



**JOHNS HOPKINS**  
BLOOMBERG SCHOOL  
*of* PUBLIC HEALTH

# Hopkins Participant Research Innovation Laboratory for Enhancing WIC Services (HPRIL) Final Report

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David Paige, MD, MPH, and Marycatherine Augustyn, PhD,  
Johns Hopkins University Bloomberg School of Public Health

February 16, 2023



**Food and Nutrition Service**  
U.S. DEPARTMENT OF AGRICULTURE



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## Executive Summary

### *Background*

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) was established to improve the health of low-income women and children by providing nutritious supplemental foods, education, breastfeeding support, and referrals to health and social service programs. WIC is available to low-income pregnant, postpartum, and breastfeeding women and children up to age five who reside in the United States (US), including the 50 geographic states, Washington, DC, tribal areas, and US territories.<sup>1</sup> Participation in WIC is associated with reduced socioeconomic inequities in birth outcomes, child nutrition status, and child health outcomes, all of which have impacts lasting into adulthood.<sup>2 3</sup>

Despite the need for the program and demonstrated effectiveness, WIC participation has declined in recent years, and there are recognized problems with retention (i.e., continued participation), particularly among children 1-4 years.<sup>4 5</sup> Common reasons for non-participation include lack of knowledge of the program and of eligibility requirements, lack of transportation, problems with appointment scheduling, documentation burdens, low frequency of communication from the WIC office, and long wait times.<sup>6 7 8 9</sup>

Strategies to improve participation and retention in WIC include improving communications, operations, and convenience of accessing WIC benefits. Most studies evaluating innovative strategies to improve WIC participation have not utilized a rigorous impact evaluation, and those that do have faced methodological challenges. In addition to a dearth of rigorous impact evaluations, very few studies of innovative approaches to improve WIC participation have evaluated impacts on child retention.

### *Project Overview*

The Johns Hopkins University Bloomberg School of Public Health (JHU), in cooperation with the United States Department of Agriculture Food and Nutrition Service (USDA/FNS), established the Hopkins Participant Research Innovation Laboratory for Enhancing WIC Services (HPRIL). HPRIL developed, executed, managed, and evaluated a competitive research program over a four-year period. The overall study goal was to improve participation and retention of children 1-4 years of age in WIC.

In 2019, HPRIL selected five WIC local agencies (LAs) as subgrantees following a national competitive Request for Proposal (RFP) process. The subgrantees and their innovative projects were as follows: A drip marketing text messaging campaign (WICBuzz) at Pima County WIC in Arizona; an on-demand video call option (*WIC-in-a-Click*) at Yavapai County WIC in Arizona; an integrated media marketing campaign at Miami-Dade County WIC in Florida; an online scheduling tool (QLess) at Cabarrus Health Alliance in North Carolina; and a participant-centered approach to identify and refer participants to community based services as needed (What Matters to You or WMTY) at Public Health Solutions (PHS) in New York.

Local projects used WIC management information systems (MIS), WIC's participant information databases, to help identify children at risk for not returning to the program, identify service gaps, and evaluate the impact of selected innovative tools on retention. To evaluate the impact of each subgrantee's project on participation and retention of children ages 1 to 4 years in WIC, HPRIL employed a quasi-experimental model where each subgrantee project had an innovation group and a comparison group, and data were obtained on cohorts of child WIC participants during a baseline period (prior to the innovation) and during the period when their innovation was implemented. This design allowed HPRIL to compare differences in retention rates and other outcomes between a baseline period and the implementation period within subgrantee projects as well across the projects.

In addition to leading the impact evaluation, HPRIL assisted funded agencies in developing implementation and evaluation plans, provided technical assistance (TA) throughout the project, and compiled training and TA materials for other local WIC agencies to use beyond the project.

### *Key Findings*

Four of the five innovations significantly improved child participation and retention, and each HPRIL subgrantee provided important information on innovations that aim to improve WIC participation and retention among children through engagement strategies and improved client services.

The Miami-Dade integrated media marketing campaign increased participation and retention by 5% among children, and their process evaluation revealed that pregnant and first-time mothers had the highest engagement with their social media ads. The Pima County drip marketing texting campaign increased participation and retention by 7% among children, and WIC participants reported that the text messages added value to the WIC client experience. PHS' WMTY was found to be generally acceptable to both WIC caregivers and staff and results indicated that it was associated with nearly 8% higher retention among children 0 to 2 years (the project-specific target audience). The Cabarrus QLess scheduling innovation had a positive impact on retention (14%), and participation (10%), was used by about 14% of CHA WIC participants by the end of the project period and reduced overall call volume and wait times. At Yavapai County WIC, the proportion of appointments seen through *WIC-in-a-Click* increased from 0.1% to 33.1% during the project period, and participants and staff found *WIC-in-a-Click* highly acceptable. However, weighted analyses indicated that the Yavapai WIC innovation had no impact on participation but was associated with 9% lower retention.

The reported absolute increases in WIC child retention and participation at four of the five subgrantee agencies were statistically significant and important from a public health perspective. More research is needed to adapt to other local agency contexts and replicate the findings. It would also be important to evaluate their impact beyond the local agency level.

### *Recommendations*

Based on the findings of our project, HPRIL recommends that:

- LAs be encouraged to pilot and evaluate innovations to improve participation and retention,

- Technical Assistance (TA) for Local WIC Agencies (LAs) to build capacity for evaluation be provided,
- LAs are provided with access to their MIS data to evaluate innovations implemented at the local level,
- Partnerships between educational institutions and USDA/FNS to provide TA to build capacity of LAs to conduct evaluations of retention-related projects be supported and made permanent,
- LA efforts to use available data sources for program design, implementation, and evaluation are supported, and
- Future research focus on the impact of local innovations developed through the HPRIL project to replicate findings and evaluate beyond LA level.

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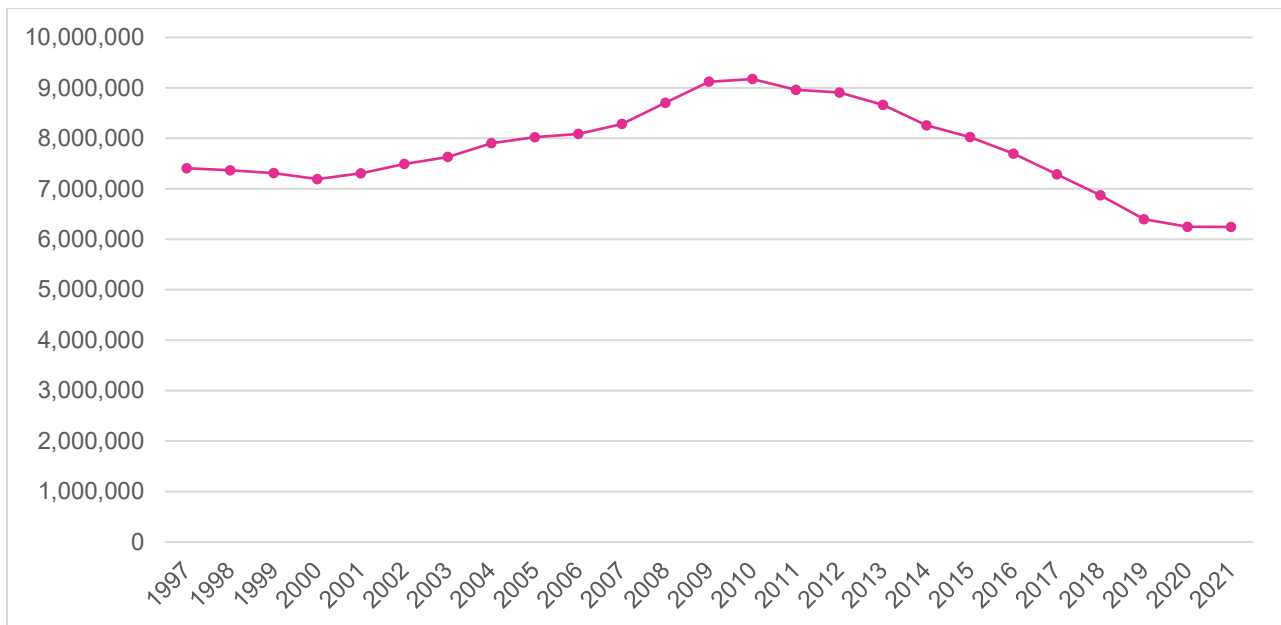


## Background

Established in 1974, the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) is administered by the Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA). WIC provides nutritious foods, nutrition education, breastfeeding promotion and support, and referrals to health and social services at no charge to participants. WIC serves low-income pregnant, postpartum, and breastfeeding women, infants, and children up to age 5 who are at nutritional risk.<sup>1</sup> The WIC program is funded through grants from the federal government and is administered by 89 State agencies through approximately 1,900 local agencies and 10,000 clinics.<sup>1</sup>

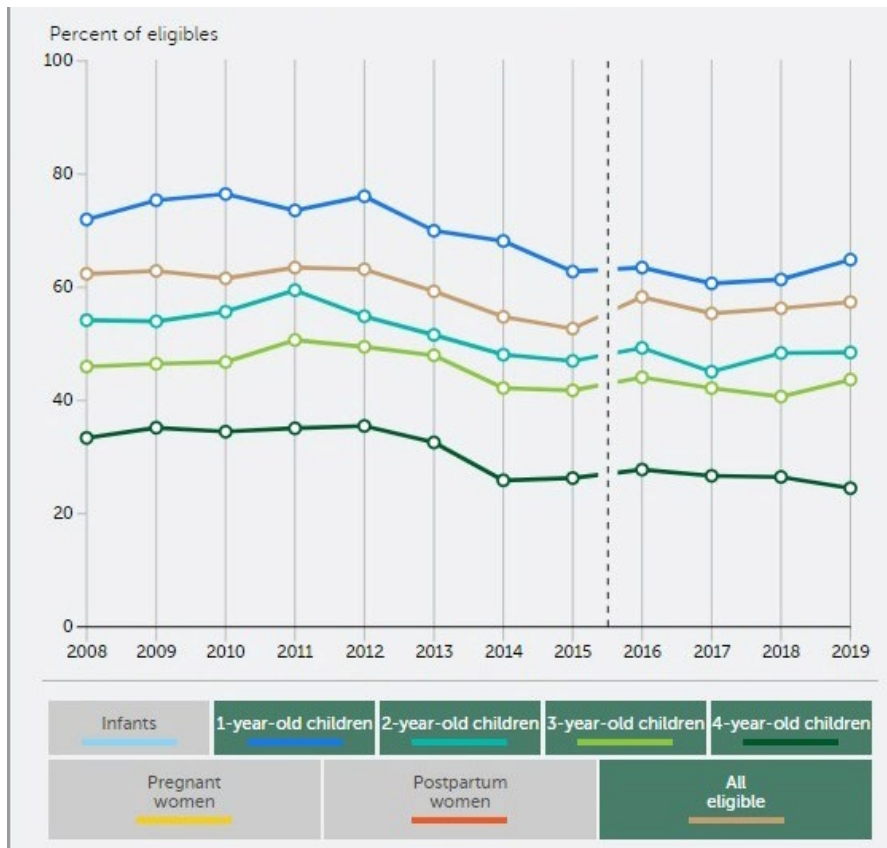
The WIC program is heralded as a public health success story. Since its inception almost fifty years ago, research has shown that WIC improves the lives of participating families. According to a recently published systematic review of WIC outcomes,<sup>2</sup> maternal WIC participation is associated with “improved birth outcomes, lower infant mortality, and better child cognitive development.” The review also found that WIC participation is associated with “purchasing healthier foods and with improved diets for pregnant women and children.”<sup>2</sup>

WIC is a discretionary rather than a mandatory federal program and is funded through the legislative appropriations process each year. Funding for WIC is dependent on current and projected WIC participation rates. After WIC received full funding in 1997, participation increased (from 7.4 million low-income women, infants, and children in 1997 to 9.2 million in 2010).<sup>3</sup> As the economy improved following the economic recession of 2008-2009, the number has fallen consistently each year (to 6.2 million in 2021) (see Figure 1).



**Figure 1.** Number of Participants: 1997–2021. *Source: United States Department of Agriculture Food and Nutrition Service (2022). WIC Data Tables: National Level Annual Summary. <https://www.fns.usda.gov/pd/wic-program>.*

WIC does not reach all those eligible for the program. Program coverage (i.e., the percent of eligible people in the population who participate in WIC) has declined in recent years. In 2019, coverage for all participants was 57.4%, down from a high of 63.5% in 2011.<sup>4</sup> Coverage dropped across all age groups of children between 2010 and 2019 (see Figure 2).

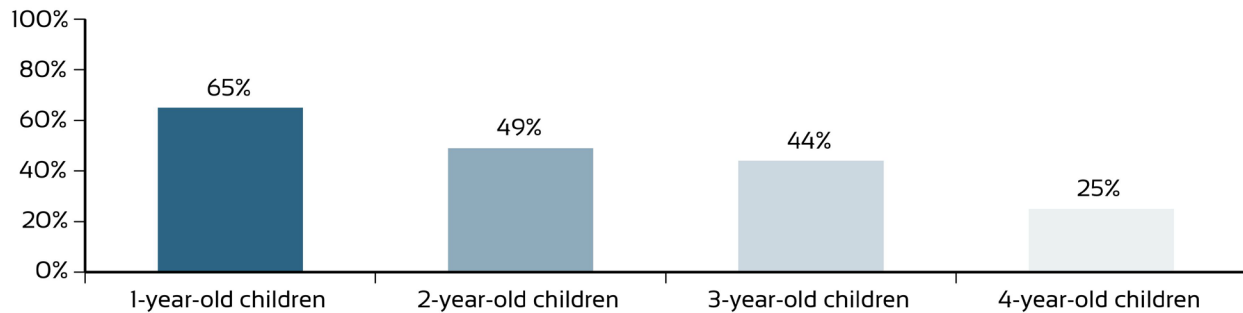


**Figure 2.** National WIC coverage rates overall and among four child categories, 2008-2019. *Source: Farson Gray, K., Balch-Crystal, E., Giannarelli, L., & Johnson, P. (2022). National- and State-level estimates of WIC eligibility and WIC program reach in 2019. U.S. Department of Agriculture Food and Nutrition Service.<sup>5</sup>*

Coverage estimates vary by participant category. In 2019, the coverage for infants was 98.4% and children 44.8%.<sup>4</sup> Coverage decreases with child age, from 64.9% at one year to 24.5% at four-years-of-age.<sup>4</sup> Data suggests that the sharp decline in participation after infancy is unlikely to reflect a change in economic status of the family.<sup>5</sup>

Retaining children in WIC for the duration of their eligibility period (i.e., until their fifth birthday) is a key public health goal, as childhood WIC participation is associated with numerous positive health outcomes when compared to children eligible but not participating in the program.<sup>2</sup> Children receiving WIC benefits are more likely to receive regular preventative health

care, such as well-child check-ups, immunizations and routine dental care.<sup>6,7</sup> They have better diet quality, greater intakes of 100% fruit juice, whole grain cereals, low-fat milk, Vitamin D and iron, and lower intake of saturated fat.<sup>2,8</sup>



**Figure 3. Decline in Coverage with Child Age (FY 2019).** *Source: Farson Gray, K., Balch-Crystal, E., Giannarelli, L., & Johnson, P. (2022). National- and State-level estimates of WIC eligibility and WIC program reach in 2019. U.S. Department of Agriculture Food and Nutrition Service.*<sup>5</sup>

There are many factors that contribute to declines in WIC participation and coverage rates among children. According to a growing body of research, common themes for non-participation and early exit include lack of knowledge of the program and of eligibility requirements, social stigma, lack of transportation, language barriers, fears around threats to immigration status, and lack of childcare.<sup>9-12</sup> Issues with the quality of service delivery include problems with appointment scheduling, documentation burdens, inconsistent information provided by WIC and other care providers, and long wait times.<sup>11</sup> According to Whaley et al (2017), factors positively associated with remaining in WIC included being breastfed, prenatal intention to breastfeed, receipt of online education, months of prenatal enrollment in WIC, other family members receiving WIC, and participation in Medicaid.<sup>10</sup> Factors negatively associated with remaining in WIC included missing benefits in the months leading up to first birthday and under-redemption of WIC benefits.

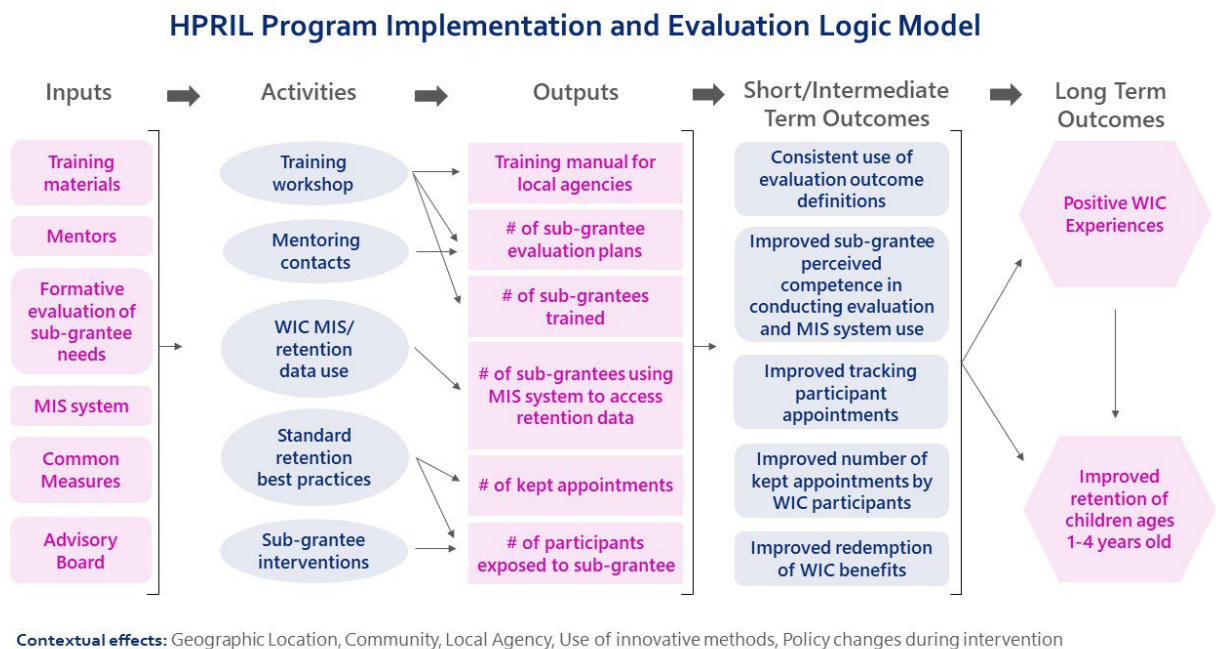
WIC has made changes to meet the needs of WIC participants and to remain nutritionally, culturally, and technologically relevant. To address clinic service issues, agencies have implemented messaging platforms for appointment reminders, education and breastfeeding support,<sup>13-15</sup> as well as mobile phone applications for assistance in shopping, appointment reminders, keeping track of WIC foods, and nutrition education.<sup>16,17</sup> To address transportation and competing time barriers, agencies have moved WIC into non-traditional spaces (e.g., shopping malls, homeless shelters), created mobile WIC clinics to reach rural areas,<sup>18,19</sup> and created partnerships with other services which support child development, such as Head Start and daycare/pre-school programs, organizations which support families (e.g., religious organizations), and others, including state and federal programs (e.g., Medicaid). To address misperceptions about WIC, marketing and outreach initiatives have been developed, including the Illinois “WIC to 5” strategy.<sup>20</sup> This strategy emphasizes that WIC helps clients address needs from the woman’s pregnancy through the child’s pre-school years.

The development and application of innovative strategies is core to quality provision of WIC services and necessary to address barriers to retention. Although there have been many innovations developed and implemented over the last decade, few have been studied for impact

on retention. Those that have been studied for impacts on WIC participation and retention have generally not been subject to a rigorous evaluation design.<sup>21</sup> The Hopkins Participant Research Innovation Laboratory for Enhancing WIC Services (HPRIL) sought to fill this research gap by supporting WIC agencies to design innovative tools specifically aimed at retaining at-risk children and rigorously evaluating the impact of the innovative tools on child retention. HPRIL, launched in September 2018, was led by a team of researchers at the Johns Hopkins Bloomberg School of Public Health in a cooperative agreement with the U.S. Department of Agriculture (USDA) Food and Nutrition Service (FNS).

A key component of the HPRIL project was the use of data from WIC Management Information Systems (MIS) to help identify children at risk for not returning to the program and evaluate the impact of selected innovative tools on child retention. The MIS system provides an opportunity to identify and pinpoint gaps in service, test innovations, and harvest data to evaluate outcomes within a framework that is cost-neutral and scalable nationally. The USDA/FNS publication, “Planning Future WIC Data Collection Needs,” provides a useful guide to the breadth and depth of the MIS nationally available within the WIC program.<sup>22</sup> Prior to HPRIL, the use of local agency (LA) MIS systems data had not been employed to more clearly define the problem of child retention nor had it been used to inform local strategies to identify participants at risk of early termination from WIC.

Through the provision of training, technical assistance (TA), and mentorship to the funded WIC agencies, in combination with the use of WIC MIS to guide project design and evaluation, HPRIL sought to: (1) increase positive WIC experiences and (2) improve participation and retention of children ages 1-4 years of age. Figure 4 below displays HPRIL’s model for implementation and evaluation.



**Figure 4.** HPRIL Program Implementation and Evaluation Logic Model

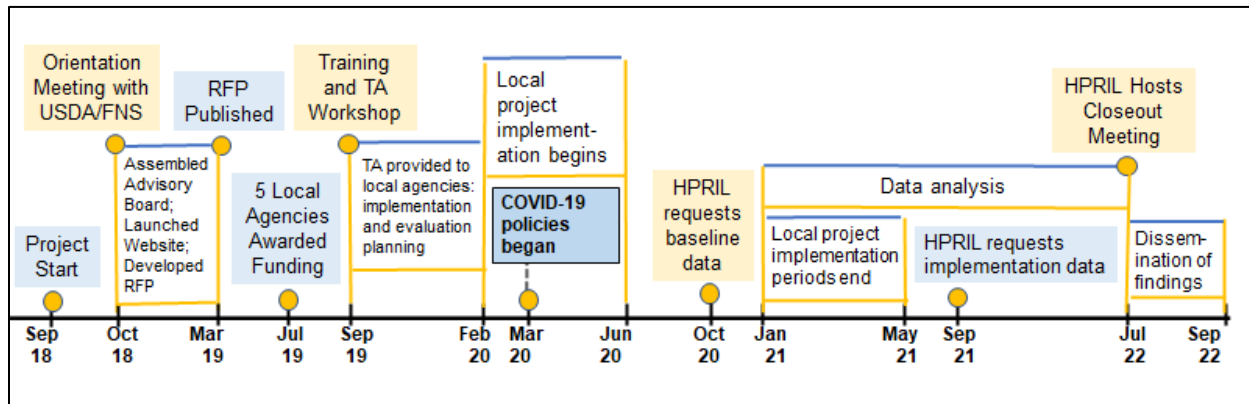
The HPRIL project hypothesized that these inputs, activities, outputs, and short- and intermediate-term outcomes would lead to our two desired long-term outcomes. Descriptions of the inputs, activities, outputs, and short and intermediate-term outcomes can be found in the Project Design, HPRIL Technical Assistance, and Impact Evaluation Methods sections of this report.

The project objectives were structured to accomplish the overall goal of improving WIC participation and retention of children one to four years of age. HPRIL's primary objectives were the following:

1. Develop and manage a competitive grants process for WIC local agencies or clinics to design and implement strategies anticipated to enhance and improve retention.
2. Conduct a rigorous evaluation of the implemented strategies that assess their impact on child retention, as a primary outcome.
3. Broadly disseminate project intervention findings among the WIC research and practitioner communities.
4. Provide ongoing evaluation-related technical assistance to State and local WIC agencies carrying out similar interventions through WIC Special Project Grants (SPGs) or other awards.
5. Sponsor and coordinate two in-person conferences at FNS headquarters: an orientation meeting at the beginning of the cooperative agreement period and a closeout session at the project's completion.

This report provides a detailed account of HPRIL's activities and accomplishments related to each of these objectives and culminates in a description of our challenges, lessons learned, and recommendations for future WIC innovation projects.

## Project Timeline



**Figure 5.** HPRIL Project Timeline

The HPRIL project was funded in September 2018 (Figure 5). The HPRIL team met with USDA/FNS headquarters on October 25, 2018 for an orientation meeting to align and confirm common objectives and timeline.

During the first six months, the project was focused on hiring staff and a full-time project manager. Attention was directed at establishing an [HPRIL advisory board](#) and hosting an initial advisory board meeting and establishing a technical assistance (TA) plan to respond to FNS supported [WIC Special Project Grant \(SPG\) awardees](#). In addition, HPRIL launched a [project website](#), developed a protocol for a nationally competitive [request for proposals](#) administered by HPRIL, and established an independent review and selection process.

HPRIL published the RFP in March 2019 and award announcements were made in July 2019. Following sub-grantee selection, HPRIL hosted a training and technical assistance workshop to provide the local agency subgrantee teams with foundational skills for designing, implementing, and evaluating their projects. The meeting was followed by HPRIL providing training in workplan development, implementation protocols, and evaluation design. Local agency technical assistance continued throughout the study.

The local agencies began implementation of their [innovative projects](#) between February and June of 2020. Beginning in March 2020, the COVID-19 pandemic resulted in WIC program operations changes in subgrantee agencies. This led to implementation delays and [adaptations of innovative tools](#).

In October 2020, the HPRIL team requested baseline MIS data for the impact evaluation. The baseline data period was the calendar year 2019 for all five agencies. In the months after this request, the HPRIL team provided guidance to subgrantees and their state agencies to assist with the baseline data request. By August 2021, the team had received acceptable baseline datasets from all five agencies. The HPRIL team sent implementation period requests in September 2021 and received acceptable implementation datasets from all agencies by April 2022.



[Data analysis](#) took place between January 2021 and July 2022. The HPRIL team completed its evaluation of the local agency projects in June 2022. In July 2022, HPRIL hosted a [closeout meeting](#) in collaboration with USDA/FNS. August and September 2022 were devoted to dissemination of project findings and the launch of a [resource guide](#) to assist local agencies in the implementation and evaluation of innovative projects.

## **Project Design**

### *Advisory Board*

HPRIL assembled an advisory board to provide guidance and oversight of the project. The Board was composed of five individuals, including a WIC State representative, a communication specialist, a former USDA/FNS WIC specialist, and two WIC researchers. The Advisory Board provided input throughout the project on HPRIL's training and technical assistance (TA), evaluation, and dissemination. HPRIL hosted four advisory board video calls over the course of the project, including two in 2019, one in 2020, and one in 2021. Members of the Advisory Board were invited to attend the HPRIL Closeout Meeting in July 2022.

### *Competitive Request for Proposals (RFP)*

HPRIL developed the Request for Proposals (RFP) in collaboration with USDA/FNS (see Appendix A for a copy of the RFP). Eligible proposals were required to:

- Identify a child population with a local WIC agency at risk for early termination, an area of service delivery or retail situation that impacts WIC clients' experiences. Identification must be based on assessment of local WIC on the Web (WOW) administrative data,
- Describe the intervention, how it addresses HPRIL's focus and purpose, and what has informed its development,
- Describe the WIC participants aged one to four years, and how the intervention is culturally and socially sensitive and relevant,
- Document inclusion of staff with management information system (MIS) experience and expertise,
- Document support from appropriate State WIC Agency,
- Commit to collaborate and cooperate with HPRIL, FNS, and other grantees, including: participation in a preliminary workshop; regular teleconferences to monitor progress, identify problems and assure appropriate progress; adherence to standard participant scheduling and confirmation practices, adherence to a common approach to reporting findings, provision of all appropriate relevant project data for the HPRIL evaluation.
- Commit to collaboratively develop an evaluation plan with HPRIL,
- Provide all progress and budgetary reports,.
- Document procedures used to maintain the quality and integrity of all data and analyses,
- Demonstrate compliance with Federal Program Regulations for all proposed strategies/solutions,

A set of customer service best practice activities were also included in the RFP as a necessary baseline; innovative tools would be in addition to these best practices. They included:

1. Appointment reminders
2. Missed appointment follow-up within 24 hours

3. Appointment scheduling
4. Alternatives to bringing in paper documentation in person
5. 30-day temporary eligibility approval
6. Customer service staff training
7. Participant-centered communication and counseling with reflective listening.

All agencies submitting applications to HPRIL were expected to complete a Customer Service Best Practices Checklist. Establishing consistent practices, measures, and methods across projects contributed to the rigor of the cross-project evaluation.

The RFP announcement was disseminated via the National WIC Association Monday Morning Report, the FNS list-serv, the WIC Access Group list-serv, and an email to State WIC Directors in March 2019. The HPRIL Team developed and hosted an RFP overview webinar (see Appendix B) and eight live topical Q&A sessions. The HPRIL website was used as the digital home for information about the HPRIL competitive grant process. The website provided contact information, details about the funding opportunity and how to apply, downloadable documents for the application, recorded webinars and Q&A sessions, and written responses to questions submitted via email (i.e., FAQs).

The team received 24 applications from 14 states. The HPRIL Team screened proposals for completion and against screening criteria outlined in the RFP. Of the 24 applications, 23 were sent out for review to a team of 5 external reviewers. External reviewers included: Joel Gittelsohn, PhD, Professor, Center for Human Nutrition, JHSPH; Anne Gilmore, PhD, RD, Pennington Biomedical Research University; Alice Lenihan, MPH, RD, LDN, Senior Global Clinical Advisor for the Special Olympic International Healthy Athletes, Health Promotion Program; Jackson Sekhobo, PhD, MPA, Director of Evaluation, Research, and Surveillance, Division of Nutrition, New York State Department of Health; and Stan Bien, MPA, former Michigan WIC Director.

Each application was assigned to two reviewers for initial thorough review and reviewers were provided with scoring criteria (see Appendix C). Once initial scores were submitted by the reviewers, the HPRIL Team compiled and calculated average scores. Proposals were then ranked, and 13 proposals with one or both reviewers scoring them highly were identified for discussion during a four-hour web-based videoconference review discussion. Reviewers with perceived conflict of interest with an application were not allowed to score that application. After the HPRIL Team calculated final average scores and ranks for each proposal from the review panelists, the top-scoring proposals were thoroughly reviewed for WIC policy compliance. Team members also reviewed for budget flags, personnel issues, implementation timeline feasibility, evaluation challenges, and population diversity.

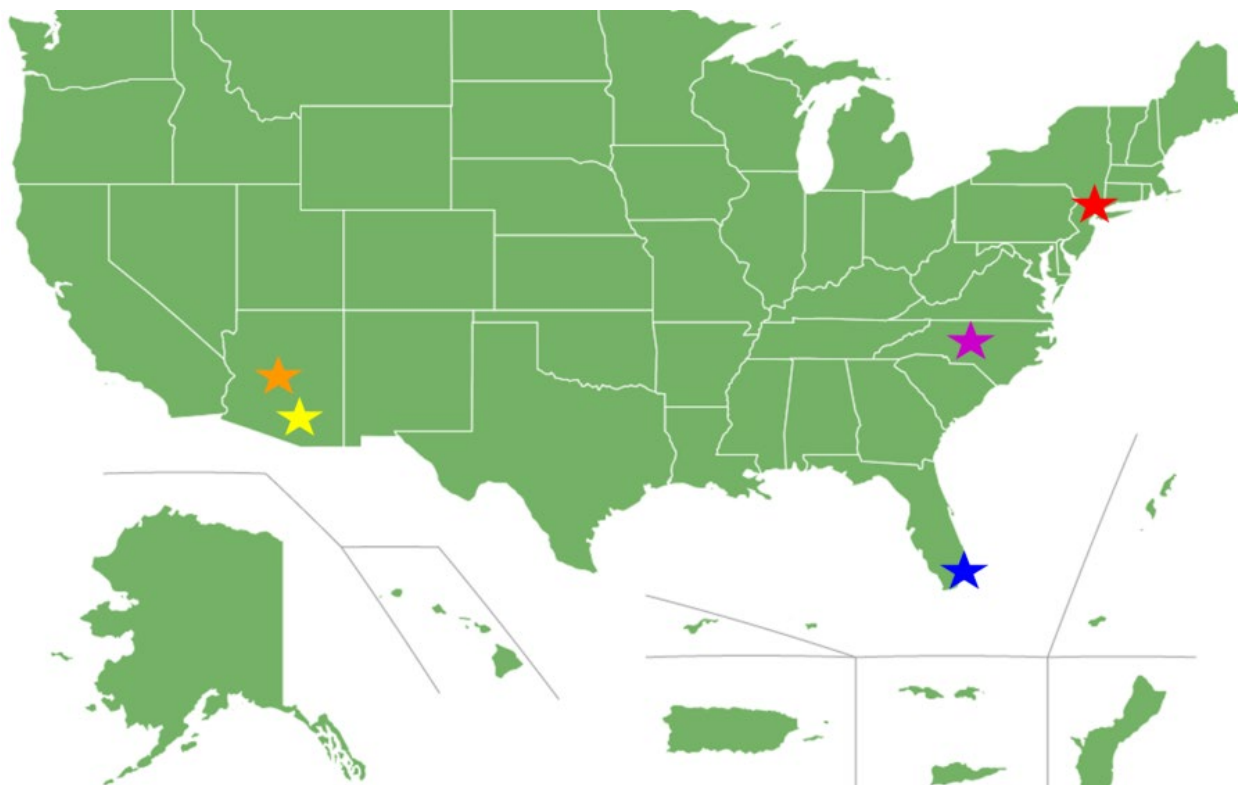
After this thorough review, it was determined that five of the top six reviewer-scored proposals were a good fit for HPRIL. The HPRIL Team recommended these five proposals to USDA/FNS for funding. Award announcements were made in July 2019 through the HPRIL website, the National WIC Association weekly newsletter, and the Johns Hopkins Bloomberg School of Public Health newsletter. Awardees were notified of their selection through a formal award letter, and all five agencies expressed their intention to accept the award. Non-selected applicants



were also notified of their status via formal letter. Contracts were drafted between JHU and each local WIC agency subgrantee with a project start date of September 1 and lasting a period of 18 months.

### *Local Agency Projects*

The selected agencies represented geographic diversity (see map below) as well as size diversity (ranging from small rural agencies to large urban agencies) and MIS diversity (four different MIS systems). Three of the local agency projects focused on enhanced outreach and engagement strategies, and two focused on administrative changes. All five agencies implemented their innovations over a period of 12-months.



- ★ Pima County Health Department WIC, AZ: WICBuzz
- ★ Yavapai County Health Department WIC, AZ: *WIC-in-a-Click*
- ★ Florida Department of Public Health Miami-Dade County WIC Program, FL: Integrated Media Marketing Strategy
- ★ Cabarrus Health Alliance, NC: QLess Online Scheduling
- ★ Public Health Solutions, NY: What Matters to You and Digital Care Coordination

Pima County, AZ: WICBuzz

Pima County Health Department (PCHD) WIC, located in southern Arizona, provides services to just over 9,000 participants each month and identified a problem with retaining eligible children in the program past their first birthday. Local MIS data indicated that 37% of clients who received WIC services from PCHD in 2018 did not take the needed steps to continue receiving WIC benefits for the next year. The group least likely to recertify were non-English speaking families with infants receiving formula benefits and children over one year. According to PCHD WIC staff, possible reasons for families exiting WIC early included a lack of understanding that benefits continue until age five, confusion around financial eligibility, and/or insufficient engagement with WIC.



To address these barriers, PCHD WIC introduced WICBuzz, a drip marketing text message campaign. The campaign featured targeted nutrition education and WIC brand awareness messages aimed at parents and guardians of children from birth to age four. Messages reminded caregivers of when recertification was due and how the recertification process works. WICBuzz messaging was tailored based on the participants' preferred language (English or Spanish) and child's age. Participants had the option to opt out of receiving messages each time a message was delivered. In order to determine the texting preferences of their clients, PCHD WIC developed a pre-launch client survey, which asked about preferred frequency of messages, length of messages, general interest in receiving messages and whether the client could open a link from a text message received on their phone. Survey results (n=150) were used to inform the final selection of WICBuzz messages.

WICBuzz was implemented from March 1, 2020 through February 28, 2021. The messaging was distributed at a minimum monthly, and no more than weekly. This innovative drip text messaging campaign was intended to encourage timely recertification, increase participation, and increase redemption of food benefits. Additionally, ad hoc messages were utilized to remind and/or educate caregivers of community events.

#### Yavapai County WIC, AZ: WIC-in-a-Click

Yavapai County Health Department WIC, located in central Arizona, serves about 3,300 participants and has experienced a steady decline in participation in all categories in recent years. In particular, Yavapai County WIC's retention rate for children aged 1-3 was less than 50% in 2018. According to Yavapai County WIC staff, participants left WIC early for a variety of reasons, including inconvenient appointment times, difficulty bringing children to appointments,

busy schedules which make it hard to come to the clinic, and difficulty with transportation to clinics from the remote areas in which they live.

Yavapai County WIC sought to address these barriers by introducing *WIC-in-a-Click*, an online platform allowing clients to receive online nutrition education through electronic devices including cell phones, tablets, or computers. Online sessions were provided one-on-one as well as in a group setting. *WIC-in-a-Click* was available to all participant categories with a focus on reaching families who have children ages 1 through 4. The development of online nutrition education is not a new concept, but Yavapai County WIC used online education in a different way than typically demonstrated by other agencies. *WIC-in-a-Click* was not only offered through scheduled classes but also as on-demand classes. On-demand classes consisted of clients requesting an appointment and within 1 hour receiving an invite to a Zoom session. Once the session was completed, food benefits were loaded onto the family's eWIC (i.e., electronic benefits transfer [EBT]) card. *WIC-in-a-Click* was implemented between April 1, 2020 and March 31, 2021.

