The association between attitudes and the provision of medications for opioid use disorder (MOUD) in United States jails

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HIGHLIGHTS

- Negative staff attitudes among 43 jails may prevent the provision of MOUD in jails.
- Negative staff attitudes were related to steps of MOUD care in jails.
- Fewer screenings, referrals, and diagnoses were associated with negative attitudes.
- Attitudes towards methadone, specifically, were also related to MOUD provision.

ABSTRACT

Background: Opioid use disorder is prevalent among individuals who are incarcerated, yet medications for opioid use disorder (MOUD) are not widely available in United States jails and prisons. Negative staff attitudes across the criminal legal system may prevent MOUD from being provided. We sought to determine if staff attitudes are associated with the provision of MOUD in prisons or jails.
Methods: 227 staff members of 43 jails and partnering community-based treatment providers answered questions on the effectiveness and acceptability of methadone, buprenorphine, and naltrexone. Response patterns were summarized with principal component analysis. Mixed-effects regression was performed to determine if attitudes toward MOUD were associated with the number of individuals screened and diagnosed with an OUD, referred to treatment, provided MOUD and referred to treatment after release.
Results: Sites whose staff had negative attitudes towards methadone and positive attitudes towards naltrexone were associated with fewer people being screened (Mean ratio [MR] = 0.84, 95 % CI: [0.72, 0.97]), diagnosed (MR = 0.85, 95 % CI: [0.73, 0.99]), referred (MR = 0.76, 95 % CI: [0.65, 0.89]), provided MOUD (MR = 0.70, 95 % CI: [0.58, 0.84]), and referred after release (MR = 0.82, 95 % CI: [0.72, 0.94]). Sites with overall positive attitudes towards all MOUD were associated with more people being screened (MR = 1.16, 95 % CI: [1.01, 1.34]), diagnosed (MR = 1.37, 95 % CI: [1.18, 1.60]), and referred to treatment (MR = 1.41, 95 % CI: [1.20, 1.65]).
Conclusions: Attitudinal barriers exist in the criminal legal system and are associated with the provision of MOUD.

1. Introduction

Opioid use disorder (OUD) is prevalent among individuals incarcerated in jails and prisons across the United States. A 2007–2009 survey determined that over half of individuals in state prisons (58 %) and two-thirds of those in jail settings (63 %) met the criteria for drug dependence or misuse. Additionally, 4 in 10 individuals used drugs at the time of the offense for which they were incarcerated, 7 % of which reported opioid use. Furthermore, one-fifth (19 %) of those in jail settings reported regular opioid use (Bronson et al., 2017). Although these

statistics are outdated, the opioid epidemic has only worsened in the past decade, and therefore, they may underestimate the number of individuals who are incarcerated with an OUD (Centers for Disease Control and Prevention, 2022). Despite the data illuminating the need of individuals who are incarcerated for OUD treatment, many jails and prisons are not well equipped to treat and care for individuals with an OUD.

The dangers of being formerly incarcerated with an OUD cannot be understated. Research has determined that those with OUDs are at a greater risk of dying from an overdose upon their release from incarceration (Merrall et al., 2010). This risk of a overdose-related death is greatest in the two weeks that follow an individual's release and has been estimated to be twelve times greater compared to non-incarcerated individuals (Binswanger et al., 2007). The increased risks of a drug-related death or a fatal overdose are likely due to the forced withdrawal or 'detoxification' many individuals undergo while incarcerated, which may influence their tolerance to opioids (Binswanger et al., 2007, 2012). However, evidence-based treatments have proven effective at mitigating the heightened risk of a drug-related death among former incarcerated individuals (Joudrey et al., 2019).

Evidence-based and FDA-approved treatments for an OUD include methadone, buprenorphine, and naltrexone, or collectively, medications for opioid use disorder (MOUD). These medications are available in various forms, including oral tablets and monthly injections. MOUD have proven to mitigate the risk of overdose upon release from incarceration (Cates and Brown, 2023). Individuals who were provided methadone during their incarceration experienced fewer non-fatal overdoses 12 months after their release compared to individuals who experienced forced withdrawal (Brinkley-Rubinstein et al., 2018). In fact, the risk of a fatal overdose after release from jail was reduced by 80 % by providing methadone or buprenorphine just three days before the scheduled release (Lim et al., 2023). Providing MOUD to individuals who are incarcerated not only reduces the risk of overdose, but also reduces the likelihood of heroin or injection drug use after release (Moore et al., 2019). Furthermore, individuals who received MOUD during incarceration were more likely to continue treatment in the community after being released (Martin et al., 2023; Rich et al., 2015; Zaller et al., 2013). Lastly, providing MOUD during incarceration may be associated with decreased recidivism (Evans et al., 2022). Despite the marked effectiveness of MOUDs, they are limited in United States carceral facilities.

All three forms of are not widely available in United States prisons and jails. According to research from 2021, 90 % of state prison systems provide MOUD, yet only 7 % of state prisons provided all three MOUD (Scott et al., 2021). Most jails (92 %) provide some form of MOUD, yet only 20 % of these jails provide these medications to anyone who has been diagnosed with an OUD (Scott et al., 2022). It is important to identify and understand barriers to MOUD in the criminal legal system.

