Washington DC WIC Agency (DC WIC): Advancing Telehealth Technology and Innovation in DC WIC (ATTAIN DC WIC)
DC.1 Technical Appendix

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DC.1.1   THIS-WIC Study Framework

USDA/Tufts Telehealth Intervention Strategies for WIC (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 DC.1.1**). The first stage starts with suggesting a technology-based solution for a health problem (stage 1, concept development) and may include a needs analysis, proof of concept, and a technical evaluation of the concept. In the next stage (stage 2, service design), feasibility and accessibility are studied to determine how the service delivery model should be modified to accommodate the proposed telehealth intervention. In stage 3, pre-implementation, the telehealth solution is studied under a controlled environment to assess efficacy or studied in real-world settings where the goal is to assess effectiveness (stage 4, implementation). After implementing a telehealth intervention, research then shifts to focus on operational use and sustainability of the solution (stage 5, operational use). The District of Columbia's (DC's) project was in stage 5, operational use.

In the context of THIS-WIC, the model mapped a multistage journey from developing a telehealth solution to the assessment of 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. DC falls along the fifth stage of the model because it focuses on operational use of the mobile-friendly telehealth technology.

DC.1.2   WIC Agencies Participating in THIS-WIC Evaluation

The four local agencies involved in the telehealth implementation were Mary's Center, Unity Health Care, Children's National, and Howard University Hospital. Howard University Hospital closed in October 2022 and was not part of the THIS-WIC evaluation. **Table DC.1.1** lists the local agencies involved in the THIS-WIC evaluation.

Table DC.1.2 shows the number of staff, number and types of clients served, and race/ethnicity of clients served by participating agencies. There was diversity in agency size, as measured by the number of staff and clients served across participating agencies. In all three agencies, children accounted for the largest caseload, followed by infants; about 50 percent of clients were considered high-risk. There was considerable variability in race/ethnicity of clients served across the three agencies.

Figure DC.1.1. THIS-WIC Five-Stage Model for Comprehensive Telehealth Research and Priority Areas
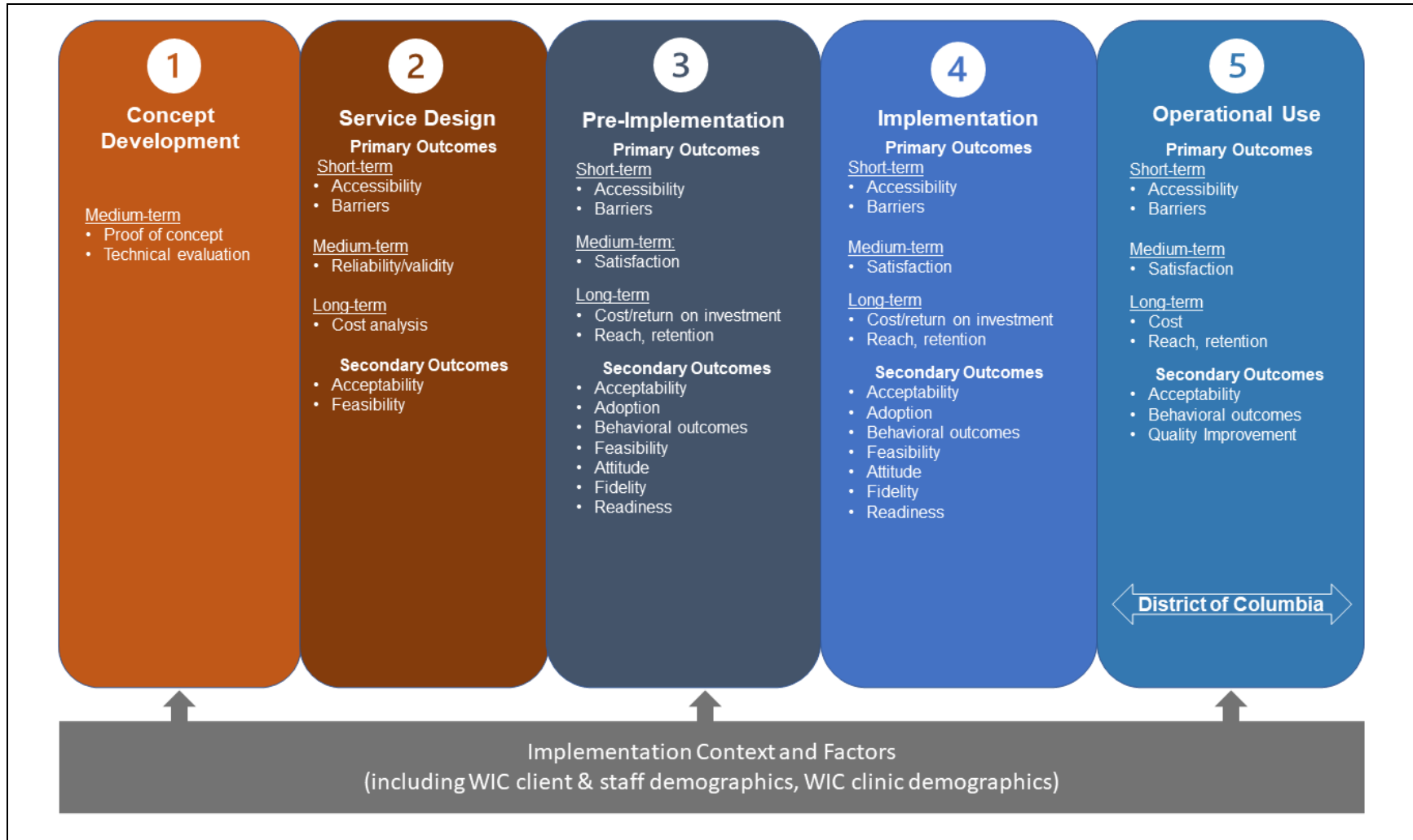
Table DC.1.1. List of WIC Agencies in THIS-WIC Evaluation, DC

