

# Advancing Pharmacological Treatments for Opioid Use Disorder (ADaPT-OD): an Implementation Trial in Eight Veterans Health Administration Facilities



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**BACKGROUND:** Identifying effective strategies to improve access to medication treatments for opioid use disorder (MOUD) is imperative. Within the Veterans Health Administration (VHA), provision of MOUD varies significantly, requiring development and testing of implementation strategies that target facilities with low provision of MOUD.

**OBJECTIVE:** Determine the effectiveness of external facilitation in increasing the provision of MOUD among VHA facilities with low baseline provision of MOUD compared to matched controls.

**DESIGN:** Pre-post, block randomized study designed to compare facility-level outcomes in a stratified sample of eligible facilities. Four blocks (two intervention facilities in each) were defined by median splits of both the ratio of patients with OUD receiving MOUD and number of patients with OUD not currently receiving MOUD (i.e., number of actionable patients). Intervention facilities participated in a 12-month implementation intervention.

**PARTICIPANTS:** VHA facilities in the lowest quartile of MOUD provision (35 facilities), eight of which were randomly assigned to participate in the intervention (two per block) with twenty-seven serving as matched controls by block.

**INTERVENTION:** External facilitation included assessment of local barriers/facilitators, formation of a local implementation team, a site visit for action planning and training/education, cross-facility quarterly calls, monthly coaching calls, and consultation.

**MAIN MEASURES:** Pre- to post-change in the facility-level ratio of patients with an OUD diagnosis receiving MOUD compared to control facilities.

**KEY RESULTS:** Intervention facilities significantly increased the ratio of patients with OUD receiving MOUD from an average of 18% at baseline to 30% 1 year later, with an absolute difference of 12% (95% confidence interval [CI]: 6.6%, 17.0%). The difference in differences between intervention and control facilities was 3.0% (95% CI: -0.2%, 6.7%). The impact of the intervention varied by block, with smaller, less complex facilities more likely to outperform matched controls.

**CONCLUSIONS:** Intensive external facilitation improved the adoption of MOUD in most low-performing facilities and may enhance adoption beyond other interventions less tailored to individual facility contexts.

**KEYWORDS:** Substance use disorder; Medication treatment for opioid use disorder; Implementation science; External facilitation; Adoption; Evidence-based practice.

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## BACKGROUND

Opioid use disorder (OUD) poses substantial risks to human life and has long-term, adverse implications for healthcare utilization, risk of infectious disease,<sup>1,2</sup> societal costs,<sup>3,4</sup> and quality of life.<sup>5</sup> Medication treatments for opioid use disorder (MOUD)—including formulations of buprenorphine, methadone, and naltrexone (injectable only)—are the evidence-based, guideline-recommended treatments for OUD.<sup>6-12</sup> Buprenorphine and naltrexone can be provided in outpatient settings (e.g., primary care, mental health), which allows for greater access to care through lower regulatory burden. However, most individuals with OUD never receive MOUD.<sup>13-17</sup>

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As such, increasing access to MOUD is a US priority, including within the Veterans Health Administration (VHA).

The VHA includes the largest system for substance use disorder (SUD) care in the USA.<sup>18</sup> The VHA's efforts over the past decade to improve access to MOUD through mandates, national initiatives, guidelines, and using the facility-level ratio of patients who receive MOUD to patients with OUD diagnoses (MOUD/OUD ratio) as a quarterly performance metric have resulted in a substantial increase in MOUD.<sup>17,19,20</sup> However, access to MOUD care among the 140 VHA facilities varies widely from 1 to 68%<sup>15</sup> with some facilities lagging in the provision of MOUD care both in SUD specialty clinics and other outpatient clinics.

Applying intensive implementation strategies at facilities with low baseline provision of MOUD may improve MOUD uptake. External facilitation is an evidence-based implementation intervention and differs from national, top-down VHA efforts by empowering local clinical teams, building on local resources and strengths, tailoring strategies to specific facility-level barriers, and promoting sustained attention to implementation.<sup>21</sup> External facilitation has been used successfully within VHA to implement other behavioral health interventions including hepatitis prevention services and integration of mental health services into primary care clinics.<sup>22–24</sup> We sought to examine the impact of external facilitation on MOUD implementation within eight VHA facilities that had low rates of baseline MOUD provision, as measured at the facility level by MOUD/OUD ratio (primary outcome). Testing strategies to increase the adoption of MOUD in settings with low MOUD provision is essential to improving access to MOUD and optimizing outcomes for patients with OUD.

