Cash Transfers in the Perinatal Period and Investigations of Infant Maltreatment: Quasi-Experimental Evidence from the Rx Kids Program

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Abstract

Infants are most vulnerable to child maltreatment, which may be due in part to economic instability during the perinatal period. In 2024, Rx Kids was launched in Flint, Michigan, achieving near 100% aggregate take up and providing every expectant mother with unconditional cash transfers during pregnancy and infancy. Synthetic difference-in-differences was used to compare changes in allegations of maltreatment within the first six months of life in Flint before and after implementation of Rx Kids relative to the corresponding change in control cities without the program. In the three years prior to the implementation of Rx Kids, the proportion of infants with a maltreatment allegation within the first six months of life was 21.7% in Flint and 19.5% among control cities. After implementation of Rx Kids in 2024, the maltreatment allegation rate dropped to 15.5% in Flint, falling below the maltreatment allegation rate of 20.6% among the control cities. Rx Kids was associated with a statistically significant 7.0 percentage-point decrease in the maltreatment allegation rate, corresponding to a 32% decrease relative to the pre-intervention period. There was a decrease in the rate of neglect-related, non-neglect-related, and substantiated allegations; these were directionally consistent with the primary outcome but not statistically significant. Results were robust to alternative model specifications. The Rx Kids prenatal and infant cash prescription program led to a significant reduction in allegations of maltreatment among infants. These findings provide important evidence about the role of economic stability in preventing child welfare system involvement.

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1. Introduction

Poverty is a major risk factor for child maltreatment and involvement with the child welfare system (Hunter and Flores 2021). Children living in low-income households experience maltreatment at 5 times the rate of other children and are 7 times more likely to experience neglect-specific maltreatment (Sedlak et al. 2010). Living in communities of concentrated disadvantage also increases maltreatment risk (Maguire-Jack and Sattler 2023; Kim and Drake 2023). There are several possible interrelated mechanisms: Poverty increases the material hardships faced by families, including food and housing insecurity, and can limit parents' ability to purchase essential items for their children (e.g., diapers, car seats, adequate clothing, utilities). Financial strain also contributes to family stress, which can undermine the capacity of parents to provide a safe, stable, and nurturing home environment, and increases parental risk of mental health challenges, substance use, partner conflict, and domestic violence (against children or an intimate partner) (Conger and Donnellan 2007; Mani et al. 2013; Masarik and Conger 2017; Feely et al. 2020). Consequently, a growing body of research finds that income supports in the U.S., such as refundable tax credits, can prevent child maltreatment (Palermo et al. 2024; Machado et al. 2024; Pac et al. 2023).

Infants (under 1 year of age) are the most vulnerable to maltreatment, with a substantiated allegation rate 2 to 4 times greater than other pediatric age groups (U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau 2025). The heightened physical and mental demands of the perinatal period—coupled with the acute economic shock from decreasing income and increasing expenses before and after birth—present unique vulnerabilities that can exacerbate risk factors associated with child maltreatment (Berger 2004;

Stanczyk 2020; Hamilton et al. 2023; Marçal et al. 2023). Health-related factors in the perinatal period, such as inadequate prenatal care, low birthweight, and prematurity, also increase the risk for infant maltreatment (Austin, Parrish, and Shanahan 2018; Puls et al. 2019; Buek and Mandell 2024). Whether a time-bound perinatal cash transfer program can prevent investigations into alleged maltreatment remains an open question and one of critical importance given the lifelong trajectories of early life adversity.

In January 2024, Rx Kids launched in Flint, Michigan, a mid-sized city with one of the nation's highest child poverty rates. All expectant mothers residing in the city of Flint are eligible for a one-time transfer of $1,500 mid-pregnancy and $500 monthly after birth until age one. Rx Kids is the first cash transfer program in the U.S. that targets the perinatal period with universal eligibility (i.e., community-wide and no means testing based on income or asset thresholds). The program has achieved a high aggregate take-up of nearly 100% (Zamani-Hank et al. 2026), and prior work has demonstrated improved family financial security, prenatal care utilization, birth outcomes, and maternal mental health, leading to the hypothesis that the program could reduce child maltreatment and prevent child protective services (CPS) investigations (Agarwal et al. 2025; Hanna et al. 2025; Hanna, Agarwal, and Shaefer 2025). Our research tests this hypothesis by using a quasi-experimental study design to examine the effects of Rx Kids on the prevention of investigated allegations.

Using synthetic difference-in-differences to estimate the change in Flint before and after Rx Kids implementation compared to a the corresponding change a synthetic control constructed from a donor pool of 21 control cities, Rx Kids was associated with a statistically significant 7.0 percentage-point decrease (95% CI, -12.9 to -1.0; $p = 0.021$) in the investigated allegation rate, corresponding to a 32% decrease (95% CI, -59 to -5) relative to the rate in Flint

during the pre-intervention period. There was also a decrease in the rate of neglect-related and non-neglect-related allegations, similar in magnitude on an absolute and relative basis, and the rate of substantiated allegations; these were directionally consistent with the overall investigated allegation rate but not statistically significant. In sensitivity analyses, the results were robust to excluding city characteristics as covariates, using an alternative donor pool, and adding two additional years to the pre-intervention period. Synthetic difference-in-differences was a more robust and appropriate method compared to the original synthetic control method.

Rx Kids may have prevented maltreatment investigations through multiple, overlapping pathways. Poverty is a risk factor for CPS referral and increasingly recognized as causally linked to child maltreatment (Feely et al. 2020). It may also be co-morbid with a range of factors that lead to neglect or abuse, including behavioral health conditions (Ridley et al. 2020). A prior study of Rx Kids showed that the program was associated with reductions in food insecurity, housing instability, and other financial hardships (Hanna et al. 2025). In fact, Rx Kids led to a near-elimination of postpartum evictions among eligible mothers, consistent with evidence from eviction moratoria during the Covid-19 pandemic that reduced county-level rates of child maltreatment (Zhang, Wang, and Berger 2025). The Rx Kids program was also associated with improvements in maternal mental health and parenting stress (Finegood et al. 2025; Hanna et al. 2025; Wolock et al. 2026). The reduction in financial strain and parental stress can in turn reduce the risk of child maltreatment (Warren and Font 2015; Wu and Xu 2020; Griffith et al. 2022). Furthermore, premature and low birthweight infants have the highest risk for maltreatment (Buek and Mandell 2024). Rx Kids reduced the rate of these adverse birth outcomes (Agarwal et al. 2025), suggesting another pathway the program could have prevented maltreatment investigations.

