INDIANA PREGNANCY PROMISE PROGRAM EVALUATION

TO 049 IPPP Evaluation

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WISE Indiana
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This report was prepared by WISE Indiana for Indiana FSSA Office of Medicaid Policy and Planning

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The IPPP would like to acknowledge the Medicaid Managed Health Plans - Anthem, CareSource, MDwise, and MHS partners who are aligned in the mission to improve outcomes for mothers and infants in Indiana. We would also like to acknowledge the many mothers, infants, and families across Indiana affected by the opioid epidemic who courageously demonstrate resilience in the pursuit of overcoming adversity, and in doing so, inspire hope for others.

About WISE Indiana

WISE Indiana (Well Being Informed by Science and Evidence in Indiana) is a partnership between the Indiana Clinical and Translational Sciences Institute's Monon Collaborative and the Indiana Family and Social Services Administration to engage Indiana's nationally recognized academic experts to evaluate and inform Indiana practices, programs and policies. This partnership aligns with and furthers the visions of both organizations by facilitating timely, high-quality evidence-informed research, evaluation and analysis to the benefit of all Hoosiers.

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Executive Summary

The Indiana Pregnancy Promise Program (IPPP) aims to connect women to prenatal, postpartum, and mental health care, including opioid use disorder (OUD) treatment, during the prenatal period and for up to 12 months after pregnancy. This evaluation had two primary objectives: (1) to construct a matched comparison cohort of Medicaid-enrolled women with an OUD who did not participate in the program, and (2) to assess the health outcomes and costs associated with IPPP participation.

Using Medicaid claims and enrollment data, the task order team used a 1:1 propensity score match to identify 647 matched pairs of IPPP participants with a corresponding mother in the non-participant cohort with a live birth between January 2021 and September 2023 and an opioid use disorder diagnosis prior to delivery. The participants were matched using a combination of demographic, socioeconomic, clinical, and pregnancy-related variables.

Using Medicaid claims data to compare outcomes and costs between the matched groups, several key indicators of the success of the Indiana Pregnancy Promise Program were identified.

- **Evidence of Improved Continuity of Medicaid Enrollment** – Among IPPP participants compared to the comparison cohort, Medicaid enrollment was higher at each time point: 99.7% vs. 98.6% at 90 days postpartum, 99.5% vs. 96.9% at 180 days, and 97.9% vs. 95.3% at one year postpartum
- **Increased Frequency of Postpartum Care** – At both 90 days (58.6% vs 47.6%, $p < 0.0001$) and 120 days (59.0% vs 48.4%, $p = 0.0003$), IPPP participants received more postpartum care than the comparison cohort
- **Increased Wraparound Support** – IPPP participants had more frequent documentation of social determinants (Z-codes) related to housing instability and food insecurity
- **Higher Mental Health and Substance Use Disorder Outpatient Utilization** – IPPP participants had higher rates of outpatient visits for mental health or substance use disorder within 90 days postpartum (62.6% vs 53.5%, $p = 0.0012$) and one year postpartum (82.2% vs 71.5%, $p = 0.0001$)
- **Increased Diabetes Screening** – IPPP participants had higher rates of Diabetes screening at 90 days (29.2% vs 21.9%, $p = 0.0032$) and one year postpartum (64.0% vs 55.2%, $p = 0.0071$)
- **Higher Rates of OUD Treatment** – IPPP participants had higher rates of OUD diagnosis one year postpartum (84.8% vs 77.1%, $p = 0.0032$), which suggests these individuals are more likely to be engaged in OUD treatments
- **Improved Child Vaccination Schedule Adherence** – Children born to IPPP participants were more likely to be on schedule for vaccinations (42.4% vs 36.4%, $p = 0.0399$)
- **Increased Outpatient Utilization for Children** – Children born to IPPP participants had higher costs associated with outpatient care, which includes well-child visits that deliver important preventative care such as vaccinations and anticipatory guidance
- **Medicaid Cost Neutrality –** Improved outcomes and utilization among IPPP mothers and children did not significantly increase Medicaid costs

Overall, IPPP demonstrates strong potential to enhance access to critical maternal and behavioral health services without significantly increasing Medicaid costs. These findings support the value of continued investment in comprehensive, supportive care models for pregnant and postpartum women with OUD.

Introduction

Maternal diagnosis of Opioid Use Disorder (OUD) increases the risks of adverse outcomes to the mother and infant both during pregnancy and after delivery. This includes withdrawal during pregnancy, neonatal abstinence syndrome (NAS), sudden infant death syndrome, impaired fetal growth, abruptio placentae, preterm labor, fetal distress, intrauterine passage of meconium, and infant mortality. The economic and social emotional burden of these outcomes is extensive, resulting in longer hospital stays for mothers and infants, which may require more intensive treatment, such as pharmacotherapies. Consequently, costs for mothers and infants affected by OUD and related diagnoses can be exponentially higher than to infants born without maternal OUD.

In collaboration with Indiana Family and Social Services Administration (FSSA), this task order focused on the evaluation of the Indiana Pregnancy Promise Program (IPPP).[a] The Indiana Pregnancy Promise Program began enrollment on July 1, 2021, and is a free, voluntary program for pregnant Medicaid members who use opioids or have used opioids in the past. PROMISE is an acronym for Promoting Recovery from Opioid Use, Maternal Infant Support and Engagement. The Indiana Pregnancy Promise Program takes a unique multigenerational approach by offering enhanced case management and care coordination services for both the mother and infant, beginning in pregnancy and extending through 12 months postpartum, ensuring women's privacy and confidentiality. All IPPP participants were consented to engage in this program and explicitly allowed for data sharing as it pertains to the rigorous evaluation of outcomes among participants and their children as performed for this task order. Indiana is one of seven states to have been selected and awarded the 5 -year Centers for Medicare & Medicaid Services (CMS) Maternal Opioid Misuse (MOM) Model grant. This model is a cooperative agreement to implement and evaluate interventions to improve maternal and child health outcomes among pregnant and postpartum women who have an OUD. The goal of the MOM Model (Figure 1) is to improve the quality of care being provided to mothers and children, while also reducing costs.

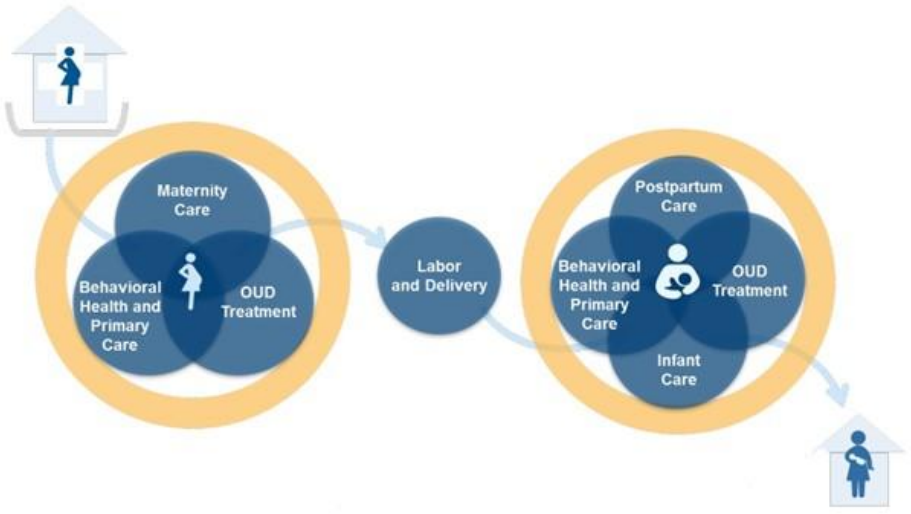

Figure 1. CMS Maternal Opioid Misuse Model Program Flow Visual

[a] https://www.in.gov/fssa/promise/

IPPP connects women to prenatal and postpartum care, other physical and mental health care, and treatment for opioid use disorder. IPPP provides resources and support during the prenatal period and for 12 months after the end of pregnancy, which includes screening for unmet health related social needs within the family and making appropriate referrals to acquire needed resources such as housing, transportation, childcare and adequate nutrition. The IPPP case managers are RN or LCSW credentialed and are located within the Indiana Medicaid Managed Health Plans – Anthem, CareSource, MDwise and MHS. IPPP case managers carry smaller caseloads, 1:35 mother/infant dyads compared to other Medicaid care management programs, which range considerably. The IPPP case managers are trained in standards and best practices for perinatal care, mental health and substance use disorder treatment, including medications for opioid use disorder, tobacco cessation interventions, infant safe sleep practices, and trauma-informed care. IPPP case managers utilize relationship-based approaches (motivational interviewing, stigma reduction practices etc.) to develop trust and rapport with each IPPP mother/infant dyad. Eligibility criteria for IPPP includes to:

- Enroll during pregnancy or at least 90 days postpartum
- Identify as having current or previous opioid use
- Be eligible for or receive Medicaid health coverage

Although there is a robust MOM-wide evaluation underway, Indiana FSSA sought additional support through WISE Indiana collaboration to:

1. Identify a comparison population for the IPPP cohort that addresses potential selection bias and other factors contributing to IPPP participation in order to rigorously evaluate the programmatic impact on maternal and child outcomes; and
2. Estimate cost savings resulting from the program in terms of Medicaid-related expenditures for both mother and baby in the postpartum/neonatal period.

Objective 1: IPPP Comparison Cohort

Methods

Using Indiana Medicaid enrollment and claims data of all pregnant women with an OUD diagnosis between 2016 and present, this task order aimed to define the comparison population for IPPP (Objective 1) and assess the cost savings (or excesses) attributable to IPPP (Objective 2).

Data Acquisition, Storage, and Initial Cleaning

In accordance with the study's IRB (Indiana University Protocol #24241), and the WISE Indiana Business Associate Agreement between Indiana FSSA and Indiana University, the team received IPPP enrollment data, as well as Medicaid data for all individuals identified as female in the Medicaid recipient tables who were born between January 1, 1975 and December 31, 2007 (the birth year period was informed by the range of birth years of IPPP enrollees). The IPPP enrollment data received contained Medicaid recipient ID, IPPP enrollment date, and IPPP exit date. The Medicaid data received for this analysis was comprised of the recipient table, Medicaid enrollment dates, and Medicaid claims data tables (including claim diagnoses, claim procedures, and claim medications sub-tables). Using the Medicaid data dictionary, the IU team identified which fields from those tables were necessary for analysis, and the FSSA team created the extract using only those fields prior to transferring the data.

Per an existing data use agreement between FSSA and Indiana University, data were transferred from the FSSA team to Objective 1 team using Indiana University's encrypted data transfer system, Secure Share. Data were directly downloaded onto Objective 1's secure server into a designated project folder, with restricted access permission to the Objective 1 team members. We performed extensive data cleaning on the raw Medicaid data elements received. This included trimming extraneous spaces from text fields and standardizing key data elements. For example, dates of birth and death were originally stored as text; we parsed these into Stata date formats and dropped placeholder values (such as a death date of "31DEC9999") as needed.

Medicaid ID Creation and Data Linkage

To ensure accurate tracking across multiple datasets, unique Medicaid IDs were created by reconciling active and inactive recipient identifiers. Duplicate or inconsistent matches were identified and resolved by using logical checks, primarily through matching date of birth records to recipient IDs. When inconsistencies occurred, Medicaid IDs were reassigned based on internal recipient IDs, ensuring each record represented a unique individual. These standardized Medicaid IDs were then uniformly applied across all demographics, enrollment, and claims datasets.

IPPP Participant Cohort Creation

The IPPP cohort was defined using program enrollment data for the Indiana Pregnancy Promise Program. Under the terms of the data use agreement, we obtained a list of IPPP participants with their program enrollment and disenrollment dates. IPPP enrollment data were cleaned and standardized by parsing enrollment and disenrollment dates into consistent date formats. People without disenrollment dates were provided with an imputed predetermined placeholder date (October 31, 2024) to ensure we could properly search for claims received between enrollment and disenrollment periods. The October 31, 2024,

date was chosen as we received claims and data up to the middle of October 2024. Overlapping enrollment and disenrollment periods were identified and consolidated by merging continuous enrollment intervals. Specifically, if a disenrollment date matched the subsequent enrollment date, these periods were combined into a single, continuous enrollment period, effectively removing redundancies and preserving accurate timelines for analysis. These records were merged with the cleaned Medicaid beneficiary file by person ID to retrieve demographic details and Medicaid coverage history for each participant. We calculated each participant's total months enrolled in IPPP by taking the interval between enrollment and disenrollment dates (any fractional months were rounded up to whole months). This resulted in an IPPP participant cohort file that included the Medicaid ID, demographic variables (age, race/ethnicity, etc.), and IPPP enrollment details for each woman who ever enrolled in IPPP.

It is important to note that not all IPPP enrollees would necessarily have a live birth delivery during the study period as some may enroll in the program and/or not carry a pregnancy to term within the study time window. Therefore, in the next steps, we intersected these participants with observed pregnancy and birth events in Medicaid claims to define IPPP participants who had a live birth during the study time window as the analytic cohort.

Study Cohort Definition (IPPP and Comparison Groups)

The study cohort was defined as Medicaid-covered pregnancies resulting in a live birth between January 2021 and September 2023, in which the mother had at least one encounter with an opioid use disorder (OUD) diagnosis 2 years prior to delivery and/or 7 days following delivery (further justification below). Furthermore, by virtue of having a delivery identified through Medicaid claims, all individuals had at least one month of Medicaid enrollment. This cohort was then divided into the IPPP group (deliveries to mothers who participated in IPPP at the time of delivery) and the comparison group (deliveries to mothers who met study inclusion criteria but who were not enrolled in IPPP during delivery or 90 days after). Sensitivity analyses were performed using a broader set of inclusion criteria of 3 and 4 years prior to delivery and 30- and 90-days following delivery as described below.

