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Telehealth Use in a National Pediatric Weight Management Sample During the COVID-19 Pandemic

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Abstract

Background: This study aimed to assess the implementation and access to telehealth-delivered pediatric weight management (PWM) during the initial phase of the COVID-19 pandemic at six US PWM programs (PWMP) using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) framework.

Methods: The COVID-19 period (COVID) was defined in this retrospective, multisite study as the time when each site closed in-person care during 2020. The Pre-COVID period (Pre-COVID) was an equivalent time frame in 2019. Patients were stratified by visit completion status. Patient characteristics for COVID and Pre-COVID were compared to examine potential changes/disparities in access to care.

Results: There were 3297 unique patients included across the six sites. On average, telehealth was initiated 4 days after in-person clinic closure. Compared with Pre-COVID, COVID (mean duration: 9 weeks) yielded fewer total completed visits (1300 vs. 2157) and decreased revenue (mean proportion of nonreimbursed visits 33.30% vs. 16.67%). Among the completed visits, COVID included a lower proportion of new visits and fewer patients who were male, non-English speaking, Hispanic, or Asian and more patients who were Black or lived ≥20 miles from the program site ($p < 0.05$ for all). Among no-show/canceled visits, COVID included more patients who had private insurance, older age, or a longer time since the last follow-up.

Conclusion: Rapid implementation of telehealth during COVID facilitated continuity of PWM care. Clinic volume and reimbursement were lower during COVID and differences in the patient population reached by telehealth emerged. Further characterization of barriers to telehealth for PWM is needed.

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Introduction

Obesity is a multifactorial disease affecting nearly one in five youth in the United States.[1,2] The adverse health effects of obesity are well documented and often begin in childhood.[3–5] Although genetics and social determinants of health strongly influence weight status, lifestyle behaviors associated with our current obesogenic environment have significantly contributed to the childhood obesity epidemic.[6–11]

The COVID-19 pandemic has been associated with obesogenic behaviors among youth, including increased snacking, consumption of unhealthy foods, sedentary behavior, and later sleep schedules.[12–14] These changes are likely related to a disruption in daily structure and may have more deleterious effects on youth of lower socioeconomic status.[15–17]

One foundational treatment goal among pediatric weight management (PWM) programs (PWMP) is to improve lifestyle behaviors. However, PWM treatment requires time-intensive care, which can often be a barrier for patients with limited resources and access, such as unreliable transportation or prolonged travel time, leading to high attrition.[18,19]

COVID-19 stay-at-home orders and social distancing further challenged PWM access. In response to COVID-19, many PWMP adopted telehealth technology to offer remote visits. Telehealth has the potential to overcome many challenges of PWM treatment by reducing disparities in access, especially for low-income and rural communities.[20] However, implementation must be carefully studied to ensure that target outcomes are being equitably achieved.

The primary objective of this study was to describe telehealth-delivered PWM during COVID from a geographically diverse US sample using the RE-AIM framework.[21,22]

RE-AIM was originally developed to aid in planning and evaluating research to assure generalizability to target community or clinical settings.[21,22] Since its conception, application of the RE-AIM framework has broadened.[21,22] The present study was guided by concepts from RE-AIM to evaluate the success of transitioning from in-person-delivered PWM care to telehealth-delivered care necessitated by the COVID-19 pandemic.

Methods

This retrospective chart review of six US multidisciplinary PWMP, each participating in the COMPASS (Childhood Obesity Multi-Program Analysis and Study System) research network, compared program- and patient-level variables during the initial COVID-19 period (spring 2020) to an equivalent Pre-COVID period (Pre-COVID) (spring 2019). The COVID-19 period (COVID) was specific to each PWMP, defined as starting when all in-person clinics closed and ending when any aspect of in-person care resumed at the site. The Pre-COVID was also unique to each site and defined as a period of time 1 year earlier during which the program had the capacity to schedule an equivalent number of patients. Factors considered in selecting this equivalent time period included scheduling variations caused by provider vacation/medical leave.

Listed in an alphabetical order, not correlating to the site number, the following sites collected data: AdventHealth for Children (Orlando, FL, USA), Children's Hospital Colorado (Aurora, CO, USA), Cincinnati Children's Hospital (Cincinnati, OH, USA), Penn State Health (Hershey, PA, USA), Riley Hospital for Children (Indianapolis, IN, USA), and UF Health Shands Hospital (Gainesville, FL, USA). This study was approved by each site's Institutional Review Board and a Data Use Agreement was in place. Patients were identified through electronic medical records. All patient- and program-level data were collected through a central REDCap database. All patients treated by the six PWMP during COVID and Pre-COVID were included. Data quality was optimized using required field validations, data quality checks using a database-specific data quality plan, and REDCap's internal program to flag outliers and missing data. Discrepancies were queried by site to be corrected or verified. Patient-level information was deidentified.

