

Adoption of a Digital Health Tool for Opioid Use Disorder Treatment in Primary Care: Facilitators and Challenges

Omar Nieto, Allison D Rosen, Mariah M Kalmin, Li Li, Steven J Shoptaw, Steven P Jenkins, Zahra Zarei Ardestani, Bengisu Tulu

Submitted to: Journal of Medical Internet Research
on: December 12, 2024

Disclaimer: © The authors. All rights reserved. This is a privileged document currently under peer-review/community review. Authors have provided JMIR Publications with an exclusive license to publish this preprint on its website for review purposes only. While the final peer-reviewed paper may be licensed under a CC BY license on publication, at this stage authors and publisher expressly prohibit redistribution of this draft paper other than for review purposes.

Table of Contents

Original Manuscript..... 5

Supplementary Files..... 24

..... 24

Figures..... 25

 Figure 1..... 26

 Figure 4..... 29

Adoption of a Digital Health Tool for Opioid Use Disorder Treatment in Primary Care: Facilitators and Challenges

Omar Nieto^{1, 2} BA; Allison D Rosen¹ PhD; Mariah M Kalmin³ PhD; Li Li^{2, 4} PhD; Steven J Shoptaw^{1, 2, 4} PhD; Steven P Jenkins⁵; Zahra Zarei Ardestani^{6, 7} MS; Bengisu Tulu⁸ PhD

¹ Department of Family Medicine University of California, Los Angeles Los Angeles US

² UCLA Center for HIV Identification, Prevention, and Treatment Services (CHIPTS) University of California, Los Angeles Los Angeles US

³ Department of Behavioral and Policy Sciences RAND Corporation Santa Monica US

⁴ Department of Psychiatry and Biobehavioral Sciences University of California, Los Angeles Los Angeles US

⁵ Q2i LLC Boston US

⁶ Department of Social Science and Policy Studies Worcester Polytechnic Institute Worcester US

⁷ Department of Data Science Worcester Polytechnic Institute Worcester US

⁸ The WPI Business School Worcester Polytechnic Institute Worcester US

Corresponding Author:

Omar Nieto BA

Department of Family Medicine
University of California, Los Angeles
10880 Wilshire Blvd, Suite 1800
Los Angeles
US

Abstract

Background: The United States is facing an opioid overdose epidemic resulting in an unprecedented number of preventable deaths. The use of medications including buprenorphine and methadone have proven effective for opioid use disorder (OUD), but many patients struggle to stay in treatment. Novel solutions, such as digital health tools, offer options to increase retention in treatment, maximize treatment benefits, and prevent overdose deaths.

Objective: Using a mixed methods approach, we investigated facilitators and barriers to utilization of a third-party digital health platform called Opioid Addiction Recovery Support (OARS) to aid OUD treatment engagement and adherence in a primary care setting.

Methods: Patient and provider utilization of OARS was observed for ten months and summarized using descriptive statistics. Differences in utilization were assessed using Wilcoxon signed rank tests. Additionally, key informant interviews were conducted with providers that prescribe medication for opioid use disorder (MOUD) and their support staff to understand the facilitators and barriers to implementation. Qualitative data were analyzed using a Coding Reliability Thematic Analysis approach.

Results: Among 205 MOUD patients invited to use OARS, 158 patients signed up and 60 used it more than once. Patients whose provider had entered their information into OARS viewed test results ($p < 0.05$), progress ($p < 0.01$), and educational content ($p < 0.05$) more days than patients without information in OARS. There was no difference in OARS utilization for patients who were and were not actively engaged in MOUD treatment. Providers and support staff reported that OARS increased patient-provider communication and allowed patients to better track their overall MOUD treatment. They also recognized challenges in integrating OARS with the electronic health record (EHR).

Conclusions: Findings from this study suggest that digital health tools can be beneficial for both patients and providers because they have the potential to increase patient-provider communication, support patients' ability to track their own progress, and enhance providers' ability to identify patients at risk for relapse. The primary barrier to utilization for providers was the lack of integration between OARS and the EHR. Future research is needed to determine ways to routinize use of digital health tools in MOUD treatment, primarily by solving technical and organizational challenges associated with EHR integration. Findings show digital health tools do not diminish outcomes when implemented in opioid treatment clinics.

(JMIR Preprints 12/12/2024:69953)

DOI: <https://doi.org/10.2196/preprints.69953>

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**

Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.

Only make the preprint title and abstract visible.

No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**

Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain visible to all users.

Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <https://www.jmir.org/>

No. Please do not make my accepted manuscript PDF available to anyone. I understand that if I later pay to participate in <https://www.jmir.org/>

Original Manuscript

Original Paper

Adoption of a Digital Health Tool for Opioid Use Disorder Treatment in Primary Care: Facilitators and Challenges

Omar Nieto^{1,2}, BA, **Allison D Rosen**¹, PhD, **Mariah M Kalmin**³, PhD, **Li Li**, PhD^{2,4}, **Steven J Shoptaw**, PhD^{1,2,4}, **Steven P Jenkins**⁵, **Zahra Zarei Ardestani**^{6,7}, MS, **Bengisu Tulu**, PhD⁸

¹*Department of Family Medicine, University of California, Los Angeles, Los Angeles, CA;*

²*UCLA Center for HIV Identification, Prevention, and Treatment Services (CHIPTS), Los Angeles, CA;*

³*Department of Behavioral and Policy Sciences, RAND Corporation, Santa Monica, California;*

⁴*Department of Psychiatry and Biobehavioral Sciences, University of California Los Angeles, Los Angeles, CA;*

⁵*Q2i LLC, Boston, MA;*

⁶*Department of Data Science, Worcester Polytechnic Institute, Worcester, MA;*

⁷*Department of Social Science and Policy Studies, Worcester Polytechnic Institute, Worcester, MA;*

⁸*The WPI Business School, Worcester Polytechnic Institute, Worcester, MA*

Corresponding author:

Omar Nieto, UCLA Department of Family Medicine, 10880 Wilshire Blvd, Suite 1800, Los Angeles, CA, 90024, USA; Phone: 310-794-0229; Email: onieto@mednet.ucla.edu

Adoption of a Digital Health Tool for Opioid Use Disorder Treatment in Primary Care: Facilitators and Challenges

Abstract

Background: The United States is facing an opioid overdose epidemic resulting in an unprecedented number of preventable deaths. The use of medications including buprenorphine and methadone have proven effective for opioid use disorder (OUD), but many patients struggle to stay in treatment. Novel solutions, such as digital health tools, offer one option to help improve clinic management and improve treatment engagement.

Objective: Using a mixed methods approach, we investigated facilitators and barriers to utilization of a third-party digital health platform called Opioid Addiction Recovery Support (OARS) to aid OUD treatment engagement and adherence in a primary care setting.

Methods: Patient and provider utilization of OARS was observed for ten months and summarized using descriptive statistics. Differences in utilization were assessed using Wilcoxon signed rank tests. Additionally, key informant interviews were conducted with providers who prescribe medication for opioid use disorder (MOUD) and their case managers to understand the facilitators and barriers to implementation. Qualitative data were analyzed using a Coding Reliability Thematic Analysis approach.

Results: Among 205 patients invited to use OARS, the median age was 37 years old, 63% identified as men, and 94% identified as non-Hispanic white. Of these 205 patients, 158 (77%) used the application at least one time. The median number of days the 158 patients viewed test results was 1 (IQR: 1 – 3), progress was 1 (IQR: 0 – 2), and educational content was 0 (IQR: 0 – 1). The 55 patients whose providers had manually entered their results into OARS when the EHR integration failed viewed test results ($p<0.01$), progress ($p<0.01$), and educational content ($p<0.01$) more days than the 103 patients who could not view their results in OARS. Providers and the lead case manager reported that OARS increased patient-provider communication, allowed patients to better track their overall MOUD treatment, and enhanced providers' ability to identify patients at risk for relapse. They also acknowledged that the lack of integration between OARS with the electronic health record (EHR) resulted in administrative burdens, which impacted provider utilization of the system.

