An Innovative Online Appointment System to Enhance WIC Services

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CABARRUS HEALTH ALLIANCE

About Cabarrus Health Alliance

Cabarrus Health Alliance (CHA) was created in 1997 as a successor to the Cabarrus County Health Department. CHA serves both suburban and rural low-income residents to improve community health and eliminate health disparities. Public health services include: disease surveillance, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), community education, case management, and environmental health enforcement. Clinical services encompass: pediatrics, dental, women's health, school nursing, and communicable disease services. Parts of Cabarrus County are designated Medically Underserved/Health Professional Shortage Areas in primary, dental, and mental healthcare. It includes three Qualified Opportunity Zones, and over 35% of census tracts are considered USDA Low Income/Low Access (food deserts). A CHA WIC satellite relocated in June 2019 to the Cabarrus Dream Center that is collocated with other agencies assisting low-income residents. Please visit www.cabarrushealth.org for more information.

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Executive Summary

Background

Nationally, WIC participation, specifically in children ages 1 to 4 years, has been on a steady decline since 2011. Similar patterns were seen in the WIC Department at the local level at Cabarrus Health Alliance (CHA) in Kannapolis, North Carolina. Further internal data from the North Carolina management information system (MIS) system, Crossroads, showed from 2014 to 2018 a loss of participation across all categories, with children ages 1 to 4 years representing the largest loss in number and second largest in percentage. In addition, a survey was conducted in 2018 among CHA WIC participants indicating specific barriers. Two identified barriers were making appointments and in-lobby wait times. The CHA-WIC staff observed these barriers as possible reasons why participation has been declining.

Following the data, CHA decided to implement an intervention to better serve WIC families and to facilitate better retention rates.

Description of Innovative Tool

QLess is a queue management system and appointment scheduling tool that is meant to improve efficiency and satisfaction. The goal of QLess is to remove lines and reduce customer wait times, as well as gain important data on participant's habits when making appointments. The system has the ability to customize text messages as well as appointment types.

Project Implementation Description

CHA was selected through a competitive process by the Hopkins/USDA Participant Research Innovation Laboratory for Enhancing WIC Services (HPRIL) to implement an online scheduling system for WIC participants. The appointment system would allow participants to make their appointments with the click of a button instead of waiting on the phone for the next available WIC staff member to assist them. The project team hypothesized that the new appointment system would promote retention in children ages 1 to 4 years.

The implementation of the online appointment system, QLess, spanned across one year (June 2020 to May 2021). During this time period, staff and participants utilized QLess as the main system for appointment making. The number of families who used the system were tracked in a database throughout the year. Pre and post surveys were also conducted during that time.

Impact of COVID-19

Similar to many WIC clinics across the nation, CHA WIC clinics halted all in-person visits in March 2020 and continued to serve participants over the phone for the remainder of the intervention. COVID-19 impacted the ability to educate our participants regarding the online appointment system and precluded the in-office wait time portion of the intervention.

Evaluation Design

The project was evaluated using a mixed methods quasi-experimental design with one innovation agency, CHA WIC and one comparison agency, Catawba County Health Department WIC. Factors considered during evaluation were: implementation capacity, participation rate, staff and

participant satisfaction and retention rate among children ages 1 to 4 years old. Short-term results were evaluated by analyzing phone reports. The data included volume of calls from baseline to implementation period, speed of answer, and number of clicks on the online appointment system. Data was collected by the monthly Mitel Phone System phone report and the program coordinator.

Results

Process Evaluation

The original project proposal had two major goals. One of the goals was met while the other was unable to be implemented due to the COVID-19 pandemic. 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. Barriers were identified by both staff and participants through surveys.

Short-term impact evaluation

Data from the phone reports provided compared to baseline, volume of calls decreased during the implementation period. Additionally, the speed of answer decreased during the implementation period, reflecting a lower volume of calls and less time participants were on hold. Lastly, the number of clicks increased over time during the implementation period reflecting marketing strategies and participant education outreach.

Impact of retention and evaluation

The Cabarrus QLess scheduling innovation appears to have had a positive impact on recertification, retention and continuous benefit issuance, overall and among children. No impact on these outcomes was observed among infants. In adjusted analyses, recertification was 12.9% higher (95% CI: 8.2%-17.6%), retention was 13.8% higher (95% CI: 9.1%-18.5%), and continuous benefit issuance was 9.9% higher (95% CI: 5.3%-14.5%) at Cabarrus Health Alliance than Catawba County

Discussion

Overall, QLess was able to provide flexibility to WIC families and reduce over the phone wait times. In turn, WIC families were served faster and better during the implementation period than at baseline. QLess was able to establish the groundwork for the adoption of an online appointment system (OAS) tool for the CHA WIC clinic and has created sustainable change for the adoption of a similar platform at a reduced price that fits the needs of the clinic. State administrators and local WIC agencies need to work together to launch an online scheduling platform to feed into their MIS system. This will ensure seamless adoptions of the program. Due to limited resources, QLess was unable to work with the MIS system and therefore staff had to work with two systems, making the additional administrative tasks burdensome for staff.

Introduction

Nationally, WIC participation, specifically in children ages 1 to 4 years, has been on a steady decline since 2011. Similar patterns were seen in the WIC Department at the local level at Cabarrus Health Alliance (CHA) in Kannapolis, North Carolina. Further internal data from the North Carolina model information system (MIS), Crossroads, in the calendar year 2018, the most recent data available at the start of the project period, provided additional context. The MIS data reported an annual average of 3,001 participants and 13,990 total appointments. The number of Infant Initial Certification appointments was 954, while Infant Subsequent Certification was 14. Child Initial Certification was 248, while Child Subsequent Certification was 1,833, suggesting that infants are being recertified as children. The overall average show rate, participants who attended their appointment, was 87%, with the lowest for Initial Certification (80%) and Subsequent Certification (83%). Children ages 1 to 4 represent the largest group at an average of 1,380 children. Fully formula-fed infants (614), post-partum women (244), and pregnant women (229) represent the next largest participation categories. CY2018 data reveals that those breastfeeding at some level maintained stable participation; however, participation numbers decreased for non-breastfeeding post-partum women (-53), fully formula-fed infants (-117), and children ages 1-4 (-201).

Data from 2014 to 2018 reveals a trend of lost participation across all categories, with children ages 1-4 representing the largest loss in number and second largest loss in percentage (Appendix A. Table A.1). In addition, a survey was conducted in 2018 among CHA WIC participants exploring specific barriers. Making appointments and long wait times were reported as challenges for WIC participants and could be possible reasons why participation was declining. The survey indicated that WIC participants had more compliments than complaints (84 to 47). Specifically, most complaints (77%) involved booking appointments and wait times and most suggestions were for improvement (71.4%) involving booking appointments and wait times.

Before 2010, CHA WIC operated under a traditional, pre-booked appointment policy. Using this model, staff faced challenges in meeting processing standards, and high no-show rates led to overbooking and long wait times in the lobby. In 2010, CHA instituted an Open Access scheduling policy and a Quality Improvement initiative to restructure the workflow of staff. Under Open Access, a large percentage of appointments (typically 50-90%) were booked the day before, or on the day the appointment is needed. At CHA's offices, nearly 95% of appointments were booked this way; the rest were walk-ins and pre-booked. Participants called in to make appointments, usually between 8:30-9:00 am, when there was three WIC staff available to answer the phone. After 9 am, due to budget and staff cuts, only one staff person was able to answer the phone, and the others began serving participants. While this method has improved the availability of appointments and helped to meet processing standards, it led to frequent participant complaints of busy signals on the phone or being left on hold for long periods. Likewise, staff reported feeling constantly rushed between phones and participants and started each day behind on appointments. In addition, staff reported a large number of appointments were booked, but were unable to be completed because of forgotten paperwork. As a result, participants had to book another appointment at a later date to complete the appointment.

To help address these barriers, CHA decided to implement an intervention to better serve WIC families and to facilitate better retention rates. CHA was selected through a competitive process by the Hopkins/USDA Participant Research Innovation Laboratory for Enhancing WIC Services (HPRIL) to implement an online scheduling system for WIC participants. The appointment system would allow participants to make their appointments with the click of a button instead of waiting on the phone for the next available WIC staff member to assist them.

The online appointment system and queue management have been implemented in other settings (retail, medical, social services) with improved show rates, increased patient satisfaction, and decreased wait time.[1,2,3] A 2018 Pew Research Center survey indicates that nationally, up to 70% of web traffic happens on mobile devices, and 94% of women under the age of 30 own a smartphone. A 2018 study from the University of North Carolina's Population Center found that 76% of North Carolina households have internet access, and 80% of residents lived in a household with internet; in addition, 99.8% of North Carolinians had access to mobile broadband service. A tool that combines Online Appointment System (OAS) with queue management texting, service alerts, and confirmation reminders is technologically feasible and appropriate in Cabarrus County, where the majority of WIC participants are under the age of thirty, own mobile phones/smartphones, and have access to internet. Within this context, as a tool, it is also highly replicable across North Carolina and the United States.

QLess[4] was selected through a competitive process as the online system platform for this project. There were various reasons for its selection, including: ease of appointment-making process for the participant, real-wait time updates, customizable text fields, kiosk check-in system, and ability to be embedded within CHA-WIC's website. The real-wait time updates were an added feature to allow the WIC clinic to understand patterns and enhance participant customer satisfaction with in-lobby wait times. The kiosk check-in system was necessary due to the limited capability of having a receptionist at the front desk. The kiosk allowed participants to check-in in a timely manner. The customizable text message feature was imperative to the project to send accurate information of address and clinic information as CHA-WIC has two locations.

The project team hypothesized that the new appointment system would promote retention in children ages 1 to 4 years. The goals of the project were to 1) document the planning and evaluation of the intervention and 2) improve retention rates among the entire cohort of WIC child participants ages 1 to 4. The logic model is a graphic illustration between the relationship of the project's activities (see Appendix A, Table A.2).

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[1] Houde, D. (2015). Arizona WIC Mobile Online Appointment Scheduling Feasibility Study. Prepared by LifeCycle Delivery for the Arizona Department of Health Services, Arizona WIC Program.
[2] Almomani, I., AlSarheed A. (2016). Enhancing outpatient clinics management software by reducing patients' waiting time. *Journal of Infection and Public Health*, 9(6), 734-743.
[3] Cao, W., Wan, Y., Tu, H., Shang, F., Liu, D., Tan, Z., Xu, Y. (2011). A web-based appointment system to reduce waiting for outpatients: a retrospective study. *BMC health services research*, 11, 318.
[4] QLESS. 2022. QLESS. Retrieved from https://qless.com/?utm_term=qless&utm_campaign=S-Pros-USA-Leads-BRANDED&utm_source=adwords&utm_medium=ppc&hsa_acc=5247522832&hsa_cam=15752613720&hsa_grp=132274744472&hsa_ad=572565624217&hsa_src=g&hsa_tgt=kwd-321190395966&hsa_kw=qless&hsa_mt=e&hsa_net=adwords&hsa_ver=3&gclid=EAIaIQobChMI9Ym3vfy39gIV1eKGCh1vmAI3EAAYASAAEgI5J_D_BwE

Methods

Implementation of Innovative Tool

The innovation site was collectively CHA Kannapolis (primary WIC location) and the CHA Concord location (satellite location). Both locations served WIC CHA participants, and staff are shared between the locations. Catawba County Health Department WIC was selected as the comparison site due to similar county demographics and WIC participant caseload.

The initial five-month planning period consisted of meeting with QLess representatives to execute an online appointment system that best fit CHA WIC staff and its participants. The development period allowed time to create the types of appointments, the number of text messages sent, time increments between text message reminders, text message development, and WIC staff training. Additionally, during this time, pre-implementation data was collected at both innovation and control sites. Lastly, marketing ideas, such as recreating the appointment reminder slip, were developed to ensure accurate information was passed onto WIC participants.

The soft opening of the new appointment system was on December 19, 2019. The soft opening is defined as staff having the ability to make appointments for the participants and the inclusion of the online appointment system on the CHA website. No other advertising was done at that time. Between December 2019 and March 2020, the team sought feedback from WIC participants and staff regarding the online appointment system to better configure the system prior to the official launch of the system.

Innovative Tool

The online appointment system, QLess, was customized to fit the needs of the WIC clinic. The WIC clinic director and Program Coordinator worked with QLess representatives to develop the appointment types, duration, and understand the system. In the Crossroads, platform WIC appointments are divided into five categories: Initial Certifications, Subsequent Certification (i.e., recertification), Nutrition Education Individuals, Food Benefit Issuance, and Mid-Certification. However, in the QLess platform, appointments were divided into only two types: *Recertification* and *Follow Up*. This system was ideal for WIC participants due to the ease of appointment booking. Initial and/or subsequent certifications from Crossroads were recoded as "Recertification" in QLess, while the remaining three appointment categories were recoded as "Follow up" appointments in QLess. It was determined that if a family had at least 1 member who required a Recertification appointment they would book the entire family as a Recertification in QLess. This was to reduce confusion for the family and the structure of the calendar.

A participant would first select the type of appointment and the number of family members in need of the appointment. They would then fill out the mother/guardian's information including first and last name, phone number, and optional features were to upload prescriptions and additional notes. For example, if a participant wanted to make a Subsequent Certification for 1 child, they selected Recertification and then select 1 person, and the last step would be to fill in personal information. Following the appointment booking process, participants would get a confirmation text message containing information such as the location and time of appointment. In addition, the text messages allowed participants to cancel their appointment up to 30 minutes

prior to the appointment time. Appointments were made available for either the same business day or the next business day due to staffing and COVID-19 adaptations.

Text Message Development

Text messages were a key feature of the intervention. Text messages were developed by the Program Coordinator and WIC Director and were deployed using the QLess platform. Text messages were tested frequently to ensure messages were sent at the correct times with the appropriate language. Integrated messages were sent depending on the time of booking. In most cases, an initial confirmation message was sent at the time of booking. Subsequent messages were sent an hour, 30 minutes, and 15 minutes before their appointment time, the number of reminders was dependent on when the appointment was made. For example, if WIC participants made an appointment within the hour, they would only receive two text messages at the 30- and 15-minute mark (See Appendix B, Figure B.1).

Implementation of Innovative Tool

Due to the novel tool, implementation protocols and training materials were developed specifically for this project. Implementation of the tool was developed and applied during a soft launch or pilot of the product. This meant that the WIC staff booked appointments for WIC participants when they called over the phone. During this time, feedback was collected from the WIC staff regarding QLess, and the platform was then adjusted according to the feedback. Feedback included rewording the required information as well as adding additional time increments for the various appointment times.

Training materials for staff and WIC participants were developed. Staff materials included standards of work on how to make an appointment and assist WIC families. The staff checklist reminder included steps on information the staff would need to make appointments (Appendix B, Figure B.2). WIC participants were also given reminder appointment slips (found in Appendix B, Figure B.3). These slips were mailed or given to families to remind them of when and how to make their next appointment. This was also translated into Spanish to ensure equitable access for all. Lastly, training videos were made and posted on Facebook and on the CHA WIC website which walked through the steps families needed to take to make an online appointment.

The QLess software was available and advertised for all WIC participants during the implementation period. Data on advertisements via the CHA WIC website was collected, specifically regarding the number of clicks on three different links: Cabarrus Health Alliance Homepage, the sub-tab on how to make an appointment online, and the link to redirect WIC families to the QLess page. Participants who were transferring from a different WIC clinic or new to WIC including infants and children were advised to call the CHA WIC clinic to ensure accurate information in our MIS. Participant engagement, or when a participant made their own appointment online without assistance from WIC staff, was recorded daily by the program coordinator.

Impact of COVID-19

Similar to virtually all other WIC agencies across the country, CHA abided by the COVID-19 State of Emergency in March 2020. This halted QLess implementation as the staff needed time to transfer all WIC services to virtual operations. Due to the frequent changes in policies and

guidance during the early months of the COVID-19 crisis, the QLess project paused from March to June 2020. In March, due to virtual services and social distancing, most staff worked from home. Both locations operated with limited staff working in the office. With the satellite WIC location only having staff 2 days a week. The project team used this time to make modifications to the QLess project in order to adapt to remote WIC service delivery.

The project resumed on June 1, 2020, with virtual adaptations in place. The satellite location also reopened around this time. The project team resumed marketing efforts for the online appointments system and updated text messages with appropriate reminders of the virtual appointments. WIC appointments remained virtual for the remainder of the project period.

