Technical Report: An Integrated Data System Analysis of Substance Use and Home Visiting

i2d2
Iowa's Integrated Data System for Decision-Making

Heather Rouse, Cassandra Dorius, Seulki Ku, Maya Bartel, & Jessica Bruning

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IDS ANALYSIS

REPORT 2 OF 3 FOR GRANT ACTIVITIES RELATED TO THE 2018 IDPH-CDC SUBAWARD

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STAFF: Rachael Voas

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PROJECT OVERVIEW

The purpose of this study was to test the capacity of Iowa's Early Childhood Integrated Data System (IDS) to understand cross-systems characteristics and service utilization patterns of families with substance use histories. It focused on families with young children who are involved in state-funded home visiting programs and was designed to investigate whether or not there are different risk factors, services patterns, or service outcomes for families with histories of substance use. Data from the DAISEY home visiting system were integrated with Vital Statistics Birth records and included any family who participated in home visiting for one calendar year in the federal MIECHV program. Prior environmental scans of existing state administrative data about families with substance use histories revealed this was a high value source of available data that included substance use histories and could be accessed through legal data sharing agreements between the Iowa Department of Public Health and Iowa State University.

Analyses included a sample of 755 families in the final integrated dataset that included home visiting records and vital statistics birth records. The majority of children in this sample were under age 3, though the range included 0 – 71 months, with 305 (40%) having been enrolled prenatally. Caregiver reports indicated that 22% (n=171) of families had a history of substance use/abuse prior to enrollment in home visiting programs. Three primary questions guided the work:

1. What characteristics differentiate families in home visiting programs who do or do not have histories of substance use?
2. Are there different home visiting service utilization patterns and outcomes for families with histories of substance use compared to those without such histories?
3. What are the primary factors that affect successful home visiting program completion?

Findings from this study are intended to inform cross-systems outreach and intervention for families facing challenges associated with substance use. As a test of Iowa's Early Childhood IDS, they also inform future IDS development efforts by highlighting strengths and challenges in existing administrative data about families with substance use histories.

PROJECT DESIGN

This study included integrated administrative data from DAISEY home visiting records and Iowa Department of Public Health Vital Statistics (VS) birth records. The target sample included all families who participated in the federal Maternal Infant and Early Childhood Home Visiting program (MIECHV) during calendar year 2017. Administrative records from VS and DAISEY were integrated using deterministic and probabilistic matching techniques. Extensive data cleaning and verification were conducted prior to the match, following standardized data verification procedures (Long, 2009) including internal consistency and missing data reviews.

Variables for the study were coded to analyze birth risks, home visiting enrollment characteristics, and home visiting outcomes (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

DAISEY* January 1- December 31, 2017*: Active/recent home visiting experience		
Analytic Variable	**Variable (original name)**	**Description of how the analytic variable was created**
Child age at enrollment	enrollment date child date of birth	Child age (months) at enrollment was generated by subtracting child birth date from caregiver enrollment date. Negative values of child age (months) at enrollment indicate prenatal enrollment and those values were replaced with 0
Prenatal enrollment	See above	Children with negative values on the child age at enrollment variable (see above) were identified as prenatal enrollees, whereas those with values at or above 0 were identified as postnatal enrollees.
Successful completion	discharge reason	Caregivers who responded *completed program or child aged out* were coded as 1 (*successfully completed*). Those who responded the following responses, *moved out of service area, no contact or could not locate*, *no longer interested in services*, *too busy, parental rights were terminated or lost custody*, *miscarriage or still birth*, and *other,* were coded as 0 (*didn't complete*).
Breastfeeding	was child breastfed at any point in reporting period (earliest) was child breastfed at any point in reporting period (latest)	This variable indicates whether children had experience of being breastfed either on the earliest or the latest report.
Enrollment duration	discharge date enrollment date child date of birth	For prenatal enrollees, child enrollment date is the same as their birth date, whereas child enrollment date for postnatal enrollees is the same as caregiver enrollment date. Enrollment duration (months) was constructed by subtracting child enrollment date from discharge date.
Average number of visits per month	total number of home visits in period	Total number of home visits in period was divided by enrollment duration (months) to create an average number of visits per month.
History of substance use	history of substance abuse (earliest) history of substance abuse (latest)	Caregivers who had used substance at any time of period were identified as having history of substance abuse.

Vital Statistics* 2010-2017*: At the time of the focal 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	It was 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.
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.

SUMMARY OF KEY FINDINGS

Question 1: *What are the characteristic differences between families in home visiting programs who do or do not have histories of substance use?*

The analytic sample included 755 families. Table 2 provides descriptive information about the sample, with relative distributions of characteristics by families with and without substance use histories. The majority of children in this sample were under age 3, though the range included 0 – 71 months. Caregiver reports indicated that 22% (n=171) of families had a history of substance use/abuse prior to enrollment in home visiting programs.