The RE-AIM framework was used to structure study questions and outcomes[21,22] (Table 1). Effectiveness dimension was viewed from a program operation lens where volume was defined as patients seen by provider type per week per 1.0 clinical full-time equivalent (FTE). Capacity was defined as appointments available by provider type per week per 1.0 clinical FTE. Clinic utilization was defined as percent of capacity utilized by completed visits by provider type per 1.0 clinical FTE. These values were analyzed per week, per 1.0 clinical FTE, to facilitate equitable comparisons regardless of program size when assessing changes in volume, capacity, and clinic utilization during COVID. Patients were dichotomized into two groups—those who completed one or more visits and those with only no-show/canceled visits. Each patient was enrolled only once per period regardless of number of visits or provider types seeing the patient.

Comparisons were made between completed COVID and Pre-COVID visit patient characteristics, and no-show/canceled COVID and Pre-COVID visit patient characteristics using Fisher's exact tests for proportions and Wilcoxon rank sum tests for continuous variables. These analyses were conducted on the entire patient cohort and by PWMP. For the combined analyses, mixed-effects modeling was used, with PWMP included as a random effect to account for differences by site. Additional analyses were performed to determine which patient characteristics

Table 1. Study-Specific Research Questions and Associated Outcomes by RE-AIM Framework Dimension

Dimension	Research question(s) asked	Outcomes evaluated
Reach	• What are the demographic characteristics of patients by visit completion status during telehealth delivery of PWM during the initial phase of the pandemic (COVID) and during Pre-COVID? • Are there disparities in access to telehealth delivery of PWM during COVID vs. Pre-COVID?	• Total patients reached[a] • Comparison of patient demographics (all sites) between completed visits COVID and Pre-COVID[a] • Comparison of patient demographics (all sites) between no-show/cancel visits COVID and Pre-COVID[a] • Comparison of patient demographics (site specific) between completed visits COVID and Pre-COVID[a] • Comparison of patient demographics (site specific) between no-show/cancel visits COVID and Pre-COVID[a]
Effectiveness	• Note: Effectiveness was viewed from a program operation lens, opposed to an assessment of patient outcomes. • How did telehealth delivery during the initial phase of the pandemic impact visit types, capacity, clinic utilization, and revenue for PWM programs, compared with a comparable Pre-COVID period?	• New visit, follow-up visits, and orientation visit volumes[b] • Clinic capacity (appointments available per clinical FTE)[b] • Clinic volume (patients seen per clinical FTE)[b] • Clinic utilization (percent of capacity utilized)[b] • Proportion of reimbursed visits[b]
Adoption	• What were the program characteristics/composition of included PWM sites that adopted telehealth during COVID and Pre-COVID?	• Staff composition (number and type of interdisciplinary providers)[b]
Implementation	• How long did it take to begin offering telehealth? • What infrastructure and training were used/required to implement PWM via telehealth? • What components of traditional PWM were retained using telehealth delivery, and what adaptations were required?	• Time to initiation of telehealth[b] • Platforms and technology used for telehealth[b] • Training methods utilized[b] • Interpreter availability by telehealth[b] • Anthropometrics and diagnostics collected at each time period[b] • Outreach strategies to patients, referring providers, community[b]
Maintenance	• Do PWM programs in this study intend to continue to offer telehealth after the initial phase of the pandemic?	• Frequency of continued telehealth use[b] • Reasons supporting continuation[b] • Barriers to maintenance[b]

[a]Outcomes based on patient-level variables.

[b]Outcomes based on program-level variables.

FTE, full-time equivalent; Pre-COVID, Pre-COVID period; PWM, pediatric weight management.

were associated with visit completion status during COVID and Pre-COVID. For the combined analyses, mixed-effects modeling was used, with PWMP included as a random effect to account for differences by PWMP. SAS9.4® was used for statistical analyses. A p-value ≤0.05 defined statistical significance.

Results

Reach

Of the 3297 unique patients included across both the time periods, 1635 patients were from the COVID period (596 completed visits and 1039 no-show/canceled visits) and 1662 from the Pre-COVID (1004 completed visits and 658 no-show/canceled visits). All six sites provided data on completed visits. Four sites provided data on no-show/canceled visits.