Evaluation Design

The project used a quasi-experimental design with an innovative comparison site. Catawba County Health Department WIC was selected as the comparison agency for both the short- and long-term impact evaluations due to a similar WIC caseload as Cabarrus Health Alliance WIC and a similar structure of the county as Cabarrus County. Data were collected during two 12-month periods: Baseline (January 1, 2019-December 31, 2019) and Implementation (June 1, 2020-May 31, 2021).

Process Evaluation Questions and Indicators

In addition to measuring implementation fidelity, the process evaluation objectives were to understand how many participants utilized the QLess platform and how satisfied the participants were with the online platform.

Short-term Outcome

Short-term outcome objectives were identified in order to measure satisfaction of the platform. The first short-term outcome objective was to improve WIC participant customer satisfaction concerning appointment booking by 25%. Due to COVID-19, the second short-term outcome objective, improving WIC participant customer satisfaction concerning the in-clinic wait time by 25%, was unable to be fulfilled. An additional short-term objective was to reduce the volume of calls coming into the clinic.

Long-term Outcome

Prior to project implementation, HPRIL assisted CHA in identifying a comparison group, Catawba County WIC, to allow for a contemporaneous comparison evaluation design. HPRIL obtained MIS data from the State of North Carolina to conduct statistical analyses to evaluate the impact of QLess on outcomes related to child retention and participation. Data were obtained for two time periods: a baseline period that which was the 2019 calendar year and an implementation period. 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 innovation group (i.e., Cabarrus Health Alliance) to changes for the comparison group (i.e., Catawba County WIC).

The MIS data set included variables from the USDA minimum data set (MDS) necessary for describing the characteristics of the participants as well as for calculating each of the outcome

variables. Because the data set 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 1).

Table 1. 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	Monthly proportion of children with fully expired benefits (only among children who were issued benefits that month).

Each month benefits are issued for each WIC participant, and over some 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, however, is available in North Carolina's MIS.

The analyses here 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), and that benefit non-use was < 5% (during each time period) therefore these outcomes were not investigated further.[1 2]

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 the 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; the number of WIC participants in the household; multiple birth status; race and ethnicity; primary language other than English; the need for a translator; participation in other federal assistance programs such as TANF, SNAP, and Medicaid; and whether the participant was ever breastfed. Pearson chi-square tests were used to detect any significant differences between Cabarrus and Catawba in terms of participant characteristics and outcomes for each time period. Logistic regression analyses were also conducted to compare outcomes between groups (Cabarrus versus Catawba) within each time period adjusting for covariates. As noted above, reports of these analyses were created for each time period.[1 2]

To estimate program impact, HPRIL employed a difference in difference (DID) approach. As noted above, this 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 (between birth and one year of age) and children aged 1-3. Because participants are not randomly assigned to the innovation or comparison group, analysis of the impact of QLess is not straightforward. Participants are assigned to a WIC agency 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 (labeled T1 for baseline and T2 for implementation) 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 those in the innovation group during T1 as per Stuart et al., 2014.[3]

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.[4] 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 Cabarrus Health Alliance over time (at T1 and T2), Cabarrus at T1 and Catawba County at T1, and Cabarrus at T2 with Catawba 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.

The overall goal of this intervention was to improve retention of the entire cohort of WIC child participants ages 1-4. Retention is defined as recertification within 14 months, as measured by the North Carolina Crossroads MIS.

Data Collection/Analysis

To evaluate project implementation fidelity (i.e., process evaluation), documentation occurred in specific steps. We tracked: (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 (which helped us to develop better educational messages to accompany the new tool); 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 program coordinator would tally the participants making their own appointments daily using the platform. These were recorded in a database along with the type of appointment made and information on whether it was made correctly. 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 was measured by surveys, phone logs, and number of appointments booked by participants (See Appendix C for data collection tools). The surveys assisted in the understanding of barriers to accessing and using the online appointment system during the implementation period.

The pre-implementation surveys for participants, WIC staff, and comparison clinic participants were all administered in-person using pen and paper. The participant survey was administered for 5 days from October 28 through November 1, 2019, at both the innovation and comparison sites to participants while waiting for the nutritionist in private rooms. The participant survey was available in English and Spanish and contained three questions using a 5-point Likert Scale of agreement. Questions assessed the satisfaction of the current appointment-making process (See Appendix C, Figure C.1).

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. Surveys were conducted in both English and Spanish. The questions explored how participants were making their appointments as well as the barriers they had faced while making appointments. Response options were open ended and used a 5-point Likert Scale of agreement (Appendix C, Figure C.2).

Post-implementation surveys were conducted via telephone in the last week of May 2021. 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 using a 5-point Likert Scale of agreement and an optional comment section (Appendix C, Figure C.3).

The staff baseline survey was administered only to the innovation sites with a similar 5-point Likert scale of agreement (Appendix C, Figure 4). Staff baseline surveys were administered in November 2019. Post-implementation staff surveys were administered only at innovation sites in May 2021 with questions similar to the pre-implementation survey (Appendix C, Figure C.5). 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. The phone system was able to report Spanish and English lines separately throughout the project period. 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) the speed of answer. The 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 where participants hung up before a staff member was able to assist them and lastly the speed of answer measured the average minutes it took for staff to answer the incoming calls.

For the long-term outcome evaluation, North Carolina's management information system (MIS), Crossroads, was used to track participation, retention, and recertification rates. MIS data management and the transfer were done through a secure portal. Additionally, all transferred information was de-identified. To evaluate the long-term impact on retention and participation, the HPRIL team will compare the baseline MIS dataset with the implementation dataset from the innovation and comparison sites. For a more detailed description of HPRIL's methodology, please see the HPRIL Final Project Report.

Results

Results of Process 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. Adaptations were made to ensure the fidelity of the overall project, and that the adapted implementation of QLess was successful.

Participant Engagement

The clinic caseload, as collected from the MIS database, during the implementation period was 3,284 participants. A total of 696 families, some repeated, utilized QLess during the implementation period. Of those families, preliminary data indicated that 267 families made appointments for children 1 to 5 years old during the implementation period. Roughly 6.2% of eligible Cabarrus WIC participants utilized QLess at least once during the 12-month period. Monthly utilization percentages also demonstrated an uptake over the implementation period (Figure 1).

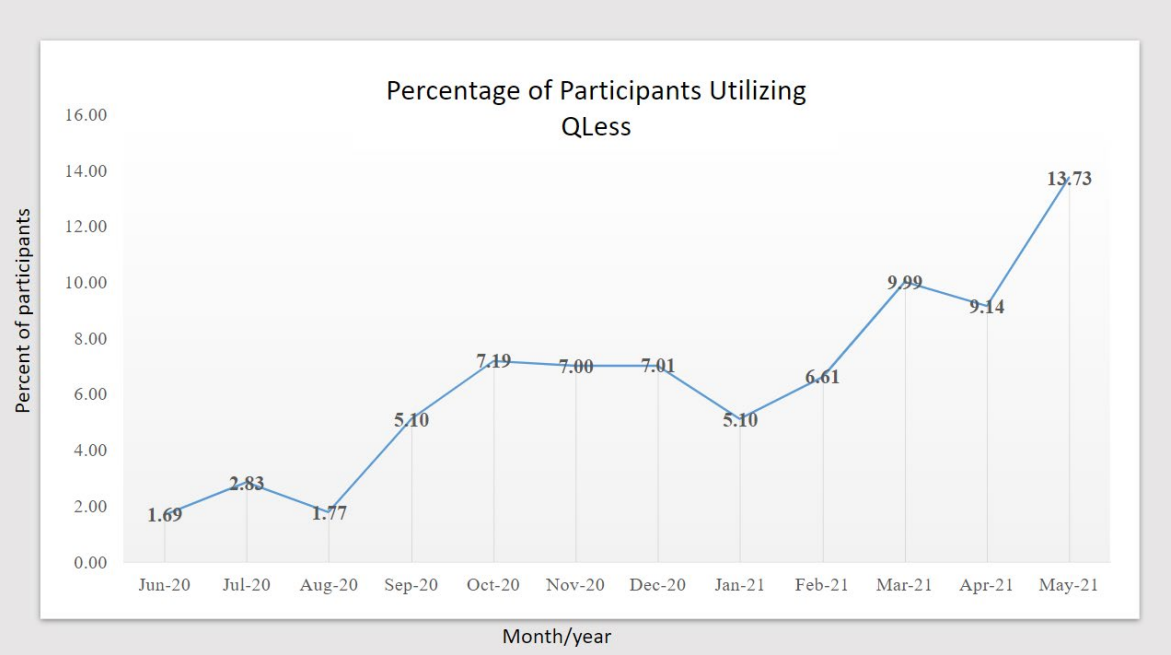


Figure 1. Participant monthly QLess utilization

Appointments were determined as inaccurately made if they fell into one or more of the following categories: (1) should not have made appointment online (i.e., a pregnant woman who has not participated in WIC before); (2) booked Recertification instead of Follow up; (3) booked Follow up but needed a Recertification; (4) the incorrect number of people selected; (5) did not need an appointment; or (6) other. 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). Fewer families booked Follow Up appointments instead of Recertification (n=17), should not have made an appointment online (n=6), or indicated "other" (n=1). The family who was in the *Other* category made the appointment incorrectly due to incorrect dates listed on their reminder slip (see Appendix A, Table A.3).

Marketing Analysis

Website traffic was collected during the majority of the implementation period (August 2020-June 2021). Due to technical difficulties, CHA was unable to collect data from June and July 2020. 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 (Figure 2). It appeared that as the families went

through the different pages in order to make an appointment, the clicks decreased. The reason for greater clicks on the homepage could also have been that families were viewing the homepage for other information.

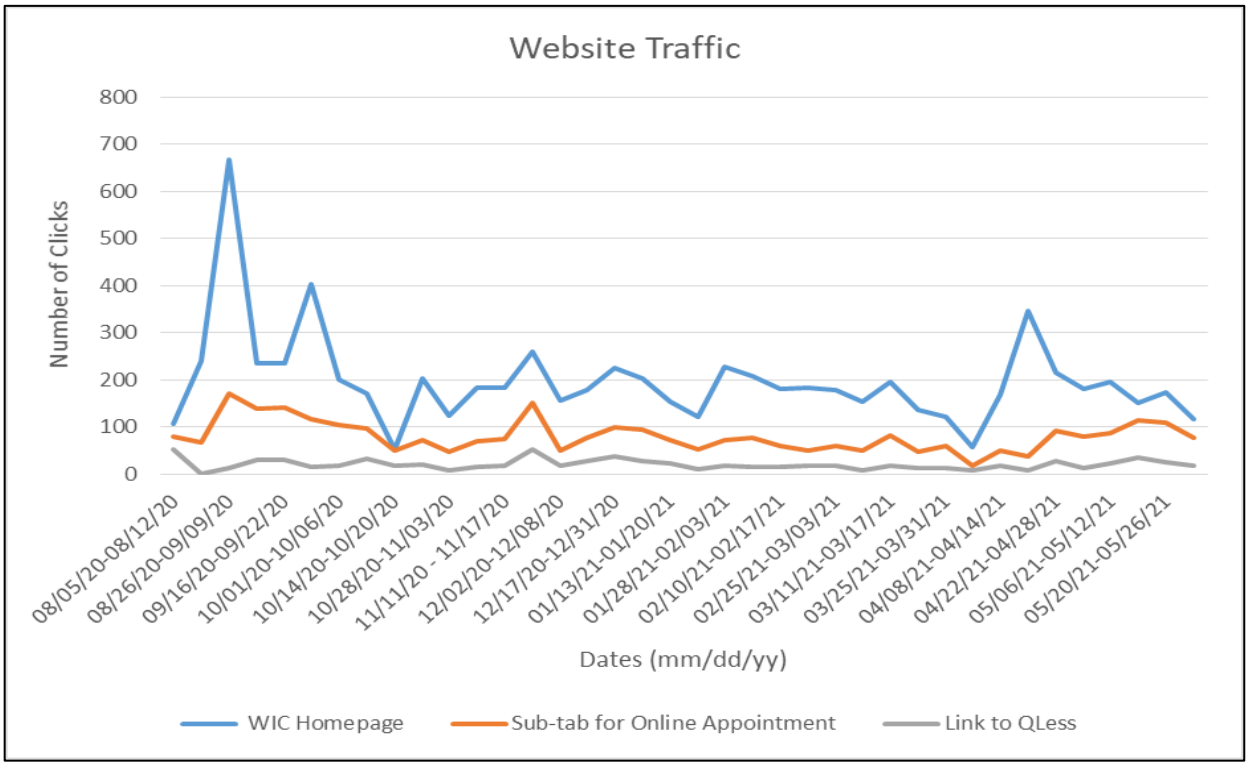


Figure 2. Website traffic during implementation period

Short-term Impact Analysis

Incoming calls to the clinic were reported monthly. Average incoming calls 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 (Figure 3). A similar pattern was seen in the Spanish line as the monthly baseline period average was 224 while the implementation period average was 211 (Figure 4). Overall, the English language was abandoned and answered calls were consistent throughout the implementation period. However, it was observed that incoming calls had a wider variation, seeing an increase in Fall 2020 and a decrease in Winter 2021.

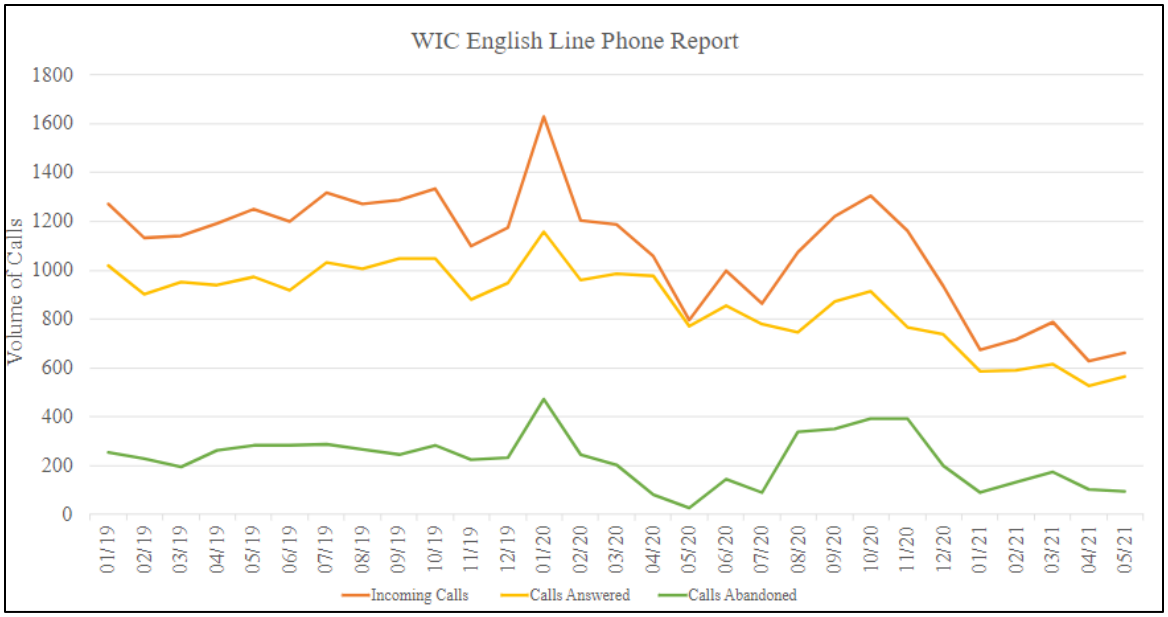


Figure 3. English line phone report

Average monthly calls abandoned in both English and Spanish decreased as well. Average English baseline monthly abandoned calls was about 253 and decreased to 208 during the implementation period (Figure 3). Average monthly Spanish abandoned calls decreased from 41 during baseline to 29 during implementation (Figure 4). It was observed that speed of answering also decreased from the baseline to implementation period in both languages (Figures 5 and 6).