TABLE 2. DESCRIPTION OF THE SAMPLE

	Mean/ prop	*SD*	Mean/ prop	Mean/ prop	
	All	All	Substance use	Non-Substance use	t-test
	n = 755		*n* = 171	*n* = 584	
Child male	0.53	0.50	0.53	0.53	ns
Mother White	0.74	0.44	0.89	0.69	* [b]
Mother Black	0.14	0.34	0.05	0.16	* [a]
Mother Other	0.12	0.33	0.05	0.14	* [a]
Mother Hispanic	0.16	0.37	0.09	0.18	* [a]
No sibling	0.49	0.50	0.51	0.48	ns
1 sibling	0.26	0.44	0.27	0.26	ns
2 or more siblings	0.25	0.43	0.22	0.26	ns

*Note. Data include matched samples of VS and DAISEY MIECHV children who were born between 2010 and 2018 in Iowa and participated in the MIECHV in 2017. Estimates are unweighted. Significant differences between families with substance use history and non-substance users are estimated by unpaired two-sample t-tests: [a] Ha = diff > 0 or [b] Ha = diff < 0. *p < .05.*

Figure 1 presents the maternal race and ethnicity from VS birth records. Findings suggest that mothers of children in MIECHV home visiting programs with a family history of substance use are significantly more likely than those without such history to be White. Mothers with a history of substance use are less likely to be Black, Hispanic, or other, compared to those without a history of substance use.

Figure 2 includes birth characteristics of children in families with and without histories of substance use. Mothers with family history of substance use had significantly higher rates of poverty at child birth, prenatal tobacco use, to be unmarried at child birth. There was no statistically significant difference in pre-term/low birth weight, teenage mothers, low maternal education, and inadequate prenatal care.

FIGURE 1. MATERNAL RACE/ETHNICITY BY FAMILY HISTORY OF SUBSTANCE USE

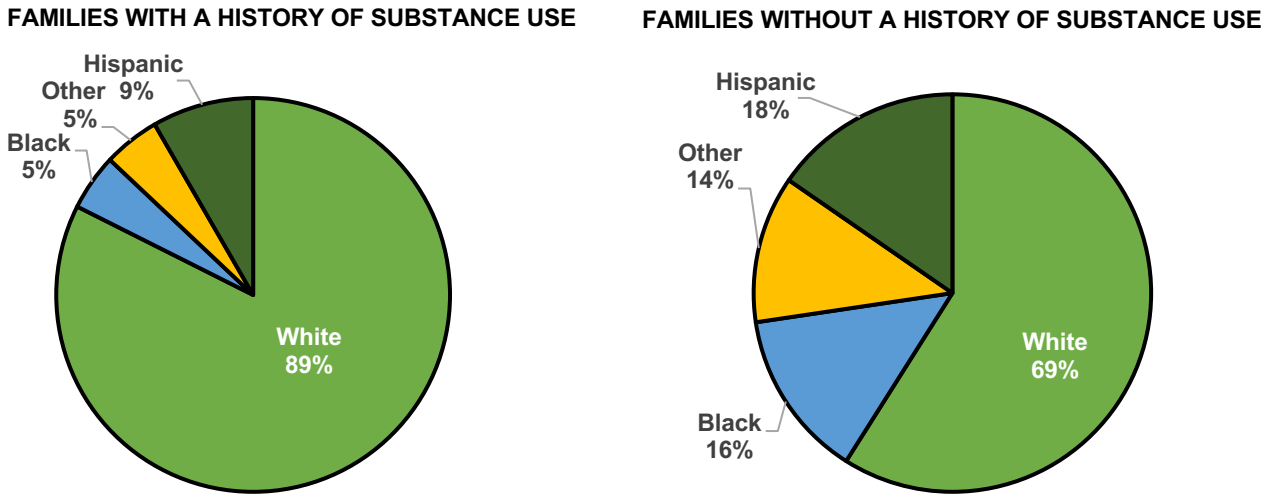
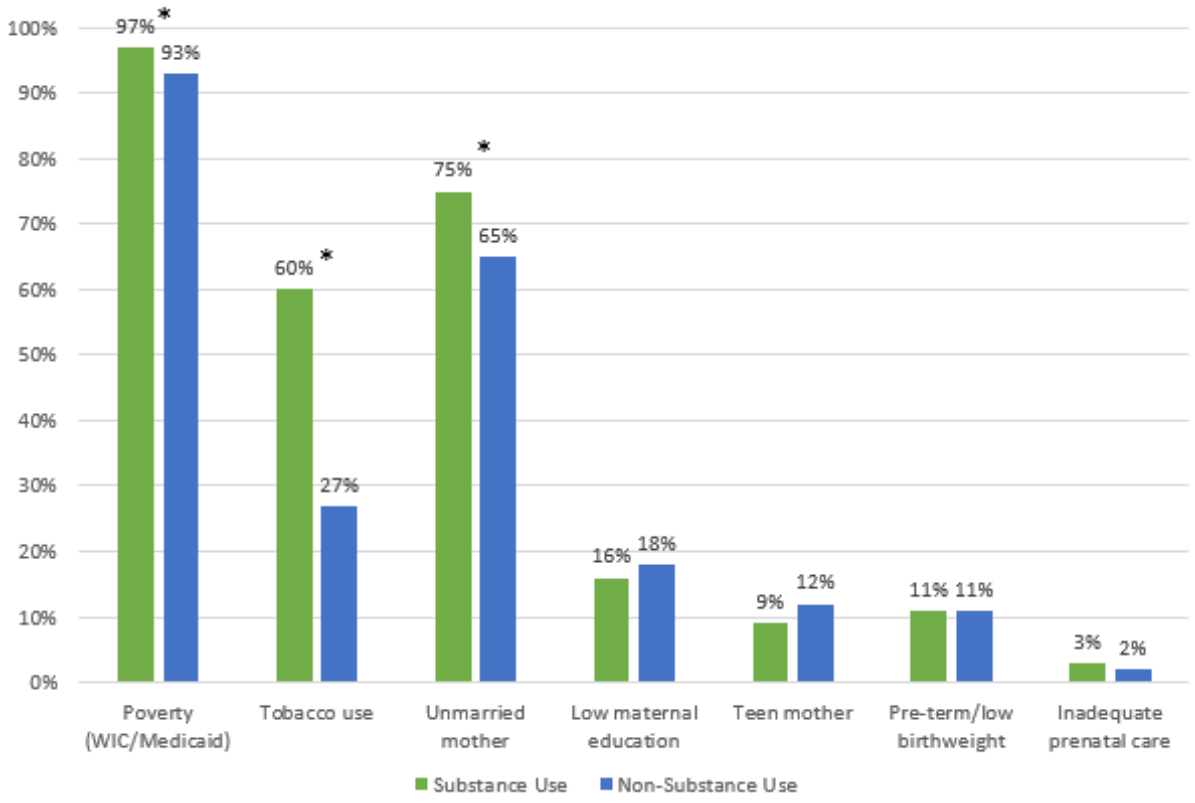