Four types of barriers – institutional, programmatic, systemic, and attitudinal – have been hypothesized to explain the lack of availability of MOUD in prisons and jails (Grella et al., 2020; Mackey et al., 2020). The present paper is concerned with attitudinal barriers. Attitudinal barriers exist due to the negative attitudes, biases and misconceptions individuals may have regarding MOUD. In a survey of stakeholders in rural Ohio, law enforcement and judicial officials expressed the belief that using MOUD is continued drug use and should only be used as a short-term treatment option (Richard et al., 2020). Similar beliefs were found after surveying criminal legal staff, in which staff that believed addiction was a moral weakness had more negative attitudes about MOUD (Moore et al., 2022). A survey of first responders, including police and paramedics, found most participants had moderately negative attitudes towards MOUD. Most notably, only a quarter of the sample of the first responders agreed that 'MOUD is a good investment for our society' (Kruis et al., 2021). A survey of court employees, including judges, probation officers, and law enforcement personnel, found the attitudes towards MOUD differed by the medication. Court employees

found naltrexone to be more favorable compared to methadone and buprenorphine, with employees expressing the most negative attitudes towards methadone (Andraka-Christou et al., 2019). Altogether, these studies have determined that negative attitudes towards MOUD exist within all facets of the criminal legal system. Additional analyses are essential in determining how these negative attitudes affect the provision of MOUD for justice-involved populations.

The objective of this analysis is to determine how staff attitudes regarding the acceptability and effectiveness of MOUD are associated with the provision of MOUD in a jail setting. The provision of MOUD in jails is modeled by a cascade of care (Williams et al., 2019), beginning first with screening individuals for an OUD, next diagnosing individuals with an OUD, then referring individuals with an OUD to treatment, providing MOUD, and finally, referring individuals to treatment post-release. We hypothesize that (1) more individuals will be screened, diagnosed, referred, and treated with MOUD in jail facilities with staff that have positive attitudes towards MOUD and (2) any increase in persons diagnosed, referred, and treated due to positive attitudes can be attributed, at least in part, to the positive association between positive attitudes and prior steps of the cascade of care.

2. Material and methods

2.1. Study design

This paper presents an exploratory analysis of data collected through the Fostering MOUD Use in Justice Populations Study. Study details can be found in the published protocol (Molfenter et al., 2021). Briefly, this study is an ongoing randomized control trial funded through the NIH HEAL Initiative and conducted by researchers at the University of Wisconsin-Madison and George Mason University. The study included jails partnered with a community-based treatment provider ($n = 12$), the community-based treatment providers (CBTP) that partnered with the jails ($n = 17$), and jails without a partnering treatment provider ($n = 14$). Jails recruited to participate in the parent study had demonstrated interest in implementing or expanding MOUD practices at their jail.

As part of participation in the parent study, each site was randomly assigned to a study arm with varying levels and types of coaching. Additionally, staff members from each site completed a survey to collect their beliefs regarding organizational readiness for implementing change and program sustainability, as well as their attitudes towards MOUD. Lastly, sites provided reports of outcomes on a month-by-month basis related to the provision of MOUD-related resources. While the primary goal of the larger study is to determine how these interventions affect the implementation or expansion of MOUD among participating jails, the present paper focuses on measuring the association between the beliefs of staff members and the monthly MOUD outcomes.

2.2. Predictor variables

The survey administered to staff of jails and CBTPs included internally developed questions to assess staff attitudes (Knudsen et al., 2005). These questions asked participants to rate their belief in the effectiveness and acceptability of 5 types of MOUD (methadone, buprenorphine (oral), buprenorphine (monthly injection), naltrexone (oral), and naltrexone (monthly injection)) for use within justice involved populations on scale a of 1 (very effective/very acceptable) to 7 (not at all effective/not at all acceptable) or 'Don't Know' (Molfenter et al., 2021) (see Supplementary Material A).

2.3. Outcome variables

Participating sites were asked to provide monthly data tracking reports, which included five MOUD outcomes: number of new individuals screened for an OUD, number of new individuals identified as having an OUD, number of new individuals referred to treatment while

incarcerated, number new of individuals receiving MOUD, and number of new individuals referred to treatment after release. Sites provided these data each month for up to 24 months. For the purposes of this study, the first six months of jail MOUD data were utilized. Six months of data were chosen as the data were representative of the typical amount of individuals provided MOUD in the jail, and the jails were less likely to have been affected by the randomized treatment of the parent study. Five months of data were used for one jail, as they only provided five months of data. If the first six months of data were complete, they were utilized. If incomplete, and the jail did not provide all relevant MOUD data, the next sequence of complete data was utilized.

2.4. Pre-processing of data

2.4.1. Missing data procedure

A total of 292 staff members were identified to complete the staff survey. Of the 292 staff members, 253 (95.8 %) began the survey. However, only 227 (86.0 %) participants completed the survey. Participants were excluded from the final sample if their site of employment did not provide MOUD outcome data. Additionally, participants were excluded if they did not complete at least one of the 10 questions of interest. In total, 50 participants were excluded, and 242 participants remained in the study.

Responses that were marked as 'Don't Know' were assigned a value of 4, chosen as it is the median value of the possible scores and reflects ambivalence between the options of 1 (very effective/acceptable) and 7 (not at all effective/acceptable). A sensitivity analysis was also performed to ensure the results did not change due to this assignment (see Supplemental Material B). Missing responses were imputed using Markov Chain Monte Carlo multiple imputation (see Supplemental Material C for details). SAS code for multiple imputation and all subsequent analyses is available in Supplemental Material D.

2.4.2. Dimension reduction of staff responses

Principal components analysis (PCA) was chosen to summarize and simplify responses to the 10 questions of interest. Several factors influenced this choice. We expected a strong correlation among responses, making it challenging to isolate their individual effects on outcomes. For example, including multiple correlated responses in a regression model leads to wide confidence intervals due to multicollinearity. Alternatively, analyzing responses one at a time can make it hard to identify which one drives associations with outcomes. To address this, popular techniques like PCA or factor analysis create less correlated variables that still capture the variation in responses across persons. While factor analysis posits a model in which latent factors generate responses, PCA adds and re-scales responses to create principal components that maximize explained variation. Lacking a specific theory for latent factors, we chose PCA over factor analysis in order to directly measure and explicitly interpret the variables generated.

