Association Between Process-Based Quality Indicators and Mortality for Patients With Substance Use Disorders

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ABSTRACT. Objective: Substance use disorders (SUDs) are associated with elevated rates of mortality. Little is known about whether receiving appropriate care is associated with lower mortality for patients with SUDs. This study examined the association between the receipt of care for SUDs and subsequent 12- and 24-month mortality. **Method:** This was a retrospective cohort study of veterans who received care for SUDs paid for by the Veterans Health Administration during October 2006–September 2007 ($n = 339,966$). Logistic regressions were used to examine the association between quality indicators measuring receipt of care and mortality while controlling for patient characteristics and facility service area. **Results:** There were four quality indicators: SUD treatment initiation, SUD treatment engagement, SUD-related psychosocial treatment, and SUD-related psychotherapy. Outcomes measured were mortality 12 and 24 months after the end of the observation period, through September 2009. Receipt of indicated care ranged from 26.5% to 58.6%,

and 12- and 24-month mortality rates were 3% and 6%, respectively. Adjusted odds ratios [95% CI] of 12-month mortality by indicator were: initiation, 0.86 [0.79, 0.93]; engagement, 0.65 [0.58, 0.74]; psychosocial treatment, 0.88 [0.84, 0.92]; and psychotherapy, 0.84 [0.79, 0.89]. For the 24-month mortality outcome, adjusted odds ratios were: initiation, 0.88 [0.84, 0.93]; engagement, 0.78 [0.71, 0.85]; psychosocial treatment, 0.91 [0.88, 0.94]; and psychotherapy, 0.87 [0.83, 0.91]. Results were similar when controlling for facility service area. **Conclusions:** Receiving appropriate care is associated with lower mortality for patients with SUDs. Significant overall and within-facility service area associations of quality indicators and mortality support their use in encouraging providers to deliver the indicated care. These indicators should be prioritized above others lacking comparably strong process-outcome associations. (*J. Stud. Alcohol Drugs*, 78, 588–596, 2017)

SUBSTANCE USE DISORDERS (SUDs) are major contributors to the total burden of illness and are associated with a relative risk of mortality twice that of the general population (Eaton et al., 2008). Appropriate SUD care is delineated in clinical practice guidelines, yet evidence suggests that many SUD patients do not receive treatment (Kessler et al., 2005), and delivered care typically does not align with recommended care (Acevedo et al., 2015; Garnick et al., 2007; Pincus et al., 2007). Efforts to improve SUD care quality include quality measurement, with reporting require-

ments included in the Patient Protection and Affordable Care Act and the Veterans Access, Choice and Accountability Act of 2014.

Receiving care that adheres to quality indicators may be associated with decreases in long-term mortality for SUD patients, yet there is limited evidence demonstrating this relationship. Previous findings examining the association of quality indicators with mortality for SUD patients focus on a limited number of indicators of appropriate care following treatment in residential (Harris et al., 2015b) or inpatient settings (Moos et al., 1994). However, in the United States, only 17% of SUD treatment admissions in facilities receiving public funding were to residential care, whereas 61% were to intensive and non-intensive outpatient settings and 22% for detoxification services (Pew Charitable Trusts & the John D. and Catherine T. MacArthur Foundation, 2015). Schmidt et al. (2016) examined the association of mortality with receipt of a week of intensive outpatient treatment for SUD, which provides a higher intensity of care (at least three 3-hour sessions of treatment per week) than standard outpatient treatment, and Watkins et al. (2016) examined the association between mortality and receipt of care in U.S. Veterans Health Administration (VHA) inpatient or outpatient settings for SUD patients with one of four co-occurring mental health disorders (schizophrenia, posttraumatic stress

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disorder, major depressive disorder, and bipolar disorder). However, the quality indicators–mortality association in the broader SUD patient population seeking care in inpatient and/or outpatient settings is unknown.