▪ Mary's Center (4)[a]	▪ Children's National (3)
▪ Unity Health Care (5)	▪ Howard University Hospital (NA)[b]

[a] Numbers in parenthesis represent the number of clinics under each local agency.
[b] Closed in October 2022, not part of THIS-WIC evaluation.

Table DC.1.2. Local WIC Agency and Client Characteristics in DC

Characteristic	Participating Local WIC Agencies		
	Mary's Center	Unity Health Care	Children's National
Number of staff	15	17	13
Number of:			
Families	2,809	3,063	2,010
Pregnant	260	330	194
Breastfeeding	441	319	207
Non-breastfeeding postpartum	83	210	190
Infants	855	1,046	804
Children	2,324	2,317	1,495
High-risk	1,361	1,455	1,191
Race/Ethnicity of Clients Served (%)			
American Indian/Alaska Native	0.0	0.0	0.0
Asian	1.4	.43	.38
Black/African American	40.3	67.3	92.9
Hispanic	53.8	31.1	5.9
Native Hawaiian/Pacific Islander	0.0	0.0	0.0
White	1.7	0.88	0.59
Other	2.8	0.31	0.24

Source: DC WIC Agency, 2020 Program Year

DC.1.3 Data Sources for ATTAIN DC WIC Evaluation

Table DC.1.3 provides a description of the data sources for the evaluation of ATTAIN DC.

Table DC.1.3. Description of Data Sources for ATTAIN DC WIC Evaluation in District of Columbia

Data Source	Description	Developed By	Collected By
Management Information System (MIS) Data	Caseload and client characteristic data. Aggregate data across participating agencies.	DC agency	DC agency
Surveys: Client and Staff	Telehealth satisfaction, quality of telehealth interaction, and whether telehealth solution addresses known barriers to WIC participation.	THIS-WIC	DC agency
Key Informant Interviews: Client and Staff Clients: Community Listening Session	Telehealth experience of local and State agency stakeholders.	THIS-WIC and ATTAIN DC WIC team	ATTAIN DC WIC team
Implementation Data	Fidelity to the intervention protocol and implementation strategies.	DC agency and THIS-WIC	DC agency
Cost Data	Source of information on startup and ongoing costs related to telehealth adoption, implementation, and sustainability.	THIS-WIC	THIS-WIC and DC agency

DC.1.3.1 Telehealth Solution Implementation Data

Implementation data were collected using two methods: staff implementation surveys developed and administered by the DC State agency twice during implementation and responses to the Implementation Tracking Tool for the startup (pre-implementation), midway, and endpoint or late phase of implementation. See **Appendix DC.3** for data collection instruments.

DC.1.3.1.1 Staff Implementation Surveys

The DC WIC State agency developed a brief, 5-item survey (**Appendix DC.3**) to track telehealth use by staff at participating agencies. Surveys were fielded at two time points to local agency staff and directors via SurveyMonkey and included questions about perceptions of length of appointments, promotion of telehealth appointments, and barriers to using telehealth.