Conclusions: Findings from this study highlight the challenges of successfully implementing OARS with patients who receive MOUD in primary care settings. Our results show discrepancies between the positive assessments that staff made about OARS and the lack of uptake among providers, case managers, and patients. We also show several barriers that impacted provider utilization, including the lack of integration between OARS and EHR. Future research is needed to 1) determine whether digital health tools like OARS are efficacious in improving OUD outcomes, and if proved efficacious 2) identify ways to routinize use of digital health tools in MOUD treatment, primarily by solving technical and organizational challenges associated with EHR integration and patient engagement.

Key Words: Opioid disorder treatment; digital health tools; primary care clinics

Introduction

The opioid overdose epidemic in the United States continues to claim many lives. In 2022, there were 6.1 million people with opioid use disorder (OUD) [1], and opioid-involved deaths rose from 49,860 in 2019 to 81,806 in 2022 [2]. Medication for opioid use disorder (MOUD) with buprenorphine or methadone is the most effective treatment to reduce opioid use and is associated with reduced risk of overdose and opioid-related acute care use [3,4]. Facilitating retention in MOUD is critical. Studies have shown that risk of death is 8.1 times lower for patients who are in MOUD compared to those who do not receive MOUD [5,6]. However, many patients discontinue MOUD treatment [7], with more than 50% of these patients relapsing [8].

Integrating MOUD into primary care settings may be an optimal strategy to expand access to treatment. Korthuis et al. (2016) suggest that offering OUD treatment in primary care settings may be particularly advantageous for those individuals already engaged in care and/or who struggle with accessing opioid treatment programs (e.g., Methadone clinics) [9]. Unfortunately, providers encounter multiple barriers to delivering MOUD in primary care settings, which include challenges to administrative logistics (i.e., orienting new patients, compressed appointment schedules), provider discomfort discussing MOUD with patients, and lack of provider buy-in regarding the expansion of MOUD in the clinic [10]. As such, innovative strategies are needed to address these barriers and enhance the delivery of MOUD in general medical settings.

Digital health solutions (e.g., mobile health apps) offer a complementary service delivery modality for MOUD provided in primary care settings to help improve clinical management and long-term patient engagement [11]. Such solutions can also help improve access to treatment and reduce psychosocial barriers [11]. In addition, multiple studies evaluating the acceptability of digital technology interventions have shown a high level of engagement or willingness to use these technologies among patients receiving MOUD services and their providers in diverse healthcare, academic, and out-patient treatment settings [12–14]. These studies describe many of the prospective benefits of digital health solutions for the management of MOUD care, including improved communication between patients and providers, patients' ability to track treatment progress, and the prevention of overdose-related deaths [12–14]. However, as noted by Miller-Rosales et al. (2023), additional work is needed to understand facilitators to the utilization of these platforms to maximize the potential benefits [15]. As such, the goal of this study was to assess the facilitators and barriers to utilizing a third-party technology system as a strategy to support MOUD services specifically within a primary care setting.

Methods

We partnered with a primary care clinic that serves as an Opioid Use Disorder Center of Excellence in the eastern US (hereafter referred to as the "Center") and followed the implementation of the Opioid Addiction Recovery Support (OARS) platform in this clinic as part of a federally funded project. This project was a pragmatic observational study in a real-world setting and the research team was not directly involved in implementation.

OARS Software

OARS was developed by Q2i (a digital health company based in Boston, Massachusetts) as a digital health platform designed to improve the clinical management of MOUD treatment by allowing providers to view records relevant to their patients' recovery journey, communicate with their patients through secure messaging, and track patient progress via a provider

dashboard; the app measures progress by tracking appointment attendance and engagement during visits. In addition, patients were given access to the OARS mobile app that allowed them to track their appointment attendance, appointment participation (i.e., engagement), and urine drug screening results. Patients were also able to document their personal feelings and/or stressors through an electronic daily log, which providers could view. Finally, the mobile app allowed patients to view their upcoming MOUD appointments, view pre-populated educational content (i.e., YouTube videos from the Substance Abuse and Mental Health Service Administration that provide information on triggers, cravings, and recovery), and directly communicate with members of their care team (e.g., providers and case managers) through secure messaging. The enhanced connection and support afforded by OARS has the potential to increase adherence to treatment plans, lead to better retention in care, and reduce negative outcomes such as relapse and overdose. While OARS can operate as a standalone platform, this study was designed with the intention to integrate OARS into the Center's electronic health record (EHR) prior to its implementation with patients. Unfortunately, EHR integration was ultimately unsuccessful, resulting in a multitude of challenges for the Center (described in the results section).

Implementation Setting

During implementation, the Center had 28 Drug Addiction Treatment Act (DATA)-2000 waived providers (e.g., MD, PA, NPs), offered MOUD treatment to 200+ patients with OUD, and had an established EHR. Based on information provided by Center staff during project check-ins, the majority of patients at this clinic were maintenance patients, rather than patients who had recently initiated treatment. As part of onboarding, Center providers attended a one-hour orientation via Zoom with Q2i staff to familiarize themselves with the dashboard and patient app. The research team also worked with the Center during this time to ensure that all regulatory processes were complete before implementation began (e.g., establishing a Reliance Agreement). In addition, Q2i staff and the research team worked with the Center to integrate OARS with their EHR.

After onboarding, providers at the Center were tasked with using OARS for a period of 10 months (from May 1, 2021, through February 28, 2022) with their patients and to participate in monthly check-in meetings with the research team to discuss project updates (e.g., barriers or challenges to patient engagement with OARS). The Q2i team was available to address any technical concerns that arose during the project. Of note, OARS was promoted as a tool that could support patient recovery, but it was not mandatory for patients to sign up for an OARS account.

Data Collection

Patient and provider utilization of OARS was observed for the entire ten-month implementation period. Data collected through the OARS platform included date and time that each feature of the OARS app was utilized (i.e., viewing urine drug screening results, viewing MOUD appointment attendance, sending secure messages, and creating daily logs). Additional patient-level data were collected through EHR extraction, which included patient demographic information, appointment attendance, and urine drug screen results. All data were de-identified by Q2i staff prior to data analysis.

In addition to the quantitative data captured through OARS, the research team also invited MOUD providers and their case managers to participate in a series of key informant interviews one-month prior to OARS implementation, two-to-three months after initial

implementation, and during the post-implementation period (i.e., at least ten months from the initial start date) to further assess the utilization of OARS overtime. Participation in the interviews was voluntary for all staff. Participants were recruited during optional monthly check-in meetings with the research team and were then separately connected with the project coordinator to schedule an interview date over Zoom. To be eligible, providers had to prescribe MOUD treatment to their patients and have a DATA-2000 waiver (required during the time of the study). Conversely, case managers had to work closely with an eligible provider at the Center to participate in the interviews. All participants provided written informed consent prior to the interview and received a \$50 electronic gift card for completing each interview. The Institutional Review Board of [BLINDED FOR REVIEW] approved all study procedures.

As part of the interview, providers and case managers were asked to describe: 1) what they liked and disliked about the OARS platform; 2) their thoughts about the usability of OARS (i.e., whether OARS is easy or difficult to use); and 3) the barriers or challenges they encountered to getting started using OARS. All interviews were transcribed verbatim by Rev.com and reviewed for accuracy by an evaluation team partner (O.N.).

Exclusion of Patients on MOUD in the Qualitative Evaluation

Due to our IRB protocol, the research team was prohibited from having any contact with patients. As such, these individuals were not directly recruited into the study. Instead, providers were asked to introduce OARS to their patients on MOUD and invite them to utilize the platform to help manage their care. However, patients were allowed to opt out of using OARS without penalty. Only Q2i staff were allowed to have direct contact with patients to address technical issues, while the research team maintained a strictly observational role during OARS implementation.

Data Analysis & Measures

The primary quantitative outcome in this analysis was number of days patients interacted with OARS, including number of days patients interacted with each specific feature. This was measured by tabulating the number of days that patients interacted with the platform, and by plotting a timeline for each individual patient who logged into OARS more than one time.

In addition, the number of days of interaction with each OARS feature was compared for patients whose providers had manually entered their results into OARS and patients whose providers had not entered their results and thus did not have any results to view (i.e., test results, appointment attendance, treatment progress). We used a Wilcoxon signed rank test to make this comparison. Despite the efforts of the research team, integrating OARS with the EHR system used in the Center was not successful. Lack of integration between the two systems resulted in providers having to manually enter test results into OARS for the patients to view the results through their app. However, providers did not always enter test results into OARS. This meant that some patients were not able to view their results in OARS, and we hypothesized that this could partially explain the lower-than-expected patient engagement with OARS throughout the study period.

