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

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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.

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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 indviduals already engaged in care and/or who struggle with accessing opioid treatment centers (e.g., Methadone clinics) [9]. Although no longer a requirement as of December 2023 [10], providers once had the option to apply for a Drug Addiction Treatment Act (DATA) of 2000 waiver to prescribe buprenorphine for the treatment of OUD in primary care settings [11], resulting in an increase in DATA-waived providers nationally. However, this increase was not sufficient to close the significant gap between the number of individuals who are eligible for MOUD and who are prescribed buprenorphine [12]. For example, in 2012, national survey data suggest that DATA-waived providers were only prescribing MOUD at 57% of their capacity, resulting in a treatment gap of nearly 1 million eligible people. Unfortunately, providers also 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 [13]. 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 [14]. Such solutions can also help improve access to treatment and reduce psychosocial barriers [14]. However, as noted in a 2020 review, despite the availability of multiple mobile health apps relevant to MOUD, studies evaluating the efficacy of these apps in MOUD are lacking [15–19]. This study reports on the utilization of a third-party technology system as a strategy to support the MOUD services in a primary care setting, with a focus on investigating the facilitators and barriers to utilization of the technology.

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.

OARS Software

OARS was developed by Q2i (a digital heath company based in Boston, Massachusetts) as a digital health platform designed to improve the clinical management of MOUD treatment through a provider dashboard and a patient app. The dashboard allows providers to view patient records relevant to the recovery journey, communicate with their patients through

secure messaging, and track patient progress (e.g., appointment attendance and engagement during visits). The patient mobile app allows patients to track their progress across three metrics, which includes appointment attendance, appointment participation, and urine drug screening results. In addition, OARS allows patients to log their personal feelings and/or stressors through an electronic "journal," which providers can also view. Finally, the mobile app allows patients to view their upcoming MOUD appointments and directly communicate with members of their care team (e.g., providers and case managers) through secure messaging. OARS can operate as a standalone platform or can be integrated into the electronic health record (EHR).

Implementation Setting

During implementation, the Center had 28 DATA-2000 waivered providers (e.g., MD, PA, NPs), offered MOUD treatment to 200+ patients with OUD, and had an established EHR. 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).

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.

Given the highly stigmatized nature of OUD and its treatment, every effort was made to ensure patient confidentiality. This included restricting direct interaction between the research team and patients who were receiving MOUD services at the Center. 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 Collection

Patient and provider utilization of OARS was observed for the entire ten-month implementation period. Data collected though the OARS platform included date and time that each feature of the OARS app was utilized (i.e., urine drug screening results, MOUD appointment attendance, secure messages, and journal entries). 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 conducted a series of key informant interviews (n=8) throughout the study period with MOUD providers (n=2) and their support staff (i.e., the lead case manager) (n=1) to further assess the utilization of OARS. 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, support staff 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 support staff 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.).

Data Analysis

OARS utilization was determined by tabulating the number of days that the platform was used and by plotting a timeline for each individual patient who logged into OARS more than one time. In addition, the number of days each OARS feature was utilized was compared for patients who did and did not have data in the platform using a Wilcoxon signed rank test. The same procedure was also used to compare feature utilization for patients who were and were not engaged in MOUD during the study period to ensure responses reflected patients receiving MOUD. 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. The number of days patients created journal entries was not included in these comparisons due to insufficient sample size. A Bonferroni correction was applied to all P values to correct for multiple comparisons, and a P value less than 0.05 was considered statistically significant after correction. Timelines of OARS utilization was described for MOUD providers and support staff. All analyses were conducted in R (version 4.2.1) [20].

All qualitative data were analyzed using a Coding Reliability Thematic Analysis approach [21]. 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

Patient demographic characteristics are provided in Table 1 and total days of OARS utilization in Figure 1. Among 205 MOUD patients invited to use the system, 158 signed up for an account in OARS, 51 used the mobile app only once, and 60 used it more than one day. Most patients identified as male, non-Hispanic White, and were between the ages of 31 and 44 years old (Table 1). The maximum number of days patients utilized OARS was 26 (Figure 2). Of the 60 patients who used OARS more than once, 34 (56.7%) used it three-to-seven days, 14 (23.3%) used it more than 7 days, and 12 (20.0%) used it two days. The days in which these 60 patients utilized OARS varied over the course of the study (Figure 3). For example, among patients who utilized OARS four days or less, some used it for a few days after signing up, while others' use was spread over the course of six months.

