Associations between children's participation in subsidized childcare and kindergarten readiness

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Education Research & Data Center

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ABOUT THE ERDC

The research presented here uses data from the Education Research and Data Center (ERDC), located in the Washington Office of Financial Management. ERDC works with partner agencies to conduct powerful analyses of learning that can help inform the decision-making of Washington legislators, parents, and education providers. ERDC's data system is a statewide longitudinal data system that includes de-identified data about people's preschool, educational and workforce experiences.

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Abstract

This study examines kindergarten readiness for Washington State low-income students who received and did not receive a childcare subsidy the year prior to kindergarten. The descriptive analysis was conducted using linked subsidy and school readiness assessment data to estimate school readiness in six domains: social-emotional, physical, language, cognitive, literacy, and math. Findings suggest that kindergarteners who participated in Washington State childcare subsidy programs were more school-ready than low-income kindergarteners without subsidized childcare in four of six areas of development (physical, language, literacy, and math). Kindergarten readiness varies among students who are ELL participants and those who experience homelessness. The percentage of kindergarten readiness in each of the six domains also varies across races/ethnicities.

Introduction

Differences in student opportunity before kindergarten have the potential to substantially impact a child's near-term and long-term outcomes. These differences can arise from multiple sources, but the most recognized differences tend to be socioeconomic. Children from low-income households are frequently unable to access the same level of paid childcare and early childhood education that more wealthy peers enjoy. Policymakers frequently attempt to close these opportunity gaps by providing financial support to those in the lowest income brackets. In Washington State, the legislature ([WAC 110-15-0002](#)) created the Working Connections Child Care (WCCC) subsidy program to specifically:

(a) Help eligible consumers pay for childcare so they can work, attend training, or enroll in educational programs; and

(b) Promote stability, quality, and continuity of care and education programming for children who participate in the WCCC program.

The WCCC program helps eligible low-income working parents, or parents participating in WorkFirst approved work activities, to pay for the cost of childcare. To be eligible for the subsidy, family income must be at or below 200% of the federal poverty level (FPL) when applying, or 220% of the FPL when reapplying. This program generally enrolls children ranging from birth to 13 years old, but individuals up to 19 years old with a verified special need or under court supervision may also qualify. A full list of eligibility requirements can be found at the [Department of Children Youth and Families' (DCYF) site](#).

This study serves as an initial analysis of a large longitudinal dataset which combines subsidy data and indicators of student preparation for kindergarten. It addresses two key research questions:

1) What are the differences in characteristics of children from low-income families who receive subsidized childcare from those children who do not receive subsidized childcare?
2) Is there any association between subsidized care in the year prior to kindergarten and children's kindergarten readiness?

These questions are addressed through descriptive analyses of student characteristics and school readiness among subsidized and not subsidized kindergarteners.

Background

Not all children experience the same development opportunities before they reach kindergarten. Differences in socioeconomic characteristics like family income and homelessness have been shown to significantly influence children's development outcomes (Hair et al., 2006; Hart and Risley, 2003). Similarly, race and ethnicity have been repeatedly shown to be correlated with academic achievement in the U.S educational system (Reardon et al., 2015). While the academic achievement gap among racial groups has been declining for the last decade, a gap between racial groups remains in school readiness (Reardon et al., 2015; Reardon & Portilla, 2016).

Differences in opportunity are important when examining a child's early development. How a child develops both before and during pre-kindergarten are key contributors to their performance in kindergarten (Justice, Bowles, Turnbull, & Skibbe, 2009). Early childhood education and childcare experiences have been found to have a positive association with future school outcomes (Shonkoff, 2000). Quality early childhood education contributes to kindergarteners' school readiness skills (Ansari & Winsler, 2013; Vandell, et al., 2010; Zhai, Brooks-Gunn & Waldfogel, 2011) while exposure to low-quality childcare is a critical indicator of children's readiness score (Herbst & Tekin, 2008 & 2016).

However, the effect of pre-kindergarten program subsidies on children's development is still in debate. Previous studies regarding how this support impacts readiness find mixed, and sometimes even contradictory, impacts on kindergarten readiness. Kindergarten readiness is an indicator of later academic achievement and Childcare subsidy contributes to kindergarten readiness (Forry, Davis & Welti, 2013; Hawkinson et al., 2013). While Forry, Davis & Welti (2013) conclude that low-income subsidized children are more likely to be school-ready than low-income kindergarteners without subsidized childcare, other studies argue that subsidized preschool children are less likely to be ready upon kindergarten entry (Hawkinson et al., 2013; Herbst & Tekin, 2008 & 2016; Jason, Martin & Brooks-Gunn, 2013). Jason, Martin, & Brooks-Gunn (2013) note that some subsidy programs have no effect on children's school readiness.

There is no published research on the effect of Washington's pre-kindergarten subsidy program on students' kindergarten readiness skills. Furthermore, no study has used the current subsidy dataset to describe kindergarten readiness in the state of Washington. This study compares the kindergarten readiness of low-income children who have received the Washington childcare subsidy the year before their kindergarten enrollment to low-income kindergarteners who have not received the subsidy. The study also presents a descriptive analysis of children's characteristics and types of subsidized childcare that children have attended in the year prior to kindergarten and their school readiness.

Data

Data for this research comes from the Washington State Department of Children, Youth, and Families (DCYF), the Department of Social and Health Services (DSHS), and the Office of Superintendent of Public Instruction (OSPI). Specific data was drawn from childcare subsidy eligibility and payment information supplied by DCYF.

Standardized kindergarten assessment data is drawn from the OSPI's Washington Kindergarten Inventory of Developing Skills (WaKIDS). WaKIDS is a tool used to support educators, families, and students through the transition into kindergarten. It assesses students' developmental skill levels based on age-appropriate expectations in six domains: social-emotional, physical, language, cognitive development, literacy, and math. While WaKIDS consists of three components, including family connection, whole-child assessment, and early learning collaboration, this analysis focuses solely on the observational assessment portion. For the observational assessment, Washington State utilizes a custom version of the Teaching Strategies GOLD assessment. This method uses a subset of 20 objectives available within all six domains to assess whether a student is ready for Kindergarten. For each objective, educators observe a student and identify where they fall on a developmental continuum based on examples of demonstrable age-appropriate skill levels from birth to kindergarten.

WaKIDS also is linked to OSPI's Comprehensive Education Data and Research System (CEDARS) enrollment tables, which provide information on student's characteristics such as homelessness status, English Language Learners (ELL) participation, and race and ethnicity. These data are collected for each student at the point of enrollment for any Washington public school. Data provided by OSPI in these tables is a combination of both directly reported and observed data[1].

The population for this research is all kindergarten students who enrolled in Washington public schools in the fall of 2018 or 2019. These students are pooled to form a single cohort that spans two years. The longitudinal data stored in both source datasets is matched using a unique student ID created by ERDC to identify each student across datasets. As such, students who participated in WCCC subsidy programs who subsequently entered Washington public schools as kindergartners are identified in the dataset.

The sample for this study is formed by identifying a treatment and a comparison group and analyzing their outcomes jointly. Kindergartners who were enrolled for all 12 months in WCCC the year prior to their kindergarten record form the study group. The treatment group is further limited to children who were enrolled under a single provider for the duration of the year (all 12 months) prior to Kindergarten entry. This enables us to focus on only those children who have no interruption in receiving childcare supports. The comparison group includes kindergartners who qualify for free and reduced-price lunch but do not have any record of the state-subsidized childcare the year prior to their kindergarten record. Both groups are from low-income families. Previous studies show a significant relationship between low-income kindergarteners who participated in ECEAP and their school readiness skills (Coker,

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[1] Variables such as homelessness and race may be added based on school/district observations when not self-reported at enrollment.

2017). Other studies also show that pre-kindergarten programs benefit special needs children and improves their school readiness (e.g. Weiland, 2016). Children from low-income families who have received special education or have participated in the state-funded Early Childhood Education and Assistance Program (ECEAP) are excluded from this study. By ruling out the confounding factors of ECEAP and special education program participation, the association between subsidy and outcomes could be more accurately estimated. See Appendix A for detailed term and variable definitions.

Analytical approaches

Since this data is relatively new and not commonly examined in existing literature, a descriptive analysis provides an introductory view of the data for subsidy recipients and non-subsidy recipients. The study is designed to explore school readiness and other students' characteristics such as ELL participation, Homelessness status, and race/ethnicity differences between the two groups.