FIGURE 2. BIRTH CHARACTERISTICS BY FAMILY HISTORY OF SUBSTANCE USE



*Note. Data include matched samples of Iowa children who were born between 2010 and 2018 and participated in the MIECHV in 2017. Estimates are unweighted. *Significant differences between families with substance use history and non-substance use are estimated by unpaired two-sample t-tests.*

Table 3 presents the prevalence and co-occurrence of each birth risk and family history of substance use. Among families with a history of substance use, higher portions of them also experienced poverty (97.08%), had unmarried mothers (75.44%), used tobacco (59.65%) compared to the entire population of families in the MIECHV cohort. Among families experiencing poverty at the time of the child's birth, 68.83% of them had unmarried mothers. For families with unmarried mothers, 95.87% of them experienced poverty at birth. Families with low maternal education also had high rates of experiencing poverty (96.95%) and having unmarried mothers (71.76%). Among families with teenage mothers, high percentage of them also experienced poverty (96.43%) and had unmarried mothers (96.43%). Families with preterm/low birth weight infants also had high rates of experiencing poverty (94.05%) and having unmarried mothers (71.43%). Among families with inadequate prenatal care, high percentage of them also experienced poverty (93.33%), had unmarried mothers (66.67%) and used tobacco (73.33%). Families with tobacco use in pregnancy tended to experience poverty (95.80%) and have unmarried mothers (74.81%).

Figures 3 and 4 provide information about cumulative risk. For this indicator, each individual risk (poverty, unmarried mother, low maternal education, birth to teen mother, preterm/low birthweight, inadequate prenatal care, and smoking during pregnancy) were summed to create a cumulative risk index. Figure 3 provides the distribution of cumulative risk across the entire population, and indicates the majority of children in MIECHV home visiting programs had 3 risks evident at birth. This distribution was used to create a cutoff of 3 or more risks for further comparison purposes. Figure 4 shows that children in families with a substance use history have significantly more risks compared to children without such history, with nearly 64% of them having 3 or more compared to 44% with no substance use history.

TABLE 3. CO-OCCURRENCE OF FAMILY SUBSTANCE USE HISTORY AND CHILD BIRTH CHARACTERISTICS

	1	2	3	4	5	6	7	8
	(22.65)	(93.91)	(67.42)	(17.35)	(11.13)	(11.13)	(1.99)	(34.70)
1. Family substance use history	-	97.08*	75.44*	15.79	8.77	10.53	2.92	59.65*
2. Poverty at birth	23.41*	-	68.83*	17.91	11.42	11.14	1.97	35.40
3. Unmarried mother at birth	25.34*	95.87*	-	18.47	15.91*	11.79	1.96	38.51*
4. Low maternal education	20.61	96.95	71.76	-	-	12.98	3.82	40.46
5. Birth to a teen mother	17.86	96.43	96.43*	-	-	7.14	2.38	20.24*
6. Preterm/low birth weight	21.43	94.05	71.43	20.24	7.14	-	8.33*	40.48
7. Inadequate prenatal care	33.33	93.33	66.67	33.33	13.33	46.67*	-	73.33*
8. Tobacco use in pregnancy	38.93*	95.80	74.81*	20.23	6.49*	12.98	4.20*	-

Note. Numbers in parentheses represent the population percentage. Numbers 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 (*).