The aforementioned procedure was also used to compare feature interaction for patients who were and were not consistently engaged in MOUD treatment during the study period, hypothesizing that patients who were consistently engaged in MOUD would be more likely to interact with OARS. Because patients were expected to engage in treatment at least once per month to receive a new 28-day prescription for MOUD, treatment engagement was defined as not having a greater than 35-day gap (one-week grace period) in appointment

attendance or urine drug testing during the study period, as measured by EHR data provided by The Center.

The number of days patients created daily logs was not included in these comparisons due to insufficient sample size. A Bonferroni correction was applied to all P values by multiplying each P value by four, the number of tests conducted, to correct for multiple comparisons; a P value less than 0.05 was considered statistically significant after correction.

Timelines of OARS utilization were also described for MOUD providers and case managers. All analyses were conducted in R (version 4.2.1) [16].

All qualitative data were analyzed using a Coding Reliability Thematic Analysis approach [17]. We first created a codebook consisting of both deductive codes from the interview guide and inductive codes from a line-by-line review of the transcripts. Next, the research team coded 2 transcripts to refine code descriptions, add or delete codes, resolve discrepancies in the interpretation of codes, and identify exemplar quotes associated with each code. This process continued until the research team reached a consensus on the code application. Three team members then independently coded an additional transcript in Dedoose (a qualitative data management software) to run a test of inter-coder reliability, and an average Cohen's kappa score was computed ($k = .85$). All remaining transcripts were uploaded into Dedoose and coded using the finalized coding scheme. As part of the analysis, we sought to assess provider buy-in, usability of the system, and the benefits of specific OARS features to providers and patients. Finally, we sought to identify barriers to implementation that arose during the project.

Results

A total of 205 patients were invited to use OARS. The median age was 37 years old (interquartile range: 31-44), 63% identified as men, and 94% identified as non-Hispanic white. Of these 205 patients, 158 (77%) signed up for an account and used the application at least one time. Patients who used OARS tended to be younger than patients who did not use OARS (Table 1).

More specifically, 76 patients interacted with OARS on one day, and 82 interacted with OARS on more than one day; the maximum number of days a patient interacted with OARS was 26 days (Table 2).

Among the 82 patients who interacted with OARS on more than one day, usage patterns varied over the course of the study (Figure 1). For example, among patients who interacted with OARS on four days or less, some used it for a few days after signing up, while others' use was spread over the course of the study.

Table 1. Patient demographic characteristics

	Invited to use OARS App (n=205)	Signed up for OARS Account	
		Yes (n=158)	No (n=47)
	n (%)	n (%)	n (%)
Age, median (IQR)*	37 (31 - 44)	36 (31 - 44)	39 (31-44)
Man	130 (63)	101 (64)	29 (62)
Non-Hispanic white race or	193 (94)	147 (93)	46 (98)

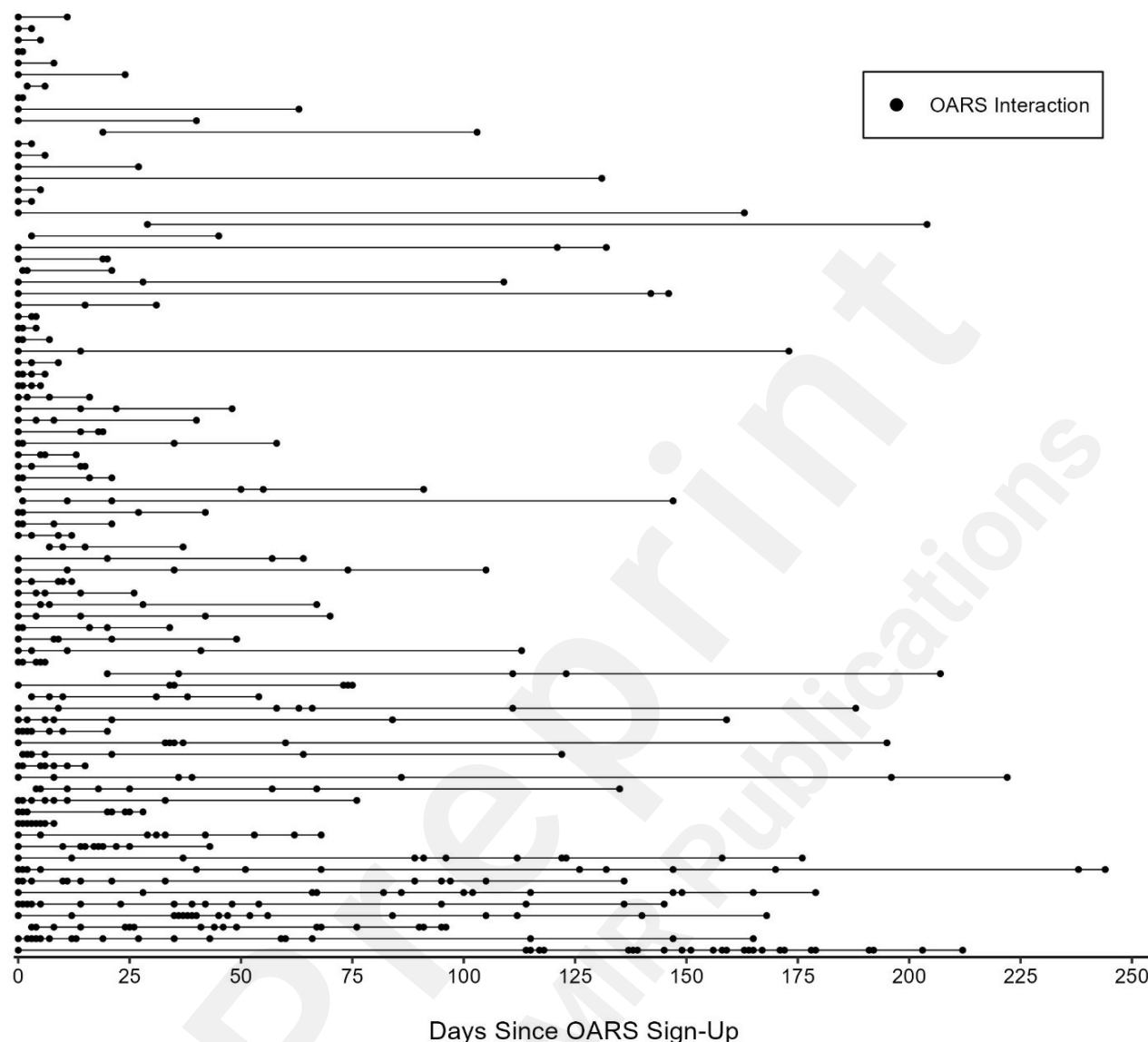
ethnicity			
-----------	--	--	--

*p<0.05

Table 2. Number of days patients interacted with OARS (n=205), May 2021 – February 2022.

Total Days of OARS Utilization	n (%)
0 days	47 (22.9)
1 day	76 (37.1)
2 days	20 (9.8)
3 days	11 (5.4)
4 days	17 (8.3)
5 days	10 (4.9)
>5 days	24 (11.7)

Figure 1. Daily OARS interactions by patients who interacted with OARS at least two days over the course of the study. Each horizontal line represents one patient, and each point represents utilization of OARS (n=82), May 2021 – February 2022.



Over the course of the study period, the median number of days the 158 patients viewed test results was 1 (IQR: 1 – 3), progress was 1 (IQR: 0 – 2), educational content was 0 (IQR: 0 – 1), sent a chat message was 0 (IQR: 0 – 1), and created a daily log was 0 (IQR: 0-0). Of note, the 55 patients whose providers had entered their results into OARS viewed test results ($p<0.01$), progress ($p<0.01$), and educational content ($p<0.01$) more days than the 103 patients who could not view their results in OARS (Figure 2). Additionally, among 112 patients who also had treatment engagement data available in their EHR, the 34 patients who were not consistently engaged in MOUD treatment viewed test results ($p<0.01$), progress ($p<0.01$), and educational content ($p<0.01$) on more days than the 78 patients who were consistently engaged in MOUD treatment (Figure 3).