Characteristics of COVID patients and Pre-COVID patients by visit completion status are summarized in Table 2. Mean BMI was consistent with class-two severe obesity in both time periods. Among completed visits, there was a significantly lower proportion of patients during COVID who were male, non-English speaking, Hispanic, or Asian when compared with Pre-COVID, and a higher proportion of patients who were Black or who lived ≥20 miles from the program site. In addition, completed visits were more frequently follow-up visits (vs. new visits) during COVID vs. Pre-COVID. Among patients who did not complete their visit, a higher percentage had private insurance, were older, and had a longer duration of time since the most recent clinic visit.

Patient characteristics for COVID and Pre-COVID analyzed by site and stratified by completion status were compared. These characteristics included sex, race, ethnicity, primary insurance type, preferred language spoken at home, visit type, and the distance a patient lived from the PWMP location. Significant findings varied by site and visit completion status (Table 3).

Within the entire sample, the percentage of no-show/canceled visits was higher during COVID (63.55%) than

Table 2. Patient Characteristics by Visit Completion Status and Time Period

	Completed visits			No-show/cancel visits		
	COVID (N = 596)	Pre-COVID (N = 1004)	p	COVID (N = 1039)	Pre-COVID (N = 658)	p
Sex (%)						
Male	44.30	49.60	**0.04**	51.49	52.43	0.73
Female	55.70	50.40	**0.04**	48.51	47.57	0.73
Age (years) (mean)	12.82	12.62	0.23	12.64	12.02	**<0.001**
Ethnicity (%)						
Hispanic	30.70	40.84	**<0.001**	39.17	42.40	0.19
Non-Hispanic	66.44	56.77	**<0.001**	57.46	54.86	0.32
Race (%)						
White	51.85	52.89	0.72	48.99	47.57	0.58
Black	23.32	16.83	**0.002**	16.75	18.69	0.33
Asian	1.17	2.89	**0.03**	2.41	1.67	0.39
Language (%)						
English	85.74	80.78	**0.01**	78.92	78.27	0.76
Non-English	14.26	19.22	**0.01**	21.08	21.73	0.76
Insurance (%)						
Public	67.95	71.51	0.14	73.05	77.05	0.07
Private	29.19	26.1	0.18	23.58	19.45	**0.05**
Patient Distance (%)						
Lives ≥20 miles from program site	37.58	25.5	**<0.001**	17.9	19.76	0.34
Lives <20 miles from program site	62.42	74.5	<0.001	82.1	80.24	0.34
BMI % (mean)	97.45	98.03	0.43	Not available	Not available	—
BMI% of the 95th%ile (mean)	129.48	129.88	0.83	Not available	Not available	—
New visit (%)	25.50	30.38	**0.04**	30.61	28.42	0.35
Follow-up visit (%)	74.50	69.62	**0.04**	69.39	71.58	0.35
Follow-up: months since most recent visit (mean)	5.12	4.72	0.49	5.17	4.45	**<0.001**

For example, Sex: male (%) to be interpreted as: of the patients who completed visits, 44.3% were male during COVID vs. 49.6% who were male during Pre-COVID, which is statistically significant ($p = 0.04$). Bold values = $p \leq 0.05$.

Pre-COVID (39.59%, $p < 0.0001$). When evaluating differences in visit completion rates across patient characteristics (Table 4), all the patient characteristics were associated with lower completion rates during COVID, except for insurance subtypes (none and unknown), and race identified as American Indian or Alaska Native, Native Hawaiian or Pacific Islander, or multiple races.

Using logistic regression, Pre-COVID, no analyzed factors were associated with prediction of completed visits vs. no-shows; however, during COVID, the preferred language spoken at home was a significant predictor of no-shows. At specific site levels, additional significant predictive factors included visit type and sex (Site 1: follow-up visits, $p = 0.02$; Site 2: female sex, $p = 0.003$).

Effectiveness

During COVID, sites completed both fewer unique new visits (266 COVID vs. 569 Pre-COVID) and fewer unique follow-up visits (1034 COVID vs. 1588 Pre-COVID). Pre-COVID, all sites offered new patient and follow-up visits, defined as having been seen by the program within 3 years. Two sites offered orientation visits (*i.e.,* a designated visit, often delivered to a group, to introduce the PWMP to families before a formal evaluation). During COVID, no site offered orientation visits, but each site continued to offer new and follow-up visits. However, site 6 did not complete new visits (Table 5).

