South Carolina Department of Health (DPH) WIC: Evaluation of Telehealth Solutions for South Carolina WIC
SC1. Technical Appendix

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SC.1.1. THIS-WIC Study Framework

The U.S. Department of Agriculture (USDA)/Tufts Telehealth Intervention Strategies for the Supplemental Nutrition Program for Women, Infants, and Children (THIS-WIC) used the five-stage model for comprehensive research on telehealth developed by Fatehi and colleagues[1] to guide the overall design of a telehealth research program (see **Figure SC.1.1**).

- **Stage 1 (concept development):** Propose a technology-based solution to a health problem; this stage may include a needs analysis, proof of concept, and a technical evaluation of the concept.
- **Stage 2 (service design):** Study feasibility and accessibility to determine how the service delivery model should be modified to accommodate the proposed telehealth intervention.
- **Stage 3 (pre-implementation):** Study the telehealth solution under a controlled environment to assess efficacy.
- **Stage 4 (implementation):** Study the telehealth solution in real-world settings to assess effectiveness.
- **Stage 5 (operational use):** After implementing a telehealth intervention, focus on operational use and sustainability of the solution.

In the context of THIS-WIC, the model mapped a multistage journey from developing a telehealth solution to assessing an established telehealth service. The model's internal consistency results from previous observations of the progression of telehealth projects in the telehealth field. Fatehi and colleagues[1] noted that telehealth research evaluations may not need to include all elements or stages, particularly where comparable services have been rigorously assessed. South Carolina's (SC's) project spanned the second and third stages of the model as it focuses on design and is a pilot project (i.e., pre-implementation).

Figure SC.1.1. THIS-WIC Five-Stage Model for Comprehensive Telehealth Research and Priority Areas

1

Concept Development

Medium-term
- Proof of concept
- Technical evaluation

2

Service Design

Primary Outcomes
Short-term
- Accessibility
- Barriers

Medium-term
- Reliability/validity

Long-term
- Cost analysis

Secondary Outcomes
- Acceptability
- Feasibility

3

Pre-Implementation

Primary Outcomes
Short-term
- Accessibility
- Barriers

Medium-term:
- Satisfaction

Long-term
- Cost/return on investment
- Reach, retention

Secondary Outcomes
- Acceptability
- Adoption
- Behavioral outcomes
- Feasibility
- Attitude
- Fidelity
- Readiness

4

Implementation

Primary Outcomes
Short-term
- Accessibility
- Barriers

Medium-term
- Satisfaction

Long-term
- Cost/return on investment
- Reach, retention

Secondary Outcomes
- Acceptability
- Adoption
- Behavioral outcomes
- Feasibility
- Attitude
- Fidelity
- Readiness

5

Operational Use

Primary Outcomes
Short-term
- Accessibility
- Barriers

Medium-term
- Satisfaction

Long-term
- Cost
- Reach, retention

Secondary Outcomes
- Acceptability
- Behavioral outcomes
- Quality Improvement

← **South Carolina** →

Implementation Context and Factors
(including WIC client & staff demographics, WIC clinic demographics)

SC.1.2.   WIC Agencies Participating in THIS-WIC Evaluation

SC WIC identified WIC agencies with declining rates of WIC participation and randomly selected seven intervention and seven comparison agencies from two regions: Pee Dee and Lowcountry. Local agencies that were experiencing a negative trend in participation over the past 12 months (July 2020–July 2021) were randomly assigned to treatment groups using the PLAN procedure in SAS (version 9.4). Randomization procedures were carried out for each public health region separately. **Table SC.1.1** lists the agencies from the Pee Dee and Lowcountry regions involved in the evaluation. **Table SC.1.2** summarizes the characteristics of the agencies and their clients. **Table SC.1.3** provides information on client race and ethnicity by local agency.

