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# Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AHN</td>
<td>Allegheny Health Network</td>
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<tr>
<td>AIU</td>
<td>Allegheny Intermediate Unit</td>
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<tr>
<td>AUC</td>
<td>area under the curve</td>
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<tr>
<td>C4K</td>
<td>Cribs for Kids</td>
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<tr>
<td>DML</td>
<td>double machine learning</td>
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<tr>
<td>FTE</td>
<td>full-time equivalent</td>
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<tr>
<td>GYN</td>
<td>gynecologist</td>
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<tr>
<td>ICC</td>
<td>interconception care</td>
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<tr>
<td>IMPLICIT</td>
<td>Interventions to Minimize Preterm and Low Birth Weight Infants Using Continuous Quality Improvement Techniques</td>
</tr>
<tr>
<td>IMPresiV</td>
<td>Infant Mortality Prediction System with Intervention Management</td>
</tr>
<tr>
<td>NFP</td>
<td>Nurse-Family Partnership</td>
</tr>
<tr>
<td>OB</td>
<td>obstetrician</td>
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<tr>
<td>PATH</td>
<td>pregnancy attitudes, timing, and how important is pregnancy prevention</td>
</tr>
<tr>
<td>PHQ-2</td>
<td>Patient Health Questionnaire-2</td>
</tr>
<tr>
<td>PHQ-9</td>
<td>Patient Health Questionnaire-9</td>
</tr>
<tr>
<td>POWER</td>
<td>Pennsylvania Organization for Women in Early Recovery</td>
</tr>
<tr>
<td>UPMC</td>
<td>University of Pittsburgh Medical Center</td>
</tr>
<tr>
<td>WIC</td>
<td>Women, Infants, and Children</td>
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Appendix A. Descriptions of Programs, Services, and Supports

Preconception and Interconception Care

**IMPLICIT Interconception Care Project**

Program Description

IMPLICIT (Interventions to Minimize Preterm and Low Birth Weight Infants Using Continuous Quality Improvement Techniques) is a collaboration of family medicine residency programs throughout the Northeast United States. The purpose of the collaborative is to educate faculty and residents about primary prevention of preterm birth. Local participating providers include three University of Pittsburgh Family Medicine practices: McKeesport, Shadyside, Saint Margaret (three sites), and Forbes Family Medicine.

IMPLICIT developed a model for interconception care (ICC), and 11 affiliated family medicine clinics, including three local practices, implemented the model. The ICC project utilizes well-child visits to screen new mothers for health risks, advise and educate them about healthy behaviors, assess positive screens, and perform or arrange for interventions with the goal of improving maternal care and future pregnancy outcomes. IMPLICIT also created a toolkit for other practices interested in implementing the intervention.

Program Components

The ICC project involves two components:

- During well-child visits from 0 to 24 months, mothers are screened for behavioral health risks including smoking, depression, compliance with contraception to increase interpregnancy interval, and multivitamin intake. Maternal depression is assessed with the two-question Patient Health Questionnaire (PHQ-2) and followed with the nine-question Patient Health Questionnaire (PHQ-9) if the results are positive.
- Interventions for those who screen positive include smoking cessation counseling using the five A’s model (ask, advise, assess, assist, arrange), educational interventions and referrals to community partners for depression, education and counseling on contraception, and recommendation or provision of multivitamins.

Most screening is done by residents who speak with the mothers accompanying their babies to the well-child visits. Some sites may have registered nurses performing the screening. Screening results are documented in the child’s chart, and interventions or referrals are performed by physicians or nurses.

Program Reach and Results

Over a ten-month period in 2014, mothers of 735 infants were screened during 1,947 well-child visits at the three local practices. The screening rate averaged around 69 percent. In a study
of 11 participating sites from 2015 to 2017, 69.1 percent of mothers were screened. Table A.1 lists the results that were observed.

Table A.1. IMPLICIT Reach and Results

<table>
<thead>
<tr>
<th></th>
<th>Positive Screen: Tobacco</th>
<th>Intervention Rate: Tobacco</th>
<th>Positive Screen: Depression</th>
<th>Intervention Rate: Depression</th>
<th>Noncompliant: Contraception</th>
<th>Intervention Rate: Contraception</th>
<th>Not Taking Multivitamin</th>
<th>Intervention rate multivitamins</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites</td>
<td>16.2%</td>
<td>80.0%</td>
<td>8.1%</td>
<td>92.8%</td>
<td>28.2%</td>
<td>76.0%</td>
<td>45.4%</td>
<td>58.2%</td>
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</tbody>
</table>

SOURCE: Srinivasan et al., 2018.
**One Key Question**

Program Description

One Key Question is an approach for primary care clinicians to ask women about their reproductive goals and provide reproductive goals counseling. The approach is designed to provide primary care clinicians with the tools to fully support women’s preventive reproductive health needs, such as preventing an unintended pregnancy or preparing for a healthy pregnancy. One Key Question is being implemented at some University of Pittsburgh Medical Center (UPMC) Family Medicine sites.

Program Components

One Key Question involves asking, “Would you like to become pregnant in the next year?” during primary care visits for women ages 18–50. If the patient responds yes, the provider offers preconception care. If the patient responds no, the provider discusses contraception options. If the patient is OK either way, the provider recommends preconception counseling and early prenatal care. If the patient is unsure, the provider offers a combination of contraception and preconception care.

Program Reach and Results

This program has not been evaluated.
Pregnancy Attitudes, Timing, and How Important Is Pregnancy Prevention

Program Description

PATH (pregnancy attitudes, timing, and how important is pregnancy prevention) is a set of questions asked by health care providers of women of childbearing age to stimulate discussion of their reproductive goals (Callegari et al., 2016). Magee-Womens Hospital is promoting the use of the questions among individual providers, but there is no clinical protocol in place.

Program Components

PATH involves providers asking three questions during appointments:

1. Do you think you might like to have (more) children at some point?
2. If women are considering future parenthood: When do you think that might be?
3. How important is it to you to prevent pregnancy (until then)?

Depending on the responses to the questions, the provider will offer preconception care, contraception options, or both.

Program Reach and Results

This program has not been evaluated. Some Magee providers report using PATH questions in practice for several years. One of these physicians noted that in her experience “the PATH questions work really well across diverse patients with varying pregnancy intentions, goals, and thoughts about pregnancy.”
Enhanced Prenatal Care

Midwife Center for Birth and Women’s Health

Program Description

The Midwife Center, located in Pittsburgh, provides an enhanced prenatal care program that includes behavioral health and wellness services, prenatal classes, breastfeeding support, and a home visit after birth. The Midwife Center accepts private and public insurance and has partnered with Adagio Health to provide services for free or on a sliding scale depending on family income and size. The Midwife Center is staffed with eight certified midwives (7 full-time equivalent [FTE]), one nurse practitioner, one licensed clinical social worker, seven registered nurses (5 FTE), an intake coordinator, a community engagement coordinator, four client service administrators (3.2 FTE), a medical assistant, and four administrative staff members. Referrals are received from word of mouth, internet searches, other health care providers, health fairs, advertising efforts, and media coverage. The Midwife Center was one of 38 American Association of Birth Centers sites that participated in the Strong Start for Mothers and Newborns Initiative.

Program Components

Pregnancy and childbirth support includes

- a one-hour initial appointment including detailed history, full physical exam, and risk assessment
- 20-minute prenatal visits and education
- standard prenatal testing, including blood work and ultrasounds as indicated
- consultation with physician specialists, certified nurse-midwives, and the nurse practitioner as needed
- classes including Childbearing Essentials, Childbirth Refresher, HypnoBirthing, Breastfeeding, and Newborn Care
- labor, delivery, and postpartum care in a birth suite with certified nurse-midwife and registered nurse birth assistants
- hospital delivery for mothers who do not meet the safety criteria for birth in our facility or who choose this option
- safe transfer to a hospital before, during, or after labor or birth if needed
- breastfeeding support at the birth center and through the early postpartum period
- home visits by a registered nurse in the first few days after birth
- two-week and six-week postpartum checkups at the birth center
- continued primary gynecological care, including annual exams, contraceptive counseling, and so on
- in-house counseling and wellness services.
Program Reach and Results

According to its annual report, the Midwife Center delivered 421 babies at the Midwife Center and UPMC Mercy Hospital and provided 1,600 gynecologist (GYN) visits (annuals, contraception, and problem visits) and 500 behavioral health visits in 2016. Of their clients, 91 percent had a vaginal birth, and 80 percent of clients who attempted a vaginal birth after cesarean and labored had one. Among clients who came to the birth center in labor, 2.58 percent had a cesarean birth. Additionally, 0.01 percent of clients had a low birth weight infant and 2.2 percent of clients had a preterm birth. Obstetrician (OB) clients attend an average of 11 prenatal and 2 postpartum visits.
CenteringPregnancy

Program Description

The CenteringPregnancy program provides group prenatal care to pregnant women. Both Magee-Womens Hospital and the Allegheny Health Network (AHN) offer CenteringPregnancy.

Program Components

The CenteringPregnancy program involves a recommended schedule of ten prenatal visits with each visit 90–120 minutes long. At each visit, women take their own weight and blood pressure and record their own health data, with private time with their provider for a belly check. This is followed by facilitated group discussion on topics such as nutrition, common discomforts, stress management, labor and delivery, breastfeeding, and infant care.

Program Reach and Results

This program has not been evaluated locally.
Home Visiting

Healthy Start

Program Description

Healthy Start of Allegheny County provides support to at-risk women and children in Allegheny County through free health education programs and services in their communities. Healthy Start is a federal initiative, funded by the Health Resources Service Administration, and locally implemented. The program enrolls women who are pregnant and up to three months postpartum and serves them until the child reaches age two. Healthy Start is staffed by 27 individuals, including 9 home visitors and other field operations support staff members and administrators. Home visitors all have advanced degrees. Referrals are historically made from medical providers, social service organizations, and word of mouth, but a new centralized intake and referral program run by the Department of Human Services (Allegheny Link) may be shifting the referral patterns and process. Currently, a staff person visits the Magee Oakland and Wilkinsburg OB clinics and attends community events, with plans for more structured outreach moving forward. The program is required to serve at least 1,000 people annually.

Healthy Start serves all of Allegheny County, with a concentration on the North Side, Center City, East End, Wilkinsburg, the South Side, the Western Communities, Duquesne, and Braddock.

Program Components

Participating families receive one home visit per month. Services during the home visit might include

- help in identifying and connecting families with other health and social services
- helping families with children stay up to date on shots, well-baby visits, and other medical services
- postpartum depression screening and referral (Edinburgh Postnatal Depression Scale screening for women; PHQ-9 for men)
- general health and prevention education utilizing the evidence-based Nurturing Parenting curriculum, covering
  - prenatal/postpartum care
  - childbirth education
  - diet
  - exercise and nutrition
  - HIV/AIDS and other sexually transmitted diseases
  - smoking cessation
  - substance abuse
  - breastfeeding support—all Healthy Start home visitors are trained lactation (breastfeeding) peer counselors, and there is a part-time lactation consultant and Breastfeeding Help Line.
Program Reach and Results

In 2016, 1,074 women were served. Healthy Start tracks the number of clients and number of visits but does not collect any outcome data.
Allegheny Intermediate Unit Early Head Start

Program Description

The Early Head Start program of the Allegheny Intermediate Unit (AIU) is a childhood development program for infants, toddlers, pregnant women, and their families who meet income eligibility guidelines. Early Head Start is a federal, locally implemented initiative funded by the Office of Head Start in the Administration for Children and Families of the Department of Health and Human Services. The program enrolls pregnant women and families with children from birth to age three. A full-time pediatric nurse collaborates with staff, the pregnant women, and their families. Referrals are historically made from the Alliance for Infants and Toddlers and pediatricians, but Allegheny Link may be shifting the referral patterns and process.

The home-based option is available for all communities in Allegheny County. The option is available for the following neighborhoods:

- Northern neighborhoods: Avalon, Bellevue, Coraopolis, Emsworth, Ingomar, Leetsdale, Natrona Heights, Plum Borough, Ross Township, Tarentum, West View, Wexford
- Eastern neighborhoods: Monroeville, Wilkinsburg
- Southern neighborhoods: Bethel Park, Bridgeville, Carnegie, Duquesne, Heidelberg, Homestead, McDonald, Munhall, Scott Township, South Fayette, South Park, Upper Saint Clair
- Western neighborhoods: Crafton, Imperial, Ingram, Moon, Robinson, Carnegie, Bethel Park, West View neighborhoods.

In the Carnegie and Duquesne neighborhoods only, an Early Head Start classroom is available.