Secondly, this study also aims to compare subsidy recipients' school readiness with non-subsidy recipients to provide a reliable and accurate analysis of early child development progression. Binary Logistic regression is an analytical tool to describe data and examine the relationship between dichotomous dependent variable and independent variables (Lever, Krzywinski & Altman, 2016). Thus, this study utilizes binary logistic regression to determine the basic association between subsidized care and children's kindergarten readiness. Low-income children without subsidized childcare but eligible for free- or reduced- price lunch (FRPL) are assigned as a comparison group. For more details about the design of the logistic regression technique, please see Appendix B.

Findings

Descriptive analysis

Children who received state-subsidized childcare in 2017 and 2018 were tracked into kindergarten in 2018 and 2019. Kindergarten data for this study derive from the same data set that fed the Early Learning Feedback Report (ELFBR) for 2018 and 2019. For the 2018 and 2019 school years, there were a total of 156,790 kindergarteners in Washington State that appeared in the preliminary OSPI data feed to ERDC in each year. This data fed the ELFBR. Excluding kindergartners with either an ECEAP enrollment in the year preceding kindergarten or who were in a kindergarten special-education program, and also limiting the study to low-income participants resulted in a study cohort of 47,017 students. Of these, 7,296 (16%) were deemed low-income due to their participation in state-subsidized childcare during the year immediately preceding their enrollment in kindergarten and the remainder were deemed low-income due to FRPL status (see Table B1 in Appendix B for detailed counts).

Table 1 outlines the race/ethnicity characteristics of the 47,017 students in the cohort. Approximately 6% of low-income kindergarteners with no subsidy are African American, compared to 12% of low-income African American kindergarteners who receive a subsidy. Asian students made up 5% of non-subsidy recipients, compared to 2% of the subsidy recipients. Eight percent of the non-subsidy recipients and 12% of subsidy recipients were also of two or more races. Approximately 33% of kindergarteners in
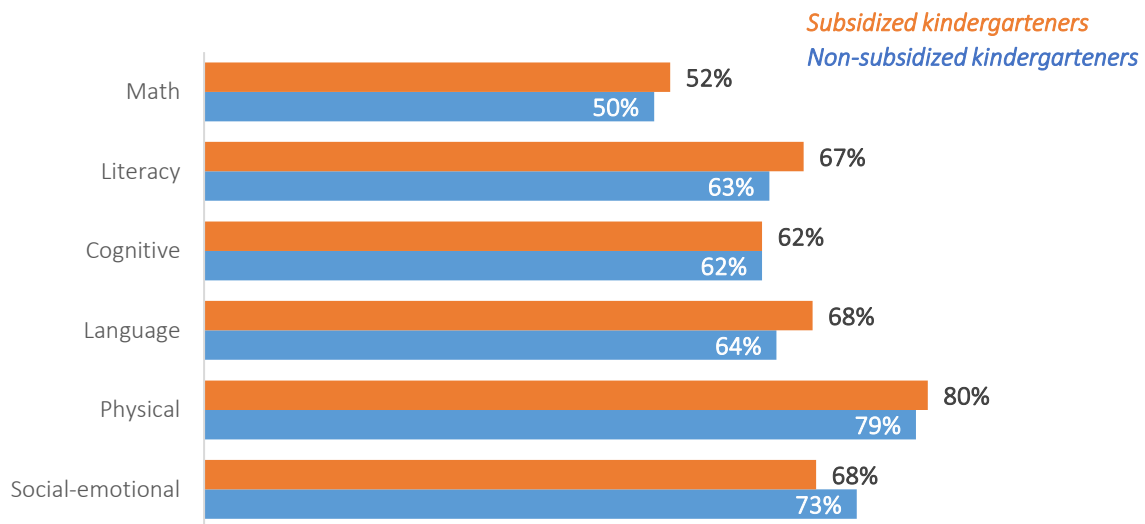
2018 and 2019 are English Language Learners (ELL). ELL participants made up approximately 35% of the kindergarteners with no subsidy, compared to 22% of the subsidy recipients. About 5% of all low-income kindergarteners experienced homelessness.

Table 1. Characteristics of low-income kindergarteners in Washington

Student Characteristics	Not subsidized	Subsidized	All low-income Kindergarteners
Non-Hispanic White	14,862 38%	2,711 37%	17,573 37%
Hispanic/Latino	15,177 38%	2,443 34%	17,620 38%
African American	2,352 6%	877 12%	3,229 7%
Asian	2,059 5%	163 2%	2,222 5%
Native Hawaiian/Other Pacific Islander	116 2%	945 2%	1,061 2%
American Indian/Alaskan Native	105 1%	853 2%	958 2%
Two or More Races	3,321 8%	853 12%	4,174 9%
ELL Participant	13,792 35%	1,597 22%	15,389 33%
Homeless	1,943 5%	422 6%	2,365 5%

There are differences in kindergarten readiness across WaKIDS domains between subsidy and non-subsidy recipients, as outlined in Figure 1 below and Table B2 of Appendix B. In the social-emotional readiness domain, 68% of subsidy recipients were kindergarten ready, compared to 73% of the non-subsidy group. Eighty percent (80%) of subsidized kindergarteners demonstrate physical readiness, compared to 79% of kindergarteners with no subsidy. Sixty-eight percent (68%) of subsidy recipients demonstrate language readiness, compared to 64% of non-subsidized kindergarteners. Literacy readiness is also more common among subsidized kindergarteners than non-subsidized kindergarteners (67% and 63%, respectively). Similarly, a higher percentage of subsidized recipients are ready in math, with 52% compared to 50% of non-subsidized kindergarteners. The rate of cognitive readiness is the same across both groups, with 62% of subsidized and non-subsidized recipients demonstrating cognitive readiness.

Figure 1. School readiness of subsidized and non-subsidized low-income kindergarteners by domain

Domain	Subsidized kindergarteners	Non-subsidized kindergarteners
Math	52%	50%
Literacy	67%	63%
Cognitive	62%	62%
Language	68%	64%
Physical	80%	79%
Social-emotional	68%	73%