Yavapai County WIC predicted that the availability of immediate online nutrition education classes would markedly increase the number of families WIC could reach in outlying areas, as well as those who had a difficult time scheduling an appointment in the clinic. *WIC-in-a-Click* empowered participants to seek WIC services when it would be convenient for them and from the comfort of their own home, office, or when they were on the go.

#### Florida Department of Public Health Miami-Dade County WIC Program, FL: Integrated Media Marketing Strategy

The Florida Department of Health Miami-Dade WIC Program has the largest WIC participation in Florida, serving roughly 64,000 participants per month. Even so, there was a significant decline in participants between 2014 and 2019. According to local data, the Miami-Dade WIC child caseload dropped from a high of 35,000+ in 2016 to a low of 31,077 in March 2019 (11.2% decrease). Miami-Dade County WIC's administrative data showed that participation decreased after children turned one and continued to steadily decline after age two. Reasons for participants dropping off early included concerns related to citizenship/residency requirements and lack of knowledge of important aspects of WIC such as shopping with WIC benefits and eligibility requirements.

To address their retention and recruitment challenges, the Miami-Dade County WIC Program implemented an integrated media marketing strategy that digitally targeted participants and potential participants with display ads, posts, and videos using precise geographical location (geo-location) technology and customized messaging for their target population. The campaign, which was implemented between June 1, 2020 and May 31, 2021, aimed to drive users to the Miami-Dade WIC website and appointment call center and increase engagement and brand awareness. Miami-Dade County WIC partnered with Foundry 360, a national media company, to implement the campaign.

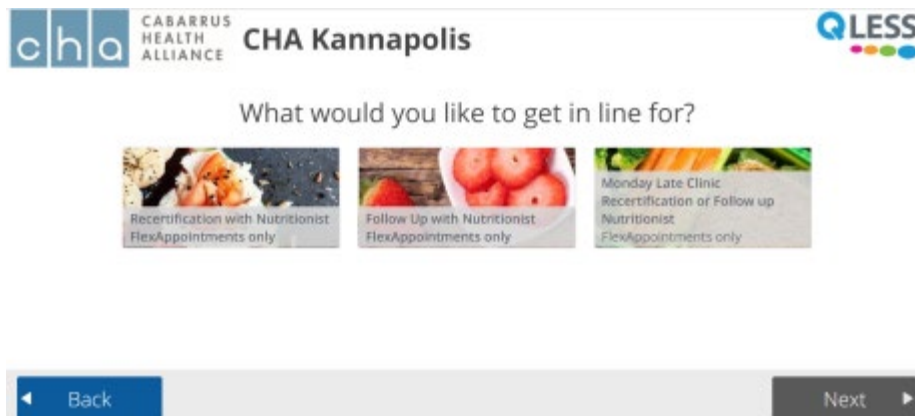


The target audience for this intervention included mothers and family members receiving WIC benefits as well as mothers and family members of potentially eligible children aged 1-3 years of age. Messages were culturally and socially relevant to identified barriers to participation. In addition, the tool provided brand awareness, specifically to promote WIC services, eligibility, and benefits after infancy. Social media posts, YouTube videos, and other advertisements were continually updated and strategically deployed based on what performed well according to Google analytics.

Cabarrus Health Alliance, NC: QLess Online Scheduling

Cabarrus Health Alliance (CHA), located just northeast of Charlotte, North Carolina, serves roughly 3,000 participants per year. Data from 2014 to 2018 indicated a decline in participation across all categories, with children ages 1-4 representing the largest loss in number and second largest loss in percentage. One possible barrier leading children to drop out of WIC early during this time was participant frustration with long hold times when they were trying to book an appointment.

The innovative tool that CHA implemented to improve child retention was a combined Online Appointment Scheduling (OAS) and queue management device called QLess. QLess, available by smartphone and/or computer, allowed participants to make appointments and also sent text reminders. This tool assisted with appointment wait times by facilitating easy, immediate, and reliable access to WIC services. QLess was implemented between June 1, 2020, and May 31, 2021.



Public Health Solutions, NY: What Matters to You and Digital Care Coordination

Public Health Solutions (PHS) is the largest provider of community-based WIC services in New York State, managing nine community-based WIC centers serving nearly 36,000 participants in New York City. PHS' WIC retention data from 2016-2018 indicated a large drop off in participation after children turned one and two. According to PHS WIC staff, reasons for non-recertification included lack of perceived value of the child food package, time, and schedule constraints, no longer qualifying financially after returning to work, inability to attain necessary documents, concerns regarding participation and impact on immigration status, transportation costs, and lack of family support.



The PHS project was informed by a socio-ecological framework which posits that the decision-making behaviors of each WIC participant are affected by factors from multiple levels of influence, including their decision-making around the utilization of WIC.<sup>23</sup> The “What Matters to You?” (WMTY) innovation was based on the shared decision-making strategy introduced by Michael Barry and Susan Edgman-Levitan in 2012 which focuses on facilitating conversations about the preferences, needs, and values of patients and families who receive healthcare and other services.<sup>24</sup> WMTY in the WIC context involved engaging WIC caregivers to identify their family’s needs beyond their infant’s dietary needs and aimed to provide additional value by addressing a greater scope of needs through referral and provision of local resources from community-based organizations (CBOs). WMTY, which was implemented from February 1, 2020 to January 31, 2021, targeted children aged one and two years (i.e., those at greatest risk of dropping out of WIC). Once needs were identified through the WMTY conversation, WIC staff utilized UniteUs, a technology-enabled coordinated accountable network, to make referrals to local CBOs. CBOs then followed up with the WIC participants to make appointments for needed services, removing the onus from the participant to seek out services. The PHS team predicted that this approach would improve the real and perceived value of WIC and encourage participants to remain in the program longer.

#### Impacts of COVID-19 on Project Implementation

The COVID-19 pandemic resulted in WIC program operations changes in subgrantee agencies beginning in March 2020. The most significant change for WIC was the rapid transition to remote service provision. All subgrantee agencies made positive adaptations to their WIC program operations, implementing new procedures enabled by state waivers that were approved by USDA/FNS. During the early months of the pandemic, the implementation of three subgrantee projects was paused. All projects resumed implementation between April and June 2020. In addition, two projects were required to adapt their innovative tools. Cabarrus Health Alliance streamlined their QLess tool to only include online scheduling and not the in-person queue-management system, while Public Health Solutions moved their What Matters to You? conversations to over-the-phone rather than in-person.

## **HPRIL Technical Assistance**

### *Kickoff Workshop*

To provide the local agency subgrantee teams with foundational skills for designing, implementing, and evaluating their projects, the HPRIL Team hosted a training and technical assistance workshop in September 2019. Prior to the workshop, HPRIL conducted a training and technical assistance needs assessment survey (see Appendix D) with the goal of assessing current knowledge, understanding, and training/TA needs related to project evaluation to inform the details of the workshop. The needs assessment survey included questions about the level of confidence in developing and carrying out implementation and evaluation plans and asked with which implementation and evaluation topics subgrantees anticipated needing further assistance. Fifteen responses were received from the subgrantee teams which helped to inform the workshop program (see Appendix E).

The HPRIL Team finalized the workshop program to include the following sessions: Welcome/project overview; subgrantee introductory presentations; customer service best practices presentation and discussion; journey mapping the WIC client experience presentation and activity; from journey map to logic model presentation; logic model creation activity; logic model share-out and feedback; from logic model to robust evaluation plan; data collection and analysis overview presentation; process evaluation planning workshop session; outcome evaluation workshop session; budgeting and reporting overview; MIS data management; workplan and timeline refinement workshop session; and daily reflections (for the workshop agenda, see Appendix F). The HPRIL team hosted a pre-workshop call with each subgrantee to introduce the team and discuss what they should prepare and bring to the workshop based on their specific project objectives and desired outcomes.

The HPRIL Training and Technical Assistance Workshop took place September 9-11, 2019 at the Johns Hopkins Bloomberg School of Public Health in Baltimore, MD. Presenters and facilitators included HPRIL team members: David Paige, Laura Caulfield, Susan Gross, Marycatherine Augustyn, Martelle Esposito, and Danielle Gaskin. Presenters also included Biostatistics Center team members: Bareng Aletta, Sanny Nonyane, and Andre Hackman (see Appendix G for a summary report of the workshop including results from the post-workshop evaluation survey).

### *CoIN Calls*

The HPRIL Team hosted monthly collaborative innovation network (CoIN) calls via the Zoom videoconferencing platform between October 2019 and June 2022. The goals of the CoIN calls were to facilitate peer learning and to provide a mechanism for HPRIL to offer ongoing guidance to the subgrantees. The calls also offered the opportunity to informally discuss project issues in a timely exchange of views critical to HPRIL and the local agencies. Each CoIN call began with dedicated time for project updates from the local agencies, followed by an in-depth presentation from HPRIL or one of the subgrantee agencies.





Each of the subgrantees presented during one CoIN call about a key aspect of their evaluation. Subgrantees led presentations on the following topics:

- Using Google Analytics (Miami-Dade)
- Conducting in-depth interviews with WIC participants (PHS)
- Assessing technology vendors (CHA)
- Use of vendor data in evaluation (Pima County)
- Use of local agency and survey data (Yavapai County)

#### *Additional TA Calls*

HPRIL led individual TA video calls as-needed with each subgrantee (at times, weekly or bi-weekly). Over the course of the project, HPRIL facilitated over 200 calls.

Topics included:

- Project design and implementation
- Evaluation and data collection
- MIS data requests
- Dissemination, including manuscripts and presentations
- Overcoming challenges

In terms of implementation guidance, HPRIL engaged in discussions with the subgrantees on how to boost innovative tool coverage and coached subgrantees through implementing their innovative tools in the context of the COVID-19 pandemic.

With regard to evaluation assistance, HPRIL provided one-on-one mentorship to the local agencies regarding evaluation design. Each subgrantee developed a unique evaluation plan that mapped out their proposed evaluation strategies for measuring their process indicators and short-term outcomes (see Appendix H). HPRIL provided coaching throughout the evaluation planning process. The team met regularly with each subgrantee agency to review and discuss their initial plans, assist with plans for data collection (both quantitative and qualitative), and support the interpretation and use of vendor data. The team also worked with subgrantees to make adaptations to their original evaluation plans as necessary to accommodate the WIC operations changes resulting from the COVID-19 pandemic response.

The requests for MIS data to be used in the HPRIL impact evaluation required intensive TA. The HPRIL team provided guidance to subgrantees and their state agencies to assist with the assembly and submission of baseline and implementation period datasets through phone calls and written guidance (see below). Upon analysis, virtually all of the initial datasets contained irregularities that required follow-up from the HPRIL team. Some of the datasets required several rounds of updates. HPRIL supported the state and local agencies throughout this lengthy process.

#### *Written Guidance*

HPRIL provided the subgrantees with the following forms of written guidance:



- Evaluation plan template (see Appendix I). This template was provided at the outset of the subgrantee project period to provide a template for the subgrantees' evaluation planning.
- Data clarification for Date of Certification, End Date of Certification, and Date of Recertification (see Appendix J). In recognition of early confusion from state agencies interpreting the baseline data request, the HPRIL team developed a document to clarify several variables.
- Final Report template (see Appendix K). HPRIL shared a guidance document with subgrantees that detailed requirements and recommendations for their final reports.
- Closeout Presentation PowerPoint template (see Appendix L). HPRIL provided this template for the local agencies to use to craft their closeout presentations. The template included slides for background, description of innovative tool, the subgrantee project logic model, evaluation design, description of project implementation, results, lessons learned, sustainability beyond the funding period, and recommendations.

#### *COVID-19 Impacts on TA*

The HPRIL team originally built in the potential opportunity of providing mentoring visits to subgrantees as needed. All mentoring occurred virtually as a result of the COVID-19 pandemic.

#### *Evaluation of HPRIL TA*

In order to assess the effectiveness of HPRIL's TA, the team conducted a post-evaluation of training competencies survey (see Appendix M). The survey explored whether and to what degree subgrantees' confidence related to skills which were targeted by the HPRIL training and TA improved and assessed the level of satisfaction and perceived usefulness of specific TA activities. Overall, the results indicate positive changes in the confidence level associated with project development and evaluation. The most dramatic increases in confidence were associated with understanding the different components of a logic model, ability to implement a project work plan, ability to analyze qualitative and quantitative data, understanding the strengths and limitations of different evaluation designs, and feeling comfortable presenting and sharing project findings to different audiences. For a summary of the training competencies survey, see Appendix N.

## Evaluation Methods

### *Process and Short-term Outcome Evaluation*

#### Pima County

The WICBuzz process evaluation included conducting mid- and post-implementation client surveys to assess acceptability, tracking client participation in WICBuzz to assess coverage and reach, and facilitating a post-implementation staff focus group to assess feasibility and staff perceptions. The WICBuzz Mid-Project Client Survey was designed to elicit feedback from clients who were enrolled in WICBuzz as of mid-August 2020. A link to the online survey, which was designed to be completed on a smartphone, was sent via text message to 4,905 clients.

Implementation fidelity indicators included documents obtained/completed, such as vendor agreements, the protocol for developing and deploying WICBuzz messages, and promotional materials, as well as implementation documentation, such as counts of messages sent. Client engagement with WICBuzz was measured by the number and percentage of client opt-outs, numbers of WIC participants without text message capability (or who have opted not to be contacted via text), and the percentage of links clicked, by message.

A post-implementation online survey was sent to 4,513 English and 577 Spanish-speaking WICBuzz participants via text message. Free tickets to the local zoo were offered as an incentive for completing the survey. The survey assessed message helpfulness (overall and any specific messages), knowledge gained (about using WIC benefits and healthy lifestyles), motivation to engage in specific actions such as trying a new food, scheduling their next WIC appointment, or using their WIC benefits, desire for additional topics/recipes, and desire to continue receiving WICBuzz messages. A post-implementation focus group was conducted to assess WIC staff perceptions. The focus group facilitator asked staff about their experience over the last year at WIC, their thoughts about the WICBuzz intervention, their opinions about the clients' awareness of the intervention, the use of technology in WIC, and WIC practices during the pandemic.

#### Yavapai County

The Yavapai County process evaluation consisted of three measures. First, staff sought to answer the question: Was the project implemented as intended, according to the workplan, intended completed documents, trained staff, and the development of the *WIC-in-a-Click* process? This question was evaluated by examining documents that were created including protocols, MIS data and training materials, as well as tracking the number of staff who were trained in *WIC-in-a-Click*. Second, the Yavapai County team explored the question: What appointment format did clients in the intervention sites choose (on-demand or traditional)? The indicators used to measure success were the number of appointments completed on-demand and the percentage of on-demand appointments. Third, client and staff satisfaction with *WIC-in-a-Click* were measured by sending a survey to WIC clients who participated in *WIC-in-a-Click* and through discussion with staff members. The client survey included questions related to ease of use, possible technical difficulties, wait time, and preferred appointment method.

The short-term evaluation explored WIC participation during the implementation period compared to the pre-implementation period, appointment type preference, and “no show” rates

using monthly MIS reports obtained from HANDS (the Arizona state MIS system). Yavapai County staff reviewed daily schedules and compared appointment types.

### Miami-Dade County

The goal of the Miami-Dade process evaluation was to augment campaign scalability and replicability by comprehensively documenting planning, implementation, and evaluation activities throughout the project. Fidelity was measured by obtaining documentation, including contracts with the National WIC Association and their media vendor, statements of work, custom and existing creative content, updates to the Miami-Dade WIC external website, documentation of staff trainings, and documentation of the social media postings. To facilitate project management, the Miami-Dade WIC leadership team developed a complex matrix which tracked the project's key milestones, timeline of activities and events by date as well as responsible person(s) for each activity.

Vendor data were used to determine if the digital media campaign reached the intended audience, how the target audience interacted with the campaign, and cost-effectiveness. The Miami-Dade WIC project team utilized monthly reports from the marketing contractor to measure digital media campaign performance. The reports included detailed key performance indicators for all digital media including Google Ads, Facebook, Instagram, and YouTube. To assess the Google Ads, the goal was to determine overall campaign performance and identify which keywords had the most clicks and drove the most visits to our website. This was measured by total and monthly impressions (the number of times the WIC display ad was presented) and clicks for all campaign keywords. Additionally, a report of monthly and annual click-through rate (CTR), which measures number of clicks compared to impressions, was provided monthly and for the overall campaign. Using these reports, the Miami-Dade team identified and described the top performing keywords in terms of impressions, clicks, and CTR.

For social media marketing, the project team aimed to assess which campaign materials performed best, stratified by platform, campaign objective, ad theme, and creative type (custom vs. existing content). The performance for Facebook, Instagram, and YouTube were measured by several metrics, including impressions (the reach of the advertisement to the target population), clicks on the advertisement which direct to the local agency website or to the phone center, CTR, and engagement with the advertisement (likes, shares, and comments on the post). The project team aimed to determine if the social media advertisements were cost-effective and sustainable by assessing cost metrics. These include cost per thousand impressions (CPM), cost per click (CPC) and cost per engagement and views (CPE/CPV).

The short-term outcome evaluation aimed to determine if the integrated digital media marketing campaign positively contributed to website and call center traffic, the degree of exposure to the ads among WIC clients, and whether exposure to the ads led to increased motivation to contact WIC. To measure traffic to the Miami-Dade WIC website and click-through to the call center, the Google Analytics (GA) platform was utilized. The following metrics were tracked and analyzed: number of sessions (clicks to the website), number of new users to the Miami-Dade WIC website, new user acquisition (how they arrived at the website), audience demographics, device, usage preferences (mobile or desktop computer, browser language, age range), and behavior while on website (clicks to the call center, downloads, page visits).

In addition to performance metrics, exposure of the campaign in the target audience and whether the integrated media marketing campaign motivated clients to contact WIC were also explored. To measure exposure and motivation, a client engagement survey was deployed. The survey was promoted to all current WIC clients, but specifically targeted clients from the innovation clinics. Assessment of the survey results included descriptive characteristics of the survey population and analysis of the clients exposed to campaign ads stratified by platform and innovation versus comparison zip codes. The project team also assessed client motivation to contact WIC after exposure to advertising stratified by digital media platform exposure.

### Public Health Solutions

The Public Health Solutions process and short-term outcome evaluations assessed participant and partner engagement, referral volume, and participant, staff, and partner perceptions of WMTY and UniteUs.

Participant engagement was assessed by quantifying the number and percentage of participants who: (1) were eligible for the intervention, (2) engaged in the WMTY conversation, (3) identified barriers to retention and/or social needs, (4) were referred to support services, and (5) enrolled in or received benefits or support services. These were calculated using data from the WMTY daily tracker and Unite NYC. Unite NYC is a coordinated care network of health and social service providers which uses the Unite US shared technology platform. Significance testing for differences between intervention sites in participant engagement metrics was performed using the chi-square test when the total number of observations was greater than 20, all observed frequencies were greater than zero, and no expected frequencies were less than 5. If sample sizes were too small to meet the observed or expected frequency conditions for the chi-square test, the Fisher's exact test was performed as an alternative. Statistically significant differences were determined to be those with a p-value less than 0.05.

Partner engagement was assessed by calculating the number and percentage of (1) participants who had accepted referrals, (2) closed cases (i.e., a case that has been accepted by the receiving organization with a documented outcome), and (3) cases that resulted in receipt of benefits or services. Significance testing for differences between intervention sites in partner engagement metrics was performed using the chi-square test under previously stated conditions. If sample sizes were too small to perform the chi-square test, then the Fisher's exact test was used. The two-proportion z-test was used to test for differences in referral outcomes by site within service categories.

To evaluate short-term impact on referral volume, summary reports exported from the New York State WIC MIS (NYWIC) were used. Due to the change of MIS from WICSIS to NYWIC in April 2019, data on referrals for the period from January 2019 through June 2019 are either missing or incomplete; therefore, the baseline data period is from July 2019 through December 2019. The implementation data period is from February 2020 through January 2021. Percent change in total volume of referrals from the baseline period to the implementation period between intervention and comparison sites using referral summary data exported from NYWIC was compared. The implementation period referral volume was adjusted down by 50% to account for the 6 months of missing data in the baseline period data.

Quantitative data on the experiences and perceived value of WIC from the participant, WIC staff, and partner perspectives was collected via tailored surveys. These data were further contextualized by the qualitative data resulting from in-depth interviews (IDIs) with select participants who identified needs during the WMTY conversation, focus groups with intervention site WIC staff, and focus groups with representatives from WMTY partner CBOs.

The post-intervention evaluation surveys of participants, WIC staff, and partners were all digital surveys distributed via texting or emailing potential respondents a link. The surveys were analyzed by calculating the number and proportion of respondents to each response option per question. Significance testing for differences in responses between intervention and comparison sites (participant and WIC staff surveys only) was performed using the chi-square test under previously stated conditions. If sample sizes were too small to meet the observed or expected frequency conditions for the chi-square test, the Fisher's exact test was performed as an alternative. Significance testing for differences between response proportions to two different questions among respondents at the same site was performed using the two-proportion z-test.

Qualitative data was collected from participants via 29 IDIs. Potential interviewees either responded to an outreach survey indicating their interest in participating in an interview or responded positively to direct outreach from the WMTY Project Coordinator. Each interviewee received a \$25 gift card in exchange for their time. All interviews were conducted virtually. The IDI guide was developed in collaboration with HPRIL and included questions about duration of WIC participation, likes and dislikes of the WIC program, barriers to participation, comfort discussing needs and barriers with WIC staff, and the perceived value of conversations with WIC staff about needs outside WIC. Subsequent interview questions were tailored based on the interviewee's progress through the referral workflow. Specifically, they were asked to reflect on their experience with the parts of the referral process that they experienced, how the option to be referred and/or enrolled in other services makes them feel about what WIC can do, and how having access to additional services (via referral) or additional information affects their plans to remain in the WIC program.

Qualitative data was also gathered from WIC staff through four focus groups and from WMTY partners through two focus groups. All Qualified Nutritionists (QNs) and Community Service Aides (CSAs) at the intervention sites were invited to participate in a focus group. No incentives were provided as participation in evaluation activities was an expectation of staff at intervention sites. The guide for WIC staff focus groups included questions about their experience (1) using the WMTY conversation guide to identify participant needs and (2) using Unite NYC to make referrals, review outcomes, and communicate with others. Staff members were also asked to reflect on the perceived impact of the WMTY project on participants. Lastly, the guide included questions about their thoughts on what should be retained and/or changed if the project were expanded, as well as recommendations for next steps. At least one representative from each partner organization was invited to participate in a focus group. Representatives from 9 of 11 partner organizations ultimately participated in a focus group. No incentives were provided as participation in evaluation activities was an expectation of network membership. The guide for partner focus groups included questions on experience with using Unite NYC for referral management, referral quality and experience with the referral workflow, sustainability, recommendations for change, feedback on overall experience, and perceived impact of services.

The qualitative data from the IDIs and focus groups were analyzed using a thematic analysis approach.

### Cabarrus Health Alliance

To evaluate project implementation fidelity, the Cabarrus team documented: (1) the number of families who utilized the QLess platform to make their own appointment and if they made it accurately; (2) common reasons appointments were made incorrectly; and (3) WIC website traffic and volume of inbound calls to the clinic (which were a measure of participant engagement). To measure WIC clients' participation in QLess, the team tracked the number of the participants making their own appointments daily using the platform. Weekly clicks on the CHA-WIC website and QLess link were tracked using Google analytics and reported by the CHA marketing team.

For the short-term outcome evaluation, satisfaction from both staff and WIC participants were measured by surveys, phone logs, and number of appointments booked by participants. The surveys assisted in the understanding of barriers in accessing and using the online appointment system during the implementation period. The pre-implementation (i.e., baseline) surveys for participants, WIC staff, and comparison clinic participants were all administered in-person using pen and paper. The participant survey was administered at both the intervention and comparison sites to participants while waiting for the nutritionist in private rooms. Questions assessed the satisfaction of the current appointment-making process. During a portion of the implementation period (January to April 2021), implementation surveys were conducted one week per month. The surveys were administered over the phone prior to the start of the participant's appointment and after obtaining consent. The questions explored how participants were making their appointments as well as the barriers they had faced while making appointments.

Post-implementation surveys were conducted via telephone during the last week of the implementation period. Due to transitioning to a new online platform, CHA and the HPRIL team deemed it appropriate to conduct the post-implementation survey during the last week of implementation in order to reduce confusion for the participant between the two online appointment scheduling platforms. The four-question survey was similar to the pre-implementation survey with three questions assessing appointment booking satisfaction. Staff baseline and post-implementation surveys were administered only to the intervention sites. Survey questions explored attitudes towards the scheduling system pre- and post-implementation.

The volume of incoming calls was recorded using the Mitel phone system report. Incoming calls to the clinic were tracked monthly to determine the impact the online appointment system may have had on the volume of incoming calls. Several different measures were used: (1) the volume of incoming calls; (2) calls handled; (3) calls abandoned; and (4) speed of answer. Volume of incoming calls measured the number of calls coming to the clinic, calls handled measured all calls that were answered by the staff, calls abandoned measured the number calls in which

participants hung up before a staff member was able to assist them, and lastly the speed of answer was measured by the average minutes it took for staff to answer the incoming calls.

### *Impact Evaluation*

To evaluate the impact of each sub-grantee's project on participation and retention of children ages 1 to 4 years in WIC, HPRIL employed a quasi-experimental model where each sub-grantee project had an innovation group and a comparison group, and data were obtained on cohorts of child WIC participants during a baseline period (prior to the innovation) and during the period when their innovation was implemented. This design allowed HPRIL to compare differences in retention rates and other outcomes between a baseline period and the implementation period within sub-grantee projects as well across the projects.

### Internal Review Board Approval

In 2019, HPRIL submitted project details to the Johns Hopkins University Bloomberg School of Public Health (JHSPH) Internal Review Board (IRB), including documentation of local WIC agency IRB determination letters. HPRIL's role was approved by the JHSPH IRB as a non-research public health surveillance project.

### Innovation and Comparison Groups

Prior to project implementation, HPRIL assisted the sub-grantees in identifying comparison sites to allow for a contemporaneous comparison evaluation design. Some of the funded agencies decided to compare clinic sites within their local agency (LA) (i.e., Public Health Solutions and Miami-Dade WIC) and others opted to compare their LA to another LA nearby (i.e., Pima County, Yavapai County, and Cabarrus Health Alliance).

Comparison clinics and agencies were selected based on a perceived high degree of similarity with the innovation site in terms of number of participants, race/ethnicity, geography, and breastfeeding initiation. Some clinics and agencies had additional similarities in terms of unemployment, poverty, or COVID-19 impacts as specified further below.

Description of the innovation and comparison groups for each of the five agencies:

- Pima County, AZ: Pinal County served as Pima County's comparison. While Pinal County is smaller than Pima County, population of 460,000 and 1.04 million, respectively, both agencies have a similar WIC caseload.
- Yavapai County, AZ: Mohave County was used as the comparison for Yavapai County. Yavapai and Mohave Counties have similar general and WIC population sizes, unemployment, poverty, and geography.
- Miami-Dade, FL: An aggregate of 11 non-innovation clinics in the Miami-Dade WIC clinic network (of 21 clinics total) served as the comparison sites. An aggregate group allowed for the greatest demographic and contextual similarity with the two clinics in the innovation group.
- Cabarrus Health Alliance, NC: Catawba County served as the comparison county for Cabarrus Health Alliance (CHA). Catawba County WIC has a slightly higher caseload

and larger program than CHA but a smaller total population. They have similar racial/ethnic demographics, rural and urban distribution, and COVID-19 economic impacts.

- Public Health Solutions, NY: One non-innovation clinic in the Public Health Solutions (PHS) New York City WIC clinic network (of 9 clinics total) served as the comparison group. This clinic had a high degree of demographic and contextual similarity with the two innovation clinics.

#### Data Specifications

A condition for eligibility for the program was concurrence from the state WIC office to provide the sub-grantee and HPRIL with MIS data for the evaluation. HPRIL obtained Management Information System (MIS) data from each state WIC office to conduct statistical analyses to evaluate the impact of each innovative tool on outcomes related to child retention and participation. Data were obtained for two time periods: a baseline period that was the 2019 calendar year and a 12-month implementation period that varied between the agencies.

Implementation periods were as follows:

- Pima County WIC: March 1, 2020-February 28, 2021
- Yavapai County WIC: April 1, 2020-March 31, 2021
- Miami-Dade County WIC: June 1, 2020-May 31, 2021
- Public Health Solutions: February 1, 2020-January 31, 2021
- Cabarrus Health Alliance: June 1, 2020-May 31, 2021

The data request was for all infants and children who were active in WIC at the beginning of each period. The HPRIL evaluation sought to compare changes in each outcome over time for the implementation group to changes for the comparison group. HPRIL developed a data codebook that contained the variables that would be used in the evaluation as well as additional variables that were necessary for the evaluation (see Table 1). The requested variables are divided into two categories: (1) Those that originate from the USDA WIC minimum data set (MDS) or supplemental dataset (SDS) and (2) those needed for the HPRIL evaluation not found in the MDS or SDS, but still available in the MIS.



**Table 1. Variables Requested**

Variables from WIC MDS or SDS	Additional Variables
Agency and clinic at the beginning and end of the data period (could include “not enrolled”)	Status at the end of the data period. Categories included Active; Terminated due to failure to recertify, categorical ineligibility, income ineligibility, residency ineligibility, or “other”; Not enrolled at the end of the period; or Missing.
Date of certification at the start of the data collection period	End date of certification at the start of the data collection period
Race/ethnicity. Categories included American Indian/Alaska Native; Asian; Black or African American; Native Hawaiian/Other Pacific Islander; White; Hispanic; or Multiracial.	Date of recertification visit during data collection period. <i>Note: HPRIL requested data for a 15-month period from January 1, 2019 through March 31, 2020 for this variable to prevent censoring of timely recertification for children with certification periods ending in late 2019.</i>
Participant category at the beginning and end of the data period. Categories included Infant-Exclusive Breastfeeding (IBE), Infant-Partial Breastfeeding (IBP), Infant-Fully Formula Fed (IFF), Child Age One (C1), Child Age Two (C2), Child Age 3 (C3), and Child Age 4 (C4), or “Missing”. <i>Note: The North Carolina WIC MIS does not differentiate between different child categories.</i>	Date of mid-certification/child assessment visit during data collection period
Household size	Dates of first, second, and third nutrition education visits during data collection period
Number of WIC participants in the household	Dates and types of first, second, third, and fourth participant services visits/other contacts during data collection period
Participation in other programs: Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), and Medicaid	Dates of benefit issuance each month during the data collection period <i>Note: Benefit issuance is at the individual level.</i>
Ever breastfed. <i>Note: This is a historical variable.</i>	Monthly expired benefits (household level). <i>Note: The Arizona WIC agency was not able to provide data on expired benefits for Yavapai or Pima County.</i>
	Age (in months) at the beginning and end of the data period
	Age at initial certification in WIC (in weeks)
	Twin status. <i>Note: Some sub-grantees were not able to provide this information.</i>
	Primary language other than English
	Need for a translator

Three of the agencies (Pima County WIC, Yavapai County WIC, and Public Health Solutions) requested additional project-specific variables to be added to their codebooks. These variables (listed in Table 2) relate to the process evaluation of the sub-grantees.

**Table 2. Agency-Specific Variables**

Agency	Variable
Pima County WIC	Participant/Family Telephone available
	Participant/Family Mobile phone available
	‘Do not text’ flagged for participant phone
	‘Do not call’ flagged for participant phone
Yavapai County WIC	Modality of recertification visit during timeframe: In person, by telephone, by Zoom, missing
Public Health Solutions	Date of first High Risk Nutrition Education Visit during the period
	Date of second High Risk Nutrition Education Visit during the period
	Date of third High Risk Nutrition Education Visit during the period
	ID of enrolled child’s mother (only if relevant)
	Infant or Child date of birth
	Self-reported household income at the beginning of period
	Self-reported household income at the end of period
	At least one referral in Health Care Provider category documented in NYCWIC (New York state MIS system) during the period
	At least one referral to SNAP category documented in NYWIC during period
	At least one referral to Medicaid category documented in NYWIC during period
	At least one referral to Breastfeeding Support Group category documented in NYWIC during period
	At least one referral to TANF category documented in NYWIC during period
	At least one referral to Child Support Enforcement Program category documented in NYWIC during period
	At least one referral to Immunization category documented in NYWIC during period
	At least one referral to Dentist category documented in NYWIC during period
	At least one referral to Head Start/Early Head Start category documented in NYWIC during period
	At least one referral to Clothing/Household Resources category documented in NYWIC during period
	At least one referral to Other category documented in NYWIC during period
	At least one referral to Child Health Plus category documented in NYWIC during period
	At least one referral to Prenatal Care category documented in NYWIC during period
At least one referral in Referral Not Needed documented in NYWIC during period	
No referrals documented in NYWIC during period	

Because the data sets included all infants and children active at the start of the period, we can examine the pattern of participation of a cohort of WIC participants over time. During any given 12-month period, each participant has an end date for the prior certification period and can be expected to recertify (or not). Participants can leave the program by not re-certifying, or they may recertify and then leave the program, and some may move and enroll in another WIC agency. Thus, at the end of the year, a child may still be active in WIC (that is, retained), inactive

because they left the program, or re-enrolled at another WIC agency (e.g., they moved out of the area) (Table 3).

Each month benefits are issued for each WIC participant, and over a time period different patterns of issuance can be observed, with less than continuous benefit issuance indicating gaps in service due to, e.g., missed appointments. Although benefits are issued to a specific WIC participant, benefit redemption at the individual level is not generally available in MIS data, nor is partial redemption of benefits. Monthly benefit non-use was available from three of the state agencies: Florida, New York, and North Carolina (Table 3). The Arizona state WIC agency was not able to provide data on benefit non-use.

The HPRIL impact analyses focused on three core outcomes regarding retention and participation. Initially, five outcomes were considered. First, child recertification was defined as documented recertification of the children during the 12-month period or during months 13-14 for those with certification end dates during the final 2 months of the period. Second, timely recertification was defined as recertification within 60 days of the end date of the prior certification period. Third, retention was defined by the child’s status at the end of each study period (i.e., active or terminated per the MIS). Fourth, child participation was measured by continuous benefit issuance (11 or 12 months). Fifth, benefit non-use was defined by a child’s benefits being fully expired (no benefits redeemed) in a given month. During analyses, it was revealed that more than 90% of recertifications were timely (during each time period) for three of the agencies (Miami-Dade, PHS, and CHA), and that benefit non-use was < 5% (during each time period) and therefore these outcomes were not investigated further.

**Table 3. Initial Child Retention and Participation Outcomes**

Outcome	Description
Recertification	The proportion of children in the dataset with a recertification date during the period. Note: includes children who left the agency and/or were not classified as “active” at the end of the period.
Timely recertification	The proportion of children (out of all children in the cohort) with a recertification date less than or equal to 60 days after the end of certification during the period.
Not-timely recertification	The proportion of children (out of all children in the cohort) with a recertification date greater than 60 days after the end of certification during the period.
Percent of recertifications that are timely	The proportion of children (only out of those with a recertification date) whose recertification date is less than or equal to 60 days after the end of the certification during the period.
Retention	The number of children active at the end of the data period at the innovation or comparison agency / (The number of children overall at the beginning of the period - children at another local agency at the end of the period)
Continuous benefit issuance	The proportion of children who were issued 11-12 months of benefits (out of 12)
Months of benefit issuance	Median and interquartile range of proportion of children issued benefits across the year
Percent of cohort issued benefits	Average proportion of children that were issued benefits each month
Benefit non-use <sup>a</sup>	Monthly proportion of children with fully expired benefits (only among children who were issued benefits that month).

<sup>a</sup>Monthly benefit non-use was only available from three of the state agencies: Florida, New York, and North Carolina

### Data Collection and Submission

With input from each sub-grantee, HPRIL compiled unique baseline and implementation period codebooks for each project. The codebooks were similar across the agencies except for the additional variables requested by the sub-grantee, and some modifications based on unique state MIS systems. Official MIS codebooks, data requests, and skeleton databases were sent to sub-grantees, and each sub-grantee was instructed to request the data from their state agency. HPRIL requested that any deviations in coding or calculation from the HPRIL codebook be documented and submitted back in the form of a revised codebook along with the data. The data request included instructions for de-identifying personal identifying information (PII) and transferring the datasets to HPRIL. HPRIL requested that the datasets be provided as a wide format CSV file and uploaded to a HIPAA/FERPA-secure Johns Hopkins University OneDrive folder.

### Data Checking

As described above, HPRIL provided technical assistance to the local and state agencies regarding the data requests, including providing feedback on preliminary versions of the datasets. HPRIL reviewed the preliminary datasets to ensure that they contained information pertaining to the desired subset of children, that the coding aligned with HPRIL's definitions, and that there were no outliers or illogical values. Many of the preliminary versions contained irregularities that were corrected in subsequent drafts. There are limitations to some of the sub-grantee data sets for our analysis; these are noted below.