Table 1. Patient demographic characteristics

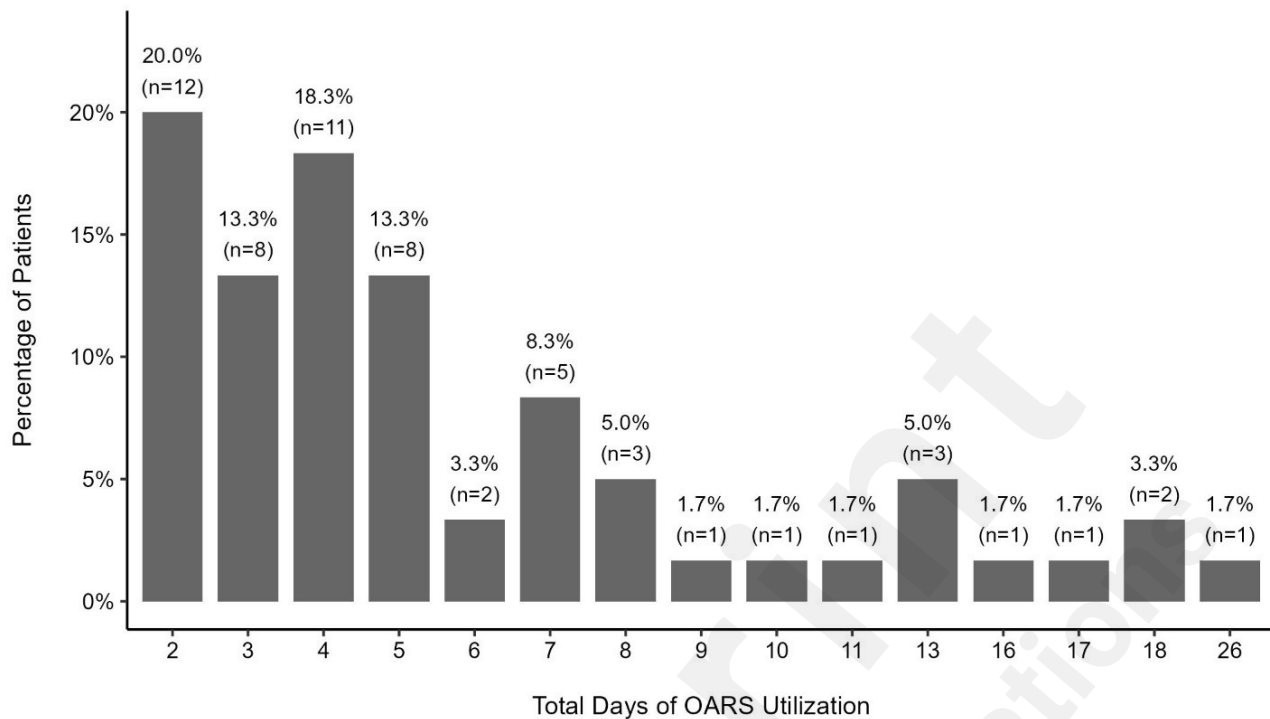|	Invited to use OARS App (n=205)	Signed up for OARS Account (N=158)	Used OARS on more than one day (N=60)
	n (%)	n (%)	n (%)
Age, median (IQR)			
	37 (31 - 44)	36 (31 – 44)	37 (33 – 43)
Male gender			
	130 (63)	101 (64)	37 (62)
Non-Hispanic white race or ethnicity			
	193 (94)	147 (93)	55 (92)

Figure 1. Total days of OARS utilization by patients (n=60), May 2021 – February 2022.