This study focused on care delivered to SUD patients seen in both inpatient and outpatient settings. We examined the overall and within-facility service area associations between SUD quality indicators and 12- and 24-month mortality, using data and indicators from a large, population-based external evaluation of the quality of SUD and mental health care provided to veterans in fiscal year (FY) 2007 by the VHA (Watkins et al., 2011). The quality indicators include SUD treatment initiation and engagement (Garnick et al., 2002; McCorry et al., 2000), versions of which are in the Healthcare Effectiveness Data and Information Set (HEDIS; National Committee on Quality Assurance, 2007, 2017), and receipt of psychosocial interventions and psychotherapy, which are recognized in the American Psychiatric Association (1995, 1997, 1998, 2000, 2002) clinical practice guidelines as part of a comprehensive SUD treatment program.

Method

Cohort identification

The study cohort of veterans was drawn from administrative data consisting of transactional data from the Veterans Affairs (VHA) Medical SAS data sets, which represent the totality of care rendered or paid for by VHA for all study veterans receiving treatment during federal FY2007, which covered October 2006 through September 2007. The data include claims data, such as diagnoses, procedures, dates of service, admissions, and discharges, as well as demographic information. The study cohort of veterans consisted of those whose administrative records contained at least one *International Classification of Diseases, Ninth Revision, Clinical Modification* (National Center for Health Statistics, 2010), diagnosis code for alcohol or other drug dependence or abuse and who also had at least one inpatient episode or two outpatient visits in the fiscal year, for any diagnosis (SUD or otherwise).

This study was approved by the institutional review boards of the Central Arkansas Veterans Healthcare Center and the University of Arkansas for Medical Sciences. The institutional review boards waived the requirement for participant informed consent as it was a minimal risk study.

Measures

Quality indicators and descriptive measures. Performance indicators drawn from the external VHA evaluation were derived from a review of peer-reviewed literature and major mental health indicator sets or clearinghouses such as HEDIS, National Quality Forum, The Center for Quality As-

essment and Improvement in Mental Health, and Standards for Bipolar Excellence. This set was reviewed by a clinical expert panel for the clinical importance of the indicator and for the feasibility of evaluation using VHA administrative data. Necessitated by the goal of testing for associations of the indicators with the relatively low-prevalence outcomes of 12- and 24-month mortality, our final set of indicators are applicable to a broad portion of VHA patients with an SUD diagnosis.

Treatment initiation and treatment engagement are two indicators developed by the Washington Circle for SUDs and are HEDIS measures (Garnick et al., 2002; McCorry et al., 2000). Both indicators apply only to individuals beginning a new treatment episode; new treatment episodes begin with an index visit for SUD. *Treatment initiation* was defined as at least one SUD-related treatment visit within 14 days of the index visit, and *treatment engagement* was defined as receiving an additional two SUD-related treatment visits within 30 days after the initiation visit, among those who had initiated. Unlike the HEDIS specifications, the treatment initiation and engagement indicators presented here and used for the FY07 external evaluation of VHA mental health care specified that the index visit must occur after a period of 5 months rather than 60 days without any SUD-related visits before the index visit (Horvitz-Lennon et al., 2009). Thus, this indicator was limited to individuals who were not currently in treatment (Harris et al., 2015a). We tested an alternative specification for the treatment initiation and engagement indicators in which we allowed the index visit and the follow-up visits to be for either the mental health or SUD diagnoses. The relationships observed were similar to the original specifications.

In the outpatient setting, the range of interventions provided to patients receiving any SUD-related psychosocial treatment was broader than just psychotherapy. Absence of care consistent with the quality indicator of receiving any SUD-related psychosocial treatment does not necessarily indicate that patients are receiving poor care, because patients could alternatively be receiving medication therapy. The American Psychiatric Association clinical practice guidelines cite extensive evidence for the efficacy of psychosocial interventions. Psychosocial treatments included psychotherapy visits and individual or group psychosocial treatment for mental disorders or SUDs, including mental health intensive case management, family psychoeducation, and supported employment. These were identified using mental health stop codes but excluded opioid substitution, biomedical care, psychological testing, and risk factor education group. Visits with Current Procedural Terminology (CPT) codes for medication management without psychotherapy, electroconvulsive therapy, and encounters with CPT codes not beginning with “9” or “H” were also excluded. This indicator reflects visits provided in FY2007.