### Data Analysis

The analyses proceeded in stages. Descriptive analyses were conducted to describe the participant characteristics and outcomes for each group during each time period. We documented characteristics with a significant percentage of missing values (> 10%), which would limit their usefulness during analysis. To assess comparability of the innovation and comparison groups within each time period, HPRIL compared participant characteristics, including participant category at the beginning and end of the data period; household size; number of WIC participants in the household; multiple birth status; race and ethnicity; primary language other than English; need for a translator; participation in other federal assistance programs such as Temporary Assistance to Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), and Medicaid; and whether the participant was ever breastfed. Pearson chi-square tests were used to detect any significant differences between innovation and comparison in terms of participant characteristics and outcomes for each time period. Logistic regression analyses were also conducted to compare outcomes between groups (innovation versus comparison) within each time period adjusting for covariates. Reports of these analyses were created for each time period.<sup>25, 26</sup>

To estimate program impact, HPRIL employed a difference in difference (DID) approach, which involves estimation of the changes over time in each outcome in the innovation versus the comparison group. Analyses were conducted for the overall sample as well as for infants (IBE, IFF, and IBP categories) and children (C1, C2 and C3 categories). Because participants are not randomly assigned to the innovation or comparison group, analysis of the impact of the social media campaign is not straightforward. Participants are assigned to a WIC clinic based on residence which is determined by the participant's family and based on multiple factors. This may lead to the problem of selection bias if these same factors also affect the likelihood of recertification, retention, or participation.

To address this issue, HPRIL employed propensity score weighting (PSW) to adjust for differences in participant characteristics between the innovation and comparison groups at each time period (labelled T1 and T2) as well as differences across the two time periods. Two common weighting approaches were used. In the first, weights were estimated using multinomial logistic regression in which observations are weighted as compared to the those in the innovation group during T1 as per Stuart et al., 2014.<sup>27</sup> In the second, a kernel approach for repeated cross-sectional data was used to weight observations relative to the innovation group during T2 as per Villa 2016.<sup>28</sup> To illustrate the balance in participant characteristics achieved through weighting, HPRIL compared the absolute standardized differences (ASD) for the means of each variable before and after weighting in the overall sample, for infants and for children. This involved comparing the balance achieved for the innovation group over time (at T1 and T2), the innovation group at T1 and comparison group at T1, and the innovation group at T1 with the comparison at T2. This approach was repeated for analyses involving infants or children.

To fully present the results, the outcomes are shown and compared over time using both unweighted and weighted data. HPRIL conducted DID analyses for all three outcomes (recertification, retention, and participation/benefit issuance) overall, for infants, and for children. Beta coefficients and 95% confidence intervals were calculated using three models: (1) Crude, unweighted; (2) Adjusted Model 1 (A1): PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; and (3) Adjusted model 2 (A2): PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option.

#### Impacts of COVID-19 on Impact Evaluation

HPRIL's robust evaluation design (with innovation and comparison groups) allowed for the measurement of impacts of each subgrantee's innovative tool amid the COVID-19 crisis. MIS data was the principal data collection vehicle and was still collected by WIC agencies during the pandemic. The key evaluation outcomes came from the MIS and did not rely on primary data collection involving in-person interactions. Furthermore, careful documentation of WIC operational changes during the COVID-19 pandemic allowed the HPRIL team to align operational changes with different time periods within the data.

## Results

### *Pima County WIC*

#### Process and Short-term Outcome Evaluation

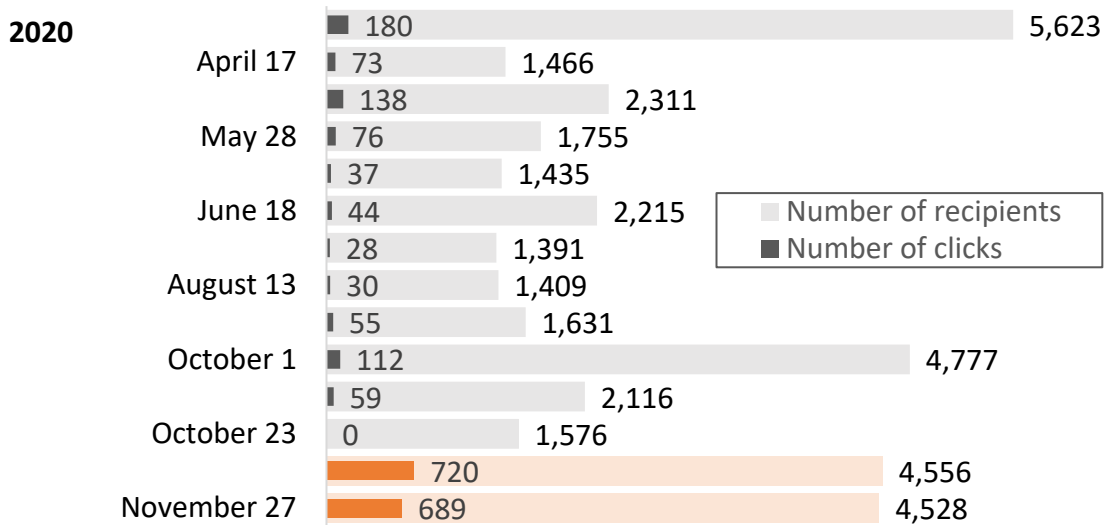
##### **Implementation Fidelity**

There were several deviations from initial planning. Implementation of the intervention was delayed by three months relative to initial planning. Programmatic changes included addition of a self-opt in option, which was developed to provide an additional enrollment mechanism in addition to using the MIS database to identify clients that provided a cell phone and gave permission to receive texts. The benefit of the self-opt in is that it contains triage questions that place the client into the appropriate messaging group based on their answers to the questions.

The COVID-19 pandemic changed the priorities of the technology support team at the Arizona Department of Health Services. The team was required to deploy their resources to reprogram the HANDS MIS system to accommodate for USDA policy waivers enabling remote services. The pandemic also changed the way that Pima County WIC promoted the intervention. Originally, the plans included promotional materials that WIC participants would see and discuss when they came to their visits at the WIC clinic. The materials included posters, staff T-shirts with WICBuzz logos and oven mitts with the WICBuzz logo and opt-in information printed on it. By April 1, 2020, PCHD WIC clinics had moved WIC services from in-person to remote service delivery. In order to address this challenge, Pima County WIC staff members suggested creating WICBuzz promotional material that could be included in all outgoing mail to WIC participants. A mini WICBuzz promotion poster was included in most mailings since April 17, 2020. The WIC clinics were still open for clients to pick up breast pumps or eWIC cards. When participants came to the clinic, they also received a WICBuzz promotional oven mitt. Finally, local evaluation activities were altered, from planned in-person interviews and focus groups to virtual focus groups and surveys administered via text message and online.

##### **Participant Engagement with the Tool**

In March 2020, 5,851 families were enrolled in WICBuzz. Of those 5,851 welcome messages, 620 (11%) were in Spanish and 5,231 (89%) in English. On November 30, 2020, an additional 1,311 were added. Of the 1,311 new participants that received the welcome message on November 30, 2020 (second enrollment of clients into WICBuzz), 1,190 (91%) identified English as their primary language and were opted into the English language groups, while 121 (9%) were opted into the Spanish-language groups. At the end of the intervention (February 2021), taking into account attrition due to client opt-outs and unrouteable messages, 5,271 (79% of those enrolled over the course of the year) continued to receive WICBuzz messages. One process measure used to assess engagement was the number of clicks on embedded links, ad hoc messages directing recipients to community resources. Two WICBuzz messages in November 2020 resulted in a higher proportion of clicks on the embedded links, than the WIC program or food-related links sent in previous WICBuzz messages (see Figure 6).



**Figure 6.** Messages sent and message clicks, April-November 2020

### Mid-Project Client Survey

There was a total of 230 valid responses to the mid-project client survey (response rate of 4.7%). Respondents indicated that the WICBuzz text messages were helpful and that the frequency and length of messages was acceptable. In response to the question, “What is the best time of day for you to receive a text message from WIC?,” nearly half selected ‘Anytime’, more than one-quarter selected ‘Morning’, less than 20% selected ‘Afternoon’, and only 5% selected ‘Evening.’ In response to the question, “I want to get messages from WIC about...,” the most popular desired message topics were ‘Reminders to schedule appointments’ and ‘When my benefits are going to expire.’ More than half of respondents selected ‘Recipes I can try with WIC foods’ and ‘Raising a healthy eater’, and slightly less than half selected ‘Infant and child behavior’ and ‘How to schedule WIC appointments.’ More than one-third chose ‘How long I can receive WIC benefits’ and ‘Community resources to meet the needs of my family.’ The vast majority of respondents indicated that they would like to be able to send a text message to WIC and get a response from staff.

The WICBuzz mid-implementation client survey findings indicated to PCHD that messaging should continue as scheduled for the remainder of the WICBuzz implementation period (in terms of message content, length and frequency) with one minor modification to the time-of-day messages were delivered. The time of delivery of WICBuzz messaging was adjusted from 6:00pm to 10:00am local time. In addition, the WICBuzz team decided to share free/low-cost food resources with clients via ad hoc messages, as more than a third of survey respondents indicated interest in receiving WICBuzz text messages with information about “community resources to meet the needs of my family.”

### Post-Implementation Staff Focus Group

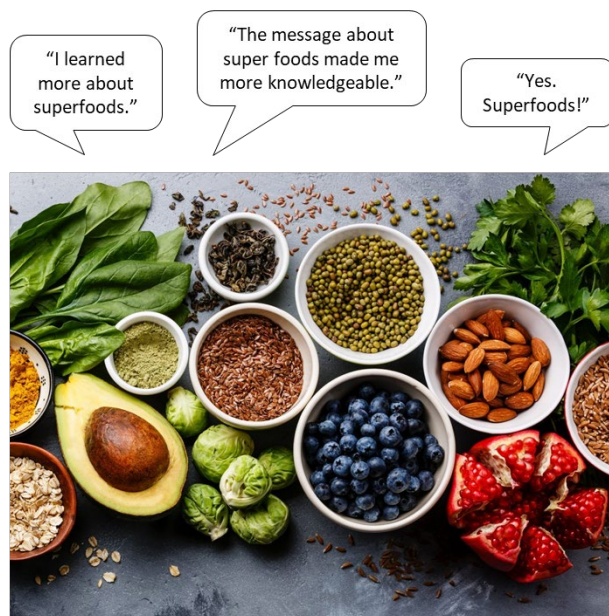
Focus group participants (n=7 WIC staff) perceived that the WICBuzz messages influenced clients to renew their certifications, call to schedule their next appointment, learn more about child development and how to use their WIC foods. The focus group (FG) offered ideas about

how to forge better connections between WIC clients and staff. FG participants felt that if staff were more aware of the messages going out, they could reinforce those messages in conversations with clients. FG participants also showed interest in helping to develop the messages and wanted to include additional text message topics in the future.

### Post-Implementation Client Survey

There were 1,565 valid responses to the Post-Implementation Client Survey (31% response rate), 1,368 of which were English and 197 of which were Spanish. Most survey respondents reported that they learned something new from WICBuzz text messages, that text messages were extremely helpful or very helpful, and that receiving WICBuzz messages motivated them to take actions such as trying a new food and/or scheduling their next WIC appointment. Respondents were able to further elucidate responses to closed-ended questions by providing descriptive answers to the survey's open-ended questions that reflected examples of specific knowledge gained and self-reported behavior change. Some responses to open-ended questions referenced specific message content, such as certain foods and/or recipes featured in WICBuzz messages, demonstrating recipient retention of content from the WICBuzz text message campaign (Figure 7).

### Do you feel you learned something new about healthy lifestyles for you or your children from the WICBuzz text messages?



**Figure 7.** A selection of open-ended responses to the question, “Do you feel you learned something new about healthy lifestyles for you or your children from the WICBuzz text messages?”

These responses, in conjunction with low levels of clients opting out of receiving the WICBuzz messages, reflect a high level of acceptability of this type of messaging campaign among WIC clients.



Impact on Retention and Participation

**Table 4.** Demographic Characteristics of Children 0-3 at Pima County WIC and Pinal County WIC at baseline (T1) and implementation (T2). Statistically significant differences by group are in bold.

		Baseline (T1)		Imple- mentati on (T2)	
		Pima (n=7,452) %	Pinal (n=6,780) %	Pima (n=5,004) %	Pinal (n=4,599) %
<b>Category at start of period</b>	<b>IBE</b>	<b>4.8</b>	<b>4.9</b>	<b>5</b>	<b>5.1</b>
	<b>IBP</b>	<b>7.8</b>	<b>5.2</b>	<b>7.6</b>	<b>4.8</b>
	<b>IFF</b>	<b>26.5</b>	<b>23.2</b>	<b>21.4</b>	<b>21.6</b>
	<b>C1</b>	<b>24.0</b>	<b>23.9</b>	<b>31.3</b>	<b>31.2</b>
	<b>C2</b>	<b>20.4</b>	<b>22.0</b>	<b>19.8</b>	<b>20.6</b>
	<b>C3</b>	<b>16.6</b>	<b>20.0</b>	<b>14.9</b>	<b>16.6</b>
<b>Number of WIC participants</b>	<b>One</b>	<b>32.1</b>	<b>29.8</b>	<b>34.6</b>	<b>30.5</b>
	<b>Two</b>	<b>36.2</b>	<b>34.0</b>	<b>35.7</b>	<b>33.9</b>
	<b>Three or more</b>	<b>31.7</b>	<b>36.2</b>	<b>29.8</b>	<b>35.6</b>
Race/ethnicity <sup>a</sup>	American Indian or Alaska Native	4.2	3.9	3.9	4.2
	<b>Asian</b>	<b>2.4</b>	<b>0.9</b>	<b>2.3</b>	<b>1</b>
	<b>Black or African American</b>	<b>14.1</b>	<b>10.3</b>	<b>15</b>	<b>10.7</b>
	Native Hawaiian or Other Pacific Islander	1.5	1.0	1.3	1.3
	<b>White</b>	<b>85.7</b>	<b>90.6</b>	<b>85.8</b>	<b>89.8</b>
	<b>Hispanic</b>	<b>67.9</b>	<b>52.0</b>	<b>68.7</b>	<b>54</b>
Enrolled	<b>TANF</b>	<b>0.7</b>	<b>0.7</b>	<b>1.3</b>	<b>0.9</b>
	<b>SNAP</b>	<b>28.0</b>	<b>23.8</b>	<b>33.5</b>	<b>29.4</b>
	<b>Medicaid</b>	<b>47.9</b>	<b>48.7</b>	<b>60.4</b>	<b>61.5</b>
<b>Primary language other than English</b>	<b>85.1</b>	<b>92.6</b>	<b>85.7</b>	<b>92.5</b>	
<b>Ever breastfed</b>	<b>Yes</b>	<b>78.1</b>	<b>70.5</b>	<b>77.7</b>	<b>66</b>
	<b>No</b>	<b>21.9</b>	<b>29.5</b>	<b>22.3</b>	<b>34</b>
<b>Household size</b>	<b>0-4</b>	<b>61.9</b>	<b>52.1</b>	<b>35.6</b>	<b>47.1</b>
	<b>Greater than or equal to 5</b>	<b>38.1</b>	<b>47.9</b>	<b>64.3</b>	<b>52.9</b>
<b>Telephone</b>		<b>1.8</b>	<b>2.7</b>	<b>1.2</b>	<b>2.1</b>
Mobile		97.9	98.1	98.5	98.9
Do not text		0.1	0.2	0	0.2
Do not call		0.2	0.3	0.1	0.2

<sup>a</sup> Participants can respond to more than one category so the total percentage may be greater than 100.

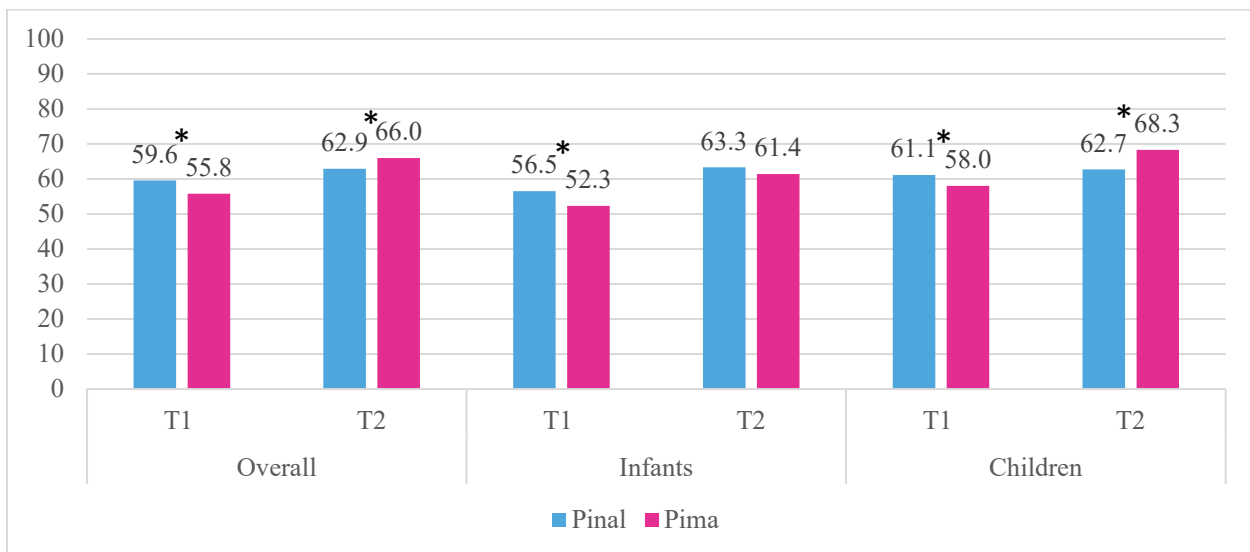
Overall, the participants in the comparison and innovation groups were similar for most demographic characteristics at baseline (T1) and implementation (T2) and over time (Table 4). Although there were statistically significant differences in many characteristics between groups during both time periods, there did not appear to be many clinically important differences. On the other hand, there were potentially important differences by race or ethnicity and primary language spoken in the household.

Pima County had fewer Hispanic participants at both T1 and T2 (52% at T1 and 54% at T2) than Pinal County (68% at T1 and 69% at T2), fewer participants with a household language other than English (85% at T1 and 86% at T2) than Pinal County (93% at T1 and 93% at T2), fewer participants that live in a household with greater than or equal to five people (38% at T1 and 36% at T2) than Pinal County (48% at T1 and 47% at T2), and a greater proportion of participants who have been ever breastfed (78% at T1 and T2) than Pinal County (70% at T1 and 66% at T2).

There were very few notable differences in participant characteristics in each group over time. One notable difference was in SNAP participation: At T1, 28% of Pima County participants and 24% of Pinal County participants also participated in SNAP, while at T2, 34% of Pima County WIC and 29% of Pinal County WIC were SNAP participants.

### Recertification

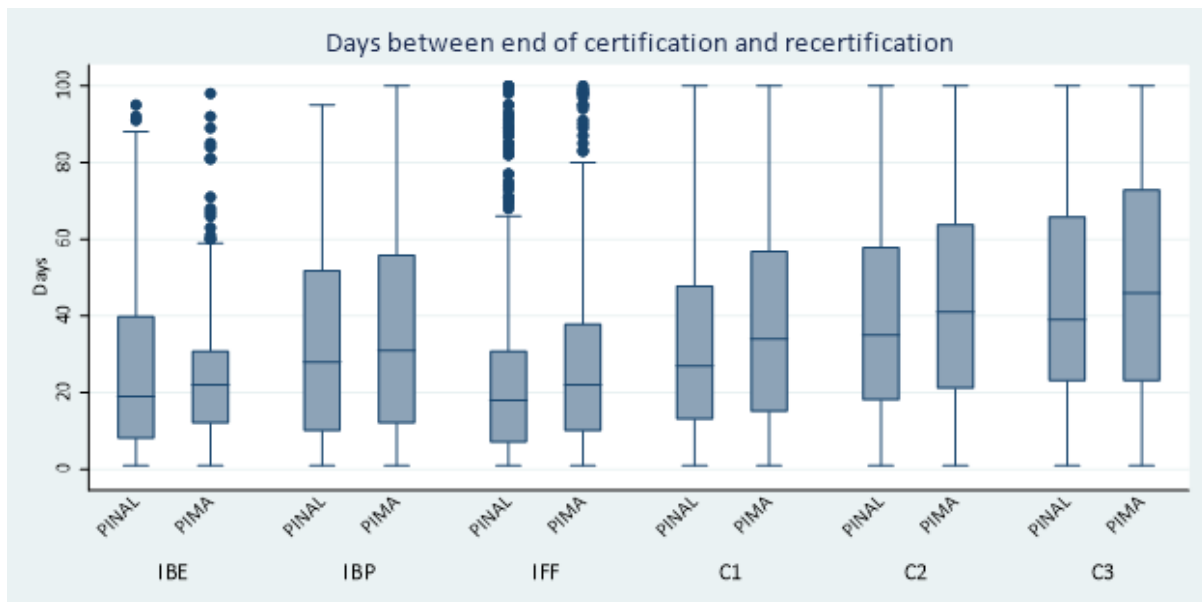
While the crude, unweighted proportion of infants and children recertified in Pima was lower than in Pinal during T1 (55.8% and 59.6%, respectively), the proportions recertified during T2 were significantly higher in Pima (66.0% and 62.9%, respectively) (Figure 20). This was also true when studying children. However, for infants, the difference between the recertification rates between Pima and Pinal County was not significant. For sample sizes of these groups, see Appendix O. Table 1.



**Figure 8.** Proportion recertified (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Pima and Pinal Counties. \*p < 0.05.

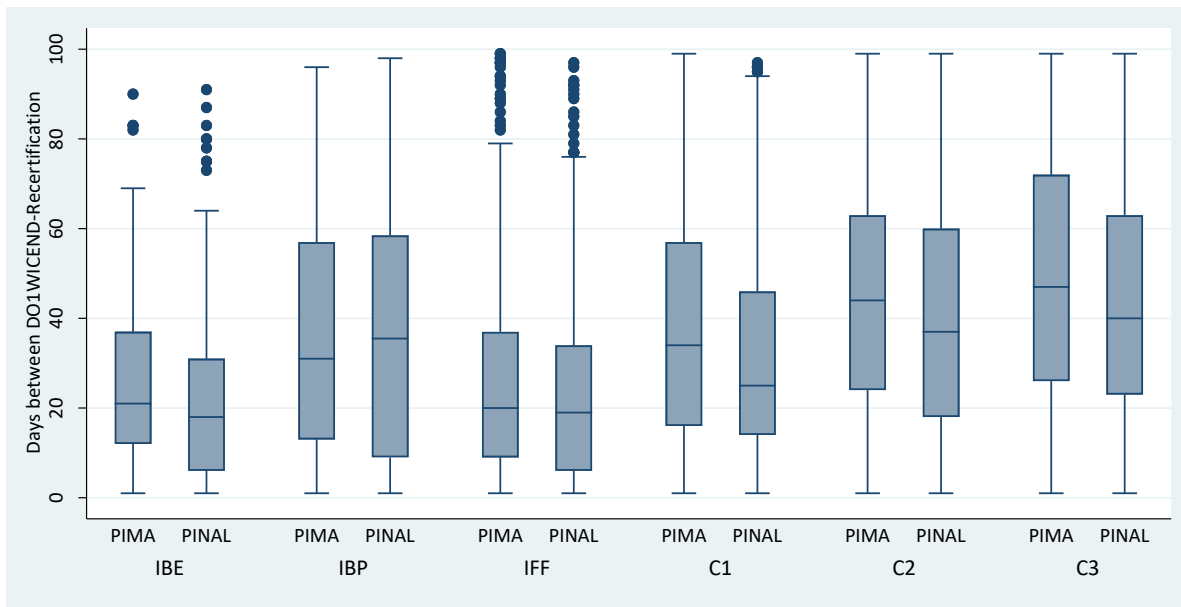
## Timeliness of Recertification

The median number of days between the end of the prior certification and recertification date during the baseline period (T1) was 50 (Interquartile range(IQR) 22, 111) for Pima County and 38 (IQR 17, 91) for Pinal County. In Pima County, median days ranged from 37 among C1s to 209 among IBPs; in Pinal County, median number of days ranged from 40.5 among IBEs to 239 among IBPs (Figure 9). Of the children with a recertification date at Pima County (n=5,020) and Pinal County (n=4,675), 43.3% and 47.4% were “timely” (i.e., less than or equal to 60 days after the end of their last certification period), respectively.



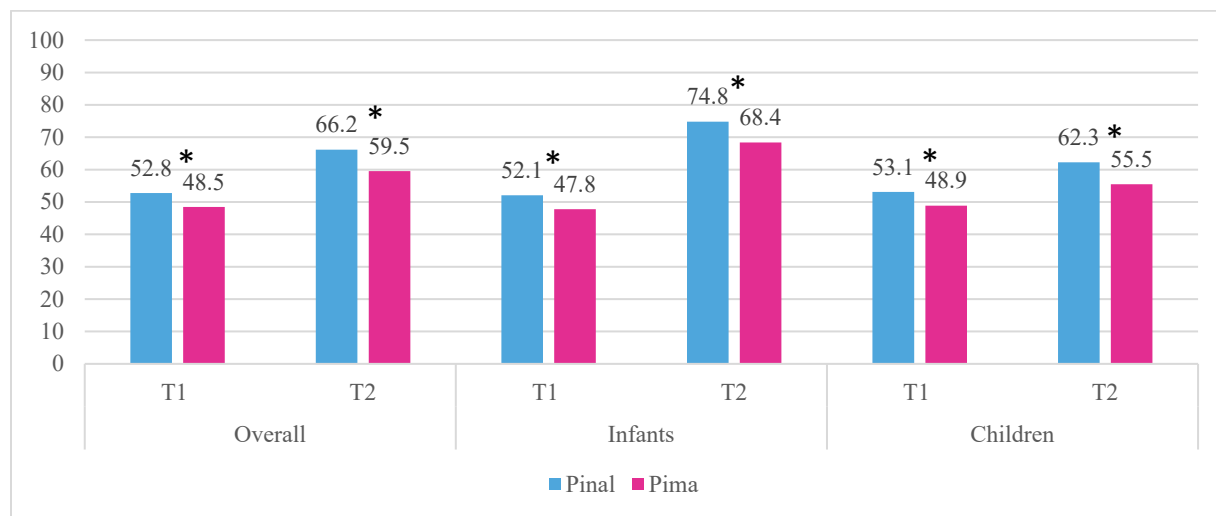
**Figure 9.** Number of days between end of certification and recertification by participant category at Pima and Pinal Counties during baseline (T1) (truncated at 100 days)

The median number of days between the end of the prior certification and recertification date during the implementation period (T2) was 50 (IQR 22, 111) for Pima County and 38 (IQR 17, 91) for Pinal County. In Pima County, median number of days ranged from 25 among IFFs to 171 among IBPs; in Pinal County, median number of days ranged from 22 among IBEs to 115 among IBPs (Figure 10). 56.4% of recertifications at Pima County during implementation were “timely” (i.e., less than 60 days after the end of the last certification period), while 64.1% of recertifications at Pinal County were timely.



**Figure 10.** Number of days between end of certification and recertification by participant category at Pima and Pinal Counties at implementation (T2) (truncated at 100 days)

The crude, unweighted proportion of participants who were timely recertified was significantly lower in Pima than Pinal during T1 and T2 overall (48.5% vs. 52.8% at T1 and 59.5% vs. 66.2% at T2) and for infants (47.8% vs. 52.1% at T1 and 68.4% vs. 74.8% at T2) and children (48.9% vs. 53.1% at T1 and 55.5% vs. 62.3% at T2) (Figure 11).

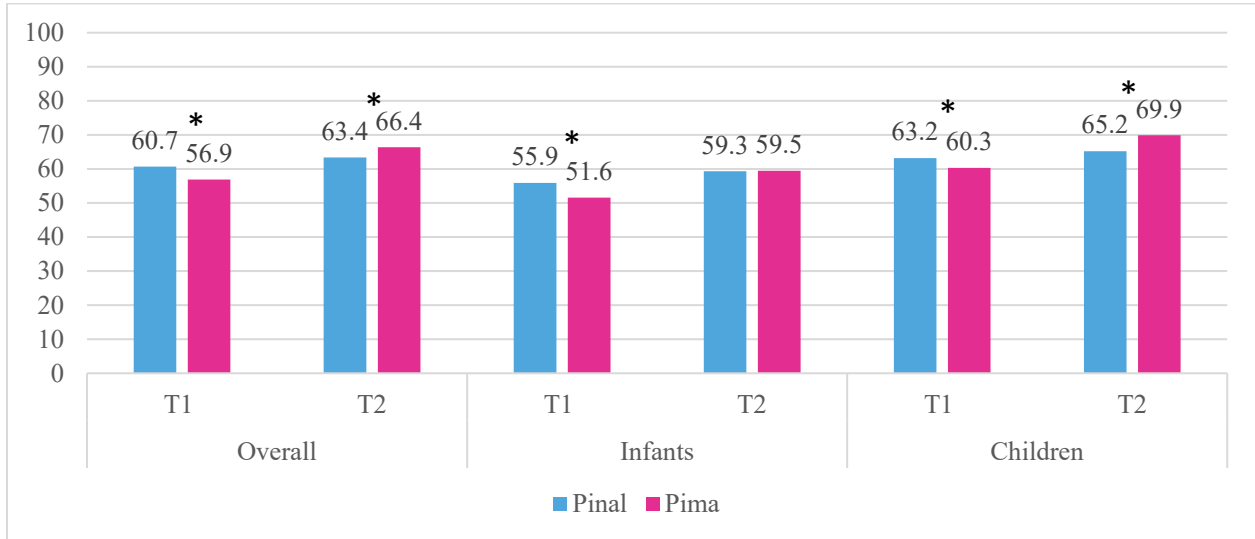


**Figure 11.** Proportion timely recertified (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Pima and Pinal. \*p < 0.05.

### Retention

The crude, unweighted proportion of participants who were retained was significantly lower in Pima than Pinal during T1 overall and for infants and children (Figure 12). At T2, the percent of

participants retained was significantly higher in Pima County than Pinal County overall (66.4% vs. 63.4%, respectively) and for children (69.9% vs. 65.2%, respectively) but not for infants.



**Figure 12.** Proportion retained (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children. \* $p < 0.05$ .

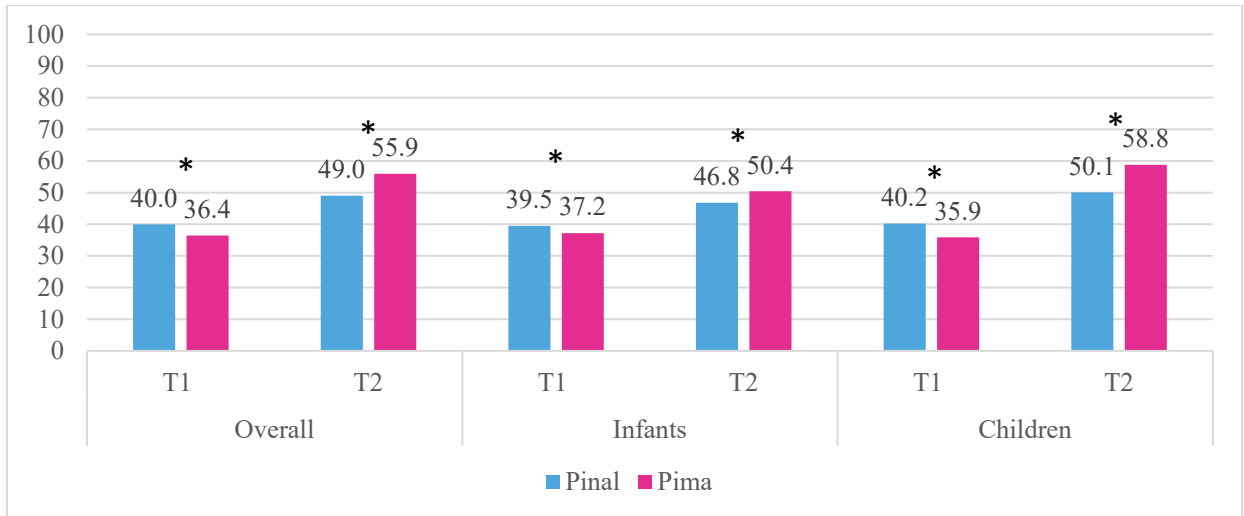
### Participation (i.e., benefit issuance)

The median number of months of benefit issuance for all participants at Pima and Pinal during T1 was 9 (out of 12) (IQR 4, 12) (Table 5). During T2, the median number of months of benefit issuance was 11 for Pima (IQR 7, 12) and 10 for Pinal (IQR 5, 12). The average percentage of the cohort issued benefits throughout the year was higher in T2 (76.2% in Pima and 70.7% in Pinal) than T1 (62.9% in Pima and 64.6% in Pinal).

**Table 5.** Benefit Issuance in Pima and Pinal Counties during Baseline and Implementation

	Baseline	(T1)	Implementation	(T2)
Agency/Group	Pima	Pinal	Pima	Pinal
Months of benefit issuance (median, IQR)	9 (4, 12)	9 (4, 12)	11 (7, 12)	10 (5, 12)
Percent of cohort issued benefits (%)	62.9	64.6	76.2	70.7

The crude, unweighted proportion of the samples that had continuous rates of benefit issuance (11-12 months) was significantly higher in Pinal than Pima during T1 overall and for infants and children (Figure 13). Conversely, during T2 participants in Pima County had significantly higher rates of benefit issuance than Pinal County overall (55.9% and 49.0%, respectively), for infants (50.4% and 46.8%, respectively), and for children (58.8% and 50.1%, respectively).



**Figure 13.** Proportion with 11-12 months of benefit issuance (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children. \* $p < 0.05$ .

### Adjusting for differences between the cohorts

The greatest differences in characteristics between the Pima County cohorts at T1 and T2 were Medicaid participation, SNAP participation, and being a category C1 (absolute standardized differences of 0.26, 0.13, and 0.17, respectively) (see Appendix P. Figure 1.). The absolute standardized difference mean across all characteristics was 0.05. After propensity score weighting, these absolute standardized differences were all reduced to below 0.05. The absolute standardized difference mean after weighting was 0.009. For ASDs for infants and children separately, see Appendix P. Table 1.

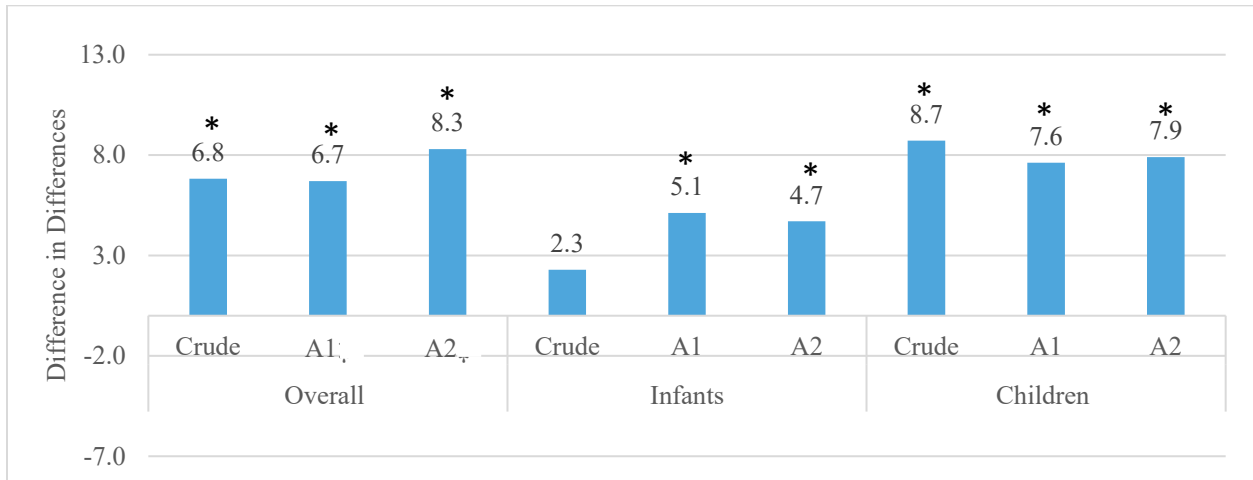
The greatest differences in characteristics between Pima County and Pinal County at T1 were household size greater than or equal to five (ASD 0.20), being White (ASD 0.32), and being Hispanic (ASD 0.23) (see Appendix P. Figure 2.). The absolute standardized difference mean across all characteristics was 0.09. After propensity score weighting, these absolute standardized differences were all reduced to below 0.05. The absolute standardized difference mean after weighting was 0.01. For ASDs for infants and children separately, see Appendix P. Table 1.

The greatest differences in characteristics between Pima County at T1 and Pinal County at T2 were household size greater than or equal to five (ASD 0.18), being White (ASD 0.28), being Hispanic (ASD 0.23), participating in Medicaid (ASD 0.28), and being ever breastfed (ASD 0.27) (see Appendix P. Figure 3.). The absolute standardized difference mean across all characteristics was 0.11. After propensity score weighting, these absolute standardized differences were all reduced to below 0.05. The absolute standardized difference mean after weighting was 0.01. For ASDs for infants and children separately, see Appendix P. Table 1.