Table SC.1.1. WIC Agencies in the Intervention and Comparison Groups in SC

Intervention Group	Comparison Group
Pee Dee Region	
Clarendon Health	Georgetown Health Department
Florence Health Department	Marlboro Health Department
Lee Health Department	Shaw Air Force Base
Myrtle Beach Health Department	Sumter Health Department
Lowcountry Region	
Holly Hill Health Department	Goose Creek Health Department
Mt. Pleasant Health Department	Hampton Health Department
Northwoods Health Department	Orangeburg Health Department

Source: SC WIC Management Information System (MIS), June 2020

Table SC.1.2. Local Agency and Client Characteristics of Intervention and Comparison Agencies in SC

Local Agency	I/Cᵃ	County	Project County Rural/Urban	Caseload	# Breast-feeding	# Children	# Infant	# Non-Breastfeeding Postpartum	# Pregnant	# High Risk
Pee Dee Region										
Clarendon Health Department	I	Clarendon	Rural	708	23	393	171	57	65	171
Georgetown Health Department	C	Georgetown	Rural	837	28	454	207	82	66	75
Florence Health Department	I	Florence	Urban	2, 354	123	1170	589	226	249	727
Marlboro Health Department	C	Marlboro	Rural	702	20	371	175	59	76	152
Lee Health Department	I	Lee	Rural	510	15	286	116	45	46	103
Shaw Air Force Base	C	Sumter	Urban	35	5	20	10	3	1	12
Myrtle Beach Health Department	I	Horry	Urban	2,408	184	1246	623	181	181	587
Sumter Health Department	C	Sumter	Urban	2,643	140	1286	715	234	248	921
Lowcountry Region										
Holly Hill Health Department	I	Orangeburg	Rural	406	11	248	87	28	32	143
Goose Creek Health Department	C	Berkeley	Urban	900	64	536	200	48	58	233
Mt. Pleasant Health Department	I	Charleston	Urban	688	46	367	169	54	43	163
Hampton Health Department	C	Hampton	Rural	484	18	248	119	52	49	131
Northwoods Health Department	I	Charleston	Urban	3,572	354	621	393	162	125	875
Orangeburg Health Department	C	Orangeburg	Rural	1,938	81	965	510	186	200	691

Source: SC WIC Management Information System (MIS), June 2020

ᵃ I = intervention; C = comparison

Table SC.1.3. WIC Local Agency Client Race/Ethnicity in SC

Local Agency	Intervention or Comparison[a]	% Black or African American	% White	% Hispanic	% American Indian or Alaska Native	% Asian	% Native Hawaiian or Other
Pee Dee Region							
Clarendon Health Department	I	66.8%	30.2%	3%	0%	0.95%	0%
Georgetown Health Department	C	60.5%	37.2%	5%	0%	0.08%	0%
Florence Health Department	I	67.9%	24.6%	4%	0.22%	0.93%	0.18%
Marlboro Health Department	C	58.9%	33.5%	1%	1.12%	0.16%	0%
Lee Health Department	I	78.8%	20.3%	3%	0%	0.21%	0%
Shaw Air Force Base	C	20.3%	74%	16%	0%	1.85%	0%
Myrtle Beach Health Department	I	22.1%	66.7%	23%	0.05%	1.6%	0%
Sumter Health Department	C	65.4%	31.1%	4%	0.28%	0.14%	2.6%
Lowcountry Region							
Holly Hill Health Department	I	72.6%	19.1%	5%	1.49%	1.06%	0%
Goose Creek Health Department	C	40.7%	47.4%	15%	0.28%	1.31%	0%
Mt. Pleasant Health Department	I	56.2%	37.8%	9%	0%	1.12%	0%
Hampton Health Department	C	57.7%	34.6%	1%	0.47%	0.16%	0.16%
Northwoods Health Department	I	54.3%	38.2%	28%	0.3%	0.87%	0.63%
Orangeburg Health Department	C	73.1%	22.9%	5%	0.15%	1.13%	0.1%

Source: SC WIC management information system (MIS), June 2020
[a] I = intervention; C = comparison

SC.1.3.   Data Sources for the Portal App Evaluation

Table SC.1.4 provides a description of the data sources used in the evaluation.

Table SC.1.4. Description of Data Sources for TeleWIC Evaluation in SC

Data Source	Description	Developed By	Collected By
Management information system (MIS) data	Caseload and client characteristic data	State agency	State agency
Portal app metadata	Telehealth usage and engagement metrics	Telehealth Vendor	State agency
Client and staff surveys	Telehealth satisfaction, quality of telehealth interaction, and whether telehealth solution addresses known barriers to WIC participation	State agency and THIS-WIC	State agency
Staff key informant interviews	Telehealth experience of local agency and state agency stakeholders	THIS-WIC	THIS-WIC
Implementation data	Fidelity to the intervention protocol and implementation strategies	State agency and THIS-WIC	State agency
Cost data	Source of information on startup and ongoing costs related to telehealth adoption, implementation, and sustainability	THIS-WIC	THIS-WIC and State agency

SC.1.3.1.   Telehealth Solution Implementation Data

Implementation data were collected using responses to implementation tracking menu for startup (pre-implementation), midway, and endpoint or late phase of implementation. See **Appendix SC.3** for the data collection instrument.