Identifying Pregnancies and Deliveries

We identified pregnancies and delivery outcomes using Medicaid claims data, specifically using diagnosis and procedure codes to find evidence of pregnancy and childbirth. First, we compiled a comprehensive list of pregnancy-related ICD-10 diagnosis codes and delivery procedure codes (a "pregnancy phenotype" reference list). These included codes for confirmed pregnancy, routine prenatal supervision, high-risk pregnancy, various delivery outcomes (live birth, stillbirth, miscarriage/spontaneous abortion, ectopic pregnancy, induced termination), and indications of multiple gestation (Appendix A). Using this list:

- We scanned claim diagnosis records for any code indicating a pregnancy or its outcome. If a claim had any such diagnosis, we flagged that claim accordingly. For example, if a claim included a code for a live birth outcome, we marked that claim as having a "live birth." If a code for spontaneous abortion was present, we marked "miscarriage," and so on. A single claim could have multiple flags (though typically a delivery claim might indicate one outcome). We aggregated these at the claim level: each claim received binary indicators for each outcome category (Live Birth = yes/no, Stillbirth = yes/no, etc.). The result was a dataset of claims with pregnancy-related indicators.
- Similarly, we checked claim procedure codes against a list of delivery-related procedures (for instance, procedure codes for labor and delivery services, C-sections, etc.). If a claim's procedure code matched a delivery code (or other pregnancy-related service), we flagged it. We then

merged this information with the diagnosis-derived flags to ensure we captured all possible indications of a pregnancy event on that claim. This step served as a cross-validation – most delivery events would be evident through either a diagnosis code (e.g., outcome of delivery) or a procedure code (e.g., obstetric procedure). We made sure that if a claim was identified by either source, it was retained as a pregnancy-related claim.

From the above, live birth deliveries were of primary interest (since our cohort is defined around live birth events). We therefore filtered the set of pregnancy-related claims to those indicating a live birth. For each such claim, we treated the claim's service date as the delivery date (infant birth date). In claims data, delivery may appear as an inpatient stay or a professional service; we used the header's "begin date of service" for consistency as the delivery date. We then created a maternal delivery dataset in which each record is a unique combination of mother's Medicaid ID and delivery date. If multiple delivery dates for one woman were recorded too close together to represent separate pregnancies, we combined or dropped such instances. Specifically, any purported second "delivery" recorded within 23 weeks (160 days) of a prior delivery was considered implausible as a separate live birth and was not counted as a new pregnancy (this prevented duplicate records of the same birth or inclusion of non-viable gestations). This ensured that each delivery event in the analysis dataset reflected a unique pregnancy. If a claim indicated multiple gestation delivery (twins, etc.), it still corresponds to one delivery event on one date for the mother (we just added a flag for multiple gestation birth events).

Identifying Opioid Use Disorder and Cohort Inclusion

To focus the analysis on mothers with opioid use disorder (OUD), we identified OUD through multiple indicators in the Medicaid data and applied these criteria to the pregnancy cohort:

- Diagnosis of OUD: Following the Medicaid Outcomes Distributed Research Network (MODRN) definition, we used any ICD-10 diagnosis code in the "F11" series (which denotes opioid-related disorders) to identify claims with "OUD diagnosis".
- Medication for OUD (MOUD): We defined a list of medication codes (NDCs) for medications used in opioid use disorder treatment (e.g., buprenorphine, methadone, naltrexone formulations used for OUD). We merged the pharmacy claims with this list; if a claim's NDC matched an OUD treatment medication, we flagged that claim as "MOUD Medication." For analysis at the person level, any evidence of MOUD during the windows of interest (within 2 years or 3-4 years prior to delivery) indicates her as having received treatment for OUD.
- OUD-related Procedures: We also compiled codes for procedures related to OUD treatment (e.g., therapy or counseling CPT codes specifically for substance use treatment or procedure codes for administering long-acting injectable naltrexone). The claims procedure file was merged with this list to flag OUD-related procedures ("MOUD Procedure").

Using these, we defined a claim-level indicator "Any OUD" which was 1 if any of the above were present (diagnosis, OUD medication, or OUD procedure). We then filtered our earlier-identified delivery claims to those with any OUD flags. More specifically, we required that the mother had evidence of OUD during the pregnancy or shortly after:

- For the cohort with a 2-year OUD inclusion period, we looked for evidence of OUD diagnosis, medication and/or procedure in the period from 2 years before delivery up to the delivery date.

If a mother had a claim with an OUD diagnosis, MOUD procedure, or Medication for OUD in that window, her delivery was included. Figure 2 shows how many births were identified by each OUD definition source for the IPPP and comparison groups.

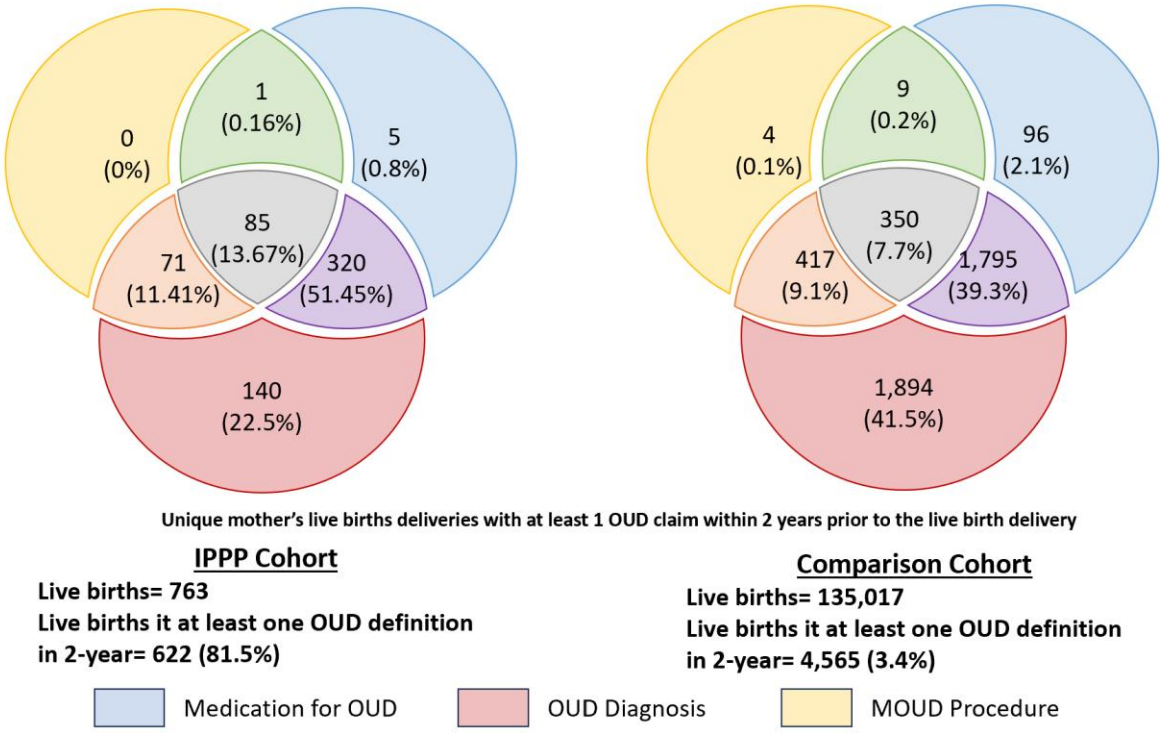

Figure 2. Comparison of OUD definitions (Diagnosis, MOUD procedures, and Medication for OUD) within 2 years prior to delivery among live births for the IPPP and comparison cohorts

- We also examined a postpartum window: OUD indicators in the first 7, 30, & 90 days postpartum were also flagged for those without OUD flags in the two years prior to delivery. This was done to ensure we included those cases where OUD had been identified at delivery or immediately after (and perhaps not earlier in pregnancy). Figure 3 shows how many births were identified when the OUD definition was applied within the 7-, 30-, and 90-days postpartum period for the IPPP and comparison groups.

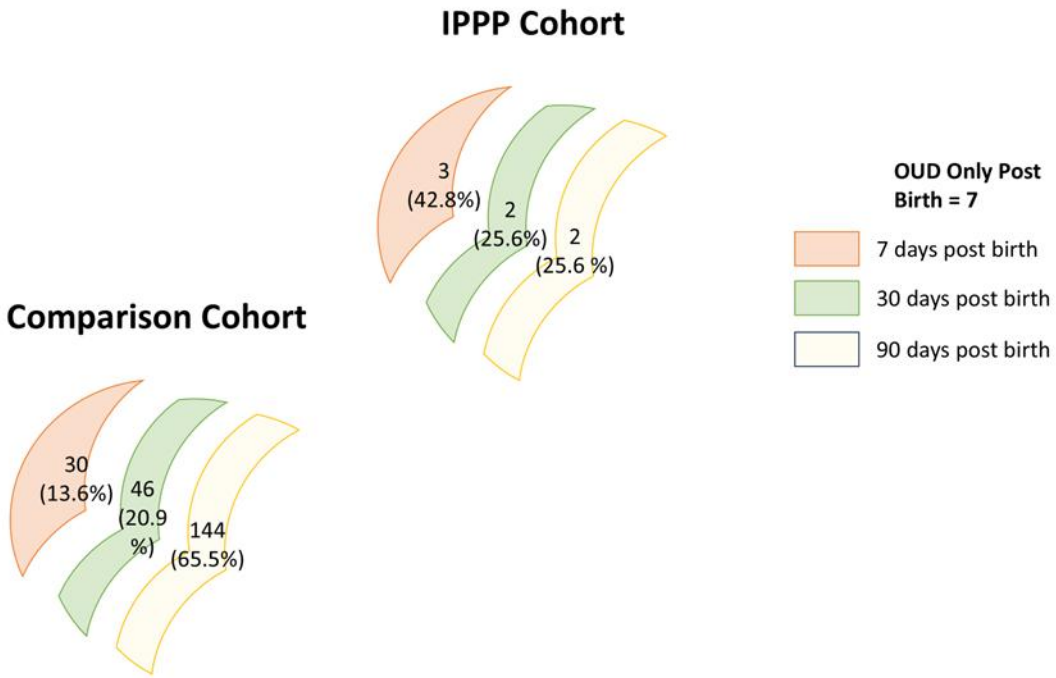

Figure 3. Comparison of OUD definitions live births among IPPP and comparison groups in the 7-90 days postpartum among live births where no OUD was identified within the 2 years prior to delivery

Ultimately, the OUD inclusion criterion used for primary analysis was that the mother had evidence of OUD diagnosis, medication, and/or procedure in either the 2 years prior to delivery or 7 days postpartum. We created a dataset where each record represented a mother–delivery pair (identified by Medicaid ID and Live birth date) meeting this criterion. This dataset included demographic fields from the Medicaid data, the delivery date, and a flag indicating whether the delivery occurred during an IPPP enrollment period or not.

IPPP vs. Comparison Group Classification

Using the IPPP program data, we marked each delivery as either an IPPP birth or a comparison group birth. If the mother was actively enrolled in IPPP at the time of delivery (i.e., the delivery date fell between her IPPP enrollment start and end dates, inclusive, or up to 90 days after disenrollment to account for deliveries shortly after program exit), then that delivery was classified as an IPPP birth. If the birth fulfilled the inclusion criteria but was not an IPPP birth, it was classified as a comparison group birth. We further

classify the IPPP births by distinguishing those deliveries where the mother was actively enrolled during the delivery vs those cases where the mother was enrolled in the 90 days postpartum period.

Defining Analytic Variables

With the cohorts defined, we defined analytic variables characterizing each mother and pregnancy. These included demographics and socioeconomic factors, Medicaid enrollment, clinical and pregnancy-related variables, and healthcare utilization measures:

Demographics and Socioeconomic Factors

- **Maternal Age at Delivery:** We calculated the mother's age in years at the time of delivery. This was done by subtracting the birth year from the delivery year and adjusting for whether the birthday had passed by the delivery date.
- **Race/Ethnicity:** Using the cleaned race and ethnicity from the demographics file, we created a combined race/ethnicity category. If ethnicity was Hispanic, we coded the person as Hispanic regardless of race. Otherwise, we used the race categories (White, Black, Asian/PI, American Indian/Alaska Native, Other, or Unknown). We then created a numeric encoded variable for use in models and matching.
- **Marital Status:** From the demographics, we had marital status codes, which included values for divorced, single, unknown, married, separated, or widowed. We grouped unknown and blanks into a single category and encoded it for analysis.
- **Rurality:** Using the county of residence at delivery, based on the enrollment month table, we created a binary rural vs. urban variable. Rurality was defined based on the 2023 USDA rural-urban continuum codes.[b] This system classifies each county from 1 to 9 based on population size and proximity to metropolitan areas, and it further aggregates them into metropolitan or nonmetropolitan counties. For the purpose of this analysis, we used a binary classification that considers metropolitan counties to be urban counties and nonmetropolitan counties to be rural ones.
    - Metropolitan counties (urban areas)
        - Code 1: Counties in metro areas of 1 million population or more
        - Code 2: Counties in metro areas of 250,000 to 1 million population
        - Code 3: Counties in metro areas of fewer than 250,000 population
    - Nonmetropolitan counties (rural areas)
        - Code 4: Urban population of 20,000 or more, adjacent to a metro area
        - Code 5: Urban population of 20,000 or more, not adjacent to a metro area
        - Code 6: Urban population of 5,000 to 20,000, adjacent to a metro area
        - Code 7: Urban population of 5,000 to 20,000, not adjacent to a metro area
        - Code 8: Urban population of fewer than 5,000, adjacent to a metro area
        - Code 9: Urban population of fewer than 5,000, not adjacent to a metro area

Medicaid Enrollment Variables

[b] https://www.ers.usda.gov/data-products/rural-urban-continuum-codes

- **Medicaid enrollment during pregnancy:** We calculated how many months the mothers were enrolled in Medicaid leading up to delivery. All deliveries had at least 1 month of enrollment (the month in which they had the delivery, and then we looked at 8 months prior to it (with mothers having a maximum total of 9 months of enrollment).
- **Medicaid pregnancy category enrollment during pregnancy:** Using the same window as above, we looked at how many of the months the mothers were enrolled in either of the pregnancy-related categories (Recipient aid categories GP, HW, M, MA, N, PE, PN, or RM).