Figure 2. Daily OARS utilization by MAT providers and support staff (n=17), May 2021 – February 2022. Each horizontal line represents one MAT provider or support staff member, and each point represents utilization of OARS.
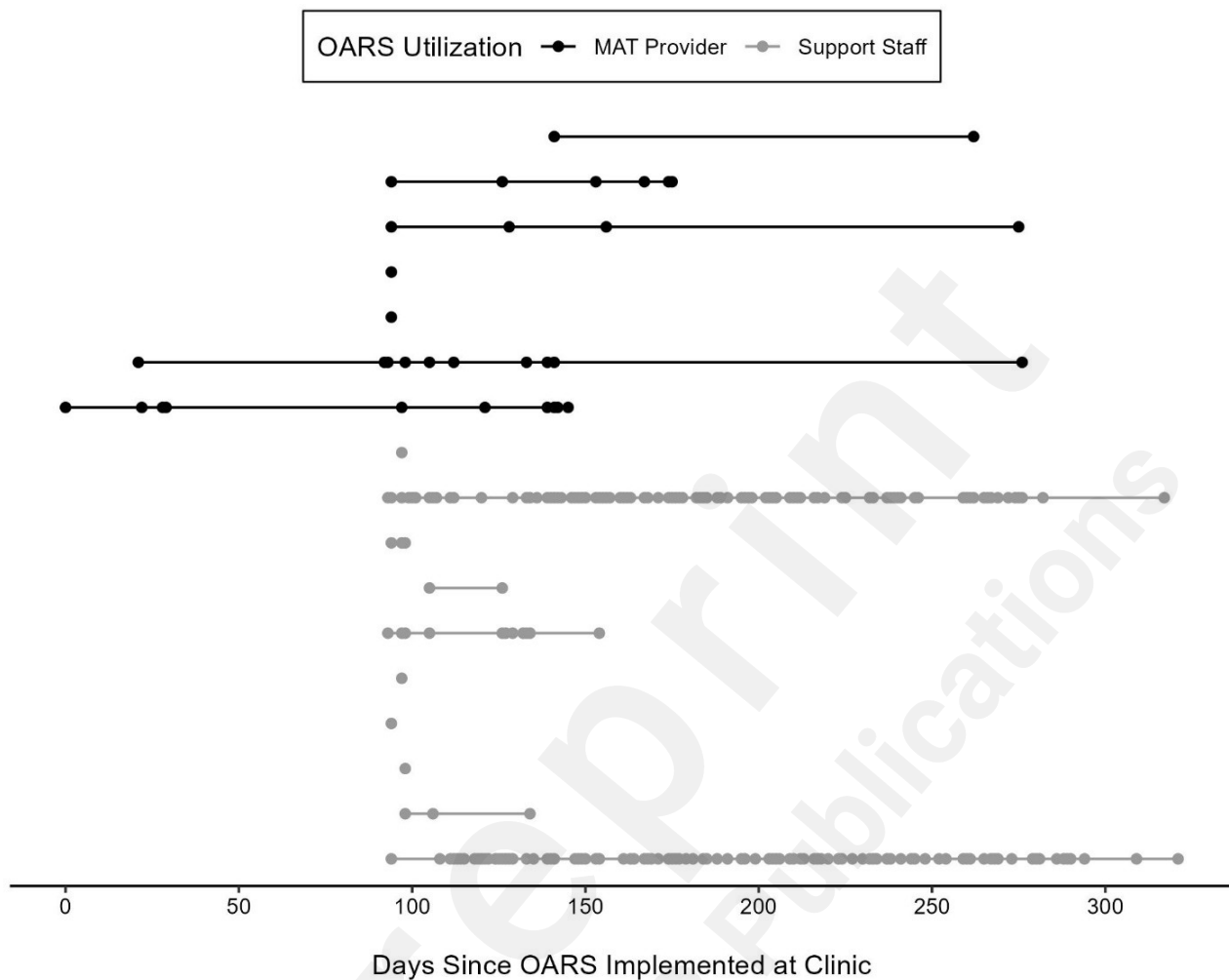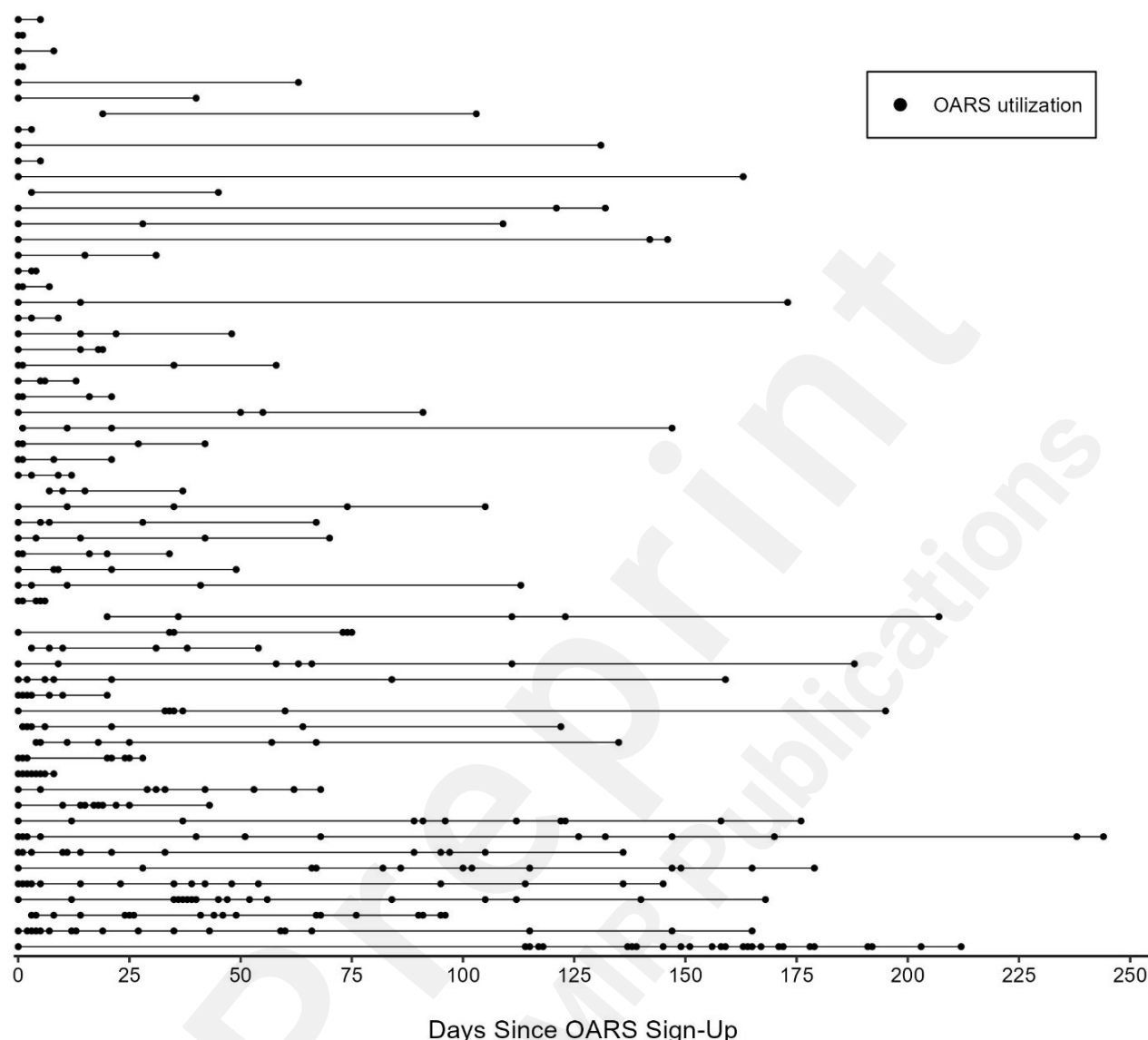
Figure 3. Daily OARS utilization by patients. Each horizontal line represents one patient, and each point represents utilization of OARS (n=60), May 2021 – February 2022.