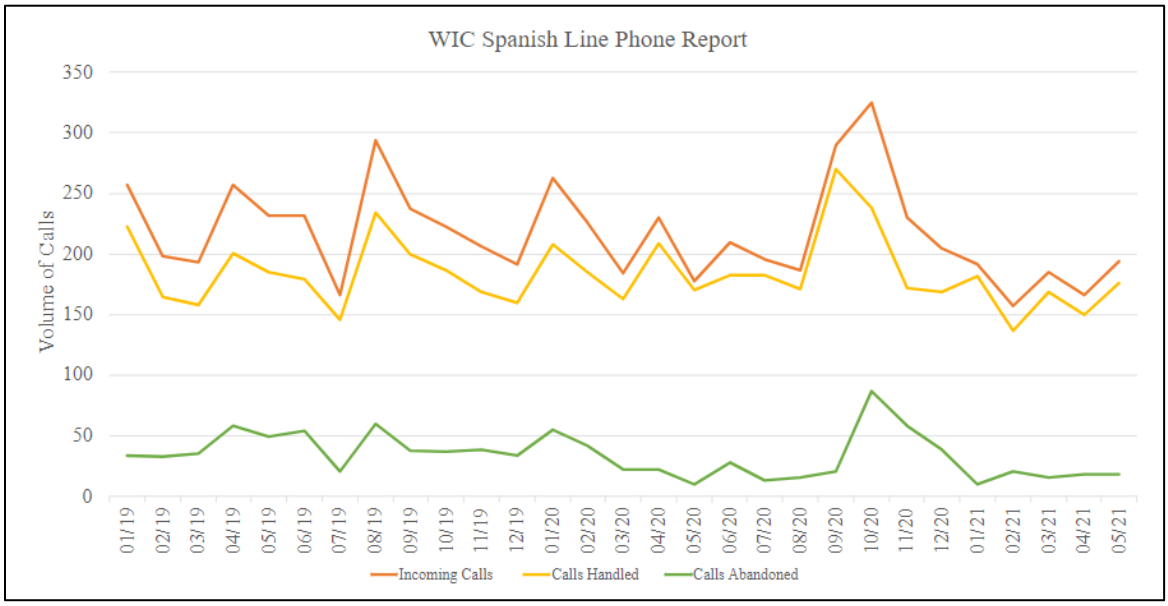


Figure 4. Spanish line phone report

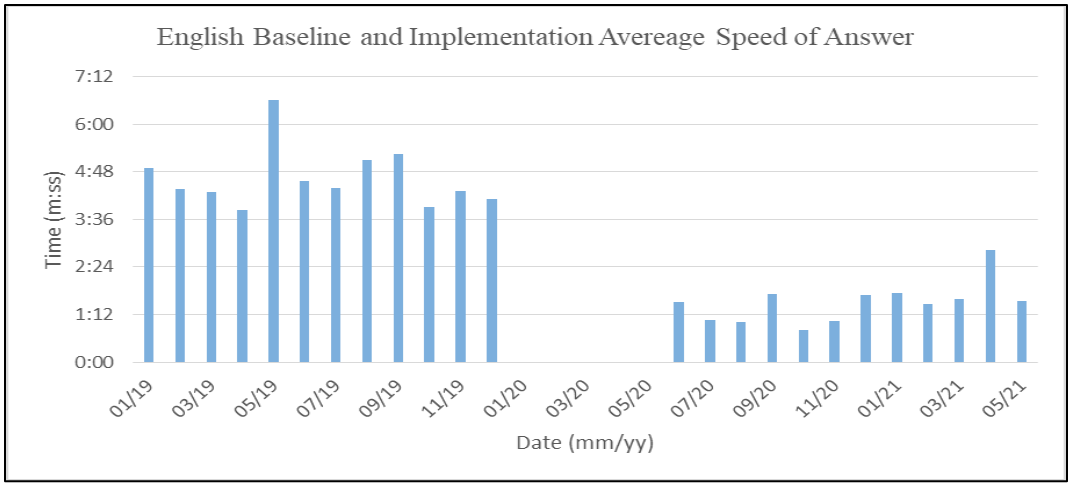


Figure 5. Baseline and implementation English language speed of answer

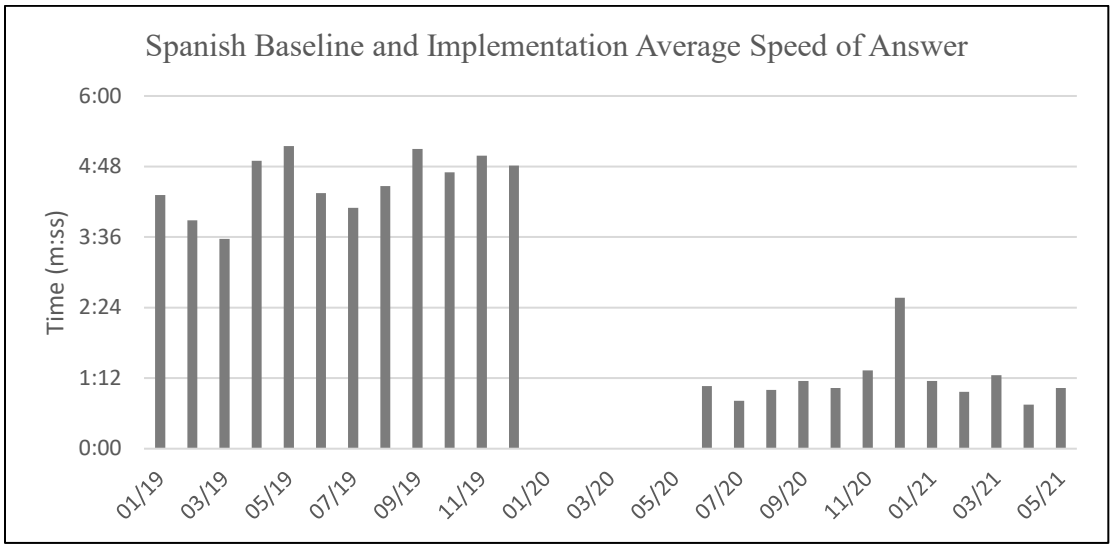


Figure 6. Baseline and implementation Spanish language speed of answer

QLess data: Text messages

Out of the 696 families, some repeated, that made their appointments online, a majority (646), received at least one text message confirming their appointment. Of the 50 who did not receive at least one text message, 31 of them did not receive a text message for the appointment made at that time but received other text messages when made at a different time. Sixteen families did not receive any text messages over the implementation period, the reason is unknown and 3 of the families did not receive text messages due to incorrect phone numbers. Overall, the text message feature was able to send at least 1 text message to about 72% of families who made their own appointments online.

Survey Analysis

Baseline Participant Survey

The baseline surveys had a higher response rate compared to the participant surveys conducted later in the project period. There were 126 responses, which was a 76.8% response rate for the CHA surveys. The survey asked three questions regarding (1) how participants made the appointment, (2) if they were satisfied with the appointment modality, specifically how they made their appointment, and (3) how easy it was to make the appointment. 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 identified 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 identified that it was very easy or easy to make the appointment by either phone call or walk-in (Appendix A, Table A.4).

Eighty-four families completed the survey at Catawba County Health Department WIC. Due to limited resources, Catawba WIC was unable to identify how many families they served during the baseline survey in order to obtain an accurate response rate. Overall, 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 (Appendix A, Table A.5). 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).

Implementation Participant Surveys

The implementation participant survey response rate fluctuated between 20-30%, with an average of 19.4% (Appendix A, Table A.6). Over the four months, the most common barriers reported 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. Appendix A, Table A.7 provides definitions of common reasons for underutilization, and Figure 7 provides the distribution. The most common reason for underutilization across all the surveys was that families were unaware of the online appointment system.

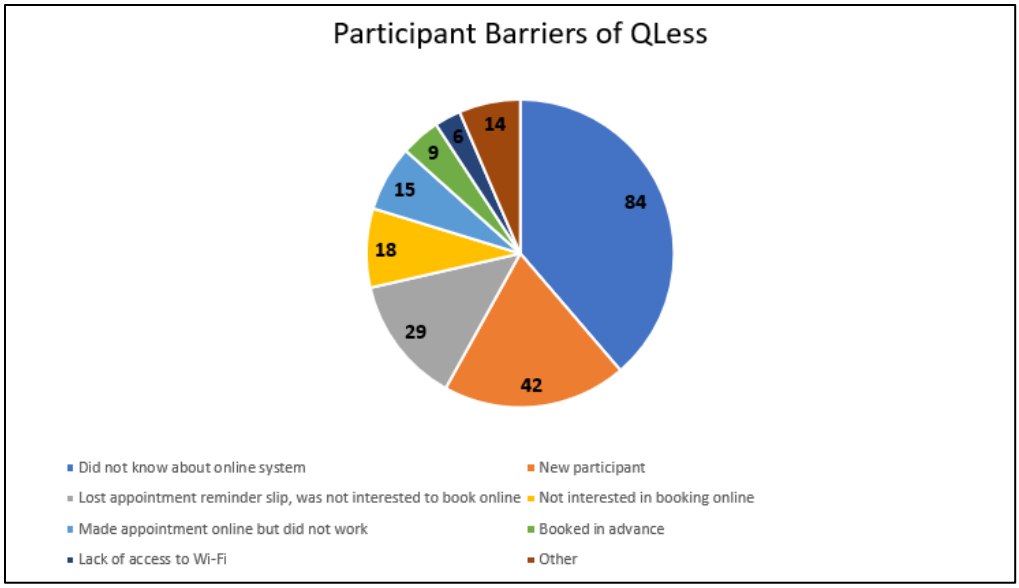


Figure 7. Participant implementation survey barrier results

Fifty-eight participants that made at least one appointment on QLess during the weeks that the implementation survey was conducted answered additional questions about their attitudes toward QLess and likelihood to use it again. As seen in Figure 8, 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 were also collected. Noteworthy testimonials 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.

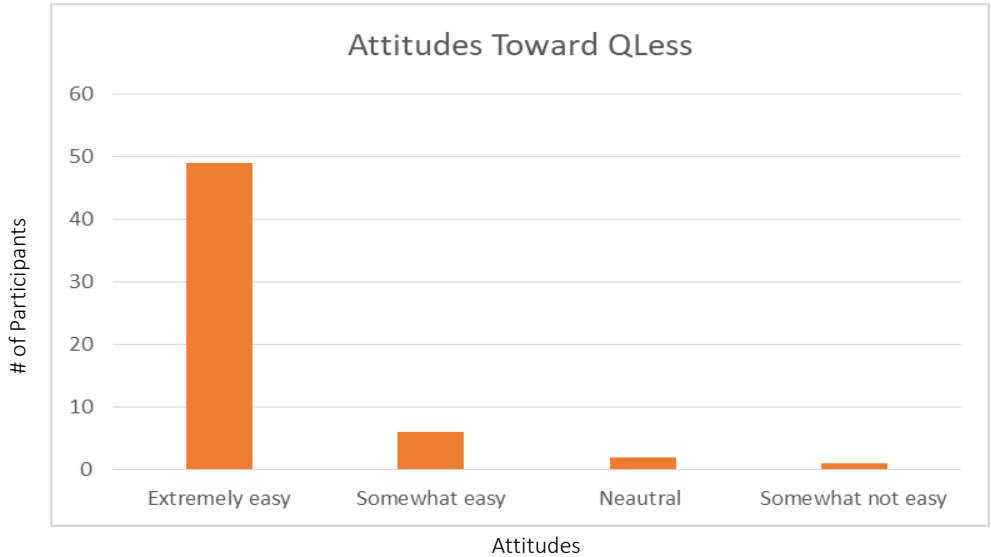


Figure 8. Participant attitudes toward QLess

Post-Implementation Participant Surveys

The post-implementation surveys explored attitudes towards QLess and the appointment-making process. There was a 23% response rate. Response rate was calculated by the number of families who opted to answer the survey (44) and the overall number of families we served (191). The majority of the respondents (29) stated that they were more likely to use the online appointment system to make their next appointment (Figure 9). 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.

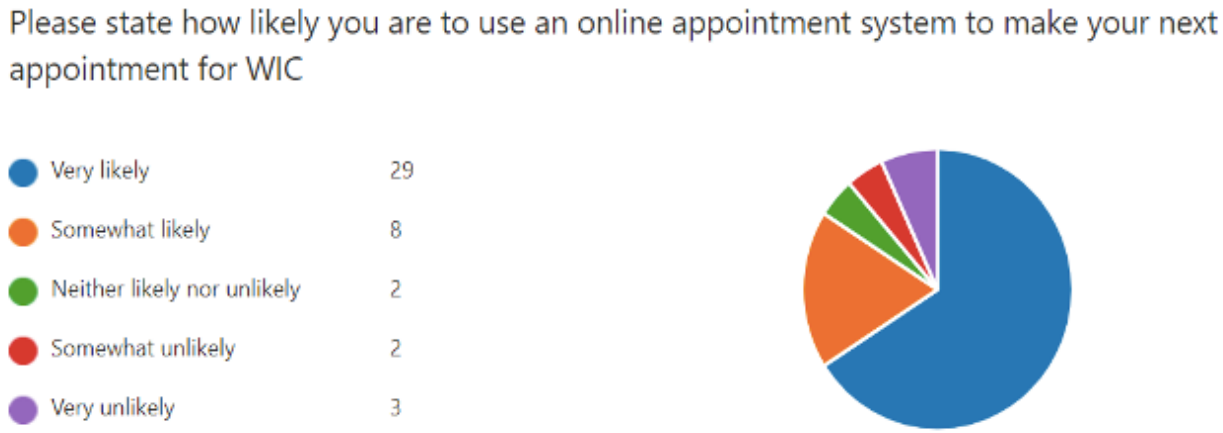


Figure 9. Post implementation likelihood of WIC families making their next appointment online

Post-Implementation: Staff Surveys

Staff surveys explored attitudes toward the appointment system. The majority of the staff were satisfied with QLess and its assistance with making appointments (Figure 10). In addition, the majority of staff (9 out of 14) were very satisfied with the text message reminder feature online (Figure 11). Further details on staff perspective of QLess can be found in Figure 12.