ELL Participants

Differences in kindergarten readiness among subsidized ELL participants and non-subsidized ELL participants are illustrated in the Figure 2 below (See Table B3 in Appendix B for further details). In the social-emotional readiness domain, 71% of non-subsidized ELL participants were kindergarten-ready, compared to 69% of the subsidized ELL participants group. Seventy-eight percent (78%) of non-subsidized ELL kindergarteners demonstrate physical readiness, compared to 77% of ELL kindergarteners who received a subsidy. In contrast, 51% of subsidized ELL recipients demonstrate language readiness, compared to 49% of non-subsidized ELL kindergarteners. Literacy readiness is also more common among subsidized ELL kindergarteners than non-subsidized ELL kindergarteners (53% and 50%, respectively). Similarly, a slightly higher percentage of subsidized ELL kindergarteners demonstrate math readiness, with 38% compared to 37% of non-subsidized ELL kindergarteners. The proportion of kindergarteners who show cognitive readiness is the same across both groups, with 55% of subsidized and non-subsidized recipients.
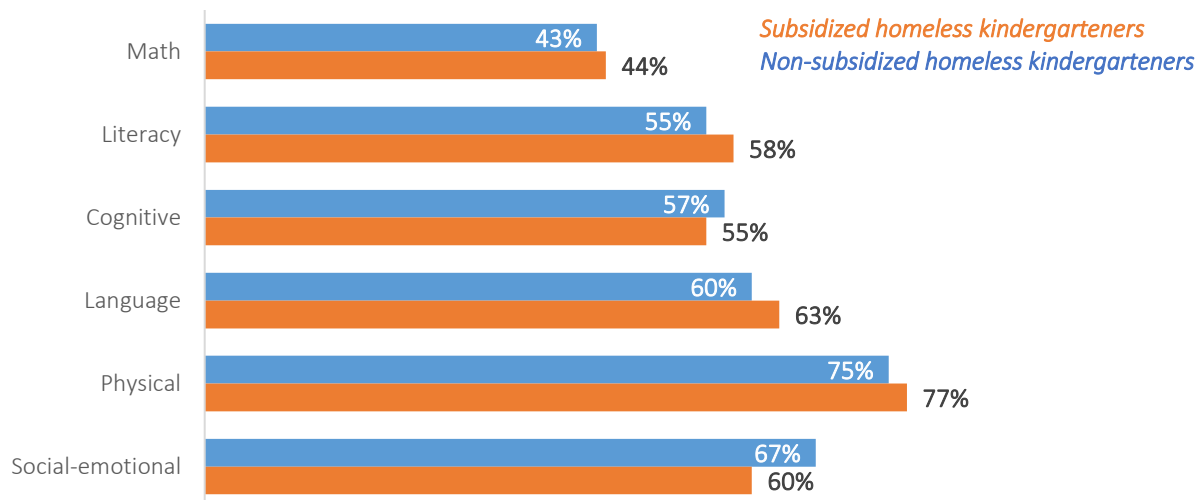
Figure 2. School readiness of subsidized and non-subsidized low-income ELL kindergarteners by domain
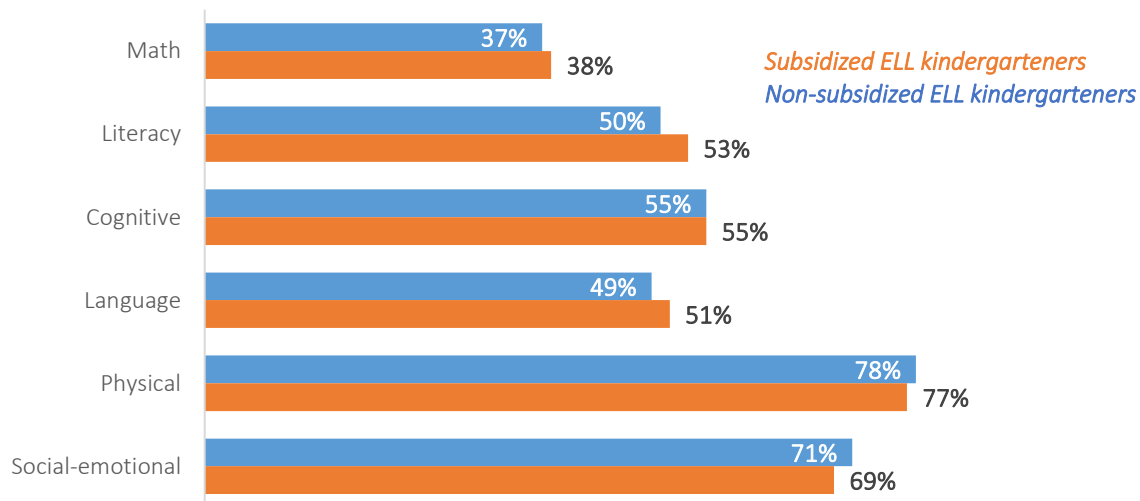
Students experiencing homelessness

Differences in kindergarten readiness across WaKIDS domains between subsidized homeless and non-subsidized homeless kindergarteners is shown in the Figure 3 below and Table B4 in Appendix B. In the social-emotional readiness domain, 67% of non-subsidized homeless kindergarteners were kindergarten-ready, compared to 60% of subsidized homeless kindergarteners. Fifty-seven percent (57%) of non-subsidized homeless kindergarteners demonstrate cognitive readiness, compared to 55% of homeless kindergarteners who received a subsidy. In contrast, 75% of non-subsidized homeless kindergarteners demonstrate physical readiness, compared to 77% of subsidized homeless kindergarteners. Similarly, a higher percentage of subsidized homeless kindergarteners are ready in language, with 63% compared to 60% of non-subsidized homeless kindergarteners. The rate of literacy readiness is also higher for subsidized homeless kindergarteners than non-subsidized homeless kindergarteners (58% and 55% respectively). A higher percentage of subsidized homeless kindergarteners are also ready in math, with 44% compared to 43% of non-subsidized homeless kindergarteners.

Figure 3. School readiness of subsidized and non-subsidized low-income homeless kindergarteners by domain

Subsidized homeless kindergarteners
Non-subsidized homeless kindergarteners

Domain	Non-subsidized	Subsidized
Math	43%	44%
Literacy	55%	58%
Cognitive	57%	55%
Language	60%	63%
Physical	75%	77%
Social-emotional	67%	60%

Race/Ethnicity: Social Emotional Readiness

Differences in kindergarten readiness among subsidized and non-subsidized students was apparent across all races and ethnicities, as outlined in Figure 4 and Table B5 in Appendix B. In the social-emotional readiness domain, 73% of non-subsidized White students were kindergarten-ready, compared to 68% of the subsidized White students. Seventy-two percent (72%) of non-subsidized Hispanic/Latino kindergarteners demonstrate social-emotional readiness, compared to 69% of Hispanic/Latino kindergarteners who received a subsidy. Seventy-one percent (71%) of non-subsidized African American kindergarteners demonstrate social-emotional readiness, compared to 65% of subsidized African American kindergarteners. Social-emotional readiness is also more common among non-subsidized Asian kindergarteners than subsidized Asian kindergarteners (76% and 69%, respectively). Similarly, a higher percentage of non-subsidized multi-racial kindergarteners demonstrate social-emotional readiness, with 73% compared to 67% of subsidized multi-racial kindergarteners. In contrast, social-emotional readiness is slightly higher among subsidized Native Hawaiian kindergarteners, at 75% compared to 72% of non-subsidized Native Hawaiian kindergarteners. Social-emotional readiness is also more common among subsidized American Indian kindergarteners than non-subsidized American Indian kindergarteners (75% and 70%, respectively).

Figure 4. Social-emotional readiness of subsidized and non-subsidized low-income kindergarteners by race/ethnicity
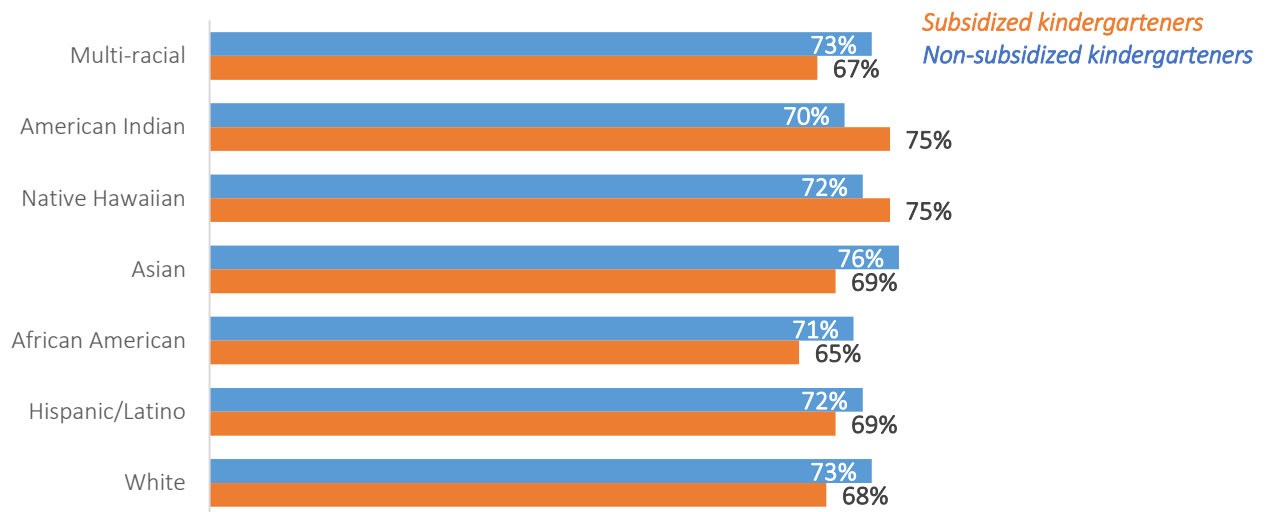
Race/Ethnicity: Physical Readiness

Differences in physical readiness between subsidy and non-subsidy kindergarteners was apparent across all races/ethnicities in Figure 5 (Table B5). In the physical readiness domain, 81% of White subsidy recipients were kindergarten-ready, compared to 80% of the White non-subsidy group. Seventy-eight percent (78%) of Hispanic/Latino subsidized kindergarteners demonstrate physical readiness, compared to 77% of Hispanic/Latino kindergarteners with no subsidy. Eighty-two percent (82%) of African American subsidy recipients demonstrate physical readiness, compared to 79% of non-subsidized African American kindergarteners. Physical readiness is also more common among subsidized Asian kindergarteners than non-subsidized Asian kindergarteners (87% and 84%, respectively). The rate of physical readiness is also higher among subsidized Native Hawaiian kindergarteners with 85% compared to 79% of non-subsidized Native Hawaiian kindergarteners. Physical readiness is also more common among subsidized American Indian kindergarteners than non-subsidized American Indian kindergarteners (85% and 81%, respectively). Similarly, a higher percentage of subsidized multi-racial students are kindergarten-ready in the physical domain, with 83% of subsidized multi-racial kindergarteners compared to 81% of non-subsidized multi-racial kindergarteners.

