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11 **Ethics Approval:** This project was reviewed by the Children's Hospital Los Angeles Institutional
12 Review Board and determined to be exempt from IRB oversight due to its classification as a quality
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ABSTRACT.

Background: Virtual delivery of comprehensive pediatric obesity treatment may reduce barriers such as time, cost, and travel distance. Despite these advantages, high no-show rates for first-time visits remain a significant challenge. The aim of this project was to reduce no-show rates for first-time visits by 10%.

Methods: This clinician-led quality improvement project included a needs assessment to identify barriers to attendance and four sequential Plan-Do-Study-Act (PDSA) cycles. Each cohort received one of the following interventions: (A) orientation phone call at referral, (B) orientation text message at referral, (C) reminder phone call, or (D) reminder text message. No-show rates before and after implementation were analyzed using control charts, linear regression, and chi-squared tests. Odds ratios (OR) and 95% confidence intervals (95%CI) were calculated to evaluate the association between interventions and attendance.

Results: A total of 845 eligible patients were included (pre-implementation n=480; post-implementation n=384). The baseline first-visit no-show rate was 38%. After implementation, the no-show rate decreased to 20%, representing an 18% absolute reduction (p=0.02). Pre-visit reminder interventions significantly improved attendance (Protocol C: OR=2.07, 95%CI=1.12-3.85, p=0.04; Protocol D: OR=2.66, 95%CI=1.12-6.33, p=0.02), whereas orientation interventions at referral showed no significant effect. Cost analysis demonstrated that reminder text messages required the least financial and labor investment ($606 annually; ~35 minutes/week), while reminder phone calls produced the greatest improvement relative to cost.

Conclusion: Pre-visit reminders delivered by phone or text significantly reduce first-visit no-show rates in pediatric weight management programs. These low-cost, scalable strategies may improve access and engagement in telehealth-based obesity care.

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INTRODUCTION.

According to the Centers for Disease Control (CDC), one in five children in the United States was identified as overweight or obese between 2017 and 2020.[1] More recent models estimate that if these rates continue by 2050, more than half of youth will live with obesity.[2] In 2023, the American Academy of Pediatrics (AAP) released updated clinical practice guidelines recommending comprehensive obesity treatment that integrates intensive lifestyle modification, obesity pharmacotherapy, and bariatric surgery for the care of youth with obesity.[2] To provide this care, many children's hospitals deliver intensive, multi-disciplinary pediatric weight management (PWM) programs that provide longitudinal comprehensive family-based treatment.[3,4] In response to the COVID-19 pandemic and the high prevalence of youth living with obesity, many PWM programs transitioned from in-person delivery to virtual models to expand the scope and reach of the program. [5–7]

Many factors threaten the sustainability of PWMs in the United States.[8] These include policy, hospital, personnel, funding, and individual-level components.[8] Virtual delivery of an intensive chronic care model may improve accessibility by addressing cost, time away from work and school, and travel barriers that many patients and families experience with in-person interventions.[9–13] Despite the potentially positive outcomes of the virtual delivery model, there remain challenges with participant adherence and engagement in PWM programs that persist across in-person and virtual delivery platforms in pediatrics to date. [14]

Growing literature has shown that PWM programs that report high attendance rates for in-person interventions often communicate with patients via telephone, mail information packets, and provide orientation sessions before or after the initial patient visit.[2,15] Many PWM programs offer standard orientation sessions before the program's initiation.[15,16] However, published data is limited on whether these additional sessions improve attendance rates and engagement consistently.[17,18] There is a paucity of literature exploring whether orientation-type interventions are required when the programs are offered purely through virtual platforms. Much of this research is limited to the United States, and there are few studies outside of the United States and none in non-Western countries.

Additionally, automated, electronic health record (EHR) managed visit reminders have been utilized for many years to inform patients and families of upcoming visits. However, this method has several limitations, including erroneous or inaccurate contact information in the EHR, families' inability to receive reminders, and imperfect technology. All these factors have limited this automated tool in significantly improving attendance rates.