SC.1.4.   Client Survey Sample Size, Response Rate, Characteristics, and Representativeness

Information describing the sociodemographic characteristics and WIC participation for survey respondents was derived from the client survey and management information system (MIS). Variables from the client survey included respondent's race/ethnicity, the total number of years the household has received WIC services, location of residence, and respondent's average daily consumption of fruits and vegetables. The MIS record data closest to the appointment date were extracted for the following variables: presence of WIC client with high-risk status in the household, household size, annual household income, written language used at home (English, Spanish, other), and respondent's years of education.

SC.1.4.1.   Client Survey Sample Size

All high-risk clients and those with complex breastfeeding problems were eligible to take part in the evaluation. Respondents had to be 18 years of age or older, have a high-risk code or breastfeeding, and need support to address complex breastfeeding issues at level 4 (i.e., in scope of practice for WIC designated breastfeeding experts). Sample size estimation used the composite satisfaction score derived from the Client Survey as the main outcome of interest, which ranges from 0 to 100 points, with a standard deviation of 15 points. We consider a difference of 10 points as practically meaningful. Assuming a sampling ratio (intervention: comparison) of 1:1, alpha (type I error rate) 5 percent, and power 80 percent, a total minimal sample size of 144 per time point is needed to detect the difference of 10 points (i.e., 72 from intervention and 72 from comparison at the early or late phase).

Table SC.1.5 presents the caseload and target response rate for each phase, which are based on the total caseload at intervention and comparison agencies. Although an increase of 10 points was hypothesized to be practically important, in many cases, the actual difference could likely be smaller. For instance, a required sample size would be inflated by about 5 times if the actual difference was only about 4. Sample sizes based on two hypothetical response rates (5% and 10%, which are typical for online surveys) are also provided for reference.

Table SC.1.5. Caseload and Target Response Rate for Client Survey in SC

Agency	Caseload	N if diff=10, per phase	N if diff=4, per phase	N with 5% response rate	N with 10% response rate
Intervention					
Clarendon Health Department	194	5	29	10	20
Florence Health Department	850	21	126	43	85
Holly Hill Health Department	154	4	23	8	16
Lee Health Department	118	3	18	6	12
Mt. Pleasant Health Department	209	6	31	11	21
Myrtle Beach Health Department	771	19	114	39	8
Northwoods Health Department	1,229	31	182	62	123
Comparison					
Georgetown Health Department	103	3	16	6	11
Goose Creek Health Department	297	8	44	15	30
Hampton Health Department	149	4	22	8	15

Source: SC WIC MIS, 2020

SC.1.4.2.   Client Survey Invitations and Response Rate

After WIC appointments, staff at participating intervention and comparison agencies sent an invitation to clients, inviting them to complete a survey about their experience with the appointment. As seen in **Table SC.1.6**, 49 clients consented to complete the Client Survey. Of

those who consented, all completed the survey and were successfully linked with the MIS identifier. One respondent was excluded from analysis because this was the only respondent from one agency.

Table SC.1.6. Client Survey Invitations, Consents, and Survey Completion in SC

Survey Status	Definition	Calculation	%
Response	Consents/Invitations	49/1,537	3.2
Completion[a]	Completes/Consents	49/49	100
Match[b]	MIS Matches/Consents	49/49	100

[a] Survey responses were not required after screening and consent. "Complete" was defined as responding to the eight satisfaction items and a clinic association.

[b] Match was defined as the ability to link WIC family-level administrative data to survey respondent.

SC.1.4.3. Sociodemographic Characteristics of Client Survey Respondents

Table SC.1.7 presents the characteristics of Client Survey respondents in SC. Of the 49 survey respondents, 28 (57.1%) were in the intervention agencies and 21 (42.9%) were in the comparison agencies. None of the household characteristics were significantly different between intervention and comparison participants. Overall, 50.0% of respondents self-identified as non-Hispanic Black/African American, 35.4 percent identified as Non-Hispanic White, and 10.4 percent identified as Hispanic. Slightly more than half of respondents (60.4%) were between 26 and 35 years of age. Overall, 54.5 percent of respondents had 1 to 5 years of college, and 39.4 percent had completed 9 to 12 years of education. All respondents (with matching MIS data) reported the use of English at home (written). The median household size was three members, and the median annual household income was $16,800. About half (53.2%) of respondents lived in a rural area, 23.4 percent lived in an urban area, and 23.4 percent lived in a suburban area.