We also examined an indicator of patients receiving SUD-related psychotherapy in the outpatient setting. This is

a descriptive indicator that can be used to explore the importance of SUD-related outpatient psychotherapy visits in the administrative data using CPT codes during FY2007.

Outcome measure. Mortality data from October 1, 2006, through September 30, 2009, were obtained from the VHA Vital Status Mini File, which is constructed from several sources, including the Medicare Vital Status file (50.7%), the SSA Death Master file (27.9%), Patient Treatment File (16.0%), BIRLS Death File (3.9%), and Fee Basis (1.5%) (Veterans Administration Information Resource Center). Death dates compiled from these combined data sources demonstrated very high sensitivity and exact agreement with dates from the National Death Index (Sohn et al., 2006). We examined 24-month mortality, which has been examined by others assessing the association of quality indicators and mortality in the SUD population (Harris et al., 2015b; Schmidt et al., 2016), and also examined 12-month mortality to explore whether any associations held more proximally.

Patient covariates. Analyses were risk adjusted for age, gender, racial/ethnic background, given variation in mortality rates (National Institutes of Health, 2003), and diagnosis of serious mental illness (any one of bipolar disorder, major depressive disorder, posttraumatic stress disorder, or schizophrenia), all obtained from administrative data. Urban/rural location was determined by mapping ZIP code information from the administrative data with Rural-Urban Commuting Area codes (WWAMI Rural Health Research Center, 2009). Because patients with complex comorbidities have been found to have higher utilization but worse outcomes (Hermann et al., 2007), a modified Charlson–Deyo comorbidity index was included to adjust for mortality risk due to physical health conditions identified in outpatient and inpatient claims data (Deyo et al., 1992; Klabunde et al., 2000). Service-connected veterans have a disability that was incurred or aggravated during active duty. As service-connected veterans receive assignment to VA enrollment priority groups based on the degree of service-connectedness, it could reflect differences in severity and utilization patterns. The service-connectedness measure is based on Veterans Benefits Administration data.

Statistical methods

We computed descriptive statistics for mortality, patient risk-adjustment characteristics, and the quality indicators. To estimate an unbiased mortality rate, we restricted analysis to the population of study veterans who were alive by the end of the observation period (Dafni, 2011).

To examine the overall association between each quality indicator and mortality endpoint, we fitted two logistic regression models. Both models included the quality indicator as an independent variable, and patient risk-adjustment characteristics were included in the adjusted analysis and omitted from the unadjusted analysis. Standard errors of model

coefficients were adjusted for the clustering of observations within one of 139 parent facility service areas (PFSAs; Rogers, 1993). PFSAs are nested within 21 regionally oriented Veterans Integrated Service Networks, which are designed to pool and align resources to better meet local health care needs. Each PFSA is anchored by a major VA medical center or a major VA outpatient clinic partnered with a non-VA hospital or medical center. The major VA medical centers are responsible for one or more community-based outpatient clinics and, in a few cases, other VA medical centers or freestanding hospitals. Because the overall associations between quality indicators and mortality might reflect factors that vary between service areas (Finney et al., 2011), we conducted a secondary analysis of the within-service area associations between quality indicators and mortality by adding fixed-effects terms for PFSAs to the logistic regressions. The estimated odds ratio (OR) for a quality indicator compares mortality risk by receipt of the quality indicator for patients within the same PFSA. Observations with missing covariate data on marital status and/or rural residence (1.8%) were omitted from the regressions. We assessed the strength of association between a quality indicator and mortality by examining the OR of mortality for the quality indicator and its 95% confidence interval. We computed predictive margins to estimate the marginal effect on mortality of receipt of care measured by each quality indicator, holding constant the risk-adjustment patient characteristics (Graubard & Korn, 1999).