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The virtual PWM program used in this study consists of a 12-month, interdisciplinary treatment using a nurse practitioner or physician and dietician focused on behavior modification and medical intervention to address the patient's specific needs in improving their weight. The patient population that the program serves is mainly non-English speaking, of low socioeconomic status, and/or uninsured or publicly insured. These factors lend to issues of low health literacy and the need for optimal technology to receive virtual communications within this population. Because of these factors, it is theorized that many patients and families need to be made aware of why or when they were referred to the clinic, what treatment is received in the program, and how and when they can schedule and access their appointments. Considering these factors, this study implements various modes of communication and orientation forms to determine the most effective reduction of no-show rates to first appointments.

This quality improvement project aims to optimize communication and orientation strategies to increase patient attendance at first-time visits to a single center, urban PWM program. The specific aims are to conduct a needs assessment from clinical staff and families, design four PDSA cycles to decrease no-show rates by 10% over three months and collect process measures to assess the time and resources required to achieve this improvement to inform future dissemination. The 10% target was selected based on historical performance benchmarks within our clinic, and informed by achievable goals in similar quality improvement initiatives.

METHODS

Design, setting, and sample

This project used a pre-and post-intervention design. This four-stage problem-solving model study design included a needs assessment to identify barriers to patients' attendance at first-time visits and four plan-do-study-act (PDSA) cycles. The driver diagram outlines how to decrease the incidence of attrition among newly referred patients to the endocrine weight management clinic (**Figure 1**).

The setting was a multidisciplinary weight management clinic at Children's Hospital Los Angeles (CHLA). The primary outcome was no-show rates for the first visit, defined as patients who either canceled their first visit within 24 hours of the scheduled date or no showed. Secondary outcomes investigated the feasibility and cost of each cycle implementation. The Children's Hospital institutional review board approved the retrospective analysis of collected data. This project was reviewed by the Children's Hospital Los Angeles Institutional Review Board and determined to be exempt from IRB oversight due to its classification as a quality improvement initiative.

Patient selection

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Patients eligible for this study were defined as youth, ages 2 to 21 years old, referred to the CHLA endocrine weight management program between January and August 2022. The four quality improvement protocols were implemented between June and August 2022, with a new cycle implemented every three weeks. For cycles A and B, all new referrals to the clinic during the respective periods of each cycle were used as subjects. In cycles C and D, all patients with a first appointment scheduled during the respective cycle periods were used as subjects. No patient who was a part of cycles A and B were used as subjects in cycles C and D. To analyze whether the combination of protocols had decreased the no-show rates for the first visit, pre-program implementation dates were defined as all patients with a first visit to the weight management clinic between June 2021 and June 2022, and post-implementation was defined as patients who attended a first visit between June 2022 and June 2023.

Interventions

A needs assessment survey was conducted in December of 2021. The assessment was a 10-question anonymous survey sent to clinicians and clinic staff in the endocrine weight management program. All clinicians and staff completed the needs assessment, and three common themes interfered with patient completion of the 12-month program: patient barriers to scheduling visit 1, low attendance to visit 1, and low attendance to follow-up visits. The weight management team in the division of endocrinology at CHLA strategically executed a series of protocols that made up a multifaceted quality improvement program, explicitly addressing the no-show rate for the first visit based on scientific evidence and accumulated experience. Since visit attendance is multifactorial, these protocols were designed to target many factors simultaneously, including confusion around the referral process and wait time, discrepancies around the expectations for the weight management intervention, and technical difficulties around telehealth. All guidelines in the program were followed simultaneously and periodically evaluated by the multidisciplinary team. Feedback and corrective measures were offered to the faculty and staff accordingly. This analysis compared the no-show rate to the first visit before and after implementing the quality improvement program.

These families were referred to a multi-disciplinary pediatric weight management program. The clinical team included a pediatric endocrinologist, pediatrician, dietitian, clinical coordinator, and two medical students. Monitoring and feedback education for staff and trainees were provided monthly, printed copies of the protocols were kept in the clinic for easy accessibility, and standardized audits were conducted to monitor compliance with interventions. A run chart, which looked at attrition trends over time, was constructed quarterly to monitor the program's effectiveness.

The purpose of protocols A and B was to increase transparency around the timing of the patient's first visit and the expectations of the weight management program. Protocols A and B included

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confirmation that their referral was received and being processed, details about the 12-month weight management intervention they were referred to, and realistic wait time estimates for scheduling their first visit as outlined in **Appendix A.** These protocols were chosen after providers identified barriers to accessing care, including long wait times between referral and first visit (~6-9 months) and the family's unawareness of the time commitment to the weight management clinic.