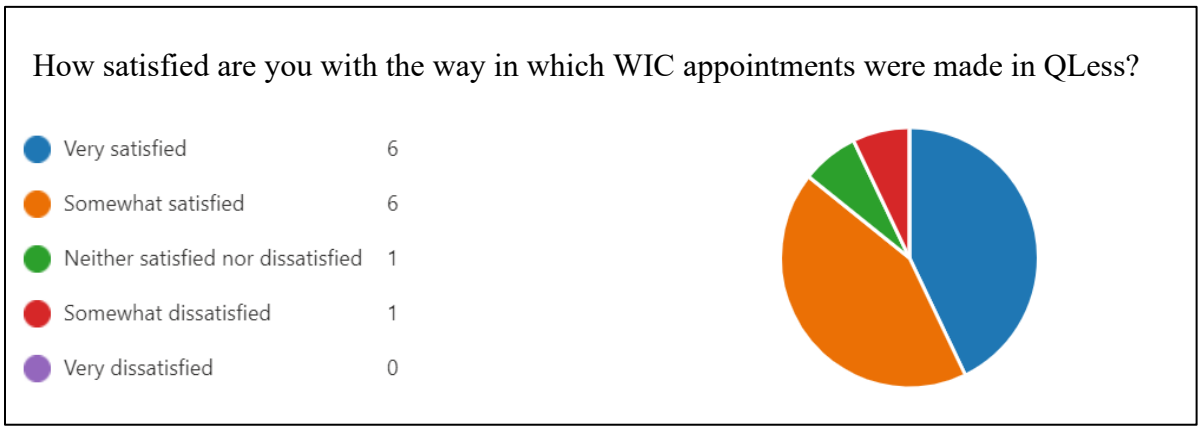


Figure 10. Staff satisfaction with QLess

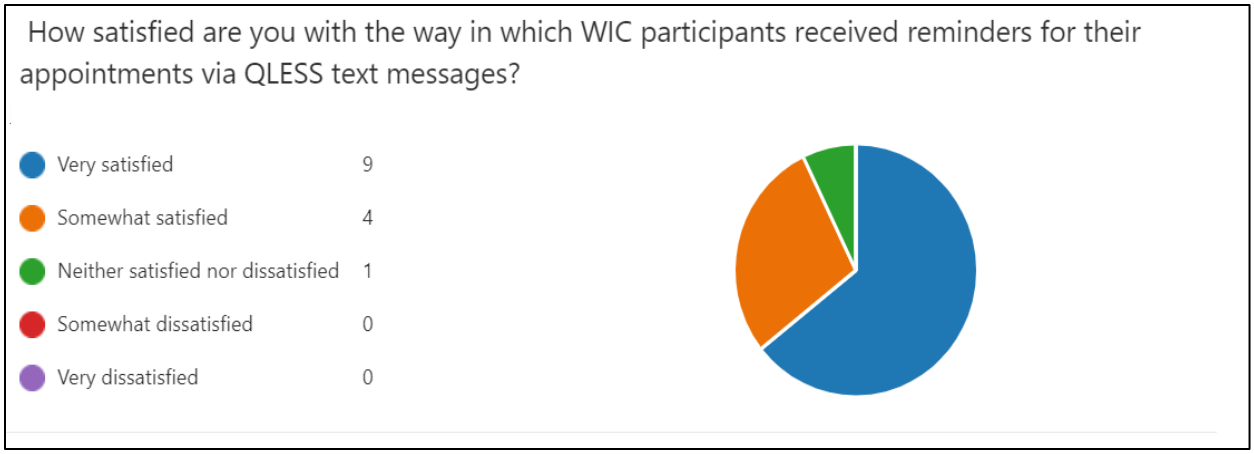


Figure 11. Staff satisfaction with QLess text reminders

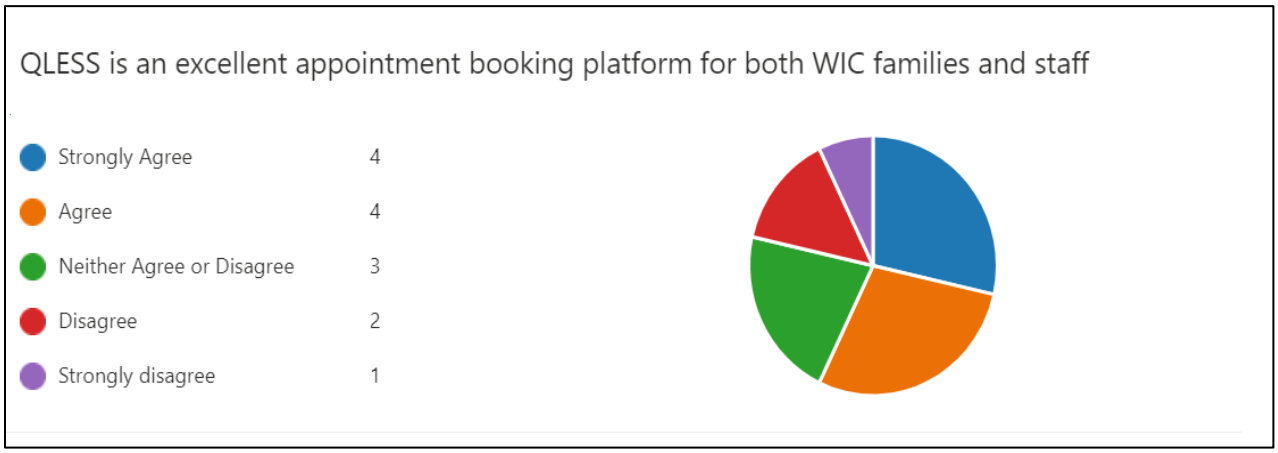


Figure 12. Staff perspective with QLess

Long-term Outcome Analysis

*Table 2. Demographic Characteristics of Children 0-3 at Cabarrus Health Alliance and Catawba County at baseline (T1) and implementation (T2). Statistically significant differences by group are in **bold**.*

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

*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.

[a] Participants can respond to more than one category so the total percentage may be greater than 100.

[b] 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.

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 2). 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 SNAP enrollment. Cabarrus at both T1and 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 2). 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%).

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 13). 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 13). For infants, the percentage recertified in T2 was significantly higher in Catawba than in Cabarrus (Figure 13). For sample sizes of these groups, please see Appendix A, Table A.8.

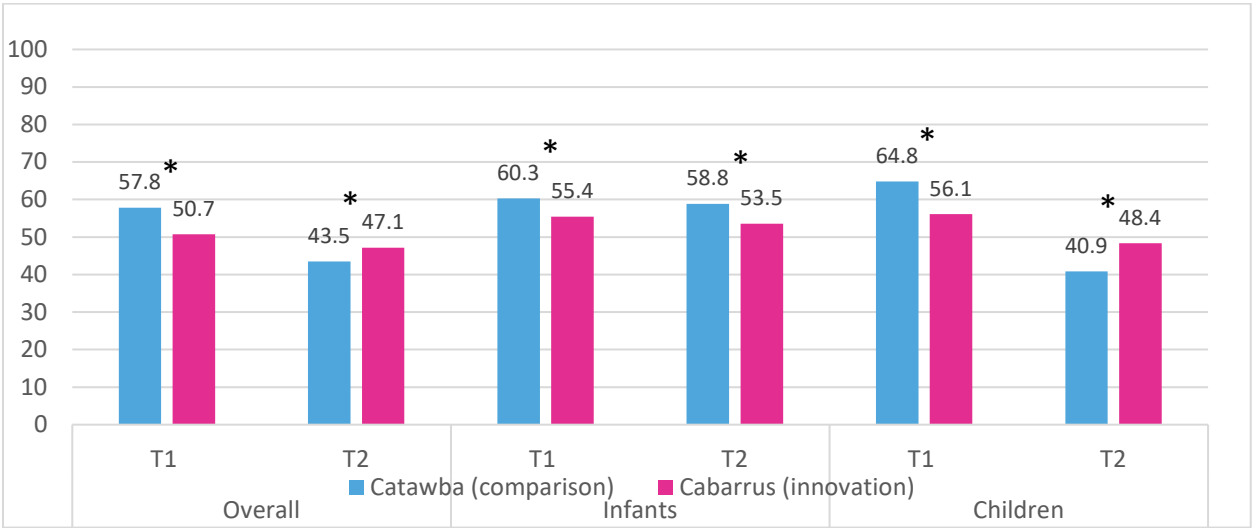


*Figure 13. Proportion recertified (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Catawba and Cabarrus. *p< 0.05.*

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). In Cabarrus, the 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 14). 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.

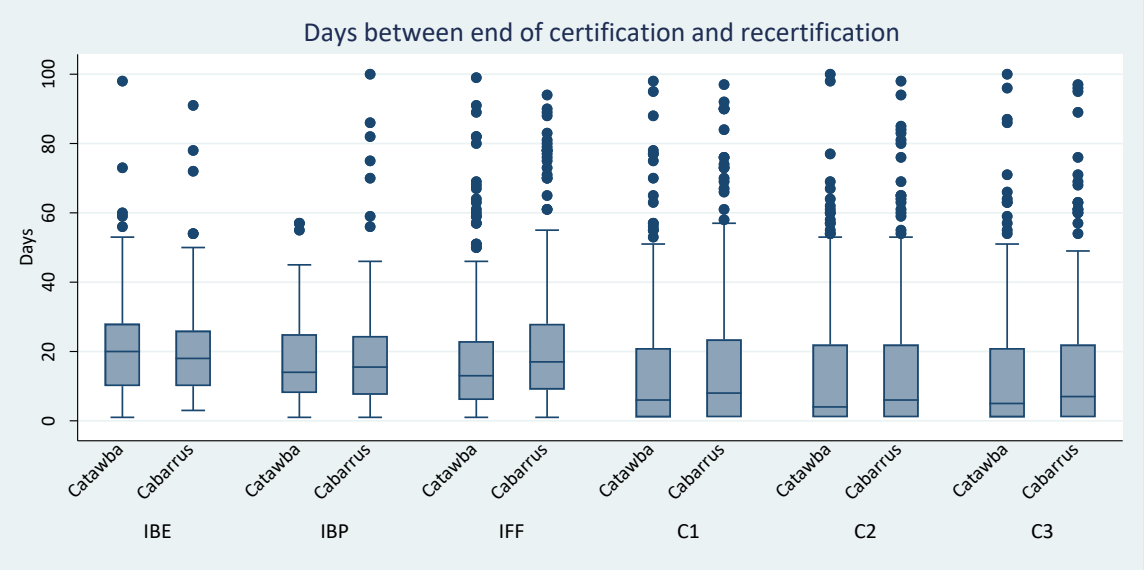


Figure 14. Number of days between end of certification and recertification by participant category at Cabarrus and Catawba during baseline (T1) (truncated at 100 days)

The median number of days between the end of the prior certification and recertification date during the implementation period was 19 (IQR 0, 91) for Catawba and 85 (IQR 19, 114) for Cabarrus. In Catawba, the 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 15). Over 67% of recertifications at Cabarrus and over 42% of recertifications at Catawba were timely during T2.

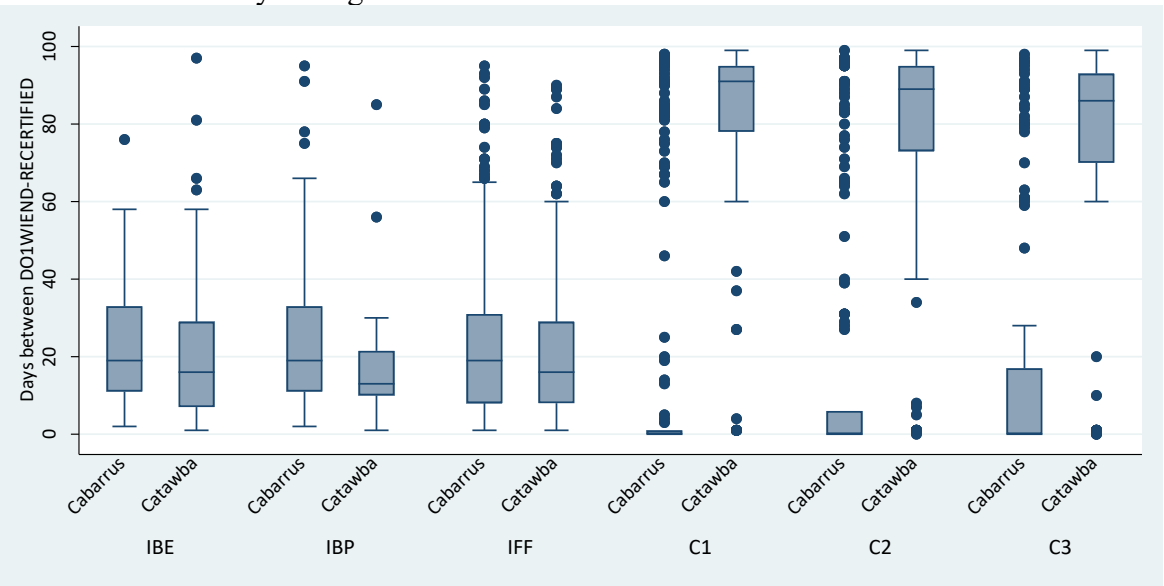


Figure 15. Number of days between end of certification and recertification by participant category at Cabarrus and Catawba during implementation (T2) (truncated at 100 days)

Retention

Overall, and for infants and children, the differences between Cabarrus and Catawba were statistically significant during T1 (Figure 16). 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%).

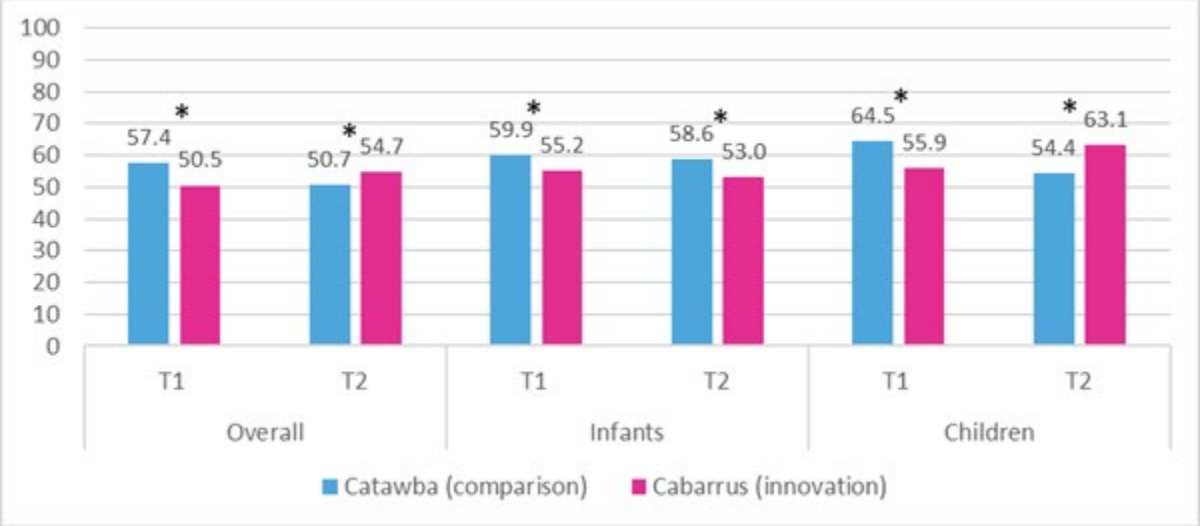


*Figure 16. Proportion retained (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Cabarrus and Catawba. *p< 0.05.*

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 3). During T2, the median number of months of benefit issuance for both Cabarrus and Catawba were 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). It should be noted that the higher rate of benefit issuance during T2 may be related to operational differences during the COVID-19 pandemic (the North Carolina WIC office utilized a federal waiver that allowed monthly issuance at the state level to all certified infants and children).

Table 3. Benefit issuance in Cabarrus and Catawba during baseline and implementation periods

	Baseline (T1)		Implementation (T2)	
Agency/Group	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 higher rates of benefit issuance than Catawba. For infants during T1 there were 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; for infants benefit issuance was lower for Cabarrus than for Catawba and for children benefit issuance was higher for Cabarrus than Catawba (Figure 17).

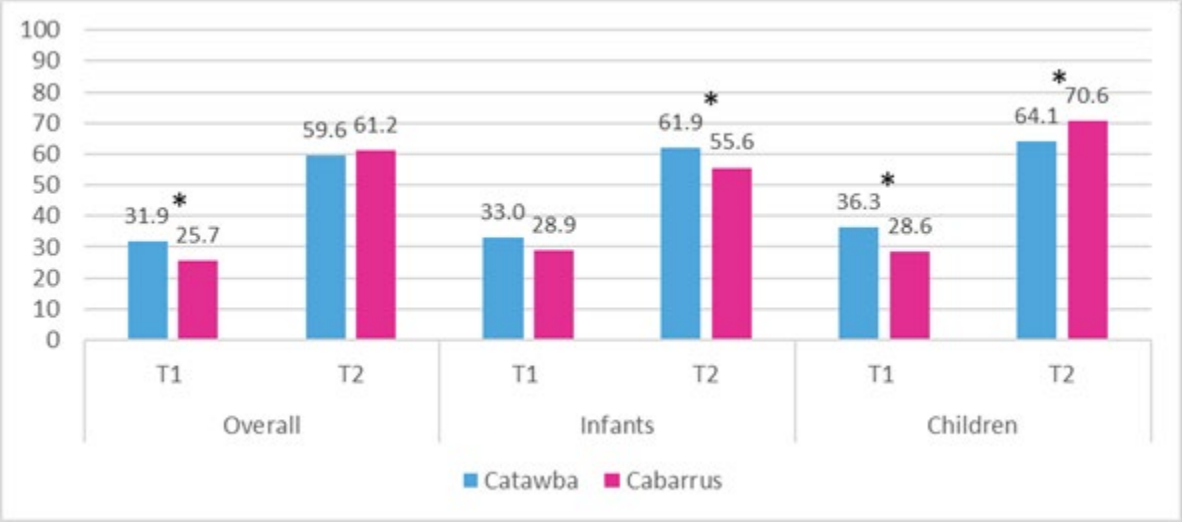


*Figure 17. Proportion with continuous benefit issuance (11-12 months) (crude, unweighted) at baseline (T1) and implementation (T2) overall, for infants, and for children at Cabarrus and Catawba. *p< 0.05.*

Balancing the groups using PSW

As mentioned above, 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) (Appendix D, Figure D.1). 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, please see Appendix A, Table A.9.

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 D, Figure D.2). 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, please see Appendix A, Table A.9.

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 D, Figure D.3). 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, please see Appendix A, Table A.9.

Difference in Difference (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 children's differences were statistically significant) (Figure 18, Table 4). 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 A, Table A.10.