## METHODS

### Study Design

The Advancing Pharmacological Treatments for Opioid Use Disorder (ADaPT-OUD) study used a 12-month intensive external facilitation strategy to improve the provision of MOUD in eight VHA facilities in the lowest quartile of MOUD/OUD performance among all VHA facilities.<sup>25</sup> This pre-post block randomized study was designed to compare facility-level outcomes.

### Eligible Facilities

VHA facilities ( $N=140$ ) are located across the USA and provide interdisciplinary healthcare services to veterans. Eligible facilities ( $N=35$ ) were VHA facilities in the lowest quartile of performance on the MOUD/OUD ratio among all VHA facilities as of October 2017 (time of eligibility). We characterized facilities by collecting rurality and facility complexity from administrative data warehouses. Rurality was extracted from the Veteran Affairs Site Tracking (VAST)

system that provides classification based on the Rural–Urban Commuting Areas (RUCA) system.<sup>26</sup> Facility complexity in the VHA is categorized into five groups (highest complexity [level 1a], high complexity [level 1b], mid-high complexity [level 1c], medium complexity [level 2], and low complexity [level 3]) based on the volume of patients, number of high-risk patients, existence of complex clinical programs, and presence of research/education infrastructure. The model that created these five facility complexity groups uses a hierarchical clustering method to assign each medical facility to a group. This method of grouping medical facilities was based on work by Bazzoli and colleagues,<sup>27,28</sup> but the specific variables used were revised to maximize relevance specifically to VHA facilities.

### Randomization and Matching

Facilities were assigned to blocks based on a median split of the MOUD/OUD ratio and number of actionable patients (e.g., patients with OUD diagnoses not currently receiving MOUD): (1) low/low, (2) high/low, (3) low/high, and (4) high/high. Note that all facilities had low MOUD/OUD ratios compared to all other VHA facilities. “High” in this context is relative to the other facilities with low provision of MOUD. Facilities were stratified in this manner as it was expected that baseline rates of MOUD provision and patient load could impact implementation efforts. For example, facilities already implementing MOUD to a substantial portion of patients or with smaller numbers of patients with OUD to manage might have an easier time expanding MOUD provision than those with limited provision and/or very large numbers of patients to manage.

From each block, two facilities were randomly selected, and SUD specialty care clinic leadership was approached to request facility-level participation in the intervention. If SUD leadership at a randomly chosen facility declined participation, another facility from that block was randomly selected to be approached next for recruitment. This process continued until each block had two intervention facilities. Leadership from five facilities declined participation. One additional facility agreed to participate but rescinded agreement shortly before they were to start the implementation phase and was replaced with another randomly selected facility from the same block. Within each block, the remaining facilities were assigned as controls. All control facilities were assigned to one intervention facility resulting in each intervention facility having two to four unique control facilities.

Intervention facilities were scheduled to start the intervention at an approximate rate of two per quarter from March 2018 to February 2019. However, one intervention facility dropped out immediately prior to the start of their intervention period and, as a result, the final replacement facility started in June 2019. We used the Standards for Reporting Implementation Studies (StaRI) checklist to report this implementation

study (Appendix 1).<sup>29</sup> Ethical approval was obtained from the Veterans Affairs Institutional Review Board (#16–23).

## Implementation Intervention

Starting with leadership and clinicians from the SUD specialty clinics, key stakeholders at intervention facilities were identified using a snowball technique and interviewed to identify local barriers and facilitators to MOUD implementation. In qualitative research, the snowball sampling technique refers to identifying one or two people as participants and relying on those individuals to identify additional participants.<sup>30</sup> Interviewees included hospital and clinic leadership and clinicians from a variety of clinics including primary care, general mental health, and pain clinics. Interview data were compiled into a comprehensive facility summary report using rapid qualitative analysis techniques, which are published elsewhere.<sup>31–33</sup> The report included the facility's facilitators, barriers, and potential resource needs to increase MOUD provision. On-site visits were scheduled over 1 to 2 days. Facilities were asked to identify a group of key stakeholders (e.g., facility leaders and clinicians across specialty SUD and general healthcare environments) to serve as the local implementation team. The facility visits consisted of a review of the facility summary report, identification of goals and strategies for local implementation, and education for a broader clinical audience on MOUD topic areas and available resources. X-waiver certification education on buprenorphine prescribing required for providers to prescribe buprenorphine was offered to all facilities; seven of the eight facilities chose to hold this training during the on-site visit.<sup>34</sup> Facility visits were followed by 12 months of external facilitation, including monthly coaching calls, quarterly cross-facility community of practice calls, quarterly facility-level feedback reports including key metrics, and access to expert consultation on MOUD practices. Details on the strategies included in the external facilitation intervention are described in Table 1 and published elsewhere.<sup>25</sup>

