Technical Report
Early Childhood Iowa Longitudinal Study: A First Look at Children 0-5

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Iowa State University | August, 2022

i2d2
Iowa's Integrated Data System
for Decision-Making

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

Understanding the importance of data informed decision-making, Iowa has invested in the development of a fully integrated administrative data system for early childhood program and policy research: Iowa's Integrated Data System for Decision-Making (I2D2). I2D2 (i2d2.iastate.edu) is a State-University partnership that brings together administrative records from public health, education, child welfare, and economic development to use for social problem solving and evidence-based decision-making.[1,2] I2D2 includes a system of data governance that maintains state and agency control of data use, in combination with advanced technical and security solutions to ensure the privacy of administrative records used in approved projects is maintained. It is recognized as a national model for the integration of administrative data to inform program and policy decisions (ACF Case Study).

The current analysis was conducted as part of a comprehensive statewide needs assessment for Iowa under a federally funded Preschool Development Grant Birth-5[3]. Led by Early Childhood Iowa, this statewide work sought to understand more about who Iowa's children are, what services they use, areas of need for families with young children, and what our child care providers and preschool teachers are experiencing across our early childhood system. The current report presents findings from the first demonstration case of I2D2. It included an integration of administrative data for an entire cohort of children born in Iowa, attending kindergarten in Iowa, and who participated in a range of services and programs between birth and kindergarten entry. The cohort was enrolled in kindergarten during the 2017-2018 school year (N = 27,219). Administrative data from Iowa Departments of Public Health (Vital records), Human Services (child care subsidy), and Education (preschool and kindergarten enrollment, Teaching Strategies GOLD preschool assessments) were integrated and used for the analyses.

The following major findings about children in this cohort were identified:

- 62% of Iowa's children experience at least 1 risk at birth that is known to significantly influence kindergarten outcomes. Risks include poverty, low maternal education, birth to a teen mother, birth to a single mother, inadequate prenatal care, preterm/low birthweight, or smoking during pregnancy.

- Rural children experience more individual and cumulative risks at birth compared to other children. However, such children are more likely to have a public preschool experience.

- Populations that are more likely to enroll in ELL programs, receive free/reduced lunch, have poor attendance, or to be suspended include children born in low-income families as well as children born to unmarried, low educated, or teen mothers, Furthermore, children of numeric minority racial status (i.e., Black, Hispanic, Asian, or multiple races) and children whose mothers smoked during pregnancy are more likely to experience these outcomes.

- Boys were significantly more likely than girls to be suspended from school in kindergarten.

These findings were discussed in a series of working stakeholder strategic planning sessions during 2019 to cultivate recommendations for statewide investments in our early childhood system. The resulting Early Childhood Iowa Strategic Plan was approved by the ECI State Board and used to guide cross-systems efforts [4].
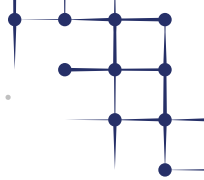
School readiness and early school success are a prioritized social need. Iowa leads the nation in the number of households with both parents (or the only parent) working, with 75% of children under the age of 6 having both parents in the workforce[5]. However, 23% of Iowans including 35% of rural Iowans live in a child care desert[6]. Given the high number of children with both parents working, children under the age of 6 are likely in non-parental care for a large portion of their lives before kindergarten entry.

Separate state reports suggest Iowa children are in different types of care, but prior to I2D2 we did not have available comprehensive information from across systems or unduplicated counts of exactly how many children experience multiple programs across time between birth and school entry. This makes it difficult to determine where gaps in care may be occurring.

Research suggests some children who are exposed to various risk factors in early childhood are less likely to meet school readiness targets[7-10]. Research also suggests some children are more or less likely to participate in formal preschool depending upon factors such as family income, cultural values, parent education, parent work status, geography, and access[11-14].

The purpose of this investigation was to use I2D2 to study an entire cohort of Iowa children entering kindergarten.

The goals include:
- Provide unduplicated counts of children participating in preschool and center-based care programs,
- examine factors which may influence child enrollment in these programs,
- examine factors which may positively or negatively impact the child benefit from these programs,
- and analyze school readiness outcomes.

The following report presents the project design and data integration process, the unduplicated counts of Iowa children participating in state preschool and child care programs, differences in family characteristics for children with various experiences, findings about the relationship between 0-5 experiences and kindergarten indicators, and findings identifying rural and urban characteristics in relation to child and family risks, preschool enrollment, and kindergarten indicators.

Administrative records from Iowa's Departments of Public Health, Human Services, and Education were used through Iowa's Integrated Data System for Decision-Making (I2D2) for all analyses. Data sharing for the purpose of this Early Childhood Iowa Longitudinal Study (ECILS) followed all applicable legal and ethical standards for protecting privacy and confidentiality as established by federal and state law and were governed by signed legal agreements by all state departments and Iowa State University. Data were integrated using deterministic and probabilistic algorithms, and then all files were anonymized (i.e., stripped of personal identifiers) for analysis. Analytic approaches included descriptive statistics, logistic regression techniques (to understand likelihoods of participation in particular sets of experiences), and group comparisons (ANOVAS and t-tests).

Iowa Department of Public Health Vital Statistics Birth Records (VS) were collected in the hospital at the time of the child's birth and included date of birth, Medicaid or WIC receipt at birth, birth weight and gestational age, mother age and marital status, parent education levels, prenatal care, and prenatal maternal smoking. The Iowa Department of Human Services Child Care Assistance (CCA) enrollment data included provider and child demographic information as well as child care assistance registration, capacity, attendance, and payment receipt. Iowa Department of Education Funded Pre-school (DE PreK) enrollment data identified children's preschool participation in Department of Education (DE) funded programs such as Statewide Voluntary Preschool, Shared Visions, or IDEA services, including information about the school of enrollment and type of classroom.

Teaching Strategies GOLD assessment data contained program enrollment, child demographics, and developmental assessments for any child enrolled in a program who participated in the statewide assessments. Iowa DE's statewide license covers administrative fees for annual subscriptions for all registered Iowa programs, and public and private preschools are allowed to use the license to complete assessments for children in their programs. Per Iowa code section 279.60, prekindergarten, or four-year-old children affiliated with a local school district, must be assessed using Teaching Strategies GOLD. All Head Start grantees across the state also use GOLD. These records were used to capture program enrollment information for students who may have received a center-based care experience, but it was not funded by DE or CCA, including Head Start and centers with private family pay. Iowa Department of Education kindergarten enrollment records contained information on public enrollment, achievement, average daily attendance, suspensions as well as provision of district programs such as Free and Reduced Lunch and English Language Learner services.

Variables for the study were coded to analyze unduplicated counts of children across early childhood programs, characteristics of children and families at birth, and kindergarten enrollment and outcomes in public school (see Table 1). Many were dichotomized to facilitate counting birth risk factors and examining the likelihood of multiple program outcomes.

TABLE 1. ORIGINAL AND ANALYTIC VARIABLES

Vital Statistics: **At the time of the child's birth**		
Analytic Variable	**Variable (original name)**	**Description of how the analytic variable was created**
Child male	gender	Child gender was originally coded as F (*female*) and M (*male*). It was recoded as 0 = *female and* 1 = *male*.
Mother race	race_parenta_derived	Original response categories include *White, Black, AIAN, API*, and *Multiple. Asian*, *API*, and *Multiple* were recoded as *other*.
Mother ethnicity	ethnicity_parenta_derived	Coded *Hispanic* and *Non-Hispanic*.
Number of siblings	count_live_births_living	A count of previous live births to the mother who were still living was used as a proxy for child's number of siblings, and was recoded to 0, 1, or 2+ siblings.
Preterm/low birth weight (LBW)	weight_infant gestation	Weight_infant and gestation were combined into a preterm/low birth weight variable identifying children who were either born prior to 36 weeks or less than 2500 grams.