Eigenvalues of the correlation matrix were calculated, and the number of principal components was selected according to how many eigenvalues were greater than one (Kaiser, 1960). A scree plot was also used to support the choice in the number of principal components. Once the number of principal components was chosen, a model was fitted to the staff response data, from which a loading matrix could be recovered and scores could be calculated for each staff member. The principal components were interpreted based on the loading matrix, which measures the degree to which a response is an indicator of the underlying principal component. The scores, which estimate the value that each component takes for a given person, were calculated through use of PROC SCORE in SAS and were carried forward to subsequent analyses.

2.5. Mixed-effects regression analysis

Mixed-effects regression was performed to measure associations between attitudes towards MOUD and each of the five MOUD outcome

variables: the number of individuals screened for an OUD, diagnosed with an OUD, referred to treatment, received MOUD, and referred after release. In total, five mixed-effects regression analyses were performed. Each regression model described the log of the given outcome variable as a function of the predictor variables, two control variables, and random effects. The predictor variables were the principal components identified in 2.4.2. Control variables were the random study arm assignment (four intervention groups) and the month of site data as a categorical variable. Random effects were included to account for correlated outcomes due to repeated measures and clustering of staff within a site. These effects included a random intercept generated by nesting the participant ID within the site ID and a random intercept generated for each participant. Each outcome was log-transformed to account for positive skewness and for the lack of a suitable site-specific denominator to normalize the outcome variables (e.g., jail population). After a log transformation, any denominator is now captured by the random effects. The analysis was performed in SAS using PROC GLIMMIX with a distribution option set to log-normal, which models the log of the outcome as a normal random variable. The parameter estimates of the regression model were input to PROC MIANALYZE, and 95 % confidence intervals were obtained for the exponentiated regression coefficient associated with each principal component. Additionally, a two-tailed Wald z test was performed to test if a given coefficient differed significantly from zero. Significance was considered a *p* value less than 0.05.

2.6. Mediation analysis

Mediation analysis was performed in order to identify how the significant associations determined in 2.5 are mediated by upstream MOUD outcomes: the number of individuals screened for an OUD, diagnosed with an OUD, referred to treatment, received MOUD, and referred after release. Diagrams are provided in Supplemental Material E to aid in the interpretation of these analyses. For each outcome, this analysis consisted of building a regression model for the outcome and a regression model for each mediator (i.e. upstream MOUD outcome). Both outcome and mediator regression models were identical to the models developed in 2.5 with one exception: the outcome model included the log of all upstream MOUD outcomes as fixed effects.

For each of the five mediation analyses, estimated coefficients from outcome and mediator models were used to calculate mediating effects known as natural direct effects and natural indirect effects (Imai et al., 2010; Vander Weele and Vansteelandt, 2014). In keeping with how mediation analyses are typically reported, the term 'effect' was used, but we caution the reader that, to be interpreted causally, these effects require prohibitively strong assumptions. Natural direct effects were defined to be the regression coefficients in the outcome model associated with the predictors. It represents the "direct" effect of staff attitudes on a MOUD outcome upon keeping the effect of staff attitudes on upstream outcomes fixed. Natural direct effects were reported only for those principal components originally found to be significant predictors of the given outcome. For a given predictor-mediator pair, a natural indirect effect is defined to be the product of the regression coefficient in the outcome model associated with a mediator and the regression coefficient in the mediator model associated with the predictor. Natural indirect effects represent the "indirect" effect of staff attitudes on MOUD outcomes that is due to induced changes to upstream MOUD outcomes. Natural indirect and direct effects are also represented as percentages of the total effect, which is the regression coefficient associated with the predictor in the corresponding model developed in 2.5.

Additionally, confidence intervals for total, natural direct, and natural indirect effects were obtained. Total and natural direct effects were recovered directly from SAS output. Confidence intervals for indirect effects were recovered by following the approach described in Eqs. (6) and (7) of MacKinnon et al. (2004) to account for the non-normality and asymmetry of distributions of indirect effects.

3. Results

3.1. Summary information of sites

In total, 43 sites were included in this analysis. Across all sites, the following 14 states were represented in the study: (California ($n = 4$), Colorado ($n = 1$), Florida ($n = 2$), Hawaii ($n = 3$), Kansas ($n = 1$), Maine ($n = 5$), Maryland ($n = 5$), Minnesota ($n = 2$), Missouri ($n = 1$), New York ($n = 5$), Ohio ($n = 4$), Virginia ($n = 6$), Washington ($n = 2$), and Wisconsin ($n = 2$)). Most jails (46.1 %) deliver healthcare to individuals who are incarcerated through a contracted model, in which a vendor is contracted to provide healthcare for the jail. The majority of jails screened for opioid use problems (88.5 %), notably through self-reported days of opioid use, clinical assessment or urinalysis. The majority of jails provided at least one MOUD (92.3 %), with naltrexone and buprenorphine being provided in more jails than methadone.

Across the 43 sites, an average of 130.6 (SD=194.6) individuals were screened for an OUD and an average of 34.0 (SD=61.3) individuals were diagnosed with an OUD. Furthermore, 28.0 (SD=60.5) individuals, on average, were referred to treatment for an OUD and an average of 56.3 (SD = 124.6) individuals received MOUD. Lastly, an average of 5.8 (SD=12.4) individuals were referred to treatment in the community after release. A histogram of the number of staff survey participants across 43 sites is provided in Supplemental Material A (Fig. S3).