FIGURE 3. CUMULATIVE NUMBER OF RISK EXPERIENCES AT BIRTH

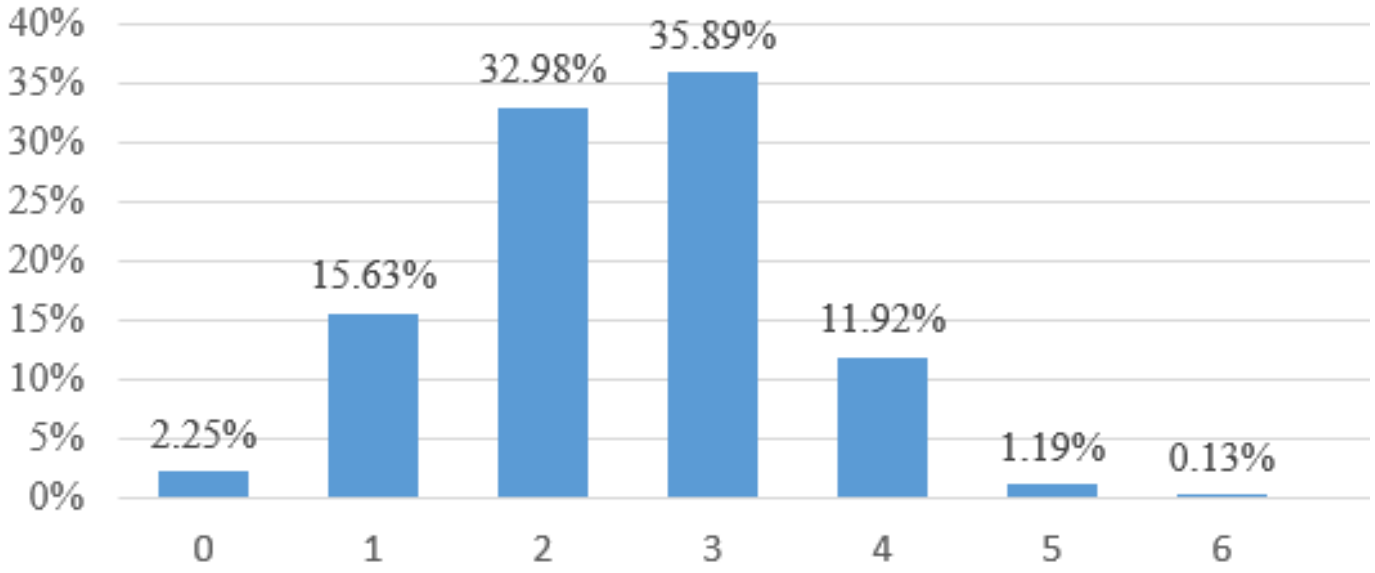
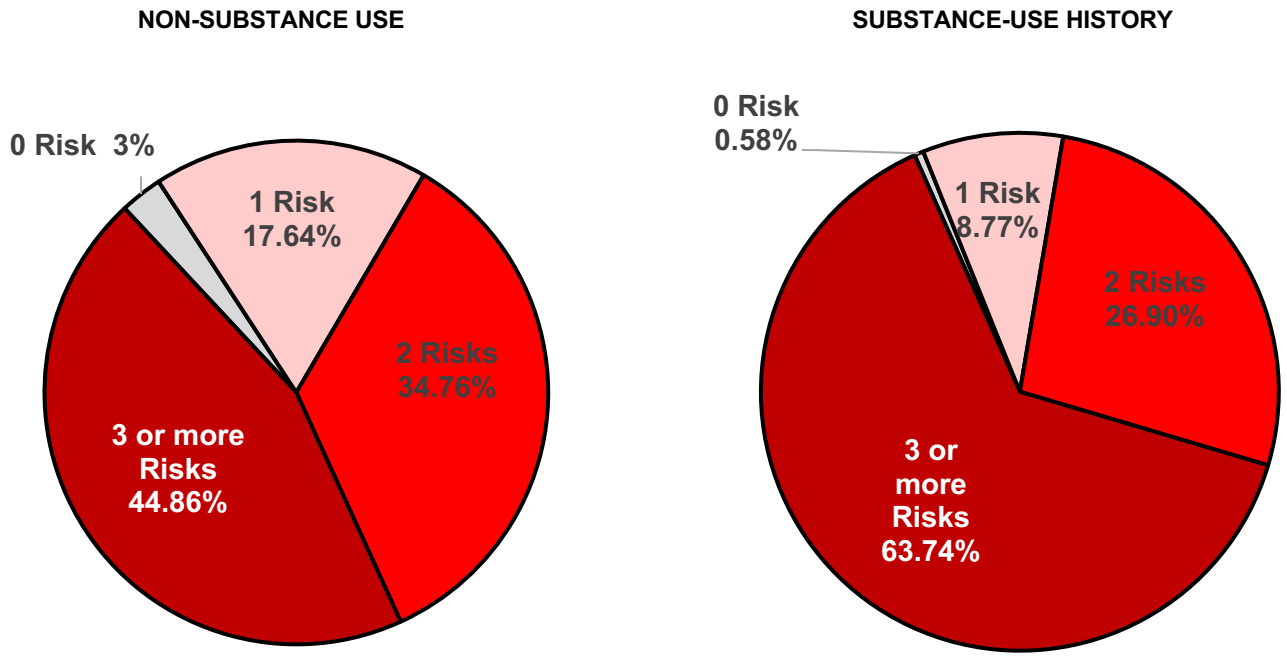


FIGURE 4. CUMULATIVE RISK BY FAMILY SUBSTANCE USE HISTORY



Question 2: *Are there different home visiting service utilization patterns and outcomes for families with histories of substance use compared to those without such histories?*

The next set of analyses examined home visiting service utilization patterns and outcomes. These variables were created from the DAISEY home visiting records (see Table 1 for full descriptions of the definitions of analytic variables and the original variables used to create them). Table 4 presents home visiting program participation characteristics by family substance use history. T-test comparisons were used to examine differences between families with and without substance use history.