Table 1 continued…

Teen mother	year_born_parenta, month_born_parenta, birth_yr_vs, and birth_mo_vs	These three source variables were used to construct both mother and child's birth dates. Teen mothers were identified when the mother's age was younger than 20 years old at the time of the child's birth.
Low maternal education	education_parenta	Mothers with low education were identified if they had less than a HS education.
Single mother	married_during_pregnancy	Mothers unmarried at the time of delivery were identified as single mothers.
Inadequate prenatal care	month_prenatal_care_start and total_prenatal_care_visits	Month_prenatal_care_start indicated a month a mother started prenatal care. Total_prenatal_care_visits included the number of visits to prenatal care. Mothers with inadequate prenatal care were identified if they received no prenatal care during the first trimester or having fewer than four prenatal visits total.
Poverty	wic_received payment_source	Wic_received indicates whether mothers received *WIC* during pregnancy. Payment_source includes responses, *Medicaid*, *private insurance*, *self-pay*, *Indian Health Service*, *CHAMPUS/TRICARE*, *other government (federal, state, local)*, and *other as their primary source of payment for delivery*. Poverty was defined as receiving WIC or Medicaid.
Tobacco	pregnancy_tobacco_use_derived, average_daily_cigarettes_prepreg, average_daily_cigarettes_trimester1, average_daily_cigarettes_trimester2, and average_daily_cigarettes_trimester3	Pregnancy_tobacco_use_derived identified whether they ever smoked during pregnancy. Average_daily_cigarettes_prepreg indicated an average number of cigarettes smoked during three months prepregnancy. Average_daily_cigarettes_trimester1, average_daily_cigarettes_trimester2, and average_daily_cigarettes_trimester3 indicated an average number of cigarettes smoked during each trimester. Mothers who smoked at any time during their pregnancy was coded.

Department of Education - Kindergarten

Analytic Variable	*Variable (original name)*	Description of how the analytic variable was created
English Language Learner		Children identified as being in an English language program
Free/Reduced Lunch Status		Children who were reported eligible for free/reduced lunch receipt
Poor attendance		Children with less than 10% of aggregate days of attendance divided by aggregate days of enrollment.
Suspensions		Children who were removed from school for actions such as dress code violations, bullying, or inappropriate use of language.

Department of Human Services – Child Care Assistance

Enrollment		Children enrolled in the child care assistance program and received a child care assistance payment

Department of Education – Teaching Strategies GOLD

GOLD experience		Collected 3 times a year in 6 content areas (Social Emotional, Physical, Language, Cognitive, Literacy, Mathematics), children with any completed objectives identified as having a GOLD experience.

Risk Indicators

Individual Birth Risk Variables. Vital Statistics birth record information was used to create risk indicators based on established definitions of risk from the research literature.[15-34] A proxy for <u>poverty</u> was assessed as whether the child's family received Medicaid or WIC at the time of birth. <u>Unmarried mothers</u> were identified as women who were not married at the time of the child's birth. <u>Low maternal education</u> indicated that the child's mother completed less than 12 years of schooling. <u>Teen motherhood</u> identified children born to mothers younger than age 20. <u>Preterm or low birth weight (LBW)</u> indicated that children were born prior to 36 weeks gestation or were born weighing less than 2,500 grams. <u>Inadequate prenatal care</u> indicated parents did not have a prenatal visit in the first trimester of pregnancy or had fewer than four visits overall. <u>Prenatal Smoking</u> was noted if mothers smoked during pregnancy or the three months prior.

Cumulative Risk Birth Variables. As children often face multiple risks that are highly correlated and accumulate over time, a cumulative risk approach was utilized to better reflect the context of children's lives and provide deeper insights into how agencies might address the needs of vulnerable children. To this end, a cumulative risk measure was constructed as a sum of the 7 individual birth risks including poverty, unmarried motherhood, low maternal education, teen motherhood, preterm/low birth weight, inadequate prenatal care, and prenatal smoking.

Child and Family Characteristics. Covariates included age at the time of preschool assessments (in months), parent-reported sex (0 = female; 1 = male), race/ethnicity (1 = non-Hispanic white; 2 = Black; 3 = Hispanic; 4 = Asian; 5 = multiple), immigration status (0 = Parent was born in US;1 = Parent immigrated), and rurality (0 = urban; 1 = rural).

Analyses

Stata 16.0[35] was used to compute proportions for child demographic characteristics and individual and cumulative risk factors as well as in main analyses. Multiple logistic regression was employed to examine relationships between individual and cumulative risk models and rurality, early childhood experiences, and kindergarten outcomes, controlling for relevant child and family demographic characteristics. Multiple logistic regression is a useful method when treating dichotomous outcomes (e.g., success or failure) for which multiple independent variables are presumed to have explanatory power. This analysis produces odds ratios which are interpreted as the likelihood of an outcome with a given characteristic compared to the likelihood of that same outcome for a child without that characteristic. An odds ratio of 1.0, for example, indicates equal likelihood (i.e., no difference in the outcome). Odds ratios of less than 1.0 indicate a decreased likelihood of the outcome occurring while odds ratios greater than 1.0 indicate an increased likelihood of the outcome occurring.
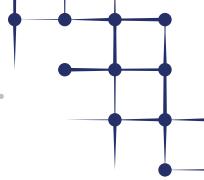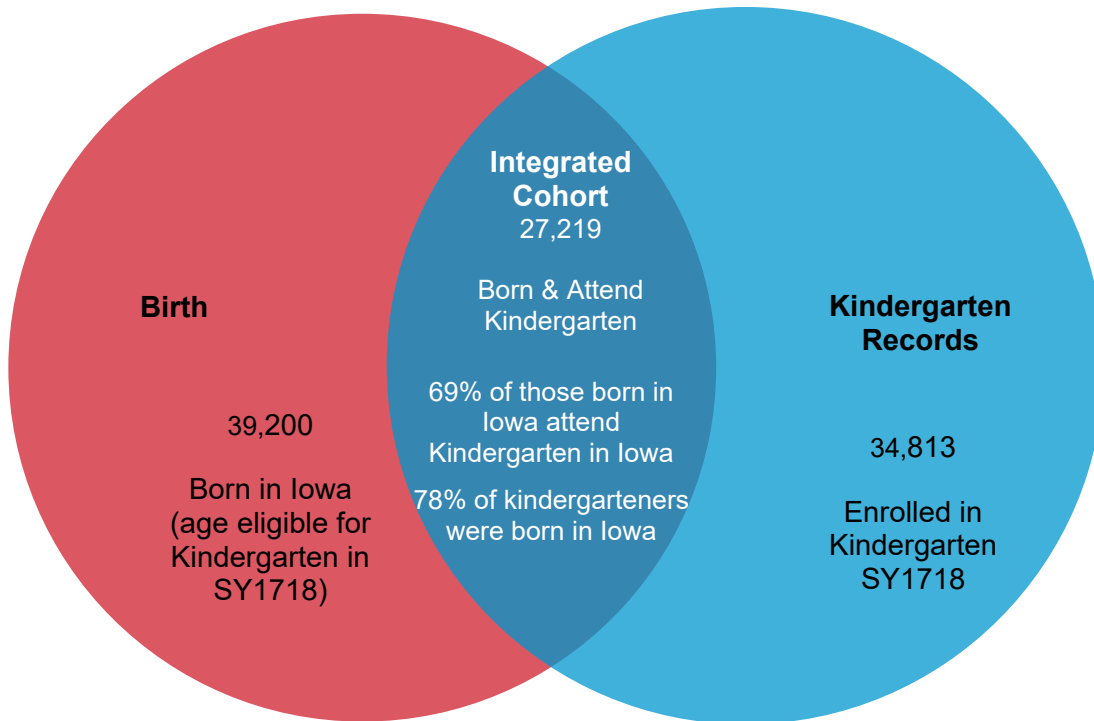
DATA INTEGRATION

Administrative records from each of the data systems were integrated using deterministic and probabilistic matching techniques for one cohort of children attending kindergarten in the 2017-2018 school year. Extensive data cleaning and verification were conducted prior to the match, following standardized data verification procedures[35] including internal consistency and missing data reviews. Birth records and education data were joined in step one, followed by joins with CCA and TS GOLD in step two. Figure 1 presents information on Step 1 from the data integration match, including the link between birth records and kindergarten enrollment. Results indicated that 69% of the 39,200 children who were born in Iowa and age eligible to attend kindergarten were matched with kindergarten enrollment records from the 2017-2018 school year.