Clinical and Pregnancy-Related Variables

- **Chronic Physical and Mental Health Conditions:** We created indicators for several chronic conditions and behavioral health diagnoses that could be relevant for this population:
    - Anxiety disorders
    - Depressive disorders
    - Hypertension
    - Heart disease (including cardiomyopathy or other cardiac conditions)
    - Diabetes (type I or II, excluding gestational diabetes for this purpose)
    - HIV
    - Hepatitis C
    - Obesity
    - Tobacco use disorder (nicotine dependence)

To create these, we used the diagnosis codes phenotypes as listed in Appendix B. We merged all claim diagnoses for each mother (not just pregnancy claims, but any claim in the dataset) with this list. For each condition category, if the mother had any diagnosis code indicating that condition in the two years prior to delivery, we set the corresponding indicator to 1. For example, if any claim had an ICD-10 code for essential hypertension, Hypertension was set to 1. If any claim had a code for major depressive disorder, Depression was set to 1, and so on.

These were first marked at the claim level and then aggregated to the person level (within a two-year window before delivery). We then merged these person-level flags back into the cohort. The result was a set of binary flags for each mother indicating the presence of each chronic condition in her medical history leading up to delivery. We later combined some of these for analysis; for instance, we created a composite "Cardio-metabolic conditions (CVD)" variable by combining hypertension, heart disease, diabetes, and obesity (this was labeled CVD and was simply the sum of those four flags). This composite was used in matching to capture overall physical health status.

- **Multiple Gestation:** We flagged if a delivery was a multiple gestation birth (twins or higher order). The claims-based pregnancy outcomes already included an indicator for multiple gestation birth (from diagnosis or procedure codes that indicate twins, etc.). This allowed us to control the complexity of a multiple gestation birth in outcomes and matching.

Healthcare Utilization Measures

- **Prenatal Care Utilization:** We aimed to measure whether the mother received adequate prenatal care, focusing in particular on first trimester care initiation. Using claims, we identified any claims that appeared to be prenatal visits. We flagged claims with diagnosis codes for routine prenatal

visits (ICD-10 Z34.xx series) or supervision of high-risk pregnancy (O09.xx series). If such codes were present, we marked that claim as a prenatal care claim. We collapsed this to get a list of claims that were prenatal visits. We then merged these prenatal care claims with our cohort's claims data to see, for each pregnancy, the timing of prenatal visits relative to the delivery date. We calculated the gestational timing by comparing the service date of the prenatal claim to the delivery date. We created a summary of care and developed two variables: Prenatal Care Trimester of first visit (coded 1, 2, 3, or 0 if no visits identified), and a binary First Trimester Care flag. In our analysis, the binary indicator for first trimester care was used as it aligns with measuring early prenatal care initiation.

Propensity Score Matching (PSM)

Given that participation in IPPP was not randomized, we employed propensity score matching (PSM) to create a comparable control group for the IPPP participants. Our goal was to match each IPPP delivery to one or more similar deliveries of women not in IPPP based on observed characteristics, thereby reducing selection bias in outcome comparisons.

We performed a logistic propensity score model where the outcome was an IPPP birth (1 for IPPP participant's delivery, 0 for a comparison participant's delivery). The covariates were chosen based on factors that might influence a mother's likelihood of enrolling in IPPP and also potentially impact postpartum/postnatal outcomes of interest:

- **Mother's age** (continuous)
- **Race/Ethnicity** (entered as categorical)
- **Year of delivery** (numerical)
- **Rural vs. urban residence** (Binary)
- **Mental health comorbidities**
    - Anxiety (binary)
    - Depression (binary)
- **Physical comorbidities**
    - HIV (binary)
    - Hepatitis C (binary)
    - Composite CVD indicator (any of hypertension/heart disease/diabetes/obesity)
- **Tobacco use disorder** (Binary)
- **Multiple gestation birth** (Binary)
- **First trimester prenatal care** (Binary)
- Medicaid Enrollment during pregnancy (Continuous)
- Pregnancy-Related Medicaid Enrollment during pregnancy (Continuous)
- **Recent OUD diagnosis:** In one model (for the 2-year window matching), we also included a binary variable indicating if the mother had an OUD related claim within the 9 months prior to delivery)

Propensity Score Matching Procedures

We conducted two main PSM analyses corresponding to different OUD evidence windows:

- **PSM 2Yr:** This matched IPPP vs non-IPPP among deliveries where mothers had OUD evidence within 2 years pre-delivery (our primary cohort definition). We did a 1:1 nearest-neighbor match with caliper = 0.01 (on the propensity score's logit scale) without replacement. This means each

IPPP case was matched to one unique control whose propensity score was within 0.01 and closest to the case's (deliveries in IPPP) score. We also tried a more liberal matching with 5:1 (each case matched to up to 5 controls) to increase sample size for comparison, still using the 0.01 caliper. And finally, a 5 consecutive 1:1 match removing the matching cases prior to the next match. We evaluated balance diagnostics for each approach. Reference Figures 4 to 6 below for visual representation of how these different matches work.

- **PSM 4Yr:** We also explored a cohort where OUD evidence extended to 4 years pre-delivery, to capture potentially more remote histories of OUD (this might include some additional mothers who had OUD in the past but perhaps not active during pregnancy).

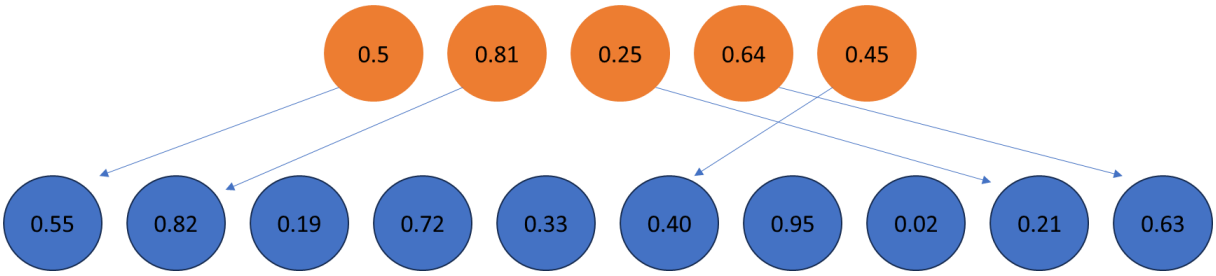

Figure 4. No replacement 1 to 1 match

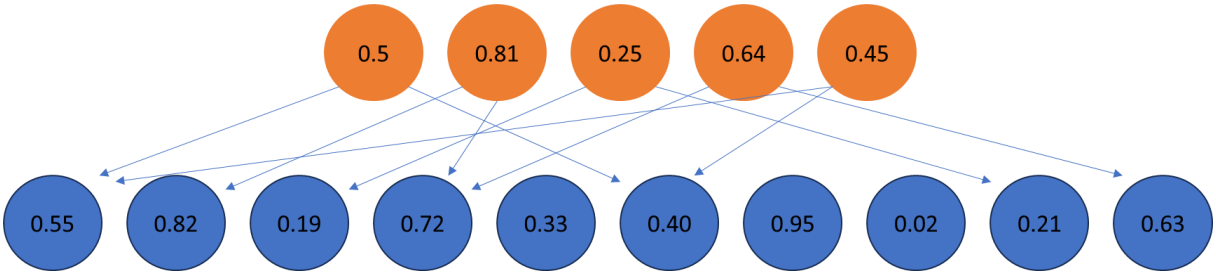

Figure 5. Replacement 1 to 5 match

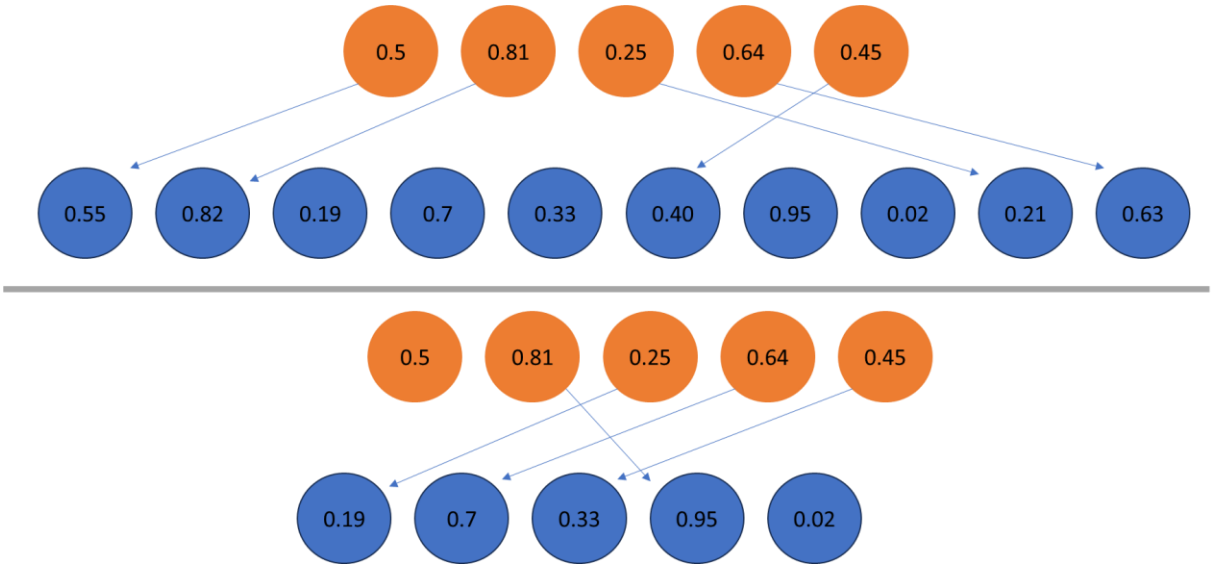

Figure 6. 5 consecutive 1 to 1 no replacement

Results

Table 1. Results of propensity score matching of IPPP cohort and comparison cohort

	IPPP Deliveries	Comparison Deliveries
Non-replacement 1 to 1 Match	**647**	**647**
OUD within 2 years prior to delivery	622	622
Delivery during program enrollment	415	415
Delivery prior to program enrollment	207	207
OUD 3-4 years prior	25	25
Delivery during program enrollment	18	18
Delivery prior to program enrollment	7	7
Replacement 1 to 5 Match	**648**	**3,226**
OUD within 2 years prior to delivery	623	3,108
Delivery during program enrollment	416	2,076
Delivery prior to program enrollment	207	1,032
OUD 3-4 years prior	25	118
Delivery during program enrollment	18	87
Delivery prior to program enrollment	7	31
5 Consecutive non-replacement 1 to 1 Match	**648**	**2,918**
OUD within 2 years prior to delivery	623	2,799
Delivery during program enrollment	215	1,853
Delivery prior to program enrollment	208	946
OUD 3-4 years prior	25	119
Delivery during program enrollment	18	88
Delivery prior to program enrollment	7	31

We matched each of the 648 IPPP deliveries using each of the three propensity score methods. On the single comparison delivery without replacement, 647 cases successfully converged and were included in the analysis (n = 647 pairs). On the 1 to 5 matching with replacement, we successfully identified at least one match for all 648 IPPP deliveries. This resulted in a total of 3,226 matched comparison deliveries. Lastly, the five sequential rounds of 1:1 matching without replacement, yielded a comparison cohort of 2,918 unique deliveries for the 648 IPPP deliveries, with all IPPP deliveries also still having at least one match.

Each of the matches was broken down into IPPP deliveries where the mother was diagnosed with OUD within the two years prior to delivery, or within the 3-4 years prior. Despite the second and third method yielding at least one comparison match for all 648 deliveries, we selected the results of the first propensity score match, as each of those delivery dates needed then to be used to find the corresponding baby in the Medicaid database, an effort that would have been quadrupled under the other two methods, while only adding one extra IPPP delivery to the analysis. Table 2 shows the breakdown of characteristics among the IPPP and comparison cohorts for the non-replacement 1 to 1 propensity score matched groups. Table 2 demonstrates the close match with this non-replacement 1 to 1 approach but does not hold the power for outcomes analyses that a 5 to 1 match would yield a conservative (bias toward the null) result.

