density (x_{6ij}, x_{7ij}), and capacity (x_{8ij}). For example, $\exp(\gamma_7)$ represents the hazard ratio comparing providers in rural areas to those in urban areas within the same county, while controlling for other provider characteristics. We answer RQ 3 by estimating $\exp(\gamma_p)$ in this model.

The relationship between these covariates and closure risk, measured by the hazard ratio, may not be constant over time. For example, the protective effect of subsidy participation may be more pronounced during periods of severe COVID-19 spread. Therefore, we relaxed the *proportionality hazard assumption* (Singer & Willett, 2003), allowing the relationship between the selected covariate and closure risk to vary across time intervals. We included interaction terms between $\mathbf{x}_{ij}$ and $\mathbf{d}_{tij}$ for each covariate in turn. We retained the covariate that demonstrated evidence of time-varying associations using leave-one-out cross-validation (LOO) and the widely applicable information criterion (WAIC). The question, "Does the association vary across time?" in RQ 2 and 3 can be answered by examining the coefficients of the interaction terms.

Finally, the relationship between provider characteristics and the likelihood of closure may differ depending on the community-level contexts. To account for this, we allowed the effect of subsidy participation to vary by COI, urban density, and child care capacity. In the last stage of model construction, we analyzed the results of the interactions between these provider and community characteristics to address RQ 4. All models were calculated utilizing Bayesian MCMC techniques implemented in the Stan software.

Results

Table 1 shows the descriptive statistics for the characteristics for FCC providers open as of March 2020, along with characteristics of those who closed and those who had never closed as of June 2022. Descriptive statistics showed some apparent differences between providers who closed and those who remained open—namely in subsidy acceptance (74.6% of those who stayed open compared to 55.0% who closed) and national accreditation (13.9% of those who stayed open and 6.3% who closed). Descriptive statistics for FCC closure revealed no clear association with community characteristics.

Changes in the Risk of Closure

Panel A in Figure 1 shows the estimated marginal discrete-time hazards for each time interval. The point estimates of hazards are identical to those presented in Table 2, but we also depict their 95% credible intervals to summarize each estimate's uncertainty. We found that the estimated risk of closure was greatest during three periods: (a) May to July 2020, (b) November 2020 to January 2021, and (c) August 2021 to March 2022. The estimated hazard for the time interval between May and July 2020, 0.192, is nearly twice as high as the hazards estimated for the other two intervals. This indicates that roughly 20% of FCC providers operating at the end of April 2020 had closed by the end of July 2020. Panel B in Figure 1 presents the estimated survival probabilities of FCC providers from March 2020 to June 2022, demonstrating that 48.2% experienced closure.

Panel A in Figure 2 associates these estimated marginal hazards with COVID-19 disease spread. Closure risk was closely linked with monthly disease spread trends. The highest estimated closure risk between May and August 2020 appears to reflect a disproportionately negative impact of the first (April 2020) and second (July 2020) waves of COVID-19 spread. Likewise, the impact of the third wave, roughly November 2020 to February 2021, was reflected in the approximately 10% closure risk during the corresponding period. Approximately 12% of the estimated risk between August 2021 and March 2022 appears to be attributable to the cumulative effect of the Delta and Omicron surges.

Provider Characteristics

Figure 3 displays the model-predicted hazard and survival probabilities, along with their 95% credible intervals, separated by provider characteristics. The effect of subsidy acceptance is particularly noteworthy. The estimated value of $\hat{\beta}_2$ was −0.73 on the clog-log scale. The exponentiated value of $\exp(-0.73) = 0.48$ represents the hazard ratio based on comparison within the same county. This ratio suggests that, after controlling for other provider and community characteristics, the closure risk for providers accepting subsidies was only an average of 48% of the risk for those not accepting subsidies.

By relaxing the proportionality hazard assumption, we could identify that the relationship between subsidy acceptance and closure risk varied across the pandemic. The protective effect of accepting subsidies appears to have been concentrated in the first and second waves of the COVID-19 pandemic. In contrast, providers without subsidies demonstrated a statistically similar risk of closure in the subsequent later phase of the pandemic. This pattern was also observed for national accreditation. Nationally accredited providers had approximately 4% ($\exp(-3.13)$) of the risk of first closure between May and July 2020 compared to those without national accreditation within the same county. Small FCCs