FIGURE 1. DESCRIPTION OF THE I2D2 BIRTH-TO-FIVE COHORT

Integrated Cohort
27,219

Born & Attend Kindergarten

69% of those born in Iowa attend Kindergarten in Iowa

78% of kindergarteners were born in Iowa

Birth

39,200

Born in Iowa (age eligible for Kindergarten in SY1718)

**Kindergarten Records**

34,813

Enrolled in Kindergarten SY1718

Representativeness of Integrated Iowa Cohort

To understand whether children in this cohort were representative of all children born in the state, we used logistic regression. These results (i.e., matched compared to unmatched children) are presented in Table 2. Analysis showed that children who were Black, Hispanic, Asian, or multiple races were less likely to be in the integrated cohort. This indicates that more of these children were born outside of Iowa and/or moved to Iowa sometime before kindergarten (i.e., they were not BOTH born in Iowa and enrolled in kindergarten in Iowa).

Male children as well as children with parents that immigrated to the United States were less likely to be born in Iowa and enter kindergarten in Iowa than they were to be born in Iowa and enter kindergarten elsewhere. Children with teen mothers, mothers with less than a high school education, and those who received inadequate prenatal care also had lower odds of being born in Iowa and entering kindergarten in Iowa than being born in Iowa and entering kindergarten elsewhere.

Conversely, children born in counties classified as rural, children who received WIC or Medicaid at the time of birth, and children with mothers who smoked during pregnancy or three months prior, were each more likely to be born in Iowa and enter kindergarten in Iowa than they were to be born in Iowa and enter kindergarten elsewhere. This pattern held for children with 2 or more risks as well. (See Appendix A for the full logistic regression table).

Descriptive statistics of data representing Iowa children are also presented in Table 2. The analytic population was comprised of 51% males and 49% females, and the average age of children was 54.39 months in preschool. Among families in the cohort, 9% of mothers had less than a high school education, about 36% of mothers were
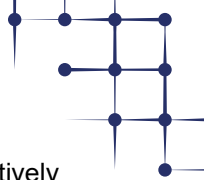
unmarried at the birth of their child, and 7% of mothers were teenagers at the birth of their child. A large proportion of children in the cohort were exposed to 2 or more risks in the cumulative index (44%), and a relatively smaller percentage of children (39%) were exposed to zero risks.

TABLE 2. DESCRIPTION OF THE INTEGRATED COHORT

	Matched All	VS only	DE only	Matched vs Nonmatched	
Child Characteristics				OR	SE
Male	51% (0.50)			0.94	(0.02)**
Race/Ethnicity					
White	78% (0.42)		59% (0.49)		
Black	5% (0.21)		15% (0.35)	0.25	(0.01)***
Hispanic	10% (0.30)		13% (0.34)	0.60	(0.02)***
Asian	2% (0.14)		7% (0.26)	0.22	(0.01)***
Multiple	5% (0.22)		5% (0.22)	0.76	(0.05)***
Age at preschool (in months)	54.39 (3.89)		54.63 (4.03)	0.98	(0.00)***
Family Characteristics					
Number of siblings	1.05 (1.14)	1.24 (1.45)		0.91	(0.01)***
Parent immigration	12% (0.33)	16% (0.37)		0.77	(0.03)***
Rural (county of birth)	29% (0.45)	27% (0.45)		1.06	(0.03)*
Individual Risks					
Poverty (WIC/Medicaid)	49% (0.50)	43% (0.50)		1.13	(0.06)*
Pre-term/LBW	8% (0.27)	8% (0.27)		0.92	(0.05)
Low mother education	9% (0.28)	11% (0.32)		0.79	(0.04)***
Unmarried mother	36% (0.48)	30% (0.46)		1.06	(0.06)
Inadequate prenatal care	7% (0.25)	11% (0.32)		0.52	(0.03)***
Teen mother	7% (0.25)	6% (0.24)		0.76	(0.05)***
Smoking	23% (0.42)	17% (0.37)		1.16	(0.06)**
Cumulative Risk [a]					
0 Risks	39% (0.49)	43% (0.49)			
1 Risk	18% (0.38)	19% (0.39)		1.09	(0.06)
2 Risks	19% (0.39)	17% (0.38)		1.21	(0.11)*
3 or more Risks	25% (0.43)	21% (0.41)		1.38	(0.20)*

Note: [+]$p<.10$; *$p<.05$; **$p<.01$; ***$p<.001$. [a] Cumulative risk index was created using a sum of Poverty (WIC/Medicaid receipt), Pre-term/Low birthweight, Low mother education, Unmarried mother, Inadequate prenatal care, Teen mother, and Smoking.
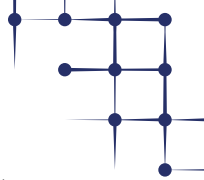
Figure 2 presents the race and ethnicity of the matched cohort provided from VS birth records in comparison to the child race and ethnicity in the unmatched DE kindergarten cohort. As these figures show, children in the matched cohort are less diverse than children who were only included in the DE population (e.g. they did not match to any VS birth record). This indicates that the population of children moving to Iowa between birth and kindergarten are more diverse than the children who are born in Iowa and attend kindergarten in Iowa.

FIGURE 2. RACE/ETHNICITY OF INTEGRATED COHORT AND ALL KINDERGARTEN CHILDREN

Matched Cohort (n=27,319)

DE Only (n=7,594)

- White
- Black
- Hispanic
- Asian
- Multiple
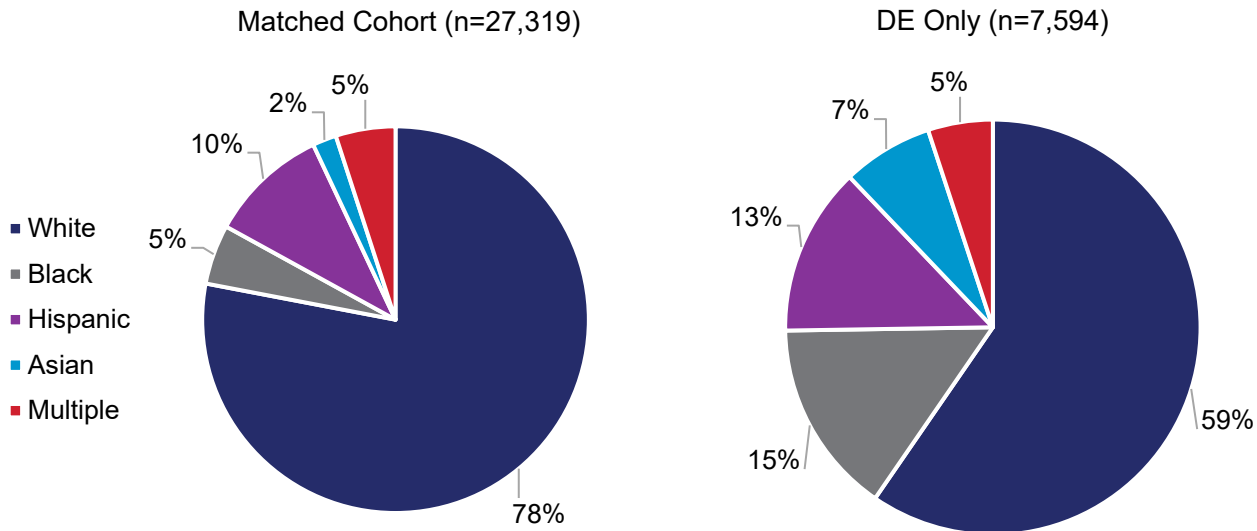
Figure 3 presents the differences in family characteristics and individual risks between the matched cohort and the full population of children born in Iowa with the asterisk denoting significant differences.

