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Care coordination between rural primary care and telemedicine to expand medication treatment for opioid use disorder: Results from a single-arm, multisite feasibility study

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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Abstract

Purpose: The use of telemedicine (TM) has accelerated in recent years, yet research on the implementation and effectiveness of TM-delivered medication treatment for opioid use disorder (MOUD) has been limited. This study investigated the feasibility of implementing a care coordination model involving MOUD delivered via an external TM provider for the purpose of expanding access to MOUD for patients in rural settings.

Methods: The study tested a care coordination model in 6 rural primary care sites by establishing referral and coordination between the clinic and a TM company for MOUD. The intervention spanned approximately 6 months from July/August 2020 to January 2021, coinciding with the peak of the COVID-19 pandemic. Each clinic tracked patients with OUD in a registry during the intervention period. A pre-/postintervention design (N = 6) was used to assess the clinic-level outcome as patient-days on MOUD based on patient electronic health records.

Findings: All clinics implemented critical components of the intervention, with an overall TM referral rate of 11.7% among patients in the registry. Five of the 6 sites showed an increase in patient-days on MOUD during the intervention period compared to the 6-month period before the intervention (mean increase per 1,000 patients: 132 days, $P = .08$, Cohen's $d = 0.55$). The largest increases occurred in clinics that lacked MOUD capacity or had a greater number of patients initiating MOUD during the intervention period.

Conclusions: To expand access to MOUD in rural settings, the care coordination model is most effective when implemented in clinics that have negligible or limited MOUD capacity.

Keywords

care coordination; medication for opioid use disorder; opioid use disorder; primary care; rural community; telemedicine

INTRODUCTION

Telemedicine (TM), the use of technology to deliver medical services at a distance, has become more prevalent in health care settings during the coronavirus disease 2019 (COVID-19) pandemic.[1,2] Even before the pandemic, the opioid crisis in highly impacted rural areas led to the recommendation that TM-based medication treatment for opioid use disorder (MOUD) might offer a means to expand treatment access and improve retention of MOUD in rural areas.[3,4] Rural communities are of particular concern because they are disproportionately impacted by opioid use disorder (OUD) and encounter many challenges to accessing MOUD (eg, limited availability of MOUD services, economic distress, older

populations, social isolation, and travel burden).[5–10] Studies comparing in-person and TM-based MOUD generally showed comparable effectiveness and even better retention outcomes in TM-based MOUD.[11–13] According to a recent study, the policy changes supportive of TM implemented during the COVID-19 pandemic had a positive effect on the access to health care and clinical outcomes of rural patients with OUD.[14] Thus, the provision of MOUD services via TM is a promising approach to quickly expand OUD treatment access in rural areas.[4]

Primary care clinics are at the core of rural health care systems but most rural primary care clinics are in medically underserved areas, facing workforce shortages and high demands for care.[15] One way for rural primary care clinics to quickly extend their capacity to effectively treat patients with OUD is by establishing a collaborative relationship with external TM providers who specialize in addiction medicine. Collaboration of this nature involves primary care clinics identifying rural patients with OUD and referring them to TM providers for MOUD if clinically appropriate, and the TM providers delivering MOUD remotely and communicating ongoing patient care status with originating clinics.[6] Such a collaborative care coordination model between rural primary care clinics and external TM providers can increase the number of rural patients served and reduce the consequences of active OUD, leading to healthier communities.

We conducted a feasibility study to examine a referral and care coordination model developed for implementation in rural settings. We selected a TM company for the study to provide a comprehensive TM-based MOUD program; the company's TM program used video conferencing between patients and their clinicians for medication prescription and management, behavioral therapies, and remotely viewed saliva/urine drug tests. At the time of the study, the TM company was offering services in 24 states in the United States and was willing to be flexible in providing services to meet the needs of the participating clinics and patients.