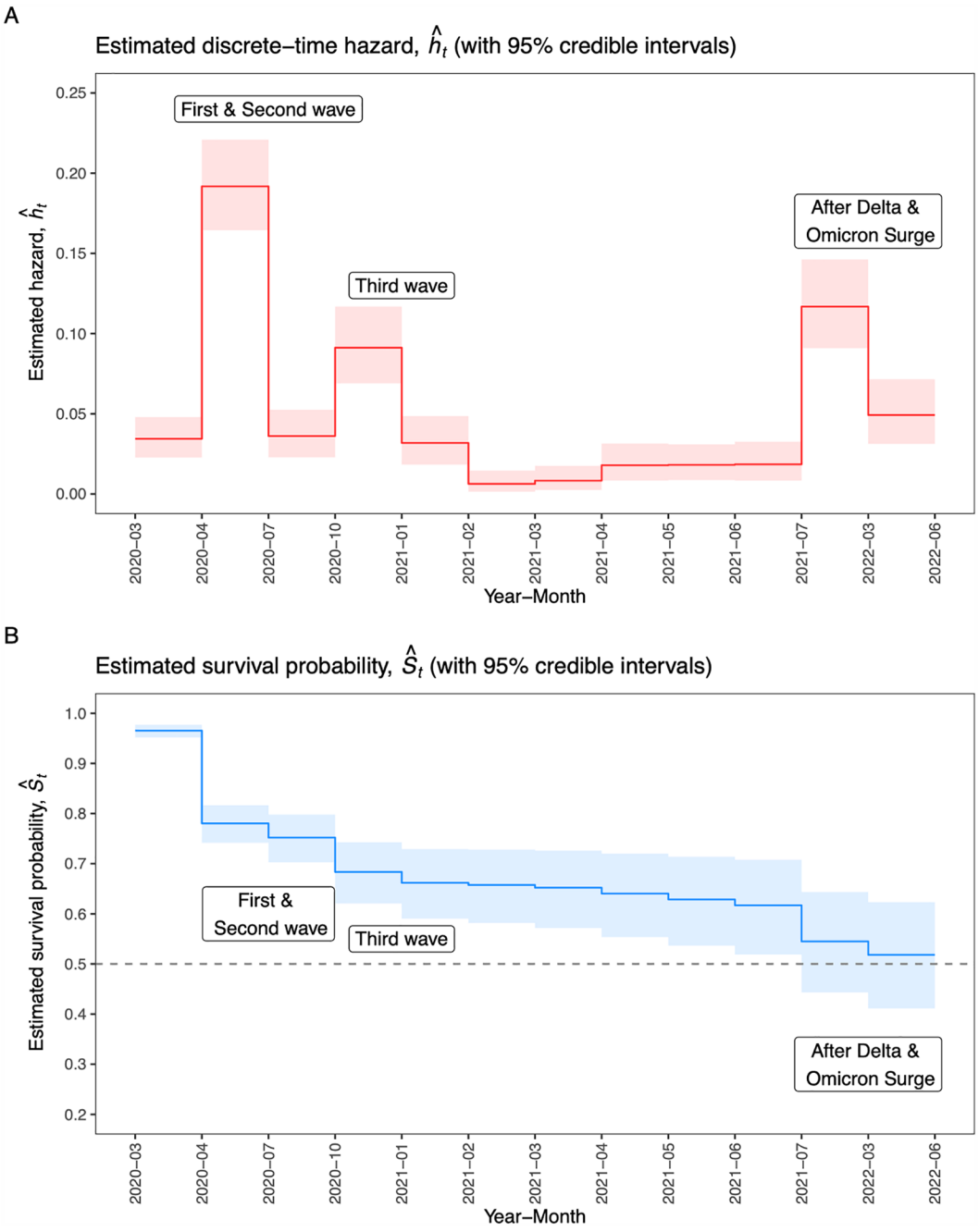

FIGURE 1. *Model-estimated marginal discrete-time hazards (conditional probabilities of FCC closure given that closure has not yet occurred) and marginal survival probabilities.*
Note: Table S1 in the Supplemental Materials contains the model estimates.

showed a 1.7 times higher risk of closure than group FCCs within the same county from May to July 2020, although the difference was not statistically significant for survival probabilities.