Seven program discharge reasons are coded in DAISEY data, including: a) completed program or child aged out; b) moved out of service area; c) no contact or could not locate; d) no longer interested in services; e) too busy; f) parental rights were terminated or lost; and g) other (for more details, see Table 1). Families who completed program or who exited the program due to child's age were identified as "successful completion of the program." Findings suggest that families with a history of substance use have a lower rate of successful completion of the program (14%) than those without a history of substance use (28%). There was no statistically significant difference in child age at enrollment, prenatal enrollment, enrollment duration, and the number of visits per month between the two groups. See Figure 5 for more details.

Further analysis examined differences in the seven program discharge types by family substance use history. Findings presented in Figure 6 indicate that children with families with substance use history were more likely to be unable to be contacted or indicate they were no longer interested in services than families without such history. They also have nearly 4 times higher rates of having parental rights terminated or lost – 7.22% compared to less than 2% of those without substance use histories.

TABLE 4. HOME VISITING PROGRAM PARTICIPATION CHARACTERISTICS BY FAMILY SUBSTANCE USE HISTORY

	Mean/ prop	*SD*	Mean/ prop	Mean/ prop	
	All	All	Substance use	Non-Substance use	t-test
	n = 755		*n* = 171	*n* = 584	
Successfully completed the program	0.25	0.43	0.14	0.28	*
Child age (months) at enrollment	6.65	13.21	5.71	6.92	ns
Prenatal enrollment	0.40	0.49	0.42	0.40	ns
Enrollment duration	20.39	16.95	19.43	20.69	ns
Number of visits per month	1.06	1.02	1.12	1.04	ns

*Note. Data include matched samples of VS and DAISEY MIECHV children who were born between 2010 and 2018 in Iowa and participated in the MIECHV in 2017. Estimates are unweighted. *Significant differences between families with substance use history and non-substance users are estimated by unpaired two-sample t-tests at p < .05.*