The clinical capacity, volume of patients seen per week, and clinic utilization varied by provider type (Table 6). Site 5 was

Table 3. Site-Specific Patient Enrollment and Comparison of Patient Characteristics Between COVID and Pre-COVID for Completed and No-Show/Cancel Visits

	Completed visits			No-show/cancel visits		
	COVID	**Pre-COVID**	***p***	**COVID**	**Pre-COVID**	***p***
Site 1						
Patients enrolled	153	264	n/a	436	240	n/a
Male (%)	47.71	47.35	1.00	47.02	42.50	0.30
Lives ≥20 miles	7.84	10.61	0.39	10.09	14.58	0.10
Black (%)	43.14	27.65	**0.002**	28.90	32.08	0.43
White (%)	43.14	57.95	**0.004**	53.67	53.75	1.00
Private insurance (%)	22.22	28.03	0.20	23.39	22.92	0.92
Public insurance (%)	75.82	71.21	0.36	75.92	76.67	0.85
English language (%)	88.24	87.50	0.88	82.57	90.83	**0.004**
New visit (%)	30.07	26.52	0.50	20.41	22.50	0.56
Hispanic (%)	13.07	19.32	0.11	20.18	15.00	0.10
Site 2						
Patients enrolled	159	426	n/a	541	376	n/a
Male (%)	45.91	52.85	0.16	55.27	60.37	0.14
Lives ≥20 miles	17.61	14.32	0.37	19.41	18.62	0.80
Black (%)	5.66	7.75	0.47	6.47	10.90	**0.02**
White (%)	52.83	47.65	0.31	46.58	42.82	0.28
Private insurance (%)	31.45	19.72	**0.004**	21.44	14.63	**0.01**
Public insurance (%)	63.52	77.46	**0.001**	72.83	80.05	**0.01**
English language (%)	85.53	70.66	**<0.001**	75.60	68.62	**0.02**
New visit (%)	34.59	34.74	1.00	40.85	32.98	**0.02**
Hispanic (%)	48.43	57.98	**0.04**	55.82	60.90	0.13
Site 3						
Patients enrolled	78	124	n/a	53	41	n/a
Male (%)	43.59	50.81	0.39	50.94	43.90	0.54
Lives ≥20 miles	61.54	48.39	0.08	62.26	51.22	0.30
Black (%)	23.08	16.94	0.36	18.87	12.20	0.41
White (%)	50.00	43.55	0.39	32.08	51.22	0.90
Private insurance (%)	34.62	33.87	1.00	41.51	43.90	0.84
Public insurance (%)	65.38	63.71	0.88	56.6	51.22	0.68
English language (%)	92.31	91.13	1.00	79.25	90.24	0.17
New visit (%)	1.28	16.13	**<0.001**	3.77	17.07	**0.04**
Hispanic (%)	28.21	29.03	1.00	32.08	31.71	1.00
Site 4						
Patients enrolled	116	90	n/a	0	0	n/a
Male (%)	38.79	40.00	0.89	—	—	—
Lives ≥20 miles	82.76	80.00	0.72	—	—	—
Black (%)	22.41	27.78	0.42	—	—	—

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Table 3. Site-Specific Patient Enrollment and Comparison of Patient Characteristics Between COVID and Pre-COVID for Completed and No-Show/Cancel Visits *continued*

	Completed visits			No-show/cancel visits		
	COVID	Pre-COVID	*p*	COVID	Pre-COVID	*p*
White (%)	51.72	47.78	0.67	—	—	—
Private insurance (%)	29.31	27.78	0.88	—	—	—
Public insurance (%)	65.52	64.44	0.88	—	—	—
English language (%)	85.34	90.00	0.40	—	—	—
New visit (%)	26.72	36.67	0.13	—	—	—
Hispanic (%)	25.86	30.00	0.53	—	—	—
Site 5						
Patients enrolled	30	7	n/a	10	7	n/a
Male (%)	53.33	57.14	1.00	50.00	42.86	1.00
Lives ≥20 miles	53.33	14.29	0.10	40.00	71.43	0.33
Black (%)	20.00	14.29	1.00	40.00	0.00	0.10
White (%)	56.67	57.14	1.00	60.00	85.71	0.34
Private insurance (%)	30.00	42.86	0.66	50.00	42.86	1.00
Public insurance (%)	70.00	57.14	0.66	50.00	57.14	1.00
English language (%)	96.67	85.71	0.35	100.00	100.00	1.00
New visit (%)	66.67	42.86	0.39	70.00	71.43	1.00
Hispanic (%)	16.67	14.29	1.00	10	14.29	1.00
Site 6						
Patients enrolled	62	101	n/a	0	0	n/a
Male (%)	37.10	49.50	0.15	—	—	—
Lives ≥20 miles	40.32	36.63	0.74	—	—	—
Black (%)	22.58	16.83	0.41	—	—	—
White (%)	70.97	73.27	0.86	—	—	—
Private insurance (%)	32.26	33.66	1.00	—	—	—
Public insurance (%)	67.74	65.35	0.86	—	—	—
English language (%)	66.13	82.18	**0.02**	—	—	—
New visit (%)	0.00	35.64	**<0.001**	—	—	—
Hispanic (%)	48.39	50.50	0.87	—	—	—