Effects of Community-Related Predictors

Overall, the effects of COI, urban density, and licensed child care capacity did not meaningfully contribute to closure risk, as shown in Figure 4. However, we found a significant moderating effect of COI on the association between subsidy acceptance and closure risk. In communities with lower opportunity, the protective effects of FCC providers' subsidy participation on closure risk were amplified. As shown in Figure 5, Panel A, in communities with low COI, the estimated closure risk during May to July 2020 was reduced by approximately elevenfold if providers

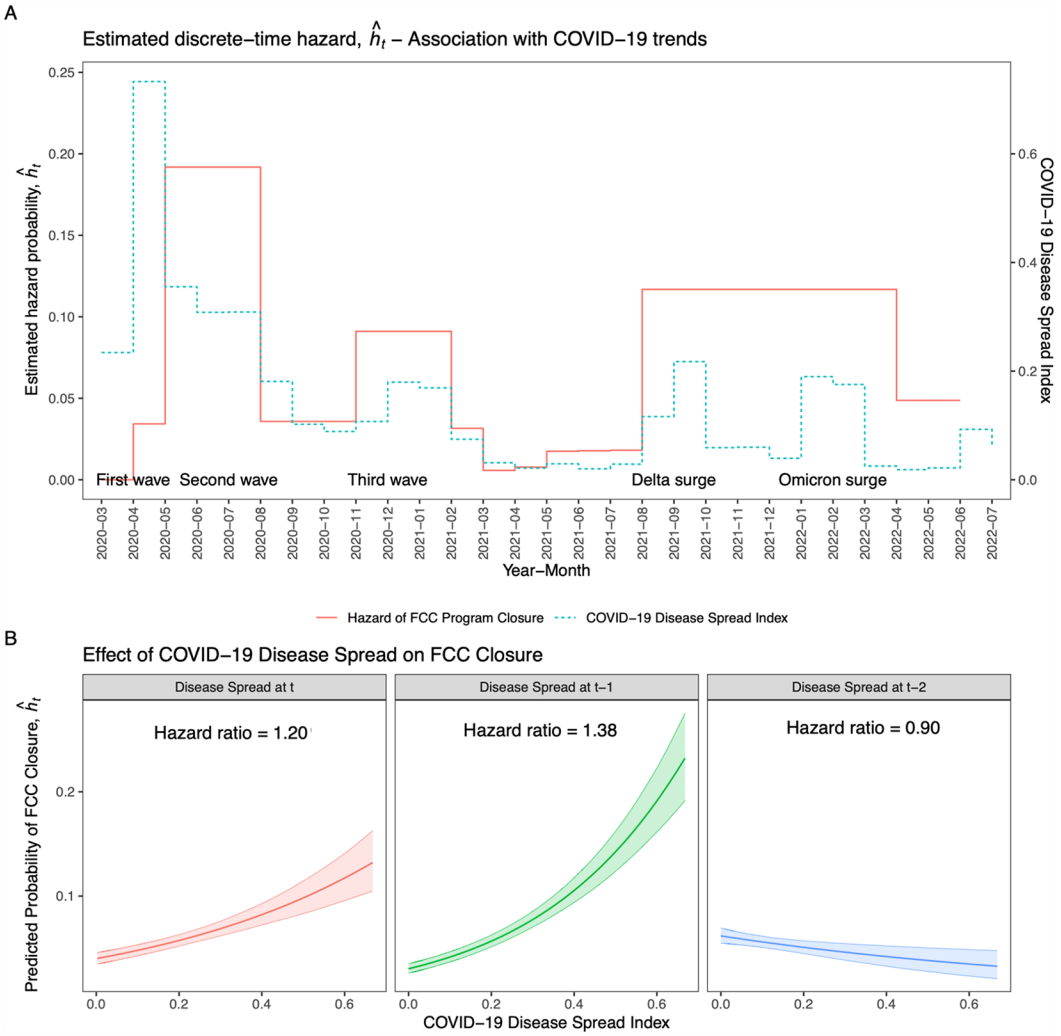

FIGURE 2. *The relationship between changes in closure risk and COVID-19 disease spread indices.*
Note: Table S2 in the Supplemental Materials contains the model estimates.

accepted subsidies. In communities with high COI, however, taking subsidies decreased the estimated hazard by only roughly twofold during the same period. Figure 5, Panel B, shows that by the end of July 2020, nearly 65% of providers in low-COI counties closed if they did not accept subsidies compared to approximately 10% of subsidy-accepting providers. In high-COI communities, the difference in estimated survival probabilities between providers with and without subsidies was not as pronounced as in communities with low COI.

Discussion

This study examined the timing and predictors of FCC closure, or exit from licensure, in Alabama during the COVID-19 pandemic. We found high closure risk among FCC providers, mirroring trends from before the start of the pandemic in Alabama and nationwide (Bromer et al., 2021; National Center on Early Childhood Quality Assurance, 2020), such as those identified in the 2017 Child Care Licensing Study (20% in Alabama and 22% nationally; NARA, 2017). Losing this many FCC programs and this much ECE capacity is significant in a state where an estimated 60% of families already lived in a child care desert before the pandemic (Malik et al., 2018). We also identified predictors of closure that may provide an avenue for supporting FCC providers' continued operation through policy and practice.