Program Components

Families participating in the home-based option receive weekly home visits. The nurse supports pregnant women and their families by introducing birthing plans, educating the family in proper prenatal care, and finding the right pediatric care within the community. Postnatal care includes providing newborn and postpartum screenings; performing assessments to ensure that each child is up to date and maintaining current Early and Periodic Screening, Diagnostic, and Treatment schedules and feeding schedules; and answering any questions parents may have about caring for their children.

The program uses the evidence-based Creative Curriculum in the classroom model and the Born to Learn Curriculum for the home-based model.

- The Creative Curriculum (classroom model) has 38 objectives under the following four areas: social-emotional, physical, language, and cognitive.
- The Born to Learn (home-based model) program elements include
  - personal/home visits by certified parent educators
  - parent group meetings about early childhood development and parenting
  - developmental and health screenings for young children
– linkages and referrals to community networks and resources.

Program Reach and Results

In 2016, the AIU Early Head Start program served 103 families. In terms of outcomes, 86 percent of children completed medical exams, 88 percent completed dental care, and 88 percent completed immunizations.
**Family Foundations Early Head Start**

Program Description

Family Foundations Early Head Start, a program of the University of Pittsburgh Office of Child Development, provides home-based early child development and family support services to vulnerable children (ages zero to three years) and pregnant women. Family Foundations is staffed by eight Office of Child Development coordinators/staff, six program coordinators, 28 home visitors, one child development specialist, three family recruiters, three program nurses, one genogram specialist, and two mental health counselors. Referrals come from the Alliance for Infants and Toddlers, Allegheny Link, family and friends, recruitment staff, and self-referrals. The program has the capacity to serve 310 families annually, 20 of which are served in childcare settings. Outreach is done at prenatal clinics and by word of mouth, community outreach, and hospital social workers.

Family Foundations Early Head Start serves the Sto-Rox, Hill District, East End, Northside, and Tri-Boro communities.

Program Components

Families participating in the home-based option receive a weekly 90-minute home visit and attend two socialization/playgroups per month. The program recently adopted an evidence-informed curriculum, Partners for a Healthy Baby. It is supplemented by Starting Young, a curriculum that includes infant mental health activities that support parent-child relationships. Services and topics provided include

- in-home child development support and activities
- parenting information and ideas
- linkages to quality child care
- nutritional services and education
- health education and referrals
- early literacy development
- support for mental health issues
- job and education information and referrals
- infant and toddler socialization
- personal leadership training
- transportation support
- drug and alcohol counseling.

Program Reach and Results

In 2016, 100 percent of enrolled children were up to date on their immunizations, had a medical home, and had a health insurance provider.
Program Description

The Council of Three Rivers American Indian Center Early Head Start program is a comprehensive child development program primarily for low-income families who meet the federal poverty guidelines. Program staff include a director; infant and toddler services manager; health coordinator; family and community Eligibility, Recruitment, Selection, Enrollment, and Attendance coordinator; Eligibility, Recruitment, Selection, Enrollment, and Attendance medical data clerk; partner and subrecipient liaison; full-time and half-time child care liaisons; support specialists; and home visitors. Referrals are made through various community-based organizations and Magee Hospital. The program receives 60–70 referrals annually, with the average wait list for the home-based program at 35–40. Outreach efforts include community meetings and fairs, the Head Start hotline, mailings sent out through the Department of Human Services, the Open Doors Campaign through Allegheny Link, and collaborations with community agencies.

The program serves northeast Allegheny County communities and communities in the southern planning district of the city of Pittsburgh.

Program Components

The program provides developmental screenings, assessments and activities, health screenings, health education, and family support services in the home or in childcare settings. The program consists of weekly home visits of 1.5 hours (40–45 visits per year) and playgroups twice a month. Screenings are completed within 45 days of program entry and then every six months using the following child development screening tools:

- Ages and Stages, third edition
- Ages and Stages: Social-Emotional, second edition
- vision screening with SureSight machine
- hearing screening with otoacoustic emissions machine
- ounce scale.

The program also collects and follows Individual Family Service Plans, collects well-child physicals and lead and hemoglobin blood test results, follows pregnant women’s OB visits, and completes the Life Skills Progression Assessment.

Program Reach and Results

During the 2015–2016 grant year, the program served 104 infants, toddlers, and pregnant women in the home-based program with two child care partners programs.

A total of 85–90 percent of home-based program participants complete the program.
**Nurse-Family Partnership**

**Program Description**

For the Allegheny Health Department’s Nurse-Family Partnership (NFP) program, nurses provide intensive home visits to first-time pregnant and postpartum women and their children up to 24 months of age. The NFP National Service Office coordinates and supports a network of community-based partners who implement NFP locally. Clients must meet income guidelines to be eligible for the program. Program staff include five nurse home visitors, one nurse supervisor, and one nurse administrator. Referrals are made from birthing hospitals, managed care organizations, and Birth Circle, with about 350 referrals made annually, but Allegheny Link may be shifting the referral patterns and process. The program is funded to serve up to 220 annually (135 through Maternal Infant and Early Childhood Home Visiting and 85 through the Office of Childhood Development and Early Learning and NFP). Outreach is done through approximately 100 presentations to providers and community agencies annually. NFP serves all of Allegheny County.

**Program Components**

The three main program goals are improved pregnancy outcomes, child health and development, and maternal life course development. The program involves weekly nurse home visits that last 60–90 minutes on the following schedule:

- **Getting to Know Each Other (the first four weeks):** Visits take place once a week.
- **Pregnancy:** Visits take place once every other week for the remainder of the pregnancy.
- **Postpartum:** Visits take place once a week for the first six weeks after the baby is born.
- **Infancy and Toddler:** Visits take place every other week until the baby is 21 months old.
- **Wrapping It Up (the last four months):** Visits take place once a month until the baby’s second birthday.

Screenings are also provided:

- depression (PHQ-9)
- anxiety (General Anxiety Disorder 7-Item)
- parent-child interaction (Dyadic Assessment of Naturalistic Caregiver-Child Experiences)
- child development (Ages and Stages, Ages and Stages: Social-Emotional)
- parent engagement (Partners in Parenting Education).

The program provides families with developmental tools to assist with education and child development using a schedule throughout the course of the program (books, spoons, cups, blocks, Oballs, etc.). Car seats and Connect Cards (bus transportation to medical appointments) may also be provided as program incentives.
Program Reach and Results

NFP serves up to 220 families annually, and the expected number of visits for each family is 64. In 2017, the program received 266 referrals, enrolled 144 new families, and provided 2,318 visits. The retention rates for 2017 were 70 percent for pregnancy, 49 percent for infancy, and 51 percent for toddlerhood. Across its three home visiting programs, the Health Department had 356 current families as of February 2018.
Healthy Families Allegheny

Program Description

The Allegheny Health Department’s Healthy Families Allegheny program provides expecting parents and parents of newborns with free child development support in the home from birth to age three. Healthy Families Allegheny nurtures the parent-child relationship to promote child well-being and prevent adverse childhood experiences, especially child abuse and neglect. Staff includes a nurse supervisor, nurse home visitors, an enrollment specialist, and a clerk. Referrals are made from birthing hospitals, Allegheny Link, and community clinics (UPMC McKeesport and Braddock). If fully staffed, the program may serve up to 75 families. Outreach is done through nurse liaison visits to birthing hospitals, Women, Infants, and Children (WIC) program offices, and provider agencies in the Mon Valley.

Healthy Families Allegheny serves Braddock, McKeesport, Clairton, and Homestead.

Program Components

Families are enrolled prenatally or within three months of birth. One home visit per week is provided for the first six months after the child’s birth. Visit frequency changes based on the family’s needs up to the child’s third birthday, and ideally up to age five. The program uses the Partners in Parenting curriculum and provides families with developmental tools to assist with education and child development using a schedule throughout the course of the program (books, spoons, cups, blocks, Oballs, etc.) and Connect Cards (bus transportation to medical appointments).

Screenings are also conducted, including

- parent/caregiver history of trauma and child abuse
- depression (Edinburgh Postnatal Depression Scale)

Program Reach and Results

In 2017, Healthy Families Allegheny enrolled 29 new families and made 250 home visits.
Public Health Nurse Home Visiting Program (We CARE)

Program Description

The Public Health Nurse Home Visiting Program is offered through the Allegheny County Health Department and the federal Health Resources and Services Administration. Any pregnant woman or woman parenting a child less than one year old is eligible to participate, with families enrolled until the child’s second birthday. Program staff include eight nurse home visitors and two nurse supervisors. Referrals are made from birthing hospitals, nurse liaisons, and Allegheny Link. Self-referrals are also accepted. The program has the capacity to serve up to 300 annually. Outreach is done through a nurse liaison, the Home Visiting Network, the Infant Mortality Strategic Planning Committee, and WIC.

The program serves all of Allegheny County.

Program Components

The program involves prenatal, postpartum, and pediatric home visits to assess and ensure that families receive appropriate medical services and anticipatory guidance to improve their health. Home visit frequency is monthly or more, as deemed necessary by the family. The home visitors use Partners for a Healthy Baby, a research-based curriculum that is evidence informed and adaptable to individual needs. Families are provided with developmental tools to assist with education and child development using a schedule throughout the course of the program (books, spoons, cups, blocks, etc.) and Connect Cards (bus transportation to medical appointments) (Healthy Start EPIC Center, n.d.).

Screenings are also conducted, including

- depression (Edinburgh Postnatal Depression Scale)

Program Reach and Results

In 2017, the program received 229 referrals, 225 new families were served, and 1,731 home visits were provided. Since families are not required to remain in the program until age two to be considered to have fulfilled the program, the average duration of participation is three to six months.
Allegheny Link

Program Description

Launched in 2016, the Department of Human Services’ Allegheny Link provides centralized intake and referral to a range of services, including home visiting programs. The hotline assists Allegheny County residents who are pregnant or caregivers of children up to six years of age to obtain referrals to home visiting programs, including the Allegheny County Health Department’s Maternal and Child Health Program, Early Head Start, Family Support Centers, Head Start, and Healthy Start.

Program Components

Allegheny Link service coordinators are available weekdays from 8:00 a.m. to 7:00 p.m. and can be reached by phone, walk-in, or email. When contact is made, the service coordinators determine eligibility and the type of services or support needed. The caller picks from among the providers offered and an electronic referral is pushed out to the provider. The provider logs in to receive the referral and then conducts outreach to engage the client. The provider records information about follow up on the Link portal.

Program Reach and Results

This program has not been evaluated.
Education Programs

_Cribs for Kids_

Program Description

The mission of Cribs for Kids (C4K) is to prevent infant sleep-related deaths due to accidental suffocation and asphyxiation by educating parents and caregivers on the importance of practicing safe sleep and by providing portable cribs to families who otherwise cannot afford a safe place for their babies to sleep. The Pittsburgh office includes seven staff members. The organization has offices in five additional states.

Program Components

The primary components of C4K are

- crib giveaways
- distribution of safe sleep materials
- public service announcements and billboards.

Hospitals in Allegheny County are legally required to provide infant safe sleep education and a safe sleep environment, if needed, to every new mother before she leaves the hospital. C4K serves all seven birthing hospitals with the required materials and portable cribs.

C4K also partners with other local organizations that can order their products to ensure that no baby “falls through the cracks.” Partners sign the C4K Trademark License Agreement and pledge to educate families according to the American Academy of Pediatrics Infant Safe Sleep Guidelines. Upon signing the agreement, they are given the password to access and use all the C4K educational materials at no cost. All organizations that have become partners are asked to make sure the mothers they work with know to ask for one of their portable cribs at the hospital.

For its public education component, in 2016, the Jefferson Regional Foundation funded a bus card and bus shelter campaign throughout the Mon Valley, which includes a large portion of Allegheny County. C4K believes these port authority campaigns were effective, since many of the families they serve rely on public transportation. Currently, C4K is preparing to launch its Safe Sleep Academy website, which will provide public access to infant safe sleep education.

Program Reach and Results

C4K works with 47 partner organizations across the county and distributes about 1,200 cribs per year.
The Safety Center

Program Description

The Safety Center, located in the UPMC Children’s Hospital of Pittsburgh, provides hands-on education and resources to help families stay safe at home and in the car.

Program Components

Hospital staff may refer families for injury prevention guidance and arrange for patients and families to visit the Safety Center’s house replica to receive hands-on training in using home safety products correctly and preventing injuries. The Safety Center’s staff also works with families who are referred to the center to complete detailed home safety assessments to make sure their homes are safe for children. Staff may also provide safety products such as cabinet locks and choke tube testers.