Bold values = $p \leq 0.05$.

excluded from these calculations because it was founded during Pre-COVID and well-established by COVID with increased volume, capacity, and clinic utilization reflecting growth of the program and not telehealth adaptation. Patient volume by provider type per week per 1.0 FTE and clinic utilization decreased during COVID compared with Pre-COVID. Capacity was similar between COVID and Pre-COVID.

Four sites provided financial information. For those four sites Pre-COVID, 94%–100% of patients were billed for visits. On average, 83.5% of bills were partially reimbursed (range 67%–100%). During COVID, reimbursement decreased. Charges were submitted for an average of 95.8% (range 83%–100%) of telehealth visits and 67.5% (range 41%–93%) of visits were partially reimbursed. COVID collections were 62.3% of Pre-COVID collections based on data from three sites.

Adoption

During in-person visits Pre-COVID, the composition of health care providers utilized in each program differed by site (Table 5). During COVID, each site preserved their provider types except for site 3, which no longer utilized dietitians.

Table 4. Patients With Completed Visits vs. No-Show/Cancel Visits for Each Patient Characteristic During COVID and Pre-COVID

	COVID		Pre-COVID		
	% Completed	% No-show/cancel	% Completed	% No-show/cancel	p
Total patient	36.45	63.55	60.41	39.59	**<0.001**
Sex					
Male	33.04	66.96	59.07	40.93	**<0.001**
Female	39.71	60.29	61.78	38.22	**<0.001**
Insurance					
Public	34.79	65.21	58.61	41.39	**<0.001**
Private	41.53	58.47	67.18	32.82	**<0.001**
Military	31.58	68.42	66.67	33.33	**0.05**
None	70.00	30.00	62.50	37.50	1.00
Unknown	22.22	77.78	14.29	85.71	0.67
Other	0.00	100.00	71.43	28.57	**0.03**
Ethnicity					
Hispanic	31.02	68.98	59.51	40.49	**<0.001**
Non-Hispanic	39.88	60.12	61.22	38.78	**<0.001**
Not reported	32.69	67.31	57.14	42.86	**0.02**
Race					
White	37.78	62.22	62.91	37.09	**<0.001**
Black	44.41	55.59	57.88	42.12	**0.001**
Asian	21.88	78.13	72.50	27.50	**<0.001**
AI/AN	83.33	16.67	100	0	0.46
NH/PI	33.33	66.67	100	0	0.40
Multiple race	40.74	59.26	57.14	42.86	0.35
Not reported	28.44	71.56	55.72	44.28	**<0.001**
Preferred language					
English	27.96	72.04	57.44	42.56	**<0.001**
Spanish	38.07	61.93	61.3	38.70	**<0.001**
Other	22.22	77.78	73.33	26.67	**0.003**
New patient	32.34	67.66	61.99	38.01	**<0.001**
Follow-up patient	38.11	61.89	59.74	40.26	**<0.001**
Patient distance from PWMP					
≥20 Miles	54.63	45.37	66.32	33.68	**<0.001**
<20 Miles	30.37	69.63	58.62	41.38	**<0.001**

For example, male to be interpreted as: during COVID, 33.04% of males completed visits and 66.96% did not, which is significantly different from Pre-Covid during which 59.07% of males completed visits and 40.93% did not ($p < 0.001$). Bold values = $p \leq 0.05$.

AI/AN, American Indian or Alaska Native; NH/PI, Native Hawaiian or Pacific Islander; PWMP, pediatric weight management programs.