Closure Risk Over Time

Our findings add to the growing literature examining the association between COVID-19 rates and outcomes like school and small business closures (e.g., Bartik et al., 2020; Crane et al., 2022; Lee & Parolin, 2021). Closure followed a similar pattern to COVID-19 disease spread. The three time

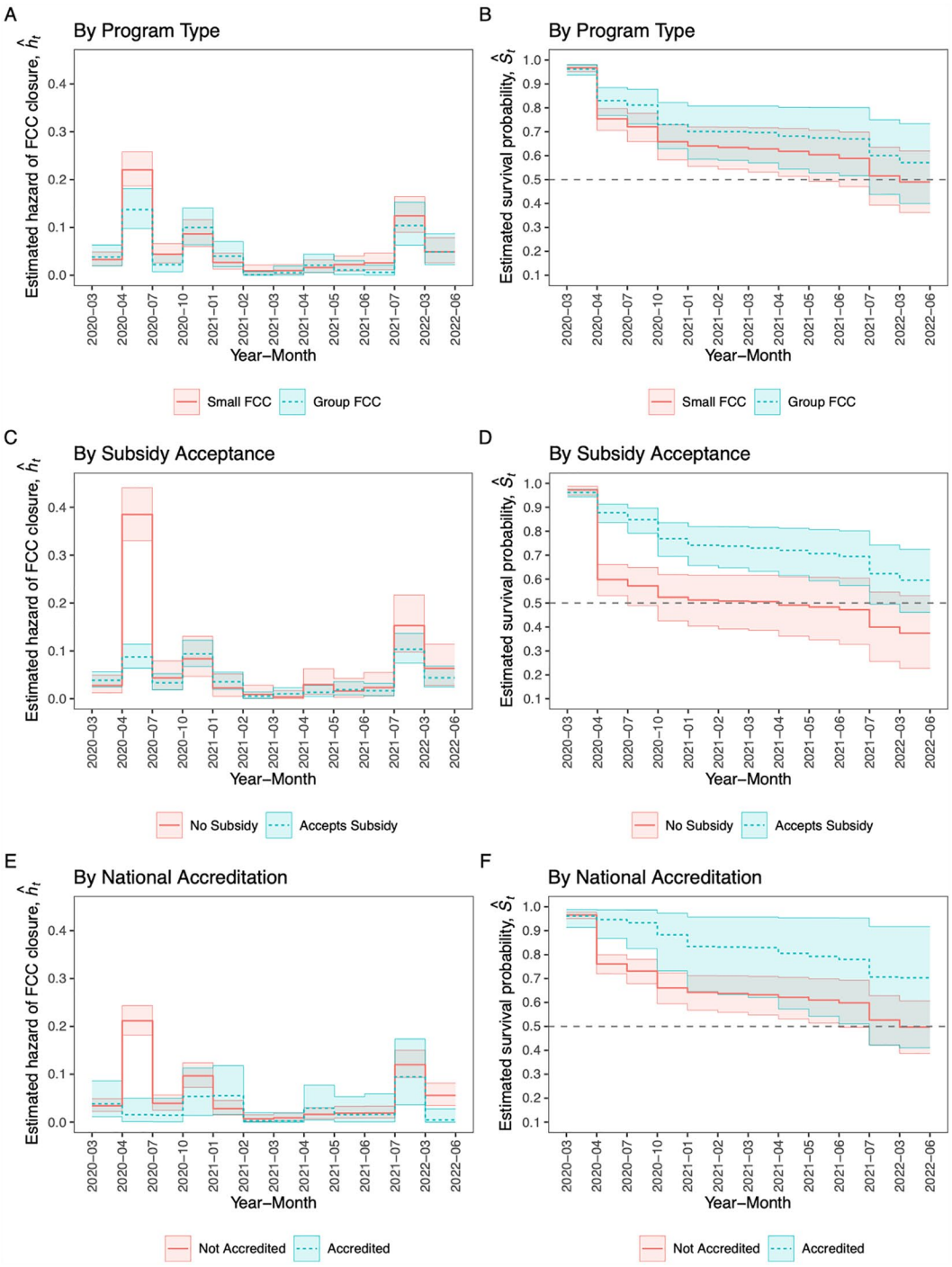

FIGURE 3. *Model-estimated hazards and survival probabilities by provider characteristics.*

intervals with the highest probability of closure closely align with COVID-19 disease spread rates. Although limited research has examined the relationship between COVID rates and closures, our findings align somewhat with the study of California ECE closures, which found two primary waves of closures, one in April 2020 and one in fall 2020 (California CCR&R Network, 2021).