DC.1.3.1.2 Implementation Tracking Tool

THIS-WIC emailed the Implementation Tracking Tool to the DC State agency at startup (see **Appendix DC.3**). DC State agency staff completed the Implementation Tracking Tool and submitted it to THIS-WIC. At midpoint, THIS-WIC emailed the DC State agency team their startup responses with instructions to review and update them to reflect their status for each

item. Similarly, at endpoint, THIS-WIC emailed the DC State agency their midpoint responses with instructions to review and update their responses to reflect their status for each item.

DC.1.4 THIS-WIC Client Survey Sample Size, Response Rate, Characteristics, and Representativeness

Information describing the sociodemographic characteristics and WIC participation for survey respondents was derived from responses to the Client Survey and MIS. Variables from the Client Survey included respondent's race/ethnicity, 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.

DC.1.4.1 Client Survey Sample Size

WIC clients who received nutrition counseling or breastfeeding support during a remote appointment were eligible to take part in the evaluation. Respondents had to be 18 years of age or older and fall into one or more of the following categories: pregnant, non-breastfeeding postpartum, breastfeeding, or the parent/guardian of a participating infant or child in WIC. Sample size was estimated using the client satisfaction score (range from 0 to 100) as the main outcome of interest. Assuming about 20 percent of the clients receive WIC services via telehealth and 80 percent via in-person appointments, we generated a sample size curve (**Figure DC.1.2**) to depict the required total sample size for three different scenarios (i.e. standard deviation of 10, 20, and 30 points). For example, if the mean client satisfaction score of the telehealth clients is 82, and the type I error rate is 5%, we will have 80% power to detect a difference between the telehealth and in-person groups with a sample size of 1,000 (800 in-person and 200 telehealth).

Figure DC.1.2. Target Total Sample Size for Client Survey in DC Assuming In-Person to Telehealth Ratio Equals 4:1
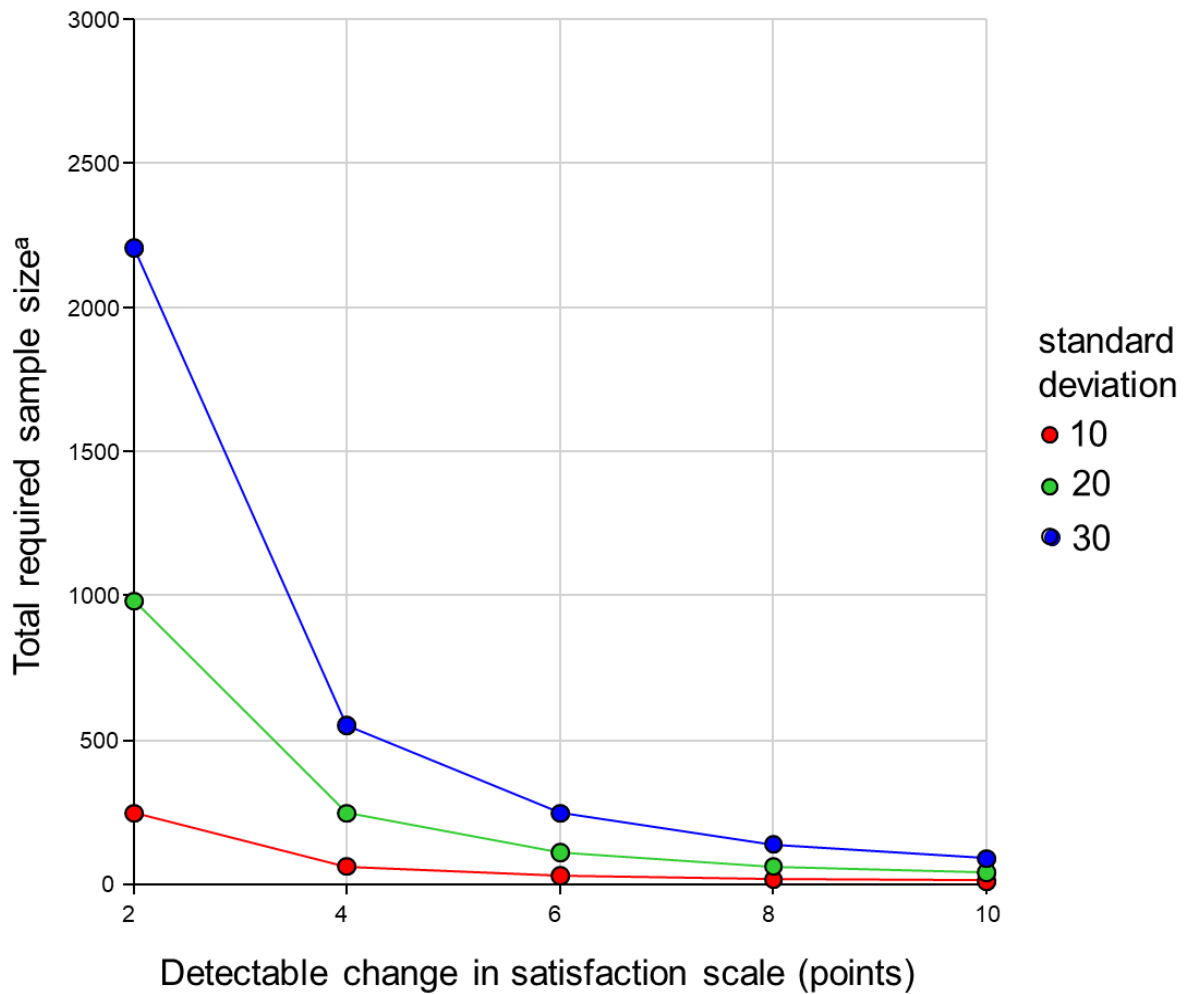
[a] Alpha=0.05, power=0.8, R=4, 2-sided t-test