The messaging and daily log features had the lowest utilization; 69 (44%) patients used the messaging feature at least one time. Of these 69 patients, 28 (40%) sent more than one message, and the maximum number of messages sent was six. Finally, among 12 (8%) patients who created daily logs, 3 (12%) made more than one entry (maximum 4 entries).

Figure 2. Comparison of the number of days of interaction with each OARS feature for patients had manually entered their results into OARS and patients whose providers had not entered their results and thus did not have any results to view(n=158). *p<0.01

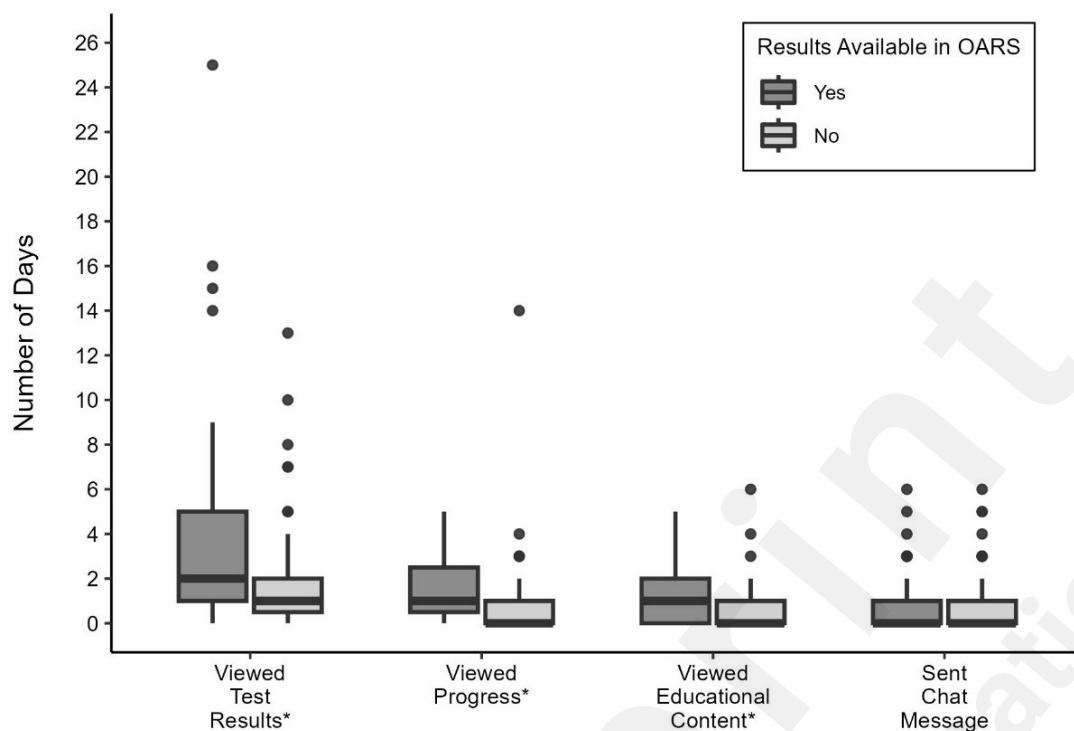
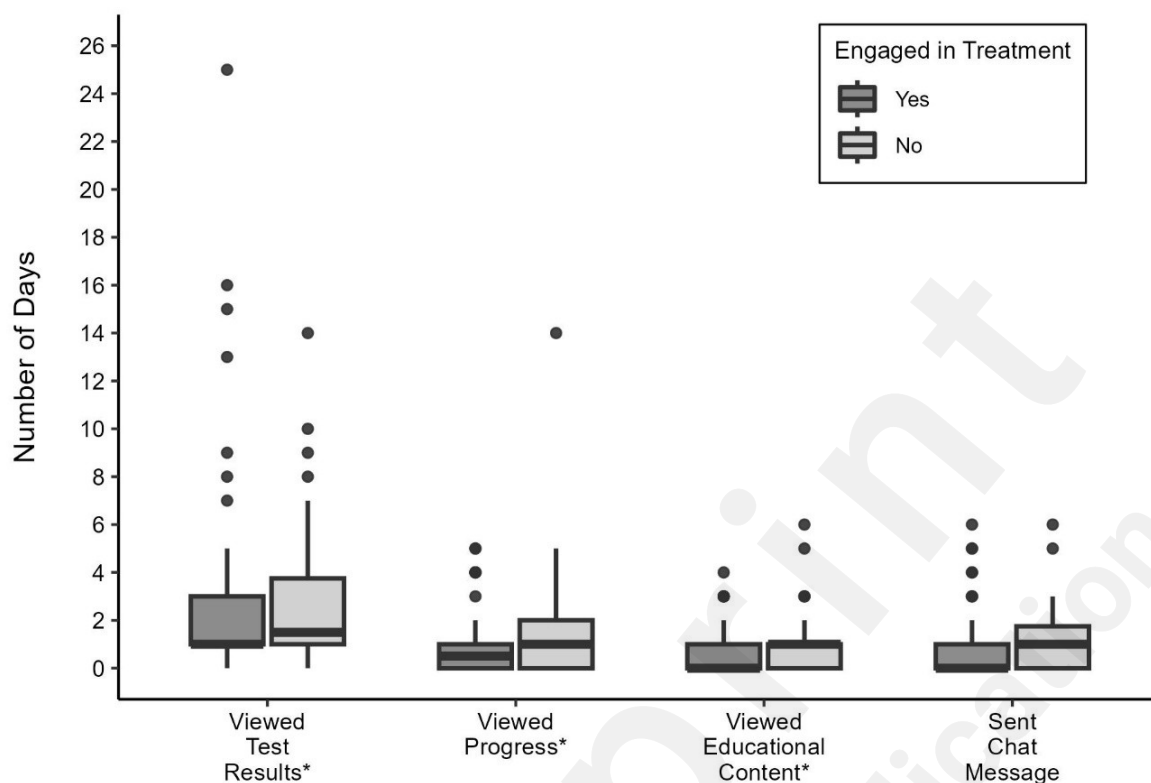
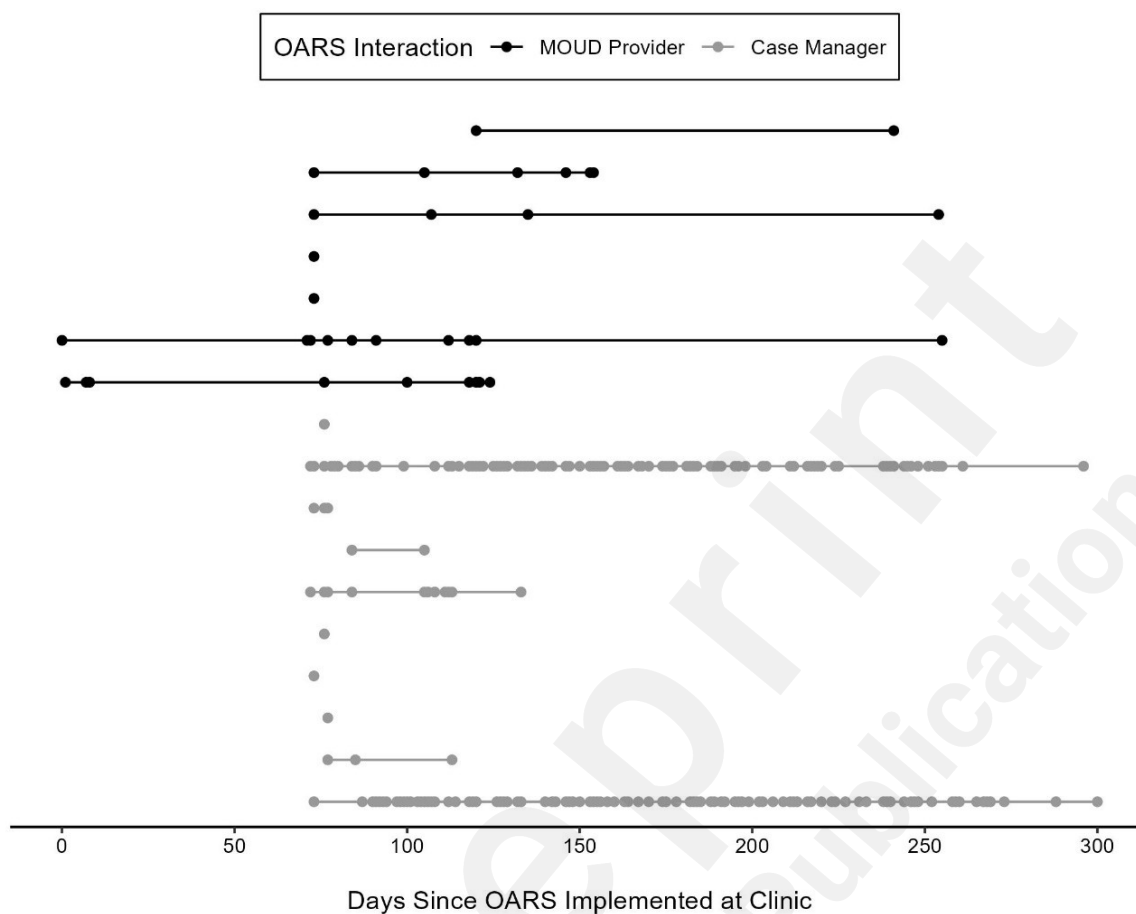


Figure 3. Comparison of the number of days of interaction with each OARS feature by consistent treatment engagement status (n=112). *p<0.01.