The purpose of protocols C and D was to remind families regarding their upcoming visit. Compared to the generic reminder call that the pre-implementation families received. Protocols C and D included additional details about the 12-month weight management intervention they were referred to, how to attend a telehealth visit, and a reminder that they could attend a telehealth visit from anywhere and did not need to come to the clinic as outlined in **Appendix A**. These protocols were chosen after clinical experience from providers identified needing clarification around how to attend a telehealth visit and what was expected from the families.

Training for team members who carried out each protocol included standardized scripts and provided supplemental information about the weight management program as outlined in **Appendix B**. The purpose of this training was to ensure standardization of information passed to each patient within each cohort.

Financial analysis

The two medical students who carried out all phone calls and texts tracked the labor time associated with protocol implementation as outlined in **Appendix C**. The cost was then calculated by the average hourly pay of clinic secretarial staff who would carry out the calls and texts in the place of the medical students outside the context of this study ($12/hour). Cost differences were compared between the four protocols.

Statistical analysis

Data was analyzed using JMP®, Version 17.0.0. SAS Institute Inc., Cary, NC, 1989–2023. Descriptive statistics were generated for categorical variables, including frequency distributions and percentages. Comparison between pre- and post-implementation groups was done using Chi-squared and Fisher's exact tests for categorical variables. All predictor variables with a p-value <.05 were considered potential confounders, and adjusted odds ratios (aOR) and 95% confidence intervals (CI) were calculated accordingly. The odds ratio, likelihood ratio, risk difference, and Fisher's exact test were generated for the no-show and cancelation rates between the pre- and post-implementation groups. Each protocol was compared independently to the pre-implementation cancelation and no-show rates

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RESULTS.

A total of 845 patients met eligibility criteria for this study. Of these, 480 patients were seen in the endocrine weight management clinic between June 2021 and June 2022 (pre-implementation group), and 384 patients were seen between July 2022 and July 2023 (post-implementation group). The overall patient population at Children's Hospital Los Angeles had a mean age of 10.5 ± 2.7 years, mean HbA1c of 5.3 ± 0.9%, 81% Hispanic, 63% female, and 85% covered by public insurance. Previous studies in the endocrine weight management clinic at CHLA indicate that this cohort mirrors the broader pediatric population served by the hospital.

Table 1 summarizes attendance, cancellations, and no-show rates for each intervention cycle, and Figures 2 and 3 visualize the no-show rates for each cohort. Youth in post-implementation protocols C (pre-visit reminder phone call) and D (pre-visit reminder text message) had significantly higher odds of attending their first visit compared with the pre-implementation group (Protocol C: OR = 2.07, 95% CI: 1.12–3.85, p = 0.04; Protocol D: OR = 2.66, 95% CI: 1.12–6.33, p = 0.02). Full details including odds ratios, likelihood ratios, p-values, risk differences, and confidence intervals are presented in Table 2.

No significant improvements in attendance were observed for protocols A (orientation phone call at referral) and B (orientation text at referral) (Protocol A: OR = 0.66, 95% CI: 0.23–1.03, p = 0.08; Protocol B: OR = 0.37, 95% CI: 0.13–0.66, p < 0.001), suggesting that pre-visit reminders were the most effective interventions.

When combining protocols C and D to assess the impact of any pre-visit reminder, the post-implementation no-show rate decreased by 18% compared with the pre-implementation group (baseline no-show rate 38%). Results are summarized in Table 3 and visualized in Figure 4.

As a balancing measure, cost-effectiveness was analyzed for each intervention. Annual costs varied across protocols: A = $4,247, B = $2,513, C = $953, and D = $606. Protocol D was the least resource-intensive, requiring approximately 35 minutes of labor per week at $12/week, whereas protocol C required 55 minutes per week at $18/week. Considering the cost-to-benefit ratio, protocol C achieved the largest reduction in no-show rates relative to cost. Full financial analysis is presented in Table 4.

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DISCUSSION.