Families learn

- car safety (how to install all types of car seats using a seat from a real car for practice)
- kitchen safety (fire, burn, and poison prevention)
- bathroom safety (water, burn, and window safety)
- stair safety (how to install baby gates and how to select the proper gate for different locations)
- other safety concerns (wheels, crib, gun, and furniture safety).

Program Reach and Results

The center serves families of Children’s Hospital patients as well as walk-ins. The hospital is also developing a Mobile Safety Center, a replica of the hospital center, which will travel to community sites to provide education and resources.
Care Coordination

**University of Pittsburgh Medical Center Health Plan Maternity Program**

Program Description

UPMC’s maternity program provides telephonic support and coordination with maternity coaches. The maternity program is designed to identify pregnant members, stratify women based on medical risk, conduct targeted outreach to members, assesses their needs, and develop a coordinated care plan created with the member’s input. As of April 2017, there were 9.5 FTE telephonic registered nurse care managers for the Medicaid line of business, as well as seven mobile registered nurse care managers who serve members in Allegheny, Butler/Armstrong, Lawrence, Mercer/Crawford/Venango, Westmoreland, and Fayette Counties who focus primarily on the Medicaid line of business. There is one social worker embedded at the high-risk unit at the Magee Outpatient Clinic and one mobile social worker who provides face-to-face interactions in Allegheny County. There are 7.5 FTE telephonic registered nurse care managers for the commercial line of business. All members receive a passive enrollment letter that discusses the program once UPMC receives an Obstetrical Needs Assessment Form from the provider. First-time mothers and those who are stratified as high risk based on established criteria receive additional telephonic outreach by registered nurse care managers.

Program Components

The maternity program components are aimed at increasing the member’s knowledge of her pregnancy, as well as preexisting medical conditions. In collaboration with her maternity care provider, the maternity nurse monitors the member’s ability to manage her care during the pregnancy and the postpartum period. The frequency of member contact is based on member acuity level, actual and potential risks for pregnancy complications, and member desire for established plans for follow-up participation. Members can be contacted telephonically or have face-to-face interaction with program staff if interested. Contact can be as frequent as several times per week or as infrequent as trimesterly based on acuity level and need. Ideally, program staff engage members early in their pregnancy and follow up at least monthly throughout the pregnancy. Postpartum follow-up is attempted about one week postpartum. If ongoing issues are present, additional follow-up is attempted. The PHQ-2/PHQ-9, GAD-7, and National Institute on Drug Abuse screens are performed during each member interaction.

The care managers reinforce provider education about healthy pregnancy behaviors (nutrition, exercise, tobacco cessation, consistent prenatal and postpartum care, etc.). The staff identifies modifiable risk factors and engages the member in lifestyle and health management programs. The care managers educate the member about changes in health conditions that may require intervention by or follow-up with a provider. The care managers also link the member with appropriate community resources to support mom and baby in the postpartum period (breast
feeding support, identification and referral for postpartum depression treatment, plans for well-baby care, and interconception care, including discussions about family planning).

Program Reach and Results

Staff reach out to approximately 13,000 members annually for participation. Approximately 3,000 members formally participate by enrolling in the program (across all health plan lines of business). Some members do not officially enroll in the program, but the staff complete a comprehensive needs assessment for them, provide applicable education and resources, and encourage them to contact them with additional questions, concerns, or changes in their condition. These members are captured in participation data. The most recent data is 60-percent reach rate and 50-percent participation rate for total number of referrals.

Approximately 50 percent of Medicaid members graduate from the program, which is defined as completing a postpartum call with assessment by a registered nurse care manager. Members also graduate from the program if they were lost to contact during the postpartum period but were compliant with their postpartum care appointment with their OB provider. Approximately 2,000 Medicaid members receive one of the incentive gifts for program participation each year. The average number of contacts per participant is four to six, and the average duration of participation is six to seven months.
**MOM Matters**

**Program Description**

Gateway Health Plan’s maternity program MOM Matters provides support and coordination to pregnant Medicaid members.

**Program Components**

The primary program components are provided by maternity team members to help pregnant members. Team members

- help pregnant members find a doctor and set up appointments for prenatal care
- answer questions, direct members to community services, and guide them throughout their pregnancy
- arrange a home visit by a nurse when needed
- provide resources for transportation to and from important doctor appointments
- connect members to the smoking quit line.

Members also earn rewards for going to all prenatal and postpartum care doctor visits.

**Program Reach and Results**

This program has not been evaluated.
Pregnancy and Postpartum Support

*Birth Circle*

Program Description

The Birth Circle is a doula program of the UPMC Department of Family Medicine with services paid through UPMC’s Medicaid Health Plan. The Birth Circle provides support to childbearing women and their families through its community-based doula program. Doulas provide emotional support and encouragement, including physical comfort measures and individualized, one-on-one education to women during pregnancy, throughout labor and birth, and during the newborn period. The Birth Circle is staffed by up to 29 individuals, including 2 lead doulas, 7 community doulas, 12 birth doulas, 2 community educators, and 4 community facilitators. Staffing fluctuates depending on funding. Referrals are made by UPMC For You Maternity program nurses; nurses, OB coordinators, and midwives throughout the county; social workers at various clinics and community sites; previous clients; and self-referrals. The program receives about 460 referrals annually.

Program Components

The Birth Circle program components include

- **Prenatal home visiting:** Community doulas conduct at least four prenatal visits and complete additional visits as necessary depending on client needs (e.g., young teen or new refugee). Clients can choose whether their community doula attends provider visits, comes to the home, or meets them in the community for the visits. Visits ideally start between 18 and 20 weeks. For late referrals (37 weeks plus), the woman may be unable to receive all prenatal visits before labor begins. Doulas attempt to at least offer a visit over the phone if in-person visits cannot occur.

- **Phone and text contact:** Community doulas provide ongoing contact, which can be as frequent as the client desires, with many clients utilizing their doula multiple times each week.

- **Continuous birth support:** All enrolled women receive continuous birth support. Emergency births at Magee-Womens Hospital can also receive continuous birth support if women meet eligibility requirements and are not enrolled at the time of hospital admission to labor and delivery.

- **Postpartum home visiting:** Community doulas provide at least three postpartum visits, with the time frame of these visits varying. Postpartum services are generally provided in the early postpartum period, defined as the first six weeks following delivery. If a mom is breastfeeding, three visits may occur within the first two weeks, and additional visits are provided as necessary. Community doulas are also available for clients who may contact them if they have specific questions, if they are going through a tough transition, if a crisis occurs, or for a subsequent pregnancy. Community doulas also refer women to other needed social services, such as WIC and parenting support groups.
Program Reach and Results

In 2016, 278 women were enrolled (had at least one prenatal visit before delivery) and 245 births were attended. On average, 70 percent of enrolled clients call for a doula at their birth. Additionally, 90–95 percent of their clients state that they would recommend the Birth Circle to a family member or friend. According to UPMC Health Plan, in 2014, more than 460 expectant mothers used the Birth Circle. Of the babies born to these women, only 4 percent weighed under 5.5 pounds (compared with 9.5 percent citywide), and only 23 percent were born by caesarean section (compared with 40 percent citywide).
Every Child

Program Description

Every Child provides foster care and adoption services, as well as clinical and therapeutic care to children and families in Southwestern Pennsylvania. Its doula program starts working with women at the beginning of the second trimester and continues with them through the six-week postpartum appointment. The program is foundation funded and is free to participants. Trained doulas provide emotional support and education to participating women and their partners. Every Child employs eight social workers, three of whom specialize in the doula program. Referrals are made from NFP, Squirrel Hill Health Center, the Jefferson Regional Foundation, and OB/GYNs.

The program serves Allegheny and surrounding counties.

Program Components

The primary program components include

- a trained doula’s attendance at every prenatal visit
- home visits (covering topics such as budget, safe home, grocery store, exercise, smoking, alcohol and substance abuse)
- coordination with a Nurturing Families birth doula who makes the birth plan, attends the birth, and serves as a lactation consultant.

Each participating woman starts with a doula who conducts a basic assessment of needs at the initial home visit. A service plan is then developed. If the woman scores at risk based on the mental health assessment, then there is an internal referral to a clinical doula for a more in-depth assessment, review by a psychologist, and therapy services by the clinical doula, a mental health clinician who can provide more intensive services than outpatient therapy. Less than 5 percent of women need a clinical doula.

The program has a built-in reward system; the participant receives points for different activities (attending prenatal class, completing CPR class, quitting smoking, etc.). The points can be used to purchase rewards such as a stroller, car seat, or breast pump.

Program Reach and Results

As of 2017, the program had seven to ten women enrolled. The average duration of participation is 18 weeks, and the program has a strong completion rate according to program staff.
Allegheny Health Network Immigrant Health Program

Program Description

The Immigrant Health Program was established in late 2017 and received a grant in 2018 to support the development of a community health model for immigrant women in the region. AHN is working with community partners to develop the Immigrant Women Community Health Model with the goal of providing immigrant women access to culturally competent and quality perinatal and other health services. The target populations are Latino, Bhutanese, and Somali women, and women will be hired from these communities for full- and part-time positions as doulas and community health workers.

Program Components

The primary program components include

- prenatal, birth, and postpartum doulas
- community health workers to help immigrant women navigate social and health care services.

Program Reach and Results

The program is doing a needs assessment for immigrant and refugee populations across its network.
Genesis House

Program Description

Genesis House was established in 1983 as a maternity care facility for women who are pregnant, over the age of 18, and in need of shelter. The goal is to provide a homelike environment while fostering responsibility and independence. Women are admitted as space is available, following an interview and needs assessment.

Program Components

The primary program components include

- housing
- assistance in postdelivery plans, including housing
- counseling sessions
- classes on prenatal care, parenting and infant care skills, smoking cessation, and infant and child first aid and CPR.

Program Reach and Results

The house can accommodate up to eight women at a time.
Genesis Centers

Program Description

Genesis Centers provide programs and services to pregnant women and new mothers at two locations, one of which is in Allegheny County (Bellevue). All programs and services are provided free of charge.

Program Components

The primary program components include

- pregnancy testing
- classes on pregnancy, childbirth, breastfeeding, and parenting for pregnant women and expectant fathers
- free maternity and baby clothing
- new or gently used baby equipment, supplies, and furniture that can be “purchased” with Baby Bucks earned through class attendance.

Program Reach and Results

In 2013, Genesis served 1,044 clients across its Allegheny County and Washington centers.
NurturePA

Program Description

NurturePA is a free text-based mentoring program that creates relationships between volunteer mentors and parents to promote infant mental health and early literacy for all interested women at participating hospitals. Mentors use a program that enables them to send and receive text messages from a computer or tablet to help put parents in touch with the relevant information they need. The program started in 2014 and currently serves southwestern Pennsylvania, with plans to expand statewide. Program staff include three part-time managers, two part-time supervisors, and 65 volunteer mentors. The program has the capacity to serve 500 families annually. NurturePA conducts targeted outreach at UPMC Mercy, West Penn Hospital, Jefferson Regional Hospital, and the Midwife Center, with plans to expand to Magee-Womens Hospital beginning in March 2018.

Program Components

The information that is provided to parents via their mentor is a combination of research-based child development information and the mentor’s personal experience. Text messages are sent weekly by volunteer parent mentors who use the program’s software, which houses conversation prompts, content, and information about local resources. NurturePA encourages back-and-forth, relationship-based conversation to take place between mentors and the mothers they serve. As needs arise, mentors may increase the frequency of communication and the intensity of resource referrals.

Each mentor is paired with 8–12 parents to support. On average, mentors spend about ten minutes per week with each parent they support. Training and supervision of the volunteer mentors are provided by a NurturePA manager who is credentialed in early child development. The training includes principles of early child development, use of the software program, and policies and procedures for interacting with parents and referring issues to a manager. The program provides a database that includes regional resources and child development milestones that is compiled from evidence-based sources.

Program Reach and Results

Currently, NurturePA serves 270 families annually. The program spans the first three years of a child’s life. Of parent participants, 50 percent typically remain engaged through the first 12 months; 33 percent through the first 24 months; and 15 percent through the end of the three-year period. The average number of contacts per participant is 25 per quarter. Mentors also make referrals, with 36 percent of referrals for breastfeeding, 26 percent for maternal and child health and well-being, and 24 percent for family support and parenting.

NurturePA measures outputs such as total messages sent and received, type of message domain, type of information, and type of referral. It is pursuing a randomized control trial to
evaluate parent-child relationships, the level of maternal stress, and the impact of the program on early literacy.
Text4baby

Program Description

Text4baby is a free service provided by Wellpass, a software service company focused on consumer health, in collaboration with Zero to Three, Voxiva, the CTIA Wireless Foundation, and Grey Healthcare Group. Women receive free text messages three times per week, timed to their due date or their baby’s birth date, through pregnancy and up until the baby’s first birthday. A free app is also available with additional information and tips.