Table 2. Cohort Descriptives for the Non-replacement 1 to 1 Propensity Score Matching

	OUD Diagnosis Within 2 Years		OUD Diagnosis Within 3-4 Years	
	IPPP (N=622)	**Comparison (N=622)**	**IPPP (N=25)**	**Comparison (N=25)**
Race/Ethnicity, n (%)				
Unknown	87 (13.99)	75 (12.06)	4 (16)	1 (4)
American Indian/Pacific Islander	2 (0.32)	3 (0.48)	0 (0)	0 (0)
Black	36 (5.79)	20 (3.22)	0 (0)	0 (0)
Hispanic	12 (1.93)	9 (1.45)	2 (8)	2 (8)
White	485 (77.97)	515 (82.80)	19 (76)	22 (88)
Rurality, n (%)				
Urban County	451 (72.51)	453 (72.83)	12 (48)	14 (56)
Rural County	171 (27.49)	169 (27.17)	13 (52)	11 (44)
Age at Delivery, n (%)				
Under 18	3 (0.48)	0 (0)	0 (0)	0 (0)
18 to 24	71 (11.41)	78 (12.54)	5 (20)	6 (24)
25 to 29	192 (30.87)	201 (32.32)	9 (36)	8 (32)
30 to 34	246 (39.55)	237 (38.10)	7 (28)	6 (24)
35 to 39	97 (15.59)	93 (14.95)	4 (16)	4 (16)
40 to 44	13 (2.09)	13 (2.09)	0 (0)	1 (4)
Marital Status, n (%)				
Divorced	43 (6.91)	45 (7.23)	2 (8)	3 (12)
Single	426 (68.49)	422 (67.85)	14 (56)	17 (68)
Unknown	31 (4.98)	29 (4.66)	2 (8)	0 (0)
Married	62 (9.97)	77 (12.38)	5 (20)	4 (16)
Separated	53 (8.52)	44 (7.07)	2 (8)	1 (4)
Widowed	7 (1.13)	5 (0.80)	0 (0)	0 (0)
Prenatal Care Timeline, n (%)				
No Prenatal Care	7 (1.13)	21 (3.38)	1 (4)	2 (8)
Prenatal Care started in 1st Trimester	338 (54.34)	347 (55.79)	14 (56)	16 (64)

Prenatal Care started in 2nd Trimester	226 (36.33)	202 (32.48)	7 (28)	7 (28)
Prenatal Care started in 3rd Trimester	51 (8.20)	52 (8.36)	3 (12)	0 (0)
Disease Prevalence*, n (%)				
Tobacco	532 (85.53)	547 (87.94)	22 (88)	23 (92)
Anxiety	442 (71.06)	431 (69.29)	12 (48)	10 (40)
Depression	371 (59.65)	384 (61.74)	9 (36)	11 (44)
HIV	4 (0.64)	4 (0.64)	0 (0)	0 (0)
Hepatitis C	239 (38.42)	249 (40.03)	6 (24)	7 (28)
CVD**	243 (39.09)	218 (35.04)	11 (44)	11 (44)

**Individuals with at least 1 diagnosis within the 2 years prior to delivery*

***Individuals with at least one of the following diagnoses: Diabetes, Hypertension, Heart Disease, or Obesity.*

Limitations & Significance of the Propensity Score Matching

It is important to note that the comparison population represents a matched group constructed through propensity score matching (PSM) and does not reflect the broader state population. This was performed intentionally to minimize bias in assessing programmatic impact of IPPP on health outcomes, given the possibility of selection bias or other residual confounding factors in program participation and outcomes of interest.

We implemented multiple PSM strategies—including non-replacement 1:1 matching, replacement 1:5 matching, and five sequential non-replacement 1:1 matches—to assess robustness and optimize covariate balance. The selection of the 1:1 non-replacement matching approach was guided by trade-offs between sample size, time, and the fact that the approach included all but one of the IPPP deliveries. As noted above, this represents a conservative (bias toward the null) approach in assessing programmatic impact of IPPP on postpartum/postnatal health outcomes. This PSM was essential to establishing a strong and credible evaluation of the IPPP program's impact on maternal and child health outcomes. Because enrollment in IPPP was not randomized, participants could differ systematically from non-participants across a range of social and health factors that are also linked to outcomes of interest. Without addressing these differences, the analysis would risk confounding program effects with pre-existing risk profiles. The PSM process minimized this selection bias by constructing a comparison group that closely matched the IPPP cohort on key demographic, geographic, and clinical variables, including race and ethnicity, rurality, age at delivery, marital status, prenatal care initiation, and the prevalence of major comorbidities such as tobacco use, depression, and hepatitis C. For example, the prevalence of tobacco use was closely matched between groups (85.5% in the IPPP cohort vs. 87.9% in the comparison cohort), and rural versus urban distribution was nearly identical (72.5% vs. 72.8% urban). Similarly, age at delivery and timing of prenatal care initiation were well balanced across groups. This strong degree of matching increases confidence that any subsequent differences in maternal and child outcomes, or in healthcare costs, can be more reliably attributed to IPPP participation rather than to baseline differences between groups.

Had the PSM process yielded a poorly matched comparison group, the integrity of the subsequent cost analysis would have been significantly compromised. Differences in healthcare expenditures, service utilization, or maternal and child outcomes could have been artifacts of underlying disparities in health status, socioeconomic conditions, or access to care rather than true program effects. Such bias could lead to either overestimating the benefits and cost savings associated with IPPP or failing to detect true program impacts, resulting in misleading policy conclusions. By achieving strong balance across a range of known confounders, this PSM process strengthens the internal validity of the evaluation. It ensures that observed differences in costs and outcomes reflect the effect of IPPP participation, providing a sound basis for understanding the program's cost-effectiveness and informing future investment decisions in maternal and child health interventions.

Objective 2: Cost & Outcomes Analysis

Methods

For Objective 2, we identified the utilization of health services and determined health outcomes from Medicaid claims data from 2021 through 2024. This included enrollment, maternal and fetal death, and health services utilization including inpatient hospitalizations (mother or child), emergency department encounters, outpatient care, and prescription drugs. Costs associated with these services, as well as total health care expenditures, were calculated and compared between the IPPP treatment group and the matched comparison group to provide the estimated cost difference attributable to participation in the IPPP.

We define health service utilization and health outcomes based on the prior literature[c] and as displayed below:

Table 3. Definitions for selected outcomes used in Objective 2

Medicaid Enrollment	Medicaid enrollment includes only full benefits coverage and excludes partial coverage such as presumptive eligibility or special eligibility categories such as dual eligibility with Medicare
Maternal Death	Any recorded date of death in Medicaid enrollment file within 1 year of delivery
Social determinants of health documentation (Z-codes)	Presence of any of the following codes in any position on any claim type. Education/literacy problems: Z55, Z555, Z556 Employment: Z56, Z57 Environment: Z58 Housing instability: Z59, Z590, Z5900, Z5901, Z5902, Z591, Z5911, Z5912, Z5919, Z598, Z5981, Z59811, Z59812, Z59819, Z5989 Food insecurity: Z594, Z5941, Z5948 Transportation challenges: Z5982 Financial insecurity: Z5986, Z5987 Concerns with family: Z60, Z62, Z63 Other: Z62833, Z62892, Z64, Z65

[c] Jarlenski M, Kim JY, Ahrens KA, Allen L, Austin A, Barnes AJ, Crane D, Lanier P, Mauk R, Mohamoud S, Pauly N, Talbert J, Zivin K, Donohue JM. Healthcare Patterns of Pregnant Women and Children Affected by OUD in 9 State Medicaid Populations. J Addict Med. 2021 Sep-Oct 01;15(5):406-413. doi: 10.1097/ADM.0000000000000780. PMID: 33560699; PMCID: PMC8339176.

Postpartum Care (HEDIS Definition)	Any of the four criteria within 90 days post-partum discharge: • CPT/HCPCS: 57170, 58300, 59430, 99501, 0503F, G0101 • ICD10CM: Z01.411, Z01.419, Z01.42, Z30.430, Z39.1, Z39.2 • CPT/HCPCS:88141, 88142, 88143, 88147, 88148, 88150, 88152, 88153, 88164, 88165, 88166, 88167, 88174, 88175, G0123, G0124, G0141, G0143, G0144, G0145, G0147, G0148, P3000, P3001, Q0091 • CPT: 59400, 59410, 59510, 59515, 59610, 59614, 59618, 59622 (included delivery claims) Excludes any services delivered in acute inpatient setting
Long-acting Reversible Contraception	CPT/HCPCS/ICDPCS: 11981, 11983, 58300, J7306, J7307, J7296, J7297, J7298, J7300, J7301, S4981, S4989, 0JHD0HZ, 0JHD3HZ, 0JHF0HZ, 0JHF3HZ, 0JHG0HZ, 0JHG3HZ, 0JHH0HZ, 0JHH3HZ, 0UH90HZ, 0UH97HZ, 0UH98HZ, 0UHC7HZ, 0UHC8HZ ICD10CM: Z30.017, Z30.014, Z30.430, Z30.433 NDC: 78206014501, 00052433001, 00023585801, 50419042101, 50419042201, 50419042208, 50419042271, 50419042301, 50419042308, 50419042401, 50419042408, 50419042471, 51285020401, 51285020402, 59365512801
Most/Moderately Effective Contraception	See Appendix F
Hospitalizations (maternal or child)	Place of service: 21 (inpatient hospital), 51 (inpatient psychiatric facility) CPT: 99221, 99222, 99223, 99231, 99232, 99233, 99234, 99235, 99236, 99238, 99239, 99251, 99252, 99253, 99254, 99255, 99291
Emergency department encounters (maternal or child)	UBREV: 0450, 0451, 0452, 0453, 0456, 0458, 0459, 0981 CPT: 99281, 99282, 99283, 99284, 99285, 99286, 99287, 99288
Outpatient Care (maternal or child) based on HEDIS definition	Place of service: 03, 05, 07, 09, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 33, 49, 50, 71, 72 (Descriptions in Appendix G) UBREV: 0510, 0511, 0513, 0514, 0515, 0516, 0517, 0519, 0520, 0521, 0522, 0523, 0526, 0527, 0528, 0529, 0982, 0983 CPT/HCPCS: 99202, 99203, 99204, 99205, 99211, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99341, 99342, 99343, 99344, 99345, 99347, 99348, 99349, 99350, 99381, 99382, 99383, 99384, 99385, 99386, 99387, 99391, 99392, 99393, 99394, 99395, 99396, 99397, 99401, 99402, 99403, 99404, 99411, 99412, 99429, 99455, 99456, 99483, G0402, G0438, G0439, G0463, T1015

Diabetes screening	Glucose test result or finding: CPT/HCPCS: 80047, 80048, 80050, 80053, 80069, 82947, 82950, 82951 HbA1c test result or finding CPT/HCPCS: 83036, 83037
Treatment for Mental Health or Substance Use Disorder	HCUP Clinical Classification Software Refined categories of ICD10CM codes in the primary position: MBD017, MBD018, MBD019, MBD020, MBD021, MBD001, MBD002, MBD003, MBD004, MBD005, MBD006, MBD007
Hepatitis C treatment medications	See Appendix H.
Foster care placement	Ever observed any of the following: Medicaid aid category: 4 (Title IV-E foster children under 18), 8 (Children Receiving Adoption Assistance [under 19]) Ward type: C (CHINS), D (Court Order)
Childhood Vaccine Status (at 9 months old)	Hepatitis B (90697, 90723, 90740, 90744, 90747, 90748, G0010): 2 doses Rotavirus (90681): 2 doses Rotavirus (90680): 3 doses DTaP (90697, 90698, 90700, 90723, 90715): 3 doses Haemophilus influenzae type b (90644, 90647, 90648, 90748): 2 doses Pneumococcal (90670, 90671, 90677, G0009): 3 doses Polio (90697, 90698, 90713, 90723): 2 doses
Well-child Visits	CPT/HCPCS: 99381, 99382, 99383, 99384, 99385, 99391, 99392, 99393, 99394, 99395, 99461, G0438, G0439, S0302, S0610, S0612, S0613 ICD10CM: Z0000, Z0001, Z00110, Z00111, Z00121, Z00129, Z002, Z003, Z01411, Z01419, Z025, Z761, Z762
Neonatal abstinence syndrome	P961 diagnosis in any position within 30 days of birth
Neonatal Intensive Care Unit (NICU)	UBREV codes: 0172, 0173, 0174, 0179
Pharmacotherapy for opioid use disorder	Denominator diagnosis of OUD 1 year postpartum (Appendix G) Numerator 1: any medication for OUD (Appendix G) Numerator 2: buprenorphine Numerator 3: oral naltrexone Numerator 4: long-acting, injectable naltrexone Numerator 5: methadone

Results

Statistically significant analysis results (p-value < 0.05) are reported in green, p-values <0.10 are reported in yellow.

Table 4. Medicaid enrollment and survival for mothers enrolled in IPPP and the comparison population

	IPPP (n=622)	Comparison (n=622)	Difference	p-value
Medicaid enrollment (with full coverage)				
At least 90 days from delivery, n/N (%)	620/622 (99.7)	613/622 (98.6)	1.1	0.0340
At least 180 days from delivery, n/N (%)	581/584 (99.5)	570/588 (96.9)	2.6	0.0010
At least 1 year from delivery, n/N (%)	455/465 (97.9)	446/468 (95.3)	2.6	0.0323
Maternal deaths within 1 year of delivery, n (mortality ratio)	2/457 (437.6 per 100,000)	5/451 (1108.6 per 100,000)	671.0 per 100,000	0.2477

Enrollment represents number enrolled over the number of mothers who could be eligible based on delivery date; p-values calculated for chi-square test.