Among the 28 staff at the Center invited to use OARS, seven MOUD providers and 10 of their case managers interacted with the system at least once during the study period. Two MOUD providers began interacting with OARS at the beginning of implementation, but most did not begin regular use until patient recruitment increased during the third month of the study. Of the seven MOUD providers, five utilized the system between two and ten days and two utilized OARS on only one day. Among case managers, eight utilized OARS up to 11 days and two utilized OARS over 90 days (Figure 4).

Figure 4. Daily OARS interactions by MOUD providers and case managers (n=17), May 2021 – February 2022. Each horizontal line represents one MOUD provider or case manager, and each point represents interaction OARS.



Facilitators to OARS Utilization

A total of eight staff members who indicated interest in using OARS were invited to participate in interviews (six MOUD providers and two case managers), but only three agreed to participate. Among those three, two were MOUD providers and one was the lead case manager. Interviews took place one month prior to implementation (n=3), soon after initial implementation (n=3), and during the post-implementation period (n=2). One of the MOUD providers opted out of the final post-implementation interview.

In general, providers and the lead case manager who participated in the interviews believed that OARS improved overall satisfaction at the Center by increasing communication between providers, case managers, and patients, as illustrated in the following quote:

“I think both parties see some improvement in that, in satisfaction. Case managers are more positive about seeing it as a tool that they can use. And patients are seeing it in a more positive light in regards to ease of communication to the case managers.” (Lead Case Manager, 2nd Interview)

OARS was also described as being easy or simple to use, straightforward, self-explanatory, and convenient. When discussing specific features, secure messaging appeared to be the most useful feature for providers because it provided their patients with a convenient way to get in

touch with members of their care team and freed up time that providers would otherwise spend fielding calls. In addition, secure messaging allowed providers to both manage the high volume of patients in their caseload and respond to patient needs in a timely manner:

“And then the communication by using the chat box, that was really efficient for my patients. Because with the amount of patients I have and the other responsibilities, it just made it easy for them to contact me rather than trying to even get me by phone. Because I would get a text message that I had a message on OARS.... So, it was a lot easier to get back in touch with a patient quickly.” (Lead Case Manager, 3rd interview)

Of note, providers did not gain much utility from viewing urine drug screening results or appointments in OARS because they already had access to this information in the EHR. Nonetheless, staff believed that patients benefited most from these features. As one provider notes, urine drug screening results were *“important for their [patients’] day-to-day life where they have a consistent record of how are they doing”* (Provider A, 2nd Interview). In addition, providers believed that OARS was especially important for patients who are forgetful and have trouble remembering upcoming appointments:

“For me, the least important for me, like I said before, because I'm the one setting up the appointments, I don't have to know. I already know when they are [scheduled to come back]. But for the patients, that's important. To them, that's important because they have a tendency to forget when their appointments are. You can tell them today and then tomorrow [they may call back to ask about the appointment].” (Lead Case Manager, 2nd Interview)

Finally, the daily logs were valued by providers, despite its limited use among patients, because it gave patients an opportunity to vent frustrations about their treatment (e.g., long wait times or delayed prescriptions) and/or communicate issues they might not otherwise feel comfortable discussing in person. More importantly, these daily logs allowed providers to identify patients who were at risk for potential relapse and allowed for early intervention:

“I felt the daily log was very useful because that is something that can be powerful, that we can use over time, because it could really predict bad outcomes. Like if you feel like someone is not doing well mentally for several days in a row, that patient is really high risk for relapse. So, I feel that daily log could help us in predictive analysis and predict relapses...” (Provider A, 2nd Interview)

Barriers to OARS Utilization

Despite the potential benefits of OARS, several barriers emerged that impacted utilization of the system. These barriers included challenges with the specific technology, lack of buy-in due to manual data entry, and access-related difficulties.

The primary technology-specific barrier was related to the OARS patient onboarding process. When patients first signed up with the system, providers were required to manually assign them to members of their care team in OARS. However, the system did not remind staff to assign newly registered patients to a care team member. Patients who were unassigned were thus unable to directly communicate with members of their care team, resulting in a potential gap in treatment.

Lack of buy-in from some staff and patients emerged as another key challenge to the utilization OARS, which was influenced by several factors. First and foremost, the lack of full technology integration between OARS and the existing EHR system forced

providers and their case managers to manually upload patient appointments and urine drug screening information into OARS, which diminished enthusiasm:

“Yeah, there was a lot of manual data entry, like the next appointment date has to be manually entered. The urine test has to be manually entered, the results. There was no interface [between OARS and the data in EHR]. So, I think that manual data entry, if that could be eliminated, it could be better utilized.”
(Provider A, 3rd Interview)

This manual entry requirement resulted in late or missed appointments and/or urine drug screening entries, which was thought to impact utilization of the app by patients.

Recurring check-in meetings with the technology partner, Q2i, provided greater context for understanding these technological challenges. Namely, the Center’s EHR system was not cloud-based and lacked open application programming interfaces (APIs) required for full integration with OARS. In the absence of full EHR integration – the ultimate purpose of the study – the Center relied on uploading relevant patient data (i.e., appointments, test results) through a secure file transfer connection in predefined intervals. In general, this data transfer took one-to-seven days to populate in OARS depending on the resources available to manually pull data from the EHR and upload it into OARS. Because using OARS required duplicate manual entry, providers believed that it was largely an “administrative” burden to the Center and were less likely to utilize the system.

Providers also believed that some features offered in OARS were redundant to the existing patient portal, which already allowed patients to view their test results and appointments, and securely messaging with providers. In addition, providers believed that the availability of similar services across multiple platforms made it confusing for patients to know when to use OARS versus the patient portal and understand the utility that OARS offered compared to what already existed at the Center. Providers also believed that some patients were hesitant to use OARS due to potential privacy-related concerns. As the Lead Case Manager indicates, patients “*were just so paranoid that they thought this is how the government’s tracking them*” (2nd Interview).

Finally, providers noted that patients encountered multiple challenges to accessing the technology. For example, their patients often struggled with or were unable to use OARS because they would lose their phone and/or lacked access to a phone, a reliable connection to the internet, or the funds to pay for minutes on their mobile devices:

“Some of my patients struggle with always having cell phone or smartphone accessibility. So, for them, it was a bit of a challenge. Whether they’re out of minutes or lost their phone or whatever it may be. So, that posed a different challenge for them.” (Provider B, 2nd Interview)

Discussion

Principle Findings

Our results highlight many of the challenges to successfully implementing OARS with patients who receive MOUD in primary care settings. As was often the case, a discrepancy emerged between our qualitative (i.e., staff members’ positive assessments of OARS) and quantitative findings (i.e., lack of uptake among providers, case managers, and patients). For instance, the two core benefits of OARS reported by staff was that it increased patient-provider communication and allowed patients to track their overall MOUD treatment progress, which

was in alignment with other studies that evaluated similar digital health solutions [13,18,19]. However, the messaging feature was under-utilized by patients, with most patients only sending a message once to providers. This suggests that providers and case managers should have taken a more active role in initiating conversation or check-ins with patients rather than relying on passive engagement from the latter.