DC.1.4.2   Client Survey Invitations and Response Rate

Following an eligible WIC appointment, clients were sent a link via text message with an invitation to complete a survey about their experience with the appointment. As seen in **Table DC.1.4**, 9,170 clients were invited, and 10.0 percent consented to complete the survey. Of those who consented, 97.7 percent completed the survey and 80.0 percent were successfully linked with the MIS identifier.

Table DC.1.4. Client Survey Invitations, Consents, and Survey Completion in DC

Survey Status	Definition	Calculation	%
Response[a]	Consents/ Invitations	972/9,710	10.0
Completion[b]	Completes/ Consents	950/972	97.7
Match[c]	MIS Matches/Consents	761/950	80.0

[a] Survey responses were not required after screening and consent.

[b] Complete was defined as response to the eight items to assess satisfaction with telehealth services.

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

DC.1.4.3   Sociodemographic Characteristics of Client Survey Respondents

Table DC.1.6 presents the characteristics of Client Survey respondents in DC. Of the 950 respondents, 151 (16%) received telehealth services and 799 (84%) received in-person services. Respondent's race/ethnicity and language were the only characteristics that were significantly different by appointment mode. Overall, 51 percent of respondents self-identified as non-Hispanic Black/African American and 41 percent as Hispanic. Less than 5 percent of respondents identified as non-Hispanic White or Asian. Nearly half of the respondents (47%) were 26 to 35 years old and almost a third (32%) were between 36 and 45 years old.

Nearly two-thirds of respondents (64%) had some high school education or graduated high school (grades 9 to 12) and 25 percent had completed 1 to 5 years of college. Sixty-five percent of respondents reported the use of English at home while 35 percent reported using Spanish at home. Fewer respondents reported using Spanish at home in the telehealth appointment mode than in the in-person appointment mode (23% vs. 37%). The median household size was four members, and the median annual household income was $10,800. All respondents lived in an urban area.

Table DC.1.5. Sociodemographic Characteristics of Client Survey Respondents in DC

Variable	Overall	Telehealth Appointment[d]	In-person Appointment	p-value[e]
		%		
Age[a]	N=742	N=114	N=628	0.8791
18 to 25	15.9	18.4	15.4	
26 to 35	46.8	43.0	47.5	
36 to 45	31.9	31.6	32.0	
46 to 55	2.8	3.5	2.7	
56 to 65	1.8	2.6	1.6	
66+	0.8	0.9	0.8	
Education[b]	N=665	N=87	N=578	0.6918
1 to 8 years	8.6	6.9	8.8	
9 to 12 years	64.2	66.7	63.8	
1 to 5 years of college	25.1	23.0	25.4	
1 or more years of grad school	2.1	3.4	1.9	
Race/Ethnicity[a]	N=734	N=111	N=623	0.0127*
Non-Hispanic Black/African American	51.1	64.9	48.6	
Non-Hispanic White	2.3	2.7	2.2	
Hispanic/Latino	41.1	27.9	43.5	
Non-Hispanic American Indian/Alaska Native	1.4	0.9	1.4	
Non-Hispanic Asian	2.2	0.0	2.6	
Non-Hispanic Native Hawaiian/Pacific Islander	0.1	0.0	0.2	
Non-Hispanic two or more races	0.0	0.0	0.0	
Non-Hispanic other	1.8	3.6	1.4	
Language read, spoken, or written at home[b]	N=757	N=133	N=624	<.0001*
English	64.6	73.7	62.7	
Spanish	34.5	22.6	37.0	
Other	0.9	3.8	0.3	
Place of residence[a]	N=841	N=99	N=742	—
Rural	0.0	0.0	0.0	
Suburban	0.0	0.0	0.0	
Urban	100.0	100.0	100.0	
Household size[b]	N=670	N=89	N=581	0.9448
Median [IQR][c]	4.0 [3.0, 5.0]	4.0 [3.0, 5.0]	4.0 [3.0, 5.0]	
Household annual income ($)[b]	N=603	N=80	N=523	0.0570
Median [IQR][c]	10,800.0 [6,000.0, 23,076.0]	8,946.0 [5,952.0, 19,610.0]	11,085.1 [6,000.0, 23,400.0]	