We used a mixed-methods approach to assess implementation processes and study outcomes. A number of early challenges during the initial implementation phase coinciding with the onset of the COVID-19 pandemic—such as clinic workflow and capacity constraints, difficulties to identify patients with OUD, patients' insurance variation, and limited access to digital devices and the internet—were identified using comprehensive qualitative approaches and have been reported elsewhere.[6,16] The present article reports the implementation of the TM care coordination for MOUD in rural primary care settings, as well as the primary patient outcome at the clinic level.

METHODS

Study population and setting

Six sites (consisting of 7 rural primary care clinics)* in 3 states (Maine, Washington, and Idaho) participated in the feasibility study. We used the Health Resources & Services

*The 6 sites include 7 clinics, with 2 clinics considered as 1 site given their geographic proximity (located in the same county) and frequent patient sharing.

Administration rural definition to define rural communities; sites were verified by using the "Am I Rural?" tool (https://www.ruralhealthinfo.org/am-i-rural). Data from the study sites' electronic health records (EHRs) were extracted for all primary care patients 18–80 years old with at least 1 visit (either in-person or virtual) to the participating clinics during the study period. The EHR data included in this analysis cover 6 months of the preintervention period and 6 months of the intervention period. The study was approved by the BRANY Institutional Review Board (IRB) as the Single IRB and registered at Clinicaltrials.gov (NCT04418453).

Study design

This was a prospective, single-arm, feasibility study. The intervention was implemented at the clinic level without randomization. To optimize the opportunity to observe diverse implementation patterns and issues, the study recruited rural clinics with varying levels of MOUD capacity (ie, according to the number of buprenorphine-prescribing clinicians at the clinic: 0–1, 2–3, or more than 3). The external TM for the study was provided by a nationwide company offering a comprehensive TM-based MOUD program as described earlier.

The study intervention phase lasted approximately 6 months (from July/August 2020 through January/February 2021), with a 6-month preparation/preintervention phase that unintentionally coincided with the onset of the COVID-19 pandemic when lockdowns occurred,[17–19] and many clinics transitioned on their own to deliver much of their care via various forms of telehealth rather than in-person right after the declaration of public health emergency in March 2020.

Study intervention: A model of care coordination between the TM provider and rural primary care clinics

Figure 1 illustrates the care coordination model facilitating TM-based MOUD for patients in rural primary care clinics involving the TM MOUD provider along the continuum of care for OUD. The model components include: (1) establishing a service delivery plan that incorporates a TM referral process; (2) identifying patients eligible for OUD treatment and documenting patients with OUD in a patient registry; and (3) providing MOUD along a continuum of care, including making patient referrals for TM-based MOUD.

The model's service delivery plan specified: the services requested by the clinic from the TM provider (eg, medication treatment for OUD, behavioral health services for OUD, coverage for MOUD services as needed when on-site clinicians were not available); referral communication options (eg, warm handoff, online referral via the TM provider's secure website, faxed referral); clinic preference for communication about patient progress (eg, frequency of clinical updates, channels of communication, including faxed clinical reports vs direct messaging to the EHR, conventional calls); and plans to address appointment no-shows and dropouts from services.

As shown in Figure 1, the primary care clinics were responsible for identifying patients with OUD. Clinic staff documented all patients identified with OUD in a patient registry (a spreadsheet template provided by the research team) to track referral status. Clinicians

worked with patients in the registry to determine whether to initiate MOUD at the clinic or through the TM provider. The TM provider assessed patients and initiated (or continued) MOUD services for patients referred by clinics. The TM provider then provided updates on patient progress to the clinics, and the TM provider and clinics coordinated to promote MOUD adherence.

For the study, clinics and the TM provider invoiced their own clinical services directly to relevant insurance/coverage entities, allowing each organization to maintain their independence with separate finances and budgets. To be pragmatic and to observe how clinics with varying MOUD capacities would utilize the external TM provider, clinics were not required by the study to refer patients to TM-based MOUD.