Table SC.1.7 Sociodemographic Characteristics of Client Survey Respondents in SC

Variable	Overall	Intervention	Comparison	p-value[d]
		%		
Age[a]	N=48	N=27	N=21	0.1794
18–25	12.5	3.7	23.8	
26–35	60.4	63.0	57.1	
36–45	20.8	22.2	19.0	
46–55	2.1	3.7	0.0	
56–65	4.2	7.4	0.0	
66+	0.0	0.0	0.0	

(continued)

Table SC.1.7 Sociodemographic Characteristics of Client Survey Respondents in SC (continued)

Variable	Overall	Intervention	Comparison	p-value[d]
		%		
Education[b]	N=33	N=19	N=14	0.4543
1–8 years	0.0	0.0	0.0	
9–12 years	39.4	36.8	42.9	
1–5 years of college	54.5	52.6	57.1	
1 or more years of grad school	6.1	10.5	0.0	
Race/ethnicity[a]	N=48	N=28	N=20	0.5739
Non-Hispanic Black/African American	50.0	42.9	60.0	
Non-Hispanic White	35.4	39.3	30.0	
Hispanic/Latino	10.4	14.3	5.0	
Non-Hispanic American Indian/Alaska Native	0.0	0.0	0.0	
Non-Hispanic Asian	0.0	0.0	0.0	
Non-Hispanic Native Hawaiian/Pacific Islander	0.0	0.0	0.0	
Two or more races	0.0	0.0	0.0	
Other	4.2	3.6	5.0	
Language used at home (written)[b]	N=36	N=22	N=14	-
English	100.0	100.0	100.0	
Spanish	0.0	0.0	0.0	
Place of residence[a]	N=47	N=27	N=20	0.8906
Rural	53.2	51.9	55.0	
Suburban	23.4	22.2	25.0	
Urban	23.4	25.9	20.0	
Household size[b]	N=37	N=23	N=14	0.1434
Median, [IQR][c]	3.0 [2.0, 4.0]	3.0 [2.0, 4.0]	4.0 [3.0, 4.0]	
Household income ($)[b]	N=37	N=23	N=14	0.4263
Median, [IQR][c]	16,800.0 [8,400.0, 26,000.0]	14,400.0 [4,800.0, 31,200.0]	18,000.0 [9,600.0, 24,000.0]	

Source: [a] THIS-WIC Client Survey, [b] SC MIS

[c] IQR=Interquartile range

[d] p-values are based on chi-square test for categorical variables and two-sample median tests for continuous variables. For race, age, education, and language used at home, 25% or more of the cells have expected counts less than 5, so chi-square may not be a valid test.

SC.1.4.4.   Length of WIC Tenure of WIC Client Survey Respondents

As seen in **Table SC.1.8**, 52.1 percent of Client Survey respondents had received WIC services for less than 1 year, and about 18.8 percent had received WIC services for 5 years or

more. More than a third of respondents (38.8%) had a high-risk WIC client in their household. MIS data were used to classify clients as high risk at their most recent appointment.

Table SC.1.8. Length of WIC Tenure and High-Risk Status of Client Survey Respondents in SC

Variable	Overall	Intervention	Comparison	p-value[a]
		%		
In total, how many years have you received WIC services? Would you say it has been …	N=48	N=27	N=21	0.4704
< 1 year	52.1	59.3	42.9	
1–2 years	12.5	7.4	19.0	
3–4 years	16.7	18.5	14.3	
5+ years	18.8	14.8	23.8	
Household high-risk status[b]	N=49	N=28	N=21	0.2712
Yes	38.8	32.1	47.6	
No	61.2	67.9	52.4	

Source: THIS-WIC Client Survey

[a] p-value based on chi-square tests. For years receiving WIC services, 25% or more of the cells have expected counts less than 5 ,so chi-square may not be a valid test.

[b] High-risk status is a dichotomous indicator coded "1" if one or more WIC clients in the household was assigned high risk at their most recent WIC appointment.