This study contributes to a large literature of income supports showing that cash transfers can prevent child maltreatment (Berger et al. 2017; Kovski et al. 2022b; a; Johnson-Motoyama et al. 2022; Biehl and Hill 2018; Coffey et al. 2024; Rittenhouse 2023; Bullinger, Packham, and Raissian 2023; Bullinger and Boy 2023; Raissian and Bullinger 2017; Machado et al. 2024; Schneider, Bullinger, and Raissian 2022; Courtin et al. 2019; Pac et al. 2023; Palermo et al. 2024; Cancian, Yang, and Slack 2013; Klevens et al. 2017; Cusick et al. 2024; Puls et al. 2021). Two particularly relevant studies examined such programs during the perinatal period. Rittenhouse used the discontinuity in tax benefits on January 1, around which infants born on either side of a calendar year receive very different refunds during infancy (Rittenhouse 2023). The study found that an additional $1,000 in tax benefits during infancy led to a 3% decline in the number of CPS referrals, investigations, and substantiated referrals by age 3 among low-income households. Bullinger et al. leveraged year-to-year variation in cash transfers from the Alaska Permanent Fund Dividend (Bullinger, Packham, and Raissian 2023), finding that an additional $1,000 in dividend payments led to a 10% reduction in unsubstantiated cases of child maltreatment and a 15% reduction in substantiated cases by age 3. The magnitude of our estimates, scaled for the size of the Rx Kids cash transfer ($4,500 by age 6 months) and assuming the effects persist beyond 6 months of age, are closer to that of Bullinger et al., possibly due to Rx Kids and the Alaska Permanent Fund Dividend both being universal in design and characterized by high take-up. Our findings alongside the prior literature support current policy efforts focused on providing concrete economic support to prevent child welfare system involvement, most notably embodied by the Family First Prevention Services Act of 2018 (The Annie E. Casey Foundation 2025). Our study also contributes to the literature on the use of

synthetic difference-in-differences versus the synthetic control method, discussed in greater detail in Section 6.

The paper proceeds as follows. Sections 2 provides an overview of the Rx Kids intervention. Sections 3 and 4 describe the data and empirical strategy. Section 5 presents the results. Section 6 discusses the results using synthetic difference-in-differences versus the original synthetic control method. Section 7 concludes.

2. The Rx Kids Cash Prescription Program

To address how poverty influences maternal and infant health, the Rx Kids cash prescription program was launched in Flint, Michigan, by Michigan State University–Hurley Children's Hospital Pediatric Public Health Initiative, in collaboration with Poverty Solutions at the University of Michigan. Rx Kids began enrolling participants in January 2024. Eligible participants enroll online and must provide documentation of 1) their residency within the city of Flint and 2) pregnancy or childbirth status as confirmed by medical documentation. After verification, the program provides participants with $1,500 during pregnancy (i.e., after 20 weeks gestation in 2024 and after 16 weeks gestation in 2025) and $500 per month for 12 months after birth, totaling $7,500 in unconditional cash and made available via direct deposit to a bank account or prepaid debit card. The program is administered by the nonprofit GiveDirectly and funded with support from the Temporary Assistance for Needy Families block grant, as well as other public and philanthropic grants. As a non-taxable gift to beneficiaries, the cash transfers are not subject to income taxes and do not affect eligibility for most other public benefits (Hanna and Shaefer 2024). No other major changes were identified in local economic conditions, CPS reporting and investigation practices, or perinatal supports and services that would coincide with the timing of the implementation of Rx Kids in Flint. Given Rx Kids' nearly 100% take-up

(Zamani-Hank et al. 2026), the exposure was defined as Flint residence among infants born in 2024 after Rx Kids implementation.

3. Data and Outcomes

This study used administrative data from Children's Protective Services in Michigan for all investigated maltreatment allegations among infants from January 2019 through June 2025. The data was provided to the University of Michigan's Child and Adolescent Data Lab under an agreement with the Michigan Department of Health and Human Services (MDHHS). The data included demographic information (e.g., date of birth, address), report date, details on the type of alleged maltreatment, and whether an allegation was substantiated. In our primary analysis, we focused on investigated allegations among infants born in 2021 through 2024 due to changes in reporting in 2019 and 2020 related to the Covid-19 pandemic (Bullinger et al. 2023; Berger et al. 2025). Infants born in 2019 and 2020 were included in sensitivity analyses described below. MDHHS also provided the study team with statewide data on all births from 2021 through 2024 based on birth certificate records, and we imputed or obtained data for birth counts from 2019 and 2020 from publicly available records. Data were geocoded based on address to the city level, after which we used a deidentified version of the data for the analysis. We obtained additional data from the 2019-2023 U.S. Census Bureau's American Community Survey comprising the demographic and socioeconomic characteristics of cities. This study was approved by the institutional review boards at the University of Michigan and Michigan State University.

The primary study outcome was investigated maltreatment allegations within the first 6 months of life. Investigated allegations were aggregated to the annual level based on the infant's date of birth, and the investigated allegation rate was calculated using yearly denominators of city birth counts. The outcomes were defined through 6 months of follow-up to ensure complete

follow-up for all infants born in 2024, and because most investigations among infants occur during the first 6 months of life (Kovski, Berger, and Cancian 2025). Secondary outcomes included whether an allegation was substantiated after investigation (substantiated allegations) and whether an allegation was classified as one related to neglect or non-neglect such as physical, emotional, or sexual abuse.

4. Empirical Strategy

We used the quasi-experimental synthetic difference-in-differences method to compare changes in outcomes in Flint before and after Rx Kids implementation relative to the corresponding change in comparable cities without the program (Arkhangelsky et al. 2021; Clarke et al. 2024). The method is the most appropriate and valid for situations such as ours with a single treated unit (cluster) and group-level data among a panel of cities. The original synthetic control method was also considered for this analysis (Abadie, Diamond, and Hainmueller 2010, 2015), but as described further in section 6, this method is known to have problems when applied to short panels of data, which can lead to faulty statistical inference (Hollingsworth and Wing 2020; Abadie and Vives-i-Bastida 2022). Synthetic difference-in-differences has been used in policy evaluations as a strategy for constructing a credible counterfactual by reweighting data from multiple untreated units and pre-intervention periods to approximate how the treated unit would have evolved absent the intervention.

Using synthetic difference-in-differences, the synthetic control for Flint was constructed from a donor pool of control cities without Rx Kids. Because the city of Flint has one of the highest child poverty rates (59% in 2023) and largest proportions of Black residents (56%) in the state—factors that are highly correlated with CPS reporting and involvement—we restricted the pool of potential control cities to mid-sized cities with a population of 5,000 to 125,000, a

poverty rate of at least 15%, and a non-Hispanic Black population of at least 20%, which led to a donor pool of 21 control cities that resembled Flint most closely in terms of population size, poverty rate, and racial composition (Agarwal et al. 2025; Hanna, Agarwal, and Shaefer 2025). After excluding areas adjacent to the city of Flint such as Beecher and Flint Township as well as Kalamazoo, which had its own perinatal programming during our study period, the twenty-one cities that met the criteria included Albion, Benton Harbor, Benton Township, Bridgeport Township, Buena Vista Township, Eastpointe, Ecorse, Harper Woods, Highland Park, Inkster, Jackson, Lansing, Muskegon, Muskegon Heights, Pontiac, River Rouge, Saginaw, St. Louis (in Michigan), Wayne, Ypsilanti, and Ypsilanti Township.