## Outcomes

The primary outcome was the MOUD/OD ratio as this is the performance metric related to OUD treatment familiar to VHA providers and administrators. The numerator of the MOUD/OD ratio includes patients receiving buprenorphine, methadone, or naltrexone (injectable only). The ADAPT-OD intervention focused primarily on buprenorphine education and implementation due to the lower regulatory burden of prescribing compared to methadone and the higher level of evidence of effectiveness compared to injectable naltrexone. Therefore, the number of patients with OUD diagnoses receiving a prescription for buprenorphine within the previous 6 months was included as a secondary measure to confirm the impact of the intervention on buprenorphine prescribing specifically.

The MOUD/OD ratio is updated nightly and reported quarterly on a clinical dashboard that can be regularly viewed by VHA operational leadership and clinical partners to evaluate their facility's performance compared to national trends. As such, this ratio was accessible to researchers, stakeholders, and clinicians for timely, transparent discussion regarding progress in the context of the external facilitation implementation intervention. Baseline MOUD/OD ratios were extracted for the quarter prior to the facility visit date because facilities had differing intervention start dates that spanned a 16-month period. Post-intervention MOUD/OD ratios were extracted for the quarter that included the 1-year post on-site visit date. The secondary outcome, the number of patients with OUD diagnoses who received a prescription for buprenorphine within the previous 6 months, is also updated nightly and reported quarterly and was extracted from VHA administrative data at the same quarterly time points as the primary outcome measure.

## Statistical Analysis

For the intervention facilities, we compared the mean baseline ratio of MOUD/OD (quarter prior to site visit) to the mean MOUD/OD ratio captured 12 months after the on-site visit with a 95% confidence interval about this mean. To analyze the data comparing each intervention facility to its matched control facilities, we used a difference-in-differences (DIDs) approach (ratio of MOUD/OD at the 12-month post on-site visit minus baseline). We did this same analysis for each block and for an overall comparison of intervention facilities to control facilities. The DIDs were bootstrapped with 1000 replicates to construct 95% confidence intervals about the sample mean DID by each intervention facility compared to its controls, by block, and for an overall comparison of intervention facilities to control facilities. Analyses were performed using SAS® 9.4 (Cary, NC, USA) and R (R Core Team 2020, Vienna, Austria).

## Sensitivity Analysis

One intervention facility (D2) differed from the other intervention facilities in several key factors. This facility replaced an original facility that dropped out immediately prior to the start of their intervention phase. Therefore, this facility started the implementation phase 4 months later than the others. In addition, this facility had the longest period of time between the determination of eligibility for the study (October 2017) and the baseline assessment of outcome measures (June 2019). During the intervening 20 months, the MOUD/OD ratio at the facility dramatically improved. Finally, because their intervention period ran from June 2019 to June 2020, they were the only facility to be directly impacted by the coronavirus 2019 pandemic during their intervention period. We conducted a sensitivity analysis that excluded this facility using the same analytic methods described above because of these unique circumstances.