Study procedures

The clinics were asked to implement several research procedures: (1) establishing a data use agreement (DUA) for data sharing; (2) documenting patients with OUD in the patient registry dataset; and (3) extracting and submitting EHR data for the study period in accord with the DUA. Clinic staff were also asked to participate in weekly meetings with the study team to report study progress (eg, number of patients recorded in the registry, receiving TM referral) as well as to discuss strategies for addressing issues encountered during the study implementation.

The DUA specified the types of data (EHR and registry) and the schedule for clinics' data extraction and submission. Informed consent by patients for sharing EHR and registry data for research purposes was waived because only limited data were shared (which did not contain personally identifiable information, except for dates and ZIP codes). The EHR data for all eligible patients included demographics, clinic encounters, diagnoses, laboratory tests, and medication prescriptions. The OUD patient registry data included study IDs and dates (eg, entry in the registry, TM referral date) for tracking eligible patients with OUD (per DSM-5 diagnosis) in the clinic during the intervention phase.

Pre-intervention phase

The clinics' commitment to this research project was established at the beginning of the preintervention phase, prior to the onset of the COVID-19 pandemic. The study team worked with clinics to develop and establish the DUAs and service delivery plans as well as identification procedures for patients with OUD. Clinic staff were trained to record eligible patients in the registry.

Intervention phase

During the intervention phase, clinics identified patients with OUD through multiple channels, including screening all primary care patients for OUD during their clinic visits, reviewing patient EHR records, and advertising TM MOUD availability in the clinic catchment areas. Care coordinators (dedicated clinic staff) started recording eligible patients with OUD in the registry. Primary care providers started TM referrals in accord with the service delivery plan agreements. Baseline EHR data were extracted and submitted per the DUA. The TM provider digitally prescribed buprenorphine (sublingual buprenorphine-

naloxone) to local pharmacies for the patients to refill (most daily dosages were 16–24 mg). The TM provider also provided video-based medication management and behavioral health services (eg, individual or group sessions), and remote saliva/urine drug tests (either through testing kits mailed to patients or referrals to a local laboratory). Throughout the intervention period, the study team met with clinic staff on a regular basis for quality control and for monitoring study progress. Additional ad hoc meetings were called if problems or issues arose or were identified either by the clinics or by the study team. After the end of the 6-month intervention phase, clinics extracted and submitted EHR and registry data covering the intervention period.

Outcome measure

The primary outcome at the clinic level was the total number of patient-days on MOUD as indicated by medication prescription records in EHRs for each clinic. Medications for MOUD included buprenorphine and naltrexone (and the different formulations of these medications). A clinic's number of patient-days on MOUD was calculated by summing the number of (nonoverlapping) days for which each MOUD medication was prescribed for a patient (by the clinic provider or the external TM provider) during the specified period, then calculating the total number of patient-days on MOUD for each clinic by summing the patients from the same site. To adjust for a site's patient population size, the site's number of patient-days on MOUD for each time period was then divided by the site's total patient population size and multiplied by 1,000 to derive the measure of the patient-days on MOUD per 1,000 patients. We used a quasi-experimental design to compare clinics' patient-days of MOUD per 1,000 patients during the 6-month intervention phase (July/August 2020 through January/February 2021) with the 6 months prior to the intervention (January/February 2020 to June/July 2020).

Statistical analysis

Characteristics of different groups in the registry (eg, patients referred to TM-based MOUD, not referred) were examined using *t*-tests for continuous outcome measures, and chi-square tests for categorical measures. The Wilcoxon signed-rank test (one-tailed) was conducted to test for significant changes in patient-days of MOUD per 1,000 patients for each clinic during the 6-month preintervention period versus the 6-month intervention period. We report both the *P*-value for significance and the Cohen's *d* statistic for the effect size.

RESULTS

Completion of the intervention and the research procedures

All clinics completed the implementation of all critical components of the intervention, including developing a service delivery plan, maintaining a patient registry, and making referrals of patients to the TM provider for MOUD. All clinics also completed all research procedures, including completing DUAs and extracting and submitting EHR data.