A potential concern with this donor pool, despite being pre-specified, is that it includes a relatively small number of cities as well as a few relatively small-sized cities. We conducted a sensitivity analysis using a distinct donor pool of control cities that was also available in the data, specifically 63 of the most populous cities in Michigan excluding townships and similarly excluding Kalamazoo as above. These 63 cities included: Adrian, Allen Park, Ann Arbor, Auburn Hills, Battle Creek, Bay City, Birmingham, Burton, Canton, Clinton, Dearborn, Dearborn Heights, Detroit, East Lansing, Eastpointe, Farmington Hills, Ferndale, Forest Hills, Garden City, Grand Rapids, Hamtramck, Holland, Holt, Inkster, Jackson, Kentwood, Lansing, Lincoln Park, Livonia, Madison Heights, Marquette, Midland, Monroe, Mount Pleasant, Muskegon, Norton Shores, Novi, Oak Park, Okemos, Pontiac, Port Huron, Portage, Redford, Rochester Hills, Romulus, Roseville, Royal Oak, Saginaw, Saint Clair Shores, Shelby, Southfield, Southgate, Sterling Heights, Taylor, Troy, Walker, Warren, Waterford, Waverly, Westland, Wyandotte, Wyoming, and Ypsilanti. This was not our preferred donor pool specification because the criterion of the largest cities diverged from the pre-specified criteria

used in prior Rx Kids studies, and it leads to a donor pool substantially different than Flint on key dimensions that are related to child maltreatment. For example, the median poverty rate of these 63 cities was 11.6% (which is different than Flint by almost a factor of three), and the median proportion of non-Hispanic Black residents was 8.2% (which is different than Flint by nearly a factor of seven). This is particularly important when using the synthetic control method, but several features of synthetic difference-in-differences make it less sensitive to the composition of the donor pool (see section 6).

Using data from the years prior to Rx Kids implementation, the algorithm of synthetic difference-in-differences assigned weights to donor pool cities as well as time-specific weights to generate a synthetic control that follows the same trends in outcomes as Flint in the pre-intervention period and approximates how Flint would have evolved in the post-intervention period in the absence of Rx Kids. City characteristics, including poverty rate, median household income, racial and educational composition, additional household characteristics (proportion that were female-headed, renter-occupied, or housing-burdened), and total population, were included as covariates. Unit and time weights were estimated through a regularized optimization procedure, which was implemented using the sdid and sdid_event packages in Stata (Arkhangelsky et al. 2021; Clarke et al. 2024). In short, the optimization procedure determines (1) unit weights that balance the pre-intervention trend in the outcome, residualized for the covariates, among the unexposed units with that of the exposed unit and (2) time weights that balance pre- and post-intervention periods for the outcome among the unexposed units. Regularization ensures well-dispersed, stable weights and prevents overfitting. These weights are then used in a weighted two-way fixed effects regression of difference-in-differences. An event study approach was used to assess for parallel trends in the pre-intervention period. The coefficient of interest from synthetic difference-in-differences was estimated as the change in

outcomes in Flint before and after the Rx Kids implementation compared to the corresponding weighted change in control cities without the program.

To examine whether observed changes in Flint could have arisen due to chance, synthetic difference-in-differences uses permutation-based placebo tests, a form of exact inference in which treatment is iteratively reassigned to control cities in the donor pool to generate a reference distribution against which a p-value can be calculated, particularly in the context of a single treated cluster. All statistical tests were 2-tailed with a level of significance set at $P<0.05$. We conducted several sensitivity analyses to probe the robustness of our results to the exclusion of city characteristics as covariates, time aggregation at the half-year level, an alternative donor pool of control cities that was also available in the data consisting of 63 of Michigan's most populous cities, and the length of the pre-intervention period. We also examined the results using the original synthetic control method, demonstrating how it leads to faulty inference in settings with a short panel. Finally, we assessed for changes in birth counts or any compositional change in who gives birth and conducted a sensitivity analysis focusing on the number of investigated maltreatment allegations as an outcome.

5. Results

From January 2021 through June 2025, there were 40,332 investigated allegations of child maltreatment within the first 6 months of life in Michigan among 404,292 infants born in 2021 through 2024 for a statewide rate of 10.0% over the study period. In the 3 years prior to the implementation of Rx Kids, the proportion of infants with an investigated maltreatment allegation within the first 6 months of life was 21.7% (646/2971) in Flint and 19.5% (3921/20124) among control cities (table 1); the trend was relatively stable from 2021 to 2023. After implementation of Rx Kids in 2024, the investigated allegation rate dropped to 15.5%

(165/1065) in Flint, falling below the investigated allegation rate of 20.6% (1303/6317) among control cities (Figures 1 and 2). The investigated allegation rate in the control cities increased modestly over the same time period.

Using synthetic difference-in-differences to estimate the change in Flint before and after Rx Kids implementation compared to the corresponding change in control cities without the program, Rx Kids was associated with a statistically significant 7.0 percentage-point decrease (95% CI, -12.9 to -1.0; p = 0.021) in the investigated allegation rate (Figure 3; Table 2), corresponding to a 32% decrease (95% CI, -59 to -5) relative to the rate in Flint during the pre-intervention period. The weights used to generate the synthetic control are presented in Tables 3 and 4 and Figure 4, and trends were parallel in the pre-intervention period (Figure 3). There was also a decrease in the investigated allegation rate at the half-year level (Figure 5) as well as a decrease in the rate of neglect-related and non-neglect-related allegations, similar in magnitude on an absolute and relative basis, and the rate of substantiated allegations; these were directionally consistent with the primary outcome but not statistically significant (Table 2).

In sensitivity analyses, the results were robust to excluding city characteristics as covariates, using an alternative donor pool, and adding two additional years to the pre-intervention period (Table 5). As a final sensitivity check, we found a 10% increase in the number of births in Flint but no significant compositional change (Table 6); furthermore, despite an increase in births in Flint that was concentrated at the beginning of 2024, Rx Kids was associated with a significant reduction in the number of investigated allegations in both halves of 2024 as well as overall for the year (-56.9 investigated allegations [95% CI, -76.4 to -37.3]) (Table 6).

6. Synthetic Difference-in-Differences versus Synthetic Control Method

When it was developed, the synthetic control method introduced a relatively new class of quasi-experimental methods (Abadie and Gardeazabal 2003; Abadie, Diamond, and Hainmueller 2010, 2015; Abadie 2021). It is useful in situations such as ours with a single treated unit and group-level data among a panel of cities. A well-known requirement of the method, however, is a long panel of data. This ensures that the creation of the synthetic controls for treated and placebo units is not based on idiosyncratic noise. As Abadie et al. wrote, "if the number of preintervention periods in the data is large, matching on preintervention outcomes (i.e., on the preintervention counterparts of Y0 and Y1) helps control for unobserved factors and for the heterogeneity of the effect of the observed and unobserved factors on the outcome of interest" (Abadie, Diamond, and Hainmueller 2015). Abadie also stated, "With a small number of pre-intervention periods, close or even perfect fit of the predictor values for the treated unit may be spuriously attained" (Abadie 2021). The classic papers by Abadie et al. had 20 years (Abadie and Gardeazabal 2003), 19 years (Abadie, Diamond, and Hainmueller 2010), and 30 years of pre-intervention period data (Abadie, Diamond, and Hainmueller 2015). Our data, however, has a maximum of 5 years of pre-intervention period data. Most published studies using this method have many more years of data to ensure accurate identification for causal inference.