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

[c] IQR = Interquartile range.

[d] Telehealth appointments were completed using Phone, Zoom, Teams, or doxy.me.

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

* p<0.05

DC.1.4.4 Length of WIC Tenure and High-Risk Status of Client Survey Respondents

As seen in **Table DC.1.6**, about 37 percent of respondents had received WIC services for less than 1 year, 26 percent had received services for 1 to 2 years, and the remaining 37 percent had received WIC services for 3 or more years. Nearly half of respondents (48%) 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 DC.1.6. Length of WIC Tenure and High-risk Status of Client Survey Respondents in DC

Variable	Overall	Telehealth Appointment[b]	In-person Appointment	p-value[c]
		%		
In total, how many years have you received WIC services? Would you say it has been ...	N=739	N=113	N=626	0.8428
<1 year	37.3	35.4	37.7	
1-2 years	25.7	23.9	26.0	
3-4 years	20.3	22.1	20.0	
5+ years	16.6	18.6	16.3	
Household high-risk status[a]	N=761	N=133	N=628	0.2587
Yes	47.4	51.9	46.5	
No	52.6	48.1	53.5	

Source: WI MIS

[a] 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.

[b] Telehealth appointments were completed using Phone, Zoom, Teams, or doxy.me.

[c] p-value based on chi-square tests.

DC.1.4.5 Client Survey Representativeness

The aggregate MIS data and Client Survey data were used to generate balance tables and assess the representativeness of the survey respondents. This analysis entailed comparing the survey respondents' sociodemographic characteristics, duration of WIC participation, and high-risk status with those of the overall and high-risk clients by appointment modality. The administrative caseload data presented in the balance tables are aggregate MIS data spanning Q1/2022 to Q3/2023; quarterly disaggregated balance tables are in Appendix DC.4. As seen in **Table DC.1.7**, the distribution of race and household size was generally similar for the administrative caseload and survey respondents by appointment modality.

Table DC.1.7. Comparison of Administrative Records and Respondents for Age and Education by Appointment Mode in DC, Average Q2/2022–Q1/2023

Q1/2022–Q3/2023	Telehealth Appointments[a]		In-person Appointments	
	Administrative	Sample	Administrative	Sample
	%			
Race	N=5,829	N=128	N=19,386	N=793
Non-Hispanic White	23.07	20.31	28.16	36.82
Non-Hispanic Black	69.22	69.53	65.20	55.23
Non-Hispanic American Indian	1.80	0.78	1.63	2.65
Non-Hispanic Asian	1.15	0.87	1.56	1.01
Non-Hispanic Pacific Islander	0.09	0.0	0.0	0.25
Non-Hispanic two or more races	4.67	7.81	3.98	4.04
Ethnicity	N=5,829	N=128	N=19,386	N=793
Hispanic (Yes)	29.34	32.77	27.34	41.36
Household size[2]	N=4,237	N=14,97	N=69	N=526
1 member	0.47	1.45	0.94	1.14
2 members	14.49	20.29	18.15	18.06
2 members	28.06	34.78	28.09	27.19
4 members	26.06	17.39	25.01	24.52
5 members	16.62	17.39	17.01	18.82
6 members	11.31	8.70	10.81	10.27

Source: DC MIS

[a] Telehealth appointments were completed using Phone, Zoom, Teams, or doxy.me.

As shown in **Table DC.1.8**, children represented the largest percentage of clients in the administrative and sample data followed by infants.