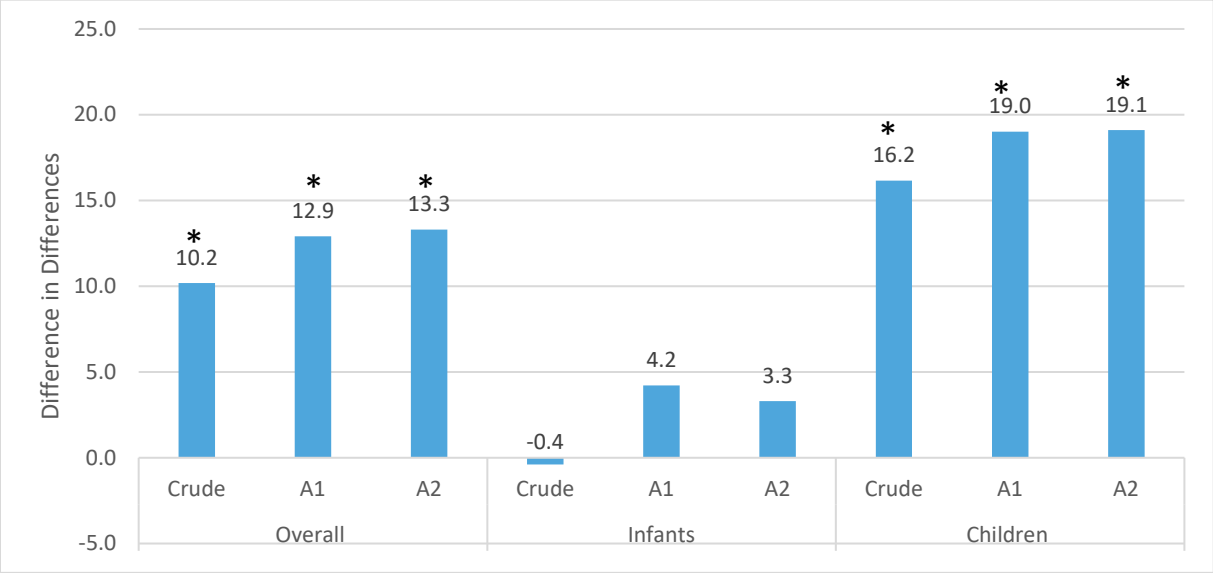


*Figure 18. Percentage point differences in recertification between Cabarrus and Catawba overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for 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 19, Table 4). 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 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 A, Table A.10.

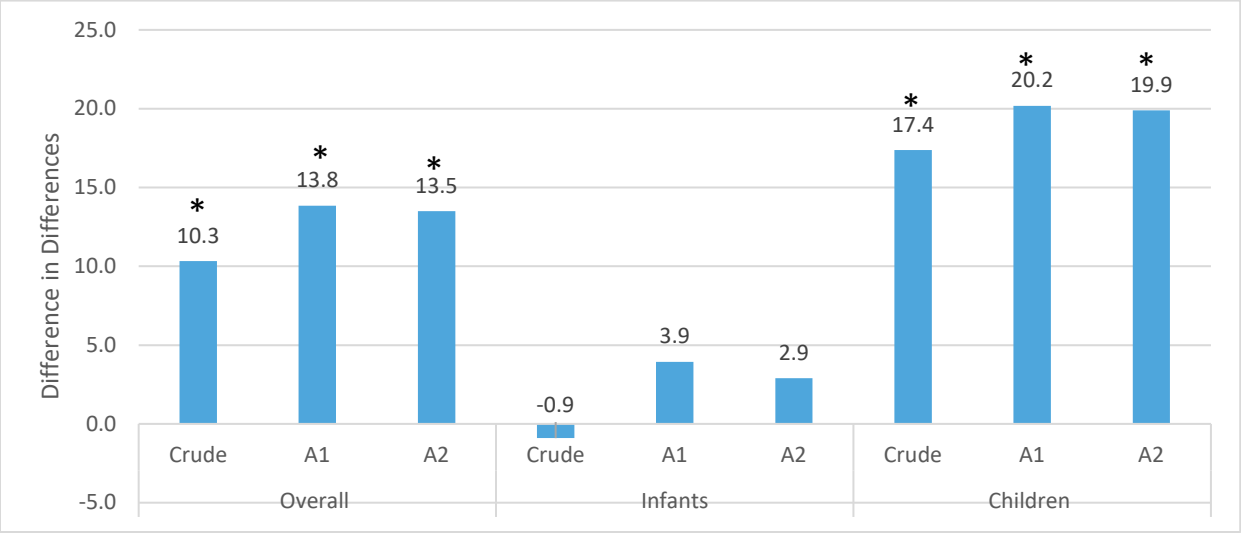


*Figure 19. Percentage point differences in retention between the Cabarrus and Catawba overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (OLS) for 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%-19.1%) (Figure 20, Table 4). Using weighted data and the adjusted Model A1, being in Cabarrus was associated with 9.9% increase in continuous benefit issuance overall (95% CI: 5.3%-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%-24.4%). Using weighted data and the adjusted Model A2, being in Cabarrus was associated with 8.8% increase in continuous benefit issuance overall (95% CI: 5.1%-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%-20.2%). For the sample sizes of each of these groups, see Appendix A, Table A.10.

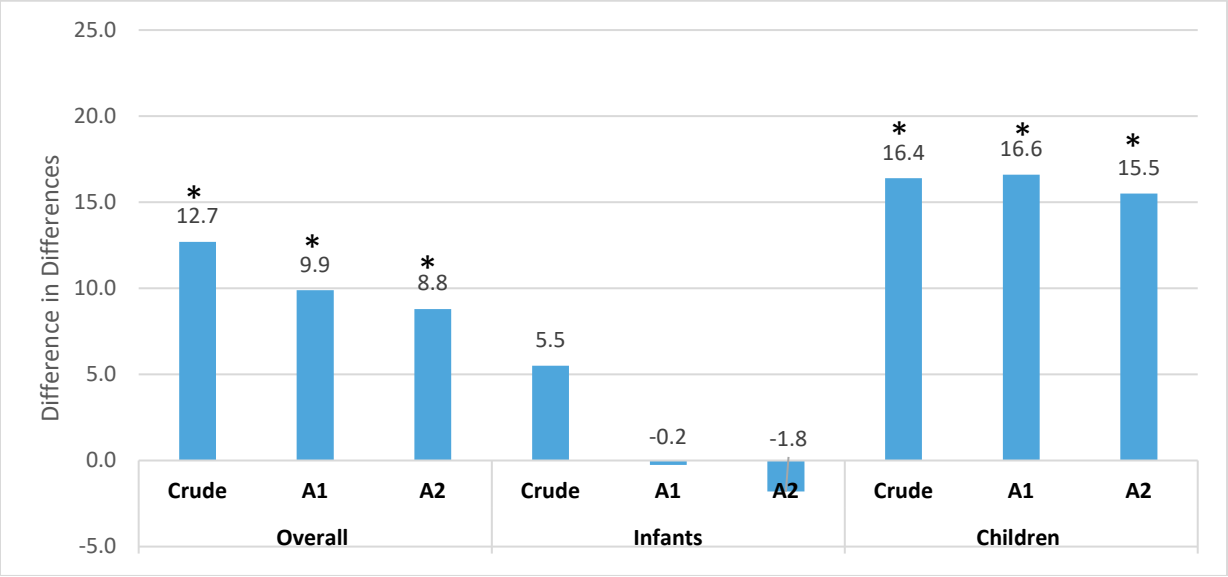


*Figure 20. Percentage point differences in continuous benefit issuance between Cabarrus and Catawba overall, for infants, and for children using three models: Crude (unweighted) and two weighting analysis techniques: A1: PSW-DID using logit for propensity score weighting (PSW) and ordinary least squares (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 4. 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

	Overall			Infants			Children		
	beta	95% CI		beta	95% CI		beta	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

Discussion

Process Evaluation Results

The original project proposal had two major goals. One of the goals was met while the other was unable to be implemented due to the COVID-19 pandemic. The goal of implementing an Online Appointment Scheduling (OAS) tool for all WIC participants was successful, while in-lobby wait times were omitted because WIC clinics were unable to serve participants in-person during the implementation period. Additionally, the OAS tool was limited in its types of appointments and capability in its cancelation and rebooking 30 minutes prior to the appointment. QLess was unable to rebook appointments if they were canceled within 30 minutes of that appointment time. This was a barrier as it limited time slots for individuals to make appointments online because the system would remove that time slot, even though it was available. To combat this issue, staff would call participants who recently missed their appointments in that month and try to serve them. These limitations may have hindered parts of the implementation and could be barriers to access for some WIC families.

Short-term Outcome Results

Call volumes of baseline and innovation periods showed that overall volume of calls to the clinic decreased during the implementation period. This may have been impacted by the online appointment system. QLess enabled participants to make appointments online in their own time without having to stay on hold. Additionally, due to the lower volume of calls, speed of answering also increased creating further overall satisfaction with WIC. Low survey response rates were common throughout the project period. This is common at CHA-WIC as many families opt out of answering surveys without an incentive. Future consideration regarding incentive processes may be considered to gather more robust survey responses. However, from the participant and staff survey responses, the project was able to gather imperative qualitative information. Of those participants who answered the survey questions, many stated they liked the QLess system as it provided autonomy for the family.

Long-term Outcome Results

The Cabarrus QLess scheduling innovation appears to have had a positive impact on recertification, retention, and continuous benefit issuance, overall and among children. No impact on these outcomes was observed among infants. In adjusted analyses, overall recertification was 12.9% higher (95% CI: 8.2%-17.6%), 4.2% higher (95% CI: -3.5%-11.9%) among infants, and 19.0% higher (95% CI: 13.1%-24.9%) among children. Overall retention was 13.8% higher (95% CI: 9.1%-18.5%), 3.9% (95% CI: -3.7%-11.6%) among infants, and 20.2% higher (95% CI: 14.3%-26.1%) among children. Overall continuous benefit issuance was 9.9% higher (95% CI: 5.3%-14.5%), 0.2% higher (95% CI: -7.7%-7.2%) among infants, and 16.6% higher (95% CI: 10.9%-24.4%) among children. The results are consistent with crude (unweighted) analyses and are robust in adjusted analysis using kernel Propensity Score Matching (PSM) DID.

It should be noted that there were operational differences between Cabarrus (innovation) and Catawba (comparison) at both T1 and T2 that may have had an impact on outcomes. During baseline (T1) Cabarrus used an Open Access policy, under Open Access, a large percentage of appointments (typically 50-90%) were booked the day before, or on the day the appointment was needed. At CHA's offices, nearly 95% of appointments were booked this way; the rest were walk-ins and pre-booked. In contrast, during baseline Catawba would make appointments for

participants by calling the families that were due for benefits and scheduling them the same day or week, meaning Catawba WIC families would not have to remember when their benefits expired to make another appointment. Agency operations changed for Catawba during implementation in that they focused their phone calls for scheduling appointments on the categories of pregnant women and infants. They did not reach out to children (C1-C4) unless their benefits expired. It should be noted that due to federal COVID-19 waivers, certification periods could be automatically extended, and benefits might be issued as much as three months after the original certification period had ended. These differences in operations between the two agencies could explain the differences in recertification and retention during baseline by favoring Catawba and could favor Cabarrus for child recertification, timely recertification, and retention during implementation due to Catawba's focus on other categories.

Limitations

Data Quality Issues

First, it was possible that there was underreporting of QLess usage during the implementation period, as the program coordinator had to physically look up if participants made their own appointment in the system that was also used by WIC staff to book appointments. There were limited ways to differentiate between the WIC staff making the appointments and WIC participants making their own appointments. Appointments may have been misidentified or missed by the program coordinator. Second, Catawba WIC Clinic was unable to complete post-implementation surveys due to supervisor transition and staffing limitations due to COVID-19.

Third, there were some important differences in the operations of the WIC clinics at Cabarrus and Catawba WIC. Catawba WIC would make appointments for participants by calling the families that were due for benefits and scheduling them the same day or week, meaning Catawba WIC families would not have to remember when their benefits expired to make another appointment. This was very different from the open access appointment system used by CHA. The appointment making process can be a confounding factor because families that were served by the Catawba clinic may have fewer negative attitudes towards making an appointment due to not having to be on hold compared to CHA families who may have to wait on hold for several minutes until one of the staff members could answer the phone. Furthermore, in 2019 Catawba WIC required families to come in for every appointment including Food Benefit Issuance. CHA WIC families, on the other hand, were able to participate in online nutrition classes and receive their benefits remotely. This difference in process also may result in different attitudes towards appointment flexibility and receiving benefits. Lastly, Catawba WIC had a larger staff than CHA WIC that included a receptionist to greet all WIC families, about 8-10 support staff, and 8-10 nutritionists (some part time). CHA had only 3-5 support staff and 6 nutritionists (some part time). The contrast between staff sizes can make the difference between families sitting in a waiting room compared to being seen right away.

Technical Issues

QLess experienced several service outages that disrupted the workflow. This impacted CHA's ability to serve participants and participants' ability to access making appointments at convenient times.

Text Messages

Text messages had character limitations and were unable to be customized by appointment type. For example, Follow Up appointments did not need all the documentation that Recertification appointments did. Due to the inability to decipher the appointment types, text messages had to be general and referred WIC participants to the CHA WIC website. QLess was unable to identify specific text messages that were sent out to families.

Two Systems

Due to software limitations, QLess was unable to feed into the MIS system, and staff were required to book new QLess families in the MIS system in order to comply with North Carolina state guidance. Therefore, WIC staff had to work in two systems in order to serve WIC families. At times, the two systems became challenging because of confusion of booking appointments in both the systems and at times led to overbooking the calendar. Table 5 provides staff perspectives of the advantages and disadvantages of the QLess platform.

Table 5. Staff perspectives on advantages and disadvantages of QLess. Qualitative data was collected via staff and participant surveys during implementation period.

Advantages	Disadvantages
In lobby wait times were available for participants	Inaccurate in lobby wait times were displayed
Online booking system was embedded into WIC website and social media pages	Platform updates were mid-day during pivotal WIC operation hours
Spanish and English translation	Inability for complete customization of queuing system
On demand IT support for all issues	Difficulty in tracking canceled appointments
Text message reminder customization	Limited characters for complete customization of text messages
WIC participants are able to make appointments with ease	Inability to feed into MIS system
	Appointment schedule needed to be consistently reviewed to prevent over-booking
	Limited number of appointment types, unlike the MIS system

Lessons Learned

Although QLess was able to assist in decreasing volume of calls and creating flexibility for WIC families, there were barriers with the adoption of this particular technology. QLess was very costly and time-consuming to train all members and to adapt the technology to fit WIC's needs. There were issues in creating different types of appointments and duration of appointments. The staff also had to work in two systems as QLess did not feed into the MIS system to create seamless transition for the staff and in turn made it difficult for the staff to serve the participants. Due to these obstacles, CHA was able to find a more flexible OAS software that fit WIC's needs. This software was cheaper in price, easier for staff to understand, and its ability to create many different appointments made it the number one choice for CHA WIC supervisors.

Future Implications

This innovative project and partnership allowed for an opportunity to promote technology for families in need of nutrition assistance. Many families are not able to stay on the phone for long periods of time to make an appointment for the same day or next day. This OAS platform provided families with the flexibility to make their appointment ahead of time using an online platform. This project laid a foundation for CHA WIC to continue using the OAS platform but transition to a new company and software. With the new software, CHA WIC is able to overcome several of the barriers faced with the QLess platform. The new software provides CHA with the ability to customize messaging by appointments, develop more appointment types, and develop a check-in system for families to check-in when CHA-WIC opens its clinics back to the public, post COVID-19.

Plans for Sustainability

Due to the success CHA WIC was able to observe with QLess, WIC supervisors continued with an OAS option for WIC participants. Due to support from the North Carolina Child Recognition Award that Cabarrus Health Alliance won in 2020, CHA WIC purchased a year contract with a new OAS platform that was lower in cost and more sustainable for the future. CHA-WIC is currently using the OAS system in the year 2022 and is pleased with the results.

Recommendations

First, if an agency would like to adapt an OAS system for their WIC clinic they would need to know if that system could feed into their state MIS. The local agency should seek buy-in from state officials in order to gain a customizable feature within the MIS for the OAS platform to feed into. This would prevent confusion and overbooking of families in addition to complying with state laws. Second, the local agency should ensure there are at least two individuals who are very familiar with the WIC workflow to vet the OAS platform(s) prior to purchase to ensure that it will not be overly time-consuming to train WIC staff to use the platform. These staff members should plan to train staff in workshop settings. Third, the agency should adopt an OAS system that is customizable. Many OAS platforms state they are customizable, without stating that roadblocks may occur due to system functions. Fourth, in order to seamlessly move to an OAS system, the agency should market the transition to participants prior to the launch. Fifth, if available, the agency should use incentives to promote the use of the OAS by WIC participants (for instance, using the platform could gain entry into a raffle to win a children's book or WIC bag full of information). Lastly, the agency should remember to gain feedback from WIC staff and participants with monthly or quarterly surveys sent out via text message or in-person to identify possible barriers they are facing with the new technology.