This quality improvement project addressed the high no-show rate for the first virtual weight management clinical program visit at a single urban center. Patients were either referred internally or by community clinicians, and the standard wait time from the day of referral to the first visit varied between three and six months due to an overwhelming number of referrals received for weight management care in this region. This study aimed to reduce the no-show rate by 10% by incorporating staged reminders by engaging with future patients at two different points: upon referral (protocols A and B) and upon first visit (protocols C and D). These cycles were not additive, and each implementation was independently used on a separate cohort. However, the discrepancy between the number of patients who were never enrolled between A and B and C and D, where more patients in groups A and B were never enrolled, must be recognized. In groups C and D, the patients had already been scheduled for their first clinic visit compared to groups A and B, who had just recently been referred to the clinic. It is possible that the subjects in groups C and D were already more likely to attend their first visit than groups A and B because they showed the initiative to schedule their clinic visit without an orientation. Therefore, groups C and D may have had fewer no-shows than groups A and B, confounding the results.

Personnel time and cost were estimated during the intervention period to assess and capture balance and process measures. The clinic received roughly 100 new referrals per month with an expected increase in the number of referrals as the pediatric obesity epidemic continues. With current capabilities, the clinic saw approximately 40 new patients a month. Each protocol had a variable time burden and, in turn, a cost burden on the clinic. Protocols A and B are significantly more expensive than protocols C and D, and no significant decrease in no-show rate was found after initiating protocol A or B alone. Protocols C and D were equally effective at decreasing the no-show rates. Still, Protocol D was 36% cheaper than Protocol C. Across pediatric healthcare systems, there was higher cost and greater underutilization of clinical service. This discrepancy resulted in increasing demand and price. [19]

While there is a paucity of pediatric data on this topic, various adult studies have highlighted the negative impacts of high no-show rates on the health care system from a cost perspective.[19] Berg *et al*, estimated 67,000 unattended scheduled visits can cost the healthcare system approximately seven million dollars.[20] While these estimates look different based on the hospital system and specialty considered, any low-cost tool available that could decrease no-show rates may be used to help healthcare organizations be more effective and efficient.[19–22] Taken together, implementing a detailed text reminder may be an affordable and effective tool for decreasing the no-show rate at a pediatric weight management clinic, increasing clinic efficiency and profitability. These results are in line with

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other meta-analyses and review papers that have found text-message reminder systems effective at increasing visit attendance.[23–25]

In a pandemic world, there remains a shortage of healthcare providers, and an increased burden on staff is undesirable.[2,26,27] One alternative that may increase attrition is to update the baseline EHR text reminder system to provide more detailed instructions. Protocols C and D provided a text/phone call with more information than the baseline generic visit reminder. Future research should compare the impact of one detailed text reminder vs. multiple detailed text reminders vs. one generic text reminder. Text reminders are chosen for future research because of their equal effect on the no-show rate compared to phone calls. In addition, a focus group is proposed to interview families on barriers to attending weight management visits and better understand what the patient and the families would prefer for additional support.

Limitations

This project was conducted in a single urban clinical setting in the United States, limiting the results' applicability. The participants were selected through convenience sampling and did not provide an accurate representation of the general population. The retrospective nature of the pre-intervention data collection puts the data at risk of selection and misclassification biases. We used a random sampling technique to distribute patients into the different protocols to decrease selection bias. Standardized protocols, random auditing, and monthly feedback education sessions for the staff and trainees were implemented to decrease misclassification bias. Only gender and age demographic data were collected; other data regarding participants' ethnicity, educational levels, and parent employment could have contributed to information on social determinants of health.

Conclusions

The primary aim of this study was to reduce no-show rates for first visits in a virtual pediatric weight management program by 10%, with secondary aims evaluating the time and financial costs of achieving this reduction. This clinician-driven quality improvement initiative demonstrated that pre-visit reminders delivered via text messages and phone calls can effectively decrease no-show rates for first-time visits. Staged reminders that include clinic-specific information were particularly effective in improving attendance in a specialty virtual clinic setting.

These findings are broadly translatable to pediatric clinical settings, especially in underserved areas where virtual care can enhance access. Reminder texts or phone calls are low-cost, scalable interventions that can be implemented in most clinics using existing infrastructure, such as phones or EMR messaging systems. Further study with prospective, controlled data collection is warranted to validate these results and optimize implementation strategies.