FIGURE 3. FAMILY CHARACTERISTICS AND INDIVIDUAL RISKS OF THE MATCHED COHORT
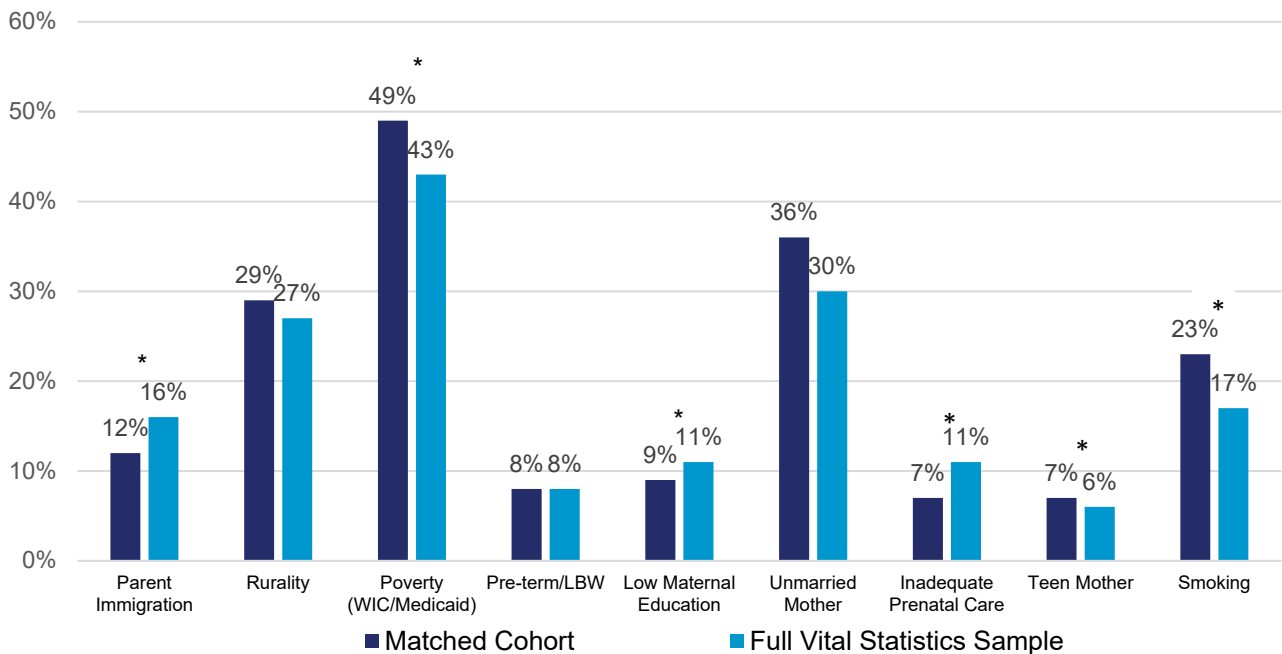
*Note. Data include matched samples of Iowa children who were born between 2010 and 2018 and were matched with preschool data. Estimates are unweighted. *Significant differences between families with substance use history and non-substance use are estimated by unpaired two-sample t-tests.*

TECHNICAL REPORT: Early Childhood Iowa Longitudinal Study (ECILS)

Aim 1: Identify the unduplicated count of children with at least 1 center-based experience the year before kindergarten entry.

Iowa children's preschool experiences

Findings on the percentage of children with each unique preschool experience are presented in Figure 4. Findings indicated 68% of Iowa children attended a DE funded preschool program, 67% had a TS GOLD assessment (i.e., were enrolled in a center-based program of any type that used the TS GOLD assessment), and 6% participated in a CCA funded center-based experience during 2016-2017. A number of Iowa children had multiple experiences, including children who participated in a DE funded preschool and also received a CCA subsidy for an additional child care experience the year before they entered kindergarten (n=1,310+67). Children were also identified in one system, such as those who had a TS GOLD assessment but did not attend a DE funded preschool program (n=1,235), but not others. Descriptive statistics for configurations of preschool experiences are presented in Appendix A, Table A2.

FIGURE 4. PRESCHOOL EXPERIENCES AMONG CHILDREN IN THE BIRTH-TO-FIVE COHORT.
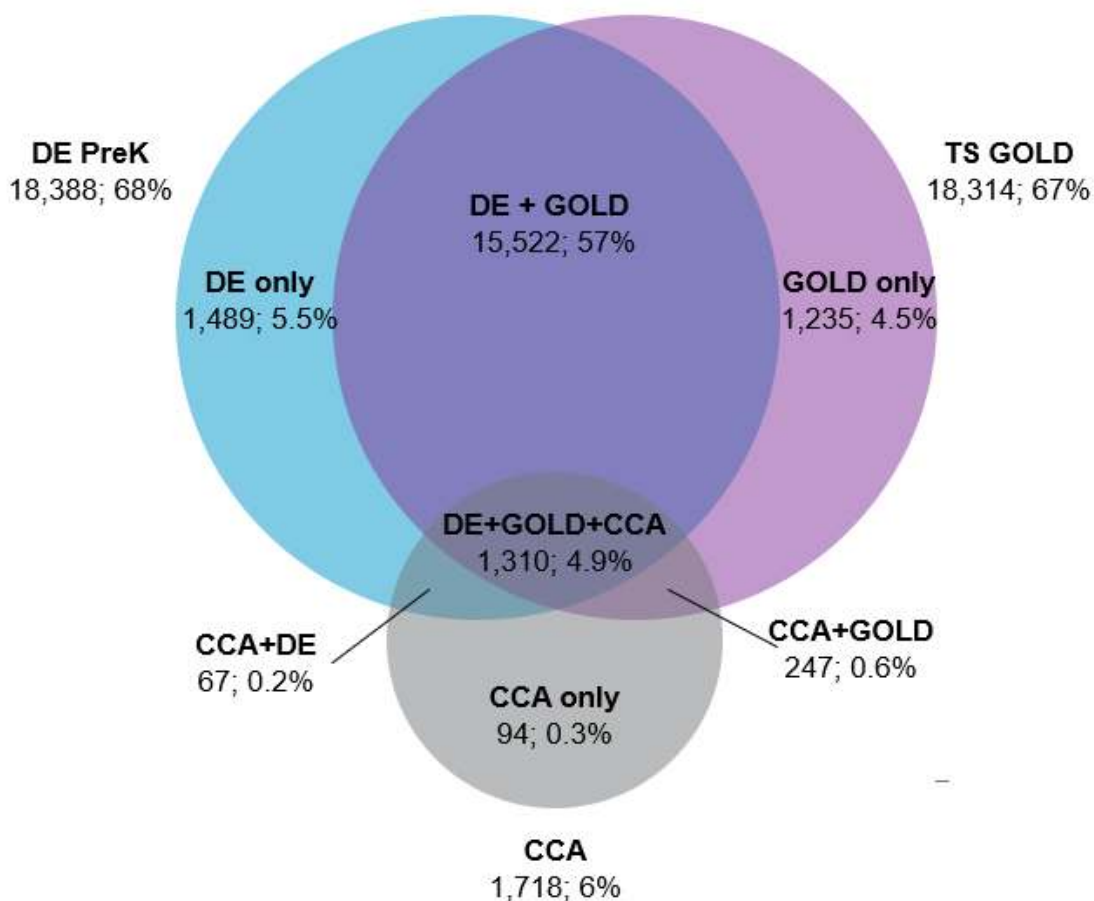
Aim 2. Describe differences in family characteristics for children with different experiences

Table 3 shows the proportion of child and family characteristics, birth risks, and cumulative risk by the respective preschool experience grouping. Compared to children with no identified risks (reference group), children experiencing 1, 2, and 3 or more risks were each more likely to have some form of public preschool experience.

Furthermore, a series of post-hoc analyses were performed varying the reference group to examine differences among children with 1, 2, and 3 or more risk experiences. These results suggested an incremental effect such that exposure to 1 risk was significantly different than exposure to 2 risks and exposure to 2 risks was significantly different than exposure to 3 or more risks ($p < .05$), indicating an increased likelihood of children participating in a public preschool experience for each additional risk beginning with one risk. See Appendix A, Table A1 and A2 for the full table of Odds Ratios relating to preschool participation.