### Difference In Difference (DID) analyses

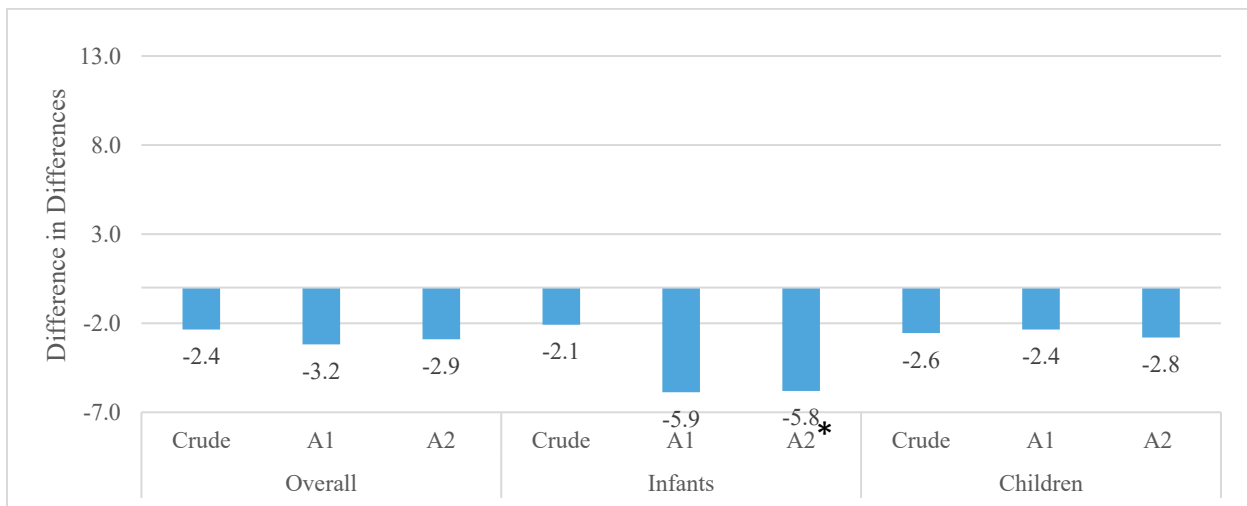
Using the unweighted data and a crude (unadjusted) analysis, being at Pima County was associated with a 6.8% increase in recertification overall, a 2.3% increase in infants, and an 8.7% increase in children (**all statistically significant**) (Figure 14). Using the weighted data and two

adjusted analysis techniques, being at Pima County was associated with a 6.7-8.3% increase in recertification overall, a 4.7-5.1% increase in recertification among infants, and a 7.6-7.9% increase in recertification among children (**all statistically significant**). For the beta coefficients and 95% confidence intervals, see Table 6. For the sample sizes of each of these groups, see Appendix O. Table 2.



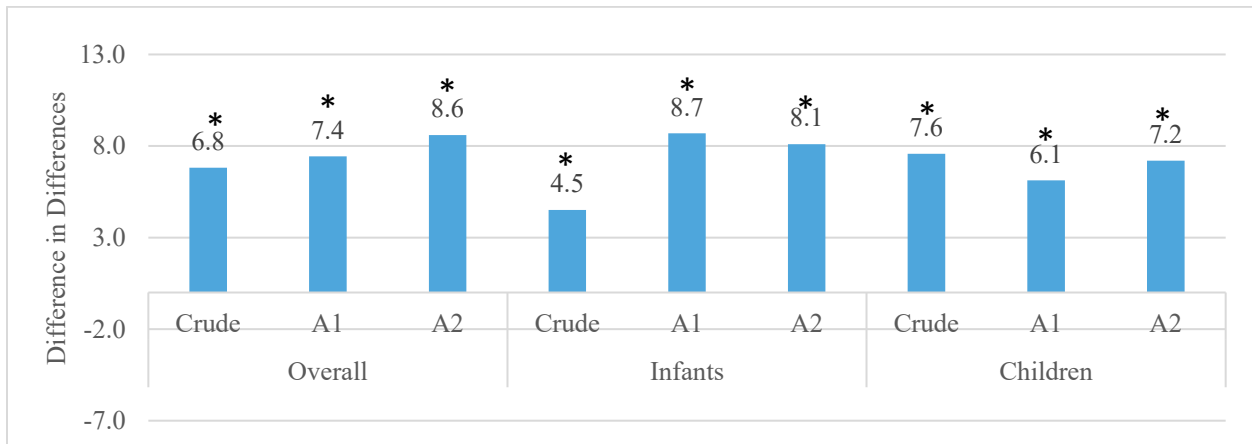
**Figure 14.** Percentage point differences in recertification between Pima and Pinal Counties overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \*p< 0.05.

Using the unweighted data and a crude (unadjusted) analysis, being at Pima County was not associated with any statistically significant differences (Figure 15). Using the weighted data and two adjusted analysis techniques, being at Pima County was only associated with one statistically significant difference in timely recertification: A 5.8% decrease among infants using the adjusted model 2 (A2). For the beta coefficients and 95% confidence intervals, see Table 6. For the sample sizes of each of these groups, see Appendix O. Table 2.



**Figure 15.** Percentage point differences in timely recertification between Pima and Pinal Counties overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \*p< 0.05.

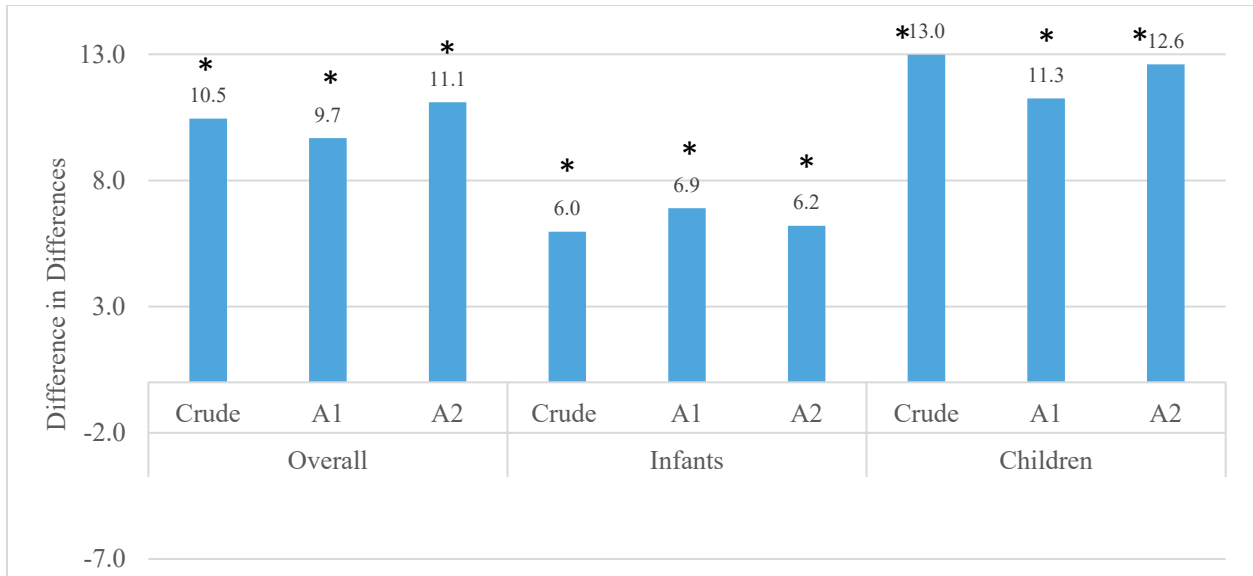
Using the unweighted data and a crude (unadjusted) analysis, being at Pima County was associated with a 6.8% increase in retention overall, a 4.5% increase in infants, and a 7.6% increase in children (all statistically significant) (Figure 16). Using the weighted data and two adjusted analysis techniques, being at the innovation clinics was associated with a 7.4-8.6% increase in retention overall, an 8.1-8.7% increase in retention among infants, and a 6.1-7.2% increase in retention among children (all statistically significant). For the beta coefficients and 95% confidence intervals, see Table 6. For the sample sizes of each of these groups, see Appendix O. Table 2.



**Figure 16.** Percentage point differences in retention between Pima and Pinal Counties overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \*p< 0.05.

Using the unweighted data and a crude (unadjusted) analysis, being at Pima County was associated with a 10.5% increase in continuous benefit issuance overall, a 6.0% increase in continuous benefit issuance in infants, and a 13.0% increase in continuous benefit issuance in children (all statistically significant) (Figure 17). Using the weighted data and two adjusted analysis techniques, being at Pima County was associated with a 9.7-11.1% increase in continuous benefit issuance overall, a 6.2-6.9% increase in continuous benefit issuance among infants, and an 11.3-12.6% increase in continuous benefit issuance among children (all statistically significant). For the beta coefficients and 95% confidence intervals, see Table 6. For the sample sizes of each of these groups, see Appendix O. Table 2.





**Figure 17.** Percentage point differences in continuous benefit issuance between Pima and Pinal Counties overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \* $p < 0.05$ .

**Table 6.** Difference-in-Difference Weighted Results for Recertification, Timely Recertification, Retention, and Benefit Issuance Using Crude and Three Adjusted Models Overall and for Infants and Children

	Overall			Infants			Children		
	Beta	95%CI		beta	95% CI		beta	95% CI	
Recertification									
(crude, unweighted)	0.068	0.043	0.094	0.023	-0.021	0.067	0.087	0.056	0.118
Timely recertification									
(crude, unweighted)	-0.024	-0.057	0.097	-0.021	-0.078	0.0361	-0.026	-0.066	0.0152
Retention									
(crude, unweighted)	0.068	0.043	0.093	0.045	0.001	0.089	0.076	0.045	0.107
Benefit issuance									
(crude, unweighted)	0.105	0.079	0.130	0.060	0.016	0.104	0.130	0.098	0.161
Recertification									
Model A1	0.067	0.040	0.094	0.051	0.003	0.100	0.076	0.046	0.107
Model A2	0.083	0.0575	0.1085	0.047	0.0039	0.0901	0.079	0.0476	0.1104
Timely recertification									
Model A1	-0.032	-0.071	0.008	-0.059	-0.122	0.005	-0.024	-0.074	0.027
Model A2	-0.029	-0.062	0.004	-0.058	-0.115	-0.001	-0.028	-0.069	0.013
Retention									
Model A1	0.074	0.047	0.101	0.087	0.039	0.135	0.061	0.030	0.093
Model A2	0.086	0.0605	0.1115	0.081	0.0359	0.1261	0.072	0.0406	0.1034
Benefit issuance									
Model A1	0.097	0.069	0.125	0.069	0.021	0.117	0.113	0.078	0.147

Model A2	0.111	0.0855	0.1365	0.062	0.0189	0.1051	0.126	0.0946	0.1574
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## Yavapai County WIC

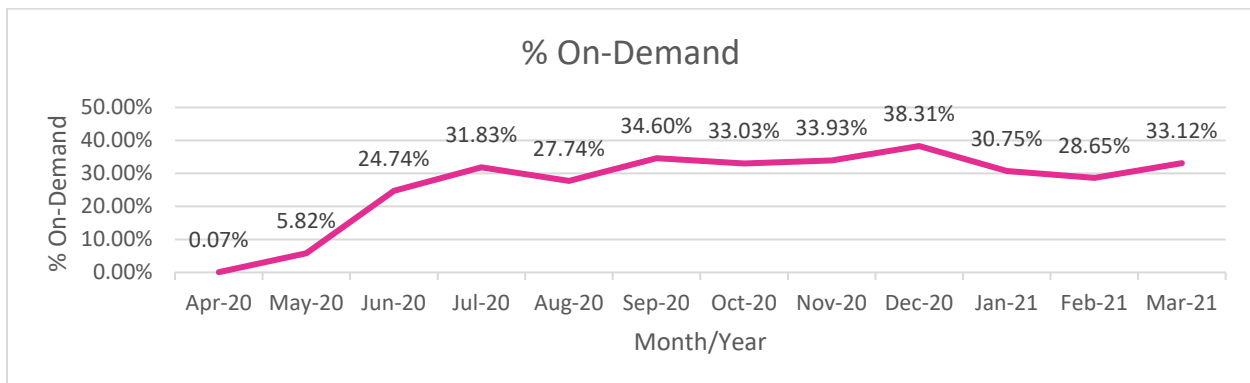
### Process and Short-term Outcome Evaluation

*WIC-in-a-Click* was implemented as intended with minor changes due to the COVID-19 pandemic. The launch date was postponed by several months, and phone appointments were added to WIC in a Click services to help keep up with the demand and to provide an efficient way for WIC participants to be serviced. Online group nutrition education classes were withdrawn from the WIC in a Click protocol due to staffing modifications. All other components of the WIC in a Click protocol remained intact and were implemented as intended.

Project implementation documentation revealed that throughout the project, there was consistent engagement with the innovative tool. All participants were offered the opportunity to receive services through WIC in a Click at least two times during a full certification period. MIS data showed that from April to July there was a steady increase in participation in WIC in a Click each month, with it leveling off in the following months. Client surveys were conducted mid-way through the project to measure ease of use of the tool; however, poor response rates excluded using these data in the evaluation.

The Yavapai WIC program saw no significant change in participation during implementation as compared to pre-implementation. There was a monthly average of 2,839 clients participating per month during implementation as compared to 2,884 clients participating in the pre-implementation period.

Participation in WIC in a Click was measured by the total number of on-demand appointments fulfilled during the month divided by the total number of appointments, both on-demand and scheduled. The total number of appointments was comprised of all appointment types including those of participants not eligible for the intervention. As seen in Figure 18, the number of WIC in a Click appointments steadily increased from April to July 2020. In July the percentage of appointments leveled off with 31% being the median number serviced per month via WIC in a Click.



**Figure 18.** Monthly Percentage of Appointments seen via WIC in a Click by month and year

The WIC in a Click intervention was significantly associated with a decrease in the number of missed appointments. During the pre-implementation period, 7.82% of participants did not attend their scheduled appointments, while in the implementation period 4.80% of participants did not attend their appointments. To calculate these percentages the No Show Rate report from HANDS was utilized and the number of “no shows” during each period was divided by the total number of appointments scheduled. These numbers and rates can be seen in Figure 19 below.

Pre-Implementation						Implementation					
Month	Year	Total Scheduled	# of No Shows	# of Attended	No Show Rate	Month	Year	Total Scheduled	# of No Shows	# of Attended	No Show Rate
January	2019	1170	94	1076	8.03%	April	2020	1144	63	1081	5.51%
February	2019	974	111	863	11.40%	May	2020	947	57	890	6.02%
March	2019	987	78	909	7.90%	June	2020	1016	44	972	4.33%
April	2019	1115	83	1032	7.44%	July	2020	952	57	895	5.99%
May	2019	1044	86	958	8.24%	August	2020	935	49	886	5.24%
June	2019	963	68	895	7.06%	September	2020	1098	52	1046	4.74%
July	2019	1124	89	1035	7.92%	October	2020	954	36	918	3.77%
August	2019	1119	88	1031	7.86%	November	2020	894	37	857	4.14%
September	2019	865	58	807	6.71%	December	2020	1206	47	1159	3.90%
November	2019	925	57	868	6.16%	January	2021	894	26	868	2.91%
December	2019	1056	75	981	7.10%	February	2021	992	40	952	4.03%
						March	2021	1102	75	1027	6.81%
<b>Total</b>		<b>11342</b>	<b>887</b>	<b>10455</b>	<b>7.82%</b>	<b>Total</b>		<b>12134</b>	<b>583</b>	<b>11551</b>	<b>4.80%</b>

**Figure 19.** Yavapai County WIC No Show Rate Report

Overall, the project showed success with client engagement and decreasing no show rates when comparing baseline data to implementation data.

Impact on Child Retention and Participation

**Table 7.** Demographic Characteristics of Children 0-3 at Yavapai and Mohave at baseline (T1) and implementation (T2). Statistically significant differences by group within a time point are **bold**.

		Baseline (T1)		Implementation (T2)	
		Mohave (n=2,374) %	Yavapai (n=2,332) %	Mohave (n=2,171) %	Yavapai (n=1,997) %
Category at start of period	<b>IBE</b>	<b>4.9</b>	<b>6.8</b>	<b>5.5</b>	<b>6.3</b>
	<b>IBP</b>	<b>4.8</b>	<b>5.9</b>	<b>4.1</b>	<b>5.9</b>
	<b>IFF</b>	<b>27.4</b>	<b>21.8</b>	<b>22.3</b>	<b>21.8</b>
	<b>C1</b>	<b>23.9</b>	<b>25.4</b>	<b>27.9</b>	<b>26.5</b>
	<b>C2</b>	<b>20.9</b>	<b>20.9</b>	<b>22.5</b>	<b>20.8</b>
	<b>C3</b>	<b>18.1</b>	<b>19.2</b>	<b>17.7</b>	<b>18.6</b>
<b>Number of WIC participants</b>	One	34.5	34.1	34.5	34.2
	Two	35.2	35.4	34.2	36.7
	Three or more	30.3	30.5	31.3	29.1

Race <sup>a</sup>	American Indian or Alaska Native	3.7	4.6	4.5	4
	Asian	<b>1.9</b>	<b>1.2</b>	1.9	1.8
	<b>Black or African American</b>	<b>6.6</b>	<b>4.1</b>	<b>5.8</b>	<b>4.1</b>
	Native Hawaiian or Other Pacific Islander	<b>1.4</b>	<b>0.7</b>	1.5	1.4
	White	96.1	96.6	95.7	96.4
	<b>Hispanic</b>	<b>36.7</b>	<b>42.0</b>	<b>36.9</b>	<b>40.3</b>
Enrolled	<b>TANF</b>	<b>1.1</b>	<b>0.3</b>	<b>1.2</b>	<b>0.2</b>
	<b>SNAP</b>	<b>28.6</b>	<b>17.8</b>	<b>34</b>	<b>20.8</b>
	<b>Medicaid</b>	<b>45.5</b>	<b>42.3</b>	<b>57.2</b>	<b>51.2</b>
<b>Primary language other than English</b>		<b>95.1</b>	<b>91.2</b>	<b>95.1</b>	<b>91.5</b>
<b>Ever breastfed</b>	<b>Yes</b>	<b>69.1</b>	<b>83.0</b>	<b>70.8</b>	<b>82.1</b>
	<b>No</b>	<b>30.9</b>	<b>17.0</b>	<b>29.2</b>	<b>17.9</b>
Household size	0-4	63.6	62.0	59.1	61.5
	Greater than or equal to 5	36.4	38.0	40.9	38.5

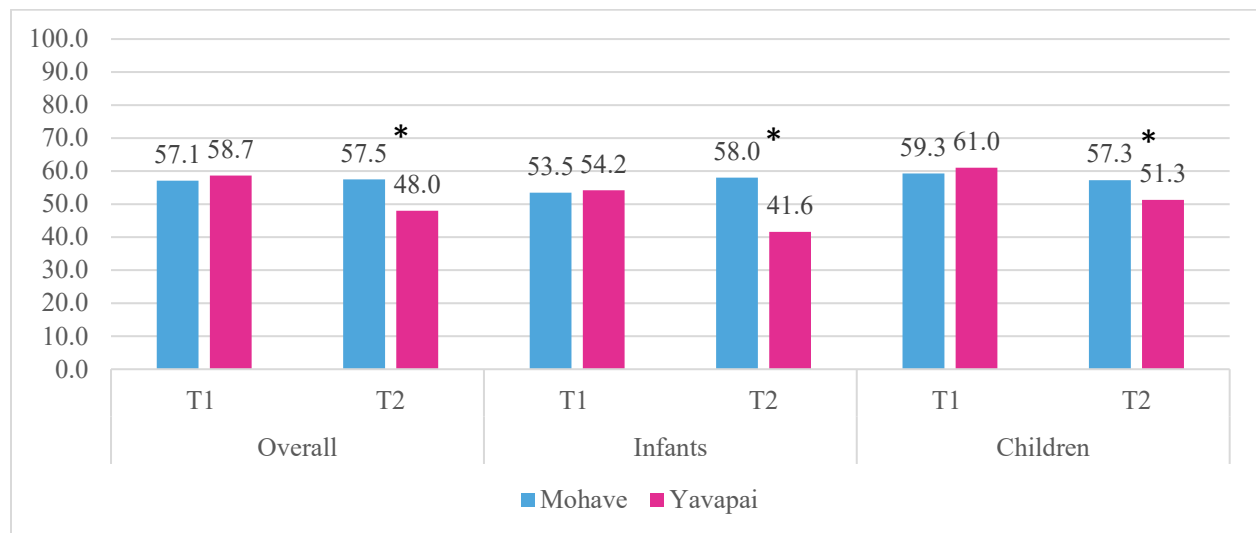
\*Abbreviations: IBE: Infant, exclusive breastfeeding; IBP: Infant, partial breastfeeding; IFF: Infant, formula feeding; C1: Child category 1 (one year old); C2: Child category 2; C3: Child category 3; TANF: Temporary Assistance for Needy Families; SNAP: Supplemental Nutrition Assistance Program.

<sup>a</sup> Participants can respond to more than one category so the total percentage may be greater than 100.

In general, the participants in the comparison and innovation groups were similar for most demographic characteristics at baseline (T1) and implementation (T2) and over time (Table 7). Although there were statistically significant differences in many characteristics between groups during both time periods, there did not appear to be many clinically important differences. However, there were larger differences between groups in the proportion enrolled in SNAP, Medicaid and in the proportion that were ever breastfed both at T1 and T2. For example, during T1, the proportion enrolled in SNAP was 17.8% for Yavapai and 28.6% for Mohave (comparison). Between the two time periods, greater proportion increases in Medicaid and SNAP enrollment are observed for Mohave (comparison) than for Yavapai. For Mohave, Medicaid enrollment increased from 45.5% in T1 to 57.2% in T2, while for Yavapai, enrollment increased from 42.3% to 51.2%.

### Recertification

The crude, unweighted proportion of infants and children recertified in the innovation and comparison groups during baseline (T1) was not significantly different (58.7% and 57.1%, respectively), the proportions recertified during implementation (T2) were significantly different (48.0% and 57.5%, respectively) (Figure 20). This was also true when studying infants and children separately. In all three cases (overall, infants, and children), the percentage recertified during T2 were significantly lower in the innovation group than in the comparison group (HPRIL Figure 1). For sample sizes of these groups, see Appendix O. Table 3.

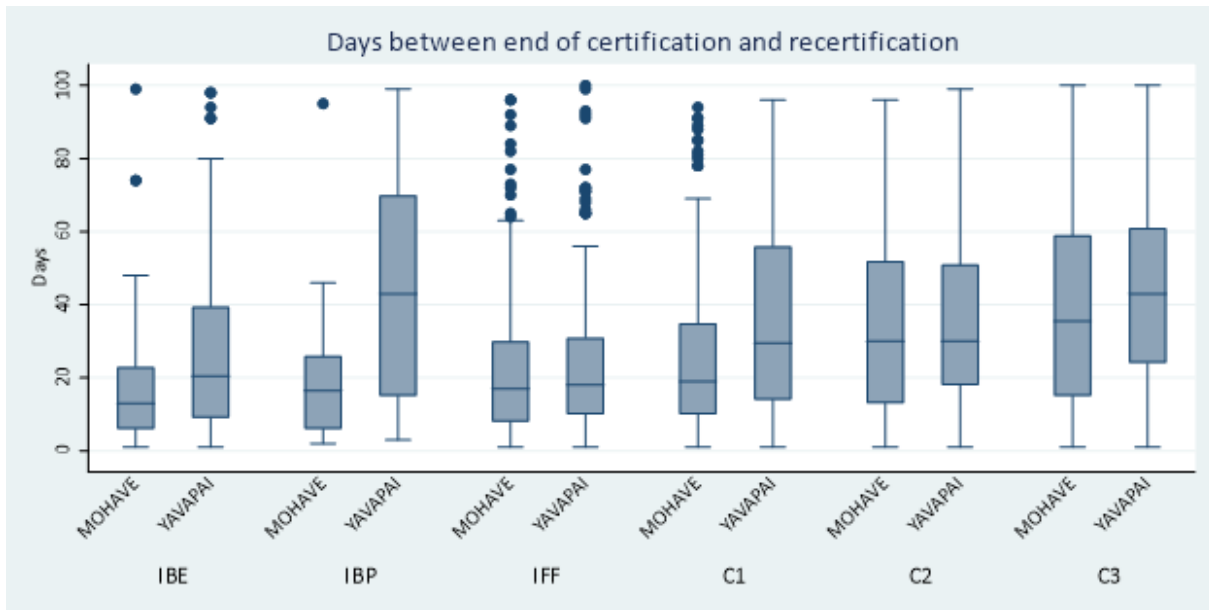


**Figure 20.** Proportion recertified (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Yavapai and Mohave. \*p < 0.05.

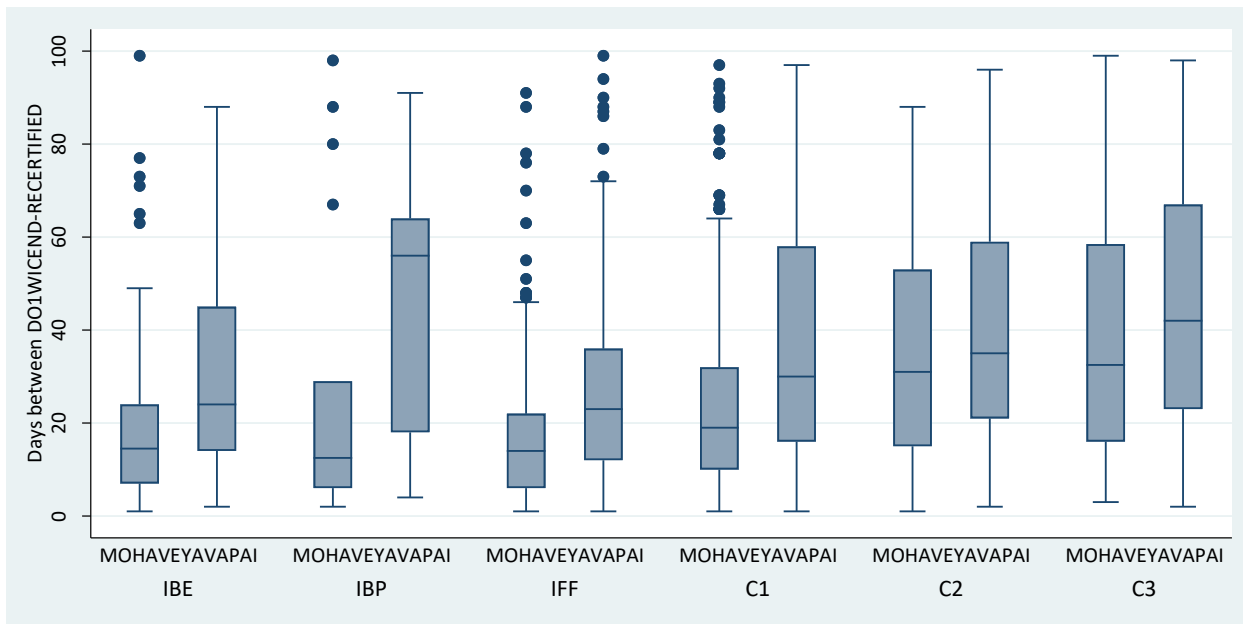
### Timeliness of Recertification

Presented in Figures 21 and 22 are the distributions of time gap between the end of a child’s certification period and their recertification (truncated at 100 days) for Yavapai and Mohave by

WIC category group and time period. As shown, there are longer time gaps for children as compared to infants, and in Yavapai as compared to Mohave, and for T2 as compared to T1.



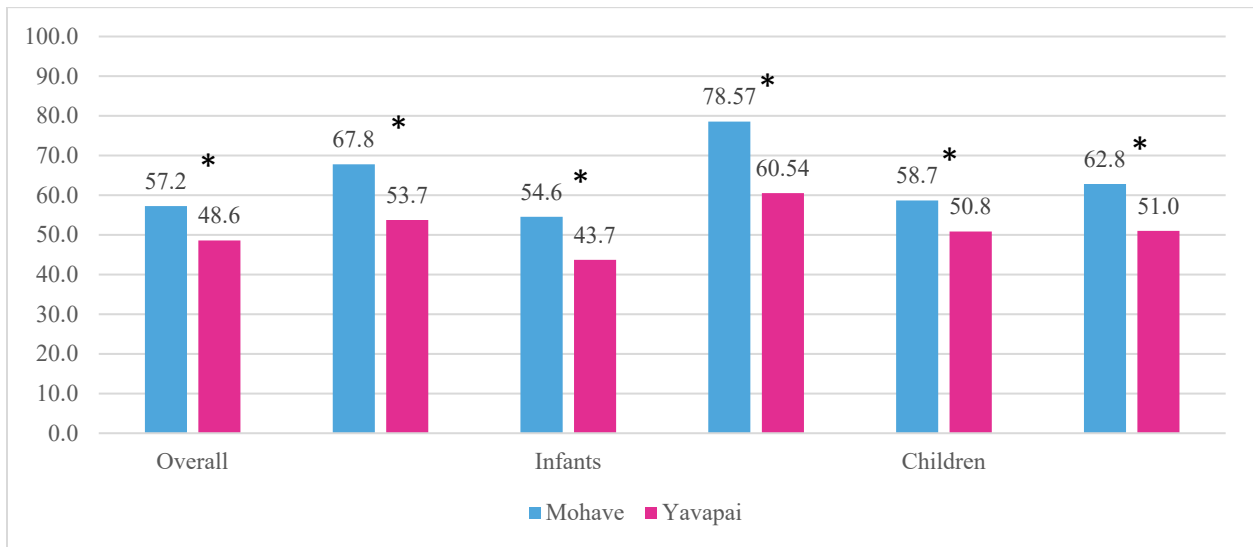
**Figure 21.** Number of days between end of certification and recertification by participant category at Yavapai and Mohave during baseline (T1) (truncated at 100 days)



**Figure 22.** Number of days between end of certification and recertification by participant category at Yavapai and Mohave during implementation (T2) (truncated at 100 days)

To examine this outcome further, HPRIL identified children as timely recertified or not and compared the percentage of timely recertification among those with recertification data. Timely recertification was determined based on whether the time gap between the end of a child’s

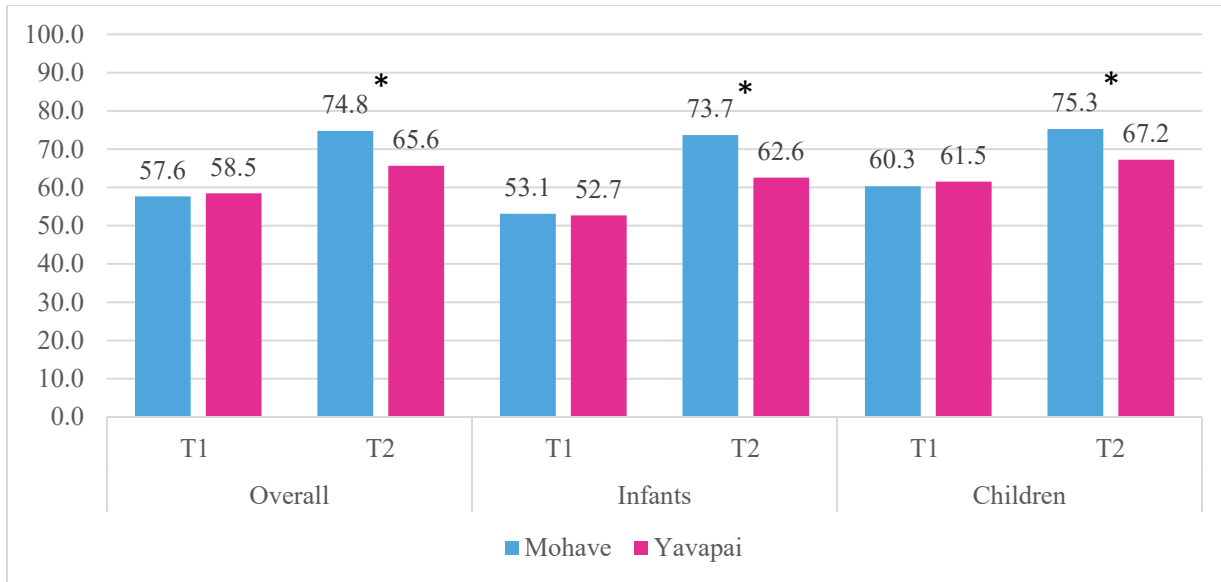
certification period and their recertification date was less than or equal to 60 days. At T1 and considering both infants and children with a recertification date, the proportion of timely recertified was significantly lower in Yavapai County (48.6%) as compared to Mohave County (57.2%). The proportion of timely recertified increased during T2, and the differences between the two counties became greater. In Yavapai County, the proportion of timely recertified increased to 53.7%, while the proportion in Mohave County increased to 67.8%. These same trends (differences between counties and time points) were evident for both infants and children. For sample sizes of these groups, see Appendix O. Table 3.



**Figure 23.** Proportion timely recertified (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Yavapai and Mohave. \* $p < 0.05$ .

### Retention

Overall, and for infants and children, the differences in retention (active at the end of the period) between innovation and comparison were not statistically significant during T1 (Figure 24). However, the proportions were significantly lower for the innovation group than the comparison group overall (65.6% vs. 74.8%, respectively), among infants (62.6% vs. 73.7%, respectively), and among children (67.2% vs. 75.3%, respectively) during T2. For sample sizes of these groups, see Appendix O. Table 3.



**Figure 24.** Proportion retained (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Yavapai and Mohave. \* $p < 0.05$ .

### Participation (i.e., benefit issuance)

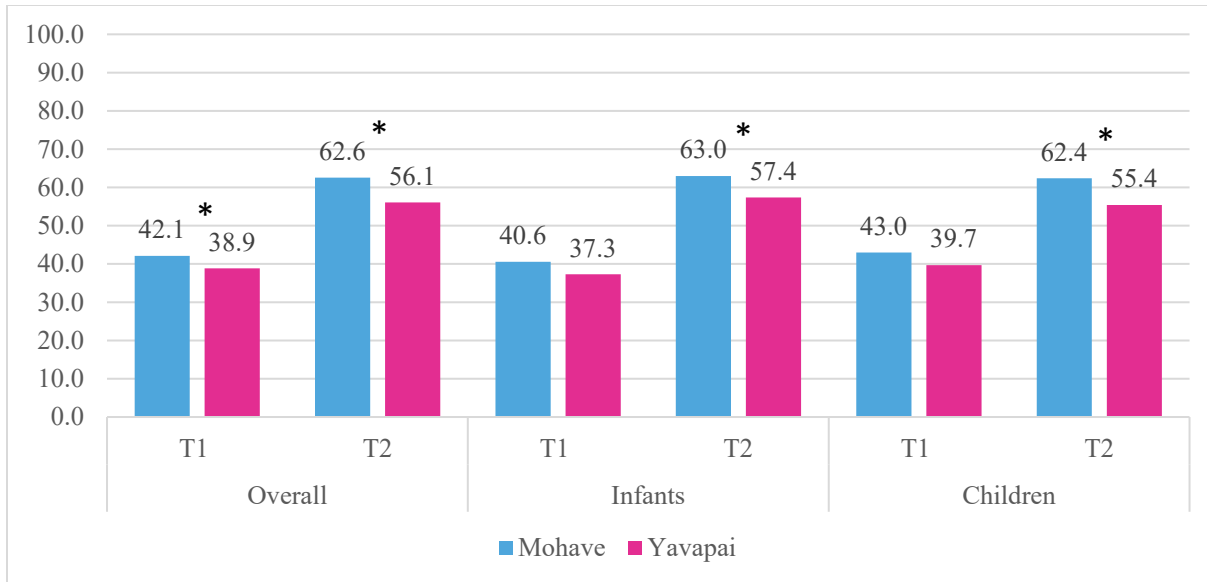
As shown in Table 3, the median months of benefit issuance was 9 for both groups at T1, and found to be higher at T2, with medians of 11 and 12 for Yavapai and Mohave, respectively. Over the period there was an increase in both groups in the percent of the cohort issued benefits.

**Table 8.** Benefit Issuance at Yavapai and Mohave during Baseline and Implementation Periods

Agency/Group	Baseline (T1)		Implementation (T2)	
	Yavapai	Mohave	Yavapai	Mohave
Months of benefit issuance (median, IQR)	9 (4, 12)	9 (3, 12)	11 (6, 12)	12 (6, 12)
Percent of cohort issued benefits (%)	63.9	63.4	74.7	77.1

The proportion of children with continuous benefit issuance (defined as 11 or 12 months of issuance) was statistically lower in Yavapai than Mohave at T1 (38.9% versus 42.1%). During T2, the proportion of children with continuous benefit issuance rose in both groups but remained lower in Yavapai than Mohave (56.1% versus 62.6%, respectively). This same pattern of differences was observed for both infants and for children. For sample sizes of these groups, see Appendix O. Table 3.





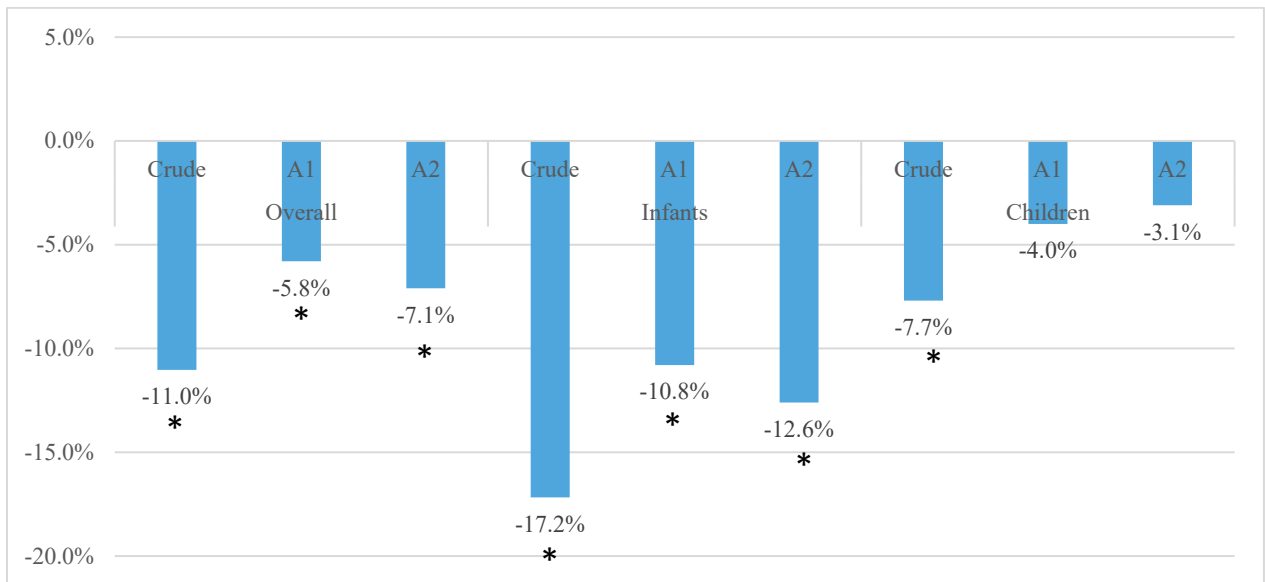
**Figure 25.** Proportion with continuous benefit issuance (11-12 months) (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Yavapai and Mohave. \* $p < 0.05$ .