Program Components

Text4baby topics include

- nutrition for mother and baby
- safe sleep tips
- baby’s milestones
- signs and symptoms of labor
- doctor visit and appointment reminders for mother and baby
- breastfeeding advice
- car seat safety
- information on health insurance
- urgent health alerts
- resource hotlines and websites.

Program Reach and Results

There were 46,175 Text4baby users in Pennsylvania during 2010–2016. Local partners include the Allegheny County Department of Human Services, Healthy Start, and UPMC Health Plan. A higher percentage of Text4baby participants live in zip codes with the highest levels of poverty compared with the overall U.S. distribution, and over half (52 percent) of respondents to a national survey of Text4baby participants reported that their household income was $16,000 or less.
Nutrition and Breastfeeding Support

*Mid-Atlantic Mothers’ Milk Bank*

**Program Description**

The Mid-Atlantic Mothers’ Milk Bank screens and collects breast milk from donor mothers, pasteurizes the milk, barcodes it, and delivers it to neonatal intensive care units throughout the region. The milk bank serves neonatal intensive care units and babies of Pennsylvania, West Virginia, and New Jersey. Donor milk may be prescribed for prematurity, allergies, malabsorption disorders, cardiac conditions, gastrointestinal conditions, metabolic disorders, or failure to thrive on an inpatient or outpatient basis.

**Program Components**

Donor human milk is collected and processed according to the guidelines set forth by the Human Milk Banking Association of North America. Donors are volunteers who complete a rigorous screening process. They pump and store milk in their own homes and freeze and drop off or ship it to the lab. After thawing and pasteurizing, the bottled donor milk is frozen and ready for distribution. With a prescription, milk can be picked up at the Three Rivers facility or shipped.

**Program Reach and Results**

In 2017, the organization served 17 hospitals and distributed 142,901 ounces of donor milk. There were an estimated 306 donors and 500 recipients in southwestern Pennsylvania. As of October 2018, the milk bank was increasing outreach efforts to potential donors to meet demand for breast milk.
Allegheny County Breastfeeding Coalition

Program Description
Facilitated by the Allegheny County Health Department, the goal of the coalition is to help support nursing in all communities.

Program Components
In conjunction with World Breastfeeding Week, the coalition launched a Sustaining Breastfeeding Together campaign in 2017 in an effort to normalize breastfeeding and to promote nursing outside the home, although information on what the campaign entailed was not available. The coalition also holds meetings with presentations on various topics, and the county maintains a breastfeeding help line. Annually, the coalition takes nominations and announces Breastfeeding Friendly Place Awards.

Program Reach and Results
This program has not been evaluated.
Women, Infants, and Children

Program Description

WIC is a health and supplemental nutrition program for pregnant women, breastfeeding women up to 12 months postpartum, nonbreastfeeding women up to 6 months postpartum, and infants and children up to five years of age who have a medical or nutritional risk and meet financial eligibility criteria. The eligibility criteria for WIC are broad, with criteria related to category (e.g., pregnant), residence (e.g., reside in a state where they apply), income (e.g., meet the income standard or participate in other programs such as the Supplemental Nutrition Assistance Program), and nutrition risk (e.g., have a medical-based or dietary-based condition such as anemia or poor diet). The Food and Nutrition Service of the U.S. Department of Agriculture provides grants to states for WIC. The program is administered locally by the Allegheny County Health Department.

See U.S Department of Agriculture (2013) for a full description of WIC services.

Program Components

Nutrition information is provided to all WIC participants. Beyond offering nutrition education, WIC is involved in addressing other areas of maternal and child health, such as educating participants about the dangers of drug, alcohol, and tobacco use and encouraging breastfeeding. WIC also provides limited referrals to health and social services.

Program Reach and Results

WIC currently serves approximately 16,000 participants in Pennsylvania and has funding to serve additional applicants.
Behavioral Health Services

*Perinatal Hope*

**Program Description**

AHN’s Perinatal Hope program is a medical home care model for pregnant women who are addicted to drugs that combines obstetrical care, drug and alcohol therapy, and medication-assisted treatment into one prenatal clinic visit. The program is currently grant funded and operating at West Penn Hospital, with plans to expand to other AHN hospitals.

**Program Components**

Program services include comprehensive case management, care coordination and navigation, facilitation of peer and family support, and partnerships with community and social service agencies. After birth, staff work to transition mothers to community drug treatment and other services as needed.

The program utilizes the CenteringPregnancy group prenatal care program.

**Program Reach and Results**

This program has not been evaluated.
Pregnancy Recovery Center

Program Description

- Magee-Womens Hospital’s Pregnancy Recovery Center provides pregnant women who struggle with an opiate dependency the opportunity to begin treatment with buprenorphine on an outpatient basis that is integrated with obstetric services for UPMC Health Plan members. The center was opened in 2014. It is staffed by two registered nurses, two social workers, two peer navigators, and one administrative assistant. In 2016, it received 108 referrals, typically from the Magee-Womens Hospital Emergency Department and self-referral. The program has the capacity to serve 500 pregnant women annually. It maintains partnerships with the Emergency Department and 24/7 on-call services with the Perinatal Addiction Consultation and Education Services consultation team, it places brochures in OB offices, and it provides education within the community to recruit pregnant women for the program.

Program Components

The program includes

- buprenorphine conversion during pregnancy or the postpartum period
- outpatient conversion
- two-day induction (conversion), weekly appointments for a month afterward, and, if in compliance, appointments every two weeks until late in the third trimester
- weekly appointments that restart at 35 weeks’ gestation and continue until delivery
- weekly or biweekly appointments that occur in the postpartum period until participation in the program reaches six months
- monthly prescriptions given at that time for an indefinite period; suboxone is prescribed at six weeks postpartum.

Staff monitor Clinical Opiate Withdrawal Scale scores, vital signs, and urine drug screening results.

Program Reach and Results

According to UPMC Health Plan, in its first year, the Pregnancy Recovery Center treated 73 women for addiction, and 35 percent of infants born to those women required medication for withdrawal symptoms, compared with 73 percent of infants born to mothers who were treated for addiction at Magee in 2013 (before the Pregnancy Recovery Center) and required medication for withdrawal (UPMC Health Plan, n.d.). In 2016, 104 women were served. Compliance with substance use treatment, including completing appointments and urine drug screening results, was 55–57 percent.
Sojourner House

Program Description

Sojourner, a local nonprofit organization, provides inpatient residential treatment (Sojourner House) and housing and supportive services (Sojourner Moms) to addicted mothers and their children. Women must have at least one child under 12 and be either pregnant or seeking custody of a child. Program staff include eight administrative staff members, ten Sojourner House staff members, eight Sojourner Moms staff members, and a team of program aides. Referrals for the inpatient program are made from other drug and alcohol programs, caseworkers, social agencies, physicians, prison and probation officers, counselors, and children, youth, and family courts. Referrals for Sojourner Moms must go through Allegheny Link. The inpatient program has 14 apartments, with a waiting list during periods when the house is full; Sojourner Moms has 42 units of recovery housing.

Program Components

Sojourner House provides inpatient residential treatment including

- up to six months in individual apartments
- evidence-based gender-responsive treatment
- individual, group, and family counseling
- children’s programming
- links to community resources.

Sojourner Moms provides indefinite safe, affordable housing and supportive services to homeless, dual-diagnosed mothers and their children, including

- job readiness and educational opportunities
- case management and referrals to community resources
- life skills and parenting counseling
- educational, recreational, and addiction prevention activities for the children.

Program Reach and Results

In 2016, 43 women received residential treatment, 59 children were served, and 50 families received housing and supportive services. Forty percent of women stayed longer than 90 days. The average duration of participation is 317 days.

One hundred percent of Sojourner House children received medical services as needed and are current with immunizations, received programming based on assessment levels, demonstrated gains in school readiness indicators, improved social behavior when interacting with their peers, demonstrated improved language skills (letters and sounds), and showed improvement in cognition and general knowledge, and 93 percent of preschool children met age-appropriate fine motor skills goals.
Neonatal Abstinence Syndrome Program

Program Description

The Children’s Institute of Pittsburgh’s Neonatal Abstinence Syndrome Program provides services that help both the mother and infant with neonatal abstinence syndrome. The program addresses the following key components for long-term success: developing a positive and healthy mother-baby relationship, reducing the return of previous lifestyle choices, early detection, and management of developmental delays. Program staff for inpatient services include nurses, physicians, health care workers, a feeding specialist, and volunteers for the “cuddler program.” Care coordination staff include a nurse care coordinator and a health coach. Referrals are made from birthing hospitals in the area, OB/GYN practices, and methadone/Subutex providers. The program has four inpatient beds available and no capacity limits for care coordination. Outreach efforts include program presentations to case management or social work and nursing staff in pediatric units and neonatal intensive care units, as well as on-site presentations at OB/GYN practices.

The program serves the tri-state area for inpatient services and the 23-county area in western Pennsylvania for care coordination.

Program Components

The program includes multiple parts: care coordination services before and after birth, inpatient services including medical care and 24/7 nursing care and support, feeding evaluation and support, and outpatient developmental pediatric services after the baby goes home.

- **Care coordination (started July 2015):** Care coordination staff meet with the mother and the birth team during the third trimester. Following the infant’s birth and neonatal abstinence syndrome diagnosis, a clinical coordinator will go to the hospital to talk about next steps. Care coordination continues to provide support throughout the child’s time at the Children’s Institute as an inpatient and during outpatient treatment. Thirty hours of care coordination is provided annually.
- **Inpatient services (started December 2016):** When the infant is healthy enough for transfer from the birth hospital, he or she will go to the pediatric inpatient unit at the Children’s Institute. Private rooms allow the mom and baby to stay together, housing resources are available for additional family members to stay, and transportation is provided for the mom as needed for methadone/Subutex or facilitating guest dosing.
- **Feeding support:** During each infant’s inpatient stay, doctors evaluate feeding needs and help decide whether feeding therapy would be helpful.
- **Outpatient services:** After a patient leaves the inpatient unit, a doctor continues to see each child until at least age three. The developmental pediatrics team addresses any developmental delays the child may have to make sure the child stays healthy.
Program Reach and Results

As of September 2017, 45 women had received care coordination, 10 women had received inpatient care, 50 percent of patients had completed care coordination, and 100 percent had participated in inpatient care. The inpatient average length of stay is 20 days; the average length of care coordination is 24 months.
Pennsylvania Organization for Women in Early Recovery

Program Description

The Pennsylvania Organization for Women in Early Recovery (POWER) provides treatment and support services for women with addiction, including pregnant women and women with co-occurring disorders. Program management staff (nine) include administrators; managers of programs, the halfway house, and outpatient services; and a volunteer coordinator. Referrals are made from the Allegheny County Department of Human Services’ Office of Children, Youth and Families; Magee-Womens Hospital of UPMC; and other sources. POWER House has the capacity to serve 25 women at any one time.

Program Components

POWER has three primary components:

- **POWER House** is a 25-bed halfway house program. Women stay at POWER House for up to six months while they receive treatment, including psychiatric and health care services.

- **POWER New Day Outpatient** provides outpatient services including partial hospitalization (10–25 hours per week), intensive outpatient programming (5.5–9.5 hours per week), and regular outpatient counseling (1–5 hours per week). Group and individual therapy, resource coordination, and psychiatric services are offered to all clients. Childcare assistance and transportation assistance are also available.

- **POWER Connection** provides in-home drug and alcohol assessment and mentoring to women, including those involved with the Office of Children, Youth and Families; Magee-Womens Hospital; and other referral sources. These services are available to women who may be high risk, such as women who are pregnant, homeless, or victims of violence.

Program Reach and Results

In 2017, POWER served 1,417 women, including 492 admissions.

Women are staying at POWER beyond the evidence-based minimum of 90 days to receive the care they need (average inpatient stay is 125 days and outpatient is 104 days). POWER’s outcomes findings indicate that “clients are enjoying positive improvements in major areas, including reduction in drug and alcohol usage, lower CYF [Office of Children, Youth and Families] involvement, reduced criminal justice involvement, better health ratings, improved employment status, personal growth, better housing conditions, and restored personal and family relationships” (POWER, 2016).
Familylinks Family Treatment Center

Program Description

Familylinks operates two Family Treatment Centers, which provide long-term (up to six months) residential treatment for women age 18 or older with substance abuse issues and co-occurring mental health disorders, with or without children. Priority is given to pregnant women and intravenous drug users. Women may bring up to two children (up to age 12) to the facility, and childcare is provided during therapy sessions.