Characteristics of patients in the registry

Across the 6 clinics, there were 582 patients in the OUD patient registry. Shown in Table 1, the mean age of registry patients was 39.7 (SD = 11.8), 43.3% were female, a majority

(93.7%) were white, and most had Medicaid (57.4%) or Medicare (9.8%), although some had private health insurance (17.4%). Comorbid health conditions were common among these patients, with a large proportion having mental health conditions (67.3%; most with anxiety [46.1%] or depression [32.0%]) or chronic pain (44.4%). Approximately 16% of patients in the registry were new patients who initiated MOUD during the study intervention phase. The mean estimated driving time to the clinic was approximately 35 minutes (SD = 56.3), based on the ZIP codes of patients' residences and clinic locations.

TM referral

Across the clinics, a total of 68 patients were referred to the TM provider, with a referral rate of 11.7% among patients in the OUD registry. Among the 68 patients, 20 (29.4%) received buprenorphine prescriptions during the 6-month intervention period. All sites made referrals to the study TM provider, ranging from 1 to 20 referrals across all clinical sites. Three sites accounted for the majority of the referrals; 1 site with 1 MOUD prescriber (who infrequently prescribed MOUD) made 17 referrals, and 2 sites with approximately 10 MOUD prescribers each made 19 and 20 referrals, respectively. The other 3 sites (each with 1–3 MOUD prescribers) had at least 1 referral.

Comparing patients who were referred to the TM provider versus those not referred, the TM referral group had more patients who had co-occurring stimulant use disorder (25.0% vs 15.2%, $P < .05$) or who had newly initiated MOUD during the intervention period (29.4% vs 14.2%, $P < .01$).

Patient-days on MOUD

Table 2 summarizes by site the change in the number of patient-days on MOUD among all clinic patients and provides the mean change, 95% confidence interval, and the *P*-value from the Wilcoxon signed-rank test (one-tailed), and the Cohen's *d* for the effect size. All but 1 site demonstrated an increase in patient-days on MOUD during the intervention period compared to the patient-days on MOUD in the preintervention period. There was an overall 4.2% increase (difference in the number of patient-days on MOUD between the 2 periods divided by the number of patient-days on MOUD during the preintervention period) over the 6 sites. The statistical analysis based on patient-days on MOUD per 1,000 patients indicates a medium effect size (Cohen *d* of 0.55), with an average increase of 132 patient-days on MOUD per 1,000 patients over the 6-month intervention period compared to the 6 months prior to the intervention, although the difference was not statistically significant ($P = .08$).

Among the 6 clinic sites, 2 sites showed the largest increases in patient-days on MOUD, with either a high percentage or a large number of increased patient-days on MOUD during the intervention period. With an approximately 20-fold increase in patient-days on MOUD, Site 2 previously had limited MOUD capacity with only 1 MOUD prescriber and 4 patients with OUD during the preintervention period. During the intervention phase, however, the site actively identified and documented 19 patients with OUD in the registry and 10 of them were new patients with OUD recruited from the local community. This clinic site referred 17 patients to the TM provider for MOUD. In contrast, Site 6 had 11 prescribers and documented 268 patients with OUD in the registry. This site referred 19 patients to

TM-based MOUD. Nevertheless, Site 6 identified 49 new patients who received MOUD only after the intervention started, which helped to explain the site's large number (3,207) of increased patient-days on MOUD.

Table S1 summarizes the details for each clinic on the patients' treatment status based on their originating clinic, including the number of patients in the registry, number of patients referred, number of patients who received buprenorphine prescriptions from the TM provider, and the number of patient-days on MOUD with the clinic and the TM provider.

DISCUSSION

This study demonstrated the feasibility of implementing the coordination of care model to facilitate MOUD services for patients in rural primary care settings referred to an external TM provider. All participating rural primary care clinics were able to establish a service delivery plan and to provide MOUD through referral to the external TM provider of MOUD services. The overall TM referral rate was 11.7% among patients in the registry over the 6-month intervention period. We did not find many differences between patients referred to the TM versus those not referred, except that new patients or patients with co-occurring stimulus use disorder were more likely to be referred to the TM provider. Unexpectedly, the driving time from patients' residences to the clinics was also similar for the 2 groups.