Table 5. Program-Level Characteristics During COVID and Pre-COVID

	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6	
	COVID	Pre-COVID	COVID	Pre-COVID	COVID	Pre-COVID	COVID	Pre-COVID	COVID	Pre-COVID	COVID	Pre-COVID
Unique patients with completed visits	153	264	159	421	78	124	116	88	29	7	61	100
Unique patients with no-show/canceled visits	436	240	540	370	53	41	0	0	10	7	0	0
Unique patients with orientation visits	0	0	0	103	0	0	0	0	0	0	0	86
Total new visits	87	195	111	219	18	32	30	34	20	3	0	86
Total follow-up visits	225	582	216	465	139	92	86	57	11	4	357	388
Medical provider—total number (telehealth trained)	3 (3)	4 (0)	9 (9)	9 (3)	4 (4)	1 (0)	3 (3)	3 (3)	2 (2)	1 (0)	1 (1)	1 (1)
Registered dietitian—total number (telehealth trained)	5 (5)	5 (5)	11 (11)	11 (2)	1 (1)	0 (0)	0 (0)	0 (0)	2 (2)	1 (0)	1 (1)	1 (1)
Exercise physiologist—total number (telehealth trained)	4 (4)	4 (1)	2 (2)	2 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (1)
Psychologist—total number (telehealth trained)	0 (0)	0 (0)	1 (1)	2 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (0)	1 (1)	1 (1)
Social worker—total number (telehealth trained)	0 (0)	0 (0)	1 (1)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Health coach—total number (telehealth trained)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (3)	3 (3)
In-person clinic closed	3/23/2020		3/16/2020		3/14/2020		3/30/2020		3/17/2020		4/1/2020	
Telehealth initiated	3/23/2020		3/23/2020		4/1/2020		3/30/2020		3/23/2020		4/1/2020	
In-person clinic resumed	5/4/2020		5/11/2020		6/5/2020		5/4/2020		5/18/2020		7/1/2020	
Duration of in-person closure	6 Weeks		8 Weeks		12 Weeks		5 Weeks		9 Weeks		13 Weeks	

Table 6. Volume, Capacity, and Clinical Utilization Across Sites During COVID vs. Pre-COVID

			Volume (mean patient/ week/FTE)		Capacity (mean appt/week/FTE)		Clinic utilization (mean %)	
			COVID	Pre-COVID	COVID	Pre-COVID	COVID	Pre-COVID
Provider type	(No. of sites utilizing per time period)	Medical provider (5 Pre-COVID, 5 COVID)	11.9	17.2	29.4	29.4	42.1	59.6
		Dietitian (3 Pre-COVID, 4 COVID)	6.8	16.1	24.1	28.3	28.4	56.9
		Exercise physiologist (2 Pre-COVID, 2 COVID)	6.9	18.5	25.9	28.9	25.1	63.7
		Psychologist (2 Pre-COVID, 1 COVID)	10.0	20.4	31.0	38.0	32.3	55.9
		Health coach (1 Pre-COVID, 1 COVID)	23.0	24.0	45.0	45.0	51.1	53.3

Definitions: volume (patients seen by provider type, per week, per 1.0 clinical FTE), capacity (appointments available by provider type, per week, per 1.0 clinical FTE), clinic utilization (percent of capacity utilized by completed visits by provider type, per week, per 1.0 FTE).

Implementation

Each PWMP ceased all in-person care and transitioned to telehealth in the spring of 2020. The mean duration of in-person program closure was 9 weeks (range 5–13 weeks). The time between in-person clinic closure and telehealth initiation was a mean of 4 business days (range 0–13), with three sites beginning telehealth immediately upon in-person clinic closure (Table 5). For sites with delayed implementation, care was bridged via billed and unbilled phone and video visits.

Pre-COVID, all PWMP predominantly followed an in-person model. One site utilized telehealth by medical providers and dietitians in a limited capacity seeing 1–2 patients per week virtually. Five sites did not include telehealth in their routine patient care but had a limited number of providers in different disciplines trained in telehealth (Table 5). During COVID, telehealth was conducted using video and audio-only options across nine different telehealth platforms. Five sites provided training to all providers using telehealth, which included online modules, job aids (*e.g.,* step-by-step guides), software/ equipment "tech checks," mock visits, email communication, and/or education at virtual meetings. All sites had access to interpreters for any requested language during Pre-COVID and COVID periods.

Routine PWM care Pre-COVID included obtaining weight (99.2% of visits), height (99.2% of visits), and blood pressure (97.1% of visits) at all sites. Laboratory testing was obtained during clinic visits at three sites (53.2% of visits). Two sites obtained resting energy expenditure (95% of visits) and bioelectrical impedance analysis (100% of visits). Differences following telehealth implementation during COVID included a lower percentage of collected weights (mean 32.9%) and heights (mean 21.3%). The medical team was also unable to check blood pressure, complete comprehensive physical examinations, draw laboratories during visits, obtain resting energy expenditure, or run bioelectrical impedance analysis.