Figure 5. Physical readiness of subsidized and non-subsidized low-income kindergarteners by race/ethnicity
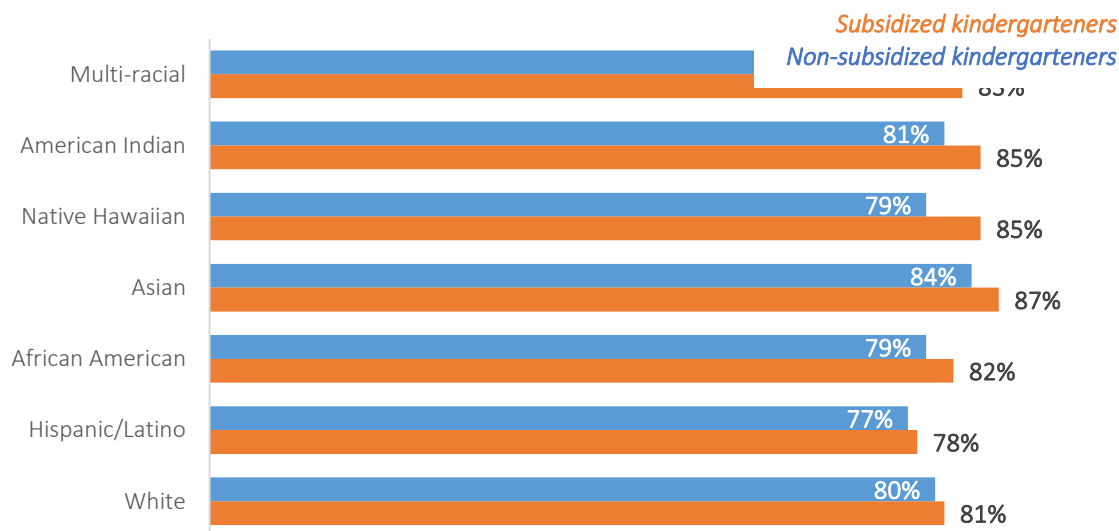
Race/Ethnicity: Language Readiness

Differences in kindergarten language readiness between subsidy and non-subsidy students was apparent across all races/ethnicities, as outlined in Figure 6 and Table B5 in Appendix B. In the language readiness domain, 72% of subsidized White students were kindergarten-ready, compared to 70% of the non-subsidized White students. Sixty-two percent (62%) of subsidized Hispanic/Latino kindergarteners demonstrate language readiness, compared to 56% of non-subsidized Hispanic/Latino kindergarteners. The rate of language readiness is also higher among subsidized Native Hawaiian kindergarteners, with 60% compared to 56% of non-subsidized Native Hawaiian kindergarteners. Similarly, a higher percentage of subsidized multi-racial kindergarteners are ready in the language domain, with 74% compared to 72% of non-subsidized multi-racial kindergarteners. In contrast, 66% of subsidized African American kindergarteners demonstrate language readiness, compared to 67% of non-subsidized African American kindergarteners. Language readiness is also more common among non-subsidized American Indian kindergarteners than subsidized American Indian kindergarteners (64% and 60%, respectively). The rate of language readiness is 59% for both subsidized and non-subsidized Asian kindergarteners.

Figure 6. Language readiness of subsidized and non-subsidized low-income kindergarteners by race/ethnicity
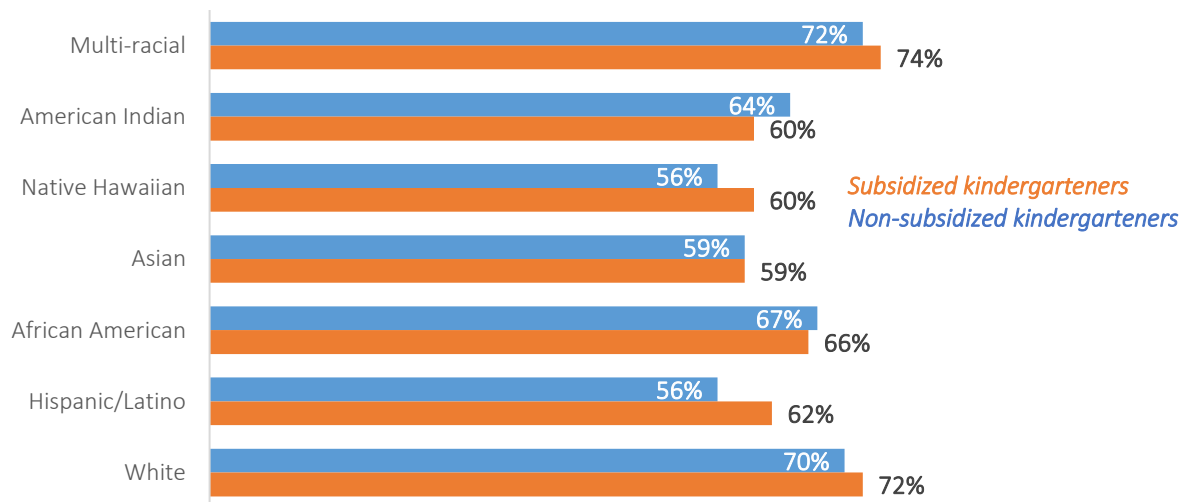
Race/Ethnicity: Cognitive Readiness

Differences in cognitive readiness between subsidized and non-subsidized kindergarteners was apparent across all races/ethnicities, as outlined in Figure 7 and Table B5 in Appendix B for more details. Cognitive readiness rate is 66% for both subsidized and non-subsidized White kindergarteners. Fifty-eight percent (58%) of subsidized Hispanic/Latino kindergarteners demonstrate cognitive readiness, compared to 57% of Hispanic/Latino kindergarteners with no subsidy. The rate of cognitive readiness is also higher among subsidized Native Hawaiian kindergarteners, with 64% compared to 54% of non-subsidized Native Hawaiian kindergarteners. Similarly, a higher percentage of subsidized American Indian kindergarteners demonstrate cognitive readiness, with 64% compared to 59% of non-subsidized American Indian kindergarteners. In contrast, 60% of subsidized African American kindergarteners demonstrate cognitive readiness, compared to 65% of non-subsidized African American kindergarteners. Cognitive readiness is also more common among non-subsidized Asian kindergarteners than subsidized Asian kindergarteners (66% and 58%, respectively). The cognitive readiness rate is also slightly higher for non-subsidized multi-racial kindergarteners, with 66% compared to 65% for subsidized multi-racial kindergarteners.