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FIGURES AND TABLES.

Figure 1. Composite Analysis Of the Smart Aim, Key Drivers, Intervention Protocol Design, and Balance Aims Executed in the Study Design Described.

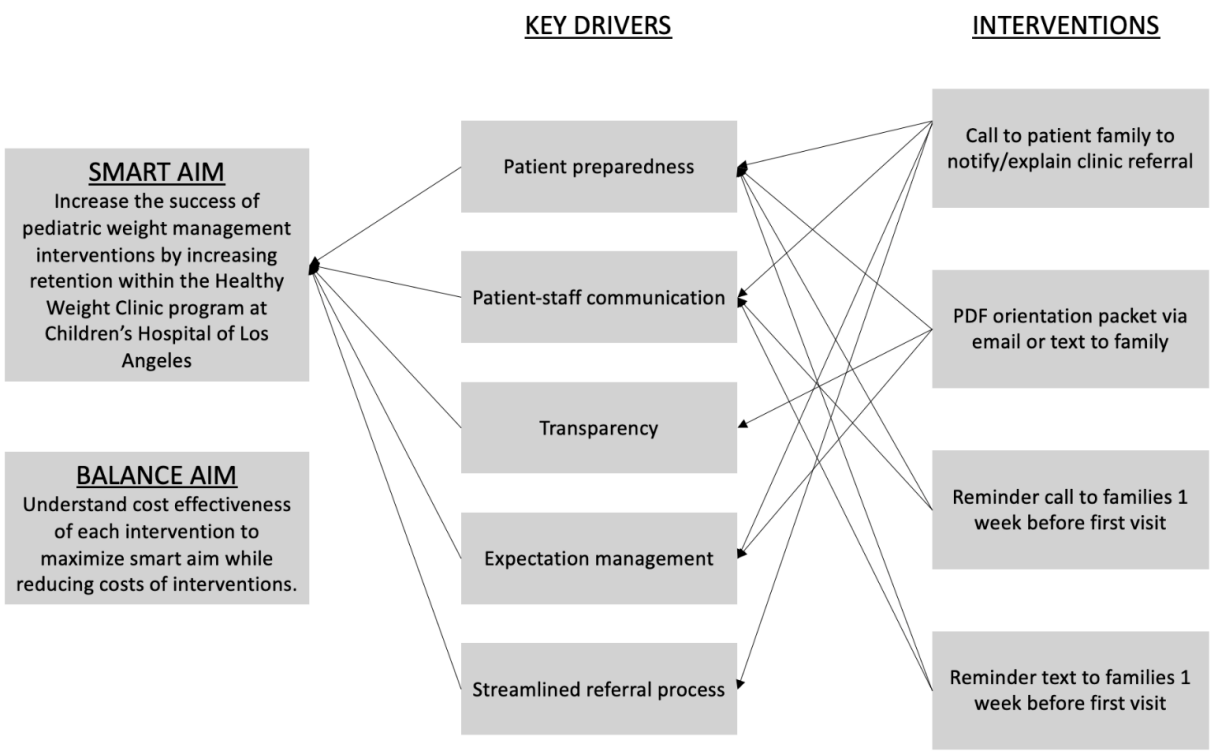

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Figure 2. Bar Graph Demonstrating the Impact Of Protocols A-D With the Percentage Results Captured on the Y-axis and Protocol on the X-axis.