One of the key problems with short panels of data in the synthetic control method is that it increases the probability of a perfect or near-perfect fit based on idiosyncratic noise, a phenomenon known as "overfitting." This is particularly problematic when the number of units in the donor pool is large relative to the number of pre-intervention periods. As one paper described it, "This leads to a high dimensional donor pool in which the number of control units exceeds the length of the pre-period. The conventional strategy for choosing synthetic control weights breaks down in this high dimensional case. In addition, a high dimensional donor pool

may raise concerns about over-fitting in the pre-period data" (Hollingsworth and Wing 2020). The problems of a short pre-intervention period and many donor units are discussed further in yet another article outlining the key principles of the synthetic control method (Abadie and Vives-i-Bastida 2022). With 63 cities in the donor pool plus Flint and only 5 years of pre-period data, for example, this large donor pool and few pre-intervention periods substantially raises the risk of overfitting based on idiosyncratic noise and leads to problems for their use of synthetic control method.

The results using the original synthetic control method show effect sizes that are similar across all specifications. Flint had the largest or second largest reduction in the investigated allegation rate compared to the placebo tests for all other units in the pre-specified and alternative donor pools. Statistical inference under the synthetic control method, however, can be unreliable in the setting of few pre-intervention periods and many cities in the donor pool. In the synthetic control method, p-values are determined by comparing the root mean square prediction error (RMSPE) ratio for Flint against a reference distribution of RMSPE ratios from placebo tests.1-3 Each ratio in the distribution is calculated as the root mean squared prediction error in the post-intervention period (the post-RMSPE) divided by the root mean squared prediction error in the pre-intervention period (the pre-RMSPE). For the 1st, 2nd, and 4th specifications in Table 7, RMSPE ratios range from less than one to the billions and trillions, driven by the denominator (pre-RMPSE); this is evidence of overfitting to idiosyncratic noise, the risk of which increases with short panels of data and large donor pools. The synthetic control method is not appropriate or valid in such a setting; in fact, there is no effect size for Flint large enough to be statistically significant, implying 0% statistical power. Extending the pre-intervention period, when possible, and trimming the donor pool to units similar to the treated unit in the pre-intervention period can

correct this issue of overfitting, as suggested by the 3rd specification listed in Table 7 that used 5 years in the pre-intervention period and a smaller group of donor units more similar to Flint (i.e., the 21 control cities in the prespecified donor pool that resembled Flint most closely in terms of population size, poverty rate, and racial composition). Synthetic difference-in-differences has several features that improve upon known limitations of the synthetic control method and was thus our primary method for studying the effect of Rx Kids on child welfare system involvement.

The synthetic difference-in-differences methodology combines attractive features of both the original synthetic control method and the difference-in-differences approach. Synthetic difference-in-differences is an extension of the synthetic control method that similarly reweights control cities (Abadie 2021), but it differs from the synthetic control method in its use of both unit-specific and time-specific weights to achieve balance in pre-intervention outcomes, focusing on trends rather than absolute levels to establish parallel trends, a key assumption of the difference-in-differences framework for causal inference. Because it reweights in two dimensions, synthetic difference-in-differences possesses a form of double robustness, thus reducing the chance for bias from unobserved factors. In addition, its use of unit and time fixed effects absorbs additive differences across units and time, further strengthening its robustness relative to the original synthetic control method. Simulation results show that synthetic difference-in-differences dominates other estimators, including the synthetic control method (Arkhangelsky et al. 2021). These features of synthetic difference-in-differences improve statistical power, limit researcher degrees of freedom, and make it less sensitive to the donor pool's composition and better suited to panels with only a few pre-intervention periods. Several empirical papers using synthetic difference-in-differences have implemented and highlight these key features of synthetic difference-in-differences (Bhalotra et al. 2023; Dench, Pineda-Torres,

and Myers 2024; Trejo, Yeomans-Maldonado, and Jacob 2024; Kakara, Bair, and Venkataramani 2024; Dench et al. 2025; Venkataramani et al. 2025).

7. Discussion

Child maltreatment, which includes abuse and neglect, is a pernicious public health problem. Over one third of children in the U.S. experience an investigation for child maltreatment by their 18th birthday (Kim et al. 2017). Children affected by maltreatment have worse mental and physical health, are more likely to be involved in the criminal justice system, attain lower levels of education, and earn less into adulthood (Felitti et al. 1998; Anda et al. 2006; Middlebrooks and Audage 2008; Currie and Widom 2010; Shonkoff et al. 2012; Currie and Tekin 2012). Each case of nonfatal child maltreatment is estimated to cost $1.1 million in 2025 dollars, reaching a national economic burden of approximately $585 billion per year (Peterson, Florence, and Klevens 2018), encompassing costs from health care, the child welfare and criminal justice systems, and other societal impacts (Currie and Widom 2010).

The implementation of Rx Kids, the nation's first community-wide, unconditional prenatal and infant cash transfer program, was associated with a substantial and statistically significant population-level decline in the proportion of infants with an investigated maltreatment allegation within the first 6 months of life. Prior to the implementation of Rx Kids, the investigated allegation rate in Flint was more than double the state rate (21.7% versus 10.0%). After Flint's rate fell to 15.5% in 2024, this disparity between the city and the state narrowed by 50%. Rx Kids prevented an estimated 57 infants from being involved in the child welfare system. These findings represent a consequential prevention of early life adversity with

broad implications for children's health and wellbeing across the life course, which could produce long-term savings and society-wide benefits.

This study has several limitations. First, because Rx Kids was not allocated randomly, there may be residual confounding unaccounted for by our quasi-experimental study design. The use of both unit and time weights establishes parallel trends to ensure the plausibility of the difference-in-differences strategy; it is analogous to techniques such as the adjustment of covariates to address the parallel trends assumption (Arkhangelsky et al. 2021). Relatedly, the primary outcome from our administrative data, investigated allegations of child maltreatment, reflects not only the actual occurrence of maltreatment but also reporting practices (e.g., among mandated reporters) and CPS capacity, screening, and investigation practices; this raises the possibility of confounding if there are concurrent and differential changes in CPS capacity or practices. The child welfare system in Michigan, however, is centrally administered at the state level, so all counties adhere to the same set of standards and practices. Based on discussions with local and statewide experts, including mandated reporters and MDHHS/CPS staff, we are not aware of differential changes related to CPS in Flint (or Genesee County) relative to the control cities (or their respective counties) that coincided with the implementation of Rx Kids. There were also no other major differential changes related to economic conditions, perinatal supports, or emergence from the COVID-19 pandemic. The synthetic difference-in-differences strategy nonetheless relies to some extent on the "common shocks" and "no concurring interventions" assumptions. We are similarly not aware of concurrent interventions specifically in the control cities, but if present, this would bias our results towards the null. Because our data only included infants, we were unable to implement a falsification test such as investigated allegations among older children that would allow us to probe these assumptions further. Older children also