**Table 1 Detailed Description of the Implementation Strategies Selected Based on Literature and Expert Recommendations<sup>37,38</sup>**

Implementation strategy	Who enacts the strategy?	What are the actions, steps, or processes enacted?	Who was the implementation target?	When was the strategy used?	What was the dosage of the strategy?
Facilitation	External facilitators	Interact with facility throughout intervention	Local implementation teams	Throughout intervention year	Minimum of one 2-day site visit and monthly calls with as-needed consultation
Conduct local needs assessment	Qualitative core	Interview local stakeholders	Local stakeholders	Prior to site visit	Up to 10 interviews per facility
Identify barriers and facilitators	Qualitative core	Rapid analysis of stakeholder interviews to formulate facility report	Local implementation teams	Prior to site visit	N/A
Capture and share local knowledge	External facilitators	Review of local facility report with local implementation teams	Local implementation teams	During site visit	2 h during site visit dedicated to reviewing and verifying site report
Identify and prepare champions	External facilitators	Champions identified through pre-intervention interviews, site visit planning process, and interactions during site visit	Local stakeholders	Prior to and during site visit	N/A
Conduct educational meetings	Clinical expert	Requested educational offerings presented during site visit	Facility clinicians	During site visit	8 h during site visit
Organize clinician implementation meetings	External facilitators	Facility coaching calls; cross-facility community of practice calls	Facility implementation teams	Facility: during facility intervention year Cross-facility: while any sites were active in intervention	Facility: 1/month × 12 months Cross-facility: 1/-quarter × 8 quarters*
Audit and feedback	External facilitators	Provide facility implementation team with report of main implementation outcomes	Facility implementation teams	During facility intervention year	Quarterly for 4 quarters
Change in credentialing or licensure standards	External facilitators along with VHA national leadership	Release of national notification instructing facilities not to place additional credentialing/privileging requirements on new prescribers beyond documentation of X-waiver	Credentialing and privileging departments at VHA facilities	Notification published October 2019	N/A
Develop/distribute educational materials	External facilitators	Facilitators compiled a large library of print and online materials addressing various educational needs; provided to facilities as requested to address knowledge gaps	Facility implementation teams and clinicians	Throughout intervention period	As requested
Provide ongoing consultation	Clinical expert	Clinical expert available as needed to consult regarding clinical care	Facility clinicians	Throughout intervention period	As requested
Tailor strategies	External facilitators	External facilitators used information from site reports, site visits, and facilitation calls to identify barriers to implementation and provide facilities with needed resources	Facility implementation team and clinicians	Throughout intervention period	N/A

\*Cross-facility conference calls ran from 3 months after the first sites started the intervention until the last site completed the intervention for a total of 8 calls in 24 months

## RESULTS

### Facility Characteristics

Facility characteristics, including facility complexity and rurality, at the time of eligibility are outlined by block (Table 2). The MOUD/OD ratio ranged from 3.7 to 19.4% for intervention facilities ( $N=8$ ) and 5.0 to 20.0% for matched control facilities ( $N=27$ , 2–4 matched controls per intervention facility). The number of actionable patients ranged from 141 to 955 for intervention facilities and 88 to 1757 for matched control facilities.

### MOUD/OD Ratio

Table 3 presents the changes in MOUD/OD ratio at the intervention facilities and control facilities, as well as the DID analysis comparing intervention and matched control facilities from pre- to post-implementation. All intervention facilities, with the exception of D2 (mentioned above in sensitivity analysis), had increases on the MOUD/OD ratio from pre- to post-implementation. Overall, there was a significant increase in the MOUD/OD ratio for intervention facilities of 12% (95% confidence interval [CI]: 6.6%, 17.4%). Control