Mothers enrolled in IPPP were more frequently enrolled in Medicaid 90 days (1.1 percentage points), 180 days (2.6 percentage points), and 1 year (2.6 percentage points) from delivery than the comparison population (Table 4). Indiana extended maternity benefits from 60 days to 12 months following delivery effective April 1, 2022; thus, some enrollment differences reflect this change while the denominator has been adjusted to account for maternal deaths and deliveries that occurred such that enrollment of that duration was not possible.

Two maternal deaths were observed in the IPPP population within 1 year of delivery (437.6 per 100,000 live births) compared with five in the comparison population (1,108.6 per 100,000 live births), as shown in Table 4. The difference, 671.0 deaths per 100,000 live births was not statistically significant at the conventional threshold. However, this statistical test is underpowered based on the population sizes and number of deaths. A sample size of 2,688 per group would be required to detect a statistically significant result based on the observed maternal mortality ratio. Thus, while not statistically significant, this difference is notable and suggests further investigation.

Table 5. Description of Z-codes present before and after delivery for mothers enrolled in IPPP and the comparison group continuously enrolled for at least 1 year

	IPPP (N=455)	Comparison (N=446)	p-value
Any Z-code before delivery, n (%)	27 (5.9)	15 (3.4)	0.0672
Average number of Z-codes, mean (SD)	1.1 (0.4)	1.0 (0)	0.3265
Any Z-code after delivery, n (%)	40 (8.8)	18 (4.0)	0.0036
Average number of Z-codes, mean (SD)	1.2 (0.4)	1.2 (0.4)	0.9394
Housing instability/homeless before delivery, n (%)	21 (4.6)	12 (2.7)	0.1241
Housing instability/homeless after delivery, n (%)	22 (4.8)	10 (2.2)	0.0355
Food insecurity before delivery, n (%)	5 (1.1)	3 (0.7)	0.4953
Food insecurity after delivery, n (%)	12 (2.6)	3 (0.7)	0.0212
Transportation challenges before delivery, n (%)	3 (0.7)	0 (0.0)	0.0859
Transportation challenges after delivery, n (%)	10 (2.2)	5 (1.1)	0.2066
Education/literacy problems before delivery, n (%)	0	0	--
Education/literacy problems after delivery, n (%)	2 (0.4)	1 (0.2)	0.5748
Financial insecurity before delivery, n (%)	0	0	--
Financial insecurity after delivery, n (%)	1 (0.2)	3 (0.5)	0.5514

p-values calculated for chi-square test.

Diagnosis codes representing determinants of health are often referred to as "Z-codes" because the International Classification of Diseases Version 10 groups these codes together with the notation "Z." Z-codes are used by clinicians to document social conditions that may be relevant to health and wellbeing. The prevalence of Z-codes in the year prior to and following delivery are presented in Table 5. Approximately 6% of the IPPP population had a documented Z-code in claims data prior to delivery compared with 3% of the comparison group (p-value 0.1241). The most frequently observed code was housing instability/homeless which represented 21 of the 27 (78%) codes observed in the IPPP population and 12 of the 15 (80%) in the comparison group. Although not statistically significant at conventional levels, the higher prevalence of Z-codes in the IPPP population may indicate greater vulnerability of the IPPP population. Following delivery, the prevalence of IPPP mothers with a Z-code increased to approximately 9% whereas the comparison population increased to 4% (p-value 0.0355). This difference, which is statistically significant, may indicate an increase in the presence of adverse social determinants of health. Alternatively, because Z-codes represent non-medical conditions and the interventions to address them are not directly reimbursable and often occur outside of the reimbursement system, Z-codes likely represent an underestimate of the true prevalence of social determinants of health. Furthermore, increased documentation may indicate more frequent contact with health care providers and is sensitive to health systems' ability to intervene or provide services to address these needs (also known as wraparound services).

Table 6. Description of Z-codes present before and after delivery for mothers enrolled in IPPP and the comparison group continuously enrolled for at least 1 year stratified by enrolled in IPPP during pregnancy or postpartum

	IPPP pregnancy (N=295)	IPPP postpartum (N=160)	Comparison (N=446)
Any Z-code before delivery, n (%)	19 (6.4)	8 (5.0)	15 (3.4)
Average number of Z-codes, mean (SD)	1.1 (0.5)	1.0 (0)	1.0 (0)
Any Z-code after delivery, n (%)	30 (10.2)	10 (6.3)	18 (4.0)
Average number of Z-codes, mean (SD)	1.2 (0.4)	1.1 (0.3)	1.2 (0.4)
Housing instability/homeless before delivery, n (%)	15 (5.1)	6 (3.8)	12 (2.7)
Housing instability/homeless after delivery, n (%)	16 (5.4)	6 (3.8)	10 (2.2)
Food insecurity before delivery, n (%)	4 (1.4)	1 (0.6)	3 (0.7)
Food insecurity after delivery, n (%)	10 (3.4)	2 (1.3)	3 (0.7)
Transportation challenges before delivery, n (%)	2 (0.7)	1 (0.6)	0 (0.0)
Transportation challenges after delivery, n (%)	7 (2.4)	3 (1.9)	5 (1.1)
Education/literacy problems before delivery, n (%)	0	0	0
Education/literacy problems after delivery, n (%)	2 (0.7)	0	1 (0.2)
Financial insecurity before delivery, n (%)	0	0	0
Financial insecurity after delivery, n (%)	1 (0.3)	0	3 (0.5)

Although most mothers enrolled into IPPP during pregnancy, more than a third enrolled after delivery. Table 6 displays Z-code prevalence stratified by when mothers enrolled in IPPP. Although no differences were statistically significant due to the small sample size (p-values not shown), mothers who enrolled in IPPP during pregnancy had greater prevalence of Z-codes than mothers enrolled postpartum. Both strata of the IPPP population had a higher prevalence of Z-codes than the comparison population. This may indicate mothers enrolled during pregnancy are more vulnerable to social needs or have more interactions with health providers who document the presence of social determinants of health.

Table 7. Receipt of postpartum and contraceptive care for mothers enrolled in IPPP and the comparison group

	IPPP (n=622)	Comparison (n=622)	Difference	p-value
Postpartum care within 90 days				
HEDIS definition, n (%)	363/620 (58.6)	292/613 (47.6)	11.0	0.0001
IPPP definition, n (%)	374/620 (60.3)	316/613 (51.6)	8.7	0.0019
IPPP definition (with inpatient exclusion), n (%)	336/620 (54.2)	274/613 (44.7)	9.5	0.0009
Postpartum care within 120 days				
HEDIS definition, n (%)	343/581 (59.0)	276/570 (48.4)	10.6	0.0003
IPPP definition, n (%)	356/581 (61.3)	299/570 (52.5)	8.8	0.0025
IPPP definition (with inpatient exclusion), n (%)	319/581 (54.9)	261/570 (45.8)	9.1	0.0020
Contraceptive Care				
Received LARC within 3 days, n (%)	89/620 (14.4)	95/613 (15.5)	-1.1	0.5734
Received LARC within 90 days, n (%)	281/620 (45.3)	271/613 (44.2)	1.1	0.6941
Received most/moderately effective contraception (within 3 days of delivery)	94/620 (15.2)	101/613 (16.5)	-1.3	0.5269
Received most/moderately effective contraception (within 90 days of delivery)	269/620 (43.4)	225/613 (36.7)	6.7	0.0167

Denominators vary based on continuous enrollment. P-value for chi-squared test.

Receipt of postpartum care using varying definitions and receipt of contraceptive care within 3 and 90 days is shown in Table 7. Postpartum care as defined by the Healthcare Effectiveness Data and Information Set (HEDIS) includes mothers who meet at least one of four criteria within a specified time interval: 1. A postpartum visit as indicated by a specified Clinical Procedure Terminology (CPT) code, 2. A postpartum encounter as indicated by a specified ICD10 code, 3. A cervical cytology procedure, or 4. A bundled CPT code indicating receipt of both prenatal and postpartum care as a package. The IPPP definition is most consistent with the codes in criteria 1 and 2 of the HEDIS definition. However, the HEDIS definition has exclusions for services delivered during inpatient stays. Although the American College of Obstetricians and Gynecologists (ACOG) recommends mothers receive a comprehensive postpartum visit no later than 12 weeks (84 days) after delivery, our analysis considered an extended time definition to understand whether some mothers may receive this care albeit delayed. The IPPP population received postpartum care between 8.8 and 10.9 percentage points more frequently than the comparison population, depending on the definition used. In all cases, this difference was statistically significant, indicating the IPPP mothers receive this care more frequently, regardless of how postpartum care is defined. When considering this care within 90 versus 120 days, we observed similar proportions of mothers receiving care (after adjusting the denominator to ensure continuous enrollment in Medicaid), indicating that measuring receipt of postpartum care is not sensitive to a 90-day definition—when the care is received, it occurs within the 90 days after delivery.

ACOG also recommends mothers have full access to contraceptive care postpartum, which may be long-acting reversible contraception (LARC) or other contraceptives that are the most or at least moderately effective. While this measure does not capture all methods of contraception, it does provide an indication of whether mothers are counseled on the topic of contraception. Approximately 45% of the IPPP population and 44% of the comparison population received LARC within 90 days of delivery, a difference which was not statistically significant. Approximately 43% of the IPPP population received most/moderately effective contraception within 90 days of delivery compared with 37% of the comparison population, which was statistically significant (p-value 0.0167).

Table 8. Incidence and Medicaid costs of health services for mothers enrolled in IPPP and the comparison population continuously enrolled for at least 90 days after delivery

	IPPP (n=620)	Comparison (n=613)	Difference	p-value
Delivery, average $ (SD)	3798.90 (2788.80)	4000.70 (2913.80)	-201.80	0.2140
Delivery length of stay, average (SD)	7.3 (5.7)	7.3 (7.1)	0	0.9771
Inpatient hospitalization, n (%)	64 (10.3)	56 (9.1)	1.2	0.4819
Inpatient hospitalization, average number of stays (SD)	0.1 (0.4)	0.1 (0.4)	0	0.9871
Inpatient hospitalization length of stay, average (SD)	0.7 (3.4)	0.7 (3.5)	0	0.9081
Inpatient hospitalization, per person average $ (SD)	277.60 (2675.00)	278.40 (2210.50)	0.80	0.9954
Inpatient hospitalization, conditional average $ (SD)	2688.90 (7982.60)	3047.10 (6766.10)	-358.20	0.7929
Emergency department visit, n (%)	138 (22.3)	135 (22.0)	0.3	0.9208
Emergency department visit, average number of events (SD)	0.3 (0.9)	0.3 (0.8)	0	0.6161
Emergency department visit, per person average $ (SD)	90.20 (253.10)	88.34 (268.30)	1.86	0.1500
Emergency department visit, conditional average $ (SD)	411.20 (401.00)	401.10 (449.70)	10.10	0.8453
Outpatient visit, n (%)	591 (95.3)	558 (91.0)	4.3	0.0028
Outpatient visit, per person average $ (SD)	1367.00 (3391.00)	1026.70 (1774.60)	340.30	0.0273
Outpatient visit, conditional average $ (SD)	1436.50 (3462.50)	1131.90 (1831.20)	304.60	0.0609
Diabetes screening, n (%)	181 (29.2)	134 (21.9)	7.3	0.0032
MH/SUD outpatient visit, n (%)	388 (62.6)	328 (53.5)	9.1	0.0012
MH/SUD outpatient visit, per person average $ (SD)	321.30 (522.00)	258.20 (396.60)	63.1	0.0170
MH/SUD outpatient visit, conditional average $ (SD)	513.30 (580.50)	482.60 (431.10)	30.70	0.4169
Prescription drugs, per person average $ (SD)	900.50 (3868.30)	622.10 (2404.70)	278.40	0.1289
Prescription drugs, conditional average $ (SD)	944.70 (3956.90)	683.50 (2512.30)	261.20	0.1846
Total costs, per person average $ (SD)	6591.80 (6306.20)	6010.60 (5388.50)	581.20	0.0820

p-value from chi-squared test or t-test.

Utilization and costs by the IPPP mothers and the comparison group within 90 days after delivery are shown in Table 8. Hospitalizations were identified using the definition in Table 3 that includes place of service and CPT codes. Because of transfers, hospital admissions that occurred on the same date as a discharge were aggregated into a single episode. Because of separate billing processes, all services used during the admission and discharge dates of the episode were considered as part of the hospitalization cost. This includes physician services, lab values, medications, and diagnostic imaging. Delivery claims were identified using procedure and diagnosis codes for live births (same definition used in Objective 1)

and excluded from all other inpatient hospitalizations. For all service utilization, two cost averages are considered. First, the per person average is the cost using the full denominator of each population (minus those who did not meet continuous eligibility requirements). This represents the cost per person overall, regardless of whether the service was utilized, to provide the average cost for each type of service. Second, the conditional average represents the total cost for those services received among only those who received the service. Total costs include all claims reimbursed by Medicaid, including services not specifically reported on, such as lab values, vision, dental, and transportation.