3.2. Summary information of staff survey participants

Of the 242 staff survey participants, 179 were from a participating jail and 63 from a partnering community-based treatment provider (Table 1). Among the participants that provided their demographic information, the mean age was 46 years. More than half of the participants identified as female (61.0 %), which may reflect the inclusion of health care professionals, and as Non-Hispanic (94.2 %) and White (70.5 %). Less than half of the participants completed a graduate or professional degree (43.6 %), and the median years of work in their profession was 16 years. Participants had various occupations, including Deputy Sheriff, Warden, Probation Officer, Physician, Nurse and Medical Director.

3.3. Dimension reduction of staff responses

Response patterns to the 10 questions (Fig. 1) were largely explained by three principal components. Responses to all MOUD questions loaded positively onto Principal Component 1 ('Overall Positive'), as indicated

Table 1
Demographic information of staff survey participants.

| Variable	N	Percent	Mean
Age (years)	220		45.6
Gender			
Female	136	61.0 %	
Male	87	39.0 %	
Ethnicity			
Hispanic or Latino	13	5.8 %	
Non-Hispanic or Non-Latino	213	94.2 %	
Race			
Asian	8	3.6 %	
Black or African American	35	15.6 %	
Native Hawaiian or Other Pacific Islander	4	1.8 %	
White	158	70.5 %	
Other	19	8.5 %	
Education			
High school graduate	6	2.5 %	
Some college, no degree	25	10.7 %	
Associate's degree	28	12.0 %	
Bachelor's degree	66	28.2 %	
Ph.D.	7	3.0 %	
Graduate or professional degree	102	43.6 %	
Time spent in profession (years)	231		16.0

by loadings with magnitudes greater than 0.3 (Table 2). Therefore, larger scores of the 'Overall Positive' component indicate positive attitudes towards MOUD, and smaller values indicate negative attitudes towards MOUD. Responses to the acceptability and effectiveness of naltrexone loaded positively onto Principal Component 2, whereas responses to the acceptability and effectiveness of methadone loaded negatively onto Principal Component 2 ('Positive Naltrexone'). Therefore, larger values of 'Positive Naltrexone' indicate positive attitudes towards naltrexone and negative attitudes towards methadone. Smaller values of 'Positive Naltrexone' indicate negative attitudes towards naltrexone and positive attitudes towards methadone. Lastly, responses to effectiveness of all MOUD loaded positively onto Principal Component 3, whereas responses to acceptability of some MOUD loaded negatively onto Principal Component 3 ('Negative Acceptability'). Therefore, larger values of 'Negative Acceptability' indicate negative attitudes towards the acceptability of MOUD and positive attitudes towards the effectiveness of MOUD, whereas smaller values of 'Negative Acceptability' indicate the opposite relationship.

3.4. Mixed-effects regression analysis

Positive associations were found between 'Overall Positive' and all steps in the cascade of care (Table 3). Of these associations, 'Overall Positive' was found to be significantly associated with the number of individuals screened for an OUD, diagnosed with an OUD, and referred to treatment. Thus, the greater the value of 'Overall Positive,' or greater positivity towards MOUD, the more individuals screened, diagnosed, and referred to treatment. Negative associations were found between 'Positive Naltrexone' and all steps in the cascade of care. Furthermore, all associations were statistically significant. Thus, the greater the value of 'Positive Naltrexone,' or greater positivity towards naltrexone and greater negativity towards methadone and buprenorphine, the less individuals screened, diagnosed, referred to treatment, received MOUD, and referred to treatment after release. Lastly, none of the associations between 'Negative Acceptability' and each step in the cascade of care were found to be statistically significant.