Program Components

Program services include individual, group, and family counseling; substance abuse, hepatitis, and HIV/AIDS education, counseling, and support; employment counseling; assistance with obtaining social services; and case management.

Program Reach and Results

This program has not been evaluated.
Alexis Joy D’Achille Center for Women’s Behavioral Health

Program Description

Located at West Penn Hospital, the center provides comprehensive treatment for women with perinatal depression. Women may be referred by their OB/GYN following screening for depression and bipolar disorder during pregnancy or postpartum or may self-refer. The program is staffed by a psychiatrist, a psychologist, a clinical social worker, and a nurse practitioner. Infants may remain with mothers during treatment.

Program Components

Depending on the level of severity and patient preference, women may elect to participate in

- weekly therapy sessions
- the Mother-Baby Intensive Outpatient Program, which includes three hours of group psychotherapy three days per week
- the Mother-Baby Partial Hospitalization Program, which includes five-hour group therapy sessions five days per week
- full hospitalization at Forbes Hospital.

Program Reach and Results

This program has not been evaluated.
Magee-Womens Behavioral Health Services

Program Description
Magee-Womens Behavioral Health Services are for women at all stages of life, including pregnancy and postpartum. Magee’s behavioral services are located at UPMC’s Magee-Womens Hospital, with services covered by health plans.

Program Components
Services offered include
• preconception evaluation and counseling
• comprehensive psychiatric assessment
• psychiatric consultation regarding use of medication in pregnancy and the postpartum period
• pharmacologic management during pregnancy and the postpartum period
• individual psychotherapy
• couples’ therapy
• stress and coping classes.

Program Reach and Results
This program has not been evaluated.
Family Support

Family Support Centers

Program Description

The Allegheny County Department of Human Services operates 28 Family Support Centers, which are neighborhood-based centers where parents with young children can attend programs, access resources, and connect with other parents. Centers are hosted by ten lead agencies, including AIU (12 centers), the Children’s Hospital of Pittsburgh (5), the Council of Three Rivers American Indian Center (1), Family Resources (1), Focus on Renewal (1), Primary Care Health Services (1), Providence Connections (1) South Hills Interfaith Ministries (1), the Kingsley Association (1), Trying Together (1), and the Urban League of Greater Pittsburgh (3), with training and technical assistance from the University of Pittsburgh Office of Child Development (Allegheny County Family Support, n.d.).

Staff members often live in the neighborhoods served by the centers, and some have nurses on staff. In 2013, the Family Support Network launched a campaign to raise awareness about the infant mortality crisis and help new mothers access information and supports. The campaign began with a poster contest across all Family Support Centers, with the winning poster distributed to all centers and the media.

Program Components

While all Family Support Centers offer a range of services, some of the core components include

- support accessing health care such as immunizations, well-baby visits, and pediatric visits
- prenatal care
- home visiting, including developmental screenings
- parenting programs.

For its parenting education component, AIU sites all use Parents as Teachers (evidence based) with fidelity; the other centers use a combination of Parents as Teachers and Nurturing Parenting (evidence informed). There are also six centers that are implementing Family Check Up (evidence based) in April 2018 through a partnership with the University of Pittsburgh.

Program Reach and Results

Together, the Family Support Centers serve about 6,000 children and their families annually. Approximately 300 women receive prenatal care, and over 1,500 children under the age of six received developmental screenings. As of February 2018, over 1,300 families were receiving home visiting services through Family Support Centers.

In a 2011 survey, parents reported greater social support and confidence after utilizing Family Support services.
**Healthy Start Fatherhood Program**

Program Description

The goal of Healthy Start’s Fatherhood Program is to assist fathers and other positive male role models to maintain involvement with their children and families through the promotion of parenting skills and the benefits derived from peer and program support. Participants in the program may be the male counterparts of women enrolled in Healthy Start or men from the community with pregnant partners or infants. The program has the capacity to serve 16 fathers in discussion groups at any one time and additional fathers for case management. Outreach efforts include the distribution of flyers in neighborhoods served by Healthy Start.

Program Components

The Fatherhood Program consists of several components:

- The Male Initiative Program educates fathers and other male caregivers about their importance to the outcome of a pregnancy and the ongoing health and well-being of their baby through health education, parenting support, case management, resource coordination, and referral. It utilizes the six-week Men of Standard curriculum. The program is being offered at three Healthy Start locations.
- Fatherhood Support Groups bring fathers together for peer support and education with a focus on relationships, responsibilities, and resources.

Program Reach and Results

After a hiatus in 2017, Healthy Start began recruiting for the program in 2018. As of July 2018, two cohorts of fathers had been through the Men of Standard curriculum, a third cohort was in progress, and another cohort was planned for later in the year. Attendance at the meetings averaged 9 participants. The program was also providing case management to 34 fathers. Healthy Start also hosted the Men of Standard Fatherhood Summit in 2018 with 72 male and female participants.
Responsible Fatherhood Program

Program Description

AIU’s Responsible Fatherhood Program is designed to support fathers to overcome parental and employment challenges. By providing the fathers with different opportunities and experiences, the program aims to equip them to become more self-sufficient and nurturing. Any father associated with AIU’s Family Support Centers is eligible to join.

Program Components

The Responsible Fatherhood Program focuses on

- economic self-sufficiency
- healthy development of children
- effective parenting.

The program utilizes the National Fatherhood Initiative’s 24/7 Dad and Doctor Dad curriculums. Monthly meetings, case management, group activities, mentoring, and home visits are offered. The meetings are held at the family centers in Wilmerding and McKees Rocks. Snacks and childcare are available.

Program Reach and Results

This program has not been evaluated.
Healthy Start Life Skills Classes

Program Description

Healthy Start’s Life Skills program is a ten-week course intended to give participants and their partners the basic training and tools to successfully apply the education they will receive during Healthy Start home visits.

Program Components

Topics include

- nutrition
- coping skills
- health
- budgeting
- cooking
- self-care
- infant care
- self-esteem
- basic house-cleaning tips.

Participants in Life Skills can receive transportation assistance and utilize onsite childcare. Additionally, they are provided a resource each week that corresponds to the session’s topic. The class is offered two times per year to 10–15 women.

Program Reach and Results

This program has not been evaluated.
**Baby Promise**

**Program Description**

Homewood Children’s Village Baby Promise is an eight-week program designed for expectant parents and parents of children ages zero to five in the Homewood community. Baby Promise is free to participants and is coordinated by Homewood Children’s Village. It explores key developmental milestones in early childhood, examines the relationship between health and environment, strengthens family bonds, and connects parents to resources in the community. Program staff include a part-time program manager and a part-time AmeriCorps employee. Referrals to the program come from other Homewood Children’s Village programs and word of mouth. The program has the capacity to serve 15–20 families at any one time and about 60 families annually. Outreach efforts include posters in the community and a Facebook page.

**Program Components**

Three-hour classes are held on Saturdays at the Homewood YWCA. Volunteers provide childcare during the sessions. Discussions are led by staff, guest speakers, and parents who become facilitators. Communication outside the classes is encouraged through a Facebook page.

Parents receive training in healthy pregnancies, stages of child development, health and safety, discipline and stress management, and nutrition and healthy foods. The program is loosely based on the Harlem Children’s Village Baby College and uses curriculum developed by La Escuelita and Eco Healthy Child.

**Program Reach and Results**

The first three cohorts served a total of 30 families, and the goal is to increase to 60 families served annually in five cohorts. Approximately 33 percent of participants complete the full program; some families have participated in multiple cohorts.
Appendix B. Causal Inference Framework

In this appendix we describe in greater depth each step of our causal inference framework. Before diving into the details of the machine learning algorithms and econometric methods that we employ in order to estimate causal effects, we must provide additional details about the Infant Mortality Prediction System with Intervention Management (IMPreSIv) data that inform our methods and the results.

As described in Chapter 2, the University of Pittsburgh team performed data quality assessments of the IMPreSIv database to examine the completeness, validity, consistency, and currency of the data. For our analyses, we treated missing data differently depending on the type of data (reportable, potentially reportable, or health care data) in the IMPreSIv database. For example, the potentially reportable and health care data from the Medical Archival Retrieval System and Magee Obstetric Maternal and Infant datasets include diagnostics. In diagnostic data, the missingness is selective since the same diagnostic tests are not performed on every mother and child. If a patient is diagnosed with a certain condition, then we can be relatively confident that the patient has the condition (unless the diagnostic test was erroneous). However, a lack of diagnosis means either that the patient does not have the condition or that the patient has not been tested for the condition. As a result, in the IMPreSIv database, we cannot distinguish between not having the condition and not being tested for the condition. The situation is different for reportable data since all women report the information as part of the birth certificate data. For example, the birth certificate data include a field for mothers to report insurance status (e.g., private insurance, Medicaid, or self-insured). As a result, we know that missing data are truly missing in the reportable data.

The options for handling missing data are to exclude observations with missing values, impute the missing values, alter the interpretation of the variable, or interpret the missing values as themselves conveying information. With the diagnostic data, the only real option is to alter the interpretation of the variable since we cannot distinguish between not having the condition and not being tested for the condition. Consequently, we interpret the diagnostic variables as indicating either a positive diagnosis or the lack of a positive diagnosis. For missing values in the reportable data and in some of the health care data, such as ultrasounds and toxicology tests, we interpret the missing values as themselves conveying information.

For missingness in the diagnostic data, we alter the interpretation of the variable. While we could exclude observations or impute missing values in the birth certificate data, we could not exclude or impute observations with missing ultrasounds or missing toxicology reports. Instead, we interpret the missing values as themselves conveying information. For instance, the number of ultrasounds during pregnancy conveys some information about the health of the fetus. Similarly, simply receiving a toxicology screen provides some information about the provider’s
perception of maternal behavioral risk factors. For the reportable data, a missing insurance status or a missing paternal education level potentially conveys information that could be correlated with the risk of infant mortality. As a result, the predictors examined sometimes include categorical variables that represent missing values.

Step 1: Infant Mortality Prediction

The first step of our causal inference framework leveraged the work of the University of Pittsburgh team on the predictions of the risk of infant mortality. These predictions were based on thousands of variables in the IMPreS IV database describing parental characteristics (e.g., race, age, and education), parental behaviors (e.g., smoking or substance abuse), pregnancy conditions (e.g., gestational age and complications), prenatal observations and diagnostics (e.g., ultrasound measurements), and postnatal observations and diagnostics (e.g., Apgar scores and birth weight), as well as socioenvironmental risk factors (e.g., local air quality). While we leveraged the predictive models of the University of Pittsburgh team by examining their results and ensuring that the risk factors that they identified as important were also included in our models, we developed our own models to predict infant mortality using each type of data at each point in time.

While this first step aims to predict the risk of infant mortality, the ultimate aim of our causal inference framework is to estimate the effect of interventions. The IMPreS IV database documents participation in various interventions that may reduce or at least be correlated with the risk of infant mortality. Consequently, when modeling $Y_{im}$, the mortality of child $i$ born to mother $m$, we include the wide array of risk factor variables in the IMPreS IV database, $X_{im}$ (e.g., parental characteristics, parental behaviors, pregnancy conditions, prenatal observations and diagnostics, postnatal observations and diagnostics, and socioenvironmental risk factors), as well as indicators documenting intervention participation. However, we will make a distinction between the intervention of interest, $T_{im}$, and the other interventions, $I_{im}$, the mother $m$ participated in. With the ultimate goal of estimating the effect of the intervention of interest, we exclude $T_{im}$ from this first step but include the indicators for participation in all the other interventions, $I_{im}$.

We also account for time trends in infant mortality using year-of-birth indicators, $\tau_i$, and indicators of the mother’s residence (by three-digit zip code), $\mu_i$. All of which results in the following model of infant mortality:

$$Y_{im} = f(X_{im}, I_{im}, \tau_i, \mu_i) + \varepsilon_{im}$$  \hspace{1cm} (1)

$\varepsilon_{im}$ describes the error term, or the difference between the prediction and the actual observations, which is an important element of the predictive methods that we employ. Also note that in Equation (1), $X_{im}, I_{im}, \tau_i, \mu_i$ are in bold, while $Y_{im}$ and $\varepsilon_{im}$ are not. This is because $Y_{im}$ and $\varepsilon_{im}$ each describe one variable, while $X_{im}, I_{im}, \tau_i, \mu_i$ each describe multiple variables. $Y_{im}$ is equal to 0 if the infant lives and 1 if the infant dies. With $X_{im}, I_{im}, \tau_i, \mu_i$
each describing multiple variables, the mathematical relationship appears simpler than it actually is. \( X_{im} \) describes thousands of risk factors documented in the IMPreSIv database, \( I_{im} \) describes participation in each of the other interventions, \( \tau_i \) describes multiple indicators of year of birth, and \( \mu_i \) describes multiple indicators of maternal residential location.