Utilization and costs were similar for the IPPP and comparison population, with some exceptions. A greater proportion of IPPP mothers had an outpatient visit (95.3%) than the comparison mothers (91.0%) and consequently the IPPP mothers had a higher per person average cost by approximately $340 over 90 days. Conditional upon use of an outpatient service, cost among IPPP mothers was approximately $304 greater, which was just beyond the conventional statistical significance level of alpha 0.05 (p-value 0.0609). This indicates the IPPP mothers used outpatient care more frequently and potentially for more complex services resulting in higher costs than the comparison population. Two notable examples that may drive this difference, in part, are diabetes screening and mental health (MH) and substance use disorder (SUD) claims. Diabetes screening was considered if a CPT procedure code indicated that a lab result or finding was reviewed for either glucose or HbA1c (Table 3), consistent with the definition used by the National Committee on Quality Assurance. Because claims data only contain services reimbursed, this may undercount the number of screenings ordered by clinicians and does not include actual lab results. Approximately 29% of the IPPP population had evidence of diabetes screening during the 90 days following delivery as compared to the comparison population where approximately 22% of mothers were screened, a difference of 7.3 percentage points (p-value 0.0032). Second, outpatient visits were considered related to MH or SUD if the primary ICD10 diagnosis code contained any designated by the Healthcare Cost and Utilization Project (H-CUP) Clinical Classifications Software (CCS) as related to encounters for MH or SUD. Approximately 63% of the IPPP population had an outpatient visit with a primary diagnosis of MH or SUD compared with the comparison population (53.5%), a difference that was statistically significant (p-value 0.0012). Consequently, the per person costs for MH/SUD outpatient visits were greater for the IPPP population; however, the conditional upon use average was no different between populations. Total costs were greater for the IPPP population by approximately $581; however, this was not statistically significant (p-value 0.0820). The results of utilization and costs within 90 days among only the IPPP mothers enrolled during pregnancy was consistent with the full IPPP population (Table 9).

Table 9. Incidence and Medicaid costs of health services for mothers enrolled in IPPP and the comparison population continuously enrolled for at least 90 days after delivery and mothers with births while enrolled in IPPP

	IPPP (n=413)	Comparison (n=613)	Difference	p-value
Delivery, average $ (SD)	3777.77 (2995.90)	4000.70 (2913.80)	-222.93	0.2342
Delivery length of stay, average (SD)	7.1 (5.8)	7.3 (7.1)	-0.2	0.5832
Inpatient hospitalization, n (%)	39 (9.4)	56 (9.1)	0.3	0.8676
Inpatient hospitalization, average number of stays (SD)	0.1 (0.4)	0.1 (0.4)	0	0.8012
Inpatient hospitalization length of stay, average (SD)	0.7 (3.3)	0.7 (3.5)	0	0.7888
Inpatient hospitalization, per person average $ (SD)	337.40 (3129.40)	278.40 (2210.50)	59.00	0.7235
Inpatient hospitalization, conditional average $ (SD)	3572.60 (9711.60)	3047.10 (6766.10)	525.50	0.7711
Emergency department visit, n (%)	90 (21.8)	135 (22.0)	-0.2	0.9301
Emergency department visit, average number of events (SD)	0.3 (0.9)	0.3 (0.8)	0	0.8543
Emergency department visit, per person average $ (SD)	87.34 (240.80)	88.34 (268.30)	-1.00	0.9505
Emergency department visit, conditional average $ (SD)	405.30 (375.80)	401.10 (449.70)	4.20	0.9401
Outpatient visit, n (%)	387 (93.7)	558 (91.0)	2.7	0.1189
Outpatient visit, per person average $ (SD)	1231.40 (1478.20)	1026.70 (1774.60)	204.70	0.0453
Outpatient visit, conditional average $ (SD)	1317.50 (1491.50)	1131.90 (1831.20)	185.60	0.0878
Diabetes screening, n (%)	118 (28.6)	134 (21.9)	6.7	0.0143
MH/SUD outpatient visit, n (%)	248 (60.1)	328 (53.5)	6.6	0.0384
MH/SUD outpatient visit, per person average $ (SD)	295.90 (529.40)	258.20 (396.60)	37.70	0.2182
MH/SUD outpatient visit, conditional average $ (SD)	492.80 (608.30)	482.60 (431.10)	10.20	0.8223
Prescription drugs, per person average $ (SD)	794.00 (2437.60)	622.10 (2404.70)	171.90	0.2684
Prescription drugs, conditional average $ (SD)	838.70 (2547.50)	683.50 (2512.30)	155.20	0.3519
Total costs, per person average $ (SD)	6248.50 (5477.30)	6010.60 (5388.50)	237.90	0.4909

p-value from chi-squared test or t-test.

Table 10. Incidence and Medicaid costs of health services for mothers enrolled in IPPP and the comparison population continuously enrolled for at least 365 days after delivery

	IPPP (n=455)	Comparison (n=446)	Difference	p-value
Inpatient hospitalization, n (%)	92 (20.2)	78 (17.5)	2.7	0.2948
Inpatient hospitalization, average number of stays (SD)	0.3 (0.7)	0.3 (0.7)	0	0.6606
Inpatient hospitalization length of stay, average (SD)	1.9 (6.3)	1.8 (7.2)	0.1	0.8540
Inpatient hospitalization, per person average $ (SD)	646.30 (3397.50)	688.0 (4885.80)	-41.70	0.8820
Inpatient hospitalization, conditional average $ (SD)	3196.20 (7024.90)	3933.90 (11181.40)	-737.70	0.6149
Emergency department visit, n (%)	226 (49.7)	236 (52.9)	-3.2	0.3300
Emergency department visit, average number of events (SD)	1.2 (2.2)	1.2 (1.9)	0	0.9231
Emergency department visit, per person average $ (SD)	316.60 (603.2)	312.90 (555.00)	3.70	0.9237
Emergency department visit, conditional average $ (SD)	649.00 (728.50)	596.50 (646.80)	52.50	0.4156
Outpatient visit, n (%)	448 (98.5)	434 (97.3)	1.2	0.2288
Outpatient visit, per person average $ (SD)	4127.20 (16257.70)	3283.40 (7721.70)	843.80	0.3185
Outpatient visit, conditional average $ (SD)	4191.70 (16376.20)	3389.80 (7823.10)	801.90	0.3517
Diabetes screening, n (%)	291 (64.0)	246 (55.2)	8.8	0.0071
MH/SUD outpatient visit, n (%)	374 (82.2)	319 (71.5)	10.7	0.0001
MH/SUD outpatient visit, per person average $ (SD)	1201.50 (1462.90)	1112.30 (1492.10)	89.20	0.3655
MH/SUD outpatient visit, conditional average $ (SD)	1461.70 (1491.20)	1555.20 (1557.10)	-93.50	0.4205
Prescription drugs, per person average $ (SD)	4415.80 (19626.60)	2919.90 (6835.60)	1495.90	0.1257
Prescription drugs, conditional average $ (SD)	4464.80 (19730.00)	3014.50 (6925.10)	1450.30	0.1427
Hepatitis C treatment, n (%)	18 (4.0)	20 (4.5)	-0.5	0.6933
Hepatitis C treatment, conditional average $ (SD)	24529.90 (3484.60)	25374.90 (7880.60)	-4396.00	0.6673
Total costs, per person average $ (SD)	14636.60 (21432.20)	12924.70 (14684.30)	1711.90	0.1616

p-value from chi-squared test or t-test.

Utilization and costs were also considered for both populations for the year following delivery, accounting for mothers who were continuously enrolled in Medicaid for the duration of that year (Table 10). Hepatitis C treatment costs over the year were based on claims for medications as specified in Appendix H. Costs were tabulated over the year postpartum only, because treatment initiation may be delayed following delivery, and the treatment duration of Hepatitis C is typically 8-12 weeks. Thus, costs were not tabulated for 90 days because it may not reflect the full course of treatment for all women. Utilization and costs were similar for the IPPP and comparison population, with only two exceptions. As with utilization

during the 90 days, diabetes screening and outpatient visits for MH or SUD were more frequent among the IPPP population, the results of which were statistically significant. Given the prevalence of chronic conditions, MH conditions, and SUD among both the IPPP population and the comparison population, greater utilization of these services likely represents a positive use of care for the IPPP cohort. Results when restricting to IPPP mothers enrolled during pregnancy in Table 11 were similar to the full population.

Table 11. Incidence and Medicaid costs of health services for mothers enrolled in IPPP and the comparison population continuously enrolled for at least 365 days and mothers with births while enrolled in IPPP

	IPPP (n=295)	Comparison (n=446)	Difference	p-value
Inpatient hospitalization, n (%)	55 (18.6)	78 (17.5)	0.9	0.6883
Inpatient hospitalization, average number of stays (SD)	0.3 (0.8)	0.3 (0.7)	0	0.7108
Inpatient hospitalization length of stay, average (SD)	1.9 (6.6)	1.8 (7.2)	0.1	0.8780
Inpatient hospitalization, per person average $ (SD)	797.80 (4148.20)	688.0 (4885.80)	109.80	0.7527
Inpatient hospitalization, conditional average $ (SD)	4279.20 (8860.80)	3933.90 (11181.40)	345.30	0.8430
Emergency department visit, n (%)	145 (49.2)	236 (52.9)	-3.7	0.3158
Emergency department visit, average number of events (SD)	1.3 (2.4)	1.2 (1.9)	0.5	0.8115
Emergency department visit, per person average $ (SD)	314.70 (581.20)	312.90 (555.00)	1.80	0.9675
Emergency department visit, conditional average $ (SD)	649.20 (693.40)	596.50 (646.80)	52.70	0.4558
Outpatient visit, n (%)	290 (98.3)	434 (97.3)	1.0	0.3755
Outpatient visit, per person average $ (SD)	3301.30 (2684.20)	3283.40 (7721.70)	17.90	0.9641
Outpatient visit, conditional average $ (SD)	3358.20 (2671.60)	3389.80 (7823.10)	-31.60	0.9382
Diabetes screening, n (%)	183 (62.0)	246 (55.2)	6.8	0.0635
MH/SUD outpatient visit, n (%)	240 (81.4)	319 (71.5)	9.9	0.0023
MH/SUD outpatient visit, per person average $ (SD)	1098.00 (1298.50)	1112.30 (1492.10)	-14.30	0.8932
MH/SUD outpatient visit, conditional average $ (SD)	1349.70 (1316.40)	1555.20 (1557.10)	-205.50	0.0998
Prescription drugs, per person average $ (SD)	3347.50 (6521.50)	2919.90 (6835.60)	427.60	0.3917
Prescription drugs, conditional average $ (SD)	3405.30 (6562.60)	3014.5 (6925.10)	390.80	0.4482
Hepatitis C treatment, n (%)	11 (3.7)	20 (4.5)	-0.8	0.6151
Hepatitis C treatment, conditional average $ (SD)	23901.70 (3752.80)	25374.90 (7880.60)	-1473.20	0.4875
Total costs, per person average $ (SD)	13479.60 (10743.10)	12924.70 (14684.30)	554.90	0.5532

p-value from chi-squared test or t-test.

Table 12. Use of pharmacotherapy for opioid use disorder for 1 year postpartum among mothers continuously enrolled in Medicaid

	IPPP (n=455)	Comparison (n=446)	Difference	p-value
Opioid use disorder (OUD) diagnosis 1 year postpartum, n (%)	386 (84.8)	344 (77.1)	7.7	0.0032
Medications for treatment of opioid use disorder among those with OUD diagnosis, n (%)	343 (88.9)	292 (84.9)	4.0	0.1109
Buprenorphine	295 (86.0)	245 (83.9)	2.1	0.4593
Oral naltrexone	10 (2.9)	9 (3.1)	-0.2	0.9022
Long-acting injectable naltrexone	9 (2.6)	3 (1.0)	1.6	0.1409
Methadone	61 (17.8)	60 (20.6)	-2.8	0.3768

p-value for chi-squared test or t-test.

Pharmacotherapy for opioid use disorder is recognized by the Substance Abuse and Mental Health Services Administration (SAMHSA) as part of a "whole patient" approach to treatment when used in combination with counseling and behavioral therapies. The proportion of mothers with an active OUD (during the year postpartum) who were using pharmacotherapy is shown in Table 12. The codes for both the OUD diagnoses and the medications for opioid use disorder (MOUD) were adopted from value sets provided by SAMHSA. All mothers included in the analyses were required to have at least one encounter with an OUD prior to delivery. The use of MOUD was calculated among only those with a postpartum OUD diagnosis. Mothers enrolled in IPPP were 7.7 percentage points more likely to have a diagnosis of OUD postpartum (p-value 0.0032). This may suggest IPPP mothers are more likely to be engaged in OUD treatments. Because claims data lack information about actual use of opioids, and because diagnoses can persist on claims, we cannot rule out that this difference is the result of coding/documentation. Among those with an OUD diagnosis, mothers in IPPP were 4 percentage points more likely to have any MOUD, although this difference was not statistically significant at conventional levels. Results for mothers enrolled in IPPP during pregnancy (Table 13) were similar to the full population results.

Table 13. Use of pharmacotherapy for opioid use disorder for 1 year postpartum among mothers continuously enrolled in Medicaid and enrolled in IPPP during pregnancy

	IPPP (n=295)	Comparison (n=446)	Difference	p-value
Opioid use disorder (OUD) diagnosis 1 year postpartum, n (%)	247 (83.7)	344 (77.1)	6.6	0.0286
Medications for treatment of opioid use disorder among those with OUD diagnosis, n (%)	217 (87.9)	292 (84.9)	3.0	0.3028
Buprenorphine	186 (85.7)	245 (83.9)	1.8	0.4593
Oral naltrexone	5 (2.3)	9 (3.1)	-0.8	0.5956
Long-acting injectable naltrexone	4 (1.8)	3 (1.0)	0.8	0.4344
Methadone	39 (18.0)	60 (20.6)	-2.6	0.4678

p-value for chi-squared test or t-test.