3.5. Mediation analysis

Both principal components, 'Overall Positive' and 'Positive Naltrexone' were found to be directly associated with the number of individuals diagnosed with an OUD, as well as indirectly, through the number of individuals screened (Table 4). Importantly, the total effect is mostly represented through the direct effect for both 'Overall Positive' and 'Positive Naltrexone' (84.7 % and 62.5 %, respectively). Similarly, the number of individuals referred to treatment was found to be directly associated with 'Overall Positive' and 'Positive Naltrexone' and indirectly associated through the mediators, number of individuals diagnosed and screened. The total effect of 'Overall Positive' and 'Positive Naltrexone' was primarily composed of the natural indirect effects (68.1 % and 56.2 %). The association between 'Positive Naltrexone' and the number of individuals that received MOUD was found to be directly associated, as well as indirectly through all mediators, the number of individuals screened, diagnosed, and referred to treatment. The total effect of 'Positive Naltrexone' was mostly represented through the natural direct effect (66.3 %), rather than through the natural indirect effects (36.1 %). Lastly, the mediation of the relationship between 'Positive Naltrexone' and the number of individuals referred to treatment after release appeared to be complex and not easily explained through the simple mediation analysis. The predictor 'Negative Acceptability' was not included in the mediation analysis, as the associations between 'Negative Acceptability' and the MOUD outcomes were not statistically significant.
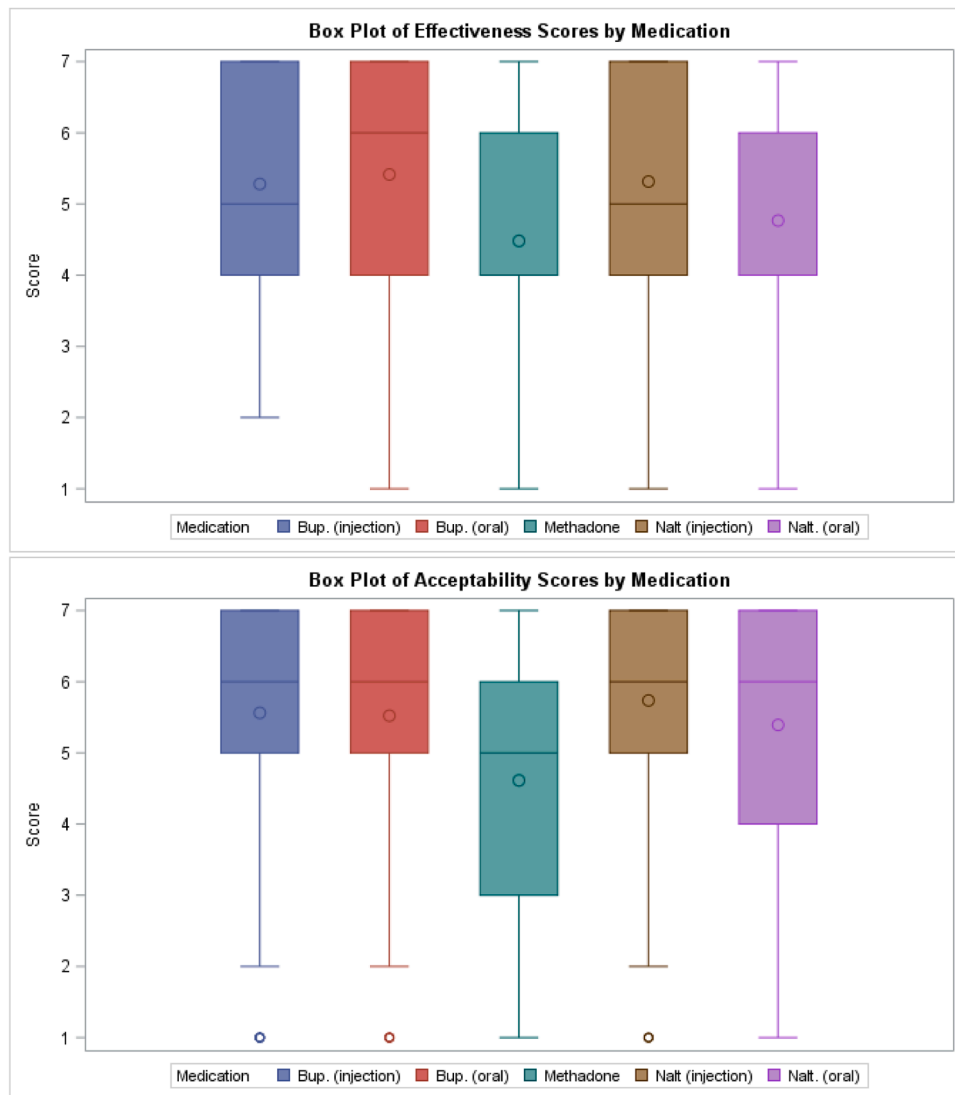
Fig. 1. Distribution of staff scores of the effectiveness and acceptability of five MOUD (buprenorphine (injection), buprenorphine (oral), methadone, naltrexone (injection), naltrexone (oral)). The box itself represents where 50 % of the scores are found. The circle in the middle of the box represents the mean score, whereas the line in the box displays the median score. The whiskers display the minimum and maximum scores, and the circle outside of the box represents an outlier.

4. Discussion

This study determined that the provision of MOUD in United States jails is associated with attitudes held by staff members. Numerous studies have documented staff attitudes towards MOUD in the criminal legal system, yet few studies have determined whether these attitudes are associated with the provision of MOUD in jails. Additionally, this study identified three different staff response patterns towards MOUD, as well as how the associations between staff attitudes and the provision of MOUD are mediated by upstream MOUD outcomes.

Firstly, the dimension reduction of the responses to the staff survey determined three distinct response patterns: 'Overall Positive,' 'Positive Naltrexone,' and 'Negative Acceptability.' These patterns are supported by studies that have examined attitudes towards MOUD in criminal legal settings. According to the literature, positive attitudes towards MOUD have been documented in the criminal legal system, most commonly by health services staff (McMillan and Lapham, 2005; Richard et al., 2020). The second pattern, 'Positive Naltrexone,' is consistent with beliefs often held by criminal legal staff, which may arise due to concerns of the diversion of methadone or buprenorphine, thus leading to favorable attitudes of naltrexone (Andraka-Christou et al., 2019; Victor et al.,

2022). Although unsubstantiated by the literature, the last pattern, 'Negative Acceptability,' may reflect an understanding of the effectiveness of MOUD, yet a belief that it is unacceptable for justice populations to be provided MOUD.

The second key finding was that staff attitudes were significantly associated with MOUD outcome data. A negative association was identified between 'Positive Naltrexone' and all aspects of the cascade of care. Additionally, a positive association was identified between 'Overall Positive' and the number of individuals screened, diagnosed, and referred to treatment in the jail. Lastly, 'Negative Acceptability' was not significantly associated with any aspects of the cascade of care, which may be due to a minimal variation explained by this response pattern as it was the third principal component identified in PCA. In summary, these associations are notable, as they indicate that attitudes towards the effectiveness and acceptability of MOUD are associated with the cascade of care, particularly the ability for individuals who are incarcerated to be screened, diagnosed, and referred to treatment for an OUD.

Thirdly, the mediation analysis indicated that attitudes are associated with each MOUD outcome, both directly and indirectly through upstream MOUD outcomes. These results further elucidate the

Table 2
Loadings of responses on each component from principal components analysis.