Days Since OARS Sign-Up

Over the course of the study period, the median number of days patients viewed test results was 3 (IQR: 2 – 5.25), progress was 1 (IQR: 0 – 2), educational content was 1 (IQR: 0 – 2), sent a chat message was 1 (IQR: 0 – 2.25), and created a journal entry was 0 (IQR: 0-0). Of note, patients whose providers entered their data into OARS viewed test results ($p<0.05$), progress ($p<0.01$), and educational content ($p<0.05$) more days than patients whose providers had not entered their data into OARS (Figure 4). In addition, 32 (53%) patients used the messaging feature at least one time. Of these 32 patients, 24 (75%) sent more than one message, and the maximum number of messages sent was seven. Finally, among nine (15%) patients who created journal entries, seven (77.8%) only created one journal entry. No statistically significant differences were observed in feature utilization for patients who were and were not engaged in MOUD during the study period. Visual inspection of the data suggests a potential trend showing that those who were not engaged in treatment may have used features slightly more than those who were engaged in treatment (Figure 5).

Figure 4. Distribution of number of days each OARS feature was utilized by patients. Patients

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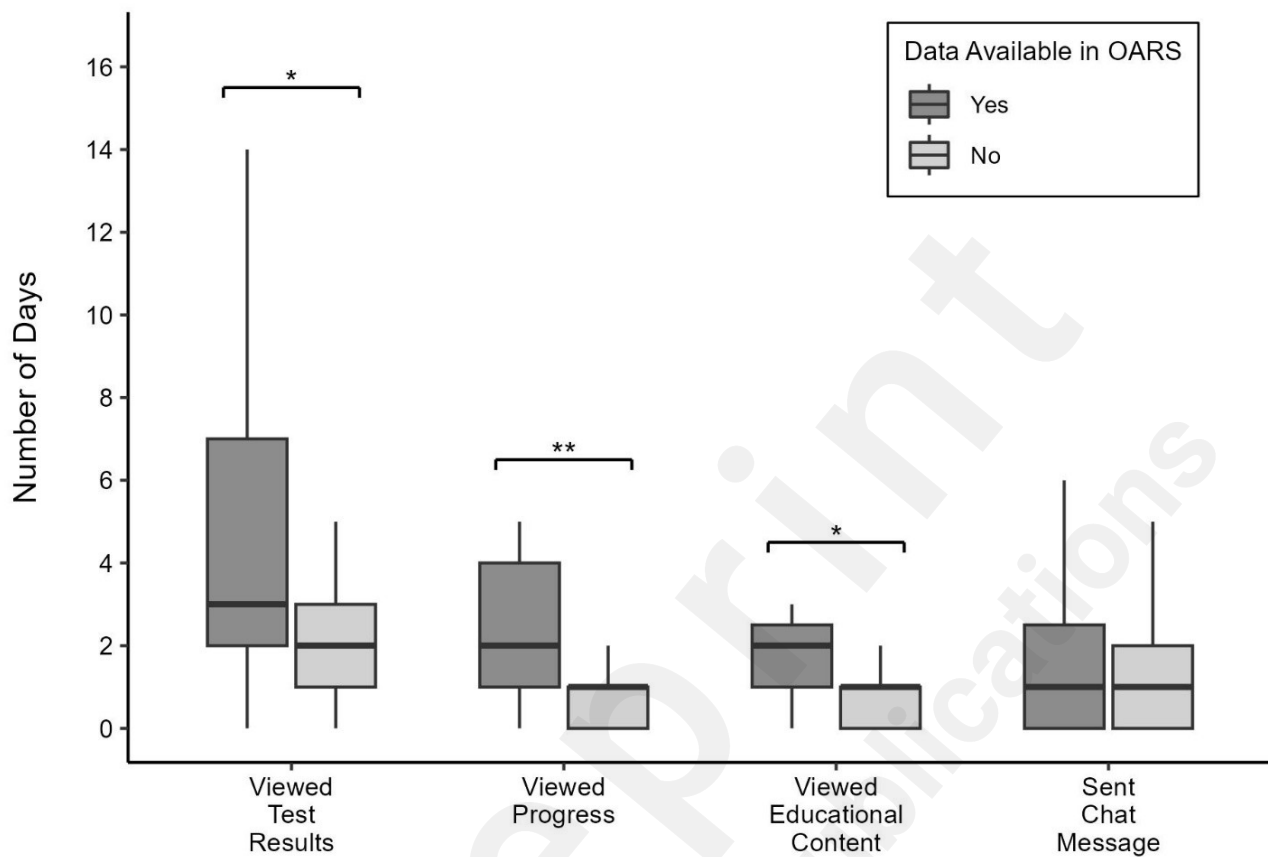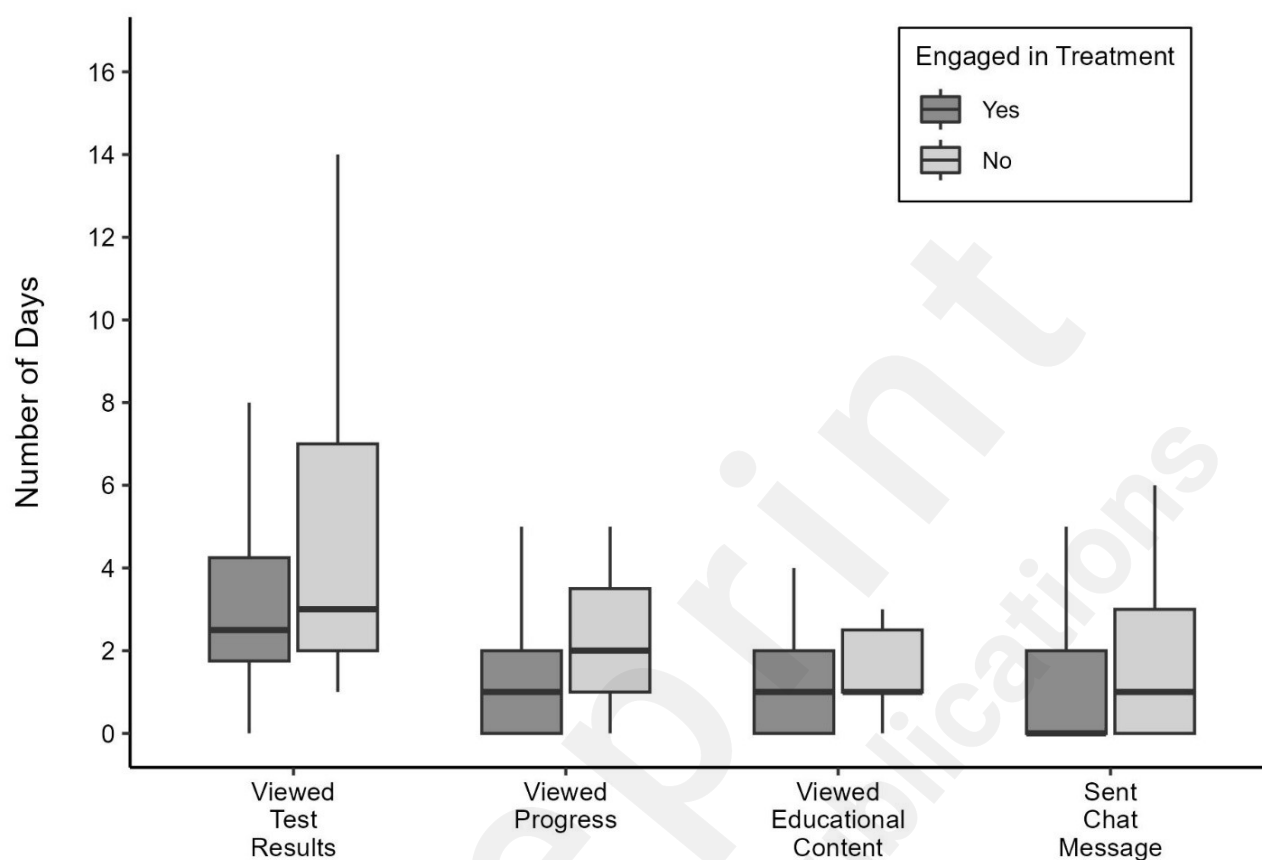
Figure 5. Distribution of number of days each OARS feature was utilized by patients. There were no statistically significant differences in number of days of utilization for patients who were vs. were not engaged in MAT treatment during the study period.