A complication to examining the quality indicator–mortality association with observational data is that the amount and quality of care received by patients could differ for those who are relatively severely ill or by patient motivation for treatment in ways that are unexplained by the measured data on patient risk factors. We applied sensitivity analysis (Lin et al., 1998) to evaluate how sensitive our results would be to a hypothetical dichotomous unmeasured confounder, U , that was unavailable in the data and had a positive association with mortality. We implemented this by assuming that the true logistic regression model should contain an additional term, $b \times U_i$, where b is the regression coefficient for U_i , the value of a hypothetical unobserved confounder for patient i . We examined how large an effect U would need to have to invalidate our statistically significant findings. For each quality indicator, we examined four scenarios under which U was associated with higher mortality: The magnitude of the effect of U exceeded the following:

- largest observed effect of the indicator and risk-adjustment variables across our analyses, corresponding to $OR(U) = \exp(b_3) = 2.14$ for Race = Black (vs. White) in the treatment engagement analyses;
- largest observed effect of the indicator and risk-adjustment variables for the treatment initiation indicator, $OR(U) = 1.59$;

TABLE 1. Demographic and patient characteristics for $n = 339,966$ veterans in the study population, fiscal year (FY) 2007

Characteristic	Total ($n = 339,966$)
Male sex, n (%)	327,658 (96.4%)
Race/ethnicity, n (%)	
Non-Hispanic White	162,053 (47.7%)
Black	77,252 (22.7%)
Hispanic	12,647 (3.7%)
Other/unknown	88,014 (25.9%)
Marital status, n (%)	
Married	100,534 (29.6%)
Not married	237,060 (69.7%)
Missing	2,372 (0.7%)
Rural/urban residence, n (%)	
Urban	266,987 (78.5%)
Rural	69,072 (20.3%)
Missing	3,907 (1.2%)
Co-occurring serious mental illness, n (%)	142,640 (42.0%)
Service connected, n (%)	120,046 (35.3%)
Age, in years, M (SD)	53.9 (11.0)
Charlson comorbidity index, M (SD)	0.39 (1.14)

- largest observed largest observed effect of the indicator and risk-adjustment variables for the SUD-related psychosocial treatment and SUD-related psychotherapy, $OR(U) = 1.41$; and
- median observed effect of the indicator and risk-adjustment variables across our analyses, $OR(U) = 1.14$.

$OR(U)$ values were chosen based on our analyses, making them plausible estimates of the potential size of an unobserved confounder's effect (Griffin et al., 2012).

Results

Descriptive statistics

A total of 339,966 veterans survived to the end of an observation period for at least one of the quality indicators, and 336,196 were alive at the end of FY2007 and thus included in the analyses of the psychotherapy and psychosocial indicators and mortality. There were 3,770 veterans excluded from those analyses because they died in FY2007, but they were included in the analyses of the SUD treatment initiation and engagement indicators and mortality because they were alive at the end of the 14-day or 30-day observation periods for the SUD treatment initiation and engagement indicators, respectively. Seventy-four percent of the study population had an SUD new treatment episode, with 88% of the new treatment episodes in outpatient settings.

The study population was predominantly male, older, not married, and living in nonrural areas (Table 1). Nearly half was non-Hispanic White. About one third of veterans were service connected, and 42% had a co-occurring serious mental illness. The mean Charlson comorbidity index was 0.39, which indicates physical comorbidity greater than that

experienced by elderly breast cancer patients ($M = 0.44$) but less than that of elderly prostate cancer patients ($M = 0.31$) (Deyo et al., 1992; Klabunde et al., 2000). Table 2 displays the percentage receiving the care described by each quality indicator.