Even with low TM referral rates, all but 1 site demonstrated an increase in patient-days on MOUD during the 6-month intervention period (relative to the 6 months prior to intervention implementation). These increases were not consistent across the sites. Two sites had a considerable increase in MOUD days either by the percentage of change or the large number of increased days. The site with the greatest percentage of increase (approximately 20-fold) in the number of patient-days on MOUD had only 1 MOUD prescriber and referred most of their patients to the TM provider. Importantly, that particular site reached out to its community (via television interviews, social media, etc.) and attracted new patients to their clinic who could then be referred to the TM-based MOUD provider. The site with the greatest increase in patient-days on MOUD (more than 3,000) also began caring for a large number of new patients who initiated MOUD during the intervention period. Thus, this care coordination approach appeared to be most effective in enhancing MOUD access for rural primary care clinics that lack the capacity to treat patients with OUD, as well as those with a high influx of new patients and thus requiring external TM-based MOUD services to assist with the patient load.

The overall low referral rate could be related to several factors. Notably, TM visits in some form (ie, remote delivery of health care via voice-only telephone or via internet-based video interactions) were already being provided by all 6 clinics during the intervention period as a result of the COVID-19 pandemic. For example, the 2 clinics that had 10 and 11 MOUD prescribers both had started clinic-based TM on their own during the pandemic and offered long-acting injectable MOUD formulations to reduce patients' need for face-to-face contact during COVID restrictions. In this case, some providers or patients may have chosen to not use the study's external TM provider for MOUD services. Whereas these clinics had not provided TM-based MOUD prior to COVID, such services

became necessary and were more readily adopted with the relaxation of regulations and accommodation of reimbursement for TM-based MOUD in response to COVID-19. Clinics with a lower number of prescribers (1–3) that had few new patients with OUD during the study period did not have an increase in MOUD patient-days or high referral to the TM provider. Furthermore, we learned that not all patients were offered the TM options.[6] Anecdotally, some patients refused the referral because they preferred to stay with their current provider. It is likely that it takes longer than 6 months for providers and patients to gain trust in or adopt any new practices. Implementation science research suggests that time, buy-in at all levels, and changes throughout clinics including adequate capacity and organizational readiness are all critical to the successful implementation and sustainability of new practices.[20] Technology barriers in rural areas, inadequate digital devices, limited broadband coverage, and patients' limited technological proficiency also deterred the uptake of home-accessed TM services or engagement with the TM provider for MOUD.[6] Future efforts should investigate reasons for patients not engaging in TM-based MOUD. A better understanding of these factors can inform the development of more effective TM referral and engagement strategies as well as an improved TM care model that can better serve rural communities.

Rural residents are less likely to have the opportunity to participate in clinical research and thus are generally underrepresented in clinical trials.[21,22] This study demonstrated that although most rural primary care clinics had limited experience participating in research studies and despite the many challenges caused by COVID-19, the study clinics were able to successfully implement all study procedures, which is an extraordinary accomplishment. Future studies focusing on rural populations and communities will increase knowledge and potentially improve practice in rural health care settings toward achieving better patient outcomes with MOUD.

Study limitations

In addition to the changing health care landscape due to COVID-19 (eg, clinic staff started using TM for patient care, reducing the need to rely on the external TM provider), there were several limitations associated with the study. Because the feasibility study intended to learn how the care model would work in rural clinics of varying MOUD capacity and to identify potential barriers and facilitators associated with its implementation in these real-world settings, implementation facilitation activities were not planned. As a consequence, the type and level of coordination with the study TM provider were not predetermined by the study, which resulted in varying levels of coordination across clinics, and only a limited number of providers in each clinic were actually involved in the study activities. Had more providers in each clinic actively engaged in MOUD delivery and TM referral, the intervention impact in terms of increasing patient-days on MOUD may have been greater.