Providers also valued the additional information that OARS offered about patients through the daily logs, which allowed them to identify patients who were at risk for relapse. However, a discrepancy emerged yet again between providers' positive evaluation of the daily logs and its utilization by patients, which was quite low in this study. While it may be important to collect self-reported information on risk factors (i.e., cravings) and other relevant life stressors (e.g., divorce, work termination), it is clear from our data that additional or alternative features were needed to keep participants engaged. For example, prior research suggests that patients on MOUD might benefit from being able to directly track cravings through a mobile app like they would with urine drug screening results and appointments [20,21]. In addition, technology interventions could also benefit from actively engaging patients through recurring wellness prompts and motivational coaching, as noted in the existing literature [20,22]. Such additions may have greatly enhanced the utility of OARS for both patients and their providers.

In addition, several notable barriers emerged that impacted the utilization of OARS and warrant further discussion. Our study revealed that provider buy-in was largely impacted by a lack of integration between OARS and the existing EHR. Literature reports that EHR integration is a common challenge facing third-party solutions and should be considered as health systems evaluate multiple products into their organization's IT infrastructure [23]. In our case, enthusiasm for OARS and frequency of interaction with the platform was diminished by the administrative overhead experienced during implementation due to lack of full EHR integration.

The experience of implementing OARS at the Center provided valuable insight that primary care clinics should consider when seeking to enhance the delivery and management of MOUD services through use of a third-party technology system. First and foremost, these settings will need to ensure they have the necessary technical capacity and/or infrastructure (i.e., open APIs) in place to integrate with systems like OARS *before* implementation begins [24]. Second, both the healthcare system and third-party technology partner need to invest the necessary resources to ensure seamless technology integration [25]. Otherwise, the resulting administrative burdens might outweigh the potential benefits of using the platform. It will also be important to develop a system-wide plan for rolling out the platform, which could include securing buy-in from administrative leadership, staff/patient training on how to use the platform, and identifying experts/advocates that could act as a go-to for all technology-related concerns (i.e., access to mobile devices, difficulty logging in, trouble with the interface) [23,26,27].

Finally, settings with a well-established EHR and/or patient portal that offers many of the same features as OARS might not benefit from implementing an additional technology platform. Instead, platforms like OARS might be most appropriate in settings that want to implement a digital health tool for the first time to support their patients on MOUD and/or who experience limited patient engagement with treatment or existing platforms. In this way, OARS can offer an alternative mean to reach patients and keep them engaged in care. However, the barriers noted in this manuscript (e.g., lack of provider buy-in, EHR integration) might still jeopardize implementation of digital health tools in diverse healthcare systems and will need to be addressed.

Limitations

The findings should be interpreted within the context of our study limitations. First, this was a single site case study where the digital health tool (OARS) was not integrated into the Center's EHR. Future research is needed to understand the implementation facilitators and barriers within primary care settings where the digital tool is integrated into the EHR to assess the utility of implementing a third-party technology platform to support the management of MOUD services. Second, this study was observational and lacked a control group, introducing selection bias into the sample of patients who used OARS. Third, the qualitative evaluation of this study involved a limited number of staff members. To understand whether the perspectives offered during the interviews were indicative of the overall staff experience implementing similar digital health tools in busy primary care settings, other approaches such as surveys or brief interviews could be conducted. Finally, contact between the study team and patients receiving MOUD at the Center was strictly prohibited in our case study. Therefore, our understanding of the value of OARS for patients is limited to the perceptions of providers who treat these patients. However, future projects seeking to implement a third-party technology platform like OARS may benefit from directly interviewing patients to understand their experiences utilizing the system and how those experiences may align or contrast with the expectations of their providers.

Conclusion

Our findings highlight many of the key challenges to be solved when integrating a third-party technology tool into existing EHR systems. Once proven efficacious, future research is needed to understand the potential utility of systems like OARS for improving outcomes (e.g., adherence) for people with OUD.

Acknowledgments

Research reported in this manuscript was supported by the National Institute on Drug Abuse of the National Institutes of Health under Award # R42DA050398. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Authors' Contributions

ON, ADR, and BT contributed to conceptualization, data curation, formal analysis, methodology, and all stages of writing (the original draft, review & editing). ZZA contributed to data curation and formal analysis. SJS contributed to funding acquisition. ON, MMK, LL, SJS, and SPJ contributed to investigation. LL contributed to methodology. ON, ADR, SJS, and SPJ contributed to project administration. SPJ provided the software for the investigation. ADR contributed to visualization. MMK, LL, SJS, SPJ, and ZZA contributed to reviewing and editing the manuscript. All authors reviewed and approved the final manuscript for submission.

Conflicts of Interest

Steve Jenkins is the CEO of Q2i. Dr. Bengisu Tulu received financial compensation as a consultant in the federally funded Small Business Technology Transfer (STTR) project (R42DA050398) awarded to Q2i. The remaining authors have no conflicts of interest to declare.

Abbreviations

API: application programming interface
DATA: Drug Addiction Treatment Act
EHR: electronic health record
MOUD: medication for opioid use disorder
OARS: Opioid Addiction Recovery Support
OUD: opioid use disorder



References

1. Substance Abuse and Mental Health Services Administration. Key Substance Use and Mental Health Indicators in the United States: Results from the 2022 National Survey on Drug Use and Health. Published online November 2023. <https://store.samhsa.gov/product/results-2022-national-survey-drug-use-and-health-nsduh-key-substance-use-and-mental-health>
2. Substance Abuse and Mental Health Services Administration. Results from the 2022 National Survey on Drug Use and Health: A Companion Infographic. Published online November 2023. <https://nationaldec.org/resourcelibrary/results-from-the-2022-national-survey-on-drug-use-and-health-a-companion-infographic/>
3. Bell J, Strang J. Medication Treatment of Opioid Use Disorder. *Biological Psychiatry*. 2020;87(1):82-88. doi:10.1016/j.biopsych.2019.06.020
4. Wakeman SE, Larochelle MR, Ameli O, et al. Comparative Effectiveness of Different Treatment Pathways for Opioid Use Disorder. *JAMA Network Open*. 2020;3(2):e1920622. doi:10.1001/jamanetworkopen.2019.20622
5. Sordo L, Barrio G, Bravo MJ, et al. Mortality risk during and after opioid substitution treatment: systematic review and meta-analysis of cohort studies. *BMJ*. 2017;357:j1550. doi:10.1136/bmj.j1550
6. Medicine NA of S Engineering, and, Division H and M, Policy B on HS, Disorder C on MAT for OU. *Medications for Opioid Use Disorder Save Lives*. National Academies Press; 2019.
7. Morgan JR, Quinn EK, Chaisson CE, et al. Variation in Initiation, Engagement, and Retention on Medications for Opioid Use Disorder Based on Health Insurance Plan Design. *Med Care*. 2022;60(3):256-263. doi:10.1097/MLR.0000000000001689
8. Bentzley BS, Barth KS, Back SE, Book SW. Discontinuation of Buprenorphine Maintenance Therapy: Perspectives and Outcomes. *Journal of Substance Abuse Treatment*. 2015;52:48-57. doi:10.1016/j.jsat.2014.12.011
9. Korthuis PT, McCarty D, Weimer M, et al. Primary Care-Based Models for the Treatment of Opioid Use Disorder. *Ann Intern Med*. 2017;166(4):268-278. doi:10.7326/M16-2149
10. Austin EJ, Chen J, Briggs ES, et al. Integrating Opioid Use Disorder Treatment Into Primary Care Settings. *JAMA Netw Open*. 2023;6(8):e2328627. doi:10.1001/jamanetworkopen.2023.28627
11. Jordan HR, Sahni S, Ahmed MM, et al. A Comprehensive Literature Review of Digital Health Interventions in the Treatment of Substance Use Disorder With Special Focus on Mobile Applications. *Cureus*. 15(10):e47639. doi:10.7759/cureus.47639
12. French C, Troy DM, Dawson S, Dalili M, Hickman M, Thomas K. Primary care-based interventions for secondary prevention of opioid dependence in chronic non-cancer pain patients on pharmaceutical opioids: systematic review. *BJGP Open*. Published online July 4, 2024. doi:10.3399/BJGPO.2024.0122
13. Nuamah J, Mehta R, Sasangohar F. Technologies for Opioid Use Disorder Management: Mobile App Search and Scoping Review. *JMIR mHealth and uHealth*. 2020;8(6):e15752. doi:10.2196/15752
14. Tas B, Lawn W, Traykova EV, et al. A scoping review of mHealth technologies for opioid overdose prevention, detection and response. *Drug and Alcohol Review*. 2023;42(4):748-764. doi:10.1111/dar.13645
15. Lyzwinski LN, Elgendi M, Menon C. Users' Acceptability and Perceived Efficacy of mHealth for Opioid Use Disorder: Scoping Review. *JMIR mHealth and uHealth*. 2024;12(1):e49751. doi:10.2196/49751
16. Ward MK, Guille C, Jafry A, et al. Digital health interventions to support women with opioid