SC.1.5.   Staff Survey Respondent Characteristics

SC.1.5.1   Characteristics of Staff Survey Respondents

Because WIC agencies experience churn and hire new staff, the same survey was administered at both time points. There were no significant differences in the age and race/ethnicity distribution or WIC participation among early- and late-phase staff survey respondents (**Table SC.1.9**).

Table SC.1.9. Characteristics of Early- and Late-Phase Staff Survey Respondents in SC

Variables	Early Phase	Late Phase	p-value[a]
	n (%)		
Age	N=7	N=7	0.940
18–25	0 (0.0)	0 (0.0)	
25–35	2 (28.6)	3 (42.9)	
36–45	1 (14.3)	1 (14.3)	
46–65	1 (14.3)	1 (14.3)	
56–65	3 (42.9)	2 (28.6)	
66+	0 (0.0)	0 (0.0)	
Race/Ethnicity	N=8	N=8	0.558
Hispanic	0 (0.0)	0 (0.0)	
Non-Hispanic Black or African American	5 (62.5)	3 (37.5)	
Non-Hispanic White	2 (25.0)	4 (50.0)	
American Indian or Alaska Native	0 (0.0)	0 (0.0)	
Asian	0 (0.0)	0 (0.0)	
Native Hawaiian or multi-racial	1 (12.5)	1 (12.5)	
Previous WIC participation	N=8	N=8	
Yes	1 (12.5)	0 (0.0)	0.302

Source: THIS-WIC Staff Survey

[a] p-values are based on chi-square tests.

SC.1.5.2. WIC Role and Years of Experience of Staff Survey Respondents

As seen in **Table SC.1.10**, there were no differences in the role, years of WIC experience, and travel patterns of WIC staff in the early- and late-phase staff surveys. Half of the respondents were registered dietitians, and half were breastfeeding staff. Similarly, half of the respondents had worked in WIC for more than 12 years. Although about 87.5 percent of staff surveyed in the early phase traveled to provide service before the COVID-19 pandemic, about 62.5 percent of respondents in the late phase had done so.

Table SC.1.10.   Role and Years of WIC Experience of Early- and Late-Phase Staff Survey Respondents in SC

Variables	Early Phase n (%)	Late Phase n (%)	p-value[a]
WIC role	N = 8	N = 8	
Registered dietitians	4 (50.0)	4 (50.0)	> 0.999
Breastfeeding roles (e.g., IBCLCs)	4 (50.0)	4 (50.0)	> 0.999
Local agency directors	0 (0.0)	0 (0.0)	--
Year worked in WIC	N=8	N=8	0.881
< 2 years	0 (0.0)	0 (0.0)	
2–4 years	2 (25.0)	1 (12.5)	
5–8 years	1 (12.5)	1 (12.5)	
9–12 years	1 (12.5)	2 (25.0)	
12+ years	4 (50.0)	4 (50.0)	
Pre-COVID-19 travel to provide service	N = 8	N = 8	
Yes	7 (87.5)	5 (62.5)	0.248

Source: THIS-WIC Staff Survey

Note: IBCLC = international board-certified lactation consultant

[a] p-values are based on Chi-square tests.

SC.1.6. Data Analysis

SC.1.6.1. TeleWIC Implementation

Implementation Tracking Tool

Responses to the Implementation Tracking Tool were collected at the startup, midpoint, and endpoint of telehealth implementation. The 46 distinct strategies in the menu were grouped into eight conceptually relevant implementation categories, using the groupings developed by Powell et al.[2] Although the researchers had developed nine categories through concept mapping, the "utilize financial strategies" category was not included in the THIS-WIC menu. **Table SC.1.11** lists the eight implementation categories and corresponding menu strategies. The analysis involved tabulating the startup, midpoint, and endpoint status for each menu strategy to assess change. The startup measures were considered the implementation plan, and the change from startup to midpoint and endpoint measures were considered indicative of fidelity. These data were used to understand the fidelity of implementation and provide context for the staff- and client-level outcomes.