FIGURE 5. PROGRAM COMPLETION RATES BY FAMILY SUBSTANCE USE HISTORY

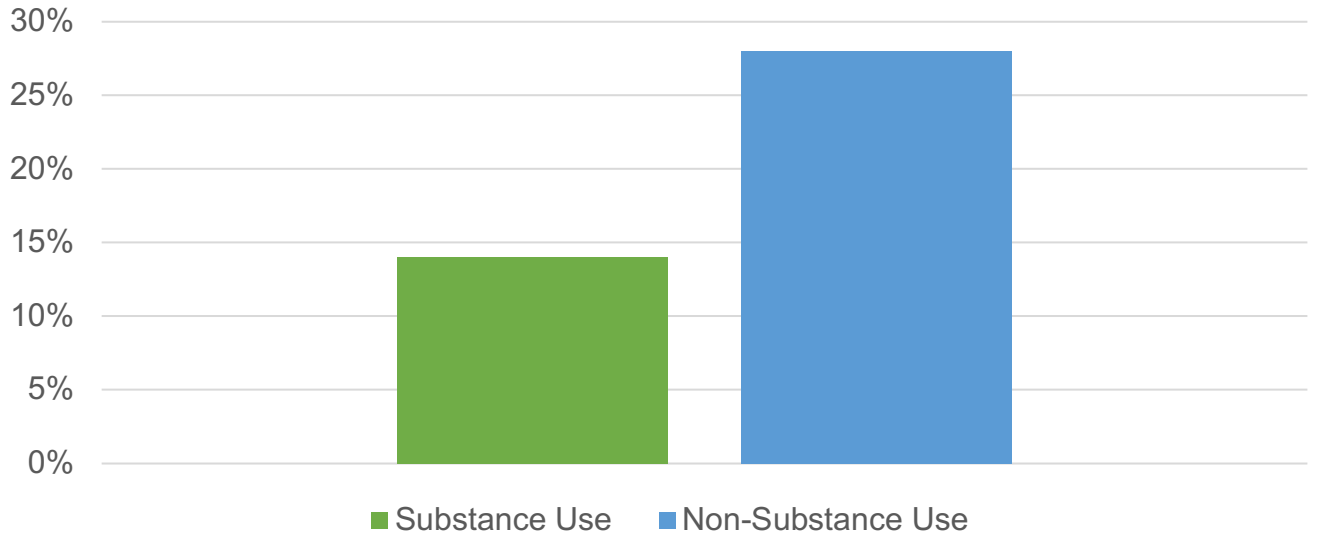
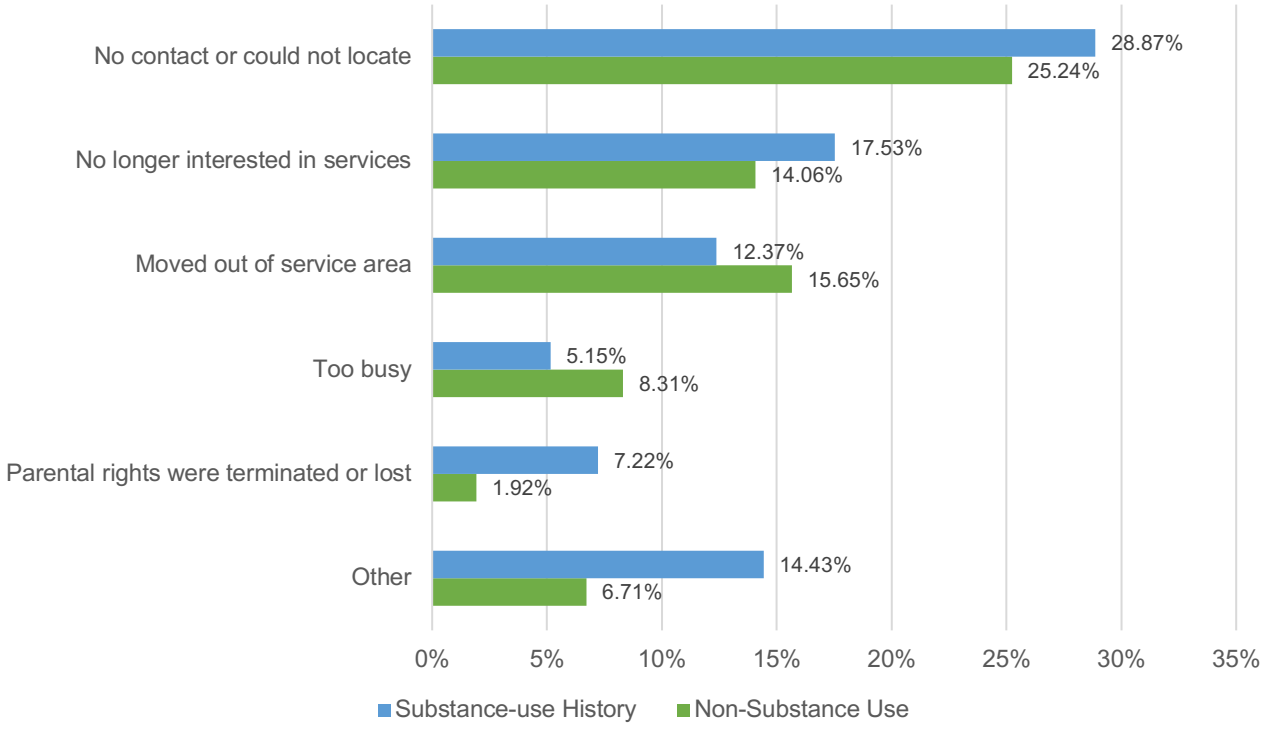


FIGURE 6. REASON FOR PROGRAM DISCHARGE BY SUBSTANCE USE HISTORY



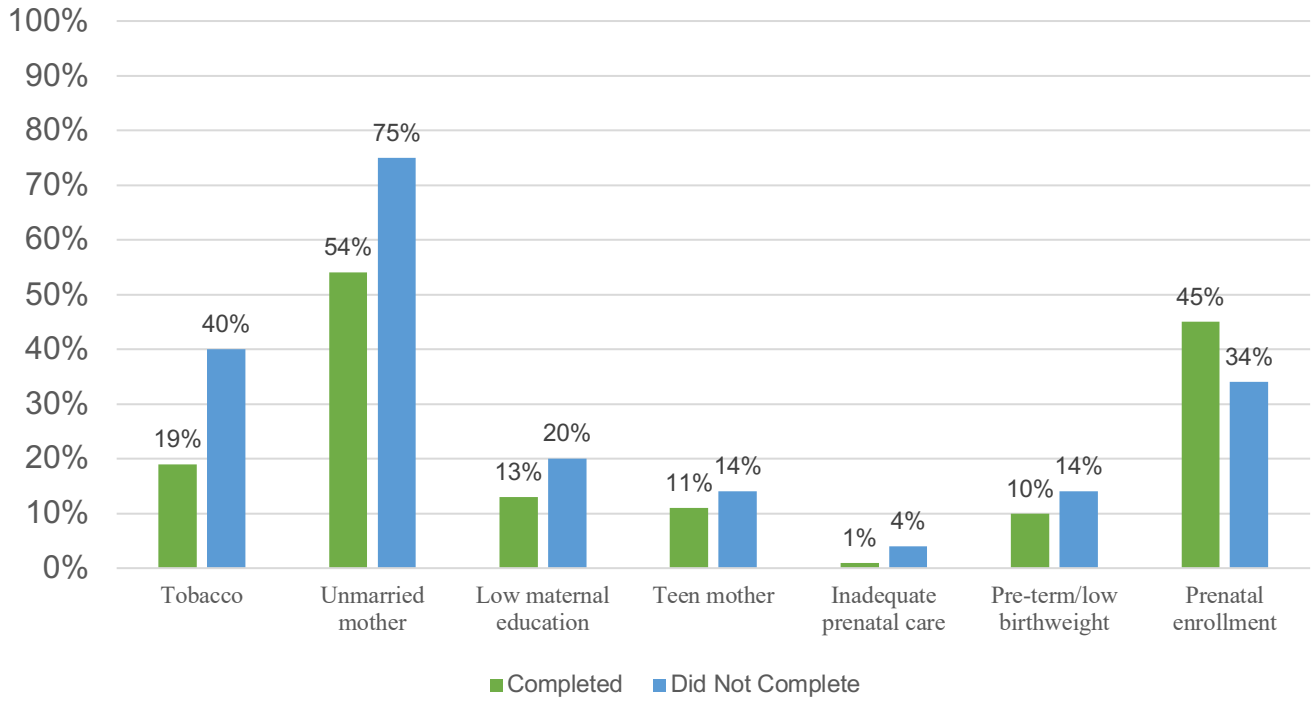
***Question 3**: What are the factors that relate to successful home visiting program completion?*