Table 14. Medicaid enrollment and survival for children born to mothers enrolled in IPPP and the comparison population

	IPPP (n=618)	Comparison (n=610)	Difference	p-value
Medicaid enrollment (with full coverage)				
At least 90 days from delivery, n (%)	610 (98.7)	603 (98.9)	-0.2	0.8147
At least 180 days from delivery, n (%)	569 / 580 (98.1)	566 / 576 (98.3)	-0.2	0.8382
At least 365 days from delivery, n (%)	453 / 462 (98.1)	452 / 460 (98.3)	-0.2	0.8136
Out of home placement, n (%)	95 (15.4)	108 (17.7)	-2.3	0.2712
Vaccines on schedule, n (%)	241 / 569 (42.4)	206 / 566 (36.4)	6.0	0.0399
Infant deaths within 1 year of birth, n (mortality ratio)	5/458 (10.9 per 1,000)	9/461 (19.5 per 1,000)	8.6 per 1,000	0.2869
Infant deaths within 1 year of birth mother enrolled pre-delivery, n (mortality ratio)	4/301 (13.3 per 1,000)	9/461 (19.5 per 1,000)	6.2 per 1,000	0.5159

p-value from chi-squared test or t-test.

Children born to mothers enrolled in IPPP were matched to the IPPP and comparison population via Recipient ID and date of delivery. Specifically, the Recipient IDs from study mothers were merged with all Medicaid enrollees on the Mother Recipient ID field. All matches were then restricted to those with a date of birth (as recorded in the Medicaid recipient file) within 160 days of the estimated delivery date for mothers included in the study. An additional 10 children were linked by searching on Medicaid case numbers that matched study mothers and again verifying date of birth and delivery date. In total, children were identified for 618 from the IPPP population (99.4%) and 610 from the comparison population (98.1%).

Medicaid enrollment at 90 days, 180 days, and 1 year from birth are shown in Table 14. The proportion was consistent across all time points and between populations. Approximately 99% of children were enrolled 90 days after delivery, which fell only slightly to 98% one year after delivery (among those with enough observed follow-up).

Out of home placement was estimated using proxy information contained within Medicaid eligibility data denoting special program enrollment in adoption assistance or foster care, or if the child was denoted to have a ward of either Children in Need of Services (CHINS) or a court order. Infant out of home placement is an adverse childhood experience and inherent traumatic event due to separation. Therefore, preserving the family unit and supporting secure parent-child attachment relationships has major effects on physical and mental health downstream and over the course of the child's lifespan. The IPPP population (15.5%) was 2.3 percentage points less likely than the comparison population (17.7%) to have out of home placement. Although this difference was not statistically significant at conventional levels, this effect size could represent a clinically meaningful difference given the seriousness of this outcome and warrants future research with improved measures.

The proportion of children on schedule for vaccines was calculated by comparing the number of recommended doses children should receive by 6 months of age and allowing a total of 9 months. The specific vaccines and doses are listed in Table 3. Among children born to mothers in IPPP, approximately 42% were on schedule for their vaccines compared with approximately 36% in the comparison population. This 6-percentage point difference was statistically significant (p-value 0.0399) and has life-long implications for the children when considering the vaccines prevent against life-threatening infections or life-altering complications including polio, pertussis, diphtheria, and hepatitis B.

Table 15. Incidence and Medicaid costs of health services for babies born to mothers enrolled in IPPP and the comparison population continuously enrolled for at least 90 days after birth

	IPPP (n=610)	Comparison (n=603)	Difference	p-value
Delivery, average $ (SD)*	8709.40 (18968.40)	8976.70 (26432.90)	-267.30	0.8413
Delivery length of stay, average (SD)*	8.7 (16.1)	9.1 (26.9)	-0.4	0.7220
Delivery included NICU stay, n (%)	231 (37.4)	223 (36.7)	0.7	0.7656
Delivery included NICU stay, average length of stay (SD)	15.5 (23.9)	16.9 (41.9)	-1.4	0.6737
Only deliveries that included NICU stay, average $ (SD)	18079.60 (27139.80)	19242.90 (40733.90)	-1163.40	0.7214
Primary diagnosis of NAS at birth, n (%)	67 (11.0)	66 (11.0)	0	0.9830
Any diagnosis of NAS within first 30 days, n (%)	197 (32.3)	183 (30.4)	1.9	0.4648
Inpatient hospitalization, n (%)	47 (7.7)	44 (7.3)	0.4	0.7873
Inpatient hospitalization, average number of stays (SD)	0.1 (0.4)	0.1 (0.4)	0	0.7077
Inpatient hospitalization length of stay, average (SD)	0.8 (5.3)	0.8 (6.4)	0	0.9626
Inpatient hospitalization, per person average $ (SD)	515.40 (5400.00)	429.40 (3478.90)	86.00	0.7420
Inpatient hospitalization, conditional average $ (SD)	6689.40 (18543.30)	5885.20 (11686.60)	804.20	0.8039
Inpatient hospitalization if NAS diagnosis (30 day), conditional average $ (SD)	8733.00 (24425.30)	4109.50 (7207.20)	4623.50	0.4692
Emergency department visit, n (%)	157 (25.7)	133 (22.1)	3.6	0.1328
Emergency department visit, average number of events (SD)	0.3 (0.7)	0.3 (0.6)	0	0.2312
Emergency department visit, per person average $ (SD)	83.05 (195.20)	67.91 (172.70)	15.14	0.1530
Emergency department visit, conditional average $ (SD)	322.70 (266.40)	307.90 (248.10)	14.80	0.6275
Emergency department visit if NAS diagnosis (30 day), conditional average $ (SD)	324.90 (226.10)	300.40 (174.60)	24.50	0.5576
Outpatient visit, n (%)	589 (96.6)	571 (94.7)	1.9	0.1123
Outpatient visit, per person average $ (SD)	704.70 (1505.20)	542.70 (632.00)	162.00	0.0601
Outpatient visit, conditional average $ (SD)	729.80 (2058.80)	573.10 (635.90)	156.70	0.0785
Prescription drugs, per person average $ (SD)	19.82 (152.40)	10.66 (47.84)	9.16	0.1574
Prescription drugs, conditional average $ (SD)	53.73 (247.60)	31.06 (77.78)	22.67	0.1929
Total costs, per person average $ (SD)	9654.90 (19024.00)	9716.90 (24470.60)	-62.00	0.9608
Total costs, conditional average $ (SD)	9670.70 (19035.60)	9831.00 (24591.30)	-160.30	0.8995

**Delivery costs identified for children of IPPP mothers, n=605 and comparison mothers, n=589 and includes all identified infants; p-value for chi-squared test or t-test*

Utilization and costs for children born to mothers enrolled in IPPP and the comparison group within 90 days after delivery are shown in Table 15. Service utilization was calculated in a similar manner as for mothers. Hospitalizations were identified using the definition in Table 3 that includes place of service and CPT codes, aggregated into a single episode and inclusive of all services. Delivery claims were identified using procedure and diagnosis codes for live births (same definition used in Objective 1) and excluded from all other inpatient hospitalizations. Overall delivery costs include neonatal intensive care unit (NICU) utilization, defined as claims with revenue centers as shown in Table 3. Utilization and costs for the subset of infants with a NICU stay are shown separately as well. Two measures of neonatal abstinence syndrome (NAS) were used. The first was limited to those infants with a primary NAS diagnosis (ICD10 P96.1) in the birth/delivery claims. The second included the NAS diagnosis in any position on any claim within the first 30 days of birth (as shown in Table 3). Costs for hospitalizations and ED visits are shown for the subset of infants with the second NAS definition (within 30 days).

Utilization and costs were similar for the IPPP and comparison population during the first 90 days of life. Although not statistically significant at conventional levels, there was greater utilization and costs observed for outpatient visits among the infants from IPPP-enrolled mothers, with p-values < 0.1. Outpatient visits include well-child visits as well as problem-oriented encounters. The overall utilization of outpatient care and costs are difficult to interpret, because it may represent a more appropriate alternative for care than an ED, but it could also indicate overutilization of care. Additionally, infants with NAS are typically more medically fragile, often require NICU care, and may have lingering health challenges in the first year. It is important to consider if higher use is driven by appropriate medical needs for this high-risk group. To gain more insights into this type of care, vaccinations and well-child visits were also considered in subsequent analyses—children's utilization of care in the first year of life.

Table 16. Incidence and Medicaid costs of health services for babies born to mothers enrolled in IPPP before delivery and the comparison population continuously enrolled for at least 90 days after birth

	IPPP (n=409)	Comparison (n=603)	Difference	p-value
Delivery, average $ (SD)*	9127.70 (21276.10)	8976.70 (26432.90)	151.00	0.9208
Delivery length of stay, average (SD)*	8.8 (18.1)	9.1 (26.9)	-0.3	0.8028
Delivery included NICU, n (%)	145 (34.9)	223 (36.7)	-1.8	0.5962
Delivery included NICU length of stay, average (SD)	16.4 (28.0)	16.9 (41.9)	-0.5	0.8966
Delivery included NICU, average $ (SD)	19926.80 (31396.60)	19242.90 (40733.90)	-683.90	0.8563
Primary diagnosis of NAS at birth, n (%)	44 (10.8)	66 (11.0)	-0.2	0.9251
Any diagnosis of NAS within first 30 days, n (%)	124 (30.3)	183 (30.4)	-0.1	0.9918
Inpatient hospitalization, average number of stays (SD)	0.1 (0.3)	0.1 (0.4)	0	0.6138
Inpatient hospitalization length of stay, average (SD)	0.4 (2.0)	0.8 (6.4)	-0.4	0.1509
Inpatient hospitalization, per person average $ (SD)	129.90 (741.50)	429.40 (3478.90)	-299.50	0.0410
Inpatient hospitalization, conditional average $ (SD)	1897.10 (2198.20)	5885.20 (11686.60)	-3988.10	0.0324
Inpatient hospitalization if NAS diagnosis (30 day), conditional average $ (SD)	1508.10 (1303.10)	4109.50 (7207.20)	-2601.40	0.1641
Emergency department visit, n (%)	102 (24.9)	133 (22.1)	2.8	0.2866
Emergency department visit, average number of events (SD)	0.3 (0.7)	0.3 (0.6)	0	0.6078
Emergency department visit, per person average $ (SD)	85.67 (202.60)	67.91 (172.70)	17.76	0.1472
Emergency department visit, conditional average $ (SD)	343.50 (276.30)	307.90 (248.10)	35.60	0.3002
Emergency department visit if NAS diagnosis (30 day), conditional average $ (SD)	339.30 (200.2)	300.40 (174.60)	38.90	0.3851
Outpatient visit, n (%)	394 (96.3)	571 (94.7)	1.6	0.2240
Outpatient visit, per person average $ (SD)	609.50 (572.70)	542.70 (632.00)	66.80	0.0812
Outpatient visit, conditional average $ (SD)	632.70 (570.70)	573.10 (635.90)	59.60	0.1286
Prescription drugs, per person average $ (SD)	16.27 (64.66)	10.66 (47.84)	5.61	0.2196
Prescription drugs, conditional average $ (SD)	45.27 (134.80)	31.06 (77.78)	14.21	0.2514
Total costs, per person average $ (SD)	9499.40 (19911.70)	9716.90 (24470.60)	-217.50	0.8767
Total costs, conditional average $ (SD)	9522.70 (19930.50)	9831.00 (24591.30)	-308.30	0.8270

**Delivery birth costs identified for children of IPPP mothers, n=404 and comparison mothers, n=589; p-value for chi-squared test or t-test.*

When limited to infants born to mothers enrolled in IPPP during pregnancy, overall results in Table 16 were similar to the full population, with the exception of inpatient hospitalization costs. The average costs of inpatient hospitalizations for infants from mothers in the IPPP program were lower by approximately $300 per person overall (p-value 0.0410) and $3988 per person (p-value 0.0324), with much less variation than the comparison population as noted by the standard deviation.

Table 17. Incidence and Medicaid costs of health services for babies born to mothers enrolled in IPPP and the comparison population continuously enrolled for at least 365 days after birth

	IPPP (n=453)	Comparison (n=452)	Difference	p-value
Inpatient hospitalization, n (%)	61 (13.5)	55 (12.2)	1.3	0.5593
Inpatient hospitalization, average number of stays (SD)	0.2 (0.6)	0.2 (0.8)	0	0.9927
Inpatient hospitalization length of stay, average (SD)	1.7 (8.9)	2.1 (18.9)	0.4	0.6888
Inpatient hospitalization, per person average $ (SD)	957.80 (8758.90)	904.40 (7021.10)	53.40	0.9193
Inpatient hospitalization, conditional average $ (SD)	7113.00 (23096.20)	7432.10 (19034.00)	-319.10	0.9352
Emergency department visit, n (%)	277 (61.2)	236 (52.2)	9.0	0.0067
Emergency department visit, average number of events (SD)	1.4 (2.0)	1.1 (1.5)	0.3	0.0085
Emergency department visit, per person average $ (SD)	319.20 (468.70)	250.20 (363.70)	69.00	0.0136
Emergency department visit, conditional average $ (SD)	524.00 (503.50)	479.30 (379.00)	44.70	0.2638
Outpatient visit, n (%)	450 (99.3)	445 (98.5)	0.8	0.2021
Outpatient visit, per person average $ (SD)	2040.70 (3297.40)	1627.80 (1911.90)	412.90	0.0215
Outpatient visit, conditional average $ (SD)	2058.80 (3306.40)	1653.40 (1915.80)	405.40	0.0250
Well-child visits by 1 year, average (SD)	3.5 (2.6)	3.0 (2.6)	0.5	0.0070
No well-child visits, n (%)	141 (31.1)	173 (38.3)	-7.2	0.0239
1 well-child visit, n (%)	4 (0.9)	4 (0.9)	0	0.9975
2 well-child visits, n (%)	8 (1.8)	11 (2.4)	-0.6	0.4836
3 well-child visits, n (%)	19 (4.2)	21 (4.7)	-0.5	0.7409
4 well-child visits, n (%)	38 (8.4)	41 (9.1)	-0.7	0.7162
5 well-child visits, n (%)	112 (24.7)	95 (21.0)	3.7	0.1844
6 well-child visits, n (%)	117 (25.8)	100 (22.1)	3.7	0.1919
7 well-child visits, n (%)	14 (3.1)	7 (1.6)	1.5	0.1235
Prescription drugs, per person average $ (SD)	145.50 (1010.70)	123.50 (795.10)	22.00	0.7163
Prescription drugs, conditional average $ (SD)	186.70 (1141.90)	163.70 (912.10)	23.00	0.7693
Total costs, per person average $ (SD)	12160.80 (23162.70)	11530.30 (32026.80)	630.50	0.7345
Total costs, conditional average $ (SD)	12160.80 (23162.70)	11555.90 (32057.70)	605.00	0.7452

p-value for chi-squared test or t-test.