Table 2 Facility Characteristics by Block at the Time of Eligibility

Block*	Intervention-control facility identification	MOUD/OD ratio <sup>†</sup>	# of actionable patients <sup>‡</sup>	Facility complexity <sup>§</sup>	Urban or rural	
<b>A: low MOUD/OD and low # of actionable patients</b>	Intervention-A1	3.7%	141	3: low	Rural	
	Control-1	6.3%	252	1c: mid-high	Urban	
	Control-2	6.3%	300	1c: mid-high	Urban	
	Control-3	8.3%	210	3: low	Rural	
	Control-4	11.7%	335	2: medium	Urban	
	Intervention-A2	8.5%	238	2: medium	Rural	
	Control-1	6.2%	289	2: medium	Urban	
	Control-2	9.3%	297	2: medium	Urban	
	Control-3	12.4%	305	3: low	Urban	
	Control-4	13.8%	432	3: low	Urban	
	<b>B: high MOUD/OD and low # of actionable patients</b>	Intervention-B1	15.6%	178	3: low	Urban
		Control-1	15.3%	164	2: medium	Rural
Control-2		15.4%	88	2: medium	Urban	
Control-3		18.6%	128	2: medium	Urban	
Intervention-B2		18.8%	411	2: medium	Urban	
Control-1		15.5%	374	1c: mid-high	Urban	
Control-2		16.4%	550	1c: mid-high	Urban	
Control-3		19.1%	441	1c: mid-high	Urban	
<b>C: low MOUD/OD and high # of actionable patients</b>		Intervention-C1	5.1%	629	3: low	Urban
		Control-1	5.0%	453	3: low	Urban
		Control-2	9.1%	472	1a: highest	Urban
		Intervention-C2	13.7%	647	3: low	Urban
	Control-1	12.3%	540	1c: mid-high	Urban	
	Control-2	14.0%	1416	1c: mid-high	Urban	
<b>D: high MOUD/OD and high # of actionable patients</b>	Control-3	14.7%	1040	1b: high	Urban	
	Intervention-D1	13.9%	871	1a: highest	Urban	
	Control-1	15.7%	1757	1c: mid-high	Urban	
	Control-2	16.7%	593	1b: highest	Urban	
	Control-3	17.0%	796	1c: mid-high	Urban	
	Control-4	19.4%	618	1c: mid-high	Rural	
	Intervention-D2	19.4%	955	1b: high	Urban	
	Control-1	17.7%	690	1c: mid-high	Rural	
	Control-2	19.0%	512	1c: mid-high	Urban	
	Control-3	19.1%	529	3: low	Rural	
Control-4	20.0%	577	2: medium	Urban		

\*The four blocks, collectively, were in the lowest quartile for MOUD/OD ratios out of all 140 VHA facilities at the time of eligibility. Blocks consisted of facilities grouped by how they compared to the median MOUD/OD ratio and the median number of actionable patients. The medians were the cut-offs to determine low and high groups of each on these two facility-level variables

<sup>†</sup>Calculated as of quarter-level data (July–September) 2017

<sup>‡</sup>Calculated as of October 6, 2017

<sup>§</sup>Facility complexity model in the VHA is categorized into five groups (highest complexity [level 1a], high complexity [level 1b], mid-high complexity [level 1c], medium complexity [level 2], and low complexity [level 3]) based on the volume of patients, number of high-risk patients, existence of complex clinical programs, and presence research/education infrastructure

facilities also demonstrated an increase in the MOUD/OD ratio with an overall mean increase of 9% (95% CI: 6.7%, 11.4%). The overall DID between all intervention and control facility MOUD/OD ratios was positive at 3.0%, but not significant (95% CI: -0.2%, 6.7%). Block B (high MOUD/OD and low # of actionable patients) and block C (low MOUD/OD and high # of actionable patients) demonstrated significant DIDs of 6.9% (95% CI: 2.5%, 10.7%) and 9.0% (95% CI: 4.8%, 13.2%), respectively. For block A (low MOUD/OD and low number of actionable patients), the DID was positive at 4.0% but not significant (95% CI: -0.2%, 8.7%). Block D (high MOUD/OD and high # of actionable patients) showed a significant DID of -7.8% (95% CI: -11.3%, -4.0%).

### Number of Patients Prescribed Buprenorphine

Table 4 presents the facility-level differences in the number of patients prescribed buprenorphine for both intervention and

control facilities, as well as the DID analysis comparing intervention and matched control facilities from pre- to post-implementation. The results for the number of patients prescribed buprenorphine mirror those for the MOUD/OD ratio. All intervention facilities, with the exception of D2, had increases in number of patients prescribed buprenorphine from pre- to post-implementation. Overall, there was a significant increase in patients prescribed buprenorphine for the intervention facilities from pre- to post-implementation (mean 41.8, 95% CI: 18.3, 61.0). Control facilities also demonstrated an increase in the number of patients prescribed buprenorphine (mean 29.4, 95% CI: 15.9, 41.6). The overall DID between intervention and control facilities for the number of patients prescribed buprenorphine was positive but not significant at 13.2 (95% CI: -4.8, 31.0). Block A (low MOUD/OD and low # of actionable patients) and block B (high MOUD/OD and low # of actionable patients) demonstrated significant DIDs of 21.3 patients (95% CI: 4.3, 33.0) and 33.0 (95% CI:

Table 3 Difference in Differences in MOUD/OD Between Intervention and Control Facilities from Pre- to 12 Months Post-Facilitation