	Principal Component 1 'Overall Positive'	Principal Component 2 'Positive Naltrexone'	Principal Component 3 'Negative Acceptability'
Effectiveness of Methadone	**0.46**	**−0.61**	**0.34**
Effectiveness of Bup. (oral)	**0.70**	−0.25	**0.40**
Effectiveness of Bup. (inject)	**0.47**	0.23	**0.49**
Effectiveness of Nalt. (oral)	**0.47**	**0.57**	**0.41**
Effectiveness of Nalt. (inject)	**0.35**	**0.72**	**0.39**
Acceptability of Methadone	**0.54**	**−0.63**	4.0E-4
Acceptability of Bup. (oral)	**0.70**	**−0.39**	−0.08
Acceptability of Bup. (inject)	**0.62**	0.07	**−0.56**
Acceptability of Nalt. (oral)	**0.70**	0.25	**−0.35**
Acceptability of Nalt. (inject)	**0.59**	**0.37**	**−0.59**

Note. Bolded values are loadings greater than 0.3 in magnitude.

Table 3
Results of analysis between attitudes towards MOUD and MOUD outcomes.

MOUD outcome	Principal Component	Exp (B)	95 % CI	z	p
Individuals screened for an OUD	'Overall Positive'	1.16	[1.01, 1.34]	2.10	.04
	'Positive Naltrexone'	0.84	[0.72, 0.97]	−2.43	.02
	'Negative Acceptability'	1.06	[0.92, 1.22]	0.80	.42
Individuals diagnosed with an OUD	'Overall Positive'	1.37	[1.18, 1.60]	4.14	< 0.001
	'Positive Naltrexone'	0.85	[0.73, 0.99]	−2.11	.04
	'Negative Acceptability'	0.98	[0.84, 1.14]	−0.25	.81
Individuals referred to treatment for an OUD	'Overall Positive'	1.41	[1.20, 1.65]	4.26	< 0.001
	'Positive Naltrexone'	0.76	[0.65, 0.89]	−3.33	< 0.001
	'Negative Acceptability'	0.96	[0.82, 1.13]	−0.47	.64
Individuals that received MOUD	'Overall Positive'	1.08	[0.89, 1.29]	0.77	.44
	'Positive Naltrexone'	0.70	[0.58, 0.84]	−3.76	< 0.001
	'Negative Acceptability'	0.91	[0.76, 1.08]	−1.10	.27
Individuals referred to treatment after release	'Overall Positive'	1.09	[0.96, 1.24]	1.28	.20
	'Positive Naltrexone'	0.82	[0.72, 0.94]	−2.91	.004
	'Negative Acceptability'	0.97	[0.85, 1.11]	−0.42	.67

Note. Because outcomes are log-transformed, Exp(B) represents an adjusted mean ratio, i.e. the multiplicative factor by which the mean outcome increases with a 1 unit increase in the respective predictor.

Table 4
Results of mediation analysis by MOUD outcome. **MOUD outcome.**

	Effect of attitudes	Value	95 % CI
# of individuals diagnosed with an OUD	'Overall Positive'		
	Total effect	0.32	[0.17, 0.47]
	Natural direct effect	0.27	[0.14, 0.40]
	Natural indirect effect	0.07	[0.00, 0.14]
	Through # screened		
	'Positive Naltrexone'		
	Total effect	−0.17	[−0.32, −0.01]
	Natural direct effect	−0.10	[−0.24, 0.03]
	Natural indirect effect	−0.08	[−0.15, −0.02]
	Through # screened		
# of individuals referred to treatment	'Overall Positive'		
	Total effect	0.34	[0.19, 0.50]
	Natural direct effect	0.11	[0.04, 0.18]
	Natural indirect effect	0.23	[0.02, 0.45]
	Through # screened	−0.02	[−0.20, 0.16]
	Through # diagnosed	0.25	[0.13, 0.37]
	'Positive Naltrexone'		
	Total effect	−0.28	[−0.44, −0.11]
	Natural direct effect	−0.14	[−0.21, −0.06]
	Natural indirect effect	−0.11	[−0.23, 0.02]
	Through # screened	0.02	[0.00, 0.04]
	Through # diagnosed	−0.13	[−0.26, −0.01]
# of individuals received MOUD	'Positive Naltrexone'		
	Total effect	−0.36	[−0.54, −0.17]
	Natural direct effect	−0.24	[−0.39, −0.08]
	Natural indirect effect	−0.13	[−0.20, −0.07]
	Through # screened	−0.02	[−0.04, −0.00]
	Through # diagnosed	−0.03	[−0.07, −0.00]
	Through # referred to treatment	−0.08	[−0.13, −0.03]
# of individuals referred to treatment after release	'Positive Naltrexone'		
	Total effect	−0.20	[−0.33, −0.07]
	Natural direct effect	0.03	[−0.10, 0.16]
	Natural indirect effect	−0.14	[−0.30, 0.01]
	Through # screened	−0.02	[−0.04, 0.00]
	Through # diagnosed	0.08	[0.01, 0.16]
	Through # referred to treatment	−0.20	[−0.33, −0.08]
	Through # received MOUD	−0.005	[−0.05, 0.03]

Note. The value of each effect is reported on the linear predictor scale, i.e. on the log-scale of the respective outcome. The table displays the total effect of the attitudes on the MOUD outcome, as well as the natural direct effect (direct association between attitudes & MOUD outcome) and the natural indirect effect (association between attitudes & MOUD outcome due to the relation between attitudes and an upstream MOUD outcome). Regression coefficients, 95 % CIs, and the percent of the total effect are displayed for all natural direct and indirect effects.

importance of attitudes towards MOUD, as they are associated with each step of the cascade of care, and therefore, may influence the care individuals who are incarcerated receive. However, it is important to note that the indirect and direct effects of the analyses do not compute precisely to a total effect of 100 %. These results may be reflective of the rudimentary analysis, and thus, the complexity of the relationship between each step in the cascade of care may not fully be captured. Future

analyses may consider utilizing more robust mediation analysis principles in order to accurately determine the most important points of intervention within the cascade of care.