### Balancing the groups using PSW

As mentioned in the methods section, we utilized two different weighting methods to balance the participant characteristics between groups and between time periods to evaluate the impact of *WIC-in-a-Click*. For the PSW approach used for Model A1, the results demonstrate the magnitude of the absolute standardized differences (ASD) between groups across characteristics and the balance achieved via weighting, and the overall mean ASD (see Appendix P. Figures 4-6.). The results are shown for each of the three relevant comparisons: Yavapai at T1 with Mohave at T1; Yavapai at T1 with Yavapai at T2; Yavapai at T1 with Mohave at T2. Through weighting, the mean ASD for each comparison are less than 5% and close to 0. For the same comparisons for infants and children separately see Appendix P. Table 2.

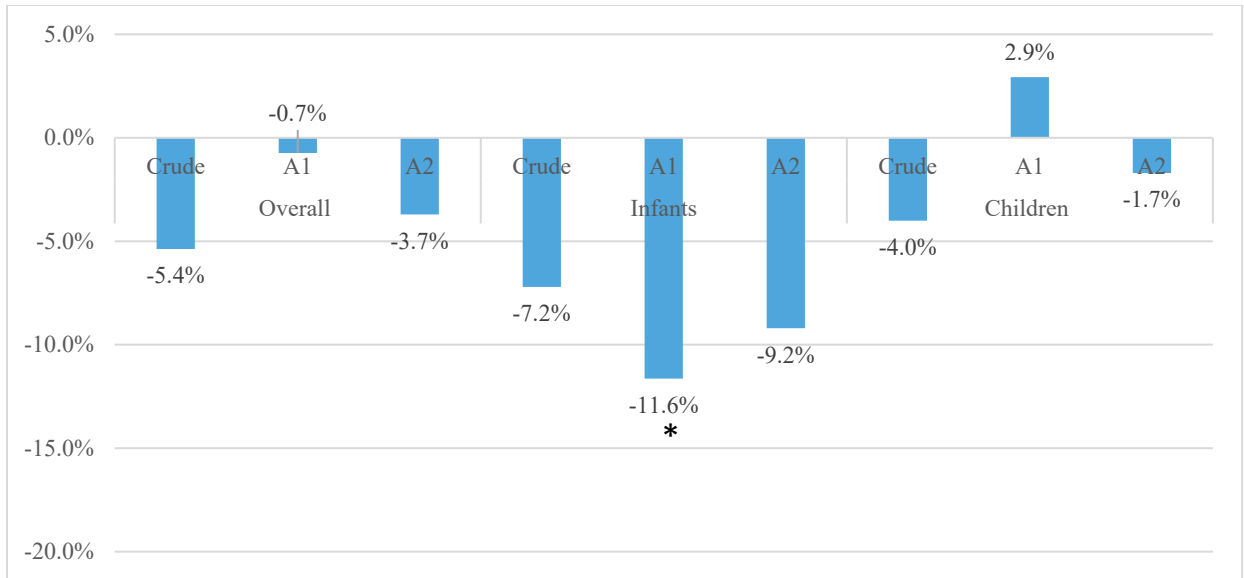
### DID analyses

Using the unweighted data and a crude (unadjusted) DID analysis, being in the innovation clinics was associated with a lower recertification overall (-11.0%; 95% CI: -15.2 to -15.2%), among infants (-17.2%; 95% CI: -24.3% to -10.1%), and among children (-7.7%; 95% CI: -12.8% to -2.6%) (all statistically significant) (Figure 26, Table 9). The negative association of *WIC in a Click* with recertification was diminished using the weighted data and adjusted model 1 (A1). In this model, being at the innovation clinics was associated with a -5.8% lower recertification rate overall (95% CI: -10.0% to -1.6%), a -10.8% lower recertification rate among infants (95% CI: -18.5% to -3.1%), and a -4.0% lower rate among children (95% CI: -8.7% to -0.8%) (all statistically significant). The results using the weighted data and the adjusted model 2 (A2) were similar in terms of statistical significance and were generally consistent in terms of magnitude. For the beta coefficients and 95% confidence intervals, see Table 9. For the sample sizes of each of these groups, see Appendix O. Table 4.



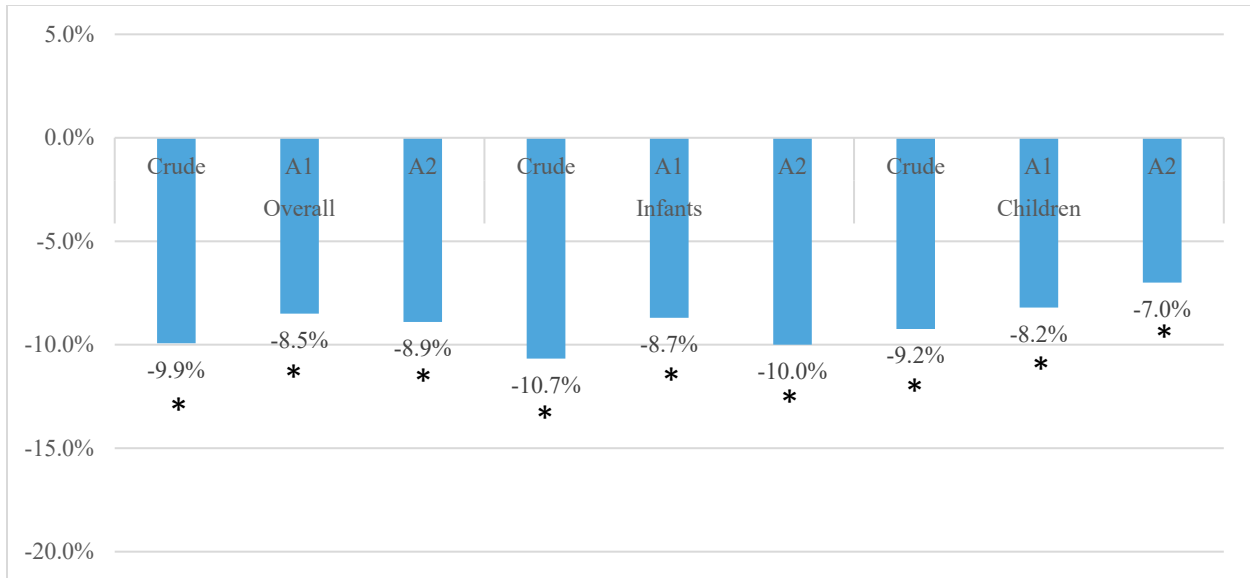
**Figure 26.** Percentage point differences in recertification between Yavapai and Mohave overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \* $p < 0.05$ .

Presented in Figure 27 are the results of the DID models for proportion of timely recertified among those who recertified. In general, the results show negative but non-statistically significant differences in the proportion timely recertified. Qualitatively, the differences are greater for infants than for children, and for model A1 among infants, *WIC in a Click* is associated with a statistically significantly negative adjusted proportion of timely recertified of -11.6% (95% CI: -22.6% to -0.6%). For the beta coefficients and 95% confidence intervals, see Table 9. For the sample sizes of each of these groups, see Appendix O. Table 4.



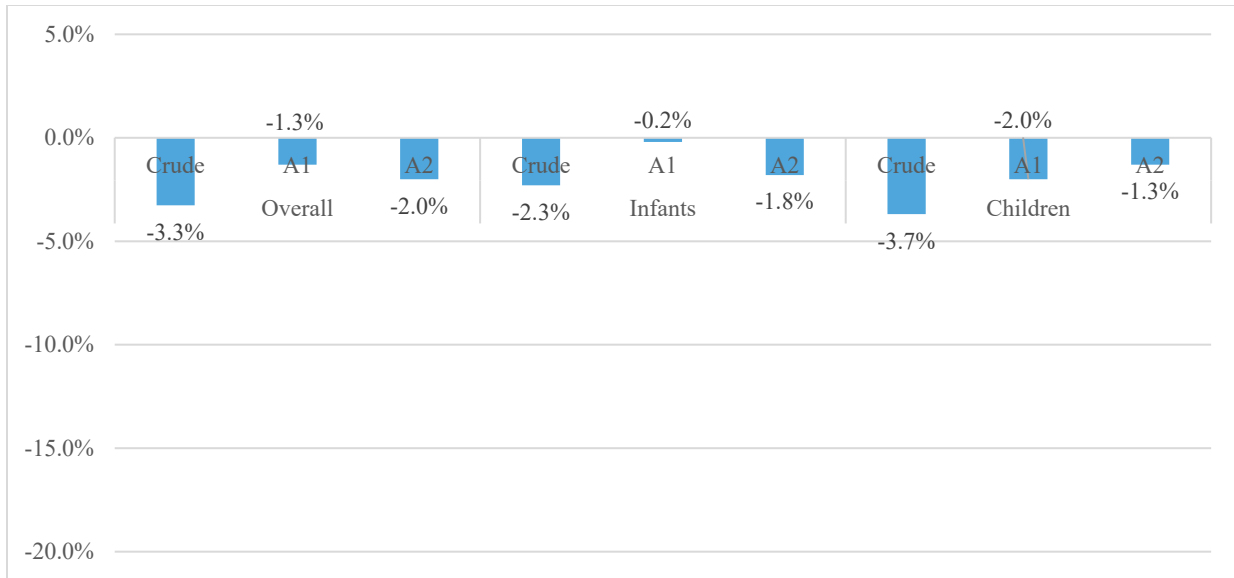
**Figure 27.** Percentage point differences in timely recertification between the Yavapai and Mohave overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \* $p < 0.05$ .

The DID results for the impact of *WIC in a Click* on child retention in WIC are found in Figure 28 and Table 9. Consistent with results for recertification, being in the innovation clinic was associated with -9.9% (95% CI: -13.9% to -5.9%) lower retention rate in crude unweighted analyses, an adjusted -8.5% (95% CI: -12.6% to -4.3%) lower rate in Model A1, and -8.9% (95% CI: -12.8% to -5.0%) lower rate in Model A2. The results are generally consistent across models and for infants and children. For the beta coefficients and 95% confidence intervals, see Table 9. For the sample sizes of each of these groups, see Appendix O. Table 4.



**Figure 28.** Percentage point differences in retention between the Yavapai and Mohave overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. All results are statistically significant. \* $p < 0.05$ .

The results for continuous benefit issuance are shown in Figure 29 and Table 9. The magnitude of the differences associated with *WIC in a Click* are negative, but small and not statistically significant. For the beta coefficients and 95% confidence intervals, see Table 9. For the sample sizes of each of these groups, see Appendix O. Table 4.



**Figure 29.** Percentage point differences in continuous benefit issuance between Yavapai and Mohave overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option.

**Table 9.** Difference-in-Difference Results of the Impact of WIC in a Click for Recertification, Retention, and Benefit Issuance Using Crude and Two Adjusted Models Overall and for Infants and Children

	Overall			Infants			Children		
	Beta	95%CI		beta	95% CI		beta	95% CI	
Recertification (crude, unweighted)	-0.110	-0.152	-0.069	-0.172	-0.243	-0.101	-0.077	-0.128	-0.026
Timely recertification (crude, unweighted)	-0.033	-0.074	0.008	-0.023	-0.093	0.047	-0.037	-0.088	0.014
Retention (crude, unweighted)	-0.099	-0.139	-0.059	-0.107	-0.176	-0.037	-0.092	-0.141	0.044
Benefit issuance (crude, unweighted)	-0.054	-0.110	0.0027	-0.072	-0.170	0.0261	-0.040	-0.109	0.0287
Recertification Model A1	-0.058	-0.100	-0.016	0.108	-0.185	-0.031	-0.040	-0.087	0.008
Model A2	-0.071	-0.112	-0.030	-0.126	-0.197	-0.055	-0.031	-0.082	0.020
Timely recertification Model A1	-0.007	-0.071	0.056	-0.116	-0.226	-0.006	0.029	-0.046	0.105
Model A2	-0.037	-0.094	0.020	-0.092	-0.192	0.008	-0.017	-0.086	0.052
Retention Model A1	-0.085	-0.126	-0.043	-0.085	-0.126	-0.043	-0.085	-0.126	-0.043
Model A2	-0.085	-0.126	-0.043	-0.100	-0.169	-0.031	-0.070	-0.119	-0.021
Benefit issuance Model A1	-0.013	-0.056	0.030	-0.002	-0.079	0.075	-0.020	-0.072	0.032
Model A2	-0.020	-0.061	0.021	-0.018	-0.089	0.053	-0.013	-0.064	0.038

*Miami-Dade WIC*

Process and Short-term Outcome Evaluation

A total of 1,994,170 campaign ad views were documented; of these, 332,580 (16.7%) interacted with an ad. Facebook consistently outperformed the other social media metrics (Instagram, YouTube and Audience Network) with a click through rate of 0.51% (compared to 0.39%, 0.17% and 0.23% respectively). Video advertisements on Facebook and Instagram did not perform as well as static posts in terms of clicks and CTRs. Analysis of social media performance indicated that customized messaging and imagery that are targeted to a specific audience, Spanish language ads, and ads focused on WIC eligibility performed best in this population.

In total, Google Ads were presented 34,894 times during the implementation period (also known as impressions). Targeted ads were clicked on a total of 6,853 times during the implementation period. The average number of impressions per month for the implementation period was 2,330. The average click-through-rate (CTR) which measures the ratio of ad clicks to ad impressions was 20.95%. The Google Ads campaign was driven by strategically selected keywords. In the first two months of the campaign, clicks were unlimited to allow for beta testing of the keywords. This resulted in the highest number of impressions (7,053) and clicks (1,099) in the first month of the campaign. In July, keywords were reduced to manage cost (ads are charged per click). The lowest performing keywords were removed from the campaign. The ten top performing keywords are described in Table 10.

**Table 10.** Top Performing Keywords

Keyword	Clicks	Impressions	CTR/Keyword	% of Total Clicks
"Food Stamps"	1243	8235	15%	18%
"wic program"	909	2472	37%	13%
"wic"	713	2357	30%	10%
"EBT"	710	5283	13%	10%
"Comida Gratis"	366	2324	16%	5%
[wic miami]	237	603	39%	3%
[wic program]	221	638	35%	3%
[wic]	201	567	35%	3%
"wic appointment"	185	437	42%	3%
[program wic]	169	508	33%	2%

There were 22,983 unique visits to the local WIC website, 69.6% of which were acquired directly from the campaign. During the digital marketing implementation period, an average of 439 new users a week visited the Miami-Dade website. There were 1,586 clicks on the Miami-Dade WIC phone number blocks on the website during this period which is significant. This number links a user directly with the local agency call center where an appointment can be booked. Since most users were accessing the website on their cell phone, these users would theoretically be able to browse the website and make an appointment in the same session/span of time. The Google Ads campaign drove the highest number of users to the WIC website (82.2%) followed by Facebook (14.8%) according to GA.

The client engagement survey showed 73% of WIC participants reported increased motivation to contact WIC after seeing campaign advertisements. The client engagement survey was completed by 1,831 clients during the implementation period. More completed surveys were received from the non-targeted clinics (87%). A total of 235 (13%) surveys from the seven target zip codes and two innovation clinics were included in the analysis. Results from the target group showed that 46% of clients saw a WIC ad in the last month. Of these, 65% stated they saw an ad on Google, 34% saw an ad on Facebook, 14% saw an ad on YouTube, and 10% saw an ad on Instagram. This is consistent with the social media and Google Ads metrics: 73% of clients in this target group stated they were motivated to contact WIC after seeing a WIC ad; and 14% of clients reported following the agency's social media accounts.

## Impact on Child Retention and Participation

**Table 11.** Demographic Characteristics of Children 0-3 at Miami-Dade WIC Comparison and Innovation Clinics at baseline (T1) and implementation (T2). Statistically significant differences by group are **bold**.

		Baseline (T1)		Implemen- tation (T2)	
		Comparison (n=41,074)	Innovation (n=6,162)	Comparison (n=38,241)	Innovation (n=5,636)
		%	%	%	%
<b>Category at start of period</b>	<b>IBE*</b>	<b>3.6</b>	<b>4.2</b>	<b>3.7</b>	<b>4.1</b>
	<b>IBP</b>	<b>14.0</b>	<b>17.0</b>	<b>14.6</b>	<b>19.9</b>
	<b>IFF</b>	<b>17.7</b>	<b>12.5</b>	<b>17.3</b>	<b>11.1</b>
	<b>C1</b>	<b>26.9</b>	<b>26.7</b>	<b>26.6</b>	<b>26.7</b>
	<b>C2</b>	<b>20.4</b>	<b>22.5</b>	<b>20.5</b>	<b>20.8</b>
	<b>C3</b>	<b>17.4</b>	<b>17.1</b>	<b>17.3</b>	<b>17.5</b>
<b>Number of WIC participants</b>	<b>One</b>	<b>50.8</b>	<b>54.0</b>	<b>53.8</b>	<b>59</b>
	<b>Two</b>	<b>16.0</b>	<b>13.0</b>	<b>17.4</b>	<b>17.1</b>
	<b>Three or more</b>	<b>1.6</b>	<b>1.1</b>	<b>1.8</b>	<b>1</b>
	<b>Missing</b>	<b>31.6</b>	<b>32.0</b>	<b>26.9</b>	<b>22.9</b>
Race <sup>a</sup>	American Indian or Alaska Native	0.1	0.2	0.2	0.2
	<b>Asian</b>	<b>0.9</b>	<b>0.5</b>	<b>0.8</b>	<b>0.5</b>
	<b>Black or African American</b>	<b>31.2</b>	<b>7.0</b>	<b>30.7</b>	<b>6.2</b>
	Native Hawaiian or Other Pacific Islander	0.2	0.0	0.2	0
	<b>White</b>	<b>70.3</b>	<b>95.8</b>	<b>70.8</b>	<b>96</b>
	<b>Hispanic</b>	<b>69.7</b>	<b>96.4</b>	<b>69.9</b>	<b>96.1</b>
Enrolled	TANF	1.4	1.0	1.1	0.8
	SNAP	49.6	57.4	38	44.8
	Medicaid	93.4	96.1	91.7	94
<b>Primary language other than English</b>	<b>50.7</b>	<b>81.7</b>	<b>49.8</b>	<b>78.4</b>	
<b>Ever breastfed <sup>b</sup></b>	<b>Yes</b>	<b>78.0</b>	<b>82.4</b>	<b>85.3</b>	<b>87.3</b>
	<b>No</b>	<b>12.4</b>	<b>9.7</b>	<b>12.4</b>	<b>9.8</b>
<b>Household size <sup>c</sup></b>	<b>0-4</b>	<b>67.6</b>	<b>72.1</b>	<b>72.5</b>	<b>69.3</b>
	<b>Greater than or equal to 5</b>	<b>31.6</b>	<b>27.6</b>	<b>29.9</b>	<b>26.8</b>

\* Abbreviations: IBE: Infant, exclusive breastfeeding; IBP: Infant, partial breastfeeding; IFF: Infant, formula feeding; C1: Child category 1 (one year old); C2: Child category 2; C3: Child category 3; TANF: Temporary Assistance for Needy Families; SNAP: Supplemental Nutrition Assistance Program.

<sup>a</sup> Participants can respond to more than one category so the total percentage may be greater than 100.

<sup>b</sup> During baseline period, 9.6% of comparison and 8.0% of innovation group were missing data for this variable. During implementation period, 2.3% of comparison and 3.0% in innovation group were missing data for this variable.

<sup>c</sup> During baseline period, 0.8% of comparison and 0.4% of innovation group were missing data for this variable.



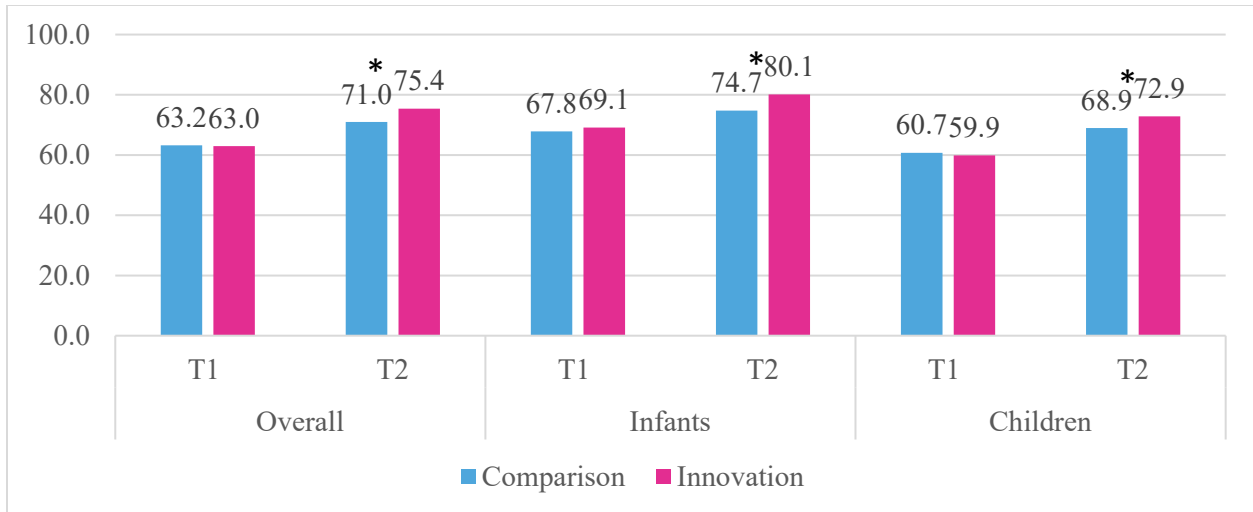
In general, the participants in the comparison and innovation groups were similar for most demographic characteristics at baseline (T1) and implementation (T2) and over time (Table 11). Although there were statistically significant differences in many characteristics between groups during both time periods, there did not appear to be many clinically important differences. On the other hand, there were potentially important differences by race or ethnicity and primary language spoken in the household. The innovation clinics at both T1 and T2 had fewer Black or African American participants (7% at T1 and 6% at T2) than the comparison clinics (31% at T1 and T2), a greater number of Hispanic participants (96% at T1 and T2 in innovation clinics vs. 70% in T1 and T2 in comparison clinics), and a higher proportion of participants whose household language was something other than English (82% at T1 and 78% at T2 in the innovation clinics vs. 51% at T1 and 50% at T2 in the comparison clinics).

During both time periods, there were large proportions of participants with missing data for the variable “number of WIC participants in the household” (between 23% and 32%). During the baseline period, between 8% and 10% of participants in both the innovation and comparison groups were missing data for the variable “ever breastfed.”

There were very few notable differences in participant characteristics in each group over time (Table 11). One notable difference was in SNAP participation: At T1, 50% of the comparison group and 57% of the innovation group participated in SNAP, whereas at T2, 38% of the comparison group and 45% of the innovation group were SNAP participants.

### **Recertification**

The crude, unweighted proportion of infants and children recertified in the innovation and comparison groups during baseline (T1) was not significantly different (63.0% and 63.2%, respectively), the proportions recertified during implementation (T2) were significantly different (75.4% and 71.0%, respectively) (Figure 30). This was also true when studying infants and children separately. In all three cases (overall, infants, and children), the percentage recertified during T2 was significantly higher in the innovation group than in the comparison group (Figure 46). For sample sizes of these groups, see Appendix O. Table 5.

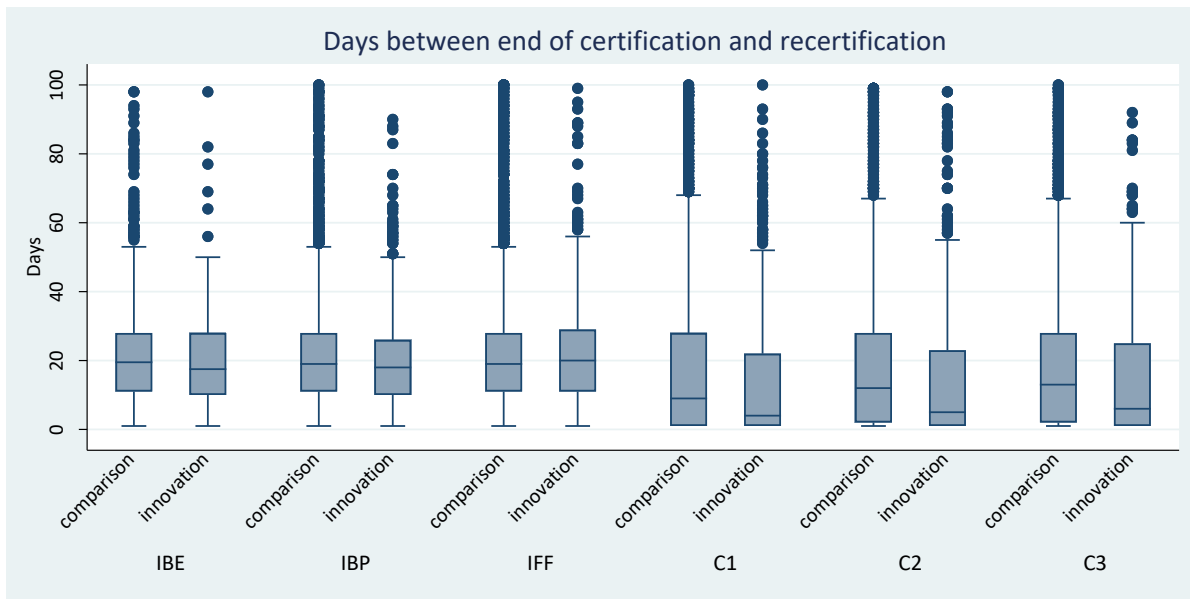


**Figure 30.** Proportion recertified (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Miami-Dade WIC comparison and innovation clinics. \* $p < 0.05$ .

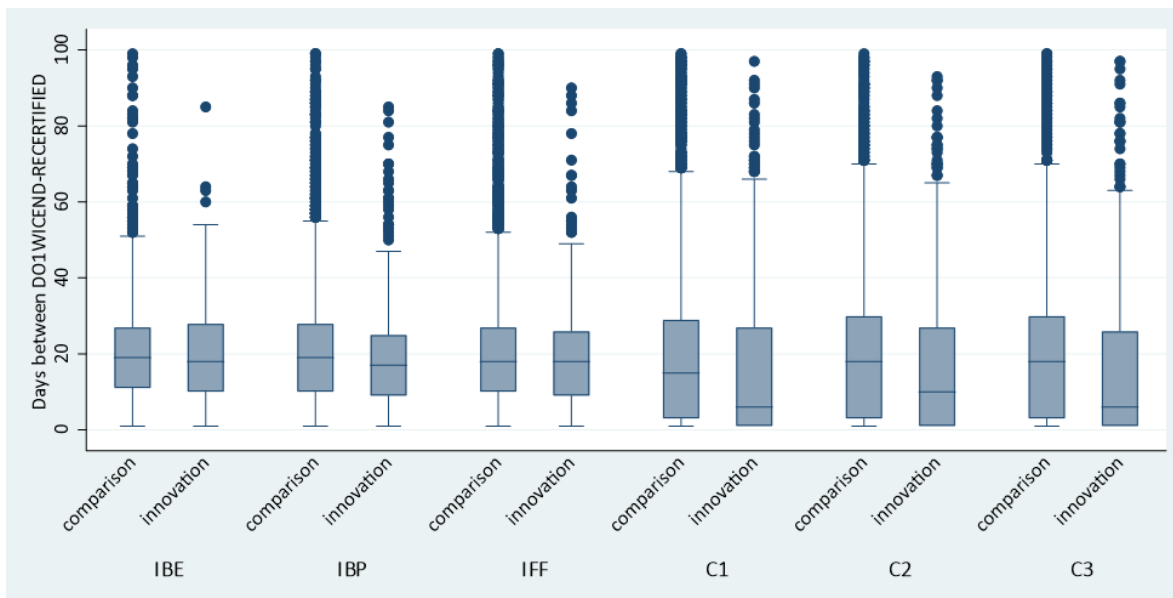
### Timeliness of Recertification

The median number of days between the end of the prior certification and recertification date during the baseline period was 13 (IQR 2, 27) for the innovation group and 16 (IQR 5, 29) for the comparison group. In the innovation group, median number of days ranged from 5 among C1s to 21 among IFFs; in the comparison group, median number of days ranged from 11 among C1s to 20 among IBEs, IBPs, and IFFs (Figure 31). Over 90% of recertifications during baseline were “timely” (i.e., less than 60 days after the end of the last certification period).

The median number of days between the end of the prior certification and recertification date during the implementation period was 14 (IQR 3, 28) for the innovation group and 19 (IQR 6, 30) for the comparison group. In the innovation group, the median number of days ranged from 7 among C1s and C3s to 18 among IBEs, IBPs, and IFFs; in the comparison group, median number of days ranged from 18 among C1s to 20 among IBPs (Figure 32). Over 90% of the recertifications during implementation were timely.



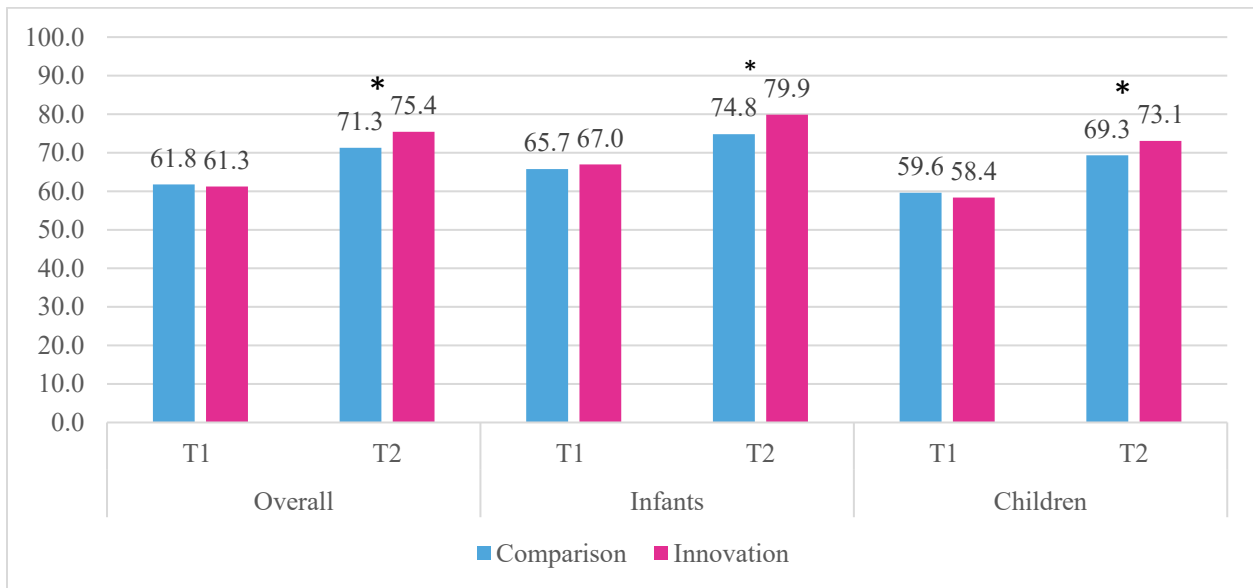
**Figure 31.** Number of days between end of certification and recertification by innovation group and participant category in Miami-Dade during baseline (truncated at 100 days)



**Figure 32.** Number of days between end of certification and recertification by innovation group and participant category in Miami-Dade during baseline (truncated at 100 days)

### Retention

Overall, and for infants and children, the differences between innovation and comparison were not statistically significant during T1 (Figure 33). However, the proportion was significantly higher for the innovation group than the comparison group overall (75.4% vs. 71.3%, respectively), among infants (79.9% vs. 74.8%, respectively), and among children (73.1% vs. 69.3%, respectively) during T2.



**Figure 33.** Proportion retained (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Miami-Dade WIC comparison and innovation clinics. \* $p < 0.05$ .

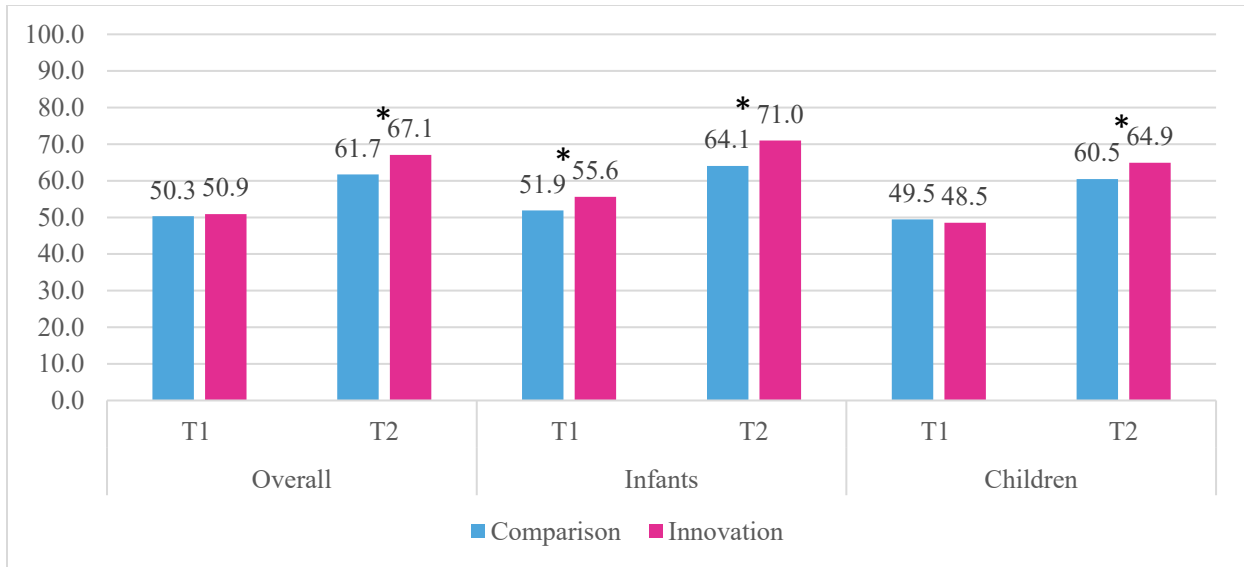
### Participation (i.e., benefit issuance)

The median number of months of benefit issuance for all participants in the innovation and comparison groups during T1 was 11 (out of 12) (IQR 4, 12) (Table 12). During T2, the median number of months of benefit issuance was 12 for both innovation (IQR 7, 12) and comparison (IQR 8, 12). The average percentage of the cohort issued benefits throughout the year was higher in T2 (79.5% in innovation and 76.5% in comparison) than T1 (68.0% in innovation and 68.1% in comparison).

**Table 12.** Benefit Issuance in Miami Dade Innovation and Comparison Groups during Baseline and Implementation Periods

Agency/Group	Baseline (T1)		Implementation (T2)	
	Innovation	Comparison	Innovation	Comparison
Months of benefit issuance (median, IQR)	11 (4, 12)	11 (4, 12)	12 (7, 12)	12 (8, 12)
Percent of cohort issued benefits (%)	68.0	68.1	79.5	76.5

The pattern evident in the crude, unweighted comparisons of recertification and retention in the innovation and comparison groups during T1 and T2 was also evident when studying the crude, unweighted proportion of the samples that had high rates of benefit issuance (11-12 months), with one exception: The innovation group had a significantly larger proportion of infants during T1 that experienced a high rate of benefit issuance than the comparison group (55.6% vs. 51.9%, respectively) (Figure 34). For overall and children during T1, there were no significant differences. In all three instances during T2, the innovation group had a significantly larger proportion of participants with a high rate of benefit issuance than the comparison group.



**Figure 34.** Proportion with continuous benefit issuance (11-12 months) (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Miami-Dade WIC comparison and innovation clinics. \* $p < 0.05$ .

### Balancing the groups using PSW

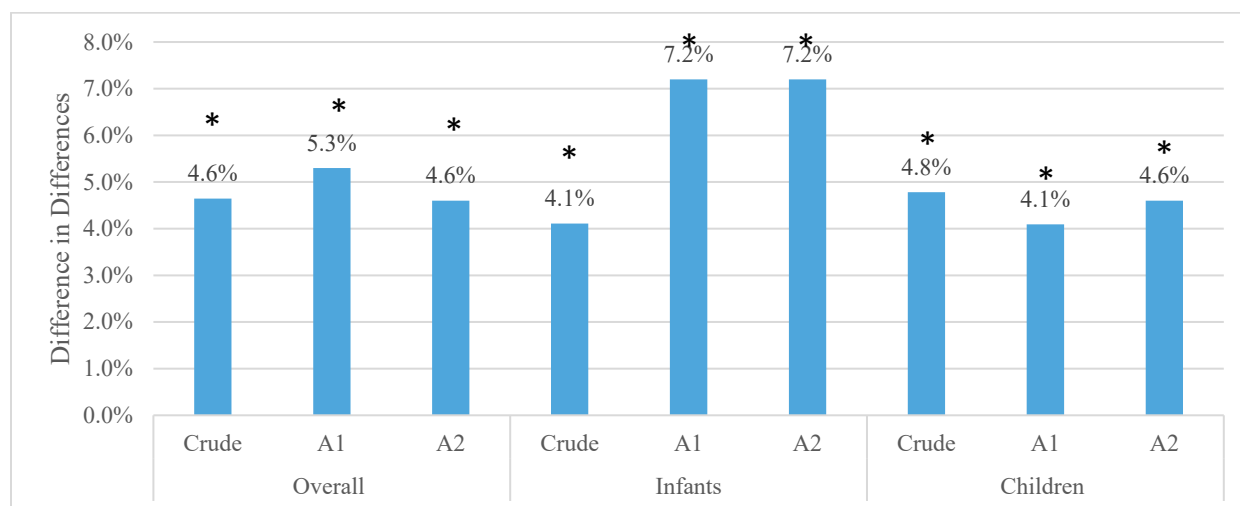
The greatest differences in characteristics between the innovation groups at T1 and T2 were SNAP participation, Medicaid participation, and primary language other than English (all with an absolute standardized difference greater than 0.05) (see Appendix P. Figure 7.). The absolute standardized difference mean across all characteristics was 0.044. After propensity score weighting, these absolute standardized differences were all reduced to below 0.05, with the exception of being an infant (0.053). The absolute standardized difference mean after weighting was 0.008. For ASDs for infants and children separately, see Appendix P. Table 3.