TABLE 3. MEANS AND PRPORTIONS FOR MATCHED COHORT BY PRESCHOOL EXPERIENCE

	DE+GOLD	DE Only	Gold Only	DE+Gold +CCA	CCA+DE	CCA+Gold	CCA only
Child Characteristics							
Male	51% (0.50)	51% (0.50)	52% (0.50)	54% (0.50)	60% (0.49)	52% (0.50)	49% (0.50)
Race/Ethnicity							
White	82% (0.38)	73% (0.44)	67% (0.47)	62% (0.49)	58% (0.50)	52% (0.50)	36% (0.48)
Black	3% (0.16)	5% (0.22)	11% (0.31)	15% (0.36)	16% (0.37)	24% (0.43)	22% (0.42)
Hispanic	9% (0.29)	16% (0.36)	14% (0.34)	11% (0.32)	13% (0.34)	9% (0.29)	20% (0.40)
Asian	2% (0.15)	2% (0.14)	2% (0.15)	1% (0.09)	1% (0.12)	0% (0.00)	1% (0.10)
Multiple	4% (0.20)	4% (0.20)	6% (0.24)	11% (0.31)	10% (0.31)	14% (0.35)	20% (0.40)
Age at preschool (months)	54.16 (3.59)	54.46 (3.76)	54.26 (3.85)	54.06 (3.60)	54.33 (3.78)	53.98 (3.77)	53.43 (3.79)
Family Characteristics							
Number of siblings	1.04 (1.09)	1.09 (1.17)	1.12 (1.26)	1.16 (1.25)	1.36 (1.37)	1.33 (1.65)	1.13 (1.34)
Parent immigration	11% (0.32)	17% (0.38)	16% (0.37)	8% (0.28)	3% (0.17)	5% (0.22)	12% (0.32)
Rural	32% (0.47)	38% (0.49)	38% (0.49)	31% (0.46)	33% (0.47)	37% (0.48)	24% (0.43)
Individual Risks							
Poverty (WIC/Medicaid)	44% (0.50)	55% (0.50)	73% (0.44)	91% (0.29)	97% (0.17)	96% (0.19)	93% (0.26)
Pre-term/LBW	8% (0.27)	8% (0.27)	9% (0.29)	8% (0.28)	6% (0.24)	11% (0.32)	12% (0.32)
Low mother education	7% (0.26)	13% (0.33)	15% (0.35)	11% (0.31)	6% (0.24)	8% (0.27)	15% (0.36)
Unmarried mother	31% (0.46)	41% (0.49)	54% (0.50)	76% (0.43)	81% (0.40)	76% (0.43)	83% (0.38)
Inadequate prenatal care	6% (0.23)	7% (0.26)	10% (0.30)	10% (0.30)	9% (0.29)	12% (0.32)	17% (0.38)
Teen mother	5% (0.22)	8% (0.27)	12% (0.32)	15% (0.36)	16% (0.37)	19% (0.39)	31% (0.46)
Smoking	21% (0.40)	24% (0.43)	33% (0.47)	40% (0.49)	48% (0.50)	45% (0.50)	40% (0.49)
Cumulative Risk[a]							
0 Risks	42% (0.49)	32% (0.47)	20% (0.40)	3% (0.18)	1% (0.12)	2% (0.13)	1% (0.10)
1 Risk	20% (0.40)	19% (0.39)	14% (0.35)	12% (0.33)	9% (0.29)	11% (0.32)	7% (0.26)
2 Risks	18% (0.39)	21% (0.41)	24% (0.43)	32% (0.47)	34% (0.48)	26% (0.44)	24% (0.43)
3 or more Risks	20% (0.40)	28% (0.45)	43% (0.49)	52% (0.50)	55% (0.50)	61% (0.49)	67% (0.47)

Note: [+]$p<.10$; [*]$p<.05$; [**]$p<.01$; [***]$p<.001$. [a] Cumulative risk index created using Poverty (WIC/Medicaid receipt), Pre-term/Low birthweight, Low mother education, Unmarried mother, Inadequate prenatal care, Teen mother, and Smoking

Co-occurrence results are presented in Table 4. Approximately 48.66% of children received WIC or Medicaid at the time of birth. The next most prevalent risks were birth to a single mother (36.44%), maternal smoking during pregnancy or three months prior (22.64%), low maternal education at birth (8.85%), preterm/LBW (7.71%), inadequate prenatal care (6.74%), and teen motherhood (6.67%). Findings from a series of chi-square tests revealed unique patterns among risk experiences.
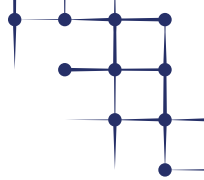
First, children born to teen mothers were nearly twice as likely to experience poverty (i.e., receive WIC or Medicaid) at the time of birth (93.14% compared to 48.66% in the general Iowa population). Children exposed to other risks were also more likely to experience poverty. For instance, roughly nine out of ten children that had mothers with less than a high school education (92.78%) or that had single mothers (86.30%) also experienced poverty. Three-quarters of children with mothers that received inadequate prenatal care (77.37%) or that smoked during pregnancy or three months prior (78.82%) were in poverty at birth.

Another noteworthy pattern that emerged suggested children exposed to poverty were less likely to be classified as having no public preschool experience compared with the overall Iowa population (23.66% compared to 26.91%). This trend extended to single mothers (24.89%) and mothers that smoked during pregnancy or three months prior (24.34%). In contrast, mothers with less than a high school education (29.51%) or mothers that received inadequate prenatal care (29.39%) were more apt to have children with no public preschool experience compared to the overall Iowa sample

TABLE 4. PREVALENCE AND CO-OCCURRENCE OF BIRTH RISKS AND NO PRESCHOOL

	1	2	3	4	5	6	7	8
	(48.66%)	(7.71%)	(8.85%)	(36.44%)	(6.74%)	(6.67%)	(22.64%)	(26.91%)
1. Poverty at birth	-	8.53*	16.91*	64.62*	10.74*	12.76*	36.68*	23.66*
2. Preterm/LBW	53.72*	-	10.24*	39.95*	9.99*	7.30	25.69*	25.83
3. Low maternal education	92.78*	8.93*	-	55.67*	16.50*	NA	32.11*	29.51*
4. Single mother	86.30*	8.47*	13.55*	-	11.36*	16.91*	40.18*	24.89*
5. Inadequate prenatal care	77.37*	11.42*	21.64*	61.28*	-	12.47*	31.72*	29.39*
6. Teen mother	93.14*	8.46	NA	92.48*	12.64*	-	31.74*	25.04
7. Tobacco use	78.82*	8.76*	12.58*	64.67*	9.47*	9.34*	-	24.34*
8. No Preschool	42.75*	7.41	9.72*	33.68*	7.38*	6.20	20.47*	-

Note. Numbers in parentheses represent the population percentage. Numbers throughout the table represent percentages of children within a risk group (row) who also experienced each of the other risks (column). Significant chi-square differences (p<.05) are indicated (*).

Aim 3. Examine the relationships between 0-5 experiences and kindergarten indicators

Individual & cumulative risk and kindergarten outcomes.
Using multiple logistic regression analysis, we examined the odds of children having various kindergarten outcomes relative to child and family characteristics as well as individual and cumulative birth risks. The full logistic regression table can be found in Appendix A in Tables A3 and A4. See Table 5 for school outcomes.

> Children with public preschool experiences were significantly less likely to be English language learners or to have poor attendance. Conversely, children who participated in public preschool were significantly more likely to receive free/reduced price lunch.

Free/Reduced Lunch
- Findings indicated that Hispanic, Black, Asian, and multiracial children were significantly more likely to qualify for Free/Reduced Priced Lunch and have poor attendance in kindergarten compared to white children ($p < .01$).
- Children born with risks including poverty, low maternal education, unmarried mothers, inadequate prenatal care, teen mothers, and prenatal smoking were significantly more likely to qualify for Free/Reduced Priced Lunch in kindergarten and have poor attendance in kindergarten compared to children who without these risks ($p < .05$).
- Children who qualified for Medicaid or WIC at birth were nearly 10 times more likely to qualify for Free/Reduced priced lunch in kindergarten, suggesting poverty persists over time; these children were also nearly 3 times more likely to be suspended in kindergarten than their non-poor counterparts.
- Children who participated in public preschool were significantly more likely to receive free/reduced price lunch.