There are a few limitations to this analysis. Firstly, the population of each jail was not available. Therefore, we did not have a suitable denominator for the MOUD outcomes (i.e. out of new jail inmates, how many screened, diagnosed, etc.). However, in the model, each outcome

was log transformed, and thus, any denominator was captured indirectly through the random effects. Another limitation exists through potential data reporting errors. Sites provided their own MOUD outcome data for each month of the study, and there may have been inaccuracies due to human error. However, apparent inaccuracies were investigated by a project coordinator to ensure the data reported were correct. Lastly, the findings of the study may not be generalizable to all United States jails. The majority of the jails that enrolled in this study were already providing at least one MOUD (92.3 %) and had shown interest in expanding or enhancing the delivery of MOUD in their institution. Thus, these findings may not be applicable to United States jails that have not or do not plan to provide MOUD.

Finally, it is important to consider reverse directionality of the identified associations, as well as interactions that may occur between attitudinal barriers and other barriers. That is, are the number of individuals provided MOUD affected by the attitudes held by staff, or do the number of individuals provided MOUD influence staff attitudes? Furthermore, the relationship between attitudes towards MOUD and the provision of care in jails is complex, and these observed associations may be a result of other barriers to MOUD, such as institutional and systemic barriers. More analyses are required to determine points of intervention.

In conclusion, this analysis demonstrated that attitudes towards MOUD are associated with the provision of MOUD in United States jails. MOUD is a life-saving treatment for individuals who have been incarcerated, and although it has proven to be effective, it has yet to be fully implemented in many jails and prisons. Through this study, it has now been determined that attitudes towards MOUD are associated with the treatment and care for an OUD within jails. Future research may consider how coaching and providing technical assistance to criminal legal staff may impact their attitudes toward MOUD and further affect the provision of MOUD in jails and prisons.

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CRediT authorship contribution statement

Aly Pfaff: Conceptualization, Formal analysis, Validation, Visualization, Writing – original draft. **Amy Cochran:** Conceptualization, Formal analysis, Methodology, Supervision, Writing – review & editing. **Jessi Vechinski:** Data curation. **Todd Molfenter:** Conceptualization, Data curation, Funding acquisition, Project administration, Writing – review & editing. **Gabriel Zayas-Cabán:** Conceptualization, Formal analysis, Supervision.

Declaration of Competing Interest

No conflict declared.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dadr.2023.100211.

References

Andraka-Christou, B., Gabriel, M., Madeira, J., Silverman, R.D., 2019. Court personnel attitudes towards medication-assisted treatment: a state-wide survey. J. Subst. Abus. Treat. 104, 72–82. https://doi.org/10.1016/j.jsat.2019.06.011.

Binswanger, I.A., Stern, M.F., Deyo, R.A., Heagerty, P.J., Cheadle, A., Elmore, J.G., Koepsell, T.D., 2007. Release from prison–a high risk of death for former inmates. N. Engl. J. Med. 356 (2), 157–165. https://doi.org/10.1056/NEJMsa064115.

Binswanger, I.A., Nowels, C., Corsi, K.F., Glanz, J., Long, J., Booth, R.E., Steiner, J.F., 2012. Return to drug use and overdose after release from prison: a qualitative study of risk and protective factors. Addict. Sci. Clin. Pract. 7 (1), 3. https://doi.org/10.1186/1940-0640-7-3.

Brinkley-Rubinstein, L., McKenzie, M., Macmadu, A., Larney, S., Zaller, N., Dauria, E., Rich, J., 2018. A randomized, open label trial of methadone continuation versus forced withdrawal in a combined US prison and jail: findings at 12 months post-release. Drug Alcohol Depend. 184, 57–63. https://doi.org/10.1016/j.drugalcdep.2017.11.023.

Bronson, J., Stroop, J., Zimmer, S., Berzofsky, M., 2017. Drug use, Dependence, and Abuse Among State Prisoners and Jail Inmates, 2007–2009. United States Department of Justice, Office of Juvenile Justice and Delinquency Prevention, Washington, DC.

Cates, L., Brown, A.R., 2023. Medications for opioid use disorder during incarceration and post-release outcomes. Health Justice 11 (1), 4. https://doi.org/10.1186/s40352-023-00209-w.

Evans, E.A., Wilson, D., Friedmann, P.D., 2022. Recidivism and mortality after in-jail buprenorphine treatment for opioid use disorder. Drug Alcohol Depend. 231, 109254 https://doi.org/10.1016/j.drugalcdep.2021.109254.

Grella, C.E., Ostile, E., Scott, C.K., Dennis, M., Carnavale, J., 2020. A scoping review of barriers and facilitators to implementation of medications for treatment of opioid use disorder within the criminal justice system. Int. J. Drug Policy 81, 102768. https://doi.org/10.1016/j.drugpo.2020.102768.

Imai, K., Keele, L., Tingley, D., 2010. A general approach to causal mediation analysis. Psychol. Methods 15 (4), 309–334. https://doi.org/10.1037/a0020761.

Joudrey, P.J., Khan, M.R., Wang, E.A., Scheidell, J.D., Edelman, E.J., McInnes, D.K., Fox, A.D., 2019. A conceptual model for understanding post-release opioid-related overdose risk. Addict. Sci. Clin. Pract. 14, 1–14.

Kaiser, H.F., 1960. The application of electronic computers to factor analysis. Educ. Psychol. Meas. 20, 141–151. https://doi.org/10.1177/001316446002000116.

Knudsen, Ducharme, Roman, & Link, 2005. Buprenorphine diffusion: the attitudes of substance abuse treatment counselors. J. Subst. Abus. Treat. 29 (2), 95–106.

Kruis, N.E., McLean, K., Perry, P., 2021. Exploring first responders' perceptions of medication for addiction treatment: does stigma influence attitudes? J. Subst. Abus. Treat. 131, 108485 https://doi.org/10.1016/j.jsat.2021.108485.