The greatest differences in characteristics between the innovation group at T1 and the comparison group at T1 were being Black, being White, being Hispanic, speaking a primary language other than English, participating in SNAP, and participating in Medicaid (all with an absolute standardized difference greater than 0.05) (see Appendix P. Figure 8.). The absolute standardized difference mean across all characteristics was 0.214. After propensity score weighting, these absolute standardized differences were all reduced to below 0.05. The absolute standardized difference mean after weighting was 0.007. For ASDs for infants and children separately, see Appendix O. Table 3.

The greatest differences in characteristics between the innovation group at T1 and the comparison group at T2 were being Black, being White, being Hispanic, speaking a primary language other than English, participating in SNAP, and participating in Medicaid (all with an absolute standardized difference greater than 0.05) (see Appendix P. Figure 9.). The absolute standardized difference mean across all characteristics was 0.231. After propensity score weighting, these absolute standardized differences were all reduced to below 0.05 with the exception of being an infant (0.083). The absolute standardized difference mean after weighting was 0.007. For ASDs for infants and children separately, see Appendix P. Table 3.

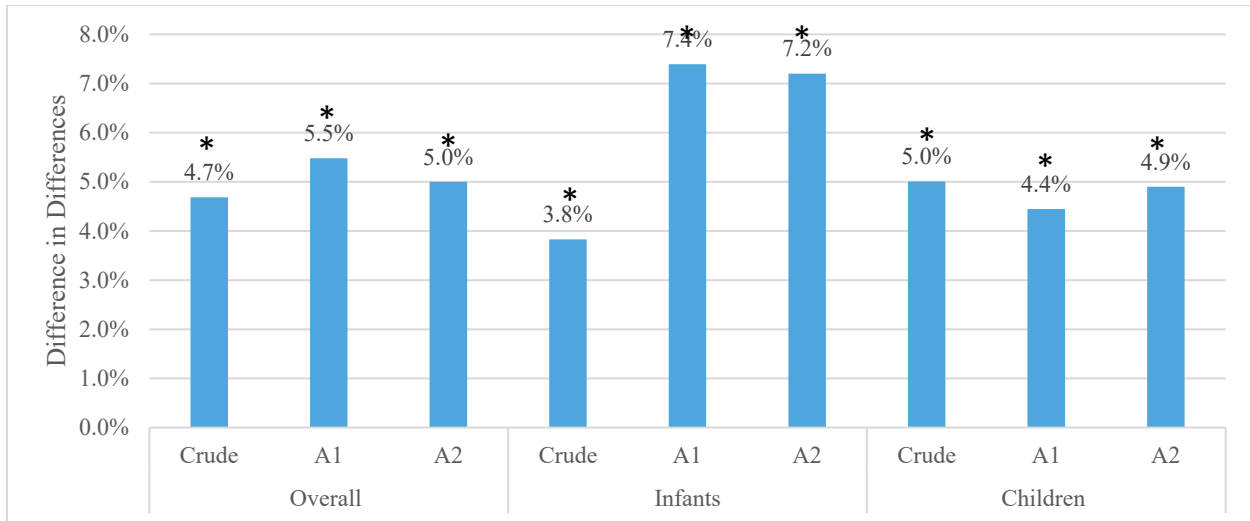
## DID analyses

Using the unweighted data and a crude (unadjusted) DID analysis, being in the innovation clinics was associated with a 4.6% increase in recertification overall (95% CI: 2.8-6.5%), a 4.1% increase in infants (95% CI: 1.1-7.1%), and a 4.8% increase in children (95% CI: 2.5-7.1%) (Figure 35, Table 13). Using the weighted data and the adjusted model A1, being at the innovation clinics was associated with a 5.3% increase in recertification overall (95% CI: 3.4-7.1%), a 7.2% increase in recertification among infants (95% CI: 3.4-11.0%), and a 4.1% increase in recertification among children (95% CI: 1.8-6.4%). Using the weighted data and the adjusted model A2, being at the innovation clinics was associated with a 4.6% increase in recertification overall (95% CI: 3.4-5.8%), a 7.2% increase in recertification among infants (95% CI: 5.2-9.2%), and a 4.6% increase in recertification among children (95% CI: 3.0-6.2%). For the sample sizes of each of these groups, see Appendix O. Table 6.



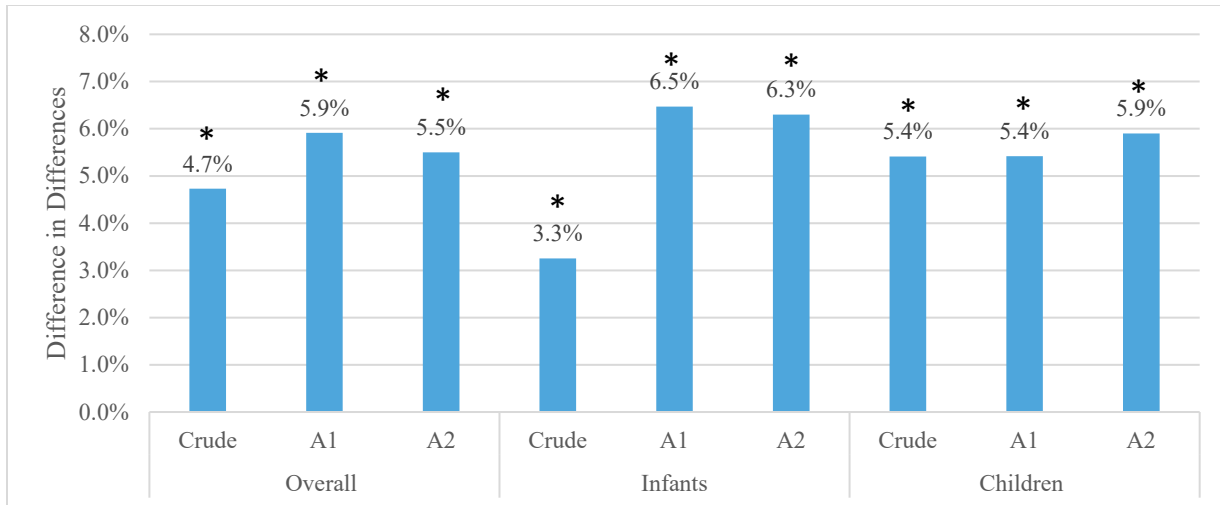
**Figure 35.** Percentage point differences in recertification between the innovation and comparison groups at Miami-Dade WIC overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \*p< 0.05.

Using the unweighted data and an adjusted DID analysis, being in the innovation clinics was associated with a 4.7% increase in retention overall (95% CI: 2.9-6.5%), a 3.8% increase in infants (95% CI: 0.8-6.8%), and a 5.0% increase in children (95% CI: 2.7-7.3%) (Figure 36). Using the weighted data and the adjusted model A1, being at the innovation clinics was associated with a 5.5% increase in retention overall (95% CI: 3.6-7.3%), a 7.4% increase in retention among infants (95% CI: 3.6-11.3%), and a 4.4% increase in retention among children (95% CI: 2.1-6.8%). Using the weighted data and the adjusted model A2, being at the innovation clinics was associated with a 5.0% increase in retention overall (95% CI: 3.8-6.2%), a non-significant 7.2% increase in retention among infants (95% CI: -6.9-21.3%), and a 4.9% increase in retention among children (95% CI: 3.3-6.5%). For the sample sizes of each of these groups, see Appendix O. Table 6.



**Figure 36.** Percentage point differences in retention between the innovation and comparison groups at Miami-Dade WIC overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \* $p < 0.05$ .

Using the unweighted data and a crude (unadjusted) analysis, being in the innovation clinics was associated with a 4.7% increase in continuous benefit issuance overall, a 3.3% increase in high rate of benefit issuance in infants, and a 5.4% increase in high rate of benefit issuance in children (all statistically significant) (Figure 37). Using the weighted data and the adjusted model A1, being at the innovation clinics was associated with a 5.9% increase in continuous benefit issuance overall (95% CI: 3.9-7.9%), a 6.5% increase in continuous benefit issuance among infants (95% CI: 2.1-10.8%), and a 5.4% increase in retention among children (95% CI: 3.0-7.9%). Using the weighted data and the adjusted model 2 (A2), being at the innovation clinics was associated with a 5.5% increase in retention overall (95% CI: 4.1-6.9%), a 6.3% increase in retention among infants (95% CI: 4.1-8.5%), and a 5.9% increase in retention among children (95% CI: 4.3-7.5%). For the sample sizes of each of these groups, see Appendix O. Table 6.



**Figure 37.** Percentage point differences in continuous benefit issuance between the innovation and comparison groups at Miami-Dade WIC overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \*p< 0.05.

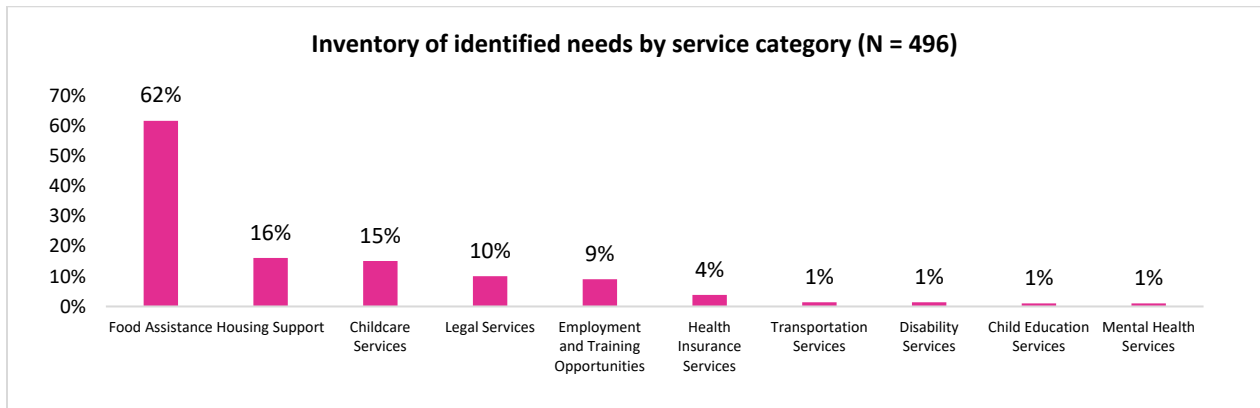
**Table 13.** Difference-in-Difference Results for Recertification, Retention, and Benefit Issuance Using Crude and Two Adjusted Models Overall and for Infants and Children at Miami-Dade WIC

	Beta	Overall			Infants			Children		
		Beta	95%CI		Beta	95%CI		Beta	95%CI	
Recertification (crude, unweighted)	0.046	0.028	0.065	0.041	0.011	0.071	0.048	0.025	0.071	
Retention (crude, unweighted)	0.047	0.029	0.065	0.038	0.008	0.068	0.050	0.027	0.073	
Benefit issuance (crude, unweighted)	0.047	0.028	0.066	0.033	0.000	0.065	0.054	0.030	0.078	
Recertification										
Model A1	0.053	0.034	0.071	0.072	0.034	0.110	0.041	0.018	0.064	
Model A2	0.046	0.034	0.058	0.072	0.052	0.092	0.046	0.030	0.062	
Retention										
Model A1	0.055	0.036	0.073	0.074	0.036	0.113	0.044	0.021	0.068	
Model A2	0.050	0.038	0.062	0.072	-0.069	0.213	0.049	0.033	0.065	
Continuous benefit issuance										
Model A1	0.059	0.039	0.079	0.065	0.021	0.108	0.054	0.030	0.079	
Model A2	0.055	0.041	0.069	0.063	0.041	0.085	0.059	0.043	0.075	



Process and Short-term Outcome Evaluation

From February 2020 to January 2021, 2,155 caregivers were eligible for the WMTY project. Of those, 78% received the WMTY conversation, 29% identified needs, 22% consented to referral, 21% were referred to at least one service, 16% had a referral accepted, and 4% (95 families) were enrolled in a program or received services. A total of 720 referrals were made for 461 caregivers, an average of 1.6 referrals per family; the most requested service was for food assistance, followed by housing support and childcare services (see Figure 38). Of the 720 referrals made, 55% were accepted, 17% were unopened, 14% were closed before intake was completed, 8% were rejected, 4% were recalled, and 3% were still in review at the end of the implementation period. Among the closed cases in the network, 25% ended in program enrollment or receipt of services. The primary reason participants with accepted referrals did not receive services was because partner organizations were unable to successfully contact participants after three outreach attempts (21% of closed cases).



**Figure 38.** Distribution of participants by category of identified need

Both intervention sites experienced an increase in referral volume from the baseline period to the implementation period. Corona WIC referral volume increased by 78% and Ocean Avenue WIC referral volume increased by 109%.

The post-intervention survey of WIC staff was delivered to 43 WIC staff, and 36 responded (84% response rate). In addition, all QNs and CSAs at the intervention sites were invited to participate in one of four focus groups. Overall, staff viewed the impact of WMTY positively. Staff found the conversation guide helpful in facilitating discussion with a WIC caregiver, even if it did not always lead to needs identification or a referral. However, staff were less confident in their ability to make more referrals with the WMTY questions. The quality and number of referral options available were more likely to impact referral volume than use of the WMTY questions. Staff also credited the program with improving the referral process for WIC families and reducing barriers to participation. Staff believed the project would help caregivers see WIC as a useful resource hub. However, staff were less confident about WMTY’s potential impact on recertification rates. They felt family-specific factors (e.g., income eligibility, child’s age,

food/formula preferences) outside of the project's control were more likely to impact a participant's recertification.

The post-intervention evaluation survey of partners was sent to 22 representatives from WMTY partner CBOs, and there was a 73% survey response rate. Representatives from 9 of 11 partner organizations also participated in one of two focus groups. Despite initial setbacks with referral quality, partner organizations overwhelmingly found the project valuable and reported that it added to their current services. According to survey respondents, the primary referral quality issue was that referred participants often did not meet eligibility criteria for age, income, geography and/or immigration status. Most partner survey respondents found it easy to receive referrals (75%) and document outcomes (67%) in Unite Us. However, less than half (42%) are interested in continuing to use Unite Us to receive referrals once WMTY ends.

Partners were committed to addressing participants' needs, even if new issues came up during intake or participants did not meet eligibility criteria. During the intake process, partners often found that participants had additional needs beyond that for which they were referred. Fortunately, many organizations were able to support these additional needs. When referred participants did not meet program criteria, organizations provided additional resources or tried to refer to other organizations.

Over half of the partner organizations in the Unite Us network (55%) were new collaborations with PHS. Nearly all partners (94%) reported interest in continuing a partnership with WIC. WMTY helped PHS establish new partnerships, grow its pool of partners, and diversify service offerings in its citywide network of community resources.

The post-intervention survey for caregivers was delivered to 15,745 WIC caregivers associated with the Corona, Ocean Avenue, and Ridgewood WIC sites; 358 qualified responses were received. In addition, the PHS team conducted 29 in-depth interviews (IDIs) with WIC caregivers. According to survey and IDI findings, caregivers currently perceive WIC as a limited community provider: while caregivers appreciated the option to receive referrals from WIC, they did not yet see WIC as the place to discuss needs beyond nutrition support. Even when probed about their needs, caregivers rarely voiced barriers to WIC participation.

In interviews, many did not view their needs outside of WIC as "barriers" to participation and as a result, did not identify any impediments. Caregivers did not feel WIC could help them with their challenges or did not think WIC could provide a referral for their specific need. Rarely did they mention referrals as a valued aspect of the program. During the in-depth interview, caregivers that did recall being offered referrals viewed them as a "perk" or something extra, rather than a core component of WIC. However, once they were told about referral options, knowing that WIC can help with connection to other services positively influenced caregivers' perception of the WIC program. Caregivers generally had a positive perception of the impact of referrals. Nearly two-thirds of WMTY caregivers at the intervention sites felt the referral helped address issues that made it difficult to participate in WIC and connected them to needed services.

## Impact on Child Retention and Participation

**Table 14.** Demographic Characteristics of subset of Age-eligible Children at Public Health Solutions Comparison and Innovation Clinics at baseline (T1) and implementation (T2). Statistically significant ( $p < 0.05$ ) differences by group are in **bold**.

		Baseline (T1)		Implementation (T2)	
		Comparison (n=2,462)	Innovation (n=2,975)	Comparison (n=2,282)	Innovation (n=2,656)
		%	%	%	%
<b>Category at start of period</b>	<b>IBE*</b>	<b>5.4</b>	<b>4.6</b>	5.2	5.0
	<b>IBP</b>	<b>26.7</b>	<b>23.1</b>	30.2	28.5
	<b>IFF</b>	<b>30.4</b>	<b>25.5</b>	22.7	22.9
	<b>C1</b>	<b>42.4</b>	<b>46.8</b>	41.9	43.6
<b>Number of WIC participants</b>	<b>One</b>	<b>33.0</b>	<b>33.6</b>	33.2	32.5
	<b>Two</b>	<b>44.4</b>	<b>40.5</b>	44.0	42.7
	<b>Three or more</b>	<b>22.6</b>	<b>25.9</b>	22.8	24.9
Race <sup>a</sup>	<b>American Indian or Alaska Native</b>	<b>21.2</b>	<b>5.0</b>	<b>18.8</b>	<b>2.6</b>
	<b>Asian</b>	<b>15.3</b>	<b>8.4</b>	<b>16.3</b>	<b>11.0</b>
	<b>Black or African American</b>	<b>27.0</b>	<b>5.0</b>	<b>29.1</b>	<b>7.0</b>
	<b>Native Hawaiian or Other Pacific Islander</b>	<b>3.9</b>	<b>0.7</b>	<b>4.4</b>	<b>0.8</b>
	<b>White</b>	<b>34.0</b>	<b>82.2</b>	<b>33.1</b>	<b>79.7</b>
	<b>Hispanic</b>	<b>39.1</b>	<b>56.2</b>	<b>42.0</b>	<b>50.4</b>
Twin status	Yes	4.0	3.0	3.1	4.0
Enrolled	<b>TANF</b>	<b>5.4</b>	<b>3.0</b>	<b>6.1</b>	<b>2.8</b>
	<b>SNAP</b>	<b>34.6</b>	<b>35.7</b>	<b>35.4</b>	<b>33.7</b>
	<b>Medicaid</b>	<b>87.0</b>	<b>85.8</b>	<b>85.0</b>	<b>84.9</b>
<b>Primary language other than English</b>		<b>47.7</b>	<b>70.8</b>	<b>47.4</b>	<b>64.7</b>
<b>Ever breastfed</b>	<b>Yes</b>	<b>91.5</b>	<b>90.0</b>	<b>91.6</b>	<b>85.8</b>

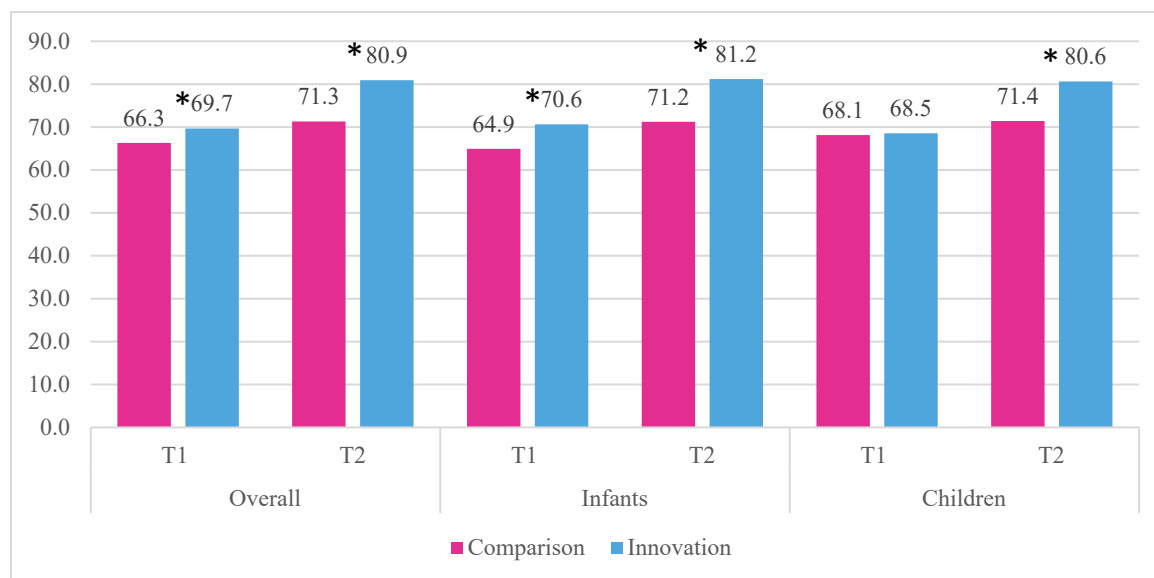
\* Abbreviations: IBE: Infant, exclusive breastfeeding; IBP: Infant, partial breastfeeding; IFF: Infant, formula feeding; C1: Child category 1 (one year old); TANF: Temporary Assistance for Needy Families; SNAP: Supplemental Nutrition Assistance Program.

<sup>a</sup> Participants can respond to more than one category so the total percentage may be greater than 100.

In general, there were statistical differences in participant characteristics between the comparison and innovation groups at baseline (T1), but several of the differences were not observed between groups during the implementation period (T2) (Table 14). The biggest differences were observed for race and ethnicity and primary language other than English; these differences in T1 were still observed in T2. The values for enrollment in TANF, SNAP and Medicaid are shown for those with data; about 30% of the sample had missing information for one of more of these programs.

### Recertification

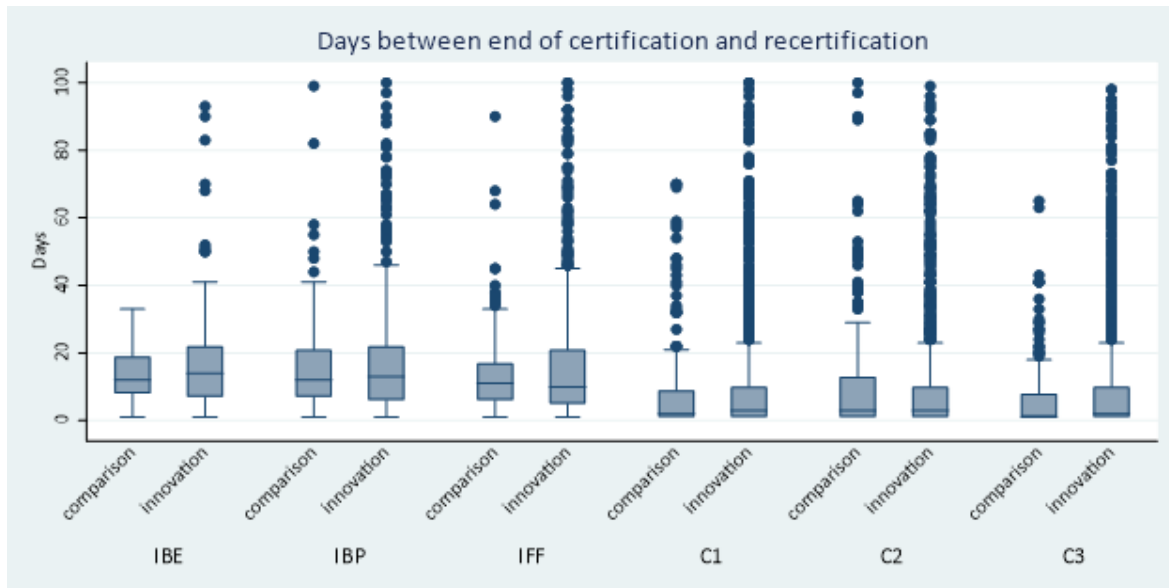
The crude, unweighted proportions of age-eligible infants and children recertified in the innovation and comparison groups during baseline (T1) were significantly different (69.7% and 66.3%, respectively), and the proportions recertified during implementation (T2) were significantly different (80.9% and 71.3%, respectively) (Figure 48 **Figure** ). This was also true when studying infants. For children, there were no differences at baseline (T1) but at T2, recertification was higher for the innovation group (Figure 39). For sample sizes of these groups, see Appendix O. Table 7.



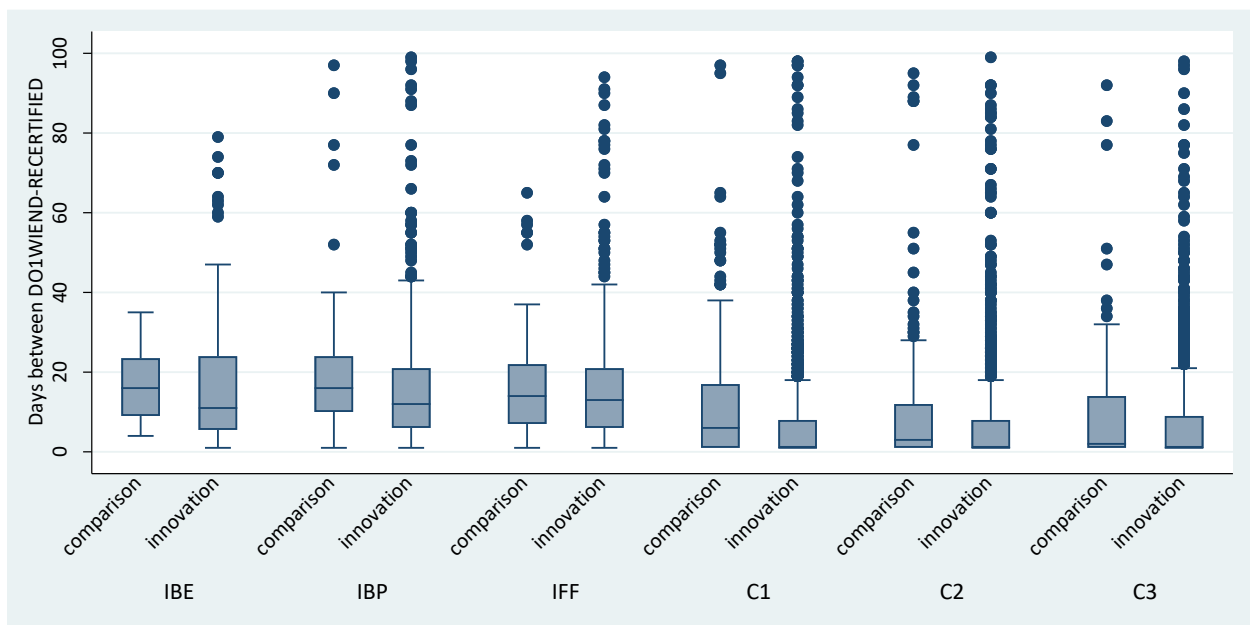
**Figure 39.** Proportion recertified (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children in an age-eligible subset of participants at Public Health Solutions comparison and innovation clinics. \* $p < 0.05$ .

### Timeliness of Recertification

Presented in Figures 40 and 41 are the distributions of time gap between the end of a child’s certification period and their recertification (truncated at 100 days) for the innovation and comparison groups at PHS during T1 and T2. As shown, during T1 the innovation and comparison groups were very similar, and children experienced more timely recertifications than infants. During T2, there was a higher degree of dissimilarity between innovation and comparison, and children were again more likely to be timely recertified.



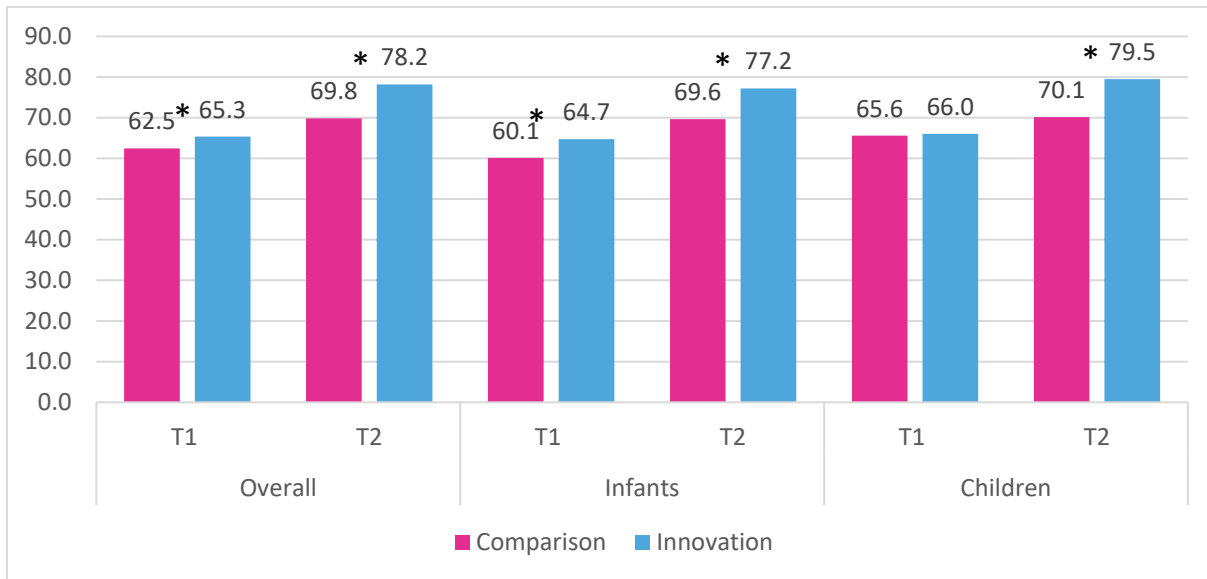
**Figure 40.** Number of days between end of certification and recertification by innovation group and participant category at Public Health Solutions during baseline (truncated at 100 days)



**Figure 41.** Number of days between end of certification and recertification by innovation group and participant category at Public Health Solutions during baseline (truncated at 100 days)

### Retention

Overall, and for infants, the differences between innovation and comparison for retention were statistically significant during T1 (Figure 42). The proportion retained was higher and statistically significant for the innovation group than the comparison group overall (78.2% vs. 69.8%, respectively), among infants (77.2% vs. 69.6%, respectively), and among children (79.5% vs. 70.1%, respectively) during T2.



**Figure 42.** Proportion retained (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children in an age-eligible subset of participants at Public Health Solutions comparison and innovation clinics. \* $p < 0.05$ .

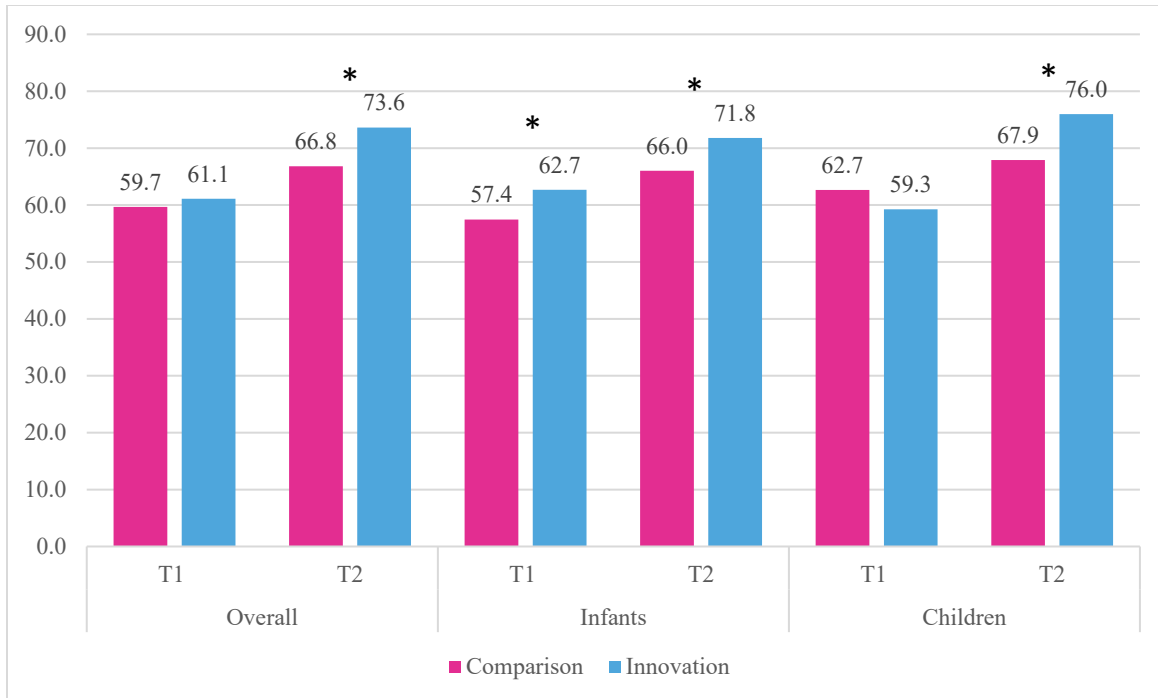
### Participation (i.e., benefit issuance)

As noted above, data were only available for seven months of benefit issuance during the baseline period, whereas a full year of data were available during the implementation period. During the baseline period the median months of benefit issuance was 6 and 7 in the two groups, and during the implementation period the median months was 12 in each group.

**Table 15.** Benefit Issuance in Public Health Solutions (PHS) Innovation and Comparison Groups during Baseline and Implementation Periods

Agency/Group	Baseline (T1)		Implementation (T2)	
	Innovation	Comparison	Innovation	Comparison
Months of benefit issuance (median, IQR)	6 (3, 7)	7 (3, 7)	12 (10, 12)	12 (8, 12)
Percent of cohort issued benefits (%)	66.9	71.4	76.4	73.1

The crude, unweighted comparisons of continuous benefit issuance overall and for infants and children are presented in Figure 43. Differences between groups at baseline (T1) were non-significant overall and for children, but significantly higher in the innovation group for infants. During the implementation period (T2), however, significant differences were observed with higher proportions of continuous benefit issuance in the innovation group overall and when stratified for infants and children.



**Figure 43.** Proportion with continuous benefit issuance (11-12 months) (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children in an age-eligible subset of participants at Public Health Solutions comparison and innovation clinics. \* $p < 0.05$ .

### Balancing the groups using PSW

The greatest differences in characteristics between the innovation groups at T1 and T2 were twin status, American Indian/Alaskan Native, Asian, Black, White, Hispanic, primary language other than English, and ever breastfed (all with an absolute standardized difference greater than 0.05) (see Appendix P. Figure 10.). After propensity score weighting, these absolute standardized differences were all reduced to below 0.05. The absolute standardized difference mean after weighting was 0.01. For ASDs for infants and children separately, see Appendix O. Table 8.

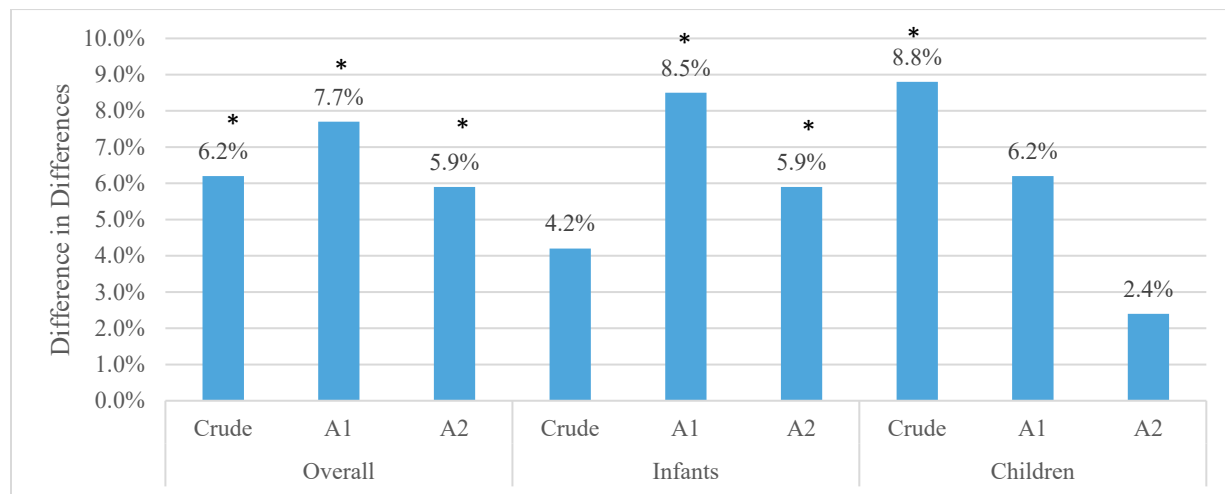
The greatest differences in characteristics between the innovation group at T1 and the comparison group at T1 were being American Indian/Alaskan Native, Asian, Black, Native Hawaiian/Pacific Islander, White, Hispanic, speaking a primary language other than English, being ever breastfed, and being an infant (all with an absolute standardized difference greater than 0.05) (see Appendix P. Figure 11.). After propensity score weighting, these absolute standardized differences were all reduced to below 0.05 except for being multiracial (ASD 0.06) and speaking a primary language other than English (ASD 0.10). The absolute standardized difference mean after weighting was 0.04. For ASDs for infants and children separately, see Appendix O. Table 8.