Figure 7. Cognitive readiness of subsidized and non-subsidized low-income kindergarteners by race/ethnicity
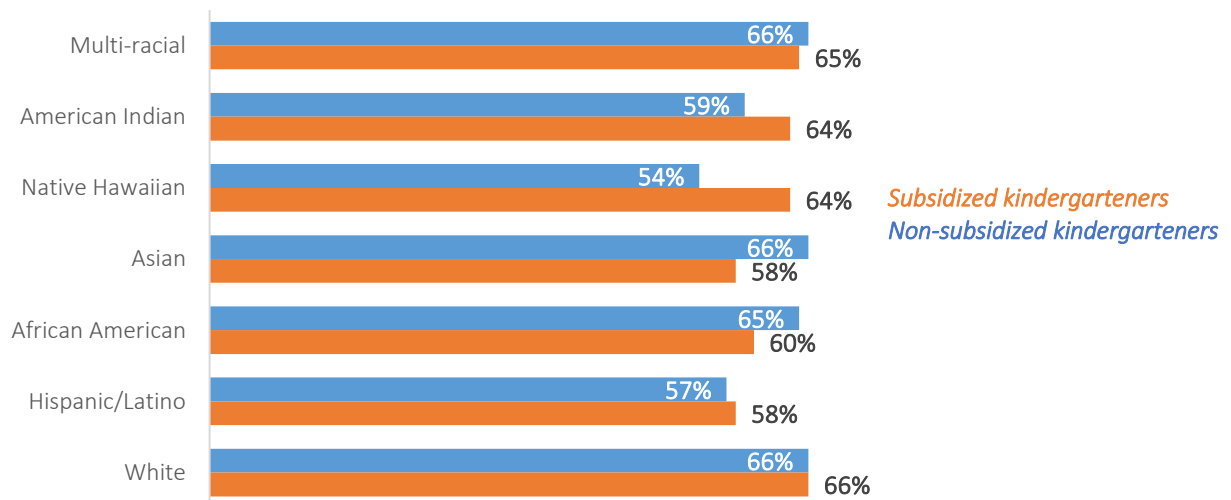
Race/Ethnicity: Literacy Readiness

Variation in literacy readiness between subsidized and non-subsidized kindergarteners was apparent across all races/ethnicities in Figure 8 and Table B5 in Appendix B. Seventy-two percent (72%) of White subsidized kindergarteners demonstrate literacy readiness, compared to 69% of White kindergarteners with no subsidy. Fifty-eight percent (58%) of subsidized Hispanic/Latino kindergarteners demonstrate literacy readiness, compared to 53% of Hispanic/Latino kindergarteners with no subsidy. The rate of literacy readiness is also higher among Native Hawaiian subsidized kindergarteners, with 57% compared to 52% of non-subsidized Native Hawaiian kindergarteners. Similarly, a slightly higher percentage of subsidized multi-racial kindergarteners demonstrate literacy readiness, with 73% compared to 71% of non-subsidized multi-racial kindergarteners. However, 70% of African American subsidized kindergarteners demonstrate literacy readiness, compared to 72% of non-subsidized African American kindergarteners. Literacy readiness is also more common among non-subsidized American Indian kindergarteners than subsidized American Indian kindergarteners (60% and 57%, respectively). The rate of literacy readiness rate is 71% for both subsidized and non-subsidized Asian kindergarteners.

Figure 8. Literacy readiness of subsidized and non-subsidized low-income kindergarteners by race/ethnicity
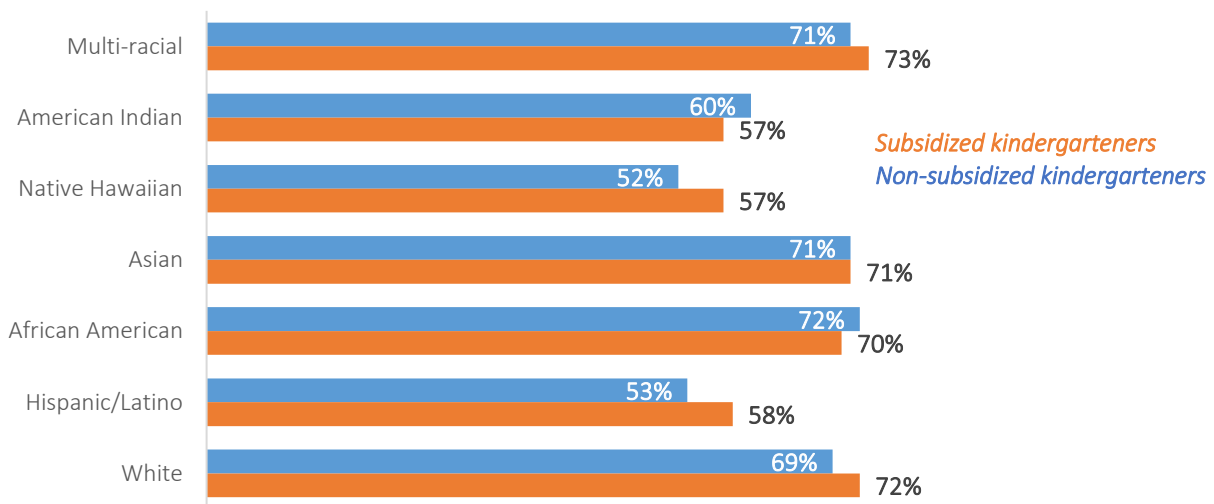
Race/Ethnicity: Math Readiness

Figure 9 shows that the percentage of subsidized and non-subsidized kindergarteners who are ready in math domain varies across races/ethnicities (See also Table B5 in Appendix B). Fifty-seven percent (57%) of non-subsidized White kindergarteners demonstrate math readiness, compared to 56% of White subsidized kindergarteners. The rate of math readiness is also slightly higher among non-subsidized African American kindergarteners than subsidized African American kindergarteners (60% and 58%, respectively). The rate of math readiness is also higher among non-subsidized Asian kindergarteners, with 62% compared to 56% of subsidized Asian kindergarteners. Similarly, a slightly higher percentage of non-subsidized American Indian kindergarteners demonstrate math readiness, with 46% compared to 45% of subsidized American Indian kindergarteners. However, the rate of math readiness is higher among subsidized Hispanic kindergarteners at 42%, compared to 39% of non-subsidized Hispanic kindergarteners. The rate of math readiness is also higher among subsidized Native Hawaiian kindergarteners, with 45% compared to 41% of non-subsidized Native Hawaiian kindergarteners. The math readiness rate is 60% for both subsidized and non-subsidized multi-racial kindergarteners.

Figure 9. Math readiness of subsidized and non-subsidized low-income kindergarteners by race/ethnicity
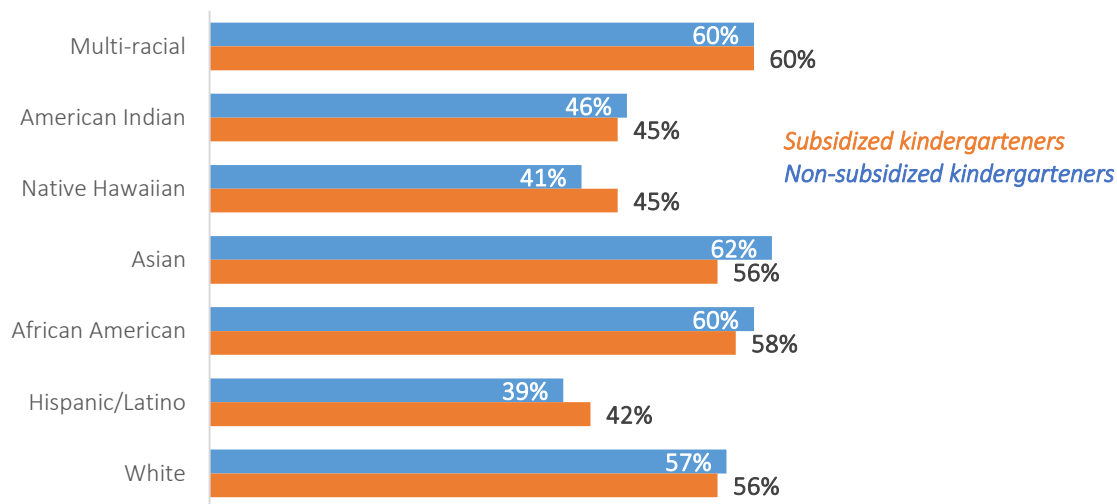
Figure 10 shows the types of care that subsidized kindergarteners attend as an indicator of children's skill development (See Table B6 in Appendix B for more details). A majority of subsidized children (62%) attend licensed full-day centers, 20% attend licensed full-day family homes, and about 17% attend licensed half-day centers. Only 0.6% of subsidized children attend licensed half-day family homes.
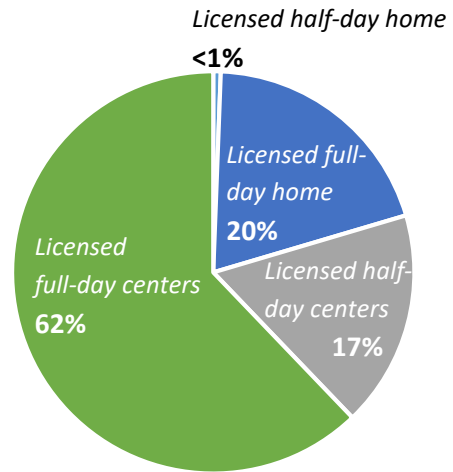

Figure 10. Types of childcare centers attended by subsidized low-income kindergarteners

Figure 11 outlines the types of care centers and school readiness among subsidy recipients (See Table B6 in Appendix B for more details). Kindergarten readiness of subsidy recipients varies based on those who attended full-time care centers or other types of subsidized childcare. A higher proportion of subsidized children who attend full-day licensed centers demonstrate kindergarten readiness in five of six development areas, compared to the readiness of those who attend half-day centers or full-day family homes. The proportion of subsidized children who attended full-time licensed centers and demonstrate readiness in math (56%), literacy (70%), cognitive (65%), language (71%), and physical (83%) areas is higher than the readiness of subsidized children who attend other types of care. However, social-emotional readiness is more prominent among subsidized children who attend half-day licensed centers (72%), compared to 68% of subsidized children who attend full-time licensed centers and 66% of subsidized children who attend full-time family homes. Finally, more children who attend half-day licensed centers demonstrate readiness in math, literacy, cognitive, language, and physical domains, than children who attend full-time family homes.