Suspension
- Boys were 7.5 times as likely to be suspended in kindergarten compared to girls.

English Language Learner
- Children with public preschool experiences were significantly less likely to be English language learners or to have poor attendance.

Cumulative Risk
Compared to children with no identified risks, children exposed to 1, 2, and 3 or more risks were each significantly more likely to participate in an ELL program, to receive free/reduced price lunch, to have poor attendance, and to be suspended ($p < .05$). A series of post-hoc analyses were performed varying the reference group to examine differences among children with 1, 2, and 3 or more risk experiences. These results suggested an incremental effect such that exposure to 1 risk was significantly different than exposure to 2 risks, and exposure to 2 risks was significantly different than exposure to 3 or more risks ($p < .05$). This suggested an increased likelihood of children enrolling in an ELL program, receiving free/reduced price lunch, having poor attendance, and being suspended for each additional risk beginning with one risk. However, there was one exception: there was not a statistically significant difference in the likelihood of suspension for children with 2 risks compared to those with 3 or more.
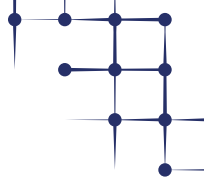
TABLE 5. CHILD AND FAMILY CHARACTERISTICS RELATED TO SCHOOL OUTCOMES

	English Language Learner (n=1,912)	Free/Reduced Lunch (n=10,655)	Poor Attendance (n=1,914)	Suspensions (n=273)
Child Characteristics				
Male	51%	51%	52%	88%
Race/Ethnicity				
White	8%	61%	58%	59%
Black	6%	10%	12%	20%
Hispanic	72%	19%	19%	7%
Asian	12%	3%	3%	1%
Multiple	1%	8%	8%	13%
Age at preschool (in months)	53.82	54.12	54.22	54.25
Family Characteristics				
Number of siblings	1.46	1.32	1.15	1.23
Parent immigration	89%	19%	17%	7%
Rural	29%	35%	32%	27%
Individual Risks				
Poverty (WIC/Medicaid)	87%	87%	81%	81%
Pre-term/LBW	8%	9%	10%	6%
Low mother education	51%	19%	18%	12%
Unmarried mother	43%	61%	62%	63%
Inadequate prenatal care	16%	11%	12%	12%
Teen mother	10%	12%	16%	13%
Smoking	4%	36%	38%	42%
Cumulative Risk [a]				
0 Risks	6%	7%	11%	13%
1 Risk	18%	16%	14%	12%
2 Risks	36%	31%	24%	27%
3 or more Risks	39%	46%	51%	48%

Note: This table presents distributions of characteristics within each column. For example, of the children who are suspended (4th column), 88% were male, 59% White, and 63% were born to an unmarried mother. [a] Cumulative risk index created using Poverty (WIC/Medicaid receipt), Pre-term/Low birthweight, Low mother education, Unmarried mother, Inadequate prenatal care, Teen mother, and Smoking

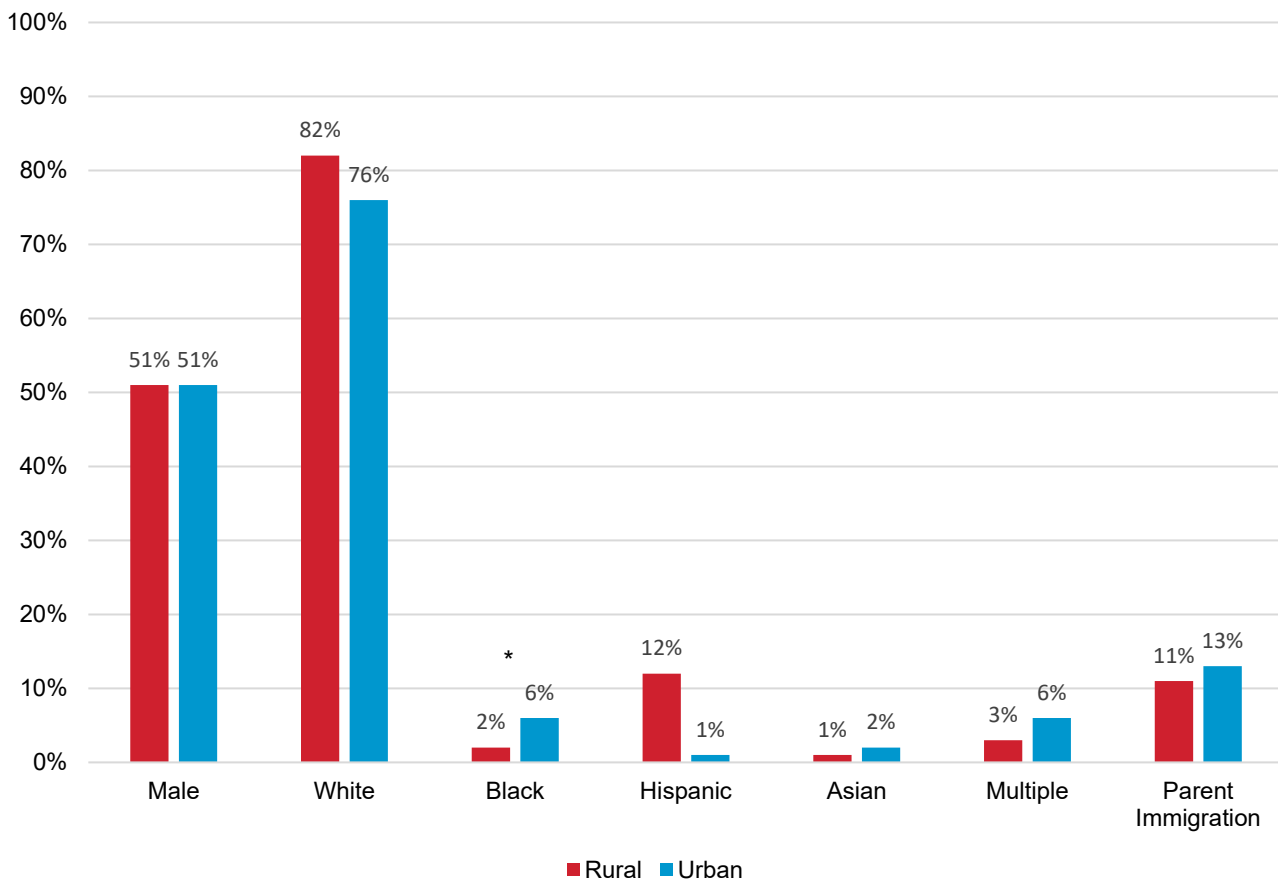# Aim 4: Examine rural and urban differences in risks, preschool enrollment, and kindergarten indicators

Iowa children's geographic location

Children were classified as living in rural or urban locations based on the location of children's residence at birth.

Child and Family Characteristics

Black children (compared to white children), children born preterm or with low birthweight, children born to an unmarried mother, or children whose parent were immigrants to the United States are more likely to be born in urban Iowa counties. See Figure 5 for the full comparison.

FIGURE 5. RURAL AND URBAN COMPARISON OF CHILD AND FAMILY CHARACTERISTICS
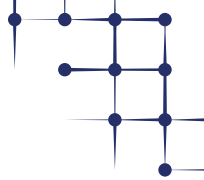
Children born to mothers were **teenagers, were in poverty, smoked during pregnancy, or had multiple children** at the time of the focal child's birth were **more likely to live in rural areas**.

Children who were identified as **having at least one public preschool experience prior to kindergarten** entry were **more than twice as likely to be born in rural areas** compared to children who did not have a preschool experience. See Figure 6 for the full comparison of rural and urban birth risks.