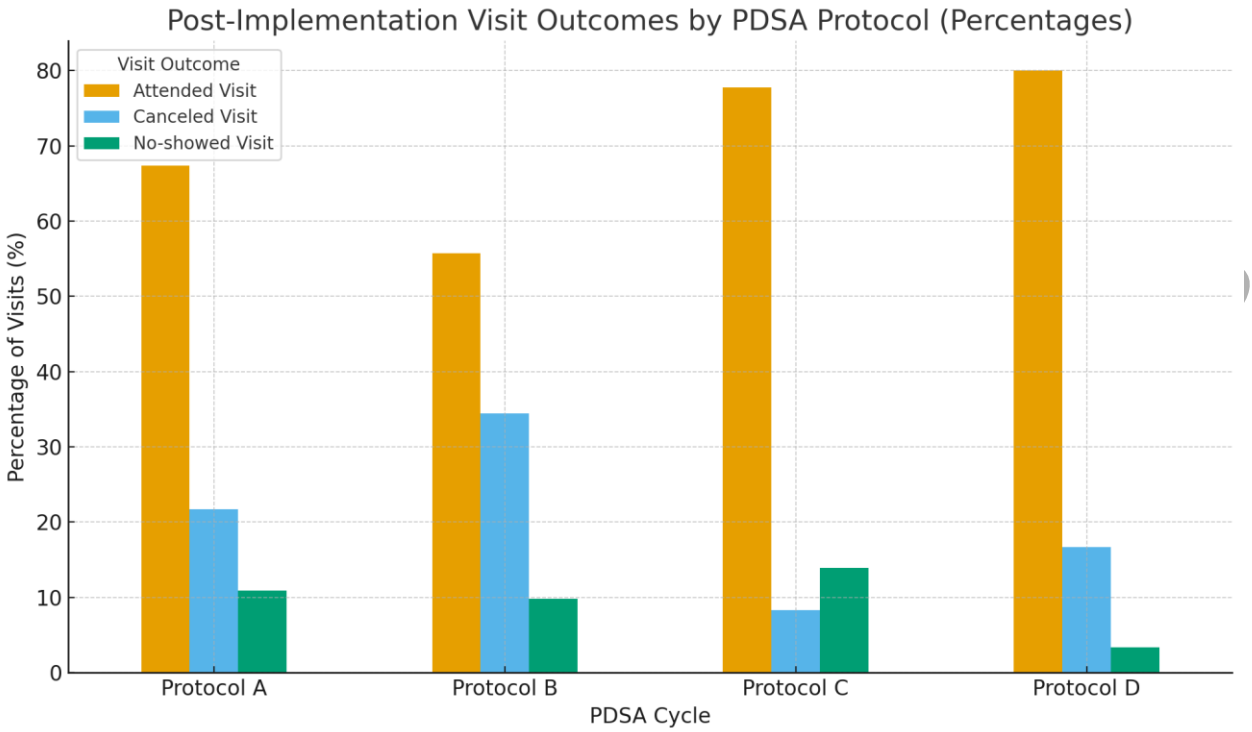

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Figure 3. Mosaic Plot Of the Impact Of Protocol A-D On No-Show Rate With the Study Type Graphed On the Y-axis and Visit Result Captured On the X-axis.

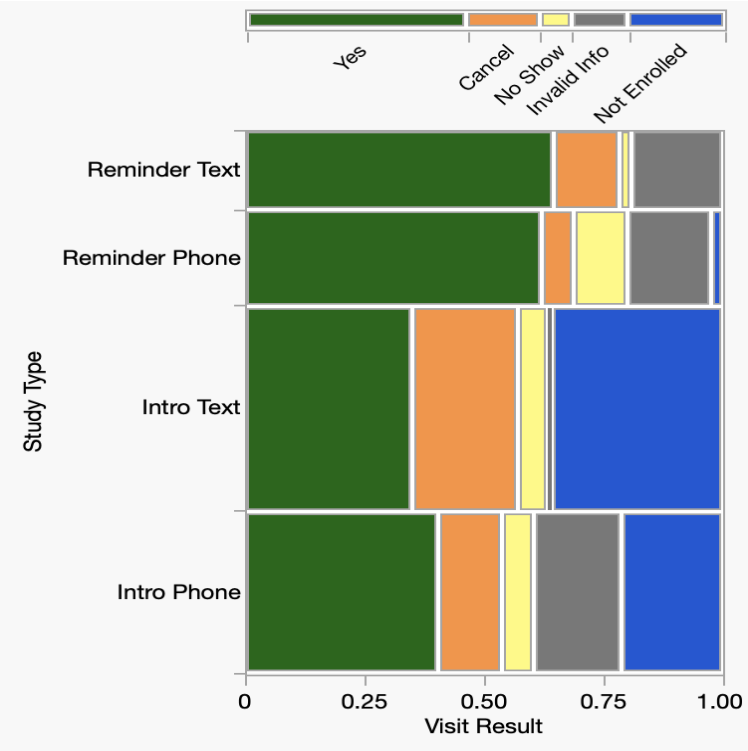

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Figure 4. Mosaic Plot Of the Impact Of Adding a Visit Reminder in the Form Of a Call or Text (Protocol C + D) on the No-Show Rate For the First Scheduled Visit.