Given the identified differences in program completion rates for families with and without substance use histories, further examination of the relationships between birth characteristics and home visiting program patterns was conducted. This analysis used the dichotomous variable of program completion [0=*not completed* (i.e., all other reasons rather than "completed program or child aged out") and 1=*successful completion* (i.e., completed program or child aged out)].

Figure 7 shows that many of the birth characteristics were differentially related to program completion rates. Families where mothers used tobacco while pregnant, were unmarried, had low education (e.g., < high school diploma), and who had inadequate prenatal care were less likely to complete the program. Families who were enrolled prenatally were more likely to complete the program.

To examine unique relations between child and family characteristics and home visiting outcomes, multiple logistic regression was used. This approach is helpful for considering multiple predictors simultaneously. Given the amount of co-occurrence among risks and characteristics, this approach was ideal to understand unique relationships among variables. This analysis produces odds ratios, which are interpreted as the likelihood of an outcome for a child with a given characteristic compared to the likelihood of that same outcome for a child without that characteristic. An odds ratio of 1.0 indicates equal likelihood (i.e., no difference). Odds ratios of less than 1.0 indicate a decreased likelihood of the event occurring while odds ratios greater than 1.0 indicate an increased likelihood of the event occurring. Statistically significant odds ratios are noted in Table 6 and suggest that children born with 2 or more siblings (compared to those with no siblings at birth), with unmarried mothers at birth, whose mothers used tobacco during pregnancy, who were younger at the time of enrollment, and who had longer enrollment durations were less likely to complete the program. Compared to families postnatally enrolled, those who were prenatally enrolled were 1.72 times more likely to complete the program. Also, families with mothers who breastfed the child were 2.10 times more likely to complete the program.

FIGURE 7. CHILD BIRTH CHARACTERISTICS AND PRENATAL ENROLLMENT BY PROGRAM COMPLETION



*Note. Data include matched samples of VS and DAISEY MIECHV children who were born between 2010 and 2018 in Iowa and participated in the MIECHV in 2017. Estimates are unweighted. * indicates significant differences between those that completed the home visiting program and those that did not are estimated by unpaired two-sample t-tests at p < .05.*

TABLE 6. ODDS RATIOS OF FAMILY CHARACTERISTICS PREDICTING HOME VISITING PROGRAM RETENTION, *n = 326*

Predictor	*Odds Ratio*	*Standard Error*
History of substance abuse	0.56	(0.24)
Child male	1.17	(0.41)
Mother Black [a]	0.55	(0.27)
Mother Other [a]	0.46	(0.29)
Mother Hispanic [b]	1.83	(0.97)
1 sibling [c]	1.12	(0.50)
2 or more siblings [c]	0.35	(0.18)*
Pre-term/Low birthweight [d]	1.90	(1.04)
Teen mother [e]	1.43	(0.79)
Low mother education [f]	0.44	(0.23)
Unmarried mother [g]	0.44	(0.19)+
Poverty (WIC/Medicaid) [h]	0.54	(0.40)

Inadequate prenatal care [i]	0.34	(0.74)
Tobacco use [j]	0.33	(0.13)**
Child age at enrollment	1.14	(0.03)***
Prenatal enrollment	3.93	(1.72)**
Enrollment duration (months)	1.11	(0.02)***
Average number of visits per month	0.97	(0.24)
Breastfeeding at any time	4.05	(2.10)**
Constant	0.03	(0.03)***
Pseudo R-squared	0.40	

*Note. Data were restricted to caregivers enrolled in MIECHV in 2017; estimates are unweighted; Pseudo R-square is provided as a reference; reference categories are as follows: a White; b non-Hispanic, c no sibling; d healthy weight and gestational 40 weeks; e mothers' age 20 and older at child's birth; f mothers with a high school degree or more; g mothers married at child's birth; h mothers with first prenatal care visit in first trimester and at least 4 prenatal care visits during pregnancy; i mothers not receiving WIC and not using Medicaid as delivery payment; and j mothers not smoking during pregnancy. +p < .10; *p < .05; **p < .01; ***p <. 001.*

DISCUSSION

This evaluation of child and family characteristics related to home visiting program utilization patterns and outcomes provided insight about differences among families with and without histories of substance use. It also used integrated administrative data from IDPH home visiting and vital statistics birth records as one of the first tests of Iowa's Early Childhood Integrated Data System (IDS). As such, it provided important information about the capacity of integrated administrative data to inform program evaluation work for the Iowa Department of Public Health, and suggests opportunities for enhancing data relevance for future programmatic work.