Appendix A. Tables

Table A.1 Crossroads total participation by category annual December trend between 12/2014 and 12/2018

Participant Category	Participation change (#)	Participation change (%)
Pregnant women	-154	-42.66
Fully Breast-feeding women	-32	-25.00
Partially breast-feeding women	-31	-14.83
Non-breastfeeding post-partum women	-70	-22.65
Fully breastfed infants	-42	-29.78
Partially breastfed infants	-52	-22.80
Fully formula-fed infants	-176	-23.97
Children	-800	-38.46
Total	-1,357	-32.39

Table A.2. Logic table illustrating project's activities

Inputs	Activities	Outputs	Outcomes	
			Short Term Outcomes	*Long-Term Outcomes*
Staff Time	• Create protocols for training staff for CHA and comparable site • Train staff • Staff buy-In for APP • Update workflow and schedules	• develop and adopt new OAS protocol • # of trained staff • Design and adopt new schedule and workflow	• less staff time booking appointments • Increased staff satisfaction	Increased retention among C1-C4 WIC participants ***Contextual Factors:*** CHA's environment, geographic location, existing schedule practice, clinic environment, participant perception, staff adherence
QLess	• Vendor interaction • Adapt, test, and refine the OAS through testing of the OAS	• finalized application/website	• increased participant satisfaction in appointment booking • increased communication and reminders to WIC participants	
Outreach/Education	• Educate WIC participants on new appointment making system • Create outreach education materials • Update CHA-WIC website	• # of WIC clients receiving text messages • # of appointments made with OAS • # of clicks on WIC website	• increased # of appointments • improved participation in food/WIC benefits • Improved show rate	
Evaluation	• Contact state • Collect data • Contact and attain comparison county • Develop instruments to collect data	• Data reports/phone reports • Comparable county finalized • Pre/post implementation survey • OAS data (text messages) • # of WIC participants utilizing OAS tool	• participant engagement • Timely recertification	

Table A.3. Inaccurate appointment making

Reasons for inaccurate appointments	**Number of families**	**Proportion (%)**
Should not have made appointment online: example- are new infants, children or pregnant women, or transfers	6	3.8
Made Recertification needed Follow up	66	41.5
Made Follow up needed Recertification	17	10.7
Incorrect number of people selected: example made appointment for 2 people need only for 1	45	28.3
Did not need appointment: example- too early to make appointment	24	15.1
Other	1	0.6
Total	*159*	

Table A.4. Cabarrus Health Alliance WIC baseline participant survey results

Question 1: How satisfied you were with the in lobby wait time for today's appointment?		*Question 2: How did you make today's appointment?*		*Question 3: How easy was it to make today's appointment?*	
Answer	#	*Answer*	#	*Answer*	#
very satisfied	108	no answer	4	very easy	105
satisfied	16	phone call	115	easy	19
neither satisfied/dissatisfied	2	walk in	11	so-so	2

Table A.5. Catawba County WIC baseline participant survey results

Question 1: How satisfied you were with the in lobby wait time for today's appointment?		*Question 2: How did you make today's appointment?*		*Question 3: How easy was it to make today's appointment?*	
Answer	#	*Answer*	#	*Answer*	#
very satisfied	60	phone call	68	very easy	67
satisfied	20	walk in	9	easy	13
dissatisfied	1	online	2	so-so	1
no answer	1	made it at previous appointment	1	no answer/blank	1
		no answer/ blank	2		

Table A.6. CHA Implementation participant survey results

Month	**Response Rate**	**N**	**Mode of Collection**
January 2021	20.53%	76	Phone
February 2021	23.21%	40	Phone
March 2021	32.46%	59	Phone
April 2021	29.77%	42	Phone
Total		217	

Table A.7 Reasons for underutilization of QLess from implementation participant survey

Code	**Reason**
A	Did not know about the online system
B	Lost the appointment reminder green slip with the instructions
C	Needed a pre-booked appointment
D	New participant (could not make appointment online)
E	Was not interested to book online
F	they were in the building
G	Made appointment online but didn't work
H	Lack of access to Wi-Fi
J	Other

Table A.8. Sample sizes at CHA WIC innovation and comparison groups: crude, unweighted

	Overall T1	Overall T2	Infants T1	Infants T2	Children T1	Children T2
Cabarrus	2,324	2,407	944	950	1,380	1,457
Catawba	2,561	2,506	1,005	921	1,556	1,585

Table A.9. Absolute standardized differences (ASDs) for model A1 for infants and children separately

	Infants: Unweighted					
	Mean	Standard Deviation	Mean	Standard Deviation	Difference in Standard Deviations	Absolute Value of Difference
	Cabarrus at T1		Cabarrus at T2			
Number in WIC	1.8283	0.3773	1.8355	0.3710	-0.0192	0.0192
Race: American Indian/Alaska Native	0.0022	0.0464	0.0043	0.0653	-0.0373	0.0373
Race: Asian	0.0119	0.1084	0.0118	0.1078	0.0012	0.0012
Race: Black	0.3790	0.4854	0.3600	0.4803	0.0394	0.0394
Race: White	0.6328	0.4823	0.6720	0.4697	-0.0823	0.0823
Hispanic	0.3250	0.4686	0.3090	0.4623	0.0344	0.0344

Primary language other than English	0.1760	0.3810	0.1421	0.3493	0.0928	0.0928
Need for a translator	0.0097	0.0982	0.0107	0.1029	-0.0096	0.0096
Participates in TANF	0.0043	0.0656	0.0043	0.0653	0.0007	0.0007
Participates in SNAP	0.4320	0.4956	0.3910	0.4882	0.0832	0.0832
Participates in Medicaid	0.8639	0.3430	0.8942	0.3077	-0.0930	0.0930
Average Standardized Absolute Mean Difference						0.0448
	Cabarrus at T1		Catawba at T1			
Number in WIC	1.8283	0.3773	1.8443	0.3627	-0.0433	0.0433
Race: American Indian/Alaska Native	0.0022	0.0464	0.0031	0.0556	-0.0182	0.0182
Race: Asian	0.0119	0.1084	0.1000	0.3002	-0.3905	0.3905
Race: Black	0.3790	0.4854	0.1948	0.3963	0.4157	0.4157
Race: Native Hawaiian/Pacific Islander	0.6328	0.4823	0.7701	0.4210	-0.3032	0.3032
Race: White	0.3250	0.4686	0.2176	0.4128	0.2432	0.2432
Hispanic	0.1760	0.3810	0.0845	0.2783	0.2742	0.2742
Primary language other than English	0.0097	0.0982	0.0412	0.1989	-0.2009	0.2009
Need for a translator	0.0043	0.0656	0.0021	0.0454	0.0400	0.0400
Participates in TANF	0.4320	0.4956	0.2680	0.4432	0.3487	0.3487
Participates in SNAP	0.8639	0.3430	0.9371	0.2429	-0.2462	0.2462
Participates in Medicaid	1.8283	0.3773	1.8443	0.3627	-0.0433	0.0433
Average Standardized Absolute Mean Difference						0.2295
	Cabarrus at T1		Catawba at T2			
Number in WIC	1.8283	0.3773	1.8609	0.3462	-0.0901	0.0901
Race: American Indian/Alaska Native	0.0022	0.0464	0.0011	0.0332	0.0262	0.0262
Race: Asian	0.0119	0.1084	0.1004	0.3008	-0.3918	0.3918
Race: Black	0.3790	0.4854	0.1733	0.3787	0.4726	0.4726
Race: Native Hawaiian/Pacific Islander	0.6328	0.4823	0.7594	0.4277	-0.2776	0.2776
Race: White	0.3250	0.4686	0.2118	0.4088	0.2576	0.2576
Hispanic	0.1760	0.3810	0.0916	0.2886	0.2497	0.2497
Primary language other than English	0.0097	0.0982	0.0221	0.1470	-0.0989	0.0989
Need for a translator	0.0043	0.0656	0.0011	0.0332	0.0618	0.0618
Participates in TANF	0.4320	0.4956	0.2660	0.4421	0.3534	0.3534
Participates in SNAP	0.8639	0.3430	0.9294	0.2564	-0.2161	0.2161
Participates in Medicaid	1.8283	0.3773	1.8609	0.3462	-0.0901	0.0901
Average Standardized Absolute Mean Difference						0.2269
	Infants: Weighted					
	Mean	Standard Deviation	Mean	Standard Deviation	Difference in Standard Deviations	Absolute Value of Difference
	Cabarrus at T1		Catawba at T2			

Number in WIC	1.8283	0.3773	1.8327	0.3735	-0.0116	0.0116
Race: American Indian/Alaska Native	0.0022	0.0464	0.0024	0.0489	-0.0050	0.0050
Race: Asian	0.0119	0.1084	0.0092	0.0956	0.0261	0.0261
Race: Black	0.3790	0.4854	0.3777	0.4851	0.0027	0.0027
Race: Native Hawaiian/Pacific Islander	0.6328	0.4823	0.6363	0.4813	-0.0072	0.0072
Race: White	0.3250	0.4686	0.3192	0.4664	0.0124	0.0124
Hispanic	0.1760	0.3810	0.1757	0.3808	0.0009	0.0009
Primary language other than English	0.0097	0.0982	0.0092	0.0954	0.0056	0.0056
Need for a translator	0.0043	0.0656	0.0040	0.0635	0.0043	0.0043
Participates in TANF	0.4320	0.4956	0.4282	0.4951	0.0076	0.0076
Participates in SNAP	0.8639	0.3430	0.8665	0.3403	-0.0074	0.0074
Participates in Medicaid	1.8283	0.3773	1.8327	0.3735	-0.0116	0.0116
Average Standardized Absolute Mean Difference						0.0083
	Cabarrus at T1		Catawba at T1			
Number in WIC	1.8283	0.3773	1.8383	0.3683	-0.0269	0.0269
Race: American Indian/Alaska Native	0.0022	0.0464	0.0016	0.0401	0.0127	0.0127
Race: Asian	0.0119	0.1084	0.0149	0.1210	-0.0259	0.0259
Race: Black	0.3790	0.4854	0.3586	0.4798	0.0423	0.0423
Race: Native Hawaiian/Pacific Islander	0.6328	0.4823	0.6500	0.4772	-0.0357	0.0357
Race: White	0.3250	0.4686	0.3404	0.4741	-0.0326	0.0326
Hispanic	0.1760	0.3810	0.1829	0.3868	-0.0179	0.0179
Primary language other than English	0.0097	0.0982	0.0103	0.1012	-0.0061	0.0061
Need for a translator	0.0043	0.0656	0.0026	0.0513	0.0285	0.0285
Participates in TANF	0.4320	0.4956	0.4341	0.4959	-0.0043	0.0043
Participates in SNAP	0.8639	0.3430	0.8541	0.3532	0.0283	0.0283
Participates in Medicaid	1.8283	0.3773	1.8383	0.3683	-0.0269	0.0269
Average Standardized Absolute Mean Difference						0.0238
	Cabarrus at T1		Catawba at T2			
Number in WIC	1.8283	0.3773	1.8198	0.3846	0.0223	0.0223
Race: American Indian/Alaska Native	0.0022	0.0464	0.0006	0.0244	0.0421	0.0421
Race: Asian	0.0119	0.1084	0.0136	0.1158	-0.0152	0.0152
Race: Black	0.3790	0.4854	0.3742	0.4842	0.0099	0.0099
Race: Native Hawaiian/Pacific Islander	0.6328	0.4823	0.6400	0.4803	-0.0150	0.0150
Race: White	0.3250	0.4686	0.3115	0.4634	0.0290	0.0290
Hispanic	0.1760	0.3810	0.1638	0.3703	0.0325	0.0325
Primary language other than English	0.0097	0.0982	0.0129	0.1128	-0.0298	0.0298
Need for a translator	0.0043	0.0656	0.0038	0.0612	0.0088	0.0088
Participates in TANF	0.4320	0.4956	0.4206	0.4939	0.0230	0.0230

Participates in SNAP	0.8639	0.3430	0.8578	0.3495	0.0178	0.0178
Participates in Medicaid	1.8283	0.3773	1.8198	0.3846	0.0223	0.0223
Average Standardized Absolute Mean Difference						0.0223

Children: Unweighted

	Mean	Standard Deviation	Mean	Standard Deviation	Difference in Standard Deviations	Absolute Value of Difference
	Cabarrus at T1		Cabarrus at T2			
Number in WIC	1.5226	0.4997	1.5094	0.5001	0.0264	0.0264
Race: Asian	0.0089	0.0939	0.0160	0.1255	-0.0641	0.0641
Race: Black	0.3227	0.4677	0.3454	0.4757	-0.0480	0.0480
Race: White	0.6847	0.4648	0.6706	0.4702	0.0301	0.0301
Hispanic	0.3806	0.4857	0.3477	0.4764	0.0683	0.0683
Primary language other than English	0.2420	0.4285	0.1904	0.3928	0.1256	0.1256
Need for a translator	0.0104	0.1013	0.0090	0.0947	0.0136	0.0136
Participates in TANF	0.0081	0.0899	0.0111	0.1049	-0.0305	0.0305
Participates in SNAP	0.5352	0.4989	0.5087	0.5001	0.0530	0.0530
Participates in Medicaid	0.9467	0.2247	0.9430	0.2319	0.0162	0.0162
Category child 1	0.4071	0.4915	0.3989	0.4898	0.0167	0.0167
Category child 2	0.3190	0.4663	0.3356	0.4724	-0.0354	0.0354
Category child 3	0.2739	0.4461	0.2655	0.4417	0.0189	0.0189
Average Standardized Absolute Mean Difference						0.0476
	Cabarrus at T1		Catawba at T1			
Number in WIC	1.5226	0.4997	1.5725	0.4949	-0.1005	0.1005
Race: Asian	0.0089	0.0939	0.1065	0.3086	-0.4281	0.4281
Race: Black	0.3227	0.4677	0.1869	0.3900	0.3154	0.3154
Race: White	0.6847	0.4648	0.7667	0.4231	-0.1845	0.1845
Hispanic	0.3806	0.4857	0.2767	0.4475	0.2224	0.2224
Primary language other than English	0.2420	0.4285	0.1275	0.3336	0.2984	0.2984
Need for a translator	0.0104	0.1013	0.0752	0.2637	-0.3244	0.3244
Participates in TANF	0.0081	0.0899	0.0033	0.0571	0.0647	0.0647
Participates in SNAP	0.5352	0.4989	0.3993	0.4899	0.2747	0.2747
Participates in Medicaid	0.9467	0.2247	0.9706	0.1690	-0.1201	0.1201
Category child 1	0.4071	0.4915	0.3993	0.4899	0.0158	0.0158
Category child 2	0.3190	0.4663	0.3235	0.4680	-0.0096	0.0096
Category child 3						
Average Standardized Absolute Mean Difference						0.2333
	Cabarrus at T1		Catawba at T2			
Number in WIC	1.5226	0.4997	1.5264	0.4995	-0.0076	0.0076
Race: Asian	0.0089	0.0939	0.1106	0.3138	-0.4393	0.4393
Race: Black	0.3227	0.4677	0.1926	0.3945	0.3007	0.3007
Race: White	0.6847	0.4648	0.7597	0.4274	-0.1680	0.1680

Hispanic	0.3806	0.4857	0.2580	0.4377	0.2652	0.2652
Primary language other than English	0.2420	0.4285	0.1221	0.3275	0.3146	0.3146
Need for a translator	0.0104	0.1013	0.0483	0.2145	-0.2263	0.2263
Participates in TANF	0.0081	0.0899	0.0019	0.0436	0.0882	0.0882
Participates in SNAP	0.5352	0.4989	0.3586	0.4797	0.3608	0.3608
Participates in Medicaid	0.9467	0.2247	0.9619	0.1916	-0.0726	0.0726
Category child 1	0.4071	0.4915	0.4113	0.4922	-0.0086	0.0086
Category child 2	0.3190	0.4663	0.3210	0.4670	-0.0043	0.0043
Category child 3	0.2739	0.4461	0.2676	0.4429	0.0140	0.0140
Average Standardized Absolute Mean Difference						0.2243