Block*	Intervention facilities	Intervention facilities MOUD/OD			Control facilities MOUD/OD			Difference in differences	
		Pre <sup>†</sup>	Post <sup>‡</sup>	Difference	Pre <sup>†</sup>	Post <sup>‡</sup>	Difference	Difference in differences <sup>§</sup>	95% CI <sup>  </sup>
A: low MOUD/OD and low # of actionable patients	A1	4.0%	18.2%	14.2%	9.2%	19.4%	10.2%	4.0%	(−1.5%, 8.5%)
	A2	10.3%	26.2%	15.9%	21.0%	32.8%	11.8%	4.1%	(−3.5%, 11.7%)
	<b>Block A mean</b>	<b>7.2%</b>	<b>22.2%</b>	<b>15.0%</b>	<b>15.1%</b>	<b>26.1%</b>	<b>11.0%</b>	<b>4.0%</b>	<b>(−0.2%, 8.7%)</b>
B: high MOUD/OD and low # of actionable patients	B1	15.6%	35.9%	20.3%	18.6%	30.9%	12.3%	8.0%	(−0.2%, 15.4%)
	B2	32.9%	42.4%	9.5%	22.9%	26.6%	3.7%	5.8%	(1.5%, 8.6%)
	<b>Block B mean</b>	<b>24.2%</b>	<b>39.2%</b>	<b>15.0%</b>	<b>20.7%</b>	<b>28.8%</b>	<b>8.1%</b>	<b>6.9%</b>	<b>(2.5%, 10.7%)</b>
C: low MOUD/OD and high # of actionable patients	C1	5.2%	26.1%	20.9%	9.6%	19.3%	9.7%	11.2%	(8.0%, 14.6%)
	C2	18.6%	31.3%	12.7%	26.4%	32.2%	5.8%	6.9%	(2.8%, 10.7%)
	<b>Block C mean</b>	<b>11.9%</b>	<b>28.7%</b>	<b>16.8%</b>	<b>18.0%</b>	<b>25.8%</b>	<b>7.8%</b>	<b>9.0%</b>	<b>(4.8%, 13.2%)</b>
D: high MOUD/OD and high # of actionable patients	D1	22.4%	26.1%	3.7%	17.8%	28.3%	10.5%	−6.8%	(−10.1%, −1.0%)
	D2	34.9%	33.5%	−1.4%	28.6%	36.0%	7.4%	−8.9%	(−14.6%, −4.7%)
	<b>Block D mean</b>	<b>28.7%</b>	<b>29.8%</b>	<b>1.1%</b>	<b>23.2%</b>	<b>32.1%</b>	<b>8.9%</b>	<b>−7.8%</b>	<b>(−11.3%, −4.0%)</b>
<b>Total</b>	<b>Overall mean</b>	<b>18.0%</b>	<b>30.0%</b>	<b>12.0%</b>	<b>19.2%</b>	<b>28.2%</b>	<b>9.0%</b>	<b>3.0%</b>	<b>(−0.2%, 6.7%)</b>

\*The four blocks were defined by being in the lowest quartile for MOUD/OD ratios out of all 140 VHA facilities at the time of eligibility. Blocks consisted of the median MOUD/OD ratio, and the median number of actionable patients were the cut-offs to determine low and high groups of each on these two facility-level variables

<sup>†</sup>Data were extracted from the quarter just prior to the facility visit date

<sup>‡</sup>Data were extracted from the quarter that included the 1-year post facility visit date

<sup>§</sup>Difference in differences is post minus pre for each intervention facility minus the mean post-pre of its matched control facilities

<sup>||</sup>95% confidence intervals (CI) bootstrapped with 1000 replicates

9.8, 52.5), respectively. Block C (low MOUD/OD and high # of actionable patients) DID was positive at 35.5 patients, but not significant (95% CI: −0.02, 67.0). Block D (high MOUD/OD and high # of actionable patients) showed a significant DID of −36.9 patients (95% CI: −70.9, −10.0).

### Sensitivity Analysis

As described above in the “Methods” section, facility D2 differed from other facilities in several ways. With this facility excluded, the DID between intervention and control facilities on MOUD/OD ratio change from pre- to post-implementation was significant at 4.7% (95% CI: 1.1%, 7.9%). The DID between intervention and control facilities on number of patients prescribed buprenorphine was also significant (23.0 patients, 95% CI: 6.1, 39.5).