The greatest differences in characteristics between the innovation group at T1 and the comparison group at T2 were being American Indian/Alaskan Native, Asian, Black, Native Hawaiian/Pacific Islander, White, Hispanic, multiracial, speaking a primary language other than

English, being ever breastfed and being an infant (all with an absolute standardized difference greater than 0.05) (see Appendix P. Figure 12.). After propensity score weighting, these absolute standardized differences were all reduced to below 0.05 except for being White (ASD 0.06), being Hispanic (ASD 0.11), speaking a primary language other than English (0.14) and number of family members in WIC (ASD 0.06). The absolute standardized difference mean after weighting was 0.05. For ASDs for infants and children separately, see Appendix O. Table 8.

### DID analyses

Using the unweighted data and a crude (unadjusted) analysis, being in the innovation clinics was associated with a 6.2% (95% CI: 2.8% to 9.7%) increase in recertification overall, a non-significant 4.2% (95% CI: -0.4% to 8.8%) increase in infants, and a significant 8.8% (95% CI: 3.5% to 14%) increase in children (Figure 44). Using the weighted data and adjusted Model A1, the WMTY innovation was associated with a 7.7% (95% CI: 3.4% to 12.0%) increase in recertification overall, an 8.5% (95% CI: 2.7% to 14.2%) increase in recertification among infants, and a non-significant 6.2% (95% CI; -0.4% to 12.8%) increase in recertification among children. In general, the results for Model A2, are lower than those for A1. For the beta coefficients and 95% confidence intervals, see Table 16. For the sample sizes of each of these groups, see Appendix O. Table 8.

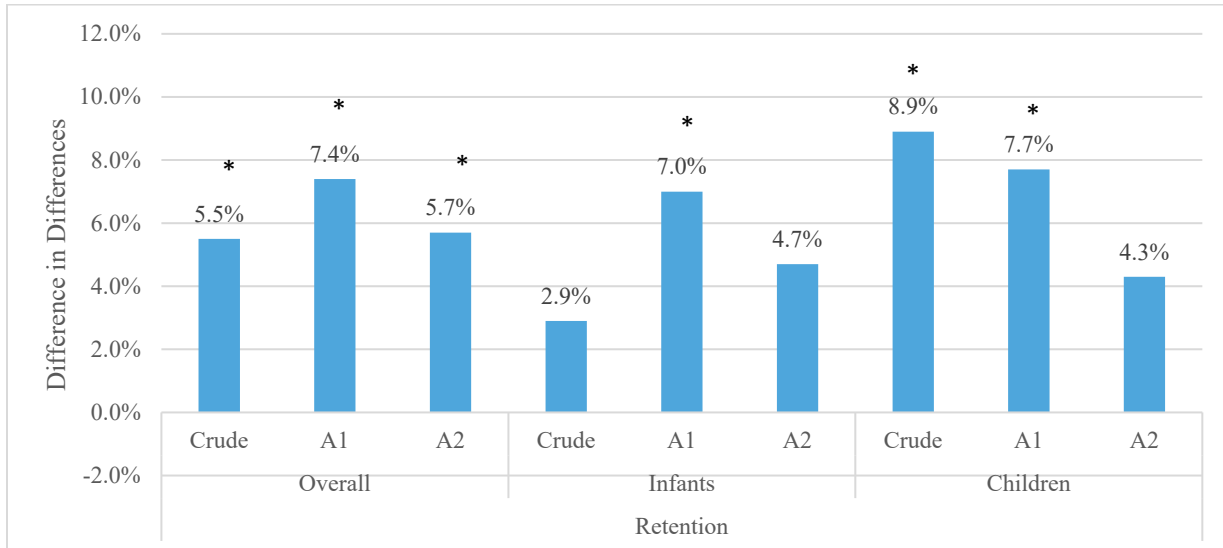


**Figure 44.** Percentage point differences in recertification between the age-eligible innovation and comparison groups at Public Health Solutions overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \* $p < 0.05$ .

Using the unweighted data and a crude (unadjusted) analysis, being in the innovation clinics was associated with a 5.5% (95% CI: 1.9% to 9.0%) increase in retention overall, a non-significant 2.9% (95% CI: -1.9% to 7.8%) increase in infants, and an 8.9% (95% CI: 3.5% to 14.2%) increase in children (Figure 45). Using the weighted data and adjusted Model A1, the WMTY innovation was associated with 7.4% (95% CI: 3.0% to 11.9%) increase in retention overall, an

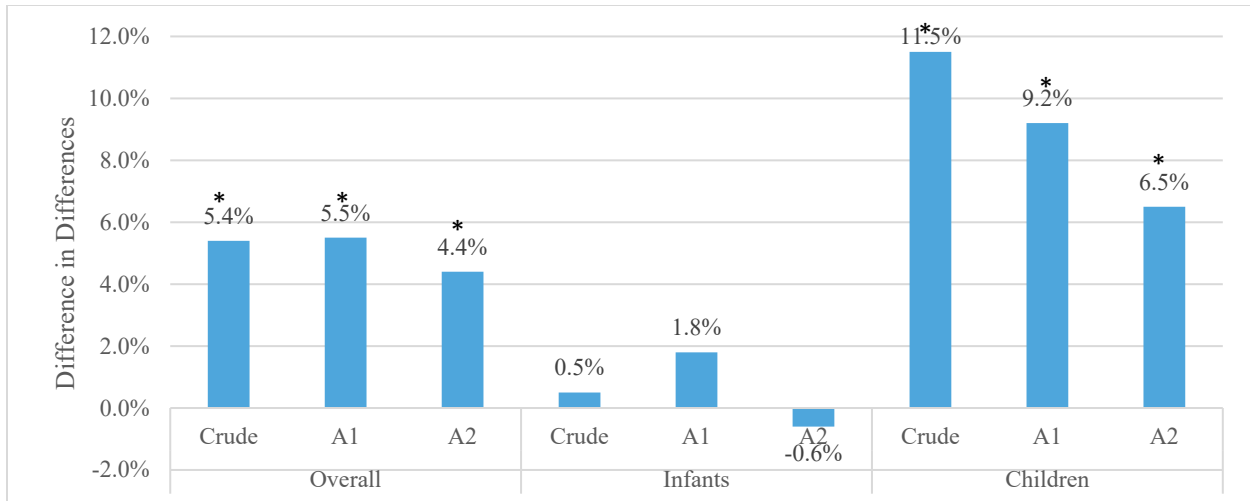


7.0% (95% CI: 1.0% to 13.0%) increase in retention among infants, and a 7.7% (95% CI: 1.0% to 14.4%) increase in retention among children. In general, the adjusted results for Model A2 were smaller in magnitude. For the beta coefficients and 95% confidence intervals, see Table 16. For the sample sizes of each of these groups, see Appendix O. Table 8.



**Figure 45.** Percentage point differences in retention between the age-eligible innovation and comparison groups at Public Health Solutions overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \*p< 0.05.

Using the unweighted data and a crude (unadjusted) analysis, being in the innovation clinics was associated with a 5.4% (95% CI: 1.7% to 9.1%) increase in continuous benefit issuance overall, a negligible 0.5% (95% CI: -4.4% to 5.5%) increase in continuous benefit issuance for infants, and a 11.5% (95% CI: 5.9% to 17.0) increase in continuous benefit issuance for children (Figure 46). Using the weighted data and the adjusted Model A1, WMTY was associated with a 5.5% (95% CI: 0.9% to 10.1%) increase in continuous benefit issuance overall, a negligible 1.8% (95% CI: -4.4% to 8.0%) in continuous benefit issuance for infants, and a 9.2% (95% CI: 2.3% to 16.2%) in continuous benefit issuance for children. The adjusted results using Model A2 are generally smaller in magnitude as compared to the results in Model A1. For the beta coefficients and 95% confidence intervals, see Table 16**Table**. For the sample sizes of each of these groups, see Appendix O. Table 8.



**Figure 46.** Percentage point differences in continuous benefit issuance between the age-eligible innovation and comparison groups at Public Health Solutions overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \* $p < 0.05$ .

**Table 16.** Difference-in-Difference Results for Recertification, Retention, and Benefit Issuance Using Crude and Two Adjusted Models Overall and for Infants and Children in Public Health Solutions Innovation and Comparison Groups

	Overall			Infants			Children		
	Beta	95%CI		beta	95%CI		beta	95%CI	
Recertification (crude, unweighted)	0.062	0.028	0.097	0.042	-0.004	0.088	0.088	0.035	0.141
Retention (crude, unweighted)	0.055	0.019	0.090	0.029	-0.019	0.078	0.089	0.035	0.143
Benefit issuance (crude, unweighted)	0.054	0.017	0.091	0.005	-0.044	0.055	0.115	0.059	0.170
Recertification Model A1	0.077	0.034	0.120	0.085	0.027	0.142	0.062	-0.004	0.128
Model A2	0.059	0.024	0.094	0.059	0.014	0.104	0.024	-0.029	0.077
Retention Model A1	0.074	0.030	0.119	0.070	0.010	0.130	0.077	0.010	0.144
Model A2	0.057	0.022	0.092	0.047	0.000	0.094	0.043	-0.010	0.096
Continuous benefit issuance: Model A1									
Continuous benefit issuance Model A1	0.055	0.009	0.101	0.018	-0.044	0.080	0.092	0.023	0.162
Model A2	0.044	0.007	0.081	-0.006	-0.055	0.043	0.065	0.010	0.120

The results above reflect an intention-to-treat approach. Further analyses were conducted to evaluate the impact of the conversation among those who received the WMTY and Unite Us

conversation. There were only small differences in participant characteristics between those offered the conversation and those not among the age-eligible innovation group at T2. Using logistic regression at T2, those offered the conversation were 2.5 to 3 times more likely to be recertified and retained and have complete benefit issuance, adjusting for multiple participant characteristics (results not shown).

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## *Cabarrus Health Alliance*

### Process and Short-term Outcome Evaluation

Due to COVID-19, project implementation was not as intended. The in-clinic wait-time was not utilized due to virtual appointments. Additionally, due to COVID-19 protocols, WIC staff were unable to train parents of targeted participants on QLess in-person and resorted to social marketing efforts. Adaptions were made to ensure fidelity of the overall project and the adapted implementation of QLess was successful.

During the implementation period, 696 families made individual appointments online. Of those families, 159 repeatedly (either two, three, or four times) used QLess for various types of appointments. Roughly 6.2% of eligible Cabarrus WIC participants utilized QLess at least once during the 12-month period. About 20.5% of appointments were made inaccurately; the most common reason was booking a recertification appointment when the family needed a follow-up (n=66 families), followed by the incorrect number of people selected (n=45) and the family did not need an appointment (n=24).

The monthly average during the 10-month data collection period was 197 clicks on the homepage, 80 clicks on the sub-tab, and 21 clicks to the QLess link. Average incoming call volume decreased over the implementation period compared to baseline. The baseline monthly average incoming English-language calls was 1,222, while the implementation monthly average volume of calls was 918. A similar pattern was seen in the Spanish line as the monthly baseline period average was 224 while the implementation period average was 211. It was observed that speed of answer also decreased from the baseline to implementation period in both languages. Out of the 696 families, some repeated, that made their appointments online, a majority (646), received at least one text message confirming their appointment.

### **Baseline Participant Survey**

There were 126 responses to the baseline survey, which was a 76.8% response rate. A majority of the 126 participants (115) made their appointment over the phone, and the remainder (11) made appointments by walking into the clinic. When asked if participants were satisfied with the lobby wait time, 124 out of the 126 families reported that they were either very satisfied or satisfied with the wait time. Similar patterns were identified when asked how easy it was to make the appointment, as 124 also reported that it was very easy or easy to make the appointment by either phone call or walk in. Eighty-four families completed the survey at Catawba County Health Department WIC. 68 participants made their appointments over the phone, followed by 9 participants making their appointments via walk-in, 2 scheduling it via an online portal, and 1 scheduling it at their previous appointment. Similar patterns were seen with 80 families stating they were either very satisfied or satisfied with the lobby wait times and 80 families reporting that it was either very easy or easy to make their WIC appointment. Catawba WIC had an online

form on their website that allowed the family to fill in basic information and have a WIC staff member call to make their appointment (which accounted for the response “Online” to the question of how they made their appointment).

### **Mid-Implementation Participant Survey**

The implementation participant survey response rate fluctuated between 20-30%, with an average of 19.4%. Over the four months that the survey was open, the most common barriers reported to using QLess were that participants did not know about the online system, or they lost the appointment reminder slips with the instructions necessary to make the appointment in a timely manner. Fifty-eight participants that made at least one appointment on QLess during the weeks that the mid-implementation survey was conducted answered additional questions about their attitudes toward QLess and likelihood to use it again. A majority of the 58 participants who booked their appointment using QLess (49) felt that it was extremely easy to use. Open-ended comments regarding the online appointment system included: “Very quick and easy;” “Quick, easy and should continue making appointments this way!;” “It was easy to navigate and book appointment;” and “It was much easier to make it online instead of waiting on the phone when I call.” The remaining testimonials were overwhelmingly positive.

### **Post-Implementation Participant and Staff Surveys**

There was a 23% response rate to the post-implementation survey (44 of the 191 surveys sent). The majority of the respondents (29) stated that they were more likely to use the online appointment system to make their next appointment. When probed, those who stated that they were somewhat or very unlikely to use the online appointment system again reported experiencing technical difficulties or a preference to speak to someone when making their appointments. According to the post-implementation staff survey, the majority of the staff were satisfied with QLess and its assistance with making appointments. In addition, the majority of staff (9 out of 14) were very satisfied with the text message reminder feature online.

### **Impact on Child Retention and Participation**

In general, the participants in the comparison and innovation groups were similar for most demographic characteristics at baseline (T1) and implementation (T2) and over time (Table 17). Although there were statistically significant differences in many characteristics between groups (Cabarrus vs. Catawba) at T1 and T2, there did not appear to be many clinically important. On the other hand, there were potentially important differences by race or ethnicity and SNAP enrollment. Cabarrus at both T1 and T2 had fewer Asian participants (1.1% at T1 and 1.5% at T2) than Catawba (10.4% at T1 and 10.7% at T2), a greater number of Black or African American participants (34.6% at T1 and 35.1% at T2) than Catawba (25.1% at T1 and 24.0% at T2), a greater number of Hispanic participants (35.3% at T1 and 33.2% at T2) than Catawba (19.0% at T1 and 18.6% at T2), a higher proportion of participants with the primary language at home other than English (21.1% at T1 and 17.1% at T2) and a higher proportion of participants enrolled in SNAP (49.2% at T1 and 46.4% at T2) than Catawba (34.8% at T1 and 32.4% at T2).

There were very few notable differences in participant characteristics in each group over time (Table 17). One notable difference was proportion of participants “Ever breastfed”: At T1, 38.2% of Cabarrus and 38.7% of Catawba “Ever breastfed” whereas at T2, 52.1% of Cabarrus and 45.0% of Catawba participants “Ever breastfed.” During both time periods, there were large

proportions of participants with missing data for the variable “Ever breastfed” (between 31 and 52%).

**Table 17.** Demographic Characteristics of Children 0-3 at Cabarrus Health Alliance and Catawba County at baseline (T1) and implementation (T2). Statistically significant differences comparing Cabarrus vs Catawba T1 and Catawba vs Catawba at T2 are in **bold**.<sup>†</sup>

		Baseline (T1)		Implementation (T2)	
		Cabarrus (n=2,324)	Catawba (n=2,561)	Cabarrus (n=2,407)	Catawba (n=2,506)
		%	%	%	%
<b>Category at start of period</b>	<b>IBE*</b>	<b>5.1</b>	<b>6.1</b>	<b>5.2</b>	<b>6</b>
	<b>IBP</b>	<b>6.0</b>	<b>3.6</b>	<b>5.6</b>	<b>3.2</b>
	<b>IFF</b>	<b>29.6</b>	<b>29.6</b>	<b>28.6</b>	<b>27.5</b>
	<b>C1</b>	<b>24.1</b>	<b>24.3</b>	<b>24</b>	<b>26</b>
	<b>C2</b>	<b>18.0</b>	<b>19.6</b>	<b>20.5</b>	<b>20.2</b>
	<b>C3</b>	<b>16.3</b>	<b>16.9</b>	<b>16</b>	<b>17</b>
<b>Number of WIC participants</b>	<b>One</b>	<b>34.9</b>	<b>31.9</b>	34.3	33.3
	<b>Two</b>	<b>34.8</b>	<b>34.4</b>	36.1	35.9
	<b>Three or more</b>	<b>30.3</b>	<b>33.6</b>	27.9	29.1
<b>Race<sup>a</sup></b>	American Indian or Alaska Native	<b>0.1</b>	<b>0.4</b>	0.2	0.3
	<b>Asian</b>	<b>1.1</b>	<b>10.4</b>	<b>1.5</b>	<b>10.7</b>
	<b>Black or African American</b>	<b>34.6</b>	<b>19.0</b>	<b>35.1</b>	<b>18.6</b>
	Native Hawaiian or Other Pacific Islander	0.1	0.0	0.1	0
	<b>White</b>	<b>66.5</b>	<b>76.8</b>	<b>67.1</b>	<b>75.9</b>
	<b>Hispanic</b>	<b>35.3</b>	<b>25.1</b>	<b>33.2</b>	<b>24</b>
Enrolled	<b>TANF</b>	0.7	0.3	<b>0.8</b>	<b>0.2</b>
	<b>SNAP</b>	<b>49.2</b>	<b>34.8</b>	<b>46.4</b>	<b>32.4</b>
	<b>Medicaid</b>	<b>91.3</b>	<b>95.7</b>	<b>92.4</b>	<b>95.1</b>
<b>Primary language other than English</b>		<b>21.1</b>	<b>11.1</b>	<b>17.1</b>	<b>11.1</b>
<b>Ever breastfed</b>	<b>Yes</b>	<b>38.2</b>	<b>38.7</b>	<b>52.1</b>	<b>45.0</b>
	<b>No</b>	<b>11.3</b>	<b>9.0</b>	<b>16.5</b>	<b>17.0</b>
	<b>Missing</b>	<b>50.5</b>	<b>52.3</b>	<b>31.4</b>	<b>38.0</b>
Household size <sup>b</sup>	0-4	53.5	55.4	55.0	55.7
	Greater than or equal to 5	45.0	43.6	42.5	43.0

<sup>†</sup> Chi-square tests were used to compare distributions of categories for each demographic characteristic between groups at each time point. Bold print indicates difference between innovation groups at T1 or differences between innovation groups at T2.

\* Abbreviations: IBE: Infant, exclusive breastfeeding; IBP: Infant, partial breastfeeding; IFF: Infant, formula feeding; C1: Child category 1 (one year old); C2: Child category 2; C3: Child category 3; TANF: Temporary Assistance for Needy Families; SNAP: Supplemental Nutrition Assistance Program.

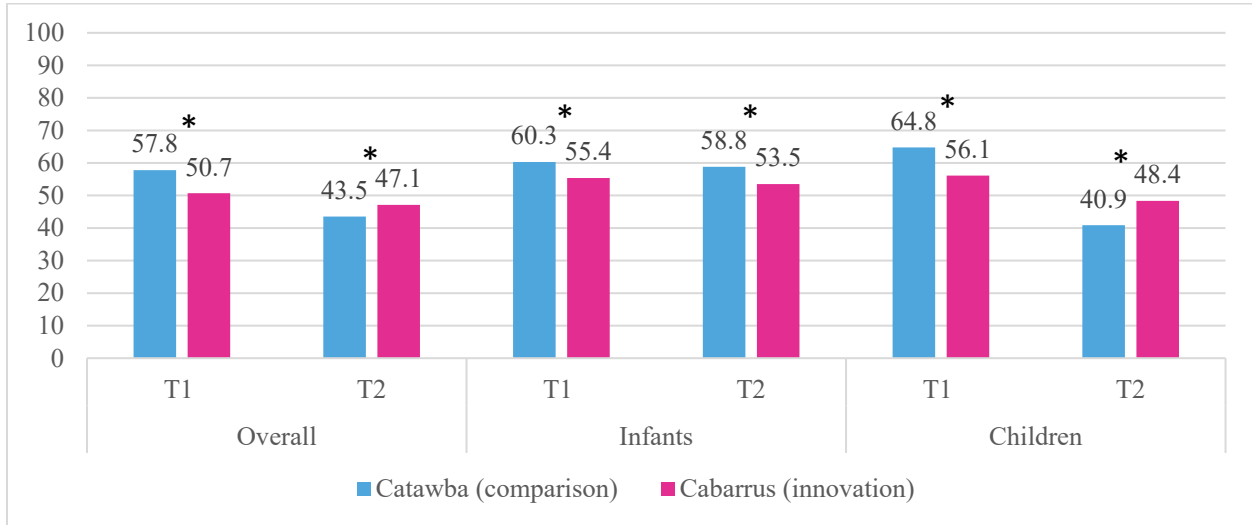
<sup>a</sup> Participants can respond to more than one category so the total percentage may be greater than 100.

<sup>b</sup> Of the 2,324 participants at Cabarrus Health Alliance and 2,561 at Catawba County during T1, 41 (1.8%) and 22 (0.9%), respectively, were missing data for this variable. Of the 2,407 participants at Cabarrus and 2,506 participants at Catawba during T2, 61 (2.5%) and 34 (1.4%), respectively, were missing data for this variable.

## Recertification

The crude, unweighted proportion of infants and children recertified in Cabarrus and Catawba during baseline (T1) were significantly different (50.7% and 57.4%, respectively); the proportions recertified during implementation (T2) were significantly different (47.1% and 43.5%, respectively) (Figure 47). This was also true when studying infants and children separately. For overall cases and children, the percentage recertified during T2 was significantly

higher in Cabarrus than in Catawba (Figure 47). For infants, the percentage recertified in T2 was significantly higher in Catawba than in Cabarrus (Figure 47). For sample sizes of these groups, see Appendix O. Table 9.

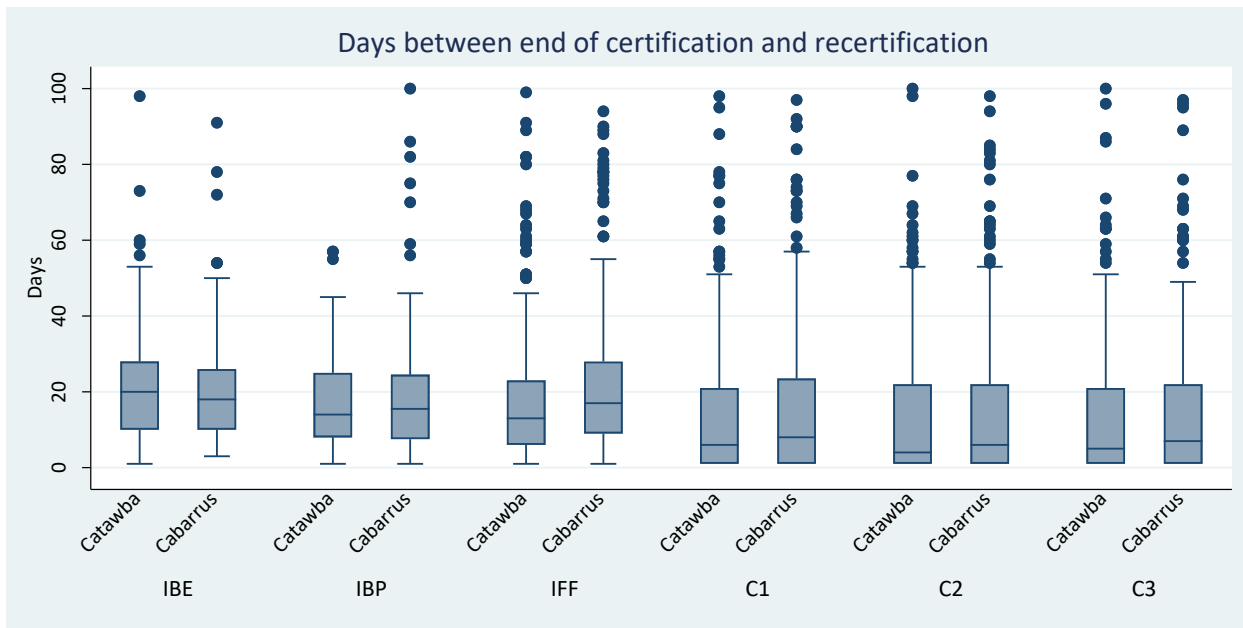


**Figure 47.** Proportion recertified (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Catawba and Cabarrus. \* $p < 0.05$ .

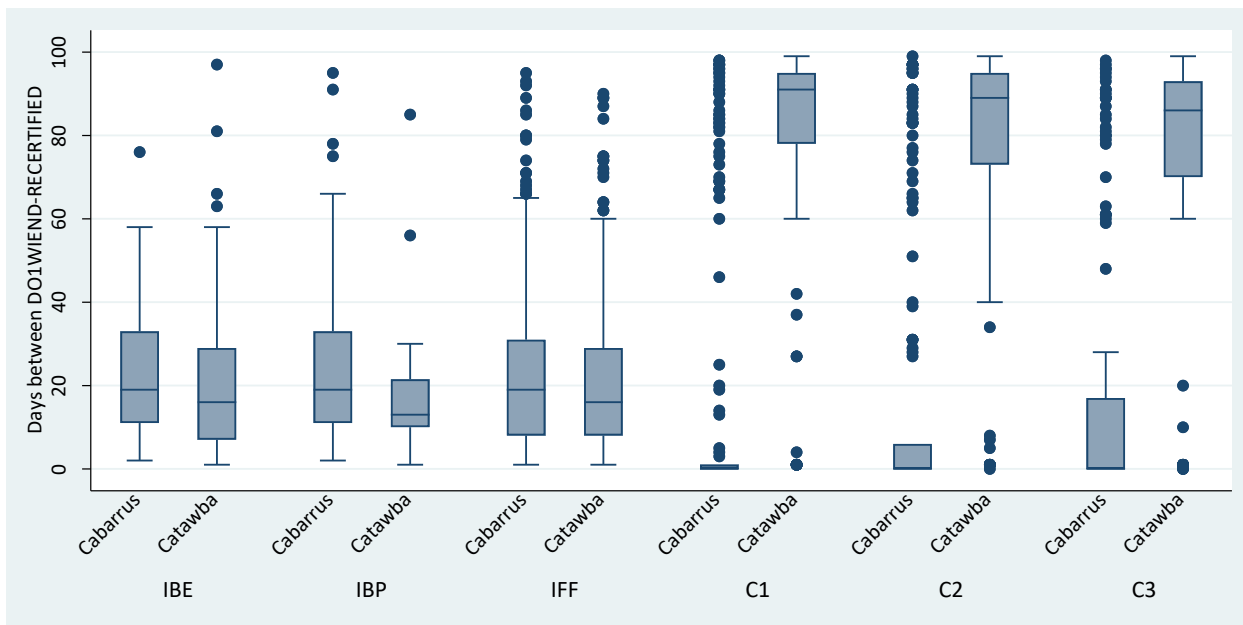
### Timeliness of Recertification

The median number of days between the end of the prior certification and recertification date during the baseline period was 13 (IQR 4, 29) for Cabarrus and 11 (IQR 1, 25) for Catawba. In Cabarrus, median number of days ranged from 9 among C1s and C2s to 19 among IBEs; in Catawba, median number of days ranged from 5 among C2s to 21 among IBEs (Figure 48). Over 87% of recertifications during baseline were “timely” (i.e., less than 60 days after the end of the last certification period) at Cabarrus, and 92% of recertifications at Catawba were timely during baseline.

The median number of days between the end of the prior certification and recertification date during the implementation period was 19 (IQR 0, 91) for Catawba and 85 (IQR 19, 114) for Cabarrus. In Catawba, median number of days ranged from 19 among IBEs and IFFs to 106.5 among C3s; in Cabarrus, median number of days ranged from 1 among C1s and C2s to 22 among IBPs (Figure 49). Over 67% of recertifications at Cabarrus and over 42% of recertifications at Catawba were timely during T2.



**Figure 48.** Number of days between end of certification and recertification by participant category at Cabarrus and Catawba during baseline (T1) (truncated at 100 days)

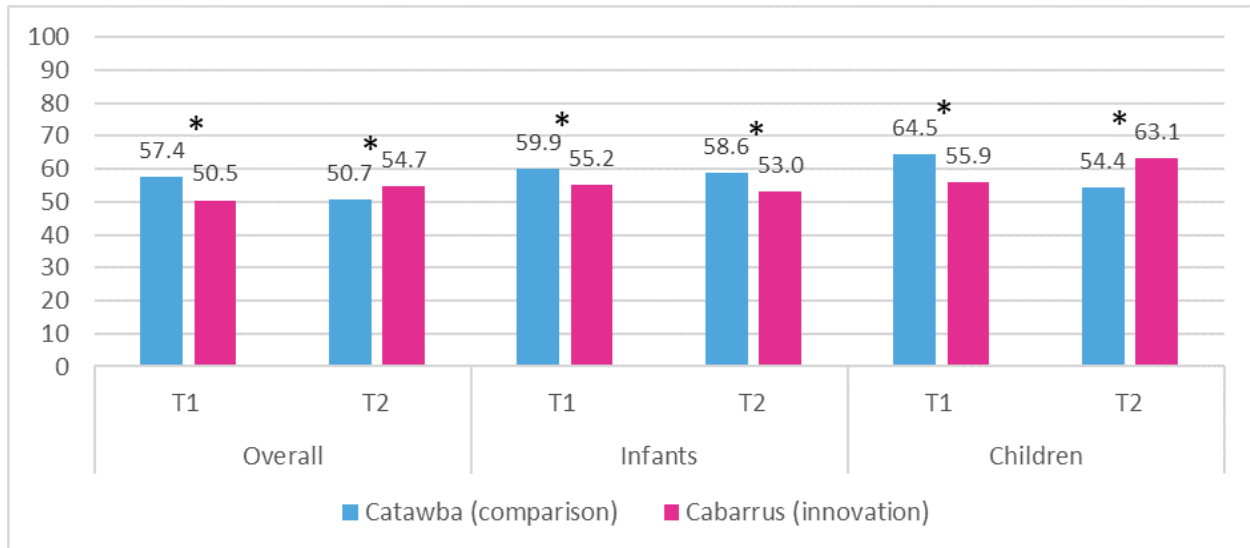


**Figure 49.** Number of days between end of certification and recertification by participant category at Cabarrus and Catawba during implementation (T2) (truncated at 100 days)

**Retention**

Overall, and for infants and children, the differences between Cabarrus and Catawba were statistically significant during T1 (Figure 50). The proportion of participants retained was significantly higher for Catawba than Cabarrus overall (57.4% vs 50.5%, respectively), among infants (59.9% vs 55.2%, respectively), and among children (64.5% vs. 55.9%). However, during

the implementation (T2), the proportion of participants retained was significantly higher for Cabarrus than Catawba overall (57.7% vs 50.7%, respectively), and among children (63.1% vs. 54.4%). The proportion of infants retained was significantly higher for Catawba than Cabarrus during implementation (58.6% vs. 53.0%) (Figure 50).



**Figure 50.** Proportion retained (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Cabarrus and Catawba. \* $p < 0.05$ .

### Participation (i.e., benefit issuance)

The median number of months of benefit issuance for all participants during baseline (T1) in Cabarrus was 7 (IQR 2, 11) and in Catawba was 8 (IQR 3, 11). This was out of 12 months (Table 18). During T2, the median number of months of benefit issuance for both Cabarrus and Catawba was 12 (out of 12) (IQR 8, 12). The average percentage of the cohort issued benefits throughout the years was higher in T2 (81.7% in Cabarrus and 81.6% in Catawba) than T1 (54.4% in Cabarrus and 59.8% in Catawba). Differences were not tested for statistical significance.

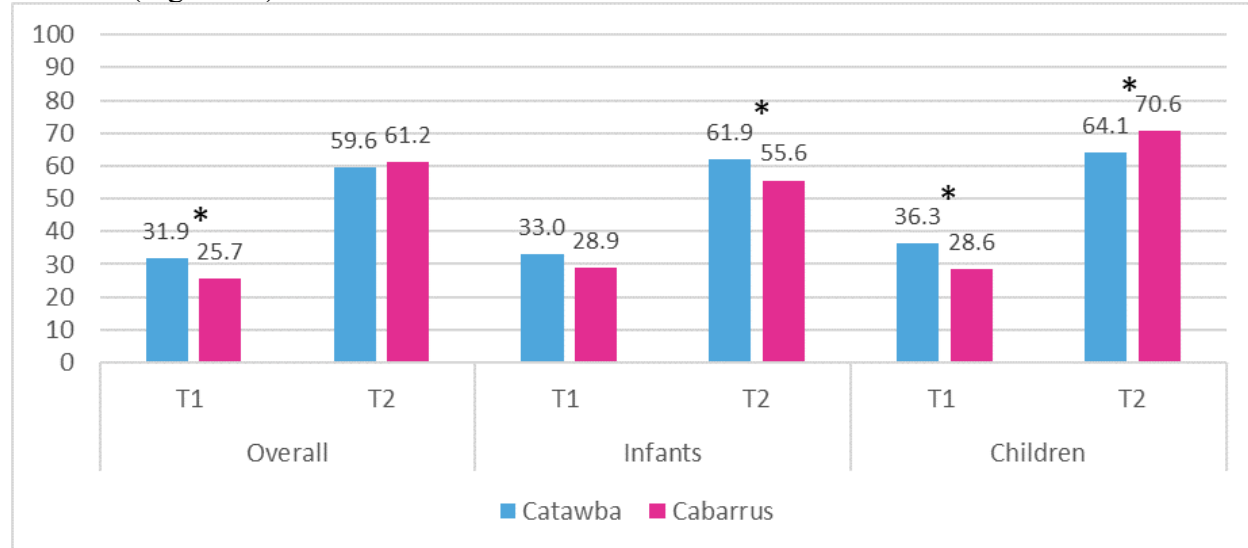
**Table 18.** Benefit Issuance in Cabarrus and Catawba during Baseline and Implementation

Agency/Group	Baseline (T1)		Implementation (T2)	
	Cabarrus	Catawba	Cabarrus	Catawba
Months of benefit issuance (median, IQR)	7 (2, 11)	8 (3, 11)	12 (8, 12)	12 (8, 12)
Percent of cohort issued benefits (%)	54.4	59.8	81.7	81.6

The pattern evident in the crude, unweighted comparisons of recertification and retention in Cabarrus and Catawba during T1 and T2 was also evident when studying the crude, unweighted proportion of the samples that had high rates of benefit issuance (11-12 months). For overall and children during T1, Cabarrus had lower proportions of participants with high rates of benefit issuance than Catawba. For infants during T1 there was no significant differences in benefit issuance between Cabarrus and Catawba. During T2, overall there was no significant difference in benefit issuance between Cabarrus and Catawba; infants benefit issuance was lower for



Cabarrus than for Catawba and for children benefit issuance was higher for Cabarrus than Catawba (Figure 51).



**Figure 51.** Proportion with continuous benefit issuance (11-12 months) (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Cabarrus and Catawba. \* $p < 0.05$ .

### Balancing the groups using PSW

The greatest differences in characteristics between Cabarrus in T1 and T2 were primary language other than English, SNAP participation, and Hispanic ethnicity (all with an absolute standardized difference greater than 0.05) (see Appendix P. Figure 13.). The absolute standardized difference mean across all characteristics was 0.04. After propensity score weighting, these absolute standardized differences were all reduced to below 0.05 with the exception of American Indian/Alaska Native (ASD 0.051). The absolute standardized difference mean after weighting was 0.01. For ASDs for infants and children separately, see Appendix P. Table 5.

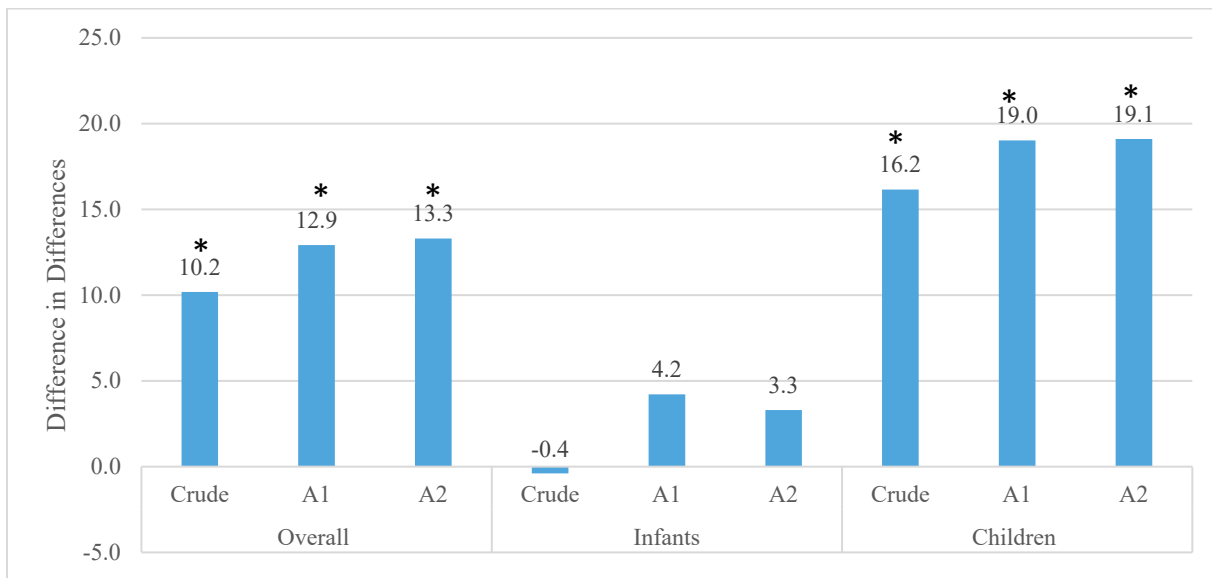
The greatest differences in characteristics between Cabarrus at T1 and Catawba at T1 were being Asian, being Black, being White, being Hispanic, speaking a primary language other than English, need for a translator, participation in SNAP and participation in Medicaid (with all absolute standardized differences greater than 0.1) (Appendix P: Figure 14). The absolute standardized difference mean across all characteristics was 0.18. After propensity score weighting, these absolute standardized differences were all reduced to below 0.05 with the exceptions of American Indian/Alaska Native (ASD 0.09) and primary language other than English (ASD 0.07). The absolute standardized difference mean after weighting was 0.03. For ASDs for infants and children separately, see Appendix P: Table 5.