represent an area for future research given the potential for spillover benefits among siblings. Second, our primary analysis focused on births between 2021 and 2024, a relatively short study duration with a single post-period year. The results, however, were robust to the inclusion of two additional years of pre-period data. Furthermore, trends were stable in the pre-intervention period, with each datapoint for Flint representing approximately 1000 births, which limits the influence of random fluctuation. We are unable to demonstrate sustainability of the results with a single year of post-period data. Part of our pre-intervention period coincided with the COVID-19 pandemic, and though we excluded 2020-2021 from our primary analysis, there could still be residual effects from the pandemic that may limit the generalizability of our findings, though the investigated allegation rate pre-pandemic in 2019 was only modestly higher compared to the pre-intervention part of our primary study period (26% versus 22% in Flint). Third, we defined exposure as Flint residence among infants born in 2024 after Rx Kids implementation rather than actual enrollment in the program. Our analysis thus followed the intention-to-treat principle to capture the population-level effect of Rx Kids, a parameter of key interest to policymakers. In the setting of incomplete take-up, the intention-to-treat estimates would be biased to the null compared to the effect of the program itself, but due to the high take-up rates of Rx Kids, our intention-to-treat estimates are likely very close to estimates for the effect of the program itself (i.e., treatment on the treated). Defining exposure based on residence also assumes that the city in which an infant resides at the time of an investigated allegation 6 months into life is the same city in which the mother resided when the infant was born. This could produce some measurement error in our outcomes to the extent that there is migration in or out of communities. Fourth, there was evidence of a slight increase in the number of births without compositional change in Flint in 2024 compared to prior years, which could mechanically reduce the

investigated allegation rate. Despite the increase in births, we found a substantial and significant decline in the absolute count of investigated allegations. Fifth, our analysis may not have been well-powered for the secondary outcomes in which we observed nonsignificant declines in the subcategories of investigated allegations. These were nonetheless directionally consistent with the primary outcome, and we follow the literature in focusing on investigated allegations as a principal outcome as opposed to substantiated allegations given that the latter is a rarer outcome, may be particularly sensitive to organizational capacity or practices of CPS, and has not been shown to be a better predictor of risk compared to unsubstantiated cases (Kohl, Jonson-Reid, and Drake 2009). Moreover, investigations, regardless of substantiation, can be disruptive and harmful to families (Merritt 2020). Investigated allegations may be sensitive to ascertainment bias, though this may be less likely since Rx Kids was not specifically implemented or publicized as an effort to prevent child maltreatment. Finally, the long-term implications of reducing investigations of child maltreatment during the first 6 months of life remain unknown, but preventing an initial investigation likely reduces the risk of future investigations (Casanueva et al. 2015), consistent with the intent of improving lifelong trajectories starting from birth. Areas for future research include replication and persistence of findings after the first year of the program as well as in Rx Kids expansion communities for generalizability, examining long-term outcomes to age one and beyond, and further exploration of mechanisms of action.

This study found that Rx Kids, designed as a universal and unconditional prenatal and infant cash prescription program to reduce perinatal poverty and improve health outcomes, yielded cross-sector benefits that extend to child welfare system involvement. Infants are among the most vulnerable to maltreatment, and Rx Kids was associated with substantial, population-level reductions in investigations of maltreatment among infants in the earliest months of life.

These findings underscore the importance of providing economic support during the perinatal period—a time of financial hardship and neurodevelopmental consequence—to improve the health and wellbeing of children.

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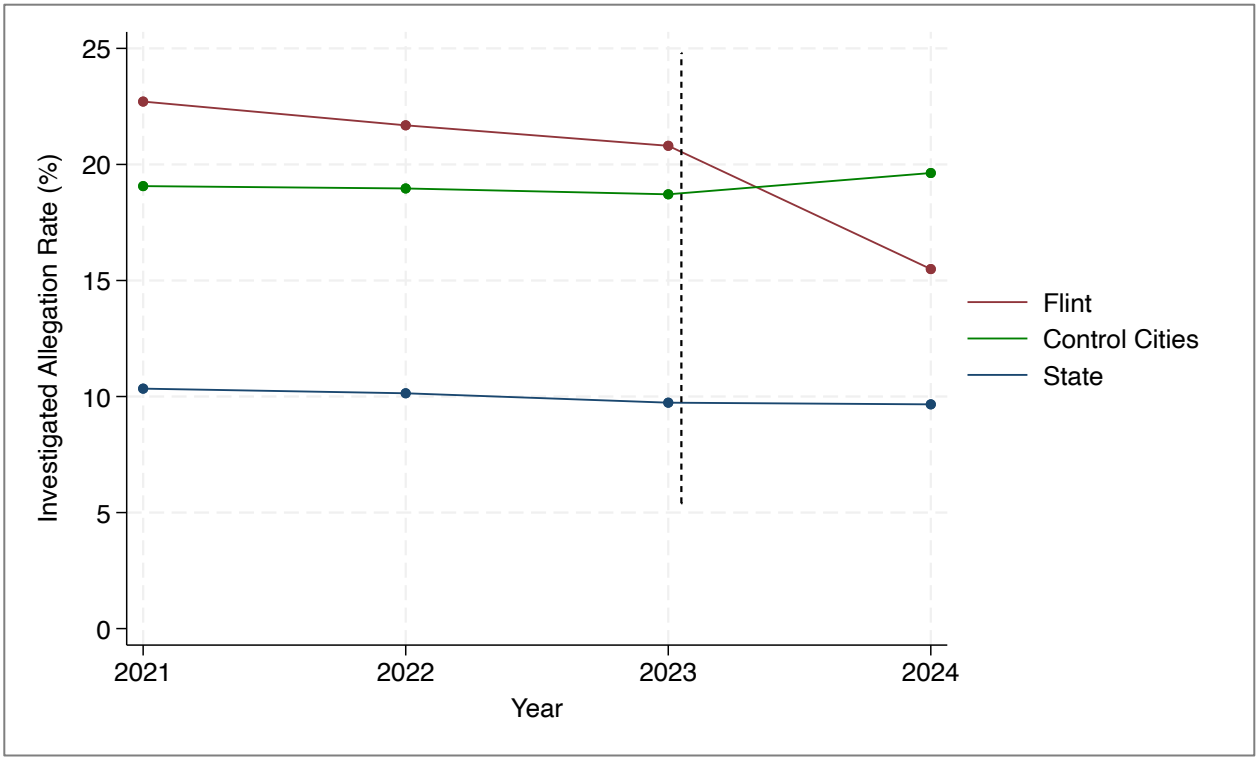
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Figure 1: Investigated Allegations Within the First Six Months of Life for Infants in Flint, Control Cities, and State of Michigan



Caption: The vertical dashed line differentiates the pre-intervention period (2021-2023) from the post-intervention period (2024).