Lim, S., Cherian, T., Katyal, M., Goldfeld, K.S., McDonald, R., Wiewel, E., Khan, M., Krawczyk, N., Braunstein, S., Murphy, S.M., Jalali, A., Jeng, P.J., MacDonald, R., Lee, J.D., 2023. Association between jail-based methadone or buprenorphine treatment for opioid use disorder and overdose mortality after release from New York City jails 2011–17. Addiction 118 (3), 459–467. https://doi.org/10.1111/add.16071.

Mackey, K., Veazie, S., Anderson, J., Bourne, D., Peterson, K., 2020. Barriers and facilitators to the use of medications for opioid use disorder: a rapid review. J. Gen. Intern. Med. 35 (3), 954–963. https://doi.org/10.1007/s11606-020-06257-4.

MacKinnon, D.P., Lockwood, C.M., Williams, J., 2004. Confidence limits for the indirect effect: distribution of the product and resampling methods. Multivar. Behav. Res. 39 (1), 99. https://doi.org/10.1207/s15327906mbr3901_4.

Martin, R.A., Alexander-Scott, N., Berk, J., Carpenter, R.W., Kang, A., Hoadley, A., Kaplowitz, E., Hurley, L., Rich, J.D., Clarke, J.G., 2023. Post-incarceration outcomes of a comprehensive statewide correctional MOUD program: a retrospective cohort study. Lancet Reg. Health Am. 18 https://doi.org/10.1016/j.lana.2022.100419.

McMillan, G.P., Lapham, S.C., 2005. Staff perspectives on methadone maintenance therapy (MMT) in a large southwestern jail. Addict. Res. Theory 13 (1), 53–63. https://doi.org/10.1080/16066350512331328159.

Merrall, E.L.C., Kariminia, A., Binswanger, I.A., Hobbs, M.S., Farrell, M., Marsden, J., Hutchinson, S.J., Bird, S.M., 2010. Meta-analysis of drug-related deaths soon after release from prison. Addiction 105 (9), 1545–1554. https://doi.org/10.1111/j.1360-0443.2010.02990.x.

Molfenter, T., Vechinski, J., Taxman, F.S., Breno, A.J., Shaw, C.C., Perez, H.A., 2021. Fostering MOUD use in justice populations: assessing the comparative effectiveness of two favored implementation strategies to increase MOUD use. J. Subst. Abus. Treat. 128, 108370 https://doi.org/10.1016/j.jsat.2021.108370.

Moore, K.E., Roberts, W., Reid, H.H., Smith, K.M.Z., Oberleitner, L.M.S., McKee, S.A., 2019. Effectiveness of medication assisted treatment for opioid use in prison and jail settings: a meta-analysis and systematic review. J. Subst. Abus. Treat. 99, 32–43. https://doi.org/10.1016/j.jsat.2018.12.003.

Moore, K.E., Siebert, S.L., Kromash, R., Owens, M.D., Allen, D.C., 2022. Negative attitudes about medications for opioid use disorder among criminal legal staff. Drug Alcohol Depend. Rep. 3, 100056 https://doi.org/10.1016/j.dadr.2022.100056.

Rich, J.D., McKenzie, M., Larney, S., Wong, J.B., Tran, L., Clarke, J., Noska, A., Reddy, M., Zaller, N., 2015. Methadone continuation versus forced withdrawal on incarceration in a combined US prison and jail: a randomised, open-label trial. Lancet 386 (9991), 350–359. https://doi.org/10.1016/S0140-6736(14)62338-2.

Richard, E.L., Schalkoff, C.A., Piscalko, H.M., Brook, D.L., Sibley, A.L., Lancaster, K.E., Miller, W.C., Go, V.F., 2020. You are not clean until you're not on anything": perceptions of medication-assisted treatment in rural Appalachia. Int. J. Drug Policy 85, 102704. https://doi.org/10.1016/j.drugpo.2020.102704.

Scott, C.K., Dennis, M.L., Grella, C.E., Mischel, A.F., Carnevale, J., 2021. The impact of the opioid crisis on U.S. state prison systems. Health & Justice 9 (1), 17. https://doi.org/10.1186/s40352-021-00143-9.

Scott, C.K., Grella, C.E., Dennis, M.L., Carnevale, J., LaVallee, R., 2022. Availability of best practices for opioid use disorder in jails and related training and resource needs: Findings from a national interview study of jails in heavily impacted counties in the U.S. Health & Justice 10 (1), 36. https://doi.org/10.1186/s40352-022-00197-3.

Vander Weele, T.J., Vansteelandt, S., 2014. Mediation Analysis with Multiple Mediators. Epidemiol. Method 2 (1), 95–115. https://doi.org/10.1515/em-2012-0010.

Victor, G., Lee, G., Pozo, B.del, Silverstein, S., Zettner, C., Cason, R., Ray, B., 2022. Medications for opioid use disorder in the criminal/legal system: knowledge, beliefs, and attitudes among rural community-based stakeholders. J. Drug Issues 52 (3), 389–405. https://doi.org/10.1177/00220426221076800.

Williams, A.R., Nunes, E.V., Bisaga, A., Levin, F.R., Olfson, M., 2019. Development of a cascade of care for responding to the opioid epidemic. Am. J. Drug Alcohol Abus. 45 (1), 1–10.

Zaller, N., McKenzie, M., Friedmann, P.D., Green, T.C., McGowan, S., Rich, J.D., 2013. Initiation of buprenorphine during incarceration and retention in treatment upon release. J. Subst. Abus. Treat. 45 (2), 222–226. https://doi.org/10.1016/j.jsat.2013.02.005.