The greatest differences in characteristics between Cabarrus at T1 and Catawba at T2 were being Asian, being Black, being White, being Hispanic, speaking a primary language other than English, need for a translator, participation in SNAP and participation in Medicaid (with all absolute standardized differences greater than 0.1) (Appendix P: Figure 15). The absolute standardized difference mean across all characteristics was 0.18. After propensity score weighting, these absolute standardized differences were all reduced to below 0.05. The absolute

standardized difference mean after weighting was 0.02. For ASDs for infants and children separately, see Appendix P: Table 5.

### DID analyses

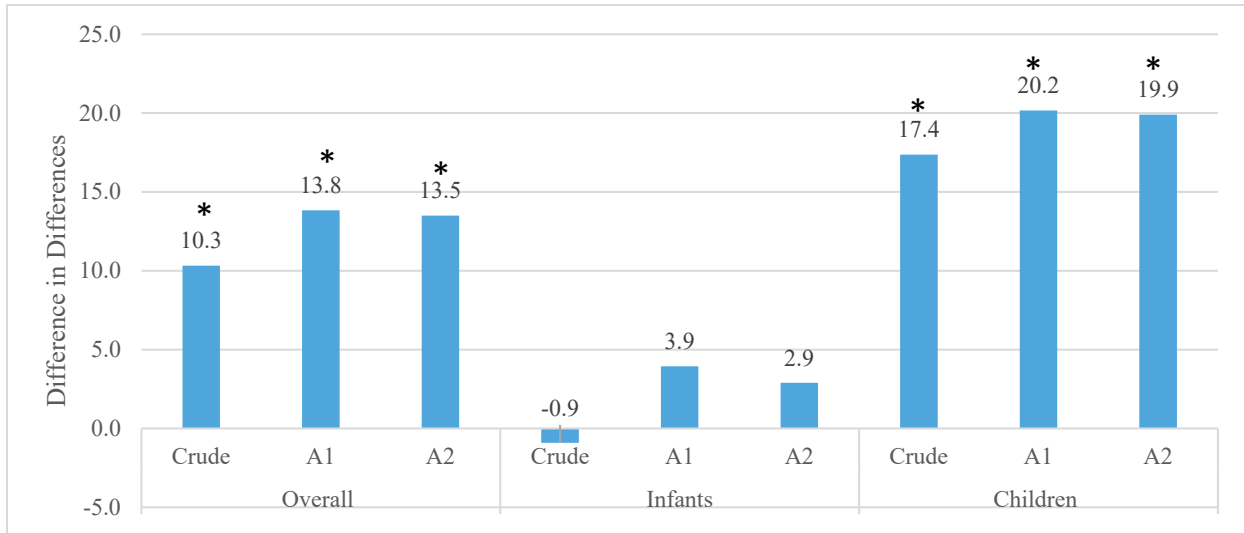
Using the unweighted data and a crude (unadjusted) DID analysis, being in Cabarrus was associated with a 10.2% increase in recertification overall (95% CI: 6.2%-14.1%), a 0.4% decrease in recertification among infants (95% CI: -6.7%-5.9%), and a 16.2% increase in recertification among children (95% CI: 11.1%-21.2%) (overall and differences among children were statistically significant) (Figure 52, Table 19). Using weighted data and the adjusted Model A1, being in Cabarrus was associated with a 12.9% increase in recertification overall (95% CI: 8.2%-17.6%), a non-significant 4.2% increase in recertification among infants (95% CI: -3.5%-11.9%), and a significant 19.0% increase in recertification among children (95% CI: 13.1%-24.9%). Using weighted data and the adjusted model 2 (A2), being in Cabarrus was associated with a 13.3% increase in recertification overall (95% CI: 9.4%-17.2%), a non-significant 3.3% increase in recertification among infants (95% CI: -3.0%-9.6%), and a 19.1% increase in recertification among children (95% CI: 14.0%-24.2%). For the sample sizes of each of these groups, see Appendix O: Table 10.



**Figure 52.** Percentage point differences in recertification between Cabarrus and Catawba overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \*p < 0.05.

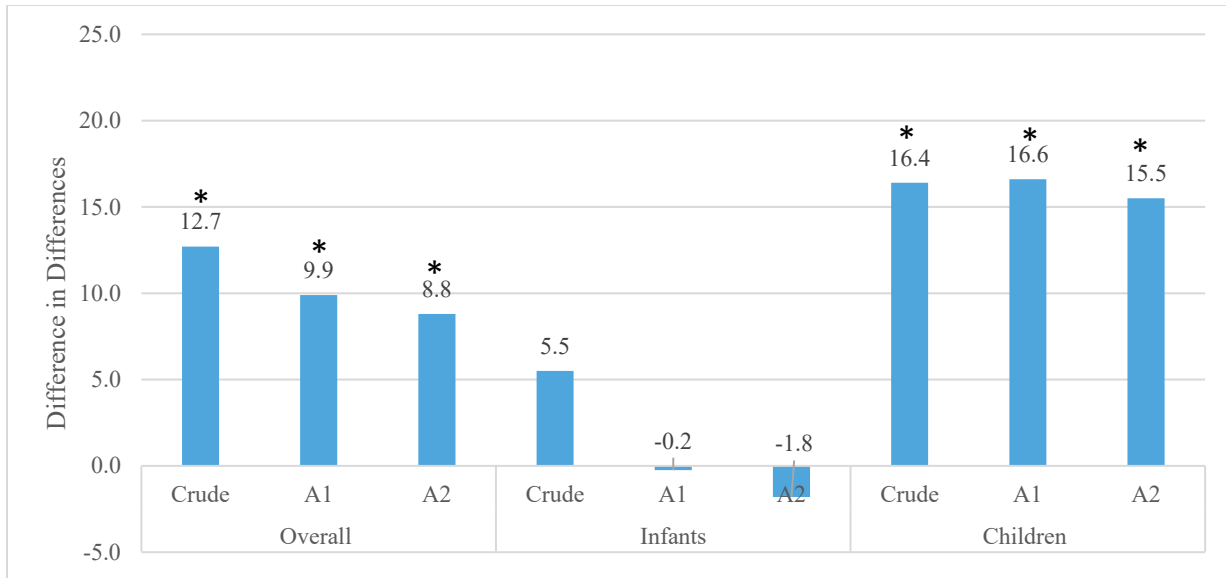
Using the unweighted data and a crude (unadjusted) DID analysis, being in Cabarrus was associated with a 10.3% increase in retention overall (95% CI: 6.3%-14.3%), a -0.9% decrease in retention among infants (95% CI: -7.3%-5.4%), and a 17.4% increase in retention among children (95% CI: 12.4%-22.4%) (Figure 53, Table 19). Using weighted data and the adjusted

Model A1, being in Cabarrus was associated with 13.8% increase in retention overall (95% CI: 9.1%-18.5%), a non-significant 3.9% increase in retention among infants (95% CI: -3.7%-11.6%), and a 20.2% increase in retention among children (95% CI: 14.3%-26.1%). Using weighted data and the adjusted Model A2, being in Cabarrus was associated with a 13.5% increase in retention overall (95% CI: 9.6%-17.4%), a non-significant 2.9% increase in retention among infants (95% CI: -3.4%-9.2%), and a 19.9% increase in retention among children (95% CI: 14.8%-25.0%). For the sample sizes of each of these groups, see Appendix O: Table 10.



**Figure 53.** Percentage point differences in retention between the Cabarrus and Catawba overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \*p < 0.05.

Using the unweighted data and a crude (unadjusted) DID analysis, being in Cabarrus was associated with a 7.7% increase in continuous benefit issuance overall (95% CI: 3.9%-11.5%), a non-significant -2.3% decrease in continuous benefit issuance among infants (95% CI: -8.4% to 3.8%), and a 14.3% increase in continuous benefit issuance among children (95% CI: 9.5% to 19.1%) (Figure 54, Table 19). Using weighted data and the adjusted Model A1, being in Cabarrus was associated with a 9.9% increase in continuous benefit issuance overall (95% CI: 5.3% to 14.5%), a negligible 0.2% increase in continuous benefit issuance among infants (95% CI: -7.7% to 7.2%), and a 16.6% increase in continuous benefit issuance among children (95% CI: 10.9% to 24.4%). Using weighted data and the adjusted Model A2, being in Cabarrus was associated with a 8.8% increase in continuous benefit issuance overall (95% CI: 5.1% to 12.5%), a negligible -1.8% decrease in continuous benefit issuance among infants (95% CI: -7.9% to 4.3%), and a 15.5% increase in continuous benefit issuance among children (95% CI: 10.8% to 20.2%). For the sample sizes of each of these groups, see Appendix O: Table 10.



**Figure 54.** Percentage point differences in continuous benefit issuance between Cabarrus and Catawba overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for DID; A2: PSM-DID using Kernel for propensity score matching (PSM) and probit for DID with repeated cross-sectional option. \* $p < 0.05$ .

**Table 19.** Difference-in-Difference Weighted Results for Recertification, Retention, and Benefit Issuance Using Crude and Two Adjusted Models Overall and for Infants and Children at Cabarrus and Catawba

	Beta	Overall 95% CI		beta	Infants 95% CI		beta	Children 95% CI	
Recertification (crude, unweighted)	0.1018	0.0623	0.1414	-0.0039	-0.0674	0.0595	0.162	0.111	0.212
Retention (crude, unweighted)	0.1033	0.0639	0.1426	-0.009	-0.073	0.054	0.174	0.124	0.224
Benefit issuance (crude, unweighted)	0.077	0.0392	0.1148	-0.023	-0.084	0.038	0.143	0.095	0.191
Recertification Model A1	0.1293	0.082	0.176	0.042	-0.035	0.119	0.190	0.131	0.2492
Model A2	0.133	0.0938	0.172	0.033	-0.0297	0.096	0.191	0.14	0.242
Retention Model A1	0.138	0.091	0.185	0.039	-0.037	0.116	0.202	0.143	0.261
Model A2	0.135	0.0958	0.174	0.029	-0.0337	0.092	0.199	0.148	0.250
Continuous benefit issuance Model A1	0.099	0.053	0.145	-0.002	-0.077	0.072	0.167	0.109	0.224
Model A2	0.088	0.0508	0.125	-0.018	-0.0788	0.043	0.155	0.108	0.202

## **Dissemination**

Disseminating project learnings was a primary objective of HPRIL. The HPRIL team developed a dissemination plan which specified target dates, lead contributors, and pertinent notes for all dissemination products (see Appendix Q). The plan included proposed presentations and written products authored by the HPRIL team as well as those led by the local agencies. The dissemination plan was conceptualized as a living document that was updated periodically as opportunities become available, further details about conferences were published and dissemination products were finalized.

### *Local Agency Needs Assessment*

In addition to providing guidance and support to the five funded subgrantee agencies, HPRIL also sought to build capacity among local WIC agencies across the country to enable them to effectively implement and evaluate retention-related projects and disseminate findings. In order to gauge current levels of experience with and interest in the development, implementation, and evaluation of retention-related projects among local WIC agencies, HPRIL developed a brief needs assessment survey (see Appendix R). The goals of the survey were to describe local WIC agencies' perceived level of experience with these activities and to determine what technical assistance (TA) they need to support them in their innovation efforts.

Overall, the survey findings indicated that despite the adoption of a growing number of strategies aimed at addressing participant retention at the local level, there remains a gap in consistent evaluation and dissemination of findings. In terms of guidance, the findings indicate that areas of particular interest include: Creating a logic model, developing a project idea, interpreting and using results (and data more broadly), and developing process and outcome evaluations. For a summary of the local agency needs assessment survey findings, see the PowerPoint slide deck in Appendix S. The survey finding results, in combination with HPRIL's experience working with the five funded agencies over the course of three years, indicated that a resource guide providing instruction and tools for implementing and evaluating innovative projects would be useful to WIC agencies. Thus, HPRIL developed an interactive online resource guide for WIC agencies interested in learning more about developing and evaluating innovative projects in their agencies.

### *Resource Guide*

[Implementing and Evaluating Innovation Projects: A Resource Guide for Local WIC Agencies](#) is designed to be used by state and local agencies (with an emphasis on local agencies) to develop, implement, and evaluate their own innovative project. Resources in the web-based guide include templates, guidance documents, training materials, data collection tools, and videos used throughout the HPRIL project and were developed by HPRIL and the five subgrantee agencies.

The guide is divided into four sections:

1. Project development
2. Implementation
3. Evaluation
4. Dissemination

**HPRIL**

# Implementing and Evaluating Innovation Projects: A Resource Guide for Local WIC Agencies

**IN THIS SECTION** | INTRODUCTION | PROJECT DEVELOPMENT | IMPLEMENTATION | EVALUATION | DISSEMINATION | TOOLS AND TEMPLATES

Home > Departments > Population, Family and Reproductive Health > Research and Practice > Life Course Framework > Child Health > Women, Infants and Children Program (WIC) > HPRIL > HPRIL - Resource Guide for Local WIC Agencies

## OVERVIEW

The Hopkins Participant Research Innovation Laboratory for Enhancing WIC Services (HPRIL) supports WIC agencies to design innovative tools aimed at retaining at-risk children and evaluates the impact of the innovative tools on child retention. The purpose of this resource guide is to assist local WIC agencies in developing, implementing, and evaluating innovative projects aimed at improving the WIC participant experience and increasing participant retention. The types of resources contained in this guide include templates; sample tools; guidance documents; sample marketing materials; and creative examples. Some of these resources have been developed by the HPRIL team at JHU; others have been adapted from the [HPRIL local agency subgrantees](#). The guide includes an introduction as well as sections for project development, implementation, evaluation, and dissemination.



**1- INTRODUCTION**      **2- PROJECT DEVELOPMENT**      **3- IMPLEMENTATION**

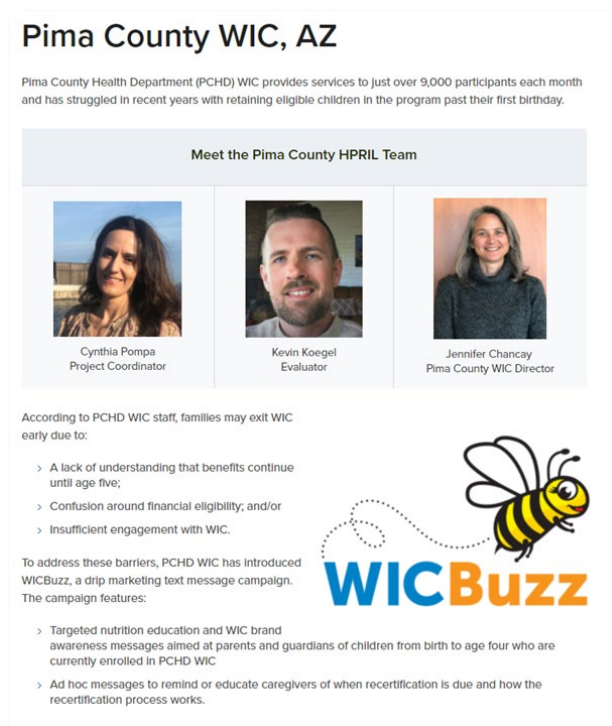
**4- EVALUATION**      **5- DISSEMINATION**      **6- TOOLS AND TEMPLATES**

**Figure 55.** HPRIL Implementing and Evaluating Innovation Projects: A Resource Guide for Local WIC Agencies webpage.

The organization of the resource guide is meant to serve as a step-by-step process for agencies to use when considering launching a new innovative tool aimed at retaining WIC participants. The resource guide was launched in October 2022.

### *HPRIL Website and Blog*

The [HPRIL website](#) was used throughout the project to share updates and findings. Launched in 2019, the website includes our project background and overview, instructions for requesting technical assistance from the HPRIL team, details about the HPRIL Advisory Board, and contact information for the HPRIL team. We used the website in March 2019 to publicize the notice of the awards for the five innovation projects.



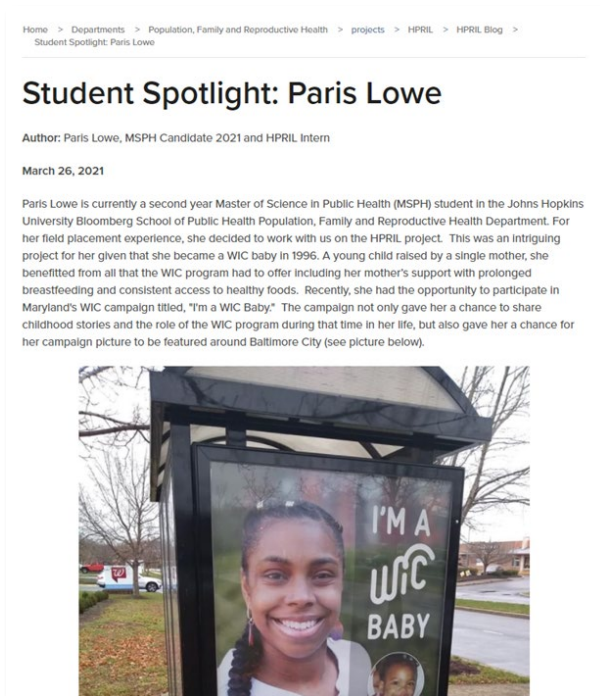
**Figure 56.** HPRIL Example of Subgrantee Webpage.

The website was updated in 2020 to include detailed descriptions of the five sub-grantee projects, including photos of team members and direct quotes describing their motivations, successes, and other aspects of their project. We also added a description of how COVID-19 has impacted the local agency projects.

In 2021, HPRIL launched a [blog](#) as a mechanism to share more frequent project updates. The blog features posts written by members of the HPRIL team as well as representatives of the local agencies. Each time a new post was added, we shared it with an email distribution list that included subgrantees and their state agencies, USDA, the JHSPH Department of Population,



Family, and Reproductive Health, the WIC Access Group, the HPRIL advisory board, and other partners. Between March 2021 and September 2022, nine posts were added to the blog. In December 2021, HPRIL was featured in the JHSPHS Population, Family, and Reproductive Health (PFRH) e-newsletter. The piece provided an overview of the HPRIL project and highlighted our presentation at the 2022 NWA Technology Conference.



### *Conference Presentations and Webinars*

Throughout the project, HPRIL seized opportunities to share HPRIL learnings with external audiences through conference presentations and webinars. HPRIL presentations included the following:

- *Hopkins/USDA Participant Research Innovation Lab for Enhancing WIC Services (HPRIL)* presented to HER NOPREN WIC Retail Research Learning Collaborative, February 2020.
- *Capacity Building for Local WIC Agency Evaluation of Innovative Projects* presented at National WIC Association 2021 Virtual Annual Conference in June 2021
- *Local Agencies Launch Technology Innovations to Enhance the WIC Participant Experience* presented at NWA 2021 Virtual Technology Conference in October 2021 (panel including representatives from JHU and local WIC agencies)
- *The Impact of Participant-Centered Innovations on Child Retention and Participation in WIC: Results of the HPRIL Project* presented to HER NOPREN WIC Learning Collaborative in September 2022
- *Local Innovations in Participant Engagement Improve Child Retention and Participation in WIC* presented at NWA's 2022 Nutrition Education and Breastfeeding Conference in September 2022 (panel including representatives from JHU and local WIC agencies)



- *The Impact of Participant-Centered Innovations on Child Retention and Participation in WIC: Results of the HPRIL Project* presented at the WIC Access Group video call meeting in October 2022
- *Implementing and Evaluating Innovation Projects: A Resource Guide for Local WIC Agencies* presented to National WIC Association during a webinar in November 2022

All slides can be found in Appendices T-Z. Subgrantee-led presentations at conferences and other meetings (6 total) can be found in Appendices AA-JJ.

### *Manuscripts*

Submitting manuscripts to peer-reviewed journals has been a key dissemination activity for HPRIL.

### **Systematic Review of Digital Marketing Techniques**

To assess the current evidence base for digital marketing techniques like those used in Miami-Dade County and Pima County, HPRIL led a systematic review of social media marketing techniques. This review aimed to identify types of digital marketing strategies used by community-serving organizations (like WIC) to promote healthy behaviors and to describe the degree of consumer engagement with and acceptability of the strategies. The population of interest included low-income pregnant women, parents, and caregivers of young children and adolescents. This systematic review manuscript was submitted to the Journal of Medical Internet Research (JMIR) in July 2022 and published in February 2023. Eppes EV, Augustyn M, Gross SM, Vernon P, Caulfield LE, Paige DM. Engagement With and Acceptability of Digital Media Platforms for Use in Improving Health Behaviors Among Vulnerable Families: Systematic Review. *J Med Internet Res.* 2023;25:e40934. Published 2023 Feb 3. doi:10.2196/40934at

### **Feasibility and Acceptability of What Matters to You**

The HPRIL team worked closely with Public Health Solutions to develop a manuscript presenting the results of their qualitative research about the acceptability of *What Matters to You?* (WMTY) as well as the data describing the feasibility and reach of the innovation. The team reviewed and provided feedback on several drafts of the manuscript. It was submitted in July 2022 to the Journal of Nutrition, Education, and Behavior and is now under revision in preparation for submission to the Maternal and Child Health Journal.

### **Additional Manuscripts**

HPRIL continues to collaborate with the subgrantee agencies on manuscripts for publication. These manuscripts will describe the innovative projects and their evaluation findings.

## **Special Project Grants Technical Assistance**

One of HPRIL's primary objectives was to provide technical assistance (TA) to USDA/FNS WIC Special Project Grant (SPG) state WIC agency grantees. Early in the project, HPRIL conducted an assessment of the SPG needs and established a TA request process. In total, HPRIL received five requests from three USDA/FNS awardees, including Arkansas WIC, South Dakota WIC, and Tufts University. HPRIL provided TA in the form of phone calls and written guidance. TA topics included collecting, interpreting and presenting data, establishing data-sharing

agreements, providing trainings and protocols to ensure proper data collection, and evaluation planning.

## Closeout Meeting

The Hopkins Participant Research Innovation Laboratory for Enhancing WIC Services (HPRIL) hosted our Closeout Meeting on Monday, July 18 from 10:00am-5:00pm ET via Zoom. This meeting was an important opportunity for the HPRIL team and subgrantees to share the HPRIL methodology and findings with key stakeholders and to engage in discussions regarding the implications of the findings. Fifty-eight (58) colleagues participated in the meeting, including representatives from the HPRIL team at the Johns Hopkins University Bloomberg School of Public Health (JHU), the subgrantee agencies, USDA Food and Nutrition Service (FNS), and the HPRIL advisory board (see Table 20 below).

**Table 20.** Stakeholder category of attendees at closeout meeting

Stakeholder category	Number of attendees
HPRIL team at JHU	10
Subgrantee Agency	16
USDA/FNS	24
HPRIL Advisory Board	4
Unspecified	4

The HPRIL team designed the agenda (see Appendix FF) to include time for each subgrantee to present on their innovative tool methodology and findings as well as time for the HPRIL team to present methods and results of the overall project. The subgrantee presentations focused on innovative tool design and implementation, process and short-term outcome evaluation results, lessons learned, sustainability beyond the funding period, and recommendations. In the months leading up to the meeting, HPRIL provided guidance to the subgrantees regarding the requirements for the closeout presentations, including a PowerPoint template for them to use. HPRIL also hosted virtual “dry-runs” with all five local agencies the week prior to the closeout meeting. This provided an opportunity for HPRIL to assist the local agencies in streamlining their presentations and focusing on the most salient details.

The HPRIL presentations at the closeout meeting focused on the methods we used to support the local agencies and evaluate the impact of the innovative tools on child participation and retention, impact evaluation results, process evaluation findings, lessons learned, and recommendations. The HPRIL team also provided time at the end of the meeting for USDA/FNS to provide remarks summarizing their response to the presentations, results, anticipated application, and ramifications for USDA/FNS programming.

### Subgrantee Survey

A post-meeting survey of subgrantees (n=10) assessed satisfaction with and perceived usefulness of HPRIL’s training and technical assistance activities, including the Closeout Meeting (see Appendix M). Overall, respondents were very satisfied with the Closeout meeting and felt prepared to share their findings. Subgrantees would have appreciated more individualized feedback from USDA/FNS and would have liked to spend more time discussing the

sustainability of each of the local projects. For a summary of the feedback received about the closeout meeting, see Appendix GG.

## **Implications of Results**

Retention of children in WIC has long been recognized as a national and a local problem. HPRIL, in partnership with participating HPRIL subgrantees, successfully completed a rigorous evaluation of the impact of local WIC agency innovations on child participation and retention. Four of the five innovations significantly improved child participation and retention, and each HPRIL subgrantee provided important information on innovations that aim to improve WIC participation and retention among children through engagement strategies and improved client services.

The Pima County drip marketing texting WICBuzz campaign positively affected outcomes with 6.7% (4.0%-9.4%) greater recertification, 7.4% (4.7%-10.1%) greater retention and 9.7% (6.9%-12.5%) greater continuous benefit issuance. The opt-out rate for WICBuzz was low, indicating that the frequency and content of the messages were acceptable to participants. Client surveys indicated the text messages added value to the WIC client experience and increased knowledge of healthy eating and WIC. Future implementation research should consider additional functionality (two-way messaging), staffing needs, etc., and replication of the approach in new settings and at scale.

Yavapai County's WIC-in-a-CLICK on-demand video calls negatively affected recertification (-5.8%: -10% to -1.6%) and retention (-8.5%: -12.6% to -4.3%) overall. When examining the proportion of those timely recertified, the results -- although negative -- were largely non-significant, and no differences in continuous benefit issuance were found (-1.3%: -5.6% to 3.0%). Because of the transition to remote services, the barrier to WIC participation addressed by WIC-in-a-CLICK was removed. Further, the relative value of having a phone appointment without pre-scheduling was reduced. Thus, one might expect to estimate no impact of WIC-in-a-CLICK on the outcomes. The findings should be interpreted with caution due to operational differences between the innovation and comparison agencies. To evaluate this innovation as intended (whether immediate phone or by zoom), research should be conducted when in-person services resume.

The Miami-Dade integrated media marketing campaign increased recertification by 5.3% (3.4%-7.1%), retention by 5.5% (3.6%-7.3%), and continuous benefit issuance by 5.9% (3.9%-7.9%). The impact of the campaign was qualitatively stronger for infants than for children. The project was not designed to target families with infants as opposed to children. Families with infants may be more active on social media than families with children and thus more likely to be exposed to the campaign components via Google searching and social media. The results provide evidence that targeted social media campaigns can improve participation and retention in WIC. The social media key performance indicators demonstrate that custom local content performed the best. Future research should evaluate impact on enrollment in WIC of all potential participants (beyond infants and children).

The PHS WMTY and Unite Us referral system had a positive impact on recertification, retention, and continuous benefit issuance in the overall sample of targeted infants and children, but no impact on benefit issuance for infants. Overall retention was 7.4% higher (95% CI: 3.0%-11.9%), 7.0% higher (95% CI: 1.0%-13.0%) among infants, and 7.7% higher (95% CI: 1.0%-14.4%) among children. The results for continuous benefit issuance should be interpreted with caution because of limitations in estimating the outcome during the baseline period. The offering of WMTY occurred for 50% of the targeted sample (“treated”). Additional multiple logistic analyses indicated that offering WMTY was associated with a more than twofold increased likelihood of retention in WIC. Smaller and non-significant effects were seen by whether or not the participant accepted the WMTY conversation. The acceptability of the WMTY conversation was high, but there were limitations in the network structure and operations. Given the positive findings, additional implementation research is warranted.

The CHA QLess innovation had a positive impact on recertification (12.9%: 8.2%-17.6%), retention (13.8%: 9.0%-18.5%), and continuous benefit issuance (9.9%: 5.5%-14.5%). The overall results were driven by differences for children as no impact was detected for infants. The results for recertification and retention should be interpreted with caution because of operational changes at Catawba during the implementation period. The operational changes would have less effect on continuous benefit issuance, and it was 9.9% higher for CHA; large increases in continuous benefit issuance were observed for both local agencies during the implementation period. This project enabled CHA WIC to test an online appointment system and identify limitations and additional tool requirements.

The HPRIL study had several strengths. First, HPRIL was unique in our use of a robust evaluation design to examine the impacts of local WIC innovations on child retention and participation. Second, the cohort approach allowed HPRIL to evaluate WIC outcomes over time similarly across all five projects, and propensity score weighting (PSW) was effectively used to balance participant characteristics. Third, clinic-based process data collected by the local agencies provided context for the MIS-based outcome data. Finally, active engagement from local and state agencies throughout the evaluation was invaluable for data collection and interpretation.

Limitations of the HPRIL study included operational differences between some of the comparison and innovation groups particularly due to COVID which may have compromised the findings (i.e., Yavapai County WIC and Cabarrus Health Alliance). Despite our use of the WIC Minimum Dataset (MDS) to standardize our study variables, not all MDS variables were available through the states’ MIS. The impact analysis had to be adapted for Public Health Solutions, as their project focused solely on infants and one-year-olds (C1). Finally, MIS databases do not frequently contain process-related data such as appointment modality, appointment making platform, and receipt of text messages. For this reason, there was incomplete sample overlap between the clinic process data and the MIS evaluation data.

Of the five innovations, findings suggest that three innovations (Miami-Dade, PHS, and Pima) significantly improved child participation and retention in WIC. These enhanced engagement strategies have the potential to positively impact recertification 6% (4%-7%), retention 6% (5%-7%) and continuous benefit issuance 6% (2%-11%). The reported absolute increases in WIC

child retention and participation are significant from a public health perspective. More research is needed on the impact of the innovations supported by HPRIL to replicate the findings and evaluate beyond local agency level. The results of the HPRIL subgrantee evaluations provide valuable information for decisionmakers to use when considering strategies to increase child participation and retention in the WIC program.

## **Challenges, Lessons Learned, and Recommendations**

### Challenges

In March 2020, the COVID-19 pandemic upended life in the US and around the world. Over the next several weeks and months, WIC agencies across the country worked diligently to adapt their services to meet the needs of their vulnerable clients and remain a reliable community resource during an uncertain time. The provision of federal waivers for certain WIC requirements (such as in-person certification), helped facilitate service delivery adaptation but also had implications for a number of the HPRIL local projects. Cabarrus Health Alliance streamlined their QLess tool to only include online scheduling and not the in-person queue-management system, and Public Health Solutions moved their What Matters to You? conversations to over-the-phone rather than in-person.

The pandemic also caused three subgrantees to delay their implementation start date or pause implementation. All five subgrantees postponed their implementation periods (for data collection purposes) by at least three months. In addition, in recognition of increased strain on state WIC staff during the early months of the pandemic, HPRIL postponed sending the request for MIS baseline data.

To overcome these delays, HPRIL requested and received a one-year project extension from USDA/FNS. This extension provided HPRIL with adequate time to complete all project objectives, including a rigorous evaluation, broad dissemination of findings, and continued technical assistance to subgrantees in their implementation, evaluation, and reporting. HPRIL also provided an opportunity for all subgrantees to request a cost extension to support one additional year of continued engagement with HPRIL and sufficient time to finalize evaluation and disseminate findings.

In addition to challenges related to the COVID-19 pandemic, the receipt of the baseline period MIS datasets was also a challenging process. The process of receiving baseline datasets, checking them for irregularities, providing guidance to state agencies regarding necessary updates, and receiving acceptable datasets from all five agencies took several months longer than anticipated. The implementation period requests were fulfilled in a much timelier manner, as the state agencies had a better understanding of the variables being requested.

Finally, HPRIL discovered while working with New York State that their agency had changed to a new MIS system midway through 2019, meaning their benefit issuance and redemption data for the baseline period was incomplete. This impacted our ability to evaluate the impact of the Public Health Solutions innovation on benefit issuance.

## Lessons Learned

1. *The model of pairing a research institution with local WIC agencies to build their capacity was effective.* The highly technical nature of WIC program administration at the state and local agency level necessitates targeted training and technical assistance for local WIC practitioners to build capacity for interpreting and using the plethora of MIS and other local data to develop, implement, and evaluate the impact of innovative tools on retention and other outcome measures. This model facilitated the establishment of strong partnerships between JHSPH and the Local WIC Agency subgrantees for implementing and evaluating their innovative tools for impact on child retention.
2. *Local WIC agencies would like to be engaged in evaluation but lack knowledge and access.* The findings from the needs assessment survey, in combination with our experience working with the local agency subgrantees, indicate that local WIC agencies are interested in evaluating innovations and using data to improve their programs, but lack access to data and the skills and knowledge necessary for analysis and interpretation. Areas of particular interest include creating a logic model, developing a project idea, interpreting and using results (and data more broadly), and developing process and outcome evaluations.
3. *It is important to obtain agreement from state WIC agencies at the beginning of the project regarding the sharing of WIC MIS data for evaluation.* State WIC agencies have strict protocols regarding the sharing of WIC participant data with external organizations. For this reason, it was important that we communicated the needs of our study with the state agencies well before making the data requests. As part of the HPRIL application process, local agencies were required to include a letter from their state WIC agency indicating willingness to share de-identified MIS data for evaluation purposes. In addition, it is advisable to consider data storage and to establish agreements with the state regarding this issue.
4. *Local agencies appreciate in-person training.* Subgrantees appreciated the opportunity to work directly with HPRIL staff on guided activities and get to know the other grantees at the in-person Training and TA Workshop in 2019. The in-person time not only allowed HPRIL to cover a lot of technical ground related to implementation and evaluation planning but also humanized the project and built subgrantee confidence with implementation and evaluation concepts and practices. Additionally, working together in-person uncovered a range of skill sets from each subgrantee that helped HPRIL provide tailored technical assistance. Due to the COVID-19 pandemic, HPRIL was unable to offer any additional in-person TA opportunities for the duration of the project. The closeout meeting, held in July 2022, was entirely virtual. Several subgrantees noted in their responses to the Post Evaluation of Training Competencies Survey that they would have preferred to attend an in-person meeting.
5. *COIN Calls provided a forum for peer learning.* COIN Calls provided space for subgrantees to discuss lessons learned and reflect on how processes used by other agencies could be integrated into their evaluation and future innovation projects.

6. *WIC agencies are capable of adapting quickly in times of crisis.* State and local WIC agencies sprang into action in the early days of the COVID-19 epidemic here in the US. With waivers from USDA that allowed them to adapt certain procedures including in-person certification, WIC agencies quickly began offering remote services to their clients. The COVID-19 crisis has been challenging for WIC in terms of increased need, lower staffing capacity, and fewer state and local resources, but WIC agencies have done an incredible job to maintain services and welcome new clients. The HPRIL team was impressed with the ability of our subgrantees to simultaneously respond to the COVID-19 crisis and continue to achieve their HPRIL project objectives with an impressive level of fidelity. Although implementation timelines got pushed back slightly as a result of the pandemic, subgrantees ensured that their innovative tools were integrated into the new COVID-19 WIC operations, making modifications as needed. The HPRIL team applauds the energy and eagerness of the subgrantees to implement their projects in the face of unprecedented challenges.
7. *The quasi-experimental study design was key to controlling for unforeseen variables like the COVID-19 pandemic.* Although COVID-19 presented a new and unanticipated variable to our study, we are confident that the robust evaluation design will help us to understand the impacts of each subgrantee’s innovative tools amid the COVID-19 crisis. With a pre-/post design that includes comparison and intervention sites for each subgrantee project, we were able to control for the pandemic response operations changes and the larger context of pandemic economic impacts in the datasets to be able to determine effect of the tool. Careful documentation of WIC operational changes during the COVID-19 pandemic allowed the HPRIL team to align operational changes with different time periods within the data. The data revealed patterns of participation and retention of infants and children pre-implementation, during implementation, and throughout the pandemic.
8. *State WIC MIS systems vary and must be accounted for when designing evaluations.* Working with the four state WIC agencies to develop and update the baseline MIS datasets taught us that, despite the use of the USDA WIC Minimum Dataset (MDS), the way variables are coded varies greatly between states, and not all states collect the same data from participants or in the same way. Some examples include: Arizona’s MIS system does not capture benefit expiration; North Carolina’s MIS system does not differentiate between child participants; and some agencies captured twin or multiple status while others did not. Discrepancies also became evident in the way different WIC agencies categorize children as “active” or “not active.” This required us to understand how each state approached this issue so that we could arrive at a common definition across sites. Studying the data also led us to discover that different agencies follow-up with participants who have missed appointments in different ways. Considering these differences, HPRIL made adjustments to the baseline request as well as our analysis of the datasets.

## Recommendations



HRPIL recommends that:

- Local agencies be encouraged to pilot and evaluate innovations to improve participation and retention.
- Technical assistance (TA) for local agencies to build capacity for evaluation be provided.
- Local agencies are provided with access to their MIS data to evaluate innovations implemented at the local level.
- Partnerships between educational institutions and USDA/FNS to provide TA to build capacity of local agencies to conduct evaluations of retention-related projects be supported and made permanent.
- Local agency efforts to use available data sources for program design, implementation, and evaluation are supported.
- Future research focus on the impact of local innovations developed through the HPRIL project to replicate findings and evaluate beyond the local agency level.

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