Utilization and costs for children continuously enrolled in Medicaid for the first year of life are shown in Table 17. Well-child visits through 1 year were calculated using either (a) procedure or (b) diagnosis codes as shown in Table 3 and measured based on counts for visits that occurred within

two weeks, 1 month, 2 months, 4 months, 6 months, 9 months, and 1 year after birth based on the recommended schedule. Because the observation window is exactly 365 days and the 1 year well visit could occur after this and be on schedule, and some children may have had birth stays that eclipsed two weeks, the optimal number of visits during this time period is not well-defined. Therefore, we present the average number of visits and the proportion with each count of visits as of 1 year of age.

There were some notable differences between the populations in utilization and cost outcomes. Emergency department utilization was greater among the children of IPPP-enrolled mothers by 8.9 percentage points (p-value 0.0067). Consequently, the per person average was greater by approximately $69 (p-value 0.0136); however, costs conditional upon utilization were not statistically different between populations. Thus, children of mothers in IPPP are more frequently being treated in the ED, but these visits are not more or less costly than the comparison population. Further research may be warranted to better understand the nature of this care; for example, to understand if it is appropriate use of the ED. Additionally, the children of IPPP-enrolled mothers had greater outpatient costs (conditional upon utilization average = $405 higher; p-value 0.0250). Almost all children had at least one outpatient visit during their first year of life, but the greater costs may reflect more frequent utilization. For example, children of mothers in the comparison group were approximately 7 percentage points more likely to have 0 well-child visits than children of IPPP-enrolled mothers (p-value 0.0239), who had on average 0.5 more well-child visits (p-value 0.0070). Taken together, these results suggest children with a mother enrolled in IPPP utilized outpatient care more frequently, especially well-child visits that deliver important preventative care such as vaccinations and anticipatory guidance. This would suggest that the greater utilization of the ED was not related to substitution of outpatient care (care that could be received by a primary care pediatrician) but may be appropriate utilization for conditions that warrant emergency treatment.

Utilization and costs for children continuously enrolled in Medicaid for the first year of life and whose mothers enrolled in IPPP during pregnancy are shown in Table 18. These results are consistent with the full population of children with IPPP-enrolled mothers that was shown in Table 17.

Table 18. Incidence and Medicaid costs of health services for babies born to mothers enrolled in IPPP before delivery and the comparison population continuously enrolled for at least 365 days after birth

	IPPP (n=297)	Comparison (n=452)	Difference	p-value
Inpatient hospitalization, n (%)	37 (12.5)	55 (12.2)	0.3	0.9059
Inpatient hospitalization, average number of stays (SD)	0.2 (0.4)	0.2 (0.8)	0	0.4344
Inpatient hospitalization length of stay, average (SD)	1.3 (5.6)	2.1 (18.9)	-0.8	0.4866
Inpatient hospitalization, per person average $ (SD)	480.90 (2327.80)	904.40 (7021.10)	-423.50	0.2358
Inpatient hospitalization, conditional average $ (SD)	3860.00 (5581.10)	7432.10 (19034.00)	-3572.10	0.1945
Emergency department visit, n (%)	182 (61.3)	236 (52.2)	9.1	0.0145
Emergency department visit, average number of events (SD)	1.4 (2.0)	1.1 (1.5)	0.3	0.0274
Emergency department visit, per person average $ (SD)	328.30 (495.10)	250.20 (363.70)	78.10	0.0200
Emergency department visit, conditional average $ (SD)	535.70 (537.70)	479.30 (379.00)	56.50	0.2292
Outpatient visit, n (%)	294 (99.0)	445 (98.5)	0.5	0.5299
Outpatient visit, per person average $ (SD)	2056.10 (3580.30)	1627.80 (1911.90)	428.30	0.0592
Outpatient visit, conditional average $ (SD)	2084.20 (3596.60)	1653.40 (1915.80)	430.80	0.0606
Well-child visits by 1 year, average (SD)	3.5 (2.6)	3.2 (2.6)	0.3	0.0120
No well-child visits, n (%)	93 (31.3)	173 (38.3)	-7.0	0.0515
1 well-child visit, n (%)	3 (1.0)	4 (0.9)	0.1	0.8618
2 well-child visits, n (%)	3 (1.0)	11 (2.4)	-1.4	0.1594
3 well-child visits, n (%)	13 (4.4)	21 (4.7)	-0.3	0.8627
4 well-child visits, n (%)	24 (8.1)	41 (9.1)	-1.0	0.6378
5 well-child visits, n (%)	74 (24.9)	95 (21.0)	3.9	0.2118
6 well-child visits, n (%)	74 (24.9)	100 (22.1)	2.8	0.3761
7 well-child visits, n (%)	13 (4.4)	7 (1.6)	2.8	0.0188
Prescription drugs, per person average $ (SD)	168.90 (1224.00)	123.50 (795.10)	45.40	0.5721
Prescription drugs, conditional average $ (SD)	211.70 (1121.20)	163.70 (912.10)	48.00	0.6374
Total costs, per person average $ (SD)	12232.20 (23028.80)	11530.30 (32026.80)	701.90	0.7275
Total costs, conditional average $ (SD)	12232.20 (23028.80)	11555.90 (32057.70)	676.30	0.7373

p-value for chi-squared test or t-test.

Limitations

Analyses of claims data has inherent limitations, in that claims represent billed and reimbursed services, which does not always provide an equivalent representation of a patient as a clinical record. That is, claims data has limitations in measuring non-reimbursable outcomes such as presence or absence of symptoms, illicit drug use, or quality of life. One notable example is the ability to measure whether mothers received a post-partum depression screening as well as what the results of that screening indicate. Similarly, among children in this analysis, we were unable to provide a measure of developmental milestones—more specifically, whether differences might occur in the early detection of missed milestones. Another limitation of claims data is the use of Z-codes to represent social determinants of health, which may be sensitive to documentation practices and whether health systems are resourced to intervene to address the needs. Thus, Z-codes approximate prevalence of social determinants of health, likely an underestimate, the extent to which may be less for the IPPP mothers due to the presence of case management. Finally, claims data has limitations in the ability to attribute service utilization to specific conditions. For example, we provide inpatient and ED costs for infants with NAS but did not differentiate whether all of the claims for these services had a NAS diagnosis on the claim. The strength of association with a NAS diagnosis on the claim and the condition's influence on the occurrence of and costs of health service utilization may be subject to clinical judgement and billing practices.

Our proxy measure of out of home placement includes adoption and foster care based on Medicaid enrollment information. Consequently, this may underestimate out-of-home placement if not recorded in Medicaid, or because of the lack of granular dates, it could overestimate. This evaluation did not look at reunification rates among families in IPPP and the comparison population, which are additional outcomes of importance.

Our measure of infant and maternal mortality only includes deaths in the 1 year postpartum and relies on Medicaid enrollment records having a death date. This means we can only capture deaths among children and mothers who maintained continuous enrollment for 1 year postpartum, or died within that time, and Medicaid updated the enrollment records to reflect that death. Some limitations of the death data must be noted. First, this may undercount the true number of deaths, and it may disproportionately undercount those in the comparison population given the presence of case management for the IPPP group. Second, because our study design has an inclusion criteria of live birth, we cannot measure deaths during pregnancy. By calculating maternal death in the 1-year postpartum period, we provide an important metric, but one that would inherently be greater than the state population averages due to the study design. Third, the lack of cause of death prevents any analyses of whether differences may exist between groups. A more comprehensive analysis of maternal mortality would incorporate vital statistics records.

Costs represent nominal dollars reimbursed by Medicaid are not inflation-adjusted. Given the matched study design, over a short time horizon, and is not comparing costs over time, inflation-adjustment would have a minimal effect on the estimated costs.

Concluding Summary

The evaluation of the Indiana Pregnancy Promise Program (IPPP) yielded several important insights into the program's impact on maternal and child health outcomes. First, we demonstrated that a propensity score matching is feasible and effective in identifying a comparison group with similar baseline characteristics to IPPP participants at the time of a live birth delivery while enrolled in Medicaid. This is critically important when robustly assessing programmatic impact on postpartum/postnatal health outcomes and associated costs while minimizing potential bias. Further, it proved very valuable to engage closely between the academic and state (FSSA) teams while defining the approach and measures of interest given the complexities of the program, the population it serves, and the intent of the evaluation. In several cases, the measures developed not only benefited the proposed analysis but other ongoing work by FSSA.

Mothers and children in the IPPP and comparison populations had high Medicaid enrollment rates (both greater than 95%), extending up to one year postpartum, however the IPPP enrolled mothers were more likely to maintain enrollment and the IPPP group showed a notable increase in engagement with postpartum care including reception of most/moderately effective contraception care, suggesting better continuity of care. At one year postpartum, nearly 98% of the IPPP enrolled mothers were enrolled in Medicaid. This trend also extended to outpatient mental health and substance use disorder services, where higher utilization was observed in the IPPP population, potentially indicating more comprehensive care for these women. Furthermore, there was a greater frequency of mothers from IPPP who had an opioid use disorder (OUD) diagnosis postpartum and although the rates among those with and OUD diagnosis were similar, the IPPP population overall had greater utilization/continuity of medications for opioid use disorder (MOUD). Taken together, the case management provided by IPPP may have improved access and navigation with the health system for IPPP mothers, especially with respect to treating mental health (MH) and substance use disorder (SUD), which is critical for the prevention of OUD relapse/return to use. This extended to children born to IPPP-enrolled mothers, who also high higher rates of well-child visits and greater vaccination uptake. These outcomes are important to consider because they are consistent with the CMS Maternal Opioid Misuse (MOM) Model goals to improve the integration of maternity care with behavioral health and OUD treatment, provide care coordination, and other supports to alleviate common barriers to care such as transportation, childcare, and stigma around seeking treatment for opioid use disorder.

Although the observed reduction in maternal deaths in the IPPP population—three fewer deaths compared to the comparison group—was not statistically significant, it highlights a potential benefit of the program, particularly given that both populations had maternal mortality rates (IPPP: 437.6 per 100,000 live births; comparison 1108.6 per 100,000 live births) significantly higher than the Indiana state four-year average of 92.2 per 100,000 live births from 2018-2021.[d,e] An important driver of maternal mortality is substance use and this reduction is consistent with the IPPP cohort's greater utilization of postpartum care and MH/SUD outpatient treatment, both of which contribute to improved maternal health outcomes over time.

[d] https://policyinstitute.iu.edu/doc/maternal-mortality-brief.pdf
[e] https://www.in.gov/health/safesleep/files/MMRC-Annual-Report-2023.pdf

Delivery costs were slightly lower for women in the IPPP program, although inpatient and emergency department visits were comparable between both groups. On the other hand, there was higher utilization and associated costs for outpatient services in the IPPP group, potentially reflecting increased engagement with health services, notably mental health and substance use care in outpatient settings.

For infants, the IPPP program demonstrated a notable reduction in infant mortality, with a rate of 10.9 per 1,000 live births compared to 19.5 per 1,000 in the comparison group, though both rates remain above the state average.[f] Other notable findings were the increased utilization of outpatient services (including well-child visits) and improved vaccine schedule adherence by children born to IPPP-enrolled mothers. These findings suggest that case management provided to IPPP mothers extend to their children—particularly given the consistency of outpatient utilization among both mothers and infants. Data limitations prevented a comprehensive analysis of out of home placement among children, but proxy measures from Medicaid enrollment category were able to provide important insights. Based on these data, there was a lower prevalence of out of home placement among children born to IPPP enrolled mothers. Although this was not statistically significant at conventional levels, this is an opportunity for more future research. Overall, the findings indicate that the Indiana Pregnancy Promise Program has the potential to improve both maternal and infant health outcomes, though there are areas where further analysis could confirm the program's overall cost-effectiveness and long-term economic benefits.

[f] https://www.in.gov/health/mch/files/2022-Infant-Mortality.pdf

Appendices

Appendices to this report were shared in a zipped folder along with this report. Appendices include:

- Appendix A – Final Pregnancy Phenotypes
- Appendix B – Final Chronic Conditions Phenotypes
- Appendix C – MOUD Drug NDC Codes
- Appendix D – MOUD Procedure Codes
- Appendix E – Objective 1 Technical Write Up
- Appendix F – Contraceptive Codes
- Appendix G – Outpatient POS
- Appendix H – Hepatitis C Treatment Medications
- Appendix I – Adult OUD Codes