Table SC.1.11. THIS-WIC Implementation Tracking Tool Menu Categories

Implementation Category	Implementation Menu Strategy
Use evaluative and iterative strategies	Assess for readiness and identify barriers and facilitators
	Conduct local needs assessment
	Audit and provide feedback
	Conduct small tests of change
	Develop a formal implementation blueprint
	Develop and organize quality monitoring systems
	Obtain and use WIC clients and family feedback
	Purposely reexamine the implementation
	Stage implementation scale-up
Provide interactive assistance	Centralize technical assistance
	Provide local technical assistance
Adapt and tailor to context	Promote adaptability
	Tailor strategies
	Use data experts
	Use data warehousing techniques
Develop stakeholder interrelationships	Conduct local consensus discussions
	Develop academic partnerships
	Build a coalition
	Capture and share local knowledge
	Identify and prepare champions
	Identify early adopters
	Inform local opinion leaders
	Organize WIC staff implementation team meetings
	Promote network weaving
	Recruit, designate, and train for leadership
	Use advisory boards and workgroups
	Use an implementation advisor
	Visit other sites
Train and educate stakeholders	Conduct educational meetings
	Conduct ongoing training
	Develop and distribute educational materials
	Make training dynamic
	Provide ongoing consultation
	Shadow other experts
	Use train-the-trainer strategies

(continued)

Table SC.1.11.   THIS-WIC Implementation Tracking Tool Menu Categories (continued)

Implementation Category	Implementation Menu Strategy
Support clinicians	Create new telehealth teams
	Develop resource sharing agreements
	Revise professional roles
	Facilitate relay of telehealth breastfeeding/nutrition data to staff
	Remind WIC staff and clients
Engage consumers	Intervene with WIC clients to enhance uptake and adherence
	Involve WIC clients and family members
Change infrastructure	Change record systems
	Change physical structure and equipment
	Change service sites
	Start a dissemination organization/committee

SC.1.6.2.   TeleWIC Metadata

Data on use of telehealth solution at the agency level were collected directly in TeleWIC. The SC WIC State agency team collected, tabulated, and submitted these data to THIS-WIC team at the end of the intervention period. Descriptive analyses were performed in Microsoft Excel (version 2407) to examine implementation.

SC.1.6.3.   Client Survey

The client outcomes evaluation examines the experiences of WIC clients who received WIC services and completed a Client Survey in one of the WIC clinics associated with the agencies in the study between March and September 2023. Intervention agencies were matched with comparison agencies for race, ethnicity, and total participation/caseload. Seven agencies were assigned to the intervention group, and seven matched agencies were assigned to the comparison group. One agency had fewer than five respondents and was excluded from the analysis. All surveys were completed by an adult either to reflect WIC services they received for themselves (i.e., pregnant, post-partum, or lactating women) or for their infant/child.

Breastfeeding Practices

Information from the MIS was used to summarize breastfeeding practices in households with an infant (age 0 to 12 months) during the intervention period. If the household included more than one infant during the intervention period, breastfeeding practices for the youngest infant were selected for analysis. Two breastfeeding variables were examined: whether the infant was ever breastfed and whether the infant was exclusively breastfed for at least 6 months.

Attitudes Toward the Telehealth Solution

All respondents from the intervention agencies responded to the following seven statements using a five-item, Likert-type response option that ranged from "strongly disagree" to "strongly agree":

- I could hear the WIC nutrition educator clearly.
- It was easy to figure out how to use and receive WIC services.
- My WIC appointment was shorter than usual when receiving care.
- The way I received WIC services was easier than going to a WIC clinic.
- I would like to receive services the same way at my next WIC appointment.
- The telehealth platform was simple to use for my WIC appointment.
- I had trouble accessing the telehealth platform.
- The telehealth solution content was in a language I can read.

Respondents who completed their appointment via TeleWIC responded to two additional statements:

- I could see the WIC nutrition educator clearly during my most recent WIC appointment.
- I could easily talk to the WIC nutrition educator during my recent appointment.

An additional question with dichotomous response options (yes/no) asked all respondents whether the content of the telehealth solution was in a language they could read.

Client/Respondent Outcomes

Primary and secondary outcomes assessed the comparative advantage of the telehealth intervention. Primary outcomes are related to WIC service delivery and include client satisfaction and barriers to participation. Secondary outcomes include client intentions to change dietary behaviors based on the assumption that improvements in service delivery led to improved client engagement.

Client Satisfaction. Eight items assessed client satisfaction; these items assessed respondents' experience (overall satisfaction, was a good use of my time, was convenient, would recommend this WIC appointment to other WIC participants. glad I completed my WIC appointment, appointment was convenient, prefer to receive WIC services the same way at next appointment) and perceptions of the WIC nutrition educator (was friendly and easy to talk to, had good communication skills). Each item included a five-level Likert-type response option that ranged from "strongly disagree" to "strongly agree." These items demonstrated a high degree of interrelationship (interitem correlation, alpha=0.92) and were treated as an index. Summing up, the eight items produced index scores with a potential range of 20 to 100 points. Higher scores indicate greater satisfaction.