### DISCUSSION

The ADaPT-OD external facilitation intervention resulted in an overall significant improvement in MOUD for facilities with low baseline provision of MOUD, as evidenced by significant increases in the MOUD/OD ratio and number

of patients prescribed buprenorphine. Intervention facilities combined treated an additional 334 patients with buprenorphine during the intervention period, which is important when considering the high rate of mortality among patients with OUD who are untreated. It is not surprising that the matched control facilities also improved. During the study period, there was national and VHA focus on addressing the opioid crisis; for example, the VHA mandated evidence-based MOUD be made available to appropriate patients in the clinical setting in which they present.<sup>17,19</sup> Within VHA, other efforts in place to improve MOUD adoption involved the inclusion of the MOUD/OD ratio as a key performance metric, an academic detailing campaign which provided outreach visits to providers to educate them about MOUD, and the Stepped-Care for Opioid Use Disorder Train the Trainer (SCOUTT) Initiative,<sup>35</sup> which aimed to increase access to MOUD in non-SUD specialty care clinics. In addition, several other large research programs were aimed at impacting MOUD adoption within various environments including community-based clinics, inpatient, and emergency room settings.<sup>36</sup>

While the overall difference in differences between intervention and control facilities was not significant, three of four intervention blocks outperformed their control sites on either

Table 4 Difference in Differences in the Number of Patients Receiving Buprenorphine Between Intervention and Control Facilities

Block*	Intervention facilities	Intervention facilities # of buprenorphine patients			Control facilities # of buprenorphine patients			Difference in differences	
		Pre <sup>†</sup>	Post <sup>‡</sup>	Difference	Pre <sup>†</sup>	Post <sup>‡</sup>	Difference	Difference in differences <sup>§</sup>	95% CI <sup>  </sup>
A: low MOUD/OD and low # of actionable patients	A1	1.0	36.0	35.0	4.0	13.5	9.5	25.5	(16.0, 33.3)
	A2	2.0	44.0	42.0	32.3	57.3	25	17.0	(-11.4, 45.9)
	<b>Block A mean</b>	<b>1.5</b>	<b>40.0</b>	<b>38.5</b>	<b>18.1</b>	<b>35.4</b>	<b>17.3</b>	<b>21.3</b>	<b>(4.3, 33.0)</b>
B: high MOUD/OD and low # of actionable patients	B1	27.0	39.0	12.0	15.7	18.7	3.0	9.0	(3.0, 12.0)
	B2	78.0	156.0	78.0	23.7	44.7	21.0	57.0	(34.0, 72.0)
	<b>Block B mean</b>	<b>52.5</b>	<b>97.5</b>	<b>45.0</b>	<b>19.7</b>	<b>31.7</b>	<b>12.0</b>	<b>33.0</b>	<b>(9.8, 52.5)</b>
C: low MOUD/OD and high # of actionable patients	C1	0.0	36.0	36.0	4.0	35.0	31.0	5.0	(-39.1, 48.7)
	C2	52.0	150.0	98.0	114.3	146.3	32.0	66.0	(30.0, 98.0)
	<b>Block C mean</b>	<b>26.0</b>	<b>93.0</b>	<b>67.0</b>	<b>59.2</b>	<b>90.7</b>	<b>31.5</b>	<b>35.5</b>	<b>(-0.2, 67.0)</b>
D: high MOUD/OD and high # of actionable patients	D1	123.0	156.0	33.0	109.3	161.0	51.8	-18.8	(-53.0, 15.5)
	D2	169.0	169.0	0.0	120.0	175.0	55.0	-55.0	(-109.4, -16.5)
	<b>Block D mean</b>	<b>146</b>	<b>162.5</b>	<b>16.5</b>	<b>114.6</b>	<b>168.0</b>	<b>53.4</b>	<b>-36.9</b>	<b>(-70.9, -10.0)</b>
<b>Total</b>	<b>Overall mean</b>	<b>56.5</b>	<b>98.3</b>	<b>41.8</b>	<b>52.9</b>	<b>81.5</b>	<b>28.6</b>	<b>13.2</b>	<b>(-4.8, 31.0)</b>