Children: Weighted

	Mean	Standard Deviation	Mean	Standard Deviation	Difference in Standard Deviations	Absolute Value of Difference
	Cabarrus at T1		Cabarrus at T2			
Number in WIC	1.5226	0.4997	1.5235	0.4996	-0.0019	0.0019
Race: Asian	0.0089	0.0939	0.0084	0.0914	0.0051	0.0051
Race: Black	0.3227	0.4677	0.3215	0.4672	0.0025	0.0025
Race: White	0.6847	0.4648	0.6892	0.4630	-0.0097	0.0097
Hispanic	0.3806	0.4857	0.3770	0.4848	0.0073	0.0073
Primary language other than English	0.2420	0.4285	0.2388	0.4265	0.0076	0.0076
Need for a translator	0.0104	0.1013	0.0093	0.0960	0.0109	0.0109
Participates in TANF	0.0081	0.0899	0.0082	0.0901	-0.0005	0.0005
Participates in SNAP	0.5352	0.4989	0.5323	0.4991	0.0058	0.0058
Participates in Medicaid	0.9467	0.2247	0.9469	0.2243	-0.0010	0.0010
Category child 1	0.4071	0.4915	0.4105	0.4921	-0.0070	0.0070
Category child 2	0.3190	0.4663	0.3124	0.4636	0.0142	0.0142
Category child 3	0.2739	0.4461	0.2770	0.4477	-0.0071	-0.0071
Average Standardized Absolute Mean Difference						0.0052
	Cabarrus at T1		Catawba at T1			
Number in WIC	1.5226	0.4997	1.5280	0.4994	-0.0108	0.0108
Race: Asian	0.0089	0.0939	0.0136	0.1158	-0.0446	0.0446
Race: Black	0.3227	0.4677	0.3312	0.4708	-0.0181	0.0181
Race: White	0.6847	0.4648	0.6744	0.4688	0.0221	0.0221
Hispanic	0.3806	0.4857	0.3370	0.4728	0.0908	0.0908
Primary language other than English	0.2420	0.4285	0.1867	0.3898	0.1351	0.1351
Need for a translator	0.0104	0.1013	0.0114	0.1063	-0.0102	0.0102
Participates in TANF	0.0081	0.0899	0.0035	0.0590	0.0612	0.0612
Participates in SNAP	0.5352	0.4989	0.5250	0.4995	0.0204	0.0204
Participates in Medicaid	0.9467	0.2247	0.9494	0.2192	-0.0123	0.0123
Category child 1	0.4071	0.4915	0.3918	0.4883	0.0313	0.0313
Category child 2	0.3190	0.4663	0.3339	0.4717	-0.0316	0.0316

Category child 3	0.2739	0.4461	0.2744	0.4463	-0.0011	-0.0011
Average Standardized Absolute Mean Difference						0.0377
	Cabarrus at T1		Catawba at T2			
Number in WIC	1.5226	0.4997	1.5143	0.5000	0.0166	0.0166
Race: Asian	0.0089	0.0939	0.0106	0.1024	-0.0174	0.0174
Race: Black	0.3227	0.4677	0.3133	0.4640	0.0203	0.0203
Race: White	0.6847	0.4648	0.6959	0.4602	-0.0243	0.0243
Hispanic	0.3806	0.4857	0.3765	0.4847	0.0084	0.0084
Primary language other than English	0.2420	0.4285	0.2267	0.4188	0.0363	0.0363
Need for a translator	0.0104	0.1013	0.0118	0.1078	-0.0133	0.0133
Participates in TANF	0.0081	0.0899	0.0071	0.0840	0.0120	0.0120
Participates in SNAP	0.5352	0.4989	0.5103	0.5001	0.0498	0.0498
Participates in Medicaid	0.9467	0.2247	0.9294	0.2562	0.0716	0.0716
Category child 1	0.4071	0.4915	0.4063	0.4913	0.0017	0.0017
Category child 2	0.3190	0.4663	0.3180	0.4658	0.0022	0.0022
Category child 3	0.2739	0.4461	0.2758	0.4470	-0.0042	-0.0042
Average Standardized Absolute Mean Difference						0.0270

Table A.10. Sample sizes for DID analyses at Cabarrus and Catawba

	Overall	Infants	Children
Crude, unweighted – Recert	9,631	3,738	5,881
Crude, unweighted – Retention	9,631	3,738	5,881
Crude, unweighted – Benefit issuance	9,631	3,738	5,881
Recertification using logit, assuming effects are multiplicative	9,603	3,722	5,881
Recertification using Kernel repeated cross-sectional option	9,608	3,720	5,882
Retention using logit, assuming effects are multiplicative	9,603	3,722	5,881
Retention using Kernel repeated cross-sectional option	9,608	3,720	5,881
Benefit issuance using logit, assuming effects are multiplicative	9,603	3,722	5,881
Benefit issuance using Kernel repeated cross-sectional option	9,608	3,720	5,881

Appendix B. Training Materials

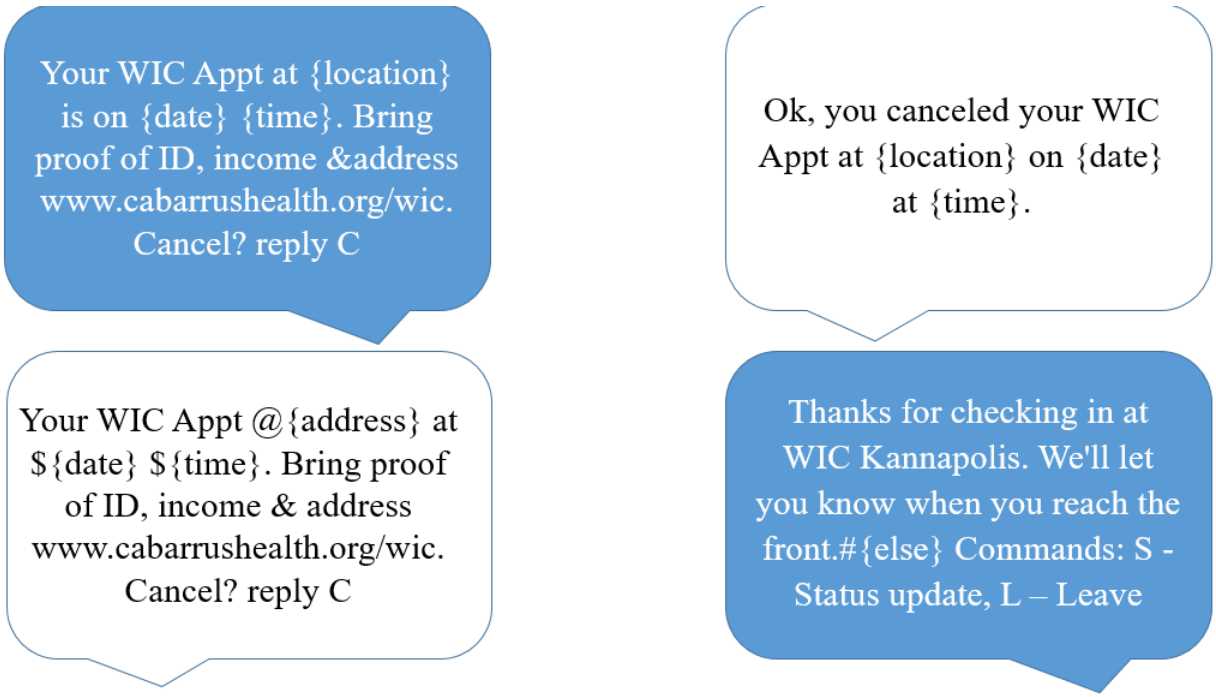


Figure B.1. Text messages from QLess

Staff Checklist

- **CEC**: this is the screen that is like the Dashboard in Crossroads, it shows the appointments for the day
  - URL: https://merchant.na4.qless.com/cec
  - Username: WIC
  - Password: Veggie$4all
  - Please refresh the page after every action you do—this will load the page faster
  - **Remember the green checkbox under *Call Ahead* means they are next for an appointment BUT they have not yet physically checked into our clinic
  - You will be notified that the participant is physically checked in when the box under *Call Ahead* is no longer **green**

- **Calendar**: booking appointments
  - URL: https://merchant.na4.qless.com/calendar/
  - Username: WIC
  - Password: Veggie$4all
  - Remember you can use the binoculars to search available appointments on the right hand upper corner
  - To create an appointment you go to the "Create new FlexAppointment"
  - **All families that have 2 NEIs please only use 1 follow-up appointment slot on QLess--G2/B2, HW/HW, G4/B4, BF status change, HW/A2 **
  - **Please remember that if a family has one Nutrition Follow up and a RC please put both family members as a RC and put a note that Person A is a Follow up while Person B is a RC
- When you have serviced a family please put them back into Crossroads as a walk-in so that our caseload is accurate (this will also be on the yellow routing slip as well)
- New people need to be added in QLess in the RC spots

KEY:

KANNAPOLIS	CONCORD
Nutritionist 1: RC	**Nutritionist 1: RC**
Nutritionist 2: Follow Up	**Nutritionist 2: Follow Up**
Nutritionist 3: Late Clinic	
Nutritionist 4: RC	
Nutritionist 5: Follow Up	

BOOK FOR 1 PERSON in the Follow UP APPT ***even though they are for 2 people***

- G2/B2
- G4/B4
- HW/HW
- HW/HGB
- FORMULA CHANGE
- BREASTFEEDING STATUS CHANGE
- A2/CL

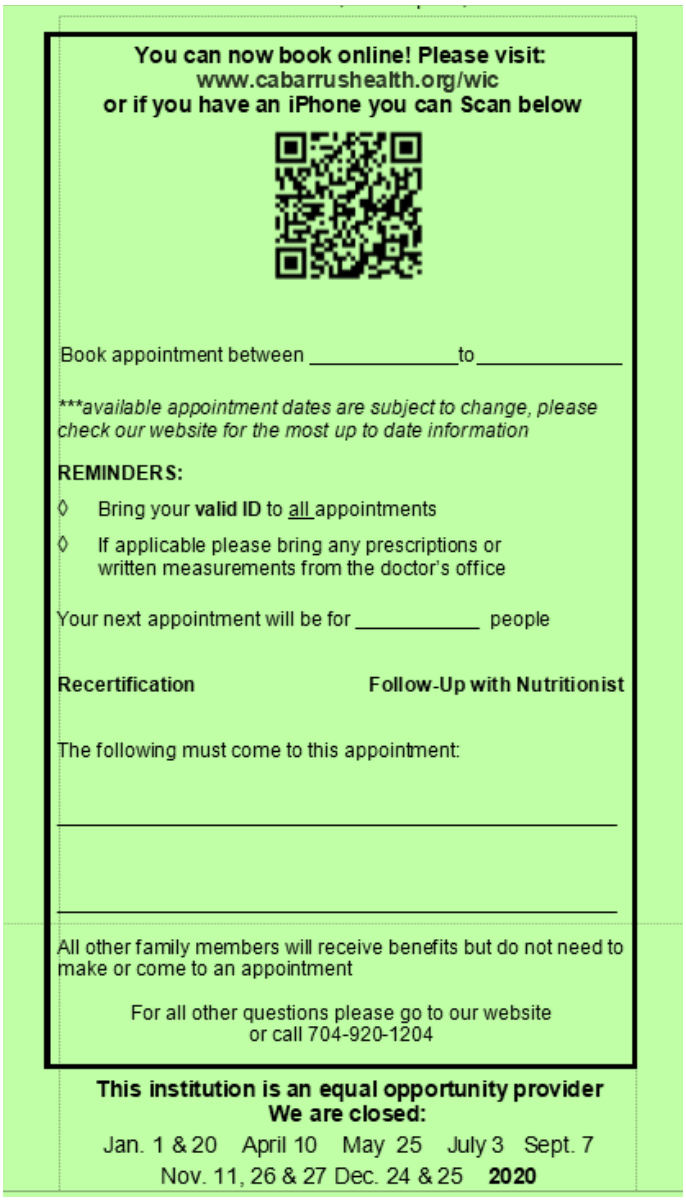
BOOK FOR 1 PERSON in the Follow UP APPT; FBI do not need a to book an appointment

- C3/CL
- B3/CL

If a family has a RC appointment

- If a family has a RC please remember to book them in the RC slot
- For example—if the family has 2 children and one child is a RC and the other a C3 please book them as RC for 2 people and add a note

Figure B.2. Staff checklist reminders



You can now book online! Please visit:
www.cabarrushealth.org/wic
or if you have an iPhone you can Scan below

Book appointment between _____to_____

****available appointment dates are subject to change, please check our website for the most up to date information*

REMINDERS:

◊ Bring your **valid ID** to all appointments

◊ If applicable please bring any prescriptions or written measurements from the doctor's office

Your next appointment will be for _____ people

Recertification **Follow-Up with Nutritionist**

The following must come to this appointment:

_____

_____

All other family members will receive benefits but do not need to make or come to an appointment

For all other questions please go to our website or call 704-920-1204

This institution is an equal opportunity provider
We are closed:
Jan. 1 & 20 April 10 May 25 July 3 Sept. 7
Nov. 11, 26 & 27 Dec. 24 & 25 **2020**

Figure B.3. Reminder appointment slip- English language

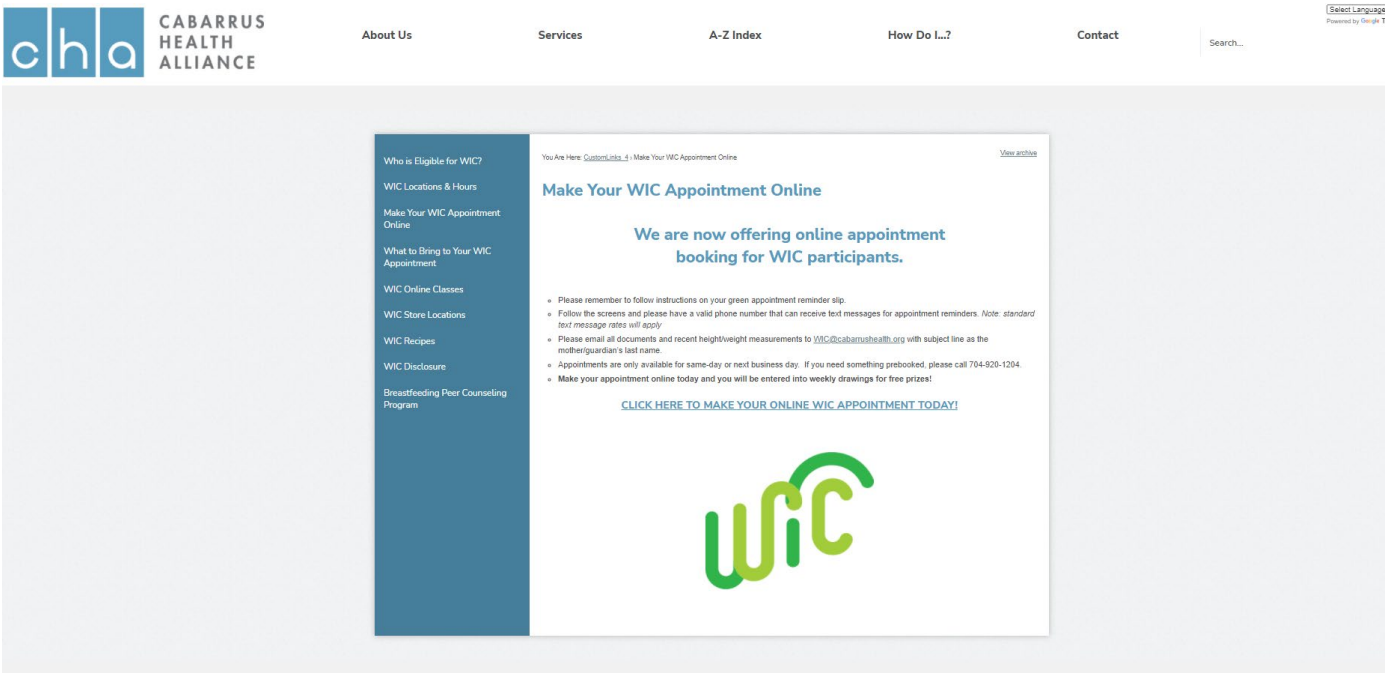


Figure B.4. CHA WIC website

Appendix C. Data Collection Tools

CABARRUS HEALTH ALLIANCE

Office Use Only/ Sólo Para uso en la Oficina

Arrival Time: _____AM/PM Start of Service Time:_____ AM/PM

Type(s) of Appointment(s):_____ # of Family Members Serviced Today:_____

1. Please select one of the options below regarding how **satisfied you were with the in lobby wait time** for **today's** appointment?

☺ Completely Satisfied	Very Satisfied	😐 Satisfied	Slightly Satisfied	☹ Not at all Satisfied

2. How did you make **today's** appointment?

Phone Call to the WIC Office	Walk- in	Other_____

3. How easy was it to make **today's** appointment?

☺ Very Easy	Easy	😐 So-So	Hard	☹ Very Hard

Spanish / Español

1. Por favor, seleccione una de las siguientes opciones con respecto a lo satisfecho que estaba con **el tiempo de espera en el vestíbulo** para la cita de **hoy**?