We found that closure risk was highest during the pandemic's start, peaking between May and July 2020. The state had not yet offered stabilization grants to incentivize programs to remain open, with the first round of stabilization grants launching in August 2020 and carrying the stipulation that programs open and stay open for at least a year. Although we do not have data about which providers utilized the

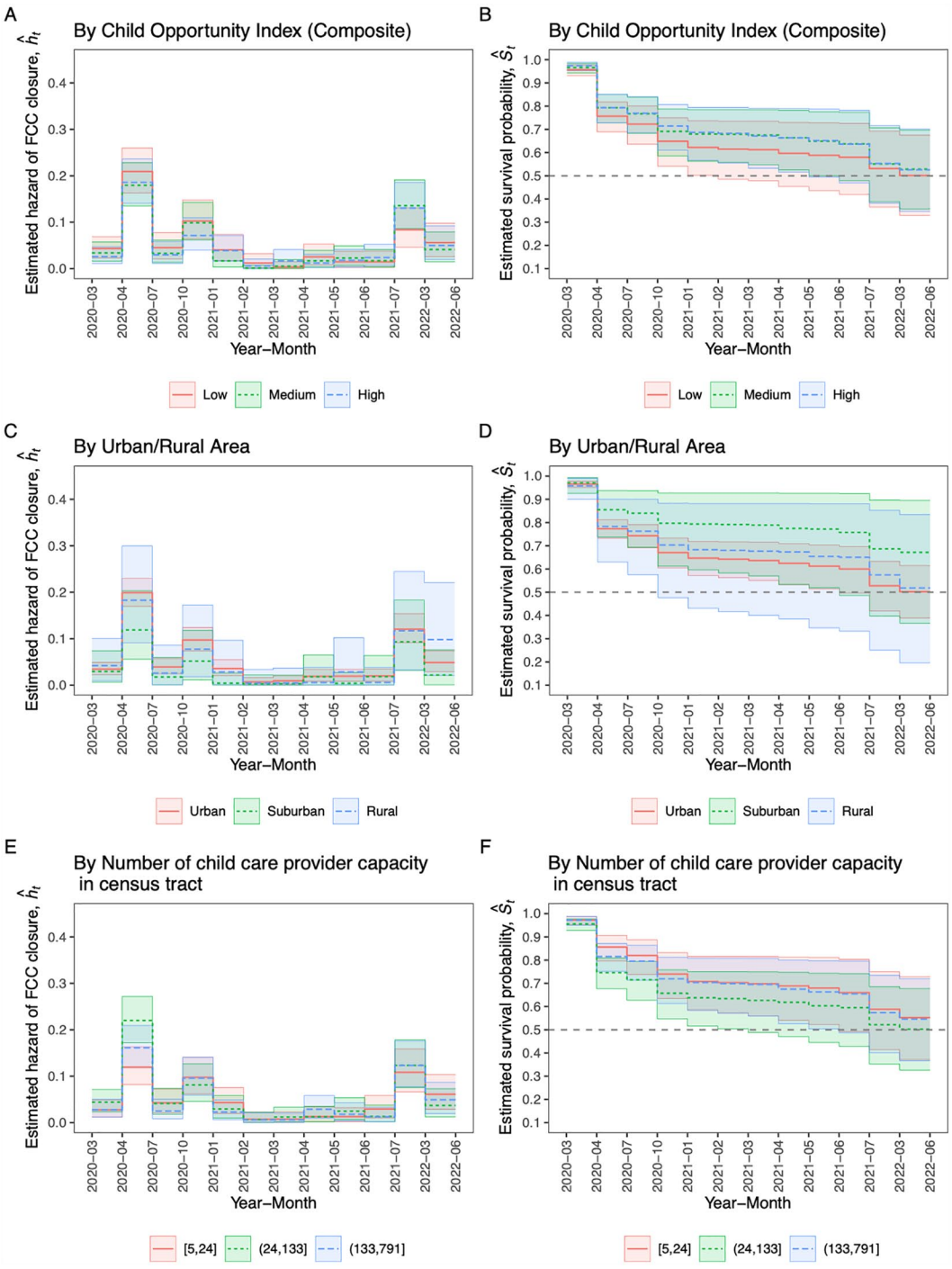

FIGURE 4. *Model-estimated hazards and survival probabilities by community characteristics.*
Note: For visualization purposes, the continuous explanatory variables, COI composite score, and licensed child care provider capacity in census tract were trichotomized based on their percentiles into categories representing low (1st tertile), medium (2nd tertile), and high (3rd tertile), respectively.

stabilization grants, it may be that these supports, combined with COVID-19 rates, influenced closure decisions. Notably, variation in time to closure was almost exclusively attributable to characteristics of the provider rather than their community.