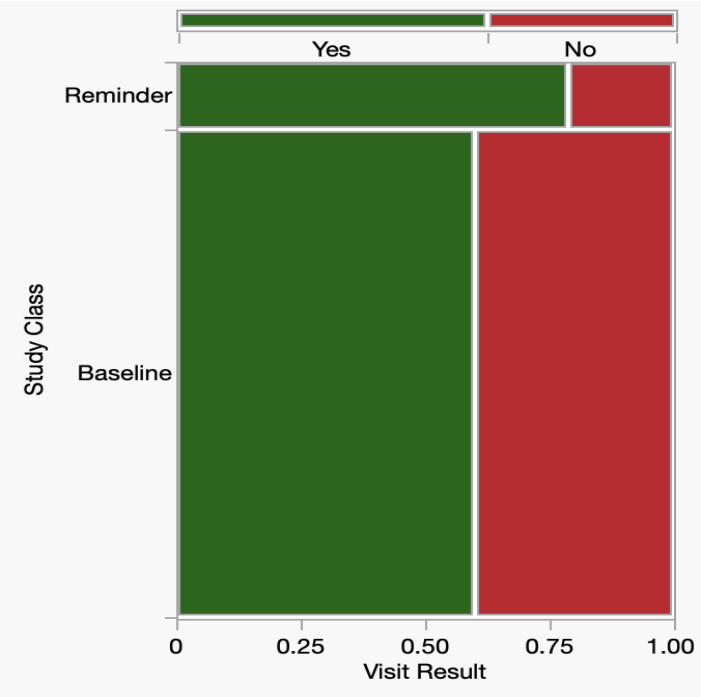

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Table 1. Summary of the Post-Implementation Attendance, Cancelation, and No-Show Rates for the Four PDSA Intervention Protocols (A, B, C, and D) Across the Study Cohort.

PDSA Cycle	Attended Visit n (%)	Canceled Visit n (%)	No-showed Visit n (%)	Total Visit n
Protocol A	31 (67)	10 (22%)	5 (11)	46
Protocol B	34 (56)	21 (34)	6 (10)	61
Protocol C	28 (78)	3 (8)	5 (14)	36
Protocol D	24 (80)	5 (17)	1 (3)	30
Total Visit n	117	39	17	173

Table 2. Odds Ratio, Likelihood Ratio, Risk Difference, and Fisher's Exact Test Were Used to Analyze the Change in No-Show and Cancelation Rates Between the Pre (n=480) and Post (n=384) Implementation Groups Across the Four PDSA Cycle Protocols.

PDSA Cycle	Combined No-show/Cancelation rate post intervention	Odds Ratio	Likelihood Ratio	p[1]	Risk Difference	95%CI	p[2]
Protocol A	33%	0.67	2.2	.13	-0.1	(-0.2,-0.03)	.08
Protocol B	44%	0.37	18.8	**<.0001**	-0.2	(-0.3, -0.1)	**<.0001**
Protocol C	22%	**2.07**	3.7	.05	0.2	**(0.01, 0.3)**	**.04**
Protocol D	20%	**2.67**	5.1	**.02**	0.2	**(0.05, 0.4)**	**.02**

[1] likelihood ratio
[2] fisher exact test

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Table 3. Impact of an Additional Aeminder In the Form Of a Call or Text (Protocol C + D) On the No-Show Rate For the First Visit. Relative Risk: 0.76, CI: 0.65-1.7, p-value: p < .001. Odds Ratio: 0.40, CI: 0.21- 0.78, p-value: < .001

Count Row %	Attended Visit	Did not attend visit	Total
Additional Reminder Before First Visit (Protocol C + D)	288	192	480
	60	40	
Pre-implementation	52	14	66
	78.79	21.21	
Total	340	206	546

Table 4. Summary Of the Time and Financial Investment Required For Each PDSA Cycle Protocol.