Other study limitations include that non-Hispanic Whites represented over 90% of the patients in the registry and received TM referrals. Dedicated efforts are needed to screen and identify patients with OUD among racial and ethnic minority groups in order to expand access to MOUD in these populations. Additionally, patient outcomes that were based on EHR data can suffer from an inaccurate recording of diagnoses and inaccurate

diagnoses.[23,24] Patient-days on MOUD were based on medication prescription records, lacking validated information on whether the medication was taken by the patients. Lastly, the feasibility study with no randomization and the short follow-up period limited our capacity to rigorously evaluate patients' clinical outcomes at the individual level, such as treatment retention and mortality. The single-arm pre-/post-design can be confounded by time-associated events (eg, the COVID-19 pandemic and in-clinic TM expansion) making it difficult to determine the extent to which the TM care coordination approach was responsible for the observed change in the number of patient-days on MOUD.

CONCLUSIONS

As intended, this study explored the feasibility of implementing the TM-based MOUD care coordination model in diverse rural clinics to shed light on whether and how such a model might be applied to facilitate the expansion of MOUD treatment in rural primary care settings. The study findings suggest that improved MOUD access and outcomes are likely to be achievable via the implementation of this model in rural primary care clinics that lack MOUD capacity. To achieve stronger and consistent improvements in patient outcomes, greater implementation support will be needed to better engage the community, providers, and patients.

Few empirical data are available to document the quality of remote care models, especially as applied in rural settings, or to guide optimal care that involves TM despite its increasing use in the health care system in general. Additional empirical evidence based on scientific studies is needed to address relevant issues and inform future practice regarding TM-based MOUD.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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CONFLICT OF INTEREST STATEMENT

Andrew J. Saxon receives royalties as a section editor for UpToDate, received travel support from Alkermes, Inc., and consultant fees from Indivior, Inc. In addition to her academic affiliation, Dr. Lisa A. Marsch is affiliated with HealthSim, LLC, Pear Therapeutics, and Square2 Systems, Inc. Dr. Marsch has worked extensively with her institutions to manage any potential conflict of interest. Dr. Murphy reports having consulted for Sandoz Inc., Nature Sacred Inc., and West Virginia Perinatal Partnership Inc., outside of the submitted work. All other authors report no financial or other possible conflict of interest.