Among the 28 MOUD providers at the Center invited to use OARS, seven MOUD providers and 10 of their support staff members used the system at least once during the study period. Of the seven MOUD providers, five utilized the system between two and ten days and two utilized OARS on only one day. Among support staff, eight utilized OARS up to 11 days and two utilized OARS over 90 days (Figure 2).

Facilitators to OARS Utilization

In general, providers and support staff 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." (Support Staff A)

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." (Support Staff A)

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). 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]." (Support Staff A)

Finally, the journaling feature was 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 journal entries allowed providers to identify patients who were at risk for potential relapse and allowed for early intervention:

> "I felt the journal entry 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 journal entry could help us in predictive analysis and predict relapses…" (Provider A)

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 support staff 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)

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 Support Staff A indicates, patients "*were just so paranoid that they thought this is how the government's tracking them.*"

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)

Discussion

Principle Findings

Our results highlighted the benefits of using platforms like OARS for providers who serve OUD patients in primary care settings and the subsequent barriers that impacted utilization of the system. The two core benefits of OARS were that it increased patient-provider communication and allowed patients to track their overall MOUD treatment progress. These findings are in line with other studies that evaluated similar digital health solutions [22–24]. For example, Waselewski et al (2020) found that MOUD patients value digital health tools because they allow for self-monitoring/management and improve accessibility to, and connectedness with providers [22]. Multiple studies suggest that a key facilitator to the initiation and maintenance of MOUD is having a trusting and empathetic relationship with one's provider [25,26]. Delivering MOUD within trusted settings like primary care facilitates (i.e., our implementation

context for the study) is one way to enhance the therapeutic alliance between providers and their patients, which has been shown to improve MOUD health outcomes [27,28].

Providers also valued the additional information that OARS offered about patient through the journaling component, which allowed providers to identify patients who were at risk for relapse. Existing studies noted several factors that can contribute to relapse among patients receiving MOUD, including an individual's baseline substance use and reported cravings [29–32]. Digital health interventions that collect self-reported information on risk factors (i.e., cravings) and other relevant life stressors (e.g., divorce, work termination) through open-ended journaling might provide critical information for providers who are trying to identify patients at risk for relapse. Early identification of at-risk patients would allow providers to proactively develop appropriate relapse prevention plans. Prior research also suggests that MOUD patients might benefit from being able to directly track cravings through a mobile app like they would with urine drug screening results and appointments [33,34]. In addition, technology interventions could also benefit from actively engaging patients through recurring wellness prompts and motivational coaching, as noted in the existing literature [33,35].

Despite the benefits identified in our study, several notable barriers 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 [36]. In our case, enthusiasm for OARS was diminished by the administrative overhead experienced during implementation due lack of 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 [37]. Second, both the healthcare system and third-party technology partner need to invest the necessary resources to ensure seamless technology integration [38]. 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) [36,39,40].