Figure 2: Investigated Allegation Rate in Flint and All Control Cities

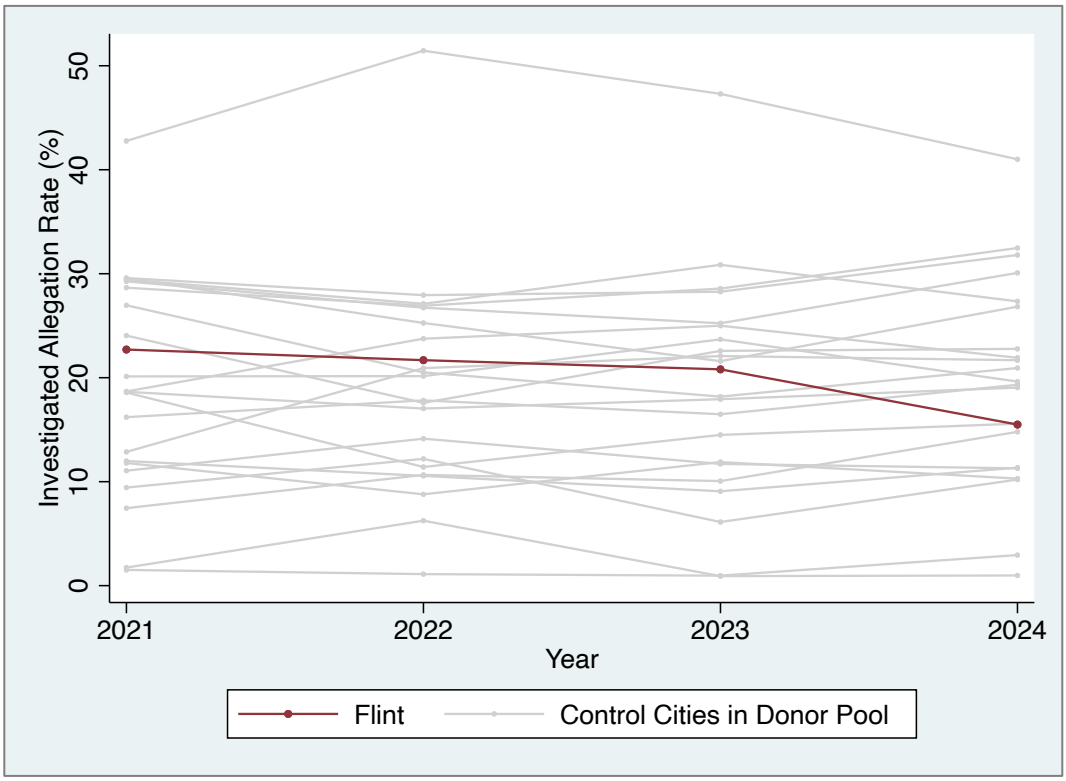
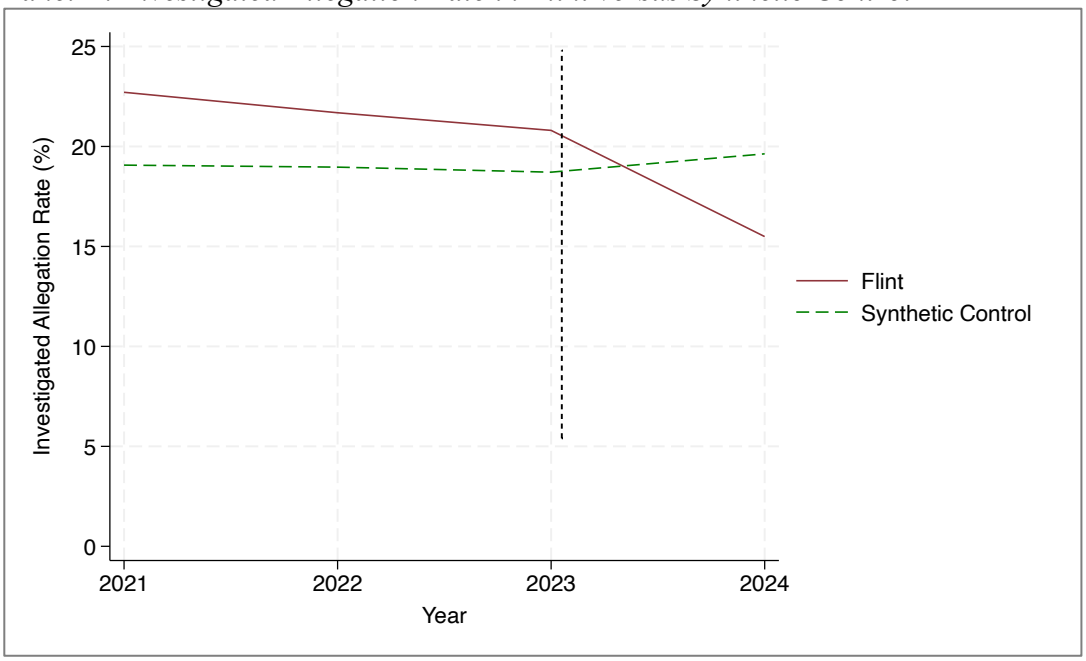
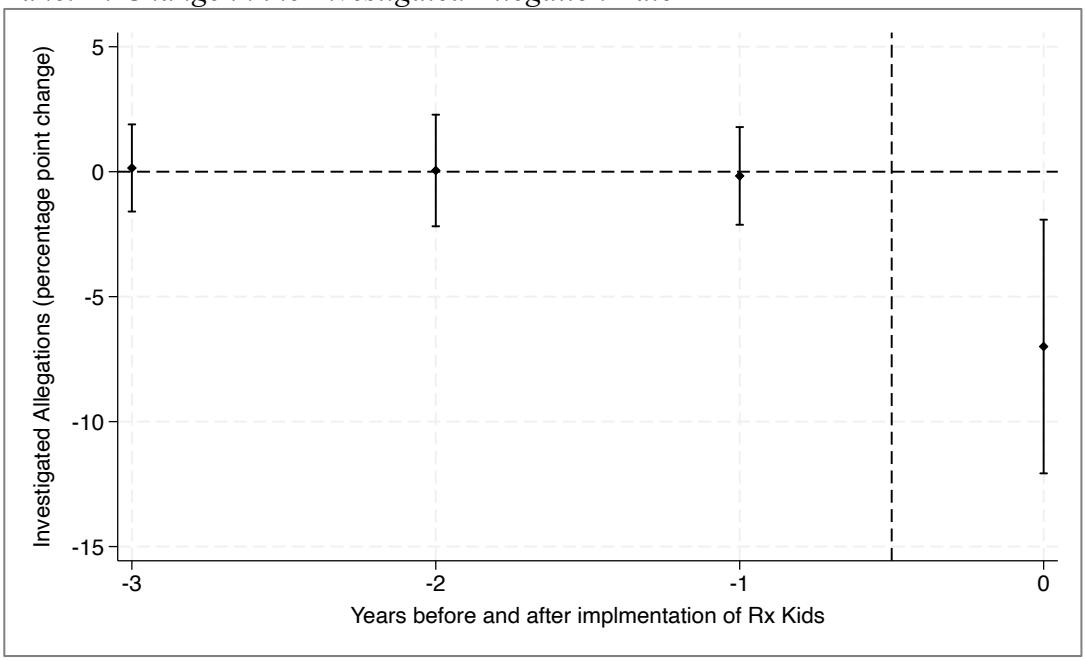