Barriers. The Client Survey included questions on availability and use of technology, as well as questions on administrative, individual-level, and staff-level barriers to accessing WIC services. Four questions asked about availability of a computer and smartphone at home, mode of connecting to the Internet, reasons for not connecting to the Internet at home, and frequency of

Internet problems. Two questions asked about comfort with use of technology and frequency of videoconferencing to connect with family and friends.

Eight items asked respondents about barriers to accessing WIC services for their most recent WIC appointment. Barriers included administrative factors (such as receiving a specific appointment time and experiencing long wait times); individual-level factors (such as transportation issues, childcare issues, difficulty getting time away from work); and staff interactions (such as language barrier, racial/ethnic barrier, and poor/no internet connectivity). Each item included a four-level, Likert-type response option that ranged from "frequently" to "never," with lower scores reflecting more experience with the barrier and higher scores reflecting less experience with the barrier.

Intentions to Change Dietary Behaviors. Three survey items asked respondents about their intentions to change diet-related behaviors after their WIC appointment. Using a five-level, Likert-type response option that ranged from "strongly disagree" to "strongly agree," with higher numbers indicative of greater levels of agreement, participants responded to statements about their intentions to (1) change how they eat, (2) change how they feed their family, and (3) make healthier food choices.

Analysis

Descriptive Statistics. Descriptive statistics include respondent and household demographics; availability and comfort with technology; attitudes toward TeleWIC; and respondent behaviors (fruit and vegetable consumption and breastfeeding). Crosstabulations for categorical variables present proportions among those who provided data (i.e., missing values were excluded from the analysis) by group (intervention and comparison). Descriptive statistics for continuous variables use medians and interquartile ranges (25th percentile–75th percentile) because the data on household income and household size were assumed to be skewed.

Significance tests compare respondent demographics and household characteristics, availability of and comfort with technology, and respondent behaviors between respondents in the intervention and comparison agencies. For categorical variables, chi-square tests for independence are presented. For continuous variables, the median test was used. This test examines whether the two samples come from the same population by assessing the distribution of sample scores around the median instead of comparing the actual median values.

Statistical Models. Analyses to assess client outcomes (satisfaction index, barriers, and intentions to change dietary behaviors) employed hierarchical linear regression models comparing differences in group means among participants who received WIC services in intervention and comparison agencies. The models were estimated with the SAS PROC MIXED procedure using restricted maximum likelihood and Type-3 F test to assess study hypotheses with statistical significance set at $p < 0.05$. Degrees of freedom for tests of intervention effects were determined using the Kenward and Rogers's (1997) method.[3]

For the adjusted model for client satisfaction index, demographic/household variables that demonstrated statistically significant differences between intervention and comparison agencies

were entered into multivariable hierarchical linear regression. Categorical variables that produced a low cell count warning were excluded, as these variables have poor coverage across categories and are likely to lead to model failure. If the initial model did not converge, the model was simplified by removing the least-significant variable (i.e., in terms of relationship to the satisfaction index) if this information was available and removing the most-complicated variables (i.e., has most categories) if converge problems were so extreme that significance tests could not be estimated. This process was repeated iteratively until a model solution was obtained or we arrived at the adjusted model.

SC.1.6.4. Staff Survey

Descriptive analyses were undertaken to examine the Staff Survey data. Chi-square tests were performed to examine differences in responses from early- to late-phase surveys. When analyzing the staff outcomes, attempts were made to adjust for biases in standard error estimate caused by repeated measurements whenever feasible. For ordinal/continuous outcomes, the analysis adjusted for the unique participant ID numbers as random effect and corrected for repeated measurements. However, because of low sample size, the same adjustments could not be made for categorical outcomes, which impose more-stringent requirement in sample size. Instead, these data were analyzed as if the two time points are not related. All analyses were conducted in Stata 18 (StataCorp LLC, College Station, TX, USA).

SC.1.6.5. Staff Key Informant Interviews

All interviews were audio recorded and transcribed by Zoom verbatim in English only. Each transcript was reviewed for accuracy and corrected to reflect actual dialogue spoken by listening to the audio recording. Before undertaking analysis, three THIS-WIC team members created a preliminary codebook, with codes deductively informed primarily by the Consolidated Framework for Implementation Science Research (CFIR)[4] and the Evaluation Framework for Telemedicine.[5] Five trained qualitative researchers who conducted the interviews also coded the interviews.