Figure 11. Kindergarten readiness among subsidy recipients by type of childcare center
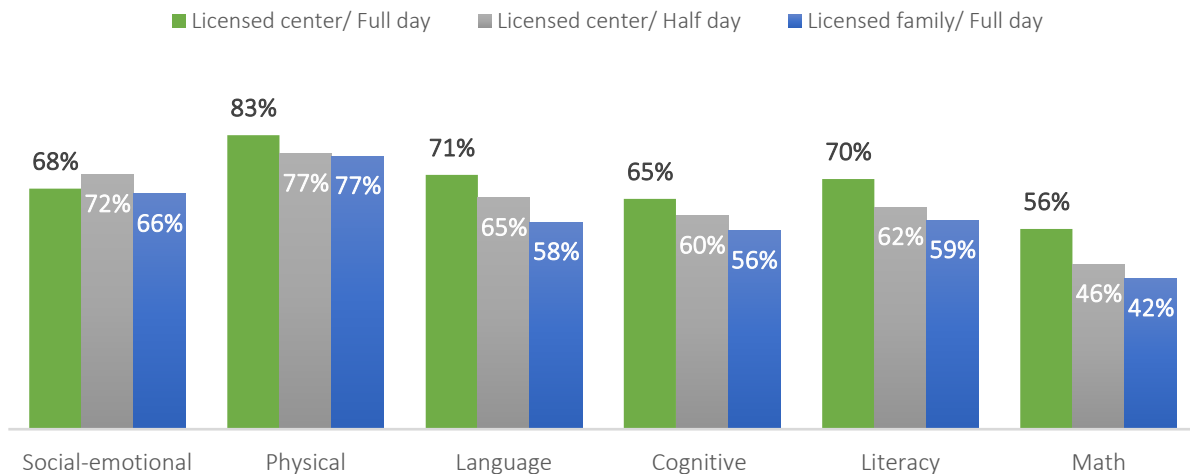
Logistic Regression Analysis

Regression model results for each of the six school readiness domains (social-emotional, physical, language, cognitive, literacy, and math) are presented in Table 2 below. Additional details can be found in Table B8 of Appendix B. To identify associations between subsidy receipt and kindergarten readiness in each domain, we ran one model for each domain and presented the following table outcomes. Results indicate that children in families who received subsidies are more likely to be fully ready in three out of six development areas.

Table 2. Associations between subsidy receipt and school readiness among low-income kindergarteners, 2016-2018

	Six Domains of School Readiness											
	Social-emotional		Physical		Language		Cognitive		Literacy		Math	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Subsidy receipt	-.215*** (.000)	.806 (-19.4%)	.085** (.008)	1.088 (8.8%)	.178*** (.000)	1.195 (19.5%)	.003 (.916)	1.003 (.3%)	.003 (.916)	1.181 (18.1%)	.071** (.005)	1.073 (73%)

*p<0.05, **p<0.01, ***p<0.001

Compared to non-subsidized children, we find that subsidy recipients are significantly less likely to demonstrate social-emotional readiness. In contrast, subsidy recipients are significantly more likely to show readiness across the physical, language, and math domains.

Discussion

Childcare subsidies offer support for low-income working families to afford proper care for children. Out of a cohort of 47,017 low-income kindergartners in Washington State, 16% received a childcare subsidy the year before kindergarten (see Table B1 in Appendix B). While previous research examined indicators of subsidized children's school readiness skills, no studies have explicitly focused on Washington State's subsidy program and subsidized kindergarteners' school readiness skills. This type of analysis is necessary because one primary objective of childcare subsidies is to address the childcare needs of low-income families and prepare them for school.

Some scholars suggest that childcare subsidy receipt can predict children's math skills (Hawkinson et al., 2013). Prior studies indicate that preschool children who have received childcare subsidies are less likely to be ready in math upon kindergarten entry (Hawkinson et al., 2013; Herbst & Tekin, 2008 & 2016; Jason, Martin & Brooks-Gunn, 2013). Findings from a basic regression (Table 2) reveal positive associations between childcare subsidy receipt and kindergarteners' school readiness. Low-income subsidized children are more likely to be school-ready than low-income kindergarteners without subsidized childcare in three of six areas of development outcomes: physical, language, and math. Our descriptive analysis indicates a higher percentage of subsidy recipients are ready in four out of six domains, including physical, language, literacy, and math, compared to kindergarteners who did not receive a subsidy (Figure 1).

However, Jason, Martin, and Brooks-Gunn (2013) find no significant relationship between subsidized childcare in preschool and social-emotional skills in the subsequent year. Additionally, Forry, Davis, and Welti (2013) identify no association between subsidized childcare and social development. Furthermore, Herbst and Tekin (2008, 2016) indicate that subsidy recipients are also more likely to have behavioral problems in kindergarten. This study's descriptive analysis also shows that a lower percentage of subsidy recipients are ready in the social-emotional domain than non-subsidized kindergarteners (Figure 1). Regression results also show that subsidized childcare recipients are less likely to be prepared in social-emotional skills than non-subsidized kindergarteners (Table 2).

Among ELL participants, a higher percentage of subsidized kindergarteners are ready in language, literature, and math (Figure 2). A higher rate of subsidized kindergarteners who experienced homelessness is also ready in physical, language, literature, and math than non-subsidized kindergarteners who experienced homelessness (Figure 3). In contrast, a higher percentage of not subsidized kindergarteners who experienced homelessness are ready in the social-emotional and cognitive domain. Previous studies also indicate that low-income children, particularly those experiencing homelessness, are more likely to exhibit emotional and behavioral concerns (San Agustin et al., 1999; Yu et al., 2008).

A higher percentage of non-subsidized White, Hispanic, African American, Asian, and multi-racial students are ready in the social-emotional domain compared to subsidized kindergarteners (Figure 4). In contrast, higher percentage of subsidized kindergarteners across all races/ethnicities are ready in the physical domain than non-subsidized kindergarteners (Figure 5). The rates of subsidized and non-subsidized students in the language domain are quite similar across all races/ethnicities. The percentage of subsidized White, Hispanic, Native Hawaiian, and multi-racial kindergarteners who demonstrate language readiness is slightly higher than non-subsidized kindergarteners (Figure 6). Similarly, a higher percentage of non-subsidized White, Hispanic, Native Hawaiian, and multiracial kindergarteners show literacy readiness compared to those kindergarteners with no subsidy (Figure 8). A higher percentage of subsidized Hispanic, Native Hawaiian, and American Indian kindergarteners show cognitive readiness compared to those with no subsidy (Figure 7).

Limitations and Directions for Future Research

Results of this study should be considered within the context of its limitations. First, ERDC does not have comprehensive data on students' family characteristics, such as the parent's education, income, marital status and career. Without information on family characteristics, researchers cannot analyze the effect of parents' socioeconomic status on children's development outcomes. Second, information about subsidized children's childcare dosage and care types were extracted from payment data to providers, which does not address how often children actually attend their care provider. Third, the subsidy data does not include information on the quality of care that subsidized children receive, which is a critical indicator of children's development outcomes. Fourth, ERDC does not on non-subsidized low-income students' preschool status to learn if they attended other non-subsidized childcare centers and to investigate the role of attending childcare on kindergarteners' school readiness skills. Finally, the study

does not include all potential variables for children, such as gender, age in months, and childcare or other early learning participation in years prior to the subsidy year.