Strategies used to engage families Pre-COVID included bulk electronic messaging (two sites), social media (two sites), internet-based resources (six sites), and individual phone calls (four sites). Strategies used to engage families were expanded during COVID. Methods included increasing bulk text messaging, social media posts (*e.g.,* posting of exercise, cooking, and nutrition videos), phone calls, and podcasts. Two sites also increased outreach to community health care providers regarding PWMP and referral processes.

Maintenance

As of January 2022, all sites maintained telehealth to some degree after in-person visits resumed. Telehealth was continued for patient convenience or preference, to reduce patient barriers, staff or patient illness, as a bridge to ramp up in-person volume, staff convenience, and adherence to institutional requirements. Barriers to the maintenance of telehealth described by the six PWMP included inability to collect complete biological measurements at home, patient or staff preference, state license restrictions, billing/ reimbursement challenges, and technical difficulties/Wi-Fi availability for patients.

Discussion

The COVID-19 pandemic posed myriad challenges and prompted creative strategies to maintain health care for youth with obesity. Our retrospective study of six geographically diverse US PWMP leveraged the natural experiment that the pandemic created to evaluate our synchronized transition to telehealth delivery. We used the RE-AIM framework to offer insight into key aspects of initial telehealth use in this population, including potential disparities in access to care. The conversion from in-person to telehealth-delivered care occurred quickly. The interdisciplinary structure inherent to PWM[23] was identified as one facilitator of this rapid adoption by the study team. This allowed for phased introduction of telehealth without complete disruption of services. Despite the swift adjustment, total patient volume and relative reimbursement decreased. Explanations for decreased revenue seen among completed visits warrant further exploration.

Possible contributors include lower reimbursement rates for telehealth vs. in-person visits, delayed utilization of expanded telehealth-based billing codes, and decreased copayment collections from families.

Patient Access and Disparities

Our data showed that a lower percentage of patients completed visits during COVID if they identified as Hispanic or did not speak English at home. These findings are consistent with prior studies showing significantly lower telehealth utilization among Hispanic patients compared with non-Hispanic White and non-Hispanic Black patients and demonstrating decreased telehealth use among non-English speakers in the pediatric outpatient setting.[24,25] A qualitative study examining barriers and facilitators to pediatric telehealth among English- and Spanish-speaking families identified lower technological access and knowledge, and situational preference for in-person visits among Spanish-speaking families.[26]

The concept of the ''digital divide,'' which refers to the gap between individuals who have easy access to modern technology and those who do not, and the concept of digital literacy, are now recognized as social determinants of health.[27] This digital divide may impact non-English-speaking patients in addition to other at-risk populations. Prior studies of telehealth for the treatment of complex pediatric chronic diseases have found disparities in effectiveness that negatively impact vulnerable populations.[28] Social determinants of health, including food insecurity, limited access to health care, and parental unemployment, will continue to be relevant to the development and treatment of pediatric obesity.[29,30] By collecting additional qualitative data from non-English speaking and at-risk families (*e.g.,* through patient advisory boards), developing more culturally sensitive, translated resources to facilitate telehealth use, and training team members to provide culturally competent care, we can take steps to address barriers to telehealth-delivered PWM.

In our study, individuals who lived farther from the PWMP and patients identifying as Black had increased visit completion during COVID compared with Pre-COVID. For those traveling from a significant distance, we can hypothesize that reduced time and cost related to travel may have boosted telehealth attendance. There are mixed data regarding telehealth utilization by race in pediatrics, and this finding requires additional study including direct patient/family input and deeper characterization of other factors.[31]

Opportunities to Improve Telehealth-Delivered PWM

Of the five major telehealth modalities,[32] PWMP in this study used real-time, synchronous care between a provider and patient. Nine different telehealth platforms were used across sites, suggesting a competitive market and ongoing opportunities for innovation. Each hospital system determined which platforms it would continue to use based on factors, including compatibility with the existing electronic medical record, ease of use, and the ability to connect with interpreter services.