Mortality analyses

The average unadjusted 12- and 24-month mortality rates were 2.3%–3.3% and 4.8%–6.4%, respectively, across the four quality indicators. Table 3 shows the overall unadjusted and risk-adjusted ORs of 12- and 24-month mortality by receipt of quality indicator. All quality indicators examined were significantly associated with lower mortality at 12 and 24 months. Table 3 shows the translation of the model results to predicted probabilities of mortality by receipt of each quality indicator. Receiving measured care reduced 12-month mortality by 11.9%–33.9% and 24-month mortality by 8.9%–21.3% across the indicators. Table 4 shows the analogous results for the within-PFSA quality indicators—mortality association estimates, which are very similar those in Table 3.

Figure 1 summarizes how large an effect an unobserved confounder would need to have to render these multivariate analysis findings nonsignificant (Lindenauer et al., 2014). These analyses build on the results shown in Table 3 only given the similarity of Tables 3 and 4. Statistical significance depends on the prevalence of U for those who receive the quality indicator ($P1$: x -axis), the prevalence among those who do not receive the quality indicator ($P0$: y -axis), and the OR of U . Darker shading indicates stronger effects of U are required to render the finding nonsignificant ($p > .05$). Specifically, going from darker to lighter gray, the shading indicates combinations of $P1$ and $P0$ for which $OR(U) = 2.14/1.59/1.41/1.14$ would render the findings nonsignificant. Nonshaded areas represent combinations of $P0$ and $P1$ for which the significance of the findings holds for the three values of $OR(U)$ examined here.

The results are most sensitive for the two descriptive indicators, SUD-related psychosocial treatment and psychotherapy. For the psychosocial treatment indicator, the largest difference observed between $P0$ and $P1$ in our data is 23 percentage points. Given this difference, only under the most extreme $OR(U)$ examined of $OR(U) = 2.14$, which is denoted with the darkest gray in Figure 1, would the 12-month psychosocial treatment indicator be rendered nonsignificant. However, the largest observed OR for an indicator or risk-adjustment variable in the SUD-related psychosocial and psychotherapy analyses is 1.41, which could render the 12- and 24-month findings nonsignificant if $P1 - P0$ meets or exceeds 20 percentage points for some values of $P1$. As the observed data indicate a 20 percentage point difference in $P1$ and $P0$ is plausible, this result suggests potential sensitivity of the findings from these two indicators to an unobserved confounder.

TABLE 2. Description of quality indicators for the 339,966 study veterans

Measure	Description	Denominator	No. of eligible patients	Rate
Treatment initiation	Treatment initiation within 14 days of the start of an index treatment episode	Veterans with an index episode in the inpatient or outpatient setting, following a 5-month period of no SUD treatment	253,512	17.4%
Treatment engagement	Two or more diagnosis-related encounters in the outpatient setting within the 30 days of the start of an index episode	Among those who initiated, veterans with an index episode in an inpatient or outpatient setting, following a 5-month period of no SUD treatment	44,129	58.6%
Psychosocial treatment	Psychosocial treatment or psychotherapy for an SUD diagnosis	All study veterans alive at the end of the observation period	336,196	48.3%
Psychotherapy	Psychotherapy treatment in outpatient setting for an SUD diagnosis	All study veterans alive at the end of the observation period	336,196	26.5%

Notes: No. = number; SUD = substance use disorder.

In contrast, the results are more robust for the SUD treatment initiation and engagement quality indicators. The largest difference observed between P0 and P1 in our data is 11 percentage points. For this difference, the significant findings would be rendered nonsignificant only if $OR(U)$ was greater than or equal to 2.14. However, for treatment initiation, the largest observed confounder has a magnitude of $OR(U) = 1.59$, in which case P0 and P1 would need to differ by at least 20 percentage points in order to render the finding nonsignificant. Given that the observed P1 – P0 difference was less than 20 percentage points in our data analysis, the sensitivity analysis shows that SUD treatment initiation is relatively robust to unobserved confounders that might have effects similar in size to those found in our analysis of observed confounders. For SUD treatment engagement, the findings are even more robust. The largest difference observed between P0 and P1 in our data is 7 percentage

points. However, for all $OR(U)$ values examined, P1 – P0 would need to differ by at least 40 percentage points (for 12-month mortality) or 20 percentage points (for 24-month mortality) to render findings nonsignificant under the most extreme unobserved confounder scenario examined here.