Another limitation of the study is the construction of the treatment and comparison groups. The comparison group is based on children with FRPL designations in kindergarten. These designations are not strictly tied to income. Moreover, in cases where the income drives the determination, the cutoff is 185% of the federal poverty level. Treatment group assignment is based on participation in subsidy prior to the kindergarten year, and the cutoff here ranges from 200% to 220% of the federal poverty level. Family income data would be helpful to constructing better treatment and comparison groups. Without this data, comparing the impact of subsidy is problematic. However, it may be less problematic to focus on children within the subsidy group and examine the impact of factors such as race/ethnicity, type of childcare setting, and their interaction on kindergarten performance.

ERDC research on the relationship between subsidy receipt and children's development outcome is still in the early stages. Despite the evidence that childcare subsidies benefit kindergarteners, estimating their net effect is challenging because recipients' social, economic, family, and institutional characteristics influence children's development outcomes as well. For example, studies argue that exposure to low-quality childcare is a critical indicator for kindergarten readiness (Herbst & Tekin, 2008 & 2016). Schochet (2018) suggests that mother's education may increase subsidy-eligible children's cognitive outcomes. While this study provides a first look of relationships between childcare subsidy receipt and kindergarten readiness, further exploring the impact of these factors will help us understand what and how childcare subsidies work.

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Appendix A. Terms and Variable Definitions

Table A1. Terms

Term	Parameters
Kindergarteners	Refers to children who participated full-day kindergarten programs. It also refers to the kindergarten grade level that consisted of kindergarteners who were age five by August 31 each academic year.
School readiness	Met or exceeded expected child development according to the cut scores specified in TS Gold or WaKIDS scale scores.
Kindergarteners with subsidized childcare	Comprised of children who were identified through the matching and linking assessment data (TS-GOLD, WaKIDS) of kindergarteners enrolled in childcare subsidy recipients based on ERDC cross-link files.
Kindergarteners without subsidized childcare	**Non-subsidized kindergarteners.** Comprised of children enrolled in full-day kindergarten assessment data (TS-GOLD, WaKIDS) of kindergarteners but not in subsidized childcare.
Low-income families in kindergarten	Those with an income level that falls within ≤130% Federal poverty Level for free lunch and 185% Federal poverty Level for reduced-price lunch.
Federal Poverty Level	Per the Healthcare.gov website, "A measure of income issued every year by the Department of Health and Human Services (HHS). Federal poverty levels are used to determine your eligibility for certain programs and benefits, including savings on Marketplace health insurance and Medicaid and CHIP coverage".

Table A2. Variable definitions

Variables	Description
Subsidy	Indicates if a kindergartener was a childcare subsidy recipient in 2017 and 2018.
FRPL eligible	Dummy variable that identifies whether a student is eligible for free- or reduced-price lunch in the 2018 and 2019 school year, which is used to indicate a student's family income status. This is the only indicator from CEDARS to proxy a student's socioeconomic status. (1= yes; 0=no)
Grade level	K – Kindergarten at age five by August 31 each academic year.
Social-emotional	Count of subsidized childcare recipients and non-recipients by grade level who were school ready in the social-emotional development area.
Physical	Count of subsidized childcare recipients and non-recipients by grade level who were school ready in the physical development area.
Language	Count of subsidized childcare recipients and non-recipients by grade level who were school ready in the language development area.
Cognitive	Count of subsidized childcare recipients and non-recipients by grade level who were school ready in the cognitive development area.
Literacy	Count of subsidized childcare recipients and non-recipients by grade level who were school ready in the literacy development area.
Math	Count of subsidized childcare recipients and non-recipients by grade level who were school ready in the mathematics development area.
Homelessness status	Dummy variable that identifies a student's homeless status. (1= yes; 0=no)
ELL participation	Dummy variable that identifies a student's ELL status. (1= yes; 0=no)
Race/Ethnicity	Race/ethnicity categories that are extracted from OSPI 2018 and 2019 CEDARS student enrollment data.
Type of care	Types of care that subsidized children attend, including full-day licensed centers, half-day licensed centers, full-day licensed homes, and half-day licensed homes.

Appendix B. Technical Notes

Study Design and Measures

Assessment of variation within the study and comparison group provides reliable and accurate picture of early child development progression. We selected kindergarteners from low-income families who participated in subsidized pre-kindergarten care programs as our treatment group. Low-income children without subsidized childcare but eligible for reduced-price or free school lunches are assigned as a comparison group. It is worth mentioning that low-income family's eligible for free or reduced school lunch (FRPL) would be eligible for the subsidy since their income level is lower than what it needs to receive the subsidy. To be eligible for the subsidy, family income must be at or below 200% of the federal poverty level (FPL) when applying, or 220% of the FPL when reapplying. To be eligible for free or reduced- price lunch the family income level must be within ≤130% Federal poverty Level for free lunch and 185% FPL for reduced-price lunch. However, low-income families may not meet the requirements to receive the subsidy; for example, parents do not work full time. Thus, non-subsidized low-income families either not sending their children to daycare (which is more likely) or have not applied for the subsidy. Thus, there is a high chance that not subsidized low-income families do not arrange any official childcare. Kindergarteners from low-income families who received special education and those who participated in state-funded pre-kindergarten (ECEAP) were further excluded. This action eliminates the effects of pre-kindergarten education program and disability, and it enables a more robust estimation.

Given that kindergarten age can affect the proportion of children who meet the expected development skills within a grade level, this study only focused on students who turned five years of age by August 31 each academic year in kindergarten. These steps ensure higher restrictions over the variability of students' characteristics for a comparative study. The construction of the analytical dataset for this study involves two data sources. The process consisted of data manipulation, such as merging and data cleaning. Demographic characteristics for children were obtained by merging WaKIDS data with subsidy data, matched and linked via a unique identifier (P20ID). Data anomalies that consisted of children with multiple identifiers or children who did not fall within the age range of 5-6 years old were excluded from the analytical dataset to create a more monotonous study sample.

The data source used for this study was drawn from the tables that fed the Early Learning Feedback Report for 2018 and 2019. The subsidy cohort years align with kindergarten school years as follows:

- Subsidy school year 2017 to K12 school year 2018
- Subsidy school year 2018 to K12 school year 2019

This data comes from the *preliminary* data feeds from each of the sources - both OSPI and DCYF. As such, you may not see as many students reported in Kindergarten in this data set as you might see on an OSPI report card.

This study began with data on 156,790 kindergartners. Again, this data does not reflect all the kindergartners that were enrolled in the school year, just the ones in the preliminary feed. Various

filters rings along the way resulted in the following counts of kindergartners. School readiness measures for kindergarten were indicated by the values, "ready" or "not ready," and kindergarten assessment data of school readiness measure were indicated by the values, "Yes' or "No." These measures were further recoded with an assigned value of 1 or 0 in all areas of development outcomes (dependent variables). The value of 1 indicates that a child was school ready, and a value of 0 indicates that a child was not ready according to each age/grade level and area of development outcomes.

To better understand the relationship between the subsidy and the six readiness variables, we designed a basic binary logistic regression model to isolate the impacts of known students' characteristic differences between students. When the dependent variable is dichotomous or binary, the logistic regression model is a predictive analysis that can be used to describe the relationship between one dependent dichotomous variable and independent variables (Menard, 2002; Hosmer & Lemeshow, 2000; Hilbe, 2009; Hosmer, 2013; Cox, 1958). The dependent variables (school readiness) include a set of kindergarten readiness measures indicating whether a child met the assessment standard for each domain. The dependent variable's indicator is assigned values of 0 and 1 (0= not ready, 1=ready). The independent variable is whether the children received a subsidy the year before kindergarten or not. The independent variable's indicator is assigned values of 0 and 1 (0= not, 1=yes). For this study's purpose, the logistic regression model is run separately for each area of school readiness. The goal of logistic regression is to find the best model to describe the relationship between receiving subsidy and low-income kindergartener's school readiness.