Table DC.1.8. Comparison of Respondent Category of Client Survey Sample With Administrative Records by Appointment Mode in DC

Q2/2022 Q1/2023	Telehealth Appointments[a]		In-person Appointments	
	Administrative	Sample	Administrative	Sample
	%			
Respondent Type Category	N=5,829	N=128	N=9,386	N=793
Infant	26.39	22.66	23.76	18.54
Breastfeeding	9.32	15.63	8.76	11.73
Non-Breastfeeding	6.81	8.59	6.49	7.57
Child	51.64	48.44	48.92	47.92
Pregnant	5.85	4.69	12.07	14.25

Source: DC MIS

[a] Telehealth appointments were completed using Phone, Zoom, Teams, or doxy.me.

DC.1.5   Client Key Informant Interviews and Community Listening Sessions

All active clients at all DC local agencies were invited to participate in the client key informant interviews. A total of 36 clients (24 English-speaking and 12-Spanish speaking) participated in the early phase interviews and 12 clients (9 English speaking and 3 Spanish speaking) participated in the late phase interviews. Similarly, 24 clients participated in the in-person community listening sessions (12 per session), and 11 participated in the virtual listening session.

DC.1.6   THIS-WIC Staff Survey Sample Size and Response Rate

All staff involved in the delivery of nutrition education were invited to participate in the THIS-WIC Staff Survey. Thirteen unique staff members responded to the survey in the early and late phase. The number of staff who completed the early and late phase survey was 28 and 11, respectively.

DC.1.6.1   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 DC.1.9**).

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

Variables	Early Phase	Late Phase	p-value[a]
	%		
Age	N=28	N=11	0.800
18–25	25.0	9.1	
25–35	32.1	45.5	
36–45	21.4	27.3	
46–65	7.1	9.1	
56–65	7.1	9.1	
66+	7.1	0	
Race/Ethnicity	N=27	N=11	0.652
Hispanic	16.5	27.3	
Non-Hispanic Black or African American	48.1	54.5	
Non-Hispanic White	22.2	18.2	
American Indian or Alaska Native	0	0	
Asian	11.1	0	
Previous WIC participation	N=11	N=6	0.387
Yes	39.3	54.5	

Source: THIS-WIC Staff Survey

DC.1.6.2   WIC Role and Years of Experience of Staff Survey Respondents

As seen in **Table DC.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. WIC staff were primarily registered dietitians and breastfeeding support staff, and about 46 percent and 55 percent of early- and late-phase staff had worked in WIC for less than two years, respectively. Although about 93 percent of staff surveyed in the early phase traveled to provide service prior to the COVID-19 pandemic, about 80 percent did so in the late phase.

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

Variables	Early Phase	Late Phase	p-value[a]
	%		
WIC role	N=9	N=4	
Registered dietitians	10.7	9.1	0.880
Breastfeeding roles (e.g., International Board-Certified Lactation Consultants)	14.3	18.2	0.762
Local agency directors	7.1	9.1	0.837
Years worked in WIC	N=28	N=11	0.883
<2 years	46.4	54.5	
2–4 years	7.1	9.1	
5–8 years	25.0	18.2	
9–12 years	3.6	9.1	
12+ years	17.9	9.1	
Pre-COVID-19 travel to provide service	N=14	N=4	0.389
Yes	93.3	80.0	

Source: THIS-WIC Staff Survey

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

DC.1.7   Staff Key Informant Interview Sample

Local agency staff at participating agencies were invited to participate in the semi-structured interviews. A total of 24 staff members participated in the early phase interviews and 9 participated in the late phase interviews; 5 participated in both early and late phase interviews.

DC.1.8   Data Analysis

DC.1.8.1   Aggregate MIS Analysis

For DC, WIC administrative data included WIC client characteristics, certification information, nutrition and risk assessment, nutrition education, and WIC food benefit redemption. DC also linked the Client Survey identifier with the client-level MIS data.

Aggregate MIS data were also used to examine agency-level trends in breastfeeding initiation and exclusive breastfeeding. Descriptive analyses were used to analyze the data and present the findings. All analyses were conducted in SAS 9.4. Cross-tabulations and chi-square statistics were used to examine the differences between in-person and telehealth appointments.

Aggregate DC MIS data were used to examine survey respondents' representativeness by comparing sociodemographic characteristics of the overall caseload with those of the survey respondents. It should be noted that although the analysis of linked DC MIS and Client Survey data provides the most useful outcome variables, it is limited by sample size, depends on the representativeness of the sample, and is available only for the time periods covered by the sample.

Administrative data linked to Client Survey respondents were also used to examine retention and benefit redemption among survey respondents. Cross-tabulations and chi-square statistics were used to examine the differences between in-person and telehealth appointments.