Accurate measurements of height, weight, body composition, and blood pressure were challenging or not possible to obtain during telehealth visits, which highlights an opportunity for the development of cost-effective remote technologies.[27,33,34] An obstacle to the widespread adoption of remote patient monitoring and telehealth modalities for PWM is the lack of reimbursement. Other barriers include difficulties with integration of peripheral data into the electronic health record, onerous contracting processes between hospitals and industry, and concerns about maintenance of confidentiality. In 2018, the Centers of Medicare and Medicaid Services (CMS) added evaluation and management codes for remote patient monitoring, which has demonstrated feasibility and improved health outcomes for millions of adults with chronic health conditions, including obesity.[35,36] Extension of this coverage to pediatric patients with obesity by Medicaid could significantly enhance patient–provider contact and facilitate enhanced accuracy of diagnostics and treatment.

Future of Telehealth in PWM

The COVID-19 pandemic has been associated with an increased incidence of pediatric obesity.[37,38] In addition, the 2023 American Academy of Pediatrics Clinical Practice Guidelines for the Evaluation and Treatment of Children and Adolescents with Obesity call for prompt initiation of treatment.[39] With increased prevalence and demands for more rapid treatment, we should anticipate a need for increased capacity of PWMP to mitigate long-term morbidity and premature mortality.[40] Taken together, these factors strongly support the need for ongoing resources to maintain and expand telehealth.

The COVID-19 pandemic led to declarations of public health emergencies, which included temporary relaxation of regulations in the form of waivers, interim final rules, and expansion of eligible billing codes that improved access to and reimbursement for telehealth. State-specific telehealth policies during the pandemic varied considerably and more permanent legislative actions taken by some states significantly differ in their impact. These changing policies are difficult to navigate. The National Consortium of Telehealth Resource Centers consolidates best practices and provides free consultations to assist practices across the United States with optimizing telehealth services with an emphasis on delivery to rural areas and communities at risk of social adversity.[32] The Center for Connected Health Policy is an additional resource for federal- and state-specific telehealth policy resources.[41]

Limitations

Limitations of this study include its retrospective design. Although we present data for all sites individually and combined, the heterogeneity across the six sites may have introduced unmeasured confounders that could influence outcomes. There is a risk for selection bias at the program level because all participating sites volunteered and successfully transitioned to telehealth. The data presented represent only the initial telehealth experience in the acute phase of the pandemic. We acknowledge that supplemental research is needed to evaluate how telehealth has evolved since.

Call to Action

Optimized access to telehealth-delivered PWM has the potential to improve reach, effectiveness, and to lower health care costs by preventing and/or mitigating weight-related complications beginning in youth, but requires further study and the development of evidence-based best practices associated with improved patient outcomes.

We advocate for the following:

1. Ongoing funding to advance research on effective, economical, and equitable approaches to deliver telehealth-based PWM.[28,42]
2. Permanent waivers from state and commercial payers that (a) reduce or eliminate geographic limitations to telehealth, (b) allow the home as an eligible site for telehealth, and (c) expand the types of clinicians who can deliver telehealth.
3. Maximizing appropriate allowable current procedural terminology (CPT) codes for telehealth reimbursement.
4. Extending insurance reimbursement for remote patient monitoring devices and interpretation.
5. Developing processes with state medical (and other professional) boards that ease the logistics of multistate licensing for the purposes of telehealth delivery.

Impact Statement

This study assessed the implementation and access to telehealth-delivered pediatric weight management (PWM) during the initial phase of the COVID-19 pandemic. Disparities in the patient population reached by telehealth emerged. Telehealth has the potential to improve reach and effectiveness of PWM, but refinement is needed to improve access and remote diagnostic assessment.

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Authors' Contributions

K.M.W.S.: Conceptualization (equal), data curation (lead), investigation (equal), methodology (lead), project administration, visualization (lead), writing—original draft (lead), and writing—review and editing (lead). R.Y.K.: Conceptualization (equal), data curation (equal), investigation (equal), methodology (equal), visualization (equal), writing—original draft, and writing—review and editing (equal). J.M.T. and R.S.: Conceptualization (equal), visualization (equal), writing—original draft (equal), and writing—review and editing (equal). M.B.N., A.M.F., A.V.B., and S.K.N.: Conceptualization (equal), investigation (equal), writing—original draft (equal), and writing—review and editing (equal). E.M.T.: Investigation (equal), writing—original draft (equal), and writing—review and editing (equal). P.R.K.: Formal analysis (lead), visualization (equal), and writing—review and editing (equal).S.P.: Conceptualization (equal), investigation (equal), methodology (equal), writing—original draft (equal), and writing—review and editing (equal). J.M.M.: Conceptualization (lead), investigation (equal), methodology (equal), visualization (equal), writing—original draft (equal), and writing—review and editing (equal).

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