The function \( f(\bullet) \) in Equation (1) also makes the mathematical relationship appear simpler than it actually is, but its vagueness is key for the machine learning algorithms we use to predict infant mortality. In this context, the objective of the machine learning algorithms we employ is to find the function, \( f(\bullet) \), that picks the most important predictive variables in \( X_{im}, \tau_i, \) and \( \mu_i \) (our models require that all the interventions in \( I_{im} \) are included in the model) and combines the interventions \( I_{im} \) and chosen \( X_{im}, \tau_i, \) and \( \mu_i \) variables in such a way that the error \( \varepsilon_{im} \), or difference between observed infant mortalities and the predicted infant mortalities, is minimized. In other words, the objective is to find the most accurate model, or function \( f(\bullet) \), of infant mortality.

Different machine learning algorithms find the most accurate model in different ways. The machine learning algorithms that we employ differ from traditional approaches to modeling in two ways. With traditional modeling, the research makes the decision about which variables to include and the form that the function \( f(\bullet) \) takes. The first decision of which variables to include in the model is called model specification. This means that if \( X_{im} \) describes \( L \) variables, the researcher chooses \( K \) of them, where \( L \geq K \). The second decision of the form of \( f(\bullet) \) means that the researcher chooses how the variables work together in combination. For instance, the most common form of \( f(\bullet) \) is linear, which would look like this:

\[
Y_{im} = \beta_1 X_{im1} + \beta_2 X_{im2} + \cdots + \beta_K X_{imK} + \delta_1 I_{im1} + \delta_2 I_{im2} + \cdots + \delta_S I_{imS} + \tau_{i1} + \cdots + \tau_{iR} + \mu_{i1} + \cdots + \mu_{iR} + \varepsilon_{im}.
\]

Here the \( \beta \)s and \( \delta \)s estimated by the model would give the associations between each of the chosen \( X_{im} \) and \( I_{im} \) variables and infant mortality. However, researchers may be biased about which variables they think are important enough to include in the model, and the simple linear form might be the best fit of the actual data. And this is the benefit of more-complex machine learning algorithms. First, the machine learning algorithms that we employ assess the variation in the data and determine which of the \( X_{im}, \tau_i, \) and \( \mu_i \) variables are most important and should be included in the model (along with all of the other interventions described in \( I_{im} \)). Using the machine learning algorithms to choose which variables to include avoids the potential model misspecification bias introduced by researchers. Second, machine learning algorithms examine many different forms of the function \( f(\bullet) \), both linear and nonlinear, until the most accurate model of the outcome is found.

The way that the most accurate model of the function \( f(\bullet) \) is found varies by algorithm. The main machine learning algorithm that we use is the gradient boosting machine. Intuitively, what the gradient boosting machine algorithm does is start with a simple function, such as the linear one we previously described. Then the algorithm analyzes the error term, \( \varepsilon_{im} \), or the difference between the prediction and the actual observations, and learns from it. The algorithm identifies
shortcomings in the model and then finds a different function $f(\cdot)$ that produces fewer errors than the first function. The gradient boosting machine algorithm identifies shortcomings in the model by using gradients in a loss function that describes the differences between the prediction and the actual outcome. And that process continues until the algorithm cannot find another function that reduces the errors (Friedman, 2002). This iterative process of generating weakly predictive models, learning from them, and using them to achieve a strong predictive model is called boosting (Schapire, 1990). We also evaluated LogitBoost, neural network, random forest, and support vector machine algorithms. With each of these algorithms there are similarities; the differences lie in the details of how they seek to accomplish the same thing. Like the gradient boosting machine algorithm, LogitBoost uses boosting—or the iterative process of learning from weakly predictive models to achieve a strongly predictive model—but instead of using gradients, it minimizes a logistic loss function (Friedman, Hastie, and Tibshirani, 2000). Neural networks, another name for deep learning that is modeled on the human brain, also use iterative learning but do so with interconnected nodes (Schmidhuber, 2015). And while the gradient boosting machine uses weakly predictive models and iteratively builds off them, random forests do not iteratively improve. Instead, they build strong decision trees (or flowcharts) for multiple random samples of the data and then aggregate the predictions (Breiman, 2001). With binary (0 or 1) outcomes, the support vector machine algorithm seeks to find the hyperplane (i.e., a line in multidimensional space) that best divides the data so that every observation on one side of the hyperplane corresponds to the outcome 0 and every observation on the other side of the hyperplane corresponds to the outcome 1 (Cortes and Vapnik, 1995). Comparing the results of these algorithms, we found that, in our context, the gradient boosting machine algorithm generally produced the most accurate predictions. Random forests were comparably accurate though considerably more computationally intensive.

For each predictive model, we divide the data into training and testing samples—training to build the model, and testing to assess its accuracy. We evaluate the performance of our models using common evaluation metrics, including area under the receiver operating characteristic curve (AUC) scores. The receiver operating characteristic curve is the graph of the true positive rate against the false positive rate. A true positive in our context is when an individual is predicted to participate in the intervention and does. A false positive is when an individual is predicted to participate in the intervention but does not. The AUC combines the true positive rate and false positive rate into one measure. Intuitively, the AUC measures the percentage of randomly drawn pairs of one individual who participates in the intervention and one individual who does not participate for which the predictive model is accurate. An AUC score of 1 describes a perfect predictive model; an AUC of 0.5 means that the predictive model is 50-percent accurate—that is, that the predictive model is no better than flipping a coin. An AUC above 0.9 is considered excellent, 0.8–0.9 is very good, 0.7–0.8 is good, 0.6–0.7 is fair, and 0.5–0.6 is poor.
The results of this step are risk scores for each delivery in Allegheny County between 2003 and 2013. Additionally, this step reveals which variables are important predictors of infant mortality.

Step 2: Intervention Participation Prediction

The second step in our causal inference framework was to develop predictive models of participation in each of the interventions observed in the data. In other words, in this step we aim to predict participation in the intervention of interest, $T_{im}$. The first difference of note between this step and the previous step is that in this step infant mortality is irrelevant. Consequently, $Y_{im}$ is excluded from our predictive models of intervention participation. However, the wide array of risk factor variables in the IMPreSv database, $X_{im}$, the indicators of participation in other interventions, $I_{im}$, birth year indicators, $\tau_i$, and maternal residential location indicators, $\mu_i$, are relevant predictors of participation in the intervention of interest, $T_{im}$. The following formula describes the relationship between the intervention of interest that the mother $m$ participated in during preconception, during pregnancy, or after the delivery of child $i$, $T_{im}$, and the relevant predictors:

$$ T_{im} = g(X_{im}, I_{im}, \tau_i, \mu_i) + \eta_{im} $$ (2)

We again used a machine learning algorithm, specifically the gradient boosting machine, to specify which $X_{im}$, $\tau_i$, and $\mu_i$ variables to include in the model (along with all the other interventions described in $I_{im}$) and choose which function $g(\cdot)$ combines the $I_{im}$ and chosen $X_{im}$, $\tau_i$, and $\mu_i$ variables to minimize the difference between the observed participation in $T_{im}$ and the predicted participation. As in step 1, we evaluated the performance of our models using common evaluation metrics, including AUC scores. The results are predictions of participation in each of the interventions available in the IMPreSv database.

Additionally, our results describe which of the predictors are most important. The relative importance measure that we use is, essentially, correlation in a multivariate setting. The measure of relative importance is a derivative of variable importance. To measure variable importance, the variables are ranked by the improvements each brings to the model. Specifically for the gradient boosting machine algorithm, which we use and which uses decision trees constructed by choosing split variables to minimize error, variable importance is calculated by the sum of the decrease in error when split by a variable. Then the relative importance is the variable importance divided by the highest variable importance value so that values are bounded between 0 and 1 (or 100). However, relative importance is a metric for nonlinear models, and it does not show direction or causation. While linear models are more easily interpretable, the assumed linearity can limit the accuracy of the model. In estimating causal effects of interventions, the accuracy of the intervention participation predictions is more important than being able to interpret how the other risk factors correlate with the outcome.
It is also important to note that many of the interventions that we model have low participation rates. For instance, only 6 percent of the deliveries in Allegheny County between 2003 and 2013 received home visiting services in pregnancy or postdelivery, and 4 percent used Family Support Centers. This means that our outcome is imbalanced, or not 50 percent either way. The same is true for our analysis in step 1, where less than 1 percent of the observed deliveries end in infant mortalities. Consequently, in our predictive models both of infant mortality and of intervention participation, we employ random oversampling. Random oversampling is a technique to synthetically adjust the distribution of the outcome in the data. Random oversampling randomly selects an observation from the minority group (i.e., the less frequently observed outcome) and adds a duplicate of the observation to the data (Chawla, 2009). There are other techniques designed to balance the data, such as random undersampling and synthetic oversampling. We evaluated and compared these various methods and found only negligible differences.

Our prediction of intervention participation serves three purposes. First, understanding the drivers of intervention participation is critical to developing appropriate recommendations so that individuals are referred to interventions that they are more likely to participate in. Second, combining the predictions of intervention participation with the predictions of infant mortality reveals which of the thousands of variables in the IMPreSlv database are important in modeling the interventions’ causal effects on infant mortality. Third, and most importantly, we can use the predictions of intervention participation to control for selection, thereby comparing the risk of infant mortality of mothers and children who are similar in terms of their likelihood of participating in the interventions.

The results of this step are presented in Chapter 7. Additionally, this step reveals which variables are important predictors of intervention participation. Combining the important predictors of intervention participation with the important predictors of infant mortality gives us a data-driven specification of the model to avoid introducing misspecification bias.

**Step 3: Causal Effect Estimation**

Our third step in the causal inference framework combined the infant mortality and intervention participation predictions and then used econometrics to estimate the causal effect of the interventions. This novel method is called double machine learning (DML), which was introduced by Chernozhukov et al. (2018). We used the following partially linear model to estimate the relationship with DML:

\[ Y_{im} = \beta T_{im} + h(X_{im}, I_{im}, \tau_i, \mu_i) + \nu_{im} \]  

As before, \( Y_{im} \) describes infant mortality, \( T_{im} \) indicates participation in the intervention of interest, \( X_{im} \) describes the potential risk factors, \( I_{im} \) indicates participation in the other interventions, \( \tau_i \) contains birth year indicators, and \( \mu_i \) contains maternal residential location.
indicators. The objective is to estimate $\beta$, or the effect of the intervention of interest $T_{im}$. DML builds off the previous predictions of infant mortality (Equation 1) and the predictions of intervention participation (Equation 2), which identify which $X_{im}$, $\tau$, and $\mu_i$ variables to include in the model and the functional form of $h(*)$. DML uses the union of risk factors shown to be important predictors of either infant mortality or intervention participation.

Intuitively, DML takes the variation in infant mortality that cannot be explained by $X_{im}$ and $I_{im}$ and determines how much can be attributed to the intervention of interest $T_{im}$. In other words, if the risk factors in $X_{im}$, other interventions in $I_{im}$, birth year indicators in $\tau$, and maternal residential location indicators in $\mu_i$ can predict infant mortality with 90-percent accuracy, 10 percent of infant mortality is left unexplained. DML estimates how much of the unexplained variation can be explained by the intervention of interest $T_{im}$ by using the predictions of intervention participation to account for selection and compare similar individuals.

Mathematically, DML estimates the effect of the intervention of interest by first calculating the difference between the actual infant mortality outcomes, $Y_{im}$, and the prediction of infant mortality, $\hat{Y}_{im}$. This difference is denoted as $\hat{W}_{im}$ and is also known as the residuals from Equation (1).

$$\hat{W}_{im} = Y_{im} - \hat{Y}_{im} \tag{4}$$

Next, DML calculates the residuals from Equation (2), or the difference between the actual participation in the intervention of interest, $T_{im}$, and the predicted participation, $\hat{T}_{im}$, denoted as $\hat{V}_{im}$:

$$\hat{V}_{im} = T_{im} - \hat{T}_{im} \tag{5}$$

Finally, DML regresses the residuals from Equation (1), $\hat{W}_{im}$, on the residuals from Equation (2), $\hat{V}_{im}$. In econometrics, regressing one set of residuals on another is known as partialling out and is based on the foundational Frisch and Waugh (1933) and Lovell (1963) theorems. The result of regressing is an estimate of the intervention $T_{im}$’s effects on infant mortality, or $\hat{\beta}$.