Retention: Retention was calculated for Client Survey respondents with matched MIS data using the date of initial certification and the date of survey completion. If the interval between the date first certified and survey date was > 180 days (6 months) the respondent was considered "retained."

Benefit Redemption: DC's MIS captures the percentage of WIC vouchers redeemed by respondents. Benefit redemption was categorized as (a) none, (b) full, and (c) partial. The proportion of WIC benefits redeemed by respondents in the month following their appointment was compared for Client Survey respondents—both overall and by respondent type—from participating agencies.

Finally, aggregate MIS data were also used to examine agency-level trends in outcomes. The analysis of aggregate data has the advantage of providing information about all WIC participants, and it provides some information about more time periods (including time periods before the intervention began). It is limited to the variables captured by the MIS. Descriptive analyses were used to analyze the data and present the findings. All analyses were conducted in SAS.

DC.1.8.2 ATTAIN DC WIC Implementation

DC.1.8.2.1 Implementation Tracking Tool

Responses to the Implementation Tracking Tool were collected at the startup, midpoint, and endpoint of telehealth implementation. See **Appendix DC.4** for implementation strategy categorization.[2, 3] As seen in **Table DC.1.11**, the 46 strategies in the tool's menu were grouped into eight conceptually relevant implementation categories, using the groupings developed by Waltz et al.[3] The analysis of the Implementation Tracking Tool 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 was considered indicative of readiness. In addition to understanding the readiness for

implementation, these data were also used to provide context for the staff- and client-level outcomes.

Table DC.1.11. Implementation Tracking Tool

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
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

Data on appointment modality (in-person or telehealth) at each participating agency were collected directly in the DC MIS.

DC.1.8.3   ATTAIN DC WIC Metadata

Because of the nature of DC WIC telehealth contracts and administrative rights, in which the local organization offering WIC services (e.g. hospital, Federally Qualified Health Center) establishes the contract, rather than the State agency, no telehealth metadata were provided by DC WIC. However, the DC MIS captured telehealth solution utilization (e.g., telehealth modality used at appointment) as noted in **Section DC.1.8.2**.

DC.1.8.4   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 three local agencies in the study between February 2022 and July 2023. The original study design did not include a comparison group because it was designed as an enhancement and expansion of existing telehealth solutions within DC WIC's local agencies to decrease barriers to access, ensure timely access to client-centered nutrition education, and enhance continuity of care.

Because of eWIC rollout, 84 percent of the Client Survey respondents had their most recent appointment in-person at a WIC clinic, and 16 percent of respondents used telehealth for their most recent appointment. Although not planned, this provided the opportunity to compare the client outcomes by appointment mode (in-person or via telehealth). Among the 950 respondents, 151 completed their appointment via telehealth and 799 did so in-person. Responses to the Client Survey and MIS data were analyzed using descriptive statistics, cross-tabulations, and regression.

DC.1.8.4.1   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.

DC.1.8.4.2   Attitudes Toward the Telehealth Solution

Respondents receiving telehealth services responded to the following 10 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.
- 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 whether the content of the telehealth solution was in a language the respondent could read.

DC.1.8.4.3   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 (inter-item correlation, alpha = .93) and were treated as an index. Summing up, the eight items produced index scores with a potential range of 20 to 100 points with higher scores indicating greater satisfaction.

Barriers. The survey included questions on availability and use of technology and questions regarding 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.

DC.1.8.4.4   Intentions to Change Dietary Behaviors

Three survey items asked respondents about their intentions to change diet-related behaviors following 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, respondents replied to statements about (1) their intentions to change how they eat,

(2) their intentions to change how they feed their family, and (3) their agreement that the lessons will help them make healthy choices.

DC.1.8.4.5   Analysis

Descriptive Statistics. Descriptive statistics include respondent and household demographics, availability and comfort with technology, attitudes toward telehealth services, and respondent behaviors (fruit and vegetable consumption and breastfeeding). Cross-tabulations for categorical variables present proportions among those who provided data (i.e., missing values were excluded from the analysis) by appointment mode (in-person vs. telehealth). Descriptive statistics for continuous variables present 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 and comfort with technology, and respondent behaviors between respondents by appointment mode. 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 (client satisfaction index, barriers, and intentions to change dietary behaviors) employed linear regression models comparing differences in means among participants who received WIC services via telehealth or in-person. The models were estimated with the SAS PROC MIXED[4] 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 method.[5]

For the adjusted model for client satisfaction index, demographic/household variables that demonstrated statistically significant differences by appointment mode were entered into multivariable linear regression. Categorical variables that produced a low cell count warning were excluded because 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 the most categories) if convergence problems were so extreme that significance tests could not be estimated. This process was repeated iteratively until a model solution was obtained. For DC, an adjusted model was attempted but could not be estimated because of small cell counts for the significant variables.