REFERENCES

1. Patel SY, Mehrotra A, Huskamp HA, Uscher-Pines L, Ganguli I, Barnett ML. Trends in outpatient care delivery and telemedicine during the COVID-19 pandemic in the US. JAMA Intern Med. 2021;181(3):388–391.
2. Busch AB, Sugarman DE, Horvitz LE, Greenfield SF. Telemedicine for treating mental health and substance use disorders: reflections since the pandemic. Neuropsychopharmacology. 2021;46(6): 1068–1070. [PubMed: 33479513]
3. Rubin R Using telemedicine to treat opioid use disorder in rural areas. JAMA. 2019;322(11):1029–1031. [PubMed: 31461125]
4. Hser YI, Mooney LJ. Integrating telemedicine for medication treatment for opioid use disorder in rural primary care: beyond the COVID pandemic. J Rural Health. 2021;37(1):246–248. [PubMed: 32579751]
5. Blue H, Dahly A, Chhen S, et al. Rural emergency medical service providers perceptions on the causes of and solutions to the opioid crisis: a qualitative assessment. J Prim Care Community Health. 2021;12:1–9. doi:10.1177/2150132720987715
6. Hser YI, Ober AJ, Dopp AR, et al. Is telemedicine the answer to rural expansion of medication treatment for opioid use disorder? Early experiences in the feasibility study phase of a National Drug Abuse Treatment Clinical Trials Network Trial. Addict Sci Clin Pract. 2021;16(1):24. [PubMed: 33879260]
7. Lofwall MR, Fanucchi LC. Long-acting buprenorphine injectables: opportunity to improve opioid use disorder treatment among rural populations. Prev Med. 2021;152(Pt 2):106756. [PubMed: 34352306]
8. Lister JJ, Weaver A, Ellis JD, Himle JA, Ledgerwood DM. A systematic review of rural-specific barriers to medication treatment for opioid use disorder in the United States. Am J Drug Alcohol Abuse. 2020;46(3):273–288. [PubMed: 31809217]
9. Slama K Rural culture is a diversity issue. Minnesota Psychol. 2004;53:9–13.
10. Weintraub E, Seneviratne C, Anane J, et al. Mobile telemedicine for buprenorphine treatment in rural populations with opioid use disorder. JAMA Netw Open. 2021;4(8):e2118487. [PubMed: 34448869]
11. Eibl JK, Gauthier G, Pellegrini D, et al. The effectiveness of telemedicine-delivered opioid agonist therapy in a supervised clinical setting. Drug Alcohol Depend. 2017;176:133–138. [PubMed: 28535455]
12. Morin KA, Parrotta MD, Eibl JK, Marsh DC. A retrospective cohort study comparing in-person and telemedicine-based opioid agonist treatment in Ontario, Canada, using administrative health data. Eur Addict Res. 2021;27(4):268–276. [PubMed: 33706309]
13. Hailu R, Mehrotra A, Huskamp HA, Busch AB, Barnett ML. Telemedicine use and quality of opioid use disorder treatment in the US during the COVID-19 pandemic. JAMA Netw Open. 2023;6(1):e2252381. [PubMed: 36692880]
14. Hughes PM, Verrastro G, Fusco CW, Wilson CG, Ostrach B. An examination of telehealth policy impacts on initial rural opioid use disorder treatment patterns during the COVID-19 pandemic. J Rural Health. 2021;37(3):467–472. [PubMed: 33720447]
15. Deligiannidis KE. Primary care issues in rural populations. Prim Care. 2017;44(1):11–19. [PubMed: 28164810]
16. Ober AJ, Dopp AR, Clingan SE, et al. Use of telemedicine to expand medication treatment for opioid use disorder in rural primary care clinics: leadership, provider and staff perspectives. Presentation at the CPDD 83rd Annual Scientific Virtual Meeting. 2021.
17. Cromartie J, Dobis EA, McGranahan JD, Pender J. Rural America at a Glance: 2020 Edition. Economic information bulletin No. (EIB-221). Economic Research Service, United States Department of Agriculture; 2020.
18. Cuadros DF, Branscum AJ, Mukandavire Z, Miller FD, MacKinnon N. Dynamics of the COVID-19 epidemic in urban and rural areas in the United States. Ann Epidemiol. 2021;59:16–20. [PubMed: 33894385]

19. Bradford J, Coe E, Enomoto K, White M. COVID-19 and Rural Communities: Protecting Rural Lives and Health. Mckinsey & Company; 2021.

20. Damschroder LJ, Reardon CM, Opra Widerquist MA, Lowery J. Conceptualizing outcomes for use with the Consolidated Framework for Implementation Research (CFIR): the CFIR Outcomes Addendum. Implement Sci. 2022;17(1):7. [PubMed: 35065675]

21. Baquet CR, Commiskey P, Daniel Mullins C, Mishra SI. Recruitment and participation in clinical trials: socio-demographic, rural/urban, and health care access predictors. Cancer Detect Prev. 2006;30(1): 24–33. [PubMed: 16495020]

22. Tanner A, Kim SH, Friedman DB, Foster C, Bergeron CD. Barriers to medical research participation as perceived by clinical trial investigators: communicating with rural and African American communities. J Health Commun. 2015;20(1):88–96. [PubMed: 25204763]

23. Howell BA, Abel EA, Park D, Edmond SN, Leisch LJ, Becker WC. Validity of incident opioid use disorder (OUD) diagnoses in administrative data: a chart verification study. J Gen Intern Med. 2021;36(5):1264–1270. [PubMed: 33179145]