Provider Characteristics Associated With Closure

The strongest closure predictor was participation in the subsidy system, with FCC providers who participated in subsidy much less likely to close than providers not

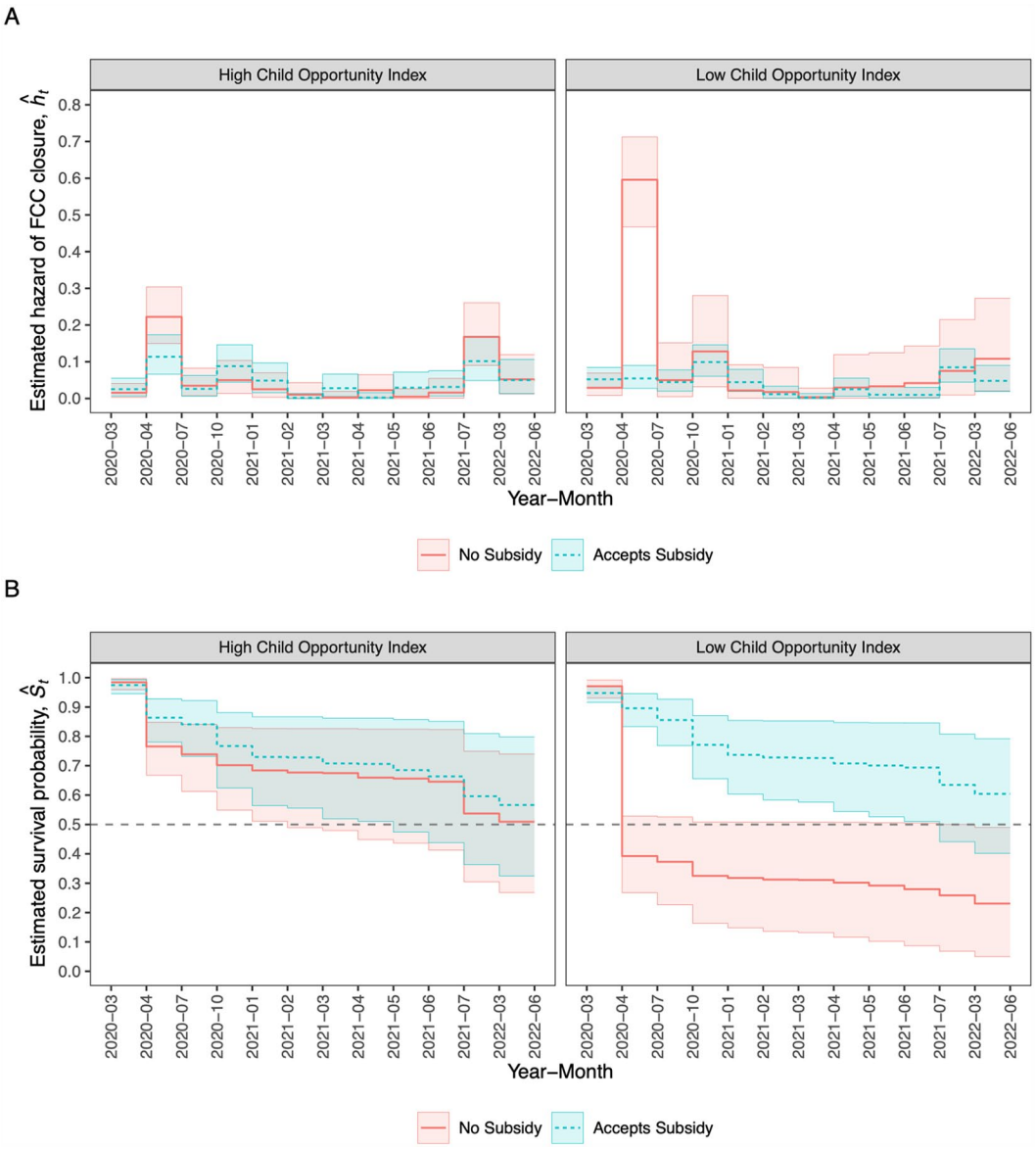

FIGURE 5. *The moderating effect of community-related Child Opportunity Index on the association between provider's subsidy acceptance and risk of FCC program closure during the COVID-19 pandemic.*
Note: For visualization purposes, the continuous explanatory variable, COI composite score, was trichotomized based on its percentiles into categories representing low (1st tertile) and high (3rd tertile).