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 MOUD patients 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.

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. Although common, this setting is representative of one of many implementation scenarios. 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, 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 the potential benefits of implementing a third-party technology system (i.e., OARS) for the management of MOUD services in a primary care setting. Findings from this study also show key challenges to be solved when integrating a third-party technology tool into existing EHR systems. In addition, findings support the potential utility of systems like OARS for improving outcomes for people with OUD by addressing unmet needs in existing general healthcare services that provide MOUD.

Acknowledgments

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

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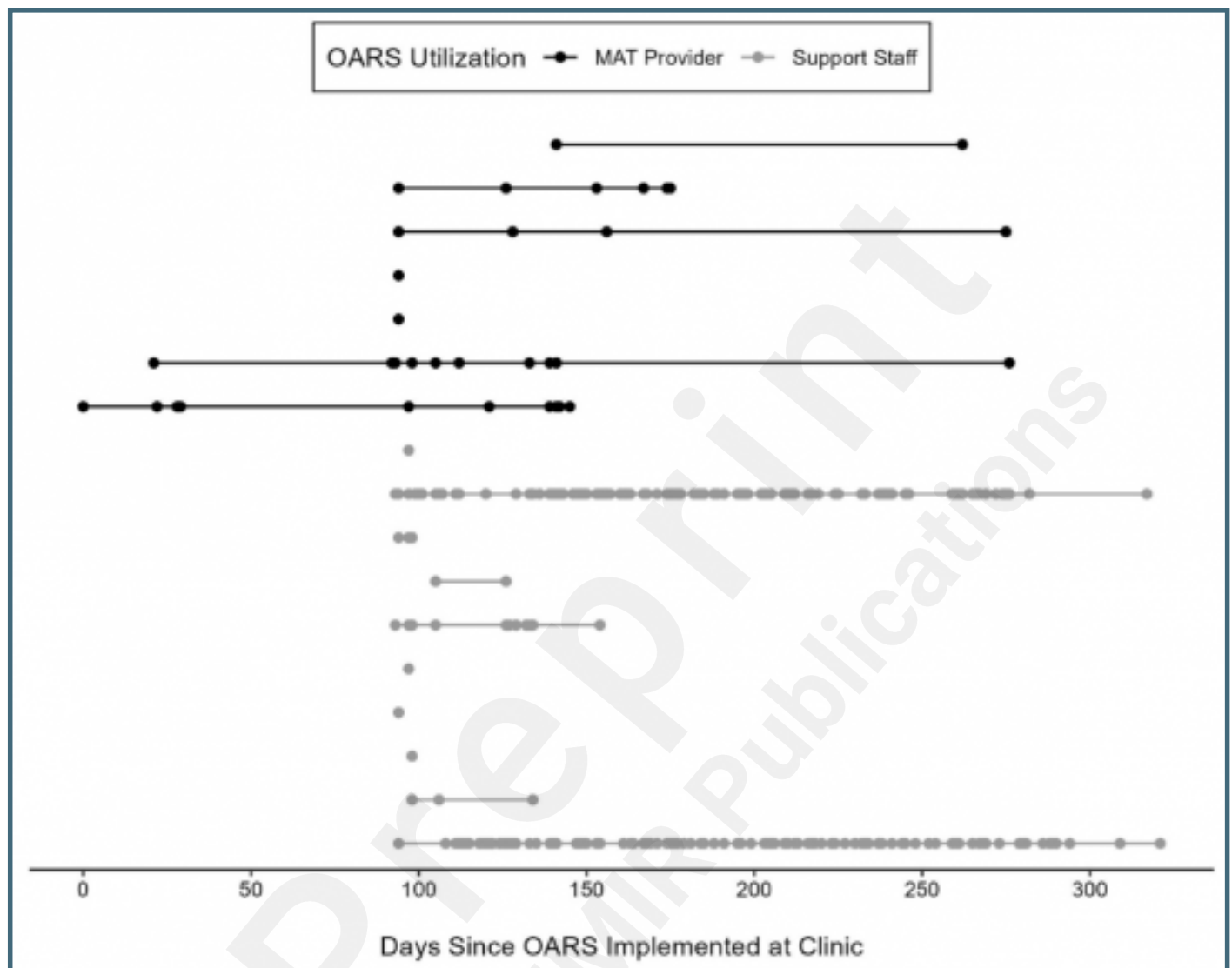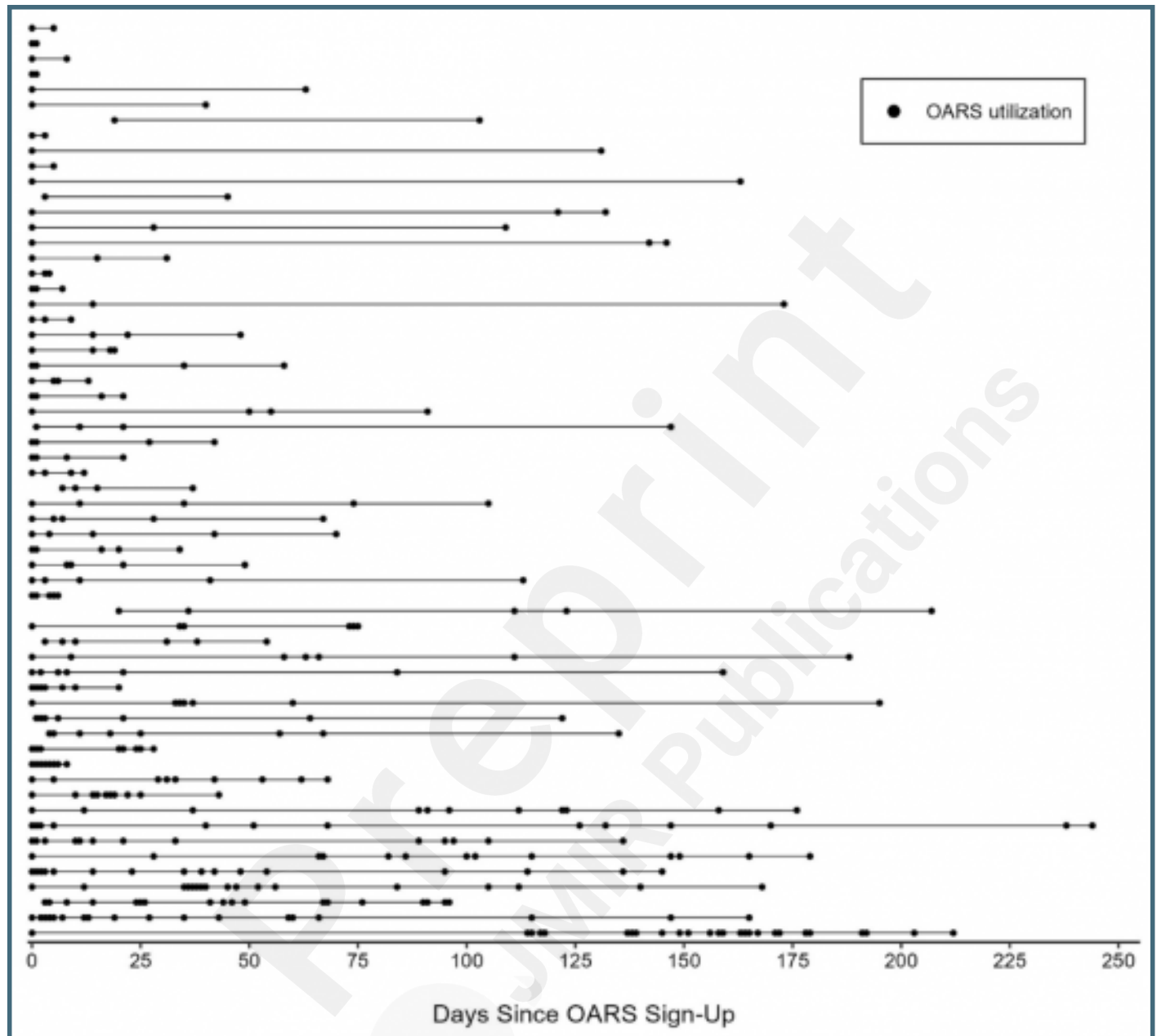
Supplementary Files