Figure 3: Synthetic Difference-in-Differences

Panel A: Investigated Allegation Rate in Flint versus Synthetic Control

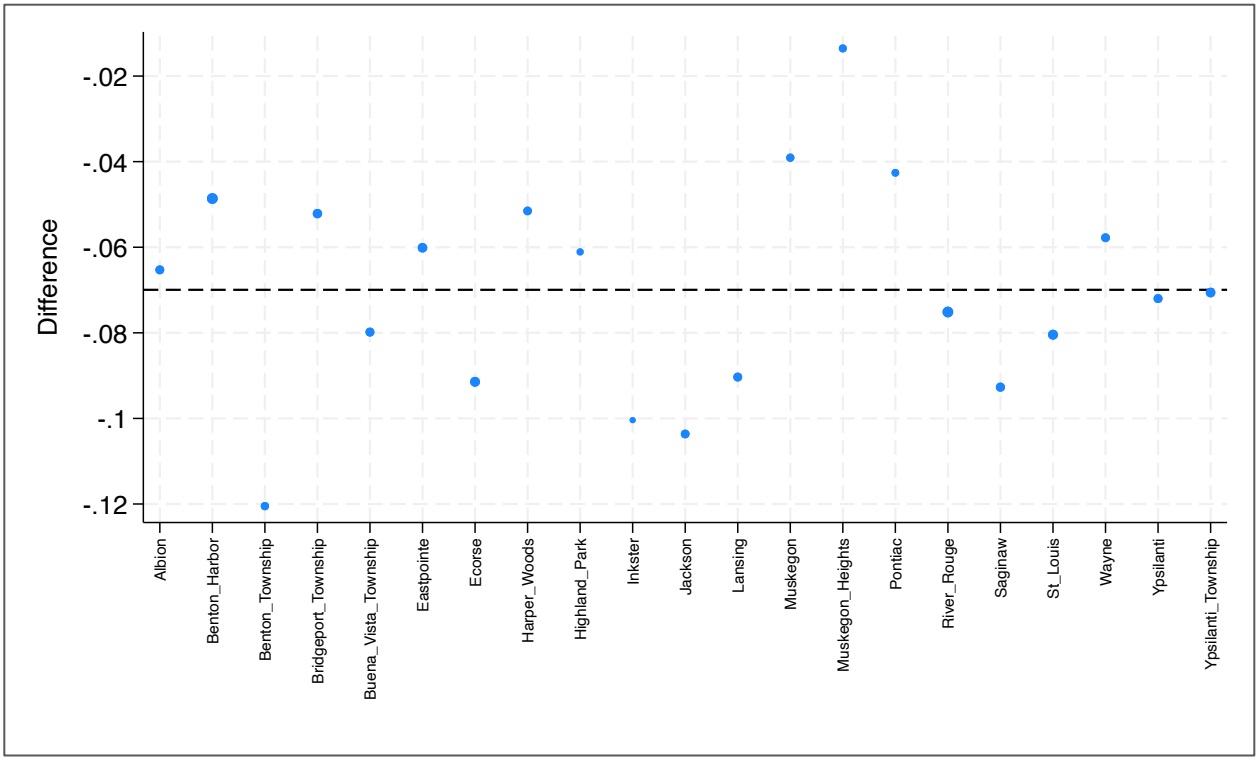


Panel B: Change in the Investigated Allegation Rate



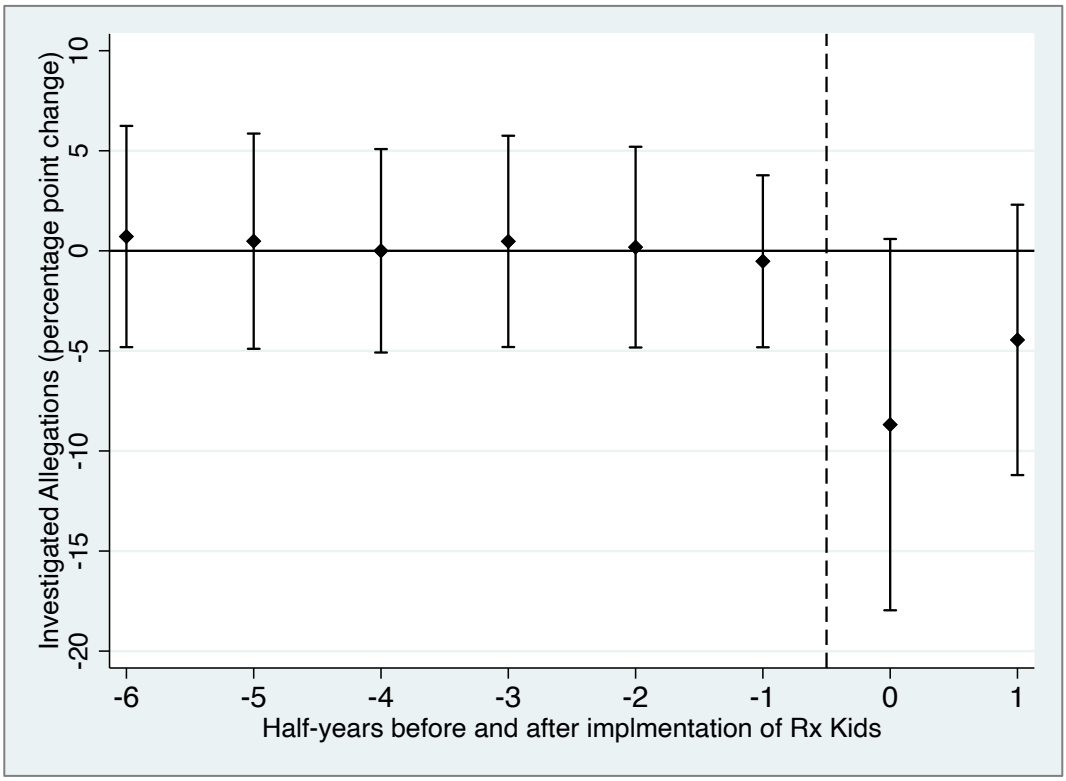
Caption: The vertical dashed line differentiates the pre-intervention period (2021-2023) from the post-intervention period (2024). Synthetic difference-in-differences uses unit- and time-specific weights (see text for details) to achieve balance in pre-intervention outcomes, focusing on trends rather than absolute levels to establish parallel trends. Panel B shows point estimates from synthetic difference-in-differences and 95% confidence intervals via permutation-based inference.