24. Lagisetty P, Garpestad C, Larkin A, et al. Identifying individuals with opioid use disorder: validity of International Classification of Diseases diagnostic codes for opioid use, dependence and abuse. Drug Alcohol Depend. 2021;221:108583. [PubMed: 33662670]

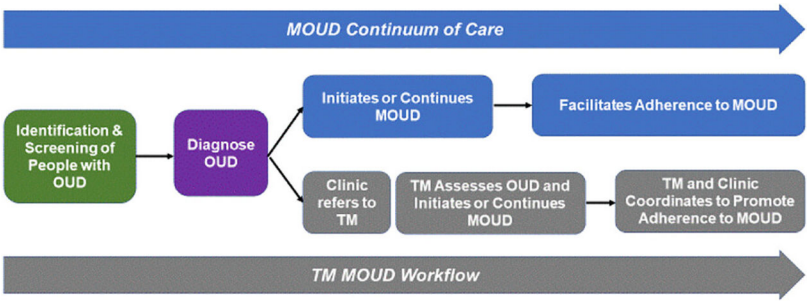

FIGURE 1.

Care coordination model between rural primary care and the TM MOUD provider.

Abbreviations: MOUD, medication treatment for opioid use disorder; TM, telemedicine.

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TABLE 1

Characteristics of patients in the OUD patient registry by referral status

	Patients in the registry (n = 582)	Patients referred to TM (n = 68)	Patients not referred to TM (n = 514)
Age in years (mean [SD])	39.7 (11.8)	38.8 (12.6)	39.8 (11.7)
18–30,%	24.3	32.4	23.2
31–64,%	72.2	63.2	73.4
65 and over, %	3.5	4.4	3.3
Female (%)	43.3	41.2	43.6
Race/ethnicity (%)			
White	93.7	95.5	93.4
Black/African American	0.5	1.5	0.4
Hispanic or Latino	1.6	0.0	1.9
Other	4.2	3.0	4.3
Health insurance (%)			
None	14.5	7.4	15.4
Medicaid	57.4	61.8	56.8
Medicare	9.8	10.3	9.8
Private	17.4	19.1	17.2
Other	0.9	1.5	0.8
Co-occurring diagnosis[a] (%)			
Mental disorder	67.3	63.2	67.7
Chronic pain	44.4	42.7	44.6
Stimulant use disorder*	16.3	25.0	15.2
Patient newly initiated MOUD (%)**	16.0	29.4	14.2
Driving time (in minutes) to clinic (mean [SD])	35.4 (56.3)	37.6 (35.1)	35.1 (58.5)

Abbreviations: OUD, opioid use disorder; TM, telemedicine.

[a]Diagnoses were based on EHR ICD-10 or SNOMED codes.

*$P<.05$.

**$P<.01$ for testing differences between the 2 groups (columns 3 and 4).

TABLE 2

Number of patient-days on MOUD during the 6-month preintervention period and the 6-month intervention period

Site	Pre-intervention	During-intervention	Change	Change per 1,000 patients*	Mean change per 1,000 patients (95% CI mean change) *P*-value	Cohen's *d*
Site 1[a]	1,086	1,307	221	86	132 (−24.4, ∞) $P = .08$	0.55
Site 2[a]	20	476	456	149		
Site 3[b]	1,310	1,379	69	6		
Site 4[b]	2,977	3,028	51	31		
Site 5[c]	39,580	38,540	−1,040	−80		
Site 6[c]	25,855	29,062	3,207	597		
Total	70,828	73,792	2,964	789		

Abbreviation: MOUD, medication treatment for opioid use disorder.

[a]Site with 0–1 prescribers.

[b]Site with 2–3 prescribers.

[c]Site with 3 or more prescribers.

*To adjust for the site's patient population size and derive the patient-days on MOUD per 1,000 patients for each site, the clinic site's number of patient-days on MOUD for each time period was divided by the site's total patient population size and multiplied by 1,000.