Note that in the DML procedure, both $f(*)$ and $g(*)$ are partialled out. In other words, the purpose of the machine learning algorithms in this method is to estimate the effects of “noise parameters,” or parameters we are uninterested in. This means that the most important aspect of the machine learning algorithms is their accuracy, and their “black box” nature (the most common critique of machine learning) is less important. However, while the “black box” critique of machine learning algorithms is less important in our case, we also directly address this critique by using different data inputs to check the sensitivity of our estimates. As previously stated, we segmented the data into three different types: reportable (containing only the variables available in the vital statistics data), potentially reportable (adds some diagnostic and medication information that women could potentially report to the vital statistics data), and health care information (test results and ultrasound measures added to the potentially reportable data). In performing the DML estimation using different data types, we should not expect the results to be
identical, but results that are outliers, that differ dramatically from others, or that differ in unexpected ways require a reexamination. Estimating using the different data types also serves the practical purpose of community implementation: social service and health care providers have access to different information about patients, which may affect their recommendations.

Additionally, in performing the DML, we use sample splitting in order to generate crossfit estimates that eliminate asymptotic bias (Chernozhukov et al., 2018) and enable endogenous stratification. Sample splitting means that we estimate Equations (1) and (2) on different splits of the sample and use the parameters estimates to fit the model using a different sample split. Then, \( \hat{W}_{im}^{s} \) is regressed on \( \hat{V}_{im}^{s} \) for each sample split \( s \), producing multiple, crossfit estimates of the intervention’s effects, \( \hat{\beta}^{s} \). Our final estimate is the average of all the crossfit estimates, or \( \frac{1}{S} \sum_{s} \hat{\beta}^{s} \). Sample splitting also allows us to endogenously stratify the results without bias.

Endogenous stratification is the stratification of the estimated effects by predictions of the outcome using in-sample data. In other words, because infant mortality is a rare event, the most relevant results describe how effective the interventions are among those who have the highest predicted risk of infant mortality. The main results that we have presented in the main report are stratified by predicted risk of infant mortality. However, endogenous stratification is typically problematic because it generates bias as a result of overfitting (Abadie, Chingos, and West 2018). Fortunately, sample splitting eliminates this bias (Abadie, Chingos, and West, 2018).\(^1\)

The causal interpretation of the estimates depends on the assumption of conditional unconfoundedness. Conditional unconfoundedness means that after conditioning on the covariates, treatment with the intervention is essentially random. In the DML context, the assumption is that our predictions of intervention participation account for enough of what drives participation that the remaining unexplained variation in intervention participation is random or unrelated to infant mortality. Given the breadth of the IMPReSIv database and the accuracy of our predictive models of intervention participation, we believe that, in general, conditional unconfoundedness is a reasonable assumption. Where the assumption may not hold is among the interventions where our participation predictions are less accurate. Less accurate predictions mean that there is more unexplained variation that could also be related to infant mortality. As demonstrated in Chapter 7, our predictive models are very accurate for most of the interventions, the least accurate models being for preconception/interconception care (AUC = 0.758) and for doula support (AUC = 0.804). While these represent decently accurate models relative to much of the predictive modeling literature, they are more susceptible to violating the assumption of conditional unconfoundedness. Consequently, we are less confident that the estimates of the effects of preconception/interconception care and doula support represent true causal effects.

The results of this step are presented in Chapter 8.

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\(^1\) Additionally, the bias introduced by endogenous stratification is reduced as the sample size grows, and our sample is large, with 155,218 observations.
Step 4: Effect Heterogeneity Estimation

In the fourth and final step in our causal inference framework, we aim to examine variation in the effects of the interventions by risk factor or intervention combinations. In other words, in this step we estimate the effectiveness of the interventions for women with particular risk factors (e.g., gestational diabetes, smoking, or prior pregnancy history) or how effective the interventions are when combined with other interventions.

We performed this step using a variant of the DML method. Instead of estimating the relationship described in Equation (3), here we estimated the following relationship:

\[ Y_{im} = \beta T_{im} + \gamma C_{im} + \delta T_{im} \times C_{im} + h(X_{im}, I_{im}, \tau, \mu_i) + \tau_{im} \]  (6)

The key difference between Equation (6) and Equation (3) is the inclusion of an interaction term, \( T_{im} \times C_{im} \). As before, \( T_{im} \) denotes participation in the intervention of interest, and \( C_{im} \) denotes the other characteristic. In the previous steps, \( C_{im} \) was either one of the risk factors in \( X_{im} \) or one of the other interventions in \( I_{im} \). For example, \( C_{im} \) could denote gestational diabetes, equal to 0 for those without gestational diabetes and 1 for those with gestational diabetes. The multiplication of \( C_{im} \) and \( T_{im} \) creates a variable that is equal to \( T_{im} \) only for those with gestational diabetes. This means that if we follow the same procedure described in step 3, we will obtain estimates for \( \hat{\beta} \), the average effect of the intervention, \( \hat{\gamma} \), the average effect of the characteristic \( C_{im} \), and \( \hat{\delta} \), how the effect of the intervention differs for those with the characteristic \( C_{im} \).

The results of this step enable more precise recommendations based on an individual’s risk profile. The results of this step are presented in Chapter 9. Overall, the four steps of our causal inference model enable us to predict the risk of infant mortality, predict who will participate in the interventions, describe the effectiveness of each intervention we observe, and examine which interventions will most benefit those at risk, depending on what is driving their risk.
Appendix C. Additional Results from the Causal Inference Framework

Step 1: Infant Mortality Prediction

Accuracy of Predictions

While predicting infant mortality was the objective of the work of the University of Pittsburgh team, the different data types that we employed (reportable, potentially reportable, and health care) at each point in time (preconception, pregnancy, and postdelivery) meant that we needed to develop our own predictive models of infant mortality. In evaluating these models, we assessed the AUC scores, and we examined the results of the University of Pittsburgh team’s models to ensure that the risk factors that they identified as important were also included in our models. However, direct comparisons of the results of our predictive models of infant mortality with the University of Pittsburgh team’s models are inappropriate for two reasons. The first reason is that while we each use the IMPreSIv database, the precise inputs to our models are different. As described, we employed three different data types that mimic the different information available to different types of providers who will ultimately utilize our work. The second reason is that the University of Pittsburgh team’s modeling efforts had to balance predictive accuracy with interpretability. For that reason, they employed algorithms that produced more easily interpretable results so that readers and users of the model could easily understand how each variable correlates with infant mortality. Our modeling efforts did not need to sacrifice accuracy for interpretability, because understanding how each risk factor correlates with infant mortality was not our objective. Our only objective in developing predictive models of infant mortality was accuracy. The more accurate the model, the better understanding we have of which variables are important to control for in estimating the effects of the interventions.

We also used this step to compare accuracy across machine learning algorithms. As described in Appendix B, we tested models using the gradient boosting machine, LogitBoost, neural network, random forest, and support vector machine algorithms. Figure C.1 shows the AUC scores of a variety of models of infant mortality. The top three bars show the AUC scores of models using the support vector machine algorithm for the three different data types (reportable, potentially reportable, and health care). The next three bars show the AUC scores of models using the random forest algorithm for the three different data types. Then we show the results of models using the neural network algorithm, followed by the results of models using the LogitBoost algorithm. Finally, the last three bars show the results of models using the gradient boosting machine algorithm. Comparing across algorithms, we see that each algorithm performs very well but the gradient boosting machine algorithm produces the most accurate predictions,
and it produces the most accurate predictions using each of the preferred models. The data type employed in our preferred models is health care, meaning the maximum amount of information. The figure shows the results for predicting intervention participation at any time.

**Figure C.1. Predicting Infant Mortality**

[Graph showing AUC values for different models]

*Predictors of Infant Mortality*

The following figures describe which pieces of information are driving the predictions. As in Chapter 7, we use the measure of relative importance to gauge which predictors are more important or useful to the models. Relative importance is a measure from 0 to 100 of which factors are strongly correlated to participation in the intervention and the strength of that correlation relative to other factors.

Figure C.2 shows which variables among those available before conception are important predictors of infant mortality. The strongest predictor of infant mortality is the mother’s lack of a social security number. Additionally, missing information about the father’s age is a strong predictor and likely related to the level of involvement of the father in the pregnancy and delivery. Marital status, race or ethnicity, and insurance status are additional important predictors of infant mortality using only information that is available before conception.
Figure C.2. Relative Importance of Predictors of Infant Mortality: Preconception

Figure C.3 shows which variables among those available during pregnancy (including those available before conception) are important predictors of infant mortality. The number of prenatal exams is an important predictor, as are the lack of a social security number, marital status, and the presence of abnormal clinical findings in the third trimester.

Figure C.3. Relative Importance of Predictors of Infant Mortality: Pregnancy

Figure C.4 shows which variables of those available after delivery (including those available before conception and during pregnancy) are important predictors of infant mortality. As expected, information about the length of gestation and birth weight, both known factors in infant mortality, are among the strongest predictors. Additionally, the number of prenatal exams, breastfeeding status, and the presence of abnormal clinical findings in the third trimester are important predictors.
Step 2: Intervention Participation Prediction

The following figures show how the accuracy of our predictions of intervention participation vary by data type: reportable, potentially reportable, and health care. We also estimated predictive models of participation in each intervention by time period. However, for brevity, the following results describe participation in the interventions at any point in time, and they are broadly representative of the results for specific time periods. Overall, the models give quite accurate predictions of intervention participation. AUC above 0.9 is considered excellent, 0.8–0.9 is very good, 0.7–0.8 is good, 0.6–0.7 is fair, and 0.5–0.6 is poor. Generally, as information is added to the models—going from the smaller set of reportable data to potentially reportable data and finally to health care data—the accuracy of the models increases.

Medical-Setting Interventions

In the first set of figures, we show the accuracy of our predictions of medical-setting interventions: preconception/interconception care (Figure C.5), prenatal care (Figure C.6), and doula support (Figure C.7). Preconception/interconception care is only reported for the potentially reportable and health care data types because three of the four types of preconception/interconception care are not available in the reportable data. The accuracy of our predictions of preconception/interconception care is the lowest of all the intervention models that we use. However, the accuracy of our models of doula support using potentially reportable and health care data is lower. Note that the model of doula support using reportable data is more accurate despite having access to less information. This finding is related to characteristics of the sample. That is, the potentially reportable and health care data types describe births that occurred only at UPMC’s Magee-Womens Hospital. The limited accuracy of our models of doula support using potentially reportable and health care data indicates that doula support is provided in a different way from how it is throughout the rest of the county. Because of the limited accuracy of
our models of doula support using potentially reportable and health care data, all of the doula support results that we present in Chapters 7, 8, and 9 rely only on the reportable data type.

**Figure C.5. Predicting Intervention Participation: Preconception and Interconception Care**

![Bar chart](image1)

**Figure C.6. Predicting Intervention Participation: Prenatal Care**

![Bar chart](image2)

**Figure C.7. Predicting Intervention Participation: Doula Support**

![Bar chart](image3)
Health Promotion and Education

In Figure C.8, we show the accuracy of our predictions of home visiting. Home visiting includes Healthy Start, Early Head Start, and NFP. As is typical for most of our predictive models, the accuracy improves as the available data grow. The reportable data type includes the lowest amount of data, the potentially reportable data type adds information about diagnostics and medications that women could potentially report to providers, and the health care data type includes all the information in the IMPreS1v database, including ultrasound measures, blood test results, and toxicology reports.

Figure C.8. Predicting Intervention Participation: Home Visiting

Support and Referrals

Here we describe the accuracy of our models in predicting participation in Family Support Centers (Figure C.9), WIC (Figure C.10), and behavioral health services (Figure C.11). In the IMPreS1v database, we observe participation in one pregnancy and postpartum support service: Family Support Centers. For breastfeeding and nutrition support services, we observe utilization of WIC. For behavioral health services, we observe participation in drug and alcohol programs and utilization of mental health support services. As with most of our predictive models, the accuracy of these models improves as the available data grow.
Here we describe the accuracy of our models in predicting participation in income, medical, and other benefits programs. In the IMPReSIV database, we observe four income benefit programs.
programs: General Assistance, the Supplemental Nutrition Assistance Program, Temporary Assistance for Needy Families, and Supplemental Security Income (Figure C.12). Additionally, we observe two medical benefits: HealthChoices (Pennsylvania’s managed care program for Medical Assistance recipients) and Medical Assistance Transportation (Figure C.13). Finally, we observe two other benefits: assisted housing and other general, public supports (Figure C.14). As with most of our predictive models, the accuracy of these models generally improves as the available data grow.