FINDINGS AND IMPLICATIONS FOR SUBSTANCE USE POLICY AND PROGRAMMING

Specific findings from this work suggest two important patterns that could be used to inform public health approaches to working with families experiencing substance abuse problems. First, children who are born into families with a history of substance use experience significantly more risks that are evident at birth. They are more likely to be born to unmarried mothers, to mothers who smoked during pregnancy, and more likely to be enrolled in WIC or Medicaid at the time of birth compared to children without family histories of substance use. They also have greater numbers of cumulative risk, with 64% experiencing three or more risks at birth compared to 45% without family histories of substance use. Where this study was comprised entirely of families involved with the MIECHV home visiting program, the comorbidities among risks suggest opportunities to further coordinate services and potentially garner additional resources to support children in these programs who experience multiple risks.

The second key finding is that families with substance use histories are less likely to complete the MIECHV home visiting program as it was designed (i.e., full service completion as directed at intake or the target child ages out appropriately). While this is not entirely surprising, understanding some of the reasons for family disconnection with this important public health service in the context of substance use history is particularly relevant for policy and program responses. Findings suggest, for example, that families with substance use histories have nearly 4 times the rate of having their parental rights terminated compared to families without substance use histories. They are also more likely to be "lost" in the system – where caseworkers are unable to locate families with substance use histories midway through the program. Combined, these findings suggest a need for more

intensive connections with these families, and potentially different types of home visiting services to ensure they are receiving the parental supports they need to ensure their family can stay together. These findings could be used garner additional resources to do such work through recent opportunities presented by the 2018 Family First Prevention Services Act. This Act offers additional resources through the child welfare system to support families at risk for child removal. Where the Iowa Departments of Public Health and Human Services seek to coordinate services and garner additional federal dollars to support at-risk families, the identification of families entering MIECHV home visiting programs with histories of substance use could be a prioritized solution.

IMPLICATIONS FOR ENHANCING THE CAPACITY OF IOWA'S EARLY CHILDHOOD INTEGRATED DATA SYSTEM

One of the primary purposes of this project was to test data integration and communications strategies proposed by the Early Childhood Iowa (ECI) IDS Taskforce for use in prioritized system enhancement work. The data management, cleaning, integration, analysis, and reporting processes used were implemented and refined as a result of the work. Findings suggest three important areas of IDS future development for consideration: data integration processes, programming to understand service utilization patterns, and limitations in self-report data captured by administrative data systems.

First, our data integration test identified limitations in current data collection efforts that inform future integrations. Vital statistics birth records, for example, collect information about parents as "parent A" and "parent B" rather than identifying roles such as mothers, fathers, or foster parents. Race/ethnicity data in birth records are also limited, as they pertain only to the parent(s) identified on the record. No race/ethnicity of the child is noted on birth records. DAISEY home visiting data are limited in that they do not collect child gender. Each of these limitations do not prohibit records from being integrated, though they do limit the ability to verify and validate matches where inconsistent values and variables are found across systems.

Second, the creation of program enrollment ages, lengths of enrollment, and completion variables using DAISEY records was a good test of how the IDS can utilize rich information that is linked to program dates and child birth dates to understand timing, duration, and sequencing of services. One of the unique purposes of the IDS is to help state and local leaders better understand longitudinal patterns in services, identify gaps in services for vulnerable children, and make connections between programs by understanding factors that precede or follow service utilization. This project allowed the IDS data team to generate programming code using dates that will be useful in future efforts designed to dig deeper into service utilization timing, duration, and sequencing.

Third, the use of self-report substance abuse history data from DAISEY records identified opportunities for future improvements in data collection and use. The primary variable used in this study to identify families with a history of substance use was collected from caregiver reports at the time of home visiting enrollment. Prior work with IDPH MIECHV team revealed that sometimes such reports are collected by home visitors in non-standardized ways. Additional training, particularly around the sensitivity of asking families about experiences such as substance use, may be warranted to ensure these data are of high quality and inform practical use. It also suggests that additional sources of data about family substance use history may prove more fruitful for identifying more rich information about the type, timing, nature, and extent of substance use. DAISEY caregiver reports, for example, do not indicate which family member experienced substance use problems, whether or not the substance use was directly observed or experienced by the child, or how long ago the substance use experiences were prior to home visiting program enrollment. Future work to identify sources of data within public service systems that captures more details about substance use and its associated outcomes or co-occurrences would be helpful.

NEXT STEPS

Two identified next steps will follow from this work. First, an environmental scan will be conducted to identify other potentially relevant data captured in administrative datasets. The scan will include a look in the literature for other state or municipal uses of administrative data that include substance use foci, as well as an examination of data dictionaries and online resources for Iowa programs to see what opportunities might exist for data exploration. Second, a data discovery workshop will be conducted in November 2019 including invited representatives from Bureaus within IDPH. This workshop will include discussions about the findings gleaned from the current study, as well as opportunities for continued data work with additional data sources maintained by IDPH that could potentially be added to the IDS in future development efforts.