Figures

Total days of OARS utilization by patients (n=60), May 2021 – February 2022.
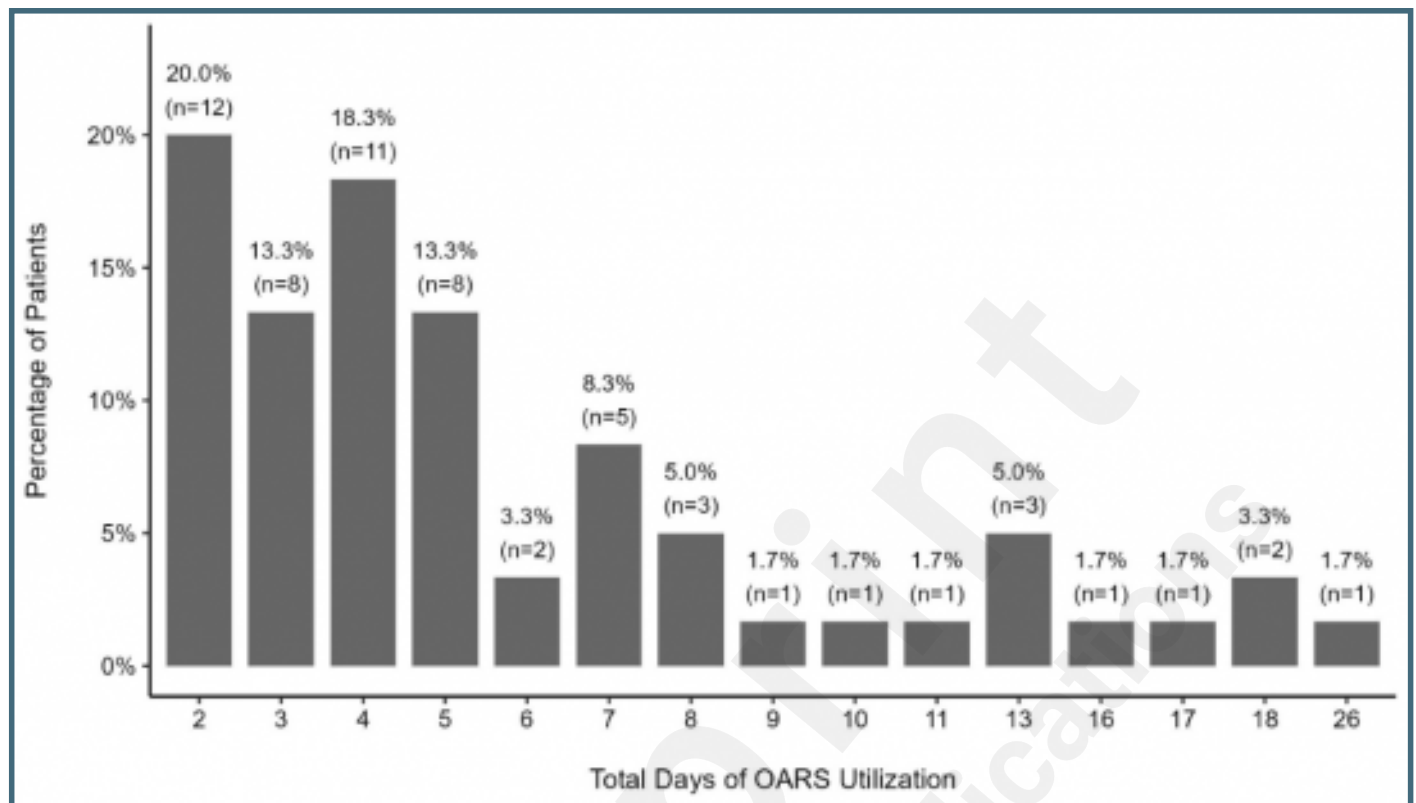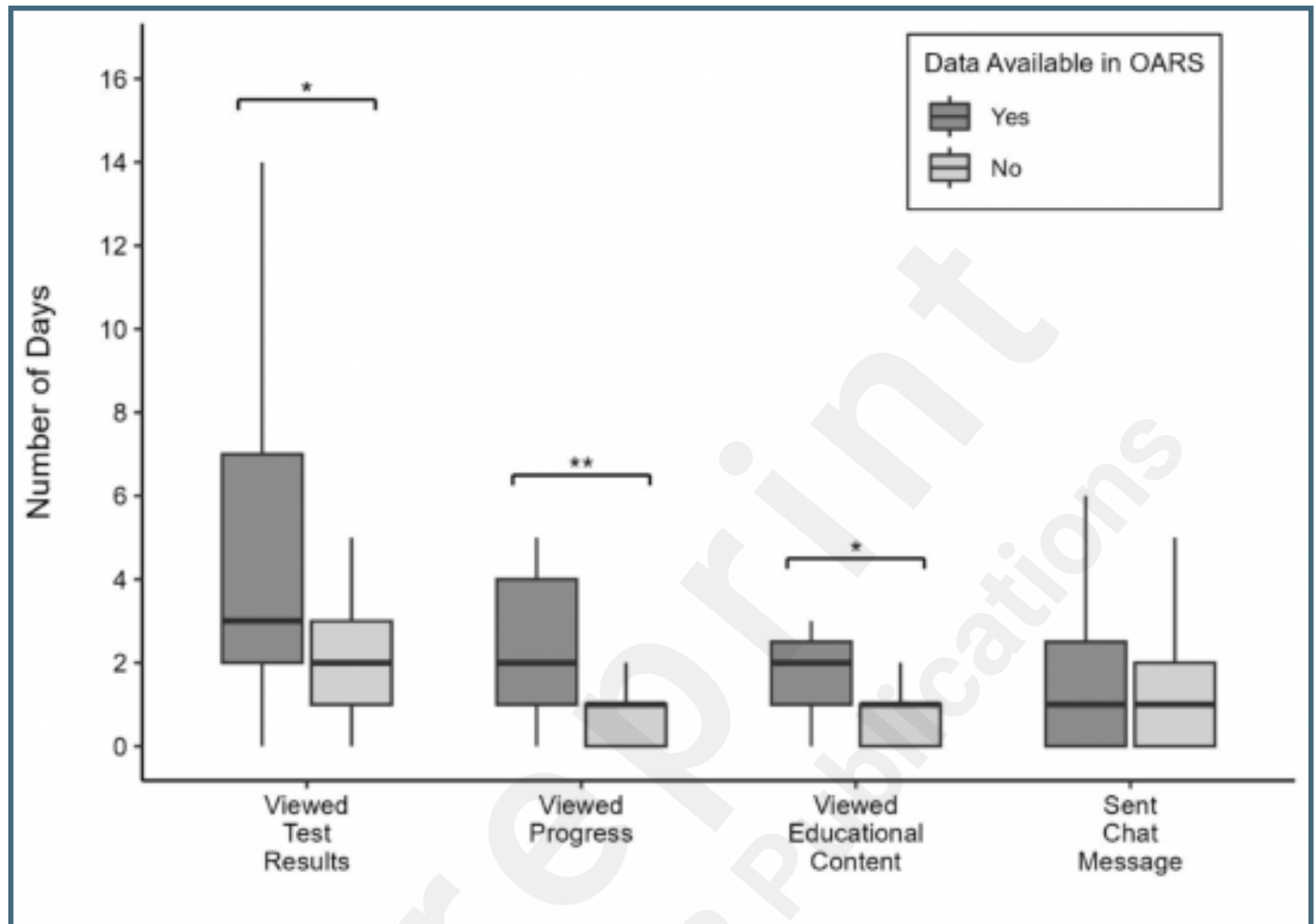
Daily OARS utilization by MAT providers and support staff (n=17), May 2021 – February 2022. Each horizontal line represents one MAT provider or support staff member, and each point represents utilization of OARS.

Daily OARS utilization by patients. Each horizontal line represents one patient, and each point represents utilization of OARS (n=60), May 2021 – February 2022.

Distribution of number of days each OARS feature was utilized by patients. There were no statistically significant differences in number of days of utilization for patients who were vs. were not engaged in MAT treatment during the study period.