- use disorder: A scoping review. *Drug and Alcohol Dependence*. 2024;261:111352. doi:10.1016/j.drugalcdep.2024.111352
17. R Core Team. R: A language and environment for statistical computing. 2018. Accessed April 18, 2024. <https://www.R-project.org/>
 18. Braun V, Clarke V. One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*. 2021;18(3):328-352. doi:10.1080/14780887.2020.1769238
 19. Waselewski ME, Flickinger TE, Canan C, et al. A Mobile Health App to Support Patients Receiving Medication-Assisted Treatment for Opioid Use Disorder: Development and Feasibility Study. *JMIR Formative Research*. 2021;5(2):e24561. doi:10.2196/24561
 20. Kawasaki S, Mills-Huffnagle S, Aydinoglu N, Maxin H, Nunes E. Patient- and Provider-Reported Experiences of a Mobile Novel Digital Therapeutic in People With Opioid Use Disorder (reSET-O): Feasibility and Acceptability Study. *JMIR Formative Research*. 2022;6(3):e33073. doi:10.2196/33073
 21. Xiong X, Braun S, Stitzer M, et al. Evaluation of real-world outcomes associated with use of a prescription digital therapeutic to treat substance use disorders. *The American Journal on Addictions*. 2023;32(1):24-31. doi:10.1111/ajad.13346
 22. Smith CL, Keever A, Bowden T, et al. Patient Feedback on a Mobile Medication Adherence App for Buprenorphine and Naloxone: Closed and Open-Ended Survey on Feasibility and Acceptability. *JMIR Formative Research*. 2023;7(1):e40437. doi:10.2196/40437
 23. Jr VLK, Siegel G, Priesmeyer HR, Siegel LH, Potter JS. Development and Evaluation of a Digital App for Patient Self-Management of Opioid Use Disorder: Usability, Acceptability, and Utility Study. *JMIR Formative Research*. 2024;8(1):e48068. doi:10.2196/48068
 24. Schuman-Olivier Z, Borodovsky JT, Steinkamp J, et al. MySafeRx: a mobile technology platform integrating motivational coaching, adherence monitoring, and electronic pill dispensing for enhancing buprenorphine/naloxone adherence during opioid use disorder treatment: a pilot study. *Addiction Science & Clinical Practice*. 2018;13(1):21. doi:10.1186/s13722-018-0122-4
 25. Marwaha JS, Landman AB, Brat GA, Dunn T, Gordon WJ. Deploying digital health tools within large, complex health systems: key considerations for adoption and implementation. *npj Digit Med*. 2022;5(1):1-7. doi:10.1038/s41746-022-00557-1
 26. Kawu AA, Hederman L, Doyle J, O'Sullivan D. Patient generated health data and electronic health record integration, governance and socio-technical issues: A narrative review. *Informatics in Medicine Unlocked*. 2023;37:101153. doi:10.1016/j.imu.2022.101153
 27. Peng C, Goswami P, Bai G. A literature review of current technologies on health data integration for patient-centered health management. *Health Informatics J*. 2020;26(3):1926-1951. doi:10.1177/1460458219892387
 28. Wisniewski H, Gorrindo T, Rauseo-Ricupero N, Hilty D, Torous J. The Role of Digital Navigators in Promoting Clinical Care and Technology Integration into Practice. *Digit Biomark*. 2020;4(Suppl. 1):119-135. doi:10.1159/000510144
 29. Cavanagh R, Gerson SM, Gleason A, Mackey R, Ciulla R. Competencies Needed for Behavioral Health Professionals to Integrate Digital Health Technologies into Clinical Care: a Rapid Review. *J technol behav sci*. 2023;8(4):446-459. doi:10.1007/s41347-022-00242-w