☺ Completamete Satisfecho	Muy Satisfecho	😐 Satisfecho	Poco Satisfecho	☹ Nunca Satisfecho

2. ¿Cómo hizo su cita **hoy**?

Teléfono (Hablar con personal de WIC)	Caminar en la oficina	Otro:_____

3. ¿Cómo calificaría la forma en que hizo su cita **hoy**?

☺ Muy Fácil	Fácil	😐 Más o menos	Difícil	☹ Muy Difícil

Adopted 10/2019

Figure C.1. Baseline survey

QLESS 03/2021 Participant Survey

Before I get started with the appointment, would you be willing to answer two questions regarding your appointment today. These questions will help WIC evaluate the appointment making process.

1. Family ID *

Enter your answer

2. Type of appointments (RC, C3, ADB) *

Enter your answer

3. How did you make your appointment today? *

- online
- over the phone
- walk-in

4. In terms of making your appointment, how easy was it to make the appointment online? *

- Extremely easy
- Somewhat easy
- Neutral
- Somewhat not easy
- Extremely not easy

5. Could you tell me more on why you selected the answer above? *

Enter your answer

6. How likely are you to make your next appointment online? *

- Very likely
- Somewhat likely
- Neither likely nor unlikely
- Somewhat unlikely
- Very unlikely

7. Do you have anything else to share about the online system? (optional)

Enter your answer

8. Please describe in a sentence or two why you did not make today's appointment online?

You can use the following as prompts in case they are unsure on how to answer:

a. Did not know about the online system
b. Lost the appointment reminder green slip with the instructions
c. Needed a pre-booked appointment
d. New participant (could not make appointment online)
e. Was not interested to book online
f. They were in the building
g. Made appointment online but didn't work
h. Lack of access to Wi-Fi *

Enter your answer

9. Do you have anything else to share about the online appointment system? (optional)

Enter your answer

Figure C.2. Implementation survey

CABARRUS HEALTH ALLIANCE

Office Use Only

Type(s) of Appointment:_____
Family ID: _____

1. How would you rate the way you made your appointment today?

(1) Excellent (2) Very Good (3) Good (4) Fair (5) Poor

2. If you answered Fair or Pair please explain why in a few words

3. How did you make your appointment today?
(1) Phone (2) Walk-in (3) Online (4) Other _____

**If answered made appointment online they will then answer the following:

4. The online appointment system made it easy for me to make an appointment.
(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree

5. The online appointment system made it easy for me continue to participate in WIC.
(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree; (4) Agree (5) Strongly agree

6. Please state how likely you are to use if an online appointment system was offered to make your next appointment for WIC.
(1) Extremely unlikely (2) unlikely (3) Neutral (4) Likely (5) Extremely likely

7. Please explain why you selected unlikely/extremely unlikely

Figure C.3. Post implementation survey

STAFF Survey 2019

Please answer the following questions as best as possible

1. How satisfied are you with the way in which WIC participants make their appointments?

Very Satisfied	**Satisfied**	**Neither Satisfied or Dissatisfied**	**Dissatisfied**	**Very Dissatisfied**

2. How satisfied are you with the way in which WIC participants receive reminders for their appointments?

Very Satisfied	**Satisfied**	**Neither Satisfied or Dissatisfied**	**Dissatisfied**	**Very Dissatisfied**

Figure C.4. Staff baseline survey

STAFF Survey 2021

Please rate below

1. How satisfied are you with the way in which WIC appointments were made in QLESS?

Very Satisfied	Satisfied	Neither Satisfied or Dissatisfied	Dissatisfied	Very Dissatisfied

2. If you chose Neither Satisfied or Dissatisfied or below please explain why:

3. How satisfied are you with the way in which WIC participants received reminders for their appointments via QLESS text messages?

Very Satisfied	Satisfied	Neither Satisfied or Dissatisfied	Dissatisfied	Very Dissatisfied

4. If you chose Neither Satisfied or Dissatisfied or below please explain why:

5. QLESS is an excellent appointment booking platform for both WIC families and staff.

Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree

6. Please explain why you selected above

Figure C.5. Staff post implementation survey

Appendix D. Propensity Score Weighting (PSW) Figures

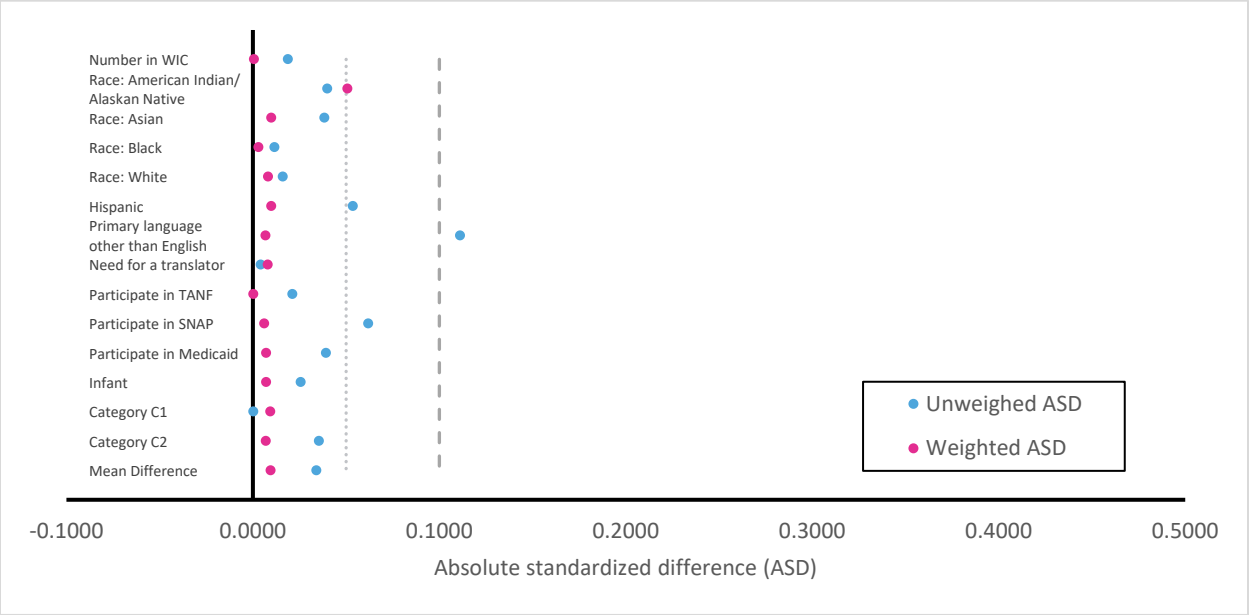


Figure D.1. Absolute standardized differences in characteristics (unweighted and weighted) at T1 vs. T2 at Cabarrus overall: infants and children

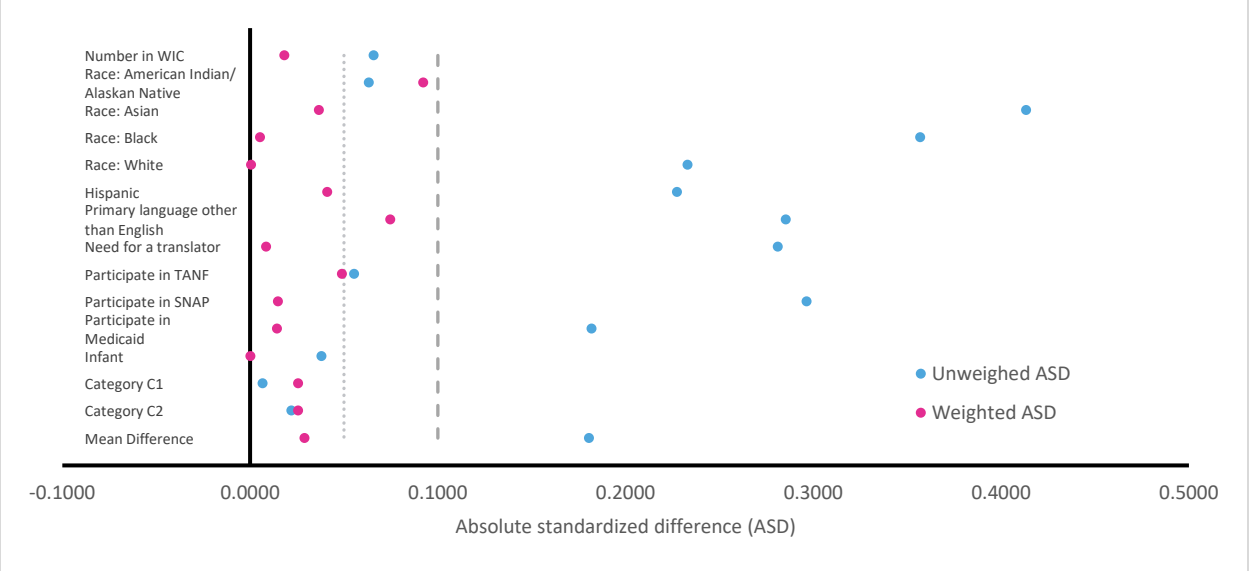


Figure D.2. Absolute standardized differences in characteristics (unweighted and weighted) at T1 at Cabarrus vs. T1 at Catawba overall: infants and children

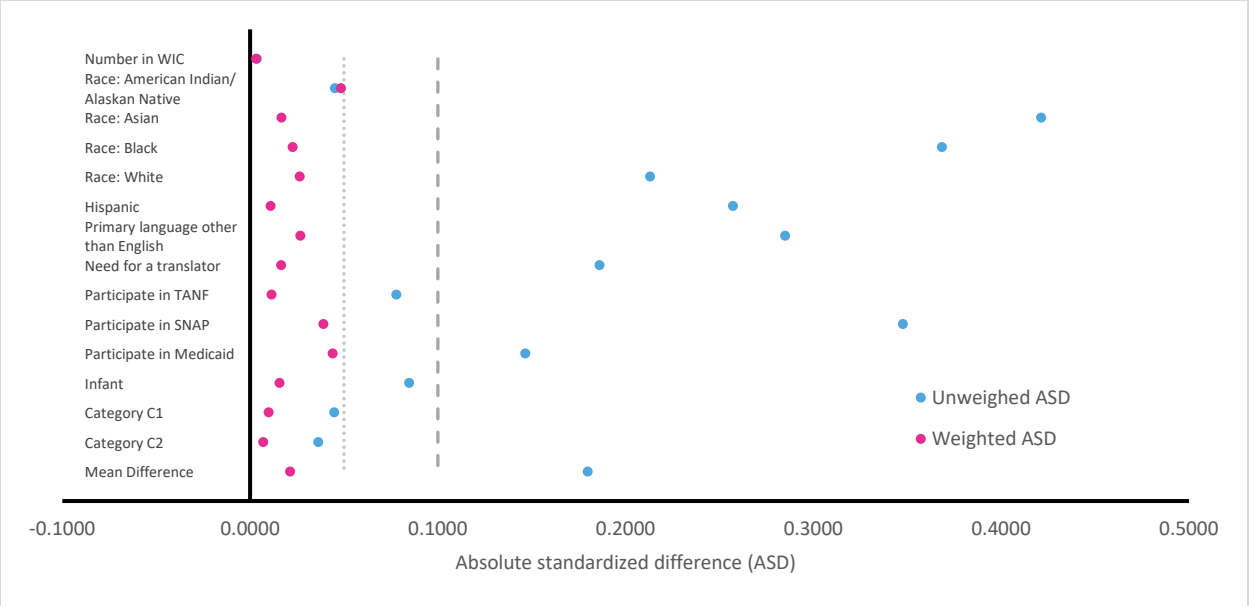


Figure D.3. Absolute standardized differences in characteristics (unweighted and weighted) at T1 at Cabarrus vs. T2 at Catawba overall: infants and children

Appendix E. Implementation Protocols

Original Confirmation text: Your WIC Appt @ 280 Concord Prkwy S #110B, Concord, NC @ ${date} ${time}. Bring proof of ID, income & address www.cabarrushealth.org/wic. Cancel? reply C

New Confirmation text: Your virtual WIC APPT is @ ${date} ${time}. Please do not come in, we will call you! Cancel? reply C

Original appointment manually deleted: Sorry, your WIC Appointment at ${appointment.queue.location.description} on ${date} at ${time} has been canceled please call 704-920-1204 for details.

New appointment manually deleted: Sorry, your virtual WIC Appointment on ${date} at ${time} has been canceled, please call 704-920-1204 for details.

Original 30 minute Reminder text: Your WIC Appt at ${appointment.queue.location.description} @ ${date} ${time}. Bring proof of ID, income & address www.cabarrushealth.org/wic. Cancel? reply C

New 30 minute Reminder text: Your phone WIC APPT is @ ${time}. Send ID, income & address proof to WIC@cabarrushealth.org. Go to www.cabarrushealth.org/wic for details. Cancel? reply C.

Original join Queue: Your scheduled FlexAppointment time is nearing. Your est. wait is currently ${wait}. #if($removeOldCallAheadSpotsIntervalMins<=0)Need more time? Reply "M". Not coming? Reply "L" to leave.#{else} Arrive and checkin within $removeOldCallAheadSpotsIntervalMins mins.#{end}

New join Queue: Your phone WIC APPT @ ${time}. Send ID, income & address proof to WIC@cabarrushealth.org. Go to www.cabarrushealth.org/wic for details Cancel? reply C- QLess

Original Uncancel APPT: Ok, your WIC Appointment is back on at ${appointment.queue.location.description} on ${date} at ${time}. Cancel? reply C

New Uncancel APPT: Ok, your virtual WIC APPT is back on at on ${date} at ${time}. Please do not come in, we will call you! Cancel? reply C

Figure E.1. Text message development Note: The original text messages were developed prior to COVID-19. Text messages were modified to adapt to COVID-19 clinic measures.

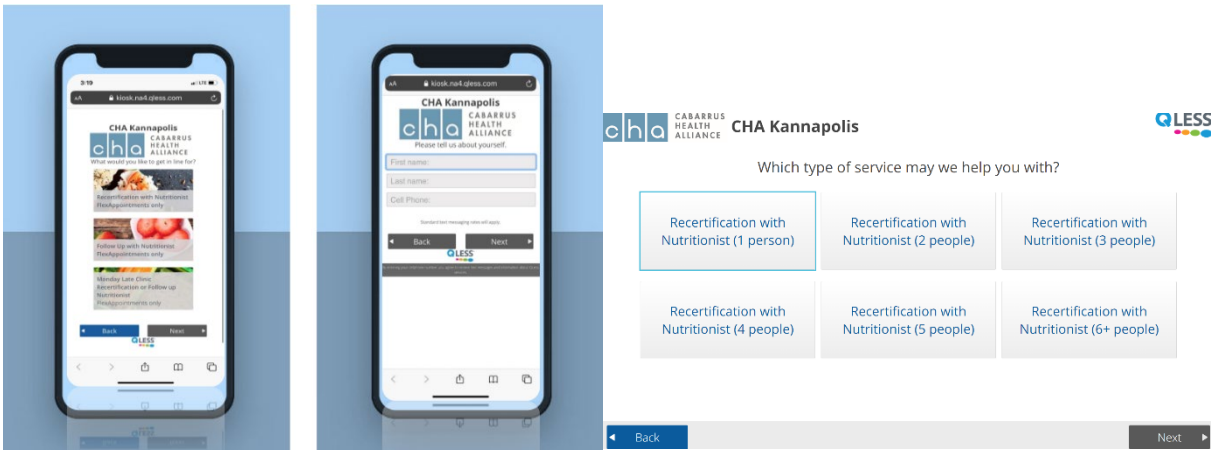


Figure E.2. Example of appointment booking process

[1] Eppes, E, Kang, Y, Caulfield, L, Gross, S. Hopkins Participant Research Innovation Laboratory for Enhancing WIC Services (HPRIL) Baseline Period Characteristics Report. 2022.
[2] Eppes, E, Kang, Y, Caulfield, L, Gross, S. Hopkins Participant Research Innovation Laboratory for Enhancing WIC Services (HPRIL) Implementation Period Characteristics Report. 2022.

[3] Stuart EA, Huskamp HA, Duckworth K, et al. Using propensity scores in difference-in-differences models to estimate the effects of a policy change. Health Services and Outcomes Research Methodology. 2014;14(4):166-182. doi:10.1007/S10742-014-0123-Z/TABLES/5.
[4] Villa JM. diff: Simplifying the estimation of difference-in-differences treatment effects. *Stata Journal*. 2016;16(1):52-71. doi:10.1177/1536867X1601600108.