	Time Required to collect patient information	**Time required to implement intervention**	**Number of patients receiving intervention**	**Total minutes of work per week**	**Weekly Labor Cost**	**Annual Cost**
Protocol A	120 min/wk	5 min	25 patients/wk	245 min/wk	$82	$4,247
Protocol B	120 min/wk	1 min	25 patients/wk	145 min/wk	$48	$2,513
Protocol C	30 min/wk	5 min	5 patients/wk	55 min/wk	$18	$953
Protocol D	30 min/wk	1 min	5 patients/wk	35 min/wk	$12	$606

Accepted, in press

Supplementary Appendix

Appendix A: Content of Pre-Visit Phone Calls and Text Messages

Phone Call Scripts

Protocol A: Call upon receiving referral

"Hello, this is [Name] calling from the Children's Hospital Los Angeles Weight Management Program. We've received a referral for [Patient First Name] to participate in our virtual weight management clinic.

I wanted to confirm that we have received the referral and to give you a brief overview of what to expect:

- The program is 12 months long and includes regular visits with a doctor or nurse practitioner and a dietitian.
- Because of high demand, it may take 3 to 6 months to schedule your first visit.
- All visits are virtual, and you will receive instructions before your appointment on how to connect.
- We'll contact you again when your appointment is scheduled.

Do you have any questions at this time about the referral or the program?"

Protocol C: Call 1 week prior to scheduled visit

"Hello, this is [Name] calling from the Children's Hospital Los Angeles Weight Management Program.

We're calling to remind you of your upcoming virtual appointment for [Patient First Name] on [Date and Time].

- The visit will be conducted via telehealth—no need to come to the hospital.
- You'll receive a Zoom link by email or text the day before the visit.
- Please make sure you have access to a smartphone, tablet, or computer with internet access.
- The appointment will last around 60–90 minutes.

If you have any questions or need to reschedule, please call us back at [Clinic Phone Number]. We look forward to seeing you!"

Text Message Templates

Protocol B: Text upon receiving referral

"Hello from CHLA Weight Management Clinic: We received your referral for [Patient First Name]. Due to high demand, your first virtual visit may be in 3–6 months. We'll contact you when it's time to schedule. Thank you!"

Protocol D: Text 1 week prior to scheduled visit

"Reminder: [Patient First Name] has a virtual CHLA Weight Management Clinic appt on [Date/Time]. No need to come in—visit is via Zoom. Check email/text day before for link. Questions? Call [Clinic Phone Number]."

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Appendix B: Staff Training for Phone Calls and Text Messaging

All phone calls and texts were conducted by two trained medical students during the study period. A standardized 30-minute training module was developed and administered by the clinical coordinator. Key elements included:

- **Script Familiarization**: Trainees were provided with the exact scripts (as above) and were instructed not to deviate significantly from the messaging.
- **Handling FAQs**: Common questions and appropriate responses were reviewed (e.g., what is the program about, what technology is needed for visits).
- **Documentation**: Each contact attempt was logged in a secure spreadsheet including time, result (answered, voicemail, no answer), and duration.
- **Cultural Sensitivity**: Trainees were instructed on respectful communication, particularly for Spanish-speaking families (translated scripts were provided).
- **Escalation Protocols**: Any clinical or scheduling questions were forwarded to the clinic coordinator.

Appendix C: Labor Time Tracking and Financial Assumptions

Labor Time Tracking

- **Tool Used**: Time was tracked using manual time logs and verified against hospital scheduling software.
- Each text message took approximately **30 seconds** to send using a pre-written template in the EHR messaging system.
- Each phone call averaged **5–7 minutes**, including time spent calling, leaving a message, or speaking directly with families.
- **Weekly totals**: Labor time was calculated as the sum of total contacts made × average time per contact, verified across 3 weeks per cycle.

Cost Calculation Assumptions

- **Labor Rate Assumption**: Cost was estimated based on the **average hourly rate** of clinic administrative staff (**$20/hour**), assuming they would take over the task outside of the study.
- **Protocol C Cost**:
  - ~11 calls/week × 6 mins = 66 mins (~$22/week)
- **Protocol D Cost**:
  - ~11 texts/week × 30 secs = 5.5 mins (~$1.83/week)
- The **reported costs** ($18/week for Protocol C and $12/week for Protocol D) included additional time for documentation, preparation, and attempts to reach families multiple times if needed.

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