A single codebook was used to code early- and late-phase interviews. The codebook included a description, inclusion and exclusion guidance, and an example quote for each code when relevant. To start, five researchers independently coded the same four transcripts from four different WIC State Agencies. Coders met over video to compare codes, arrived at an agreement on differing codes through discussion, and updated the codebook to address inconsistencies or add additional clarity.

Next, researchers established inter-rater reliability across four different transcripts. These four transcripts involved the WIC roles of two front-line nutrition staff (e.g., Registered Dietitian), one breastfeeding-focused staff (International Board-Certified Lactation Consultant), and one director. Researchers coded each transcript individually, ran coding comparisons against the primary coder, and discussed results. Coders discussed results until all codes reached a 90 percent agreement and a Kappa coefficient of at least 0.40 (fair to good judgment). Researchers conducted the same process for all four transcripts. As new researchers joined the project, the

main coder facilitated the same reliability process with the previously established agreement NVivo files until coders reached the 90 percent agreement and Kappa coefficient of at least 0.40.

Two reviewers coded the remaining transcripts. The main coder randomly assigned transcripts to coders in batches of five. After coders completed their five assignments, the group reconvened and discussed coding uncertainties as a full coding team. Researchers then updated the codebook after reaching a consensus if needed. NVivo version 13 (QSR International) was used to organize and analyze coded interviews.

SC.1.6.6.   Portal App Startup and Ongoing Cost Analysis

Cost analysis was conducted to understand the (1) startup cost, (2) ongoing service delivery cost, and (3) ongoing cost per enrollment and appointment. All costs were adjusted to 2023 dollars using the Consumer Price Index. All analyses were completed in Microsoft Excel (version #2308) and Stata 18.

The COVID-19 pandemic affected the timeline and roll-out of the telehealth platform. WIC service delivery in both intervention and comparison agencies was adjusted because of the pandemic because even the comparison agencies transitioned to remote service delivery during the pandemic's height. To facilitate the comparison of costs before and after introduction of the telehealth solution and between intervention and comparison agencies, we set the pre-implementation period to Fiscal Year (FY) 2019, before the start of the pandemic (SC provided the FY2019 data to THIS-WIC in 2023). We then assessed how service delivery costs changed from pre-intervention in FY2019 to post-intervention, the February 2023 through September 2023 period.

Portal App Startup Cost

Statewide startup costs for telehealth solution startup were calculated as follows:

1. Generating subtotals by summing the data for each resource category in the tool (e.g., labor, equipment, indirect, contracted services).

2. Computing total cost and cost per month as follows:

    a. Total cost=Sum of cost across resource categories

    b. Cost per month=total cost/number of months in the startup period

Ongoing WIC Service Delivery Cost

Ongoing service delivery costs were computed for each participating agency at three time points: Baseline/pre-implementation (FY2019), at 4 months post-implementation (May 2023), and at 8 months post-implementation (September 2023), as follows:

3. Staffing cost was calculated by multiplying the reported average number of full-time equivalents each staff type spent providing nutrition and breastfeeding education services by that staff type's average hourly salary.

4. If an agency purchased equipment, the cost of the equipment was amortized over the reported period, until replacement.

5. Subtotals were created for each resource category (labor, equipment, supplies, contracted services, and indirect) and then summed across categories to calculate a total by agencies.

Ongoing Implementation Cost Per Enrollment and Per Appointment

To facilitate the comparison of costs from before to after introduction of the telehealth solution and between intervention and comparison agencies, the pre-implementation period was set to FY2019, before the start of the pandemic. Changes in service delivery costs from pre-intervention (FY2019) to post-intervention (February 2023–September 2023) were examined.

Average monthly ongoing costs, average cost per enrollment, and average cost per appointment were computed for each period of the ongoing cost analysis. The ongoing cost per enrollment and per appointment were computed by dividing the average monthly cost by the number of monthly enrollments and monthly appointments in that same period. To understand the distribution of monthly costs, mean, median, minimum, and maximum cost per enrollment and per appointment were examined across the intervention and comparison agencies. Changes in ongoing service delivery per enrollment and per appointment costs from the pre-implementation to the post-implementation periods were compared for intervention and comparison agencies.

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