\*The four blocks were defined by being in the lowest quartile for MOUD/OD ratios out of all 140 VHA facilities at the time of eligibility. Blocks consisted of the median MOUD/OD ratio, and the median number of actionable patients were the cut-offs to determine low and high groups of each on these two facility-level variables

<sup>†</sup>Data were extracted from the quarter just prior to the facility visit date

<sup>‡</sup>Data were extracted from the quarter that included the 1-year post facility visit date

<sup>§</sup>Difference in differences is post minus pre for each intervention facility minus the mean post-pre of its matched control facilities

<sup>||</sup>95% confidence intervals (CI) bootstrapped with 1000 replicates

the MOUD/OD ratio or the number of patients prescribed buprenorphine. In addition, a sensitivity analysis demonstrated that the removal of the one outlier site (D2) resulted in the remaining intervention facilities outperforming control facilities on both outcome measures. This provides a strong signal for the impact of facility-specific external facilitation on the adoption of MOUD beyond other, concurrent efforts. While mandates and many other national efforts assisted in raising the relative priority of MOUD access nationally, individual facilities continue to lag in optimal implementation of MOUD and additional, more intensive efforts are required to assist these facilities. These findings have important implications for organizational investment in external facilitation for healthcare settings with low adoption of MOUD. Future work will clarify the cost of the external facilitation in comparison to the impact of increased access to MOUD on patient-level healthcare expenses as well as facility, provider, and patient factors that may predict greater facility adoption of MOUD.

Despite these results, the impact of the intervention was not consistent across facilities. Block D underperformed in comparison to the other blocks. Block D included facilities that, while still low adopting compared to VHA facilities overall, were at the higher end of the MOUD/OD ratio among intervention facilities at baseline. Because the MOUD/OD metric is used to evaluate overall VHA facility-level performance, the lower a facility ranks on this metric, the more likely it is to draw the attention of facility-level leaders. Block D facilities were also the only intervention facilities categorized as high complexity. While high complexity indicates a higher level of resources, it also indicates greater numbers of providers, larger volumes of patients, more high-risk patients, and the presence of complex clinical programs. The combination of high volumes of actionable patients and the high complexity of the facilities may make it more difficult to establish the relationships needed to communicate and collaborate across service lines to effectively increase MOUD adoption.

## Limitations

There are limitations of our study. First, there is a potential for type II error given that the sample size was small and may not be powered to detect clinically meaningful DID, particularly at the block or individual facility level. Despite the non-significant findings, it is important for decision-makers to know that intervention facilities, on average, had greater MOUD provision after implementation. Given the small sample size, it was also not feasible to control for facility characteristics that may have impacted MOUD adoption although the difference-in-difference design focuses on differences in improvements, and in that sense, reduces the importance of baseline differences. Second, the full effect of the external facilitation implementation intervention may not have been captured in the 12-month time. We may see a further impact on MOUD provision in the sustainability period as facilities leverage the momentum garnered during the implementation period. Future work will assess for maintenance or ongoing improvement at intervention facilities during the sustainability phase. Finally, this study was conducted in the VHA system which limits generalizability to non-VHA systems. Most notably, SUD specialty care clinics are co-located within many VHA facilities. Co-location within the facility presumably makes it easier to coordinate care for patients with OUD across clinical settings.

The VHA system has distinctive aspects, including co-location of SUD specialty care and a different reimbursement structure. However, one of the key features of the external facilitation intervention described here is the flexibility to account for the unique resources, barriers, and organizational structures of a system or facility when developing facility-specific implementation plans. Therefore, this intervention could serve as a useful model to guide other large healthcare systems and payers interested in increasing access to MOUD within various clinical settings. Future research testing the external facilitation intervention in non-VHA settings is needed to both investigate the impact of the external facilitation intervention on MOUD adoption and adapt it for other organizational contexts.

## CONCLUSIONS

An intensive external facilitation intervention improved the provision of MOUD in most VHA facilities with low provision of MOUD care. The variation in impact of the intervention may be accounted for by the heterogeneity in facility characteristics, even among facilities with low provision of MOUD at baseline. Importantly, we demonstrated clinically meaningful improvements in most facilities and provided a foundation for continued gains. Healthcare systems may consider such external facilitation interventions for facilities struggling to expand provision of MOUD.

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## Declarations:

**Conflict of Interest:** The authors declare that they do not have a conflict of interest.

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