in the subsidy system. This effect was strongest early in the pandemic. This may be due to the additional financial support offered to providers who accepted subsidies, including increased reimbursement rates and payment for child absences, that were intended in part to support ECE programs' continued operation. Additionally, aligned with the conceptualized factors contributing to FCC decline, subsidy participation may help with business sustainability, especially early in the pandemic when providers could receive additional financial support through the subsidy program (Bromer et al., 2021). It is also possible that providers accepting subsidies had greater administrative capacity going into the pandemic—they successfully navigated the application process and documentation needed to receive subsidy payments (Sandstrom et al., 2018; Slicker et al., 2022). Previous research with center-based programs suggests that administrative capacity is associated with subsidy participation (Giapponi Schneider et al., 2017; Slicker & Hustedt, 2022). Therefore, subsidy-participating providers may have had greater administrative capacity that also protected them from closure during the pandemic. Generally, results align with research finding that ECE providers receiving public

funding had more stable operations and were less likely to close (Delap et al., 2021; Weiland et al., 2021).

Providers who were nationally accredited, although they made a small proportion of the overall population of providers, were also less likely to close. This difference was most evident during the first and second COVID-19 wave surges around July 2020. Although we do not have a direct quality measure, national accreditation may indicate higher quality and greater access to resources. Accredited providers may also have greater administrative capacity, given that they have successfully obtained accreditation. This may support their continued operation and participation in other systems like subsidies (Schneider et al., 2021) and their ability to access one-time resources like grants. Both subsidy participation and accreditation being associated with lower likelihood of closure may point to the importance of engagement with external support systems for FCC providers (Hallam et al., 2019; Hooper & Hallam, 2021a), especially when these systems are tailored to the FCC context (Bromer et al., 2021; Tang et al., 2020).

Community Characteristics Associated With Closure

The three community-level characteristics we examined, urban density, COI, and licensed child care capacity, did not meaningfully predict closure. This is likely due to the overwhelming variance in closure being explained by provider characteristics. This finding is consistent with previous research that found no differences in ECE COVID-19 closures by socioeconomic status or rurality (Zhang et al., 2022). Overall, it is promising that rural providers and those in lower-opportunity communities do not seem to be at higher risk of closure, given the national concerns around insufficient ECE access in rural (Paschall et al., 2020) and lower-income communities (Malik et al., 2020).

Although community characteristics on their own did not predict closure, we found significant interaction effects between COI and subsidy acceptance. Among providers who did not participate in the subsidy program, those in lower-COI communities were more likely to close. This pattern did not exist among subsidy-accepting providers, where there was no difference in closure risk among providers in low- and high-COI communities. This suggests that subsidy participation had a protective effect against closure, especially in lower-opportunity neighborhoods. This is notable given growing concerns about inequitable access to ECE based on socioeconomic community characteristics (Henly & Adams, 2018; Weiland et al., 2021) and concerns that inequities have widened during the pandemic (Lee & Parolin, 2021; Malik et al., 2020; Zhang et al., 2022).

Overall, Alabama administrative data show that FCC decline continued during the COVID-19 pandemic. Through identifying predictors of closure, this study provides insight into supports that may mitigate decline. These may help states develop programs and strategies to support FCC providers' continued operation, such as reducing barriers to subsidy participation, increasing subsidy reimbursement rates, and assisting providers with obtaining accreditation.

Limitations and Future Directions for Research

Several limitations are important to note when interpreting the results. First, given that we rely on administrative data, we do not have access to additional provider characteristics that may relate to closing decisions. These include years licensed, household income, motivation to provide care, access to social support, and the health of the provider and their family. We also did not have access to data for every month during our 28-month period, and we lacked data for the months where delta and omicron COVID-19 rates were highest.

Another limitation of the administrative data is that it is challenging to identify precisely when a provider stopped serving children. Some FCC programs may have passively closed earlier than the date reflected in the administrative data, meaning they stopped serving children but retained their license until the license expiration date. Therefore, results related to closure risk over time should be interpreted with caution. However, despite this lack of precision around exact closing dates, the data help identify program closure trends. Data do not allow us to look at FCC programs' brief, temporary closures related to COVID-19. Additionally, we measured time to first closure. A small subset of FCC programs that exited licensure (53 of 378) reentered during the 28 months of the study.