Table B1. Washington State kindergartener student characteristics, 2017 and 2018

Counts	Description
156,790	Kindergarteners with enrollments in Cedars preliminary file
146,485	After filtering for those of standard kindergarten age - controlling for age variation by removing those older or younger than traditional kindergarten age
133,882	After filtering out the students with SPED records in Kindergarten
59,893	After filtering out all those except students with FRPL or who were ECEAP (Note that 59,893 is 45% of 133,882. breakdown below)
12,876	ECEAP (may also be FRPL as 90% were <= 110% federal poverty level and FRPL is 185% at least for the reduced part
47,017	FRPL (FRPL but not ECEAP in prior year)
7,296	Subsidy recipients

Table B2. Readiness of subsidized and non-subsidized low-income kindergarteners across six domains

	Social-emotional	Physical	Language	Cognitive	Literacy	Math
No subsidy	28,723 73%	31,349 79%	24,958 64%	24,542 62%	24,597 63%	19,786 50%
Subsidy	4,952 68%	5,859 80%	4,891 68%	4,516 62%	4,814 67%	3,766 52%

Table B3. Readiness of subsidized and non-subsidized low-income kindergarteners ELL participants across six domains

		Social-emotional	Physical	Language	Cognitive	Literacy	Math
All Low-income kindergarteners	ELL participants	10,549 71%	11,549 78%	7,119 50%	8,208 56%	7,263 51%	5,555 38%
	Non-ELL participants	21,582 72%	23,931 80%	21,427 72%	19,618 66%	20,942 70%	17,061 57%
Subsidy	ELL participants	1,103 69%	1,230 77%	794 51%	872 55%	823 53%	610 38%
	Non-ELL participants	3,849 68%	4,629 81%	4,097 72%	3,644 64%	3,991 70%	3,156 56%
No subsidy	ELL participants	9,824 71%	10,765 78%	6,588 49%	7,610 55%	6,691 50%	5,130 37%
	Non-ELL participants	18,899 73%	20,584 80%	18,370 71%	16,932 66%	17,906 69%	14,656 57%

Table B4. School readiness of subsidized and non-subsidized low-income kindergarteners and homelessness status across six domains

		Social-emotional	Physical	Language	Cognitive	Literacy	Math
All Low-income kindergarteners	Not Homeless	32,132 72%	35,422 80%	28,422 64%	27,730 62%	28,101 64%	22,524 51%
	Homeless	1,543 65%	1,786 76%	1,427 61%	1,328 56%	1,310 56%	1,028 44%
Subsidy	Not Homeless	4,699 69%	5,533 81%	4,625 68%	4,284 63%	4,571 67%	3,579 52%
	Homeless	253 60%	326 77%	266 63%	232 55%	243 58%	187 44%
No subsidy	Not Homeless	27,433 73%	29,889 79%	23,797 64%	23,446 62%	23,530 63%	18,945 50%
	Homeless	1,290 67%	1,460 75%	1,161 60%	1,096 57%	1,067 55%	841 43%

Table B5. School readiness of subsidized and non-subsidized low-income kindergarteners and Race/ethnicity across six domains

All Low-income kindergarteners						
Race/ethnicity	Social-emotional	Physical	Language	Cognitive	Literacy	Math
non-Hispanic White	12,672 72%	14,060 80%	12,289 70%	11,560 66%	12,214 70%	9,979 57%
Hispanic/Latino	12,559 71%	13,588 77%	9,780 57%	10,034 57%	9,145 54%	6,862 39%
African American	2,237 70%	2,573 80%	2,139 66%	2,040 63%	2,294 71%	1,917 60%
Asian	1,679 76%	1,869 84%	1,316 59%	1,447 65%	1,577 71%	1,369 62%
Native Hawaiian/Other Pacific Islander	766 73%	841 79%	600 57%	585 55%	555 53%	435 41%
American Indian/Alaskan Native	660 69%	763 80%	613 65%	560 59%	574 61%	439 46%
Two or More Races	2,984 72%	3,390 82%	3,022 73%	2,745 66%	2,975 72%	2,489 60%
Total	33,557 72%	37,084 79%	29,759 64%	28,971 62%	29,334 63%	23,490 50%
Subsidized low-income kindergarteners						
Race/ethnicity	Social-emotional	Physical	Language	Cognitive	Literacy	Math
non-Hispanic White	1,845 68%	2,200 81%	1,953 72%	1,773 66%	1,945 72%	1,512 56%
Hispanic/Latino	1,683 69%	1,897 78%	1,475 62%	1,416 58%	1,375 58%	1,029 42%
African American	570 65%	717 82%	579 66%	528 60%	612 70%	506 58%
Asian	112 69%	141 87%	96 59%	95 58%	115 71%	92 56%
Native Hawaiian/Other Pacific Islander	87 75%	99 85%	70 60%	74 64%	66 57%	52 45%
American Indian/Alaskan Native	68 65%	80 76%	74 71%	64 61%	69 66%	54 51%
Two or More Races	570 67%	706 83%	630 74%	551 65%	619 73%	507 60%
Total	4,935 68%	5,840 81%	4,877 68%	4,501 62%	4,801 67%	3,752 52%
Non-subsidized low-income kindergarteners						
Race/ethnicity	Social-emotional	Physical	Language	Cognitive	Literacy	Math
non-Hispanic White	10,827 73%	11,860 80%	10,336 70%	9,787 66%	10,269 69%	8,467 57%
Hispanic/Latino	10,876 72%	11,691 77%	8,305 56%	8,618 57%	7,770 53%	5,833 39%

Race/ethnicity	Social-emotional	Physical	Language	Cognitive	Literacy	Math
African American	1,667 71%	1,856 79%	1,560 67%	1,512 65%	1,682 72%	1,411 60%
Asian	1,567 76%	1,728 84%	1,220 59%	1,352 66%	1,462 71%	1,277 62%
Native Hawaiian/Other Pacific Islander	679 72%	742 79%	530 56%	511 54%	489 52%	383 41%
American Indian/Alaskan Native	592 70%	683 81%	539 64%	496 59%	505 60%	385 46%
Two or More Races	2,414 73%	2,684 81%	2,392 72%	2,194 66%	2,356 71%	1,982 60%
Total	28,622 73%	31,244 79%	24,882 64%	24,470 62%	24,533 63%	19,738 50%

Table B6. Washington State types of subsidized childcare, 2017 and 2018

Childcare Type	Frequency	Percent	Cumulative Percent
Licensed center/ Full day	4,533	62%	62%
Licensed center/ Half-day	1,268	17%	79%
Licensed home/ Full day	1,448	20%	99%
Licensed home/ Half-day	47	.6%	100%
Total	7,296	100%	

Table B7. Washington State types of subsidized childcare and school readiness, 2017 and 2018

Childcare Type	Social-emotional	Physical	Language	Cognitive	Literacy	Math
Licensed center/ Full day	3,054 68%	3,733 83%	3,222 71%	2,918 65%	3,172 70%	2,539 56%
Licensed center/ Half-day	907 72%	980 77%	819 65%	759 60%	786 62%	586 46%
Licensed home/ Full day	955 66%	1,108 77%	819 58%	806 56%	824 59%	612 42%
Licensed home/ Half-day	36 77%	38 81%	31 66%	33 70%	32 68%	29 62%
Total	4,952 68%	5,859 80%	4,891 68%	4,516 62%	4,814 67%	3,766 52%

Table B8. Binary Logistic Regression Analysis, the association between receiving the subsidy and school readiness among low-income kindergarteners, 2017 and 2018

		B	S.E.	Wald	df	Sig.	Exp(B)
Social-Emotional	Subsidy	-.215	.028	61.227	1	.000	.806
	Constant	.967	.011	7403.625	1	.000	2.631
Physical	Subsidy	.085	.032	6.998	1	.008	1.088
	Constant	1.328	.012	11585.697	1	.000	3.775
Language	Subsidy	.178	.027	42.969	1	.000	1.195
	Constant	.556	.010	2811.119	1	.000	1.743
Cognitive	Subsidy	.003	.026	.011	1	.916	1.003
	Constant	.489	.010	2227.254	1	.000	1.630
Literacy	Subsidy	.166	.027	37.931	1	.000	1.181
	Constant	.522	.010	2493.751	1	.000	1.685
Math	Subsidy	.071	.026	7.722	1	.005	1.073
	Constant	-.001	.010	.006	1	.936	.999

Variables in the Equation

a. Variable(s) entered on step 1: Subsidy.