FIGURE 6. RURAL AND URBAN COMPARISON OF BIRTH RISKS
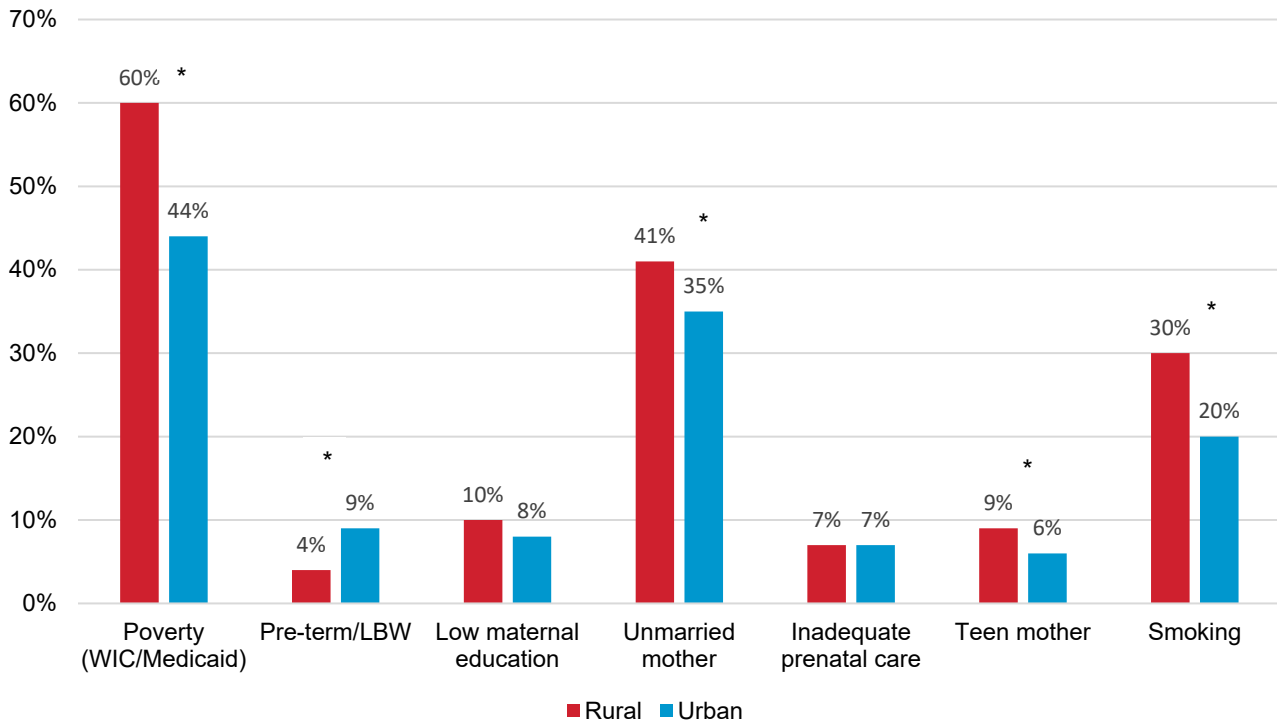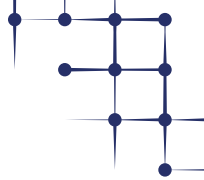
Cumulative risk multiple logistic regression models suggested children exposed to one, two, and three or more risks were more likely to be born in rural areas compared to children with zero risks identified at birth. There was an increased likelihood of children participating in a public preschool experience for each additional risk beginning with one risk (p < .05).

Similar to the individual risk models, findings suggested children who were identified as having at least one public preschool experience prior to kindergarten entry were more than twice as likely to be born in rural areas compared to children who did not have a preschool experience.

Findings from the final multiple logistic regression model predicting rurality are presented in Appendix A, Table A along with descriptive statistics.

FIGURE 7. RURAL AND URBAN COMPARISON OF CUMULATIVE RISK

Rural

Urban

- 0 risks
- 1 risk
- 2 risks
- 3+ risks

Rural: 30%, 18%, 22%, 25%

Urban: 42%, 18%, 17%, 23%
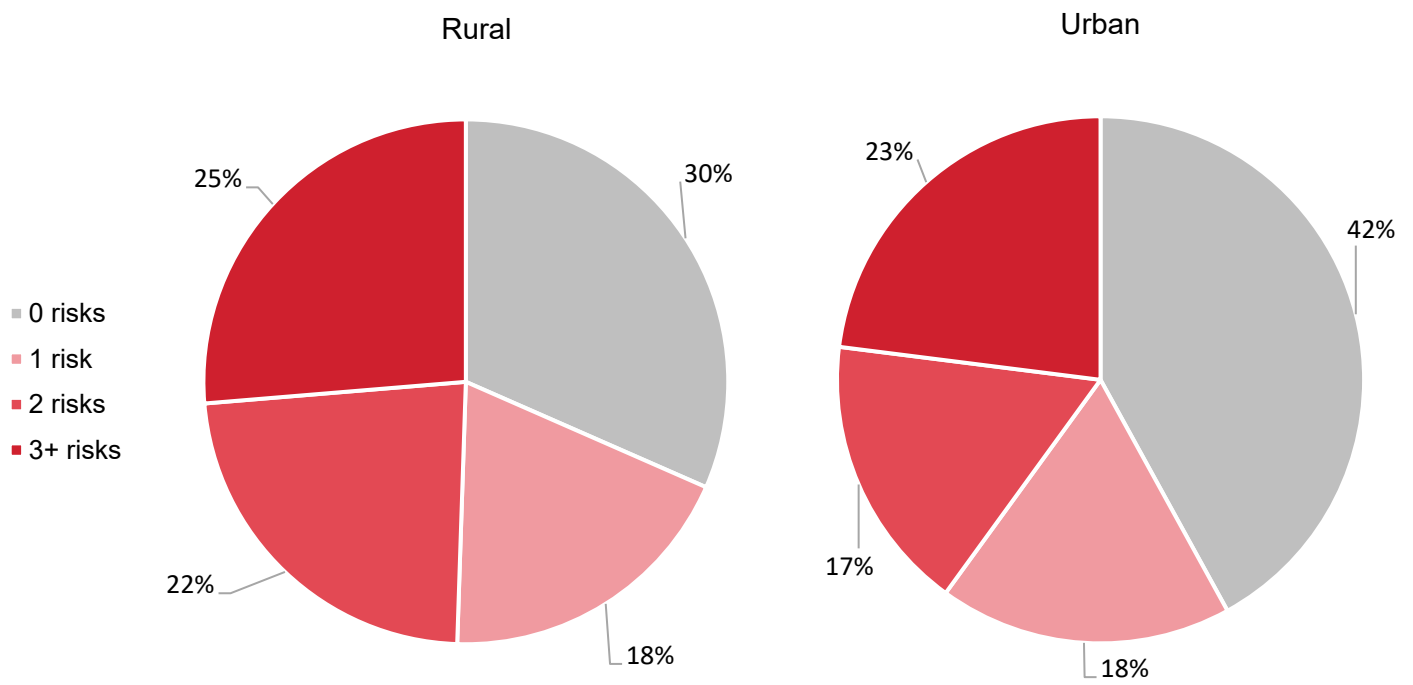
CONCLUSION

Integrating administrative data provides a unique, cost effective method of analyzing statewide systems. By leveraging administrative data that are already being collected by programs, stakeholders can make decisions based on the full landscape of birth to five programs. This analysis provided insight into 4 critical areas of Iowa's early childhood system.

Identified the unduplicated counts of Iowa children participating in state preschool programs
- 68% of Iowa children attended a DE funded preschool program.
- 67% had a TS GOLD assessment (i.e., were enrolled in a center-based program of any type that used the TS GOLD assessment).
- 6% participated in a CCA funded center-based experience during 2016-2017
- Many Iowa children had multiple experiences.

Determined differences in family characteristics for children with various preschool experiences
- Children experiencing 1, 2, and 3 or more risks were each significantly more likely to have some form of public preschool experience.
- Children born to teen mothers were nearly twice as likely to experience poverty (i.e., receive WIC or Medicaid) at the time of birth (93.14% compared to 48.66% in the general Iowa population).
- Children exposed to poverty were less likely to be classified as having no public preschool experience compared with the overall Iowa population (23.66% compared to 26.91%).
- Children born to single mothers (24.89%) and mothers that smoked during pregnancy or three months prior (24.34%) were **less likely to be classified as having no public preschool experience** compared with the overall Iowa population.
- Mothers with less than a high school education (29.51%) or mothers that received inadequate prenatal care (29.39%) **were more likely to have children with no public preschool experience** compared to the overall Iowa sample.