![Figure C.12. Predicting Intervention Participation: Income Benefits](image1)

![Figure C.13. Predicting Intervention Participation: Medical Benefits](image2)
Figures C.15, C.16, and C.17 describe which variables are important predictors of participation in the benefits program. Overall, for each type of benefit, receipt of other benefits is an important predictor. Additionally, and unsurprisingly given the eligibility requirements for these benefit programs, socioeconomic factors including marital status, race or ethnicity, and education are important predictors.

**Figure C.14. Predicting Intervention Participation: Other Benefits**

- **Reportable**: 0.916
- **Potentially Reportable**: 0.919
- **Healthcare**: 0.963

**Figure C.15. Relative Influence of Predictors of Intervention Participation: Income Benefits**

- **Marital status**
- **Father's education: HS or GED**
- **Mother's race: black**
- **Married**
- **Receives medical benefits**
Step 3: Causal Effect Estimation

The following figures show how our estimates of the interventions’ causal effects vary by data type. Then we describe the causal effects of the benefit programs on infant mortality.

Results by Data Type

Recall that showing how the results vary by data type serves two purposes: one methodological, and the other practical. Methodologically, by estimating the effects using
different data types, we are changing the inputs and thereby testing the sensitivity of the results. We should not expect the results to be identical across the different data types, but results that are outliers, that differ dramatically from others, or that differ in unexpected ways require a reexamination. Practically, because the information that social service providers can obtain differs from the information that health care providers can obtain, the different data types reflect the information each type of provider can obtain.

Medical-Setting Interventions

The following figures describe how our estimates vary by data type for preconception/interconception and prenatal care. As previously mentioned, we only estimate the effects of doula support using the reportable data type because our predictions of participation using the potentially reportable and health care data types are not sufficiently accurate.

For preconception/interconception care, reportable data are not included because three of the four specific interventions are not included in the reportable data—namely, contraceptive counseling, genetic testing, and vaccinations. The effects by data type are remarkably similar, suggesting that the results are robust to the data inputs (Figure C.18). For prenatal care, at all but the highest risk level, the results for potentially reportable and health care data are similar (Figure C.19). At higher risk levels, the effects based on reportable data are smaller than for the other data types, with the gap shrinking at lower risk levels. These differences are somewhat expected. They indicate that as the amount of data increases and the predictive models become more accurate, we are better able to control for selective participation. And it is expected that the influence of selection is larger in the more limited data types at higher levels of risk.
Health Promotion and Education

For home visiting, our estimates of the effects by data type vary, but typically the differences are not statistically significant (Figure C.20). Where the confidence intervals overlap, the
differences are generally not statistically significant. So the main difference is at the highest risk level. As with prenatal care, the effects based on reportable data are smaller than for the other data types, indicating the larger influence of selection at the highest risk levels.

Figure C.20. Causal Effects of Home Visiting by Data Type

Support and Referrals

For pregnancy and postpartum support via Family Support Centers, recall that the estimates in Chapter 8 show opposite effects—an increase in the risk of infant mortality. These results are due to not accounting for duration of participation. The results in Figure C.21 also indicate that participation in Family Support Centers is highly selective. Without the additional information in the potentially reportable and health care data types, the results using the reportable data indicate that Family Support Centers reduce the risk of infant mortality. Put together, these results indicate that extensive data are necessary to account for selection and that it is also important to measure duration of participation.
The next figures show how the estimates of the effects of WIC and behavioral health services vary by data type. For breastfeeding and nutrition support, the effects vary by data type, but typically the differences either are not statistically significant or are indicative of the influences of selection at the highest risk levels (Figure C.22). For behavioral health services, the estimates of the effects by data type vary, but typically the differences are not statistically significant (Figure C.23). So the main difference is at the highest risk level. As with prenatal care, the effects based on reportable data are smaller than for the other data types, indicating the larger influence of selection at the highest risk levels.
Figure C.22. Causal Effects of the Women, Infants, and Children Program by Data Type

Figure C.23. Causal Effects of Behavioral Health Services by Data Type
**Generalizability**

In this section we provide estimates that compare the effects of the interventions among deliveries within the UPMC system and outside the UPMC system. This is meant to address the question of generalizability, or how applicable our estimates are to other populations. In this analysis, we use the reportable data type because the available information for both the UPMC and non-UPMC samples is the same. Consequently, these estimates are most comparable to the reportable data type estimates in the Figures C.19 to C.23. Overall, the results show minor differences between the size of the estimated effects but consistent overall results for both the UPMC and the non-UPMC samples. However, without additional data from the electronic medical records of other health care systems, we cannot fully discount the potential that our estimates of the interventions’ causal effects will differ in the non-UPMC population.

**Medical-Setting Interventions**

The following figures describe how our estimates of prenatal care’s and doula support’s effects vary between the UPMC and non-UPMC samples. We cannot compare the effects of preconception/interconception care between the two samples because three of the four specific interventions are not included in the reportable data—namely, contraceptive counseling, genetic testing, and vaccinations.

The results show statistically significant differences in the size of the effects by sample, but no difference in the overall conclusions. The effects of prenatal care in the non-UPMC sample are large and significant, but, for most risk levels, the effects of prenatal care in the UPMC sample are larger (Figure C.24). Similarly, doula support shows larger effects in the UPMC sample, but the effects of doula support in the non-UPMC sample are also generally large and significant (Figure C.25).
Health Promotion and Education

For home visiting, our comparison of the estimates between the UPMC and non-UPMC samples shows no statistically significant differences (Figure C.26). The main difference is at the highest risk level, but it is not statistically significant.
Support and Referrals

For pregnancy and postpartum support via Family Support Centers, the results show no statistically significant differences between the two samples (Figure C.27). Partially this is due to the extremely wide confidence intervals of the non-UPMC sample estimates.

The next figure shows how the estimates of the effects of breastfeeding and nutrition support, or WIC, vary by sample (Figure C.28). Only at the highest risk levels are the effects significantly different. However, the results tell the same story for the two samples: as the risk of infant
mortality grows, so too do the estimated reductions in the risk of infant mortality as a result of WIC.

Figure C.28. Causal Effects of the Women, Infants, and Children Program by Sample

For behavioral health services, the estimates of the effects by sample mirror each other, though the estimates for the non-UPMC sample are substantially less precise (Figure C.29).

Figure C.29. Causal Effects of Behavioral Health Services by Sample
Effectiveness of Benefit Programs

In this section we provide additional results showing how effective income, medical, and other benefits were in reducing the risk of infant mortality. For each type of benefit program, the first figure shows the effects by predicted risk of infant mortality, the second figure shows the effects by timing of the intervention, the third figure shows the effects by the specific programs, and the fourth figure shows the effects by data type.

Income Benefits

The following figures show the effect of income benefits (e.g., General Assistance, the Supplemental Nutrition Assistance Program, Supplemental Security Income, and Temporary Assistance for Needy Families) on the risk of infant mortality. Figure C.30 suggests that additional income may be beneficial; however, none of the estimates are statistically significant. Figure C.31 shows that if the benefits are conferred postdelivery or preconception, income benefits significantly reduce the risk of infant mortality. Since most of the infant mortalities we observe occur within the first seven days after birth, the postdelivery effects refer to postneonatal infant mortalities and indicate that income benefits to the mother transfer, at least in part, to the child. In contrast, the effects in preconception likely suggest that the longer that income benefits are conferred, the more successful they are at mitigating socioeconomic stressors related to infant mortality. Figure C.32 shows the effect by specific benefit program and indicates that the Supplemental Nutrition Assistance Program and Temporary Assistance for Needy Families are comparably effective, while Supplemental Security Income is generally not effective. This may be related to differences in eligibility for each of these programs. Finally, Figure C.33 compares the estimates across data types and shows that the differences are not statistically significant.
Figure C.30. Causal Effects on Infant Mortality: Income Benefits

Figure C.31. Causal Effects by Intervention Timing: Income Benefits
Figure C.32. Causal Effects by Specific Interventions: Income Benefits


Figure C.33. Causal Effects by Data Type: Income Benefits
Medical Benefits

The following figures show the effect of medical benefits (e.g., HealthChoices and Medical Assistance Transportation) on the risk of infant mortality. Figure C.34 shows that the receipt of medical benefits significantly reduces the risk of infant mortality, and the impact of these benefits grows as the predicted risk of infant mortality grows. This is unsurprising, as medical benefits enable access to medical-setting interventions, which our results in Chapter 8 show to be very effective. Figure C.35 shows that the receipt of medical benefits preconception or during pregnancy significantly reduces the risk of infant mortality. Again, this indicates that increased access to preconception/interconception and prenatal care is beneficial. Figure C.36 shows that most of the effects are driven by access to HealthChoices. Finally, Figure C.37 compares the estimates across data types. Generally, the differences in the estimates by data type are not statistically significant.

Figure C.34. Causal Effects on Infant Mortality: Medical Benefits
Figure C.35. Causal Effects by Intervention Timing: Medical Benefits

Figure C.36. Causal Effects by Specific Interventions: Medical Benefits
Figure C.37. Causal Effects by Data Type: Medical Benefits

Other Benefits

The following figures show the effect of other benefits (e.g., assisted housing and other public benefits) on the risk of infant mortality. Figure C.38 shows that the receipt of other benefits significantly reduces the risk of infant mortality, particularly at the highest levels of predicted risk. Figure C.39 shows that the earlier that women receive these other benefits, the better. Similar to income benefits, this suggests that the longer that benefits are conferred, the more successful they are at mitigating socioeconomic stressors related to infant mortality. Figure C.40 shows that effects of assisted housing and other public benefits are similar. Finally, Figure C.41 compares the estimates across data types. Generally, the differences in the estimates by data type are not statistically significant.
Figure C.38. Causal Effects on Infant Mortality: Other Benefits

![Graph showing causal effects on infant mortality.]

Figure C.39. Causal Effects by Intervention Timing: Other Benefits

![Graph showing causal effects by intervention timing.]

Preconception
Pregnancy
Post-delivery
Figure C.40. Causal Effects by Specific Interventions: Other Benefits

Other Benefits: Effects by Specific Intervention

Predicted At Risk (> .5)
Predicted At Risk (> .6)
Predicted At Risk (> .7)
Predicted At Risk (> .8)
Predicted At Risk (> .9)

Percent Change

Assisted Housing
Other Public Benefits

Figure C.41. Causal Effects by Data Type: Other Benefits

Other Benefits: Effects by Data Type

Predicted At Risk (> .5)
Predicted At Risk (> .6)
Predicted At Risk (> .7)
Predicted At Risk (> .8)
Predicted At Risk (> .9)

Percent Change

Reportable
Potential
Healthcare
Step 4: Effect Heterogeneity Estimation

In this section we provide additional results showing how the effectiveness of the interventions varies by additional select maternal risk factors. Note that the effectiveness of the interventions among women with other risk factors has been estimated, but there are far too many risk factors documented in the IMPreSIV database to show how the effectiveness of the interventions varies by all risk factors.

Medical-Setting Interventions

The medical-setting interventions demonstrate effectiveness among women with previous poor pregnancy outcomes and chronic health conditions. Specifically, the results show that preconception/interconception care is particularly effective for those who have experienced a previous death, as well as for women with obesity (Figure C.42). Prenatal care is very effective for women with any previous poor pregnancy outcomes, as well as chronic health conditions including diabetes, hypertension, and obesity (Figure C.43). Doula support is most effective for women with chronic health conditions ranging from diabetes to autoimmune disorders, and it is also effective for women who have had preterm births or cesarean sections (Figure C.44).

Figure C.42. Intervention Effects by Risk Factor: Preconception/Interconception Care
Figure C.43. Intervention Effects by Risk Factor: Prenatal Care

Figure C.44. Intervention Effects by Risk Factor: Doula Support
Health Promotion and Education

Home visiting is most effective for women on Medicaid or single women (Figure C.45). For women with other risk factors, the estimates are not statistically significant because of large confidence intervals, indicating a wide range of potential effects.

Support and Referrals

Family Support Centers are most effective for women on Medicaid (Figure C.46). Otherwise, the estimates are not generally statistically significant for other risk factors. WIC is most effective for women who have had previous pregnancies ending in death. Additionally, WIC is effective for single women, women without a social security number, women on Medicaid, and obese women (Figure C.47). Behavioral health services are most effective for women who have had previous preterm births (Figure C.48). Otherwise, the estimates are not generally statistically significant for other risk factors.
Figure C.46. Intervention Effects by Risk Factor: Family Support Center

Figure C.47. Intervention Effects by Risk Factor: The Women, Infants, and Children Program
Figure C.48. Intervention Effects by Risk Factor: Behavioral Health Services
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