DC.1.8.5   Staff Survey

Descriptive analyses were undertaken to examine the Staff Survey data. For categorical and ordinal outcomes, chi-square tests were performed to examine differences in responses from early to late phase surveys. For ordinal/continuous outcomes, independent t-tests were

performed to examine mean differences. Of the 39 total responses, 28 were submitted in the early phase and 11 in the late phase. Because of the low count of repeated responses, the data were analyzed cross-sectionally and treated independently. All analyses were conducted in Stata 18 (StataCorp LLC, College Station, TX, USA).

DC.1.8.6   Staff Key Informant Interviews

All interviews were audio recorded and transcribed verbatim by Revref. Each transcript was reviewed for accuracy and corrected to reflect actual dialog spoken by listening to the audio recording. Qualitative data analyses were conducted by the ATTAIN DC WIC team using a grounded approach. The project data were reviewed with an eye toward understanding the role that power dynamics played throughout project implementation. Transcripts of in-depth interviews were read by project team members, and an initial set of broad thematic codes were developed. Transcripts were read again by project team members to refine the initial code list. Two project team members served as coders and applied codes to one initial transcript. Once the first transcript was coded, congruency across the multiple coders was calculated; discrepancies were identified and discussed until a high enough congruency was achieved. NVivo version 13 (QSR International) was used to organize and analyze coded interviews. THIS-WIC team members aligned these codes with the codebook developed using Consolidated Framework for Implementation Science Research[6] and the Evaluation Framework for Telemedicine.[7]

DC.1.8.7   ATTAIN DC WIC 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. Because of understaffing, one site transferred all its clients to a different provider and was therefore excluded from the ongoing service delivery cost analysis. All costs were adjusted to 2023 dollars using the Consumer Price Index. All analyses were completed in Microsoft Excel (version #2308) and Stata 18.

To facilitate the comparison of costs from before to after introduction of the telehealth solution, we set the pre-implementation period to FY2019 (i.e., before the start of the pandemic). We then assessed how service delivery costs changed from pre-intervention in FY2019 to post-intervention, the period of February 2022 through July 2023.

DC.1.8.7.1   ATTAIN DC WIC Startup Cost

Statewide costs for telehealth solution startup were calculated as follows:

- Generating subtotals by summing the data for each resource category in the tool (e.g., labor, equipment, indirect, contracted services).
- Computing total cost and cost per month as follows:
  - Total cost = Sum of cost across resource categories
  - Cost per month = Total cost/number of months in the startup period

DC.1.8.7.2 Ongoing WIC Service Delivery Cost

Ongoing service delivery costs were computed for each participating local agency at three time points: Baseline/pre-implementation (FY2019), 6 months post-implementation (August 2022), and 12 months post-implementation (February 2023), as follows:

- 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.
- If an agency purchased equipment, the cost of the equipment was amortized over the reported period until replacement.
- Subtotals were created for each resource category (labor, equipment, supplies, contracted services, and indirect) and then summed across categories to calculate a total by site.

DC.1.8.7.3 Ongoing Implementation Cost Per Enrollment and Per Appointment

To facilitate the comparison of costs from before to after introduction of the telehealth solution, the pre-implementation period was set to FY2019 (i.e., before the start of the pandemic). Changes in service delivery costs from pre-intervention (FY2019) to post-intervention (February 2022–July 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.

DC.1.8.7.4 Return on Investment Analysis

State agencies incur an initial startup cost to develop and implement the telehealth solution, and this investment may provide a return based on the difference between the cost of conducting appointments with the telehealth solution and the cost of their standard approach. If it costs less to deliver services with the telehealth solution than usual care, the telehealth solution results in a financial return to the WIC agency. Once these savings surpass the startup costs, there is a positive return on investment (ROI) in the program. These returns can be used to provide services to additional clients.

To conduct the ROI analysis, the number of appointments that would be needed to recoup the startup costs was calculated by dividing total startup costs by the potential savings associated with each appointment conducted at participating agencies. The break-even point (i.e., the point at which the financial return equals the startup cost) was estimated by dividing the number of appointments needed to recoup the cost by the number of appointments conducted at WIC agencies implementing the telehealth solution.

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