The first two years of the COVID-19 pandemic were an unprecedented time. Our results likely capture both the effects of the pandemic and Alabama's response to COVID-19, such as through public health orders and additional financial support for ECE programs. From our data, we cannot isolate the impact of each change. As a next step, research could more specifically consider the effects of individual policy changes, such as the effect of expanding subsidy eligibility to essential workers and the implementation of stabilization grants.

Another future direction could be to collect qualitative data from FCC providers who closed during the pandemic and those who remained licensed. For example, this could help disentangle why subsidy participation was negatively related to closure. It may be the increased financial incentives providers received due to COVID-19, or it may relate more to the characteristics of the providers who choose to accept subsidies and the families they serve. FCC providers may have faced administrative burdens related to licensing that contributed to closure decisions. For example, providers may have had difficulties renewing their licenses and submitting paperwork for renewal during COVID-19. It may be that some providers exited licensing but did not, in fact, stop

caring for children despite this not being a legal caregiving arrangement. Qualitative data could explore these and other important topics.

Further, collecting additional primary data from providers about their program—enrollment, ages served, hours of care—and their personal characteristics, such as level of education, motivation, health, and years of experience, would add to these results. Given that FCC providers play an essential role in meeting the ECE needs of high-priority populations (Henly & Adams, 2018; Malik et al., 2018), future research could examine whether COVID-19 disproportionately disrupted the operation of FCC providers serving racially, ethnically, and linguistically diverse families and children with disabilities. Collecting additional primary data from FCC providers who closed could also add to what is known about passive and active closure.

Implications for Policy and Practice

These results reinforce the role of provider-level features in FCC providers' continued operation. The subsidy program specifically offered FCC providers and other licensed ECE programs additional financial support during the initial 18 months of the COVID-19 pandemic, including higher reimbursement rates, payment for child absences, and partial payment during temporary closures. From these results, we do not know if this additional financial support specifically or participation in subsidy more generally—or both—protected against closure. Although the initial phases of the COVID-19 pandemic do not represent typical operating conditions for FCC programs, our results point to promising policy interventions to maintain the supply of FCC post-COVID.

Given the positive relationship between subsidy participation and remaining licensed, it is essential moving forward to ensure child care subsidy is readily accessible to FCC providers who want to participate. FCC providers often face barriers to subsidy participation, including a burdensome provider approval process, low payment rates and challenging payment processes, and state policies that are not family- or provider-friendly (Adams & Dwyer, 2021; Greenberg et al., 2018; Slicker, 2022), and these barriers may have increased as a result of the 2014 Child Care Development Block Grant (CCDBG) reauthorization (Bromer et al., 2021). Adams and Dwyer (2021) offer some suggestions for state and federal policymakers to consider that may reduce these barriers, such as simplifying the provider approval process, reviewing existing policies and procedures to ensure they do not create obstacles for FCC providers, and reevaluating payment rates to ensure equity.

In addition to reducing administrative burden, findings suggest that the increased reimbursement rate that subsidy-accepting providers received was effective in reducing permanent closures. Thirty-one states offer tiered reimbursement for FCC, where providers receive a higher subsidy reimbursement rate based on their level in their state or local Quality Rating and Improvement System (QRIS; Dwyer et al., 2020). However, most QRIS are not designed to account for the unique context of FCC and maintain a center-based view of quality that can disincentive FCC participation (Hallam et al., 2019; Hooper et al., 2021). If the goal is protecting against closure, increasing reimbursement rates for all providers may be more effective than basing rates on a quality measure.

Research on center-based programs' subsidy participation found that programs in states with higher reimbursement rates and payment for child absences were more likely to accept child care subsidies (Slicker, 2022). However, this research did not include FCC or extend to consider licensing and program closure as outcomes. Alabama's QRIS recently began including FCC providers, beginning with a small group of providers in a pilot. Therefore, we did not include QRIS participation or ratings in these analyses. However, this may be important to consider in future research. There is evidence that when QRIS account for the unique features of FCC and provide tailored, relationship-based supports, they can positively affect providers' quality improvement (Hallam et al., 2019), which may extend to their sustainability.

Overall, this study adds to what is known about FCC decline and changes to ECE access during the COVID-19 pandemic. By maximizing state administrative data and other publicly available data sources, we identified patterns and predictors of closure for FCC providers in Alabama. These patterns and predictors suggest accompanying policy and practice interventions that can be taken at the local, state, and national level to mitigate future FCC decline.

Declaration of Conflicting Interests

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Supplemental Material

Supplemental material for this article is available online.

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