Figure 4: Pre-Intervention Balance Across Control Units from Synthetic Difference-in-Differences for the Primary Outcome (Investigated Allegations)



Note: The raw unit and time weights from synthetic difference-in-differences are shown in eTables 1 and 2. This plot shows how well each control unit's pre-intervention outcomes align with Flint after optimizing the time weights.

Figure 5: Change in the Investigated Allegation Rate by Half-Year



Note: There were decreases in the investigated allegation rate in both the first and second halves of 2024. As subdivided versions of the primary outcome, these estimates had wider confidence intervals that cross zero and are thus statistically insignificant but are directionally consistent with the primary outcome aggregated at the annual level. Estimates for the components of the investigated allegation rate (i.e., birth counts and number of allegations) in the first and second half of 2024 are shown in eTable 4.

Table 1: Baseline Characteristics (Before Weighting)

	Flint	Control Cities
Investigated allegations, %	21.7	18.9
Investigated allegations (2021), %	22.7	19.1
Investigated allegations (2022), %	21.7	19.0
Investigated allegations (2023), %	20.8	18.7
Substantiated allegations, %	3.0	4.5
Poverty rate, %	34.4	26.7
Deep poverty rate, %	18.1	12.4
Median household income, $	36,194	44,552
Racial composition, %		
Hispanic	4.5	9.0
Non-Hispanic Black	56.0	45.4
Non-Hispanic White	32.6	38.7
American Indian and Alaska Native	0.3	0.3
Asian	0.6	1.1
Pacific Islander	0.0	0.0
Other	0.5	0.4
Multiple races	5.5	5.1
Educational composition, %		
Less than high school diploma, %	16.7	14.1
At least high school diploma, %	83.3	85.9
Households with children and female head of household, %	59.3	53.4
Households that are renter-occupied, %	45.0	43.8
Households that are housing-burdened, %	54.4	50.5
Gini index, mean	0.48	0.46
Public health insurance, %	70.5	56.1
Total births (2021-2023)	2,971	20,124
Population, mean	80,835	25,933

Table 2: Estimates from Synthetic Difference-in-Differences for the Primary and Secondary Outcomes

Outcome	Mean Rate in Flint Prior to 2024 (%)	Synthetic Difference-in-Differences	
		Estimate (95% CI)	*P* value
Investigated allegations	21.7	-7.0 pp (-12.9 to -1.0)	0.021
Neglect-related	10.0	-3.6 pp (-8.2 to 1.0)	0.13
Non-neglect-related	11.7	-3.4 pp (-9.0 to 2.3)	0.24
Substantiated allegations	4.5	-1.3 pp (-4.2 to 1.6)	0.36

Note: All estimates are interpreted as a percentage-point (pp) change.

Table 3: Unit Weights for the Primary Outcome (Investigated Allegations) in the Synthetic Difference-in-Differences Analysis

Donor City	Weights
Albion	0.04651482
Benton Harbor	0.07667844
Benton Township	0.03837185
Bridgeport Township	0.05365189
Buena Vista Township	0.04815389
Eastpointe	0.05666218
Ecorse	0.0606078
Harper Woods	0.04317521
Highland Park	0.02471664
Inkster	0.0159125
Jackson	0.04504911
Lansing	0.04650577
Muskegon	0.03825902
Muskegon Heights	0.03533298
Pontiac	0.03159653
River Rouge	0.07526972
Saginaw	0.05019247
St. Louis	0.06235585
Wayne	0.04630271
Ypsilanti	0.04773139
Ypsilanti Township	0.05695925

Table 4: Time Weights for the Primary Outcome (Investigated Allegations) in the Synthetic Difference-in-Differences Analysis

Year	Time Weights
2021	0.43497877
2022	0.14212496
2023	0.42289627

Table 5: Sensitivity Analyses

	Investigated Allegations	
Specifications	**Estimate (95% CI)**	***P* value**
Primary study period (2021-2024)		
Pre-specified donor pool	-7.0 pp (-12.9 to -1.0)	0.021
Alternative donor pool	-5.8 pp (-10.0 to -1.5)	0.008
Adding two additional years to the pre-intervention period (2019-2024)		
Pre-specified donor pool	-6.3 pp (-11.7 to -0.9)	0.022
Alternative donor pool	-7.9 pp (-12.5 to -3.4)	0.001

Note: All estimates are interpreted as a percentage-point (pp) change. The pre-specified donor pool is comprised of 21 control cities that resembled Flint most closely in terms of population size, poverty rate, and racial composition. The alternative donor pool is comprised of 63 of the most populous cities in Michigan.

Table 6: Results from Synthetic Difference-in-Differences for Composition of Births, Number of Births, and Number of Investigated Allegations

	Synthetic Difference-in-Differences	
Outcome	**Estimate (95% CI)**	***P* value**
Maternal age: 16-26	-1.6 pp (-12.6 to 9.3)	0.77
Non-Hispanic Black race	3.3 pp (-9.9 to 16.5)	0.62
Maternal education: less than high school	1.0 pp (-9.6 to 11.7)	0.85
Not married	2.4 pp (-5.6 to 10.4)	0.56
Medicaid as payor	3.5 pp (-15.9 to 22.9)	0.72
First birth (i.e., parity of 0)	1.9 pp (-8.2 to 12.0)	0.71
Number of births	96.7 (35.0 to 158.4)	0.002
First half of 2024	75.4 (49.0 to 101.8)	< 0.001
Second half of 2024	17.2 (-8.4 to 13.0)	0.19
Number of investigated allegations	-56.9 (-76.4 to -37.3)	< 0.001
First half of 2024	-30.1 (-40.6 to -19.6)	< 0.001
Second half of 2024	-24.2 (-33.6 to -14.7)	< 0.001

Notes: There was no statistically significant change in the composition of who gives birth using synthetic difference-in-differences. Furthermore, the point estimates for several of these would, if anything, suggest higher risk of investigated allegations in the post-period from any potential compositional change. As shown in prior work (reference 48 in the main text), there was similarly no statistically significant change in the composition of who gives birth using individual-level data from birth certificates and a difference-in-differences approach. There was a statistically significant increase in the number of births in Flint concentrated in the first half of 2024; despite an increase in births in Flint, Rx Kids was associated with a significant reduction in the number of investigated allegations in both halves of 2024 as well as overall for the year.

Table 7: Results from the Original Synthetic Control Method with a Short Panel

	Investigated Allegations			
Specification	**Estimate**	**RMSPE Ratio for Flint**	**Range of RMSPE Ratios from Placebo Tests**	***P* value**
Primary study period (2021-2024)				
Pre-specified donor pool (21 cities)	-6.9 pp	800 billion	0.29 to 5.35	0
Alternative donor pool (63 cities)	-7.1 pp	38 billion	0.27 to 4.48 trillion	0.38
Adding two additional years to the pre-intervention period (2019-2024)				
Pre-specified donor pool (21 cities)	-7.4 pp	7.78	0.17 to 3.27	0
Alternative donor pool (63 cities)	-7.7 pp	6.59	0.31 to 519 billion	0.46