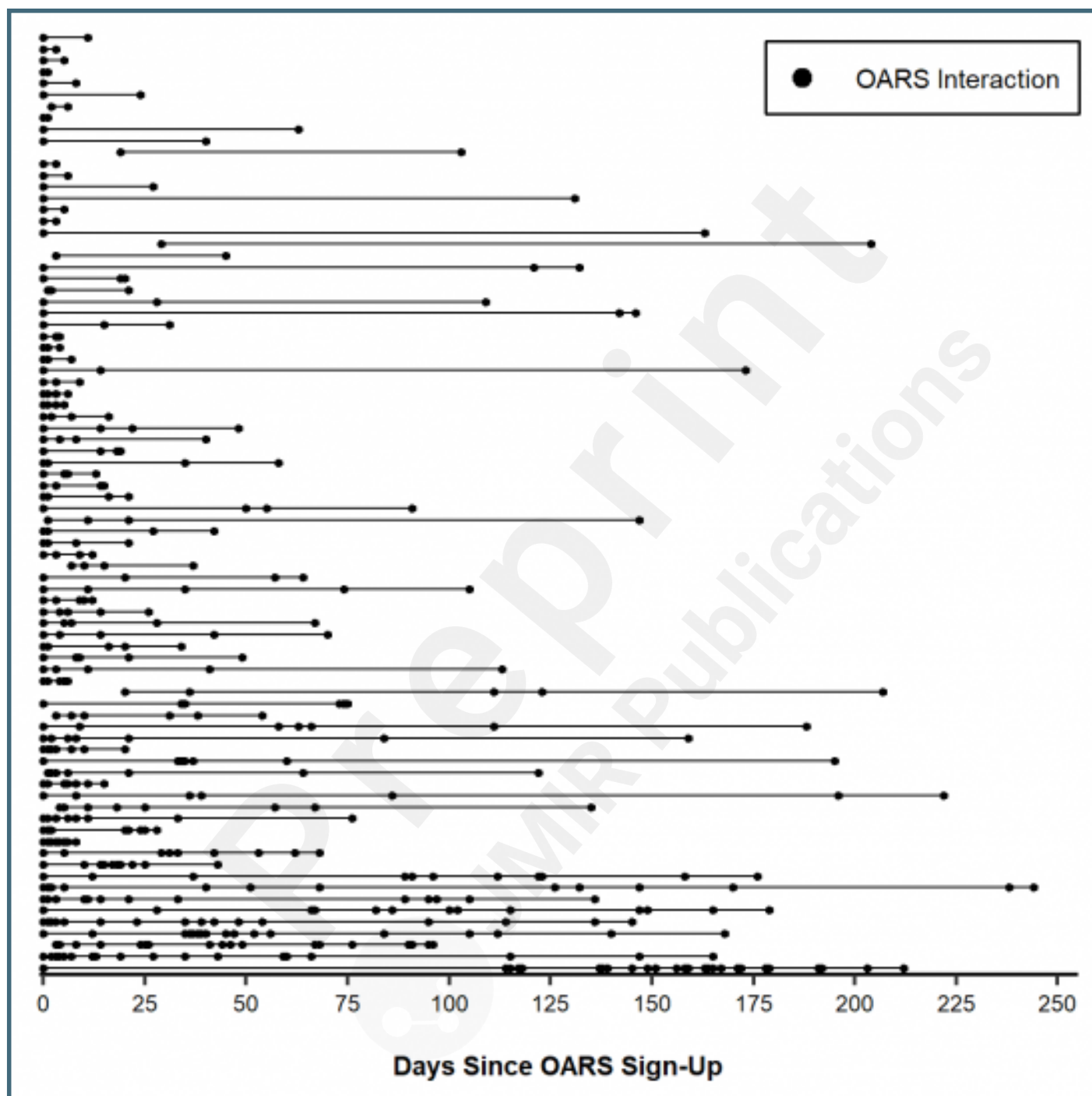
Supplementary Files

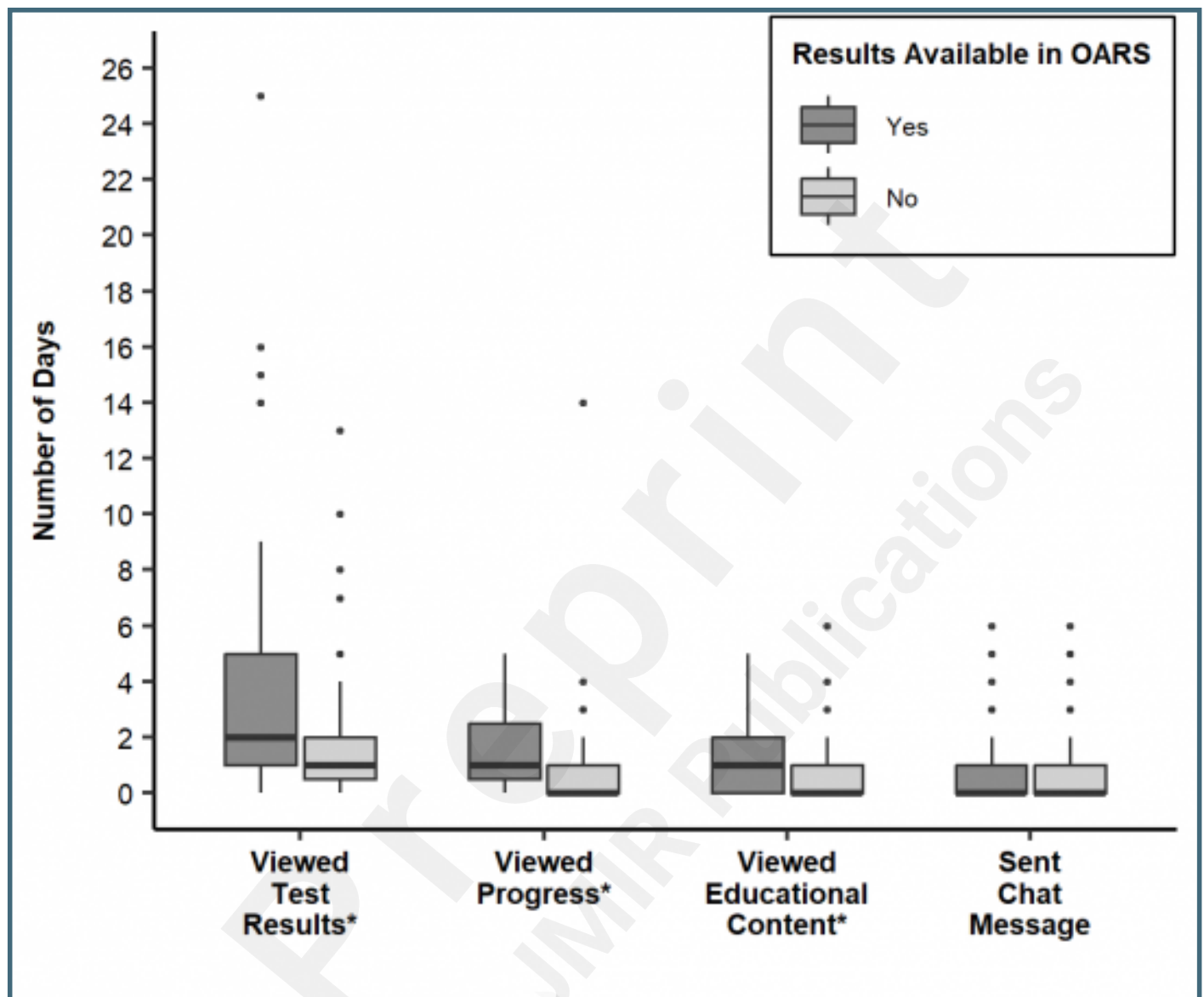
Untitled.

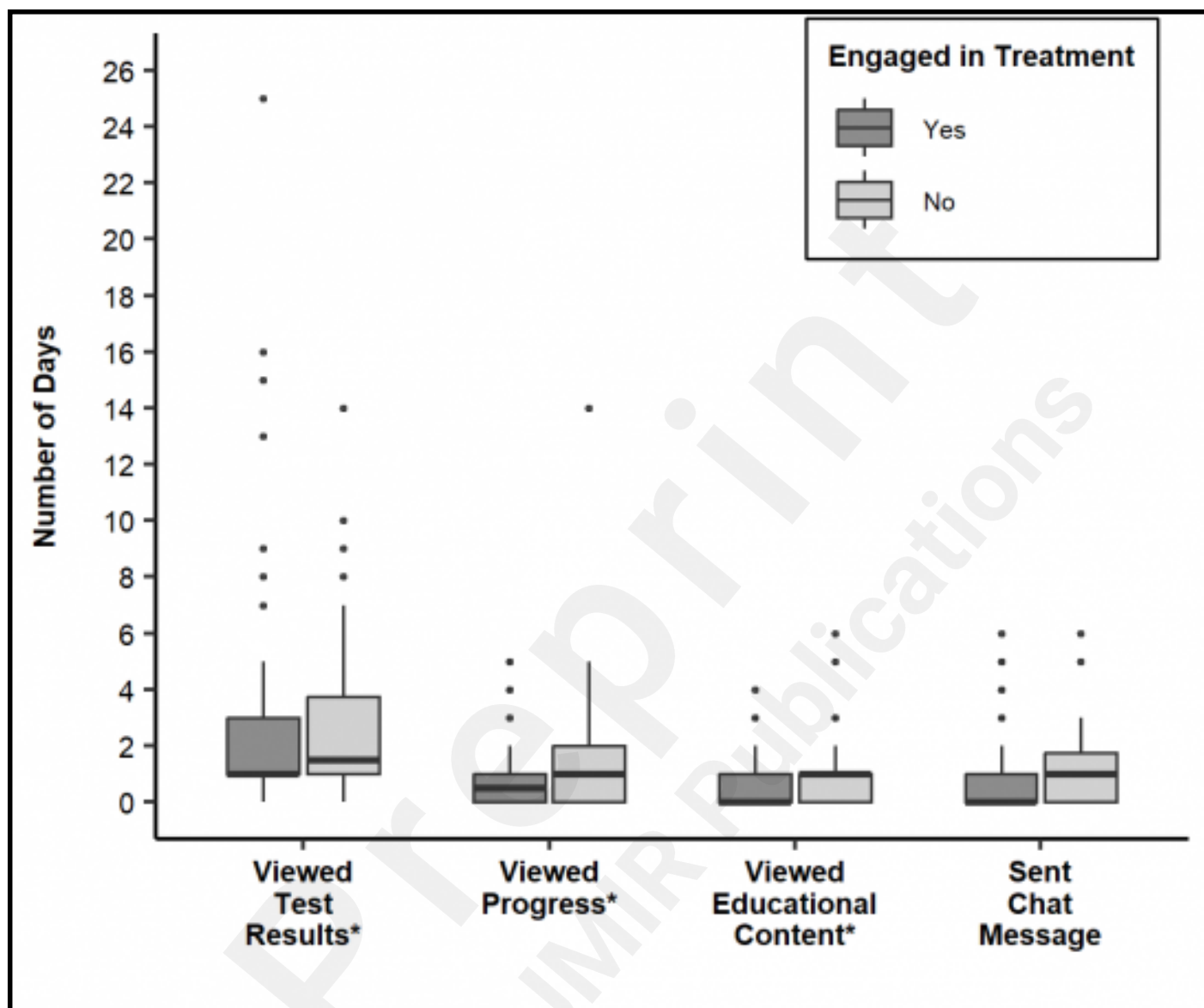
URL: <http://asset.jmir.pub/assets/df54e63275d9b0b4243202af2ea153fd.docx>

Figures

Daily OARS interactions by patients who interacted with OARS at least two days over the course of the study. Each horizontal line represents one patient, and each point represents utilization of OARS (n=82), May 2021 – February 2022.







Daily OARS interactions by MOUD providers and case managers (n=17), May 2021 – February 2022. Each horizontal line represents one MOUD provider or case manager, and each point represents interaction OARS.