## Explored the relationship between 0-5 experiences and kindergarten indicators
- Children who **qualified for Medicaid or WIC** at birth were nearly **10 times more likely to qualify for Free/Reduced priced lunch in kindergarten**, suggesting poverty persists over time; these children were also nearly **3 times more likely to be suspended** in kindergarten than their non-poor counterparts.
- Boys were **7.5 times as likely to be suspended in kindergarten compared to girls**.
- Children with public preschool experiences were significantly less likely to participate in English language learning or to have poor attendance.

Identified rural and urban characteristics in relation to child and family risks, preschool enrollment, and kindergarten indicators.
- Black children (compared to white children), children born preterm or with low birthweight, children born to an unmarried mother, or children whose parent were immigrants to the United States are less likely to be born in rural Iowa counties.
- Children whose mothers were still **teenagers, were in poverty, smoked during pregnancy, or had multiple children** at the time of the focal child's birth were **more likely to live in rural areas**.
- Children who were identified as **having at least one public preschool experience prior to kindergarten** entry were **more than twice as likely to be born in rural areas** compared to children who did not have a preschool experience.
- Children exposed to one, two, and three or more risks were more likely to be born in rural areas compared to children with zero risks identified at birth.

Future Directions

Findings from this study highlighted, for the first time, unduplicated counts of children across many of our early childhood programs. However, it was not able to fully capture Iowa's complete birth-to-five mixed delivery system. Through additional stakeholder engagement and strategic planning discussions, future work will identify priority datasets to add to I2D2 to facilitate future projects, including systems such as Head Start and Early Head Start, home visiting and group-based parent education data, additional health data (e.g., immunizations, lead registry), and child welfare data to uncover a comprehensive picture of birth-to-five experiences. This report includes public preschool experiences, and future work may leverage surveys that collect data from children and families with private preschool experiences.
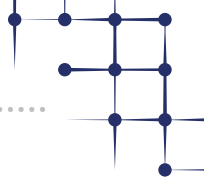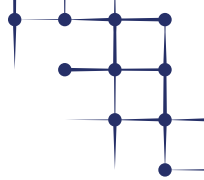
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Appendix A. Odds Ratio Tables

TABLE A1. ODDS RATIOS OF CHILD CHARACTERISTICS AND INDIVIDUAL RISKS RELATED TO ECE PARTICIPATION IN THE YEAR BEFORE KINDERGARTEN

Child Characteristics [a]	Child Care Assistance (CCA)	Department of Education (DE)	Teaching Strategies GOLD	Any PreK (CCA, DE, or GOLD)
Male	1.10	1.00	1.00	1.00
Race/Ethnicity				
Black	2.63***	0.58***	0.77***	0.82**
Hispanic	1.18	0.85**	0.78***	0.87*
Asian	0.63	1.00	1.06	1.05
Multiple	1.79***	0.71***	0.79***	0.78***
Age at preschool	0.99	0.96***	0.95***	0.95***
Family Characteristics				
Parent immigration	0.53***	0.95	0.89*	0.91
Number of siblings	1.12***	1.01	1.02	1.03*
Rural	0.98	1.72***	1.67***	2.08***
Individual Risks [b]				
Poverty (Medicaid/WIC)	7.20***	1.15***	1.33***	1.43***
Preterm or low birth weight	1.00	1.08	1.13*	1.17**
Low maternal education	0.68***	0.78***	0.76***	0.76***
Unmarried mother	2.17***	0.94	0.96	1.00
Inadequate prenatal care	0.92	0.84**	0.87**	0.85**
Teen mother	1.34***	0.77***	0.85***	0.89
Prenatal smoking	1.23***	0.89**	0.95**	0.96
Intercept	0.01***	22.23***	22.21***	32.31***
Pseudo R-Squared	0.17	0.02	0.02	0.03

Note: +$p<.10$; *$p<.05$; **$p<.01$; ***$p<.001$. [a] Reference category is white, female. [b] Reference category is a child without the noted risk.
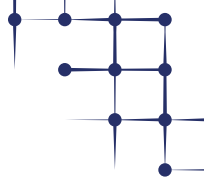
TABLE A2. LIKELIHOOD OF CHILDREN PARTICIPATING IN EACH EXPERIENCE BY CUMULATIVE RISK

	Child Care Assistance (CCA)	Department of Education (DE)	Teaching Strategies GOLD	Any PreK (CCA, DE, or GOLD)
Controlled for child and family characteristics (see Table A1)				
Cumulative Risks [b]				
1 Risk	8.73***	1.23***	1.25***	1.35***
2 Risks	21.56***	1.18***	1.31***	1.48***
3 or more Risks	27.99***	0.86***	1.09*	1.23***
Intercept	0.01***	21.63***	22.12***	32.28***
Pseudo R-Squared	0.16	0.02	0.02	0.03

Note: [+]p<.10; *p<.05; **p<.01; ***p<.001. [b] Reference category is a child with zero of the listed risks. [b] Cumulative risk index created using Poverty (WIC/Medicaid receipt), Pre-term/Low birthweight, Low mother education, Unmarried mother, Inadequate prenatal care, Teen mother, and Smoking

TABLE A3. ODDS RATIOS OF CHILD CHARACTERISTICS AND INDIVIDUAL RISKS RELATED TO KINDERGARTEN INDICATORS

	English Language Learner	Free/Reduced Lunch	Poor Attendance	Suspensions
Child Characteristics [a]	OR	OR	OR	OR
Male	1.16	0.99	1.06	7.52***
Race/Ethnicity				
Black	1.52**	3.07***	2.18***	3.82***
Hispanic	10.18***	1.87***	1.74***	0.84
Asian	4.93***	1.42**	2.05***	1.26
Multiple	0.43**	1.50***	1.41***	2.35***
Age at preschool	0.95***	0.99**	1.00	1.00
Family Characteristics				
Parent immigration	28.80***	1.38***	0.89	0.52*
Number of siblings	0.99	1.46***	1.03	1.09
Rural	0.75**	1.22***	1.03	0.87
Individual Risks [b]				
Poverty (Medicaid/WIC)	3.04***	9.43***	2.80***	2.86***
Preterm or low birth weight	0.93	1.03	1.16	0.70
Low maternal education	4.12***	2.22***	1.39***	0.95
Unmarried mother	1.03	1.79***	1.29***	1.14
Inadequate prenatal care	1.59***	1.33***	1.22*	1.18
Teen mother	3.09***	1.61***	1.80***	1.39
Prenatal smoking	0.33***	1.74***	1.53***	1.61***
Any public preschool	0.64***	1.49***	0.82***	1.16
Intercept	0.05***	0.08***	0.03***	0.00***
Pseudo R-Squared	0.65	0.36	0.09	0.13

Note: $^+p<.10$; $^*p<.05$; $^{**}p<.01$; $^{***}p<.001$. [a] Reference category is white, female, [b] Reference category is a child without the noted risk..

TABLE A4. *ODDS RATIOS OF CHILD CHARACTERISTICS AND CUMULATIVE RISKS RELATED TO KINDERGARTEN INDICATORS*

	English Language Learner	Free/Reduced Lunch	Poor Attendance	Suspensions
Controlled for Child and Family Characteristics (see Table A3)				
Cumulative Risks [b]				
1 Risk	3.14***	6.60**	2.63***	1.84*
2 Risks	5.82***	20.09***	4.09***	3.63***
3 or more Risks	8.28***	36.36***	6.89***	4.72***
Any public preschool	0.64***	1.48***	0.82***	1.17
Intercept	0.03***	0.05***	0.02***	0.00***
Pseudo R-Squared	0.62	0.34	0.09	0.13

Note: [+]$p<.10$; *$p<.05$; **$p<.01$; ***$p<.001$. [b] Cumulative risk index created using Poverty (WIC/Medicaid receipt), Pre-term/Low birthweight, Low mother education, Unmarried mother, Inadequate prenatal care, Teen mother, and Smoking