Discussion

We examined the associations between receiving care measured by quality indicators of treatment retention, engagement, SUD-related psychosocial treatment, and SUD-related psychotherapy with 12- and 24-month mortality in the population of veterans with SUD diagnoses who received care from the VA in FY2007. The main finding is that receiving the care assessed by these indicators was associated with lower mortality risk overall and within service area, providing support for the hypothesis that delivering

TABLE 3. Overall unadjusted and adjusted odds ratios (ORs) and their 95% confidence intervals (CIs) of outcome by quality indicator, along with adjusted outcome by receipt of measured care

Measures by outcome	<i>n</i>	Unadjusted OR [95% CI]	Adjusted OR [95% CI]	Adjusted marginal mortality estimate by receipt of measured care		% change
				Yes %	No %	
Treatment initiation	252,657					
12-month mortality		0.72 [0.67, 0.77]	0.86 [0.79, 0.93]	2.72	3.13	-14.0
24-month mortality		0.74 [0.70, 0.77]	0.88 [0.84, 0.93]	5.58	6.21	-11.0
Treatment engagement	43,991					
12-month mortality		0.59 [0.52, 0.66]	0.65 [0.58, 0.74]	1.93	2.87	-33.9
24-month mortality		0.71 [0.65, 0.77]	0.78 [0.71, 0.85]	4.31	5.40	-21.3
SUD-related psychosocial treatment	335,999					
12-month mortality		0.63 [0.60, 0.66]	0.88 [0.84, 0.92]	3.09	3.49	-11.9
24-month mortality		0.64 [0.62, 0.66]	0.91 [0.88, 0.94]	6.11	6.66	-8.9
SUD-related psychotherapy	335,999					
12-month mortality		0.65 [0.62, 0.69]	0.84 [0.79, 0.89]	2.92	3.44	-15.9
24-month mortality		0.67 [0.64, 0.70]	0.87 [0.83, 0.91]	5.82	6.61	-12.7

Note: SUD = substance use disorder.

TABLE 4. Within-facility service area unadjusted and adjusted odds ratios (ORs) and their 95% confidence intervals (CIs) of outcome by quality indicator, along with adjusted outcome by receipt of measured care, controlling for fixed facility service area effects

Measures by outcome	n	Unadjusted OR [95% CI]	Adjusted OR [95% CI]	Adjusted marginal mortality estimate by receipt of measured care		% change
				Yes %	No %	
Treatment initiation	252,657					
12-month mortality		0.73 [0.68, 0.78]	0.86 [0.80, 0.92]	2.74	3.13	-13.5
24-month mortality		0.74 [0.71, 0.78]	0.89 [0.84, 0.94]	5.61	6.20	-10.5
Treatment engagement	43,991					
12-month mortality		0.61 [0.54, 0.70]	0.67 [0.58, 0.76]	1.99	2.89	-32.6
24-month mortality		0.72 [0.66, 0.79]	0.77 [0.71, 0.85]	4.30	5.40	-21.5
SUD-related psychosocial treatment	335,999					
12-month mortality		0.63 [0.60, 0.65]	0.88 [0.84, 0.92]	3.09	3.49	-11.9
24-month mortality		0.65 [0.63, 0.66]	0.91 [0.88, 0.94]	6.11	6.65	-8.61
SUD-related psychotherapy	335,999					
12-month mortality		0.65 [0.62, 0.69]	0.84 [0.80, 0.89]	2.93	3.44	-15.4
24-month mortality		0.67 [0.65, 0.70]	0.87 [0.84, 0.91]	5.85	6.59	-12.0

Note: SUD = substance use disorder.

the care summarized by the indicators would be associated with decreased mortality. Although our data come from FY2007, our findings are strengthened by the consistency of the associations across the quality indicators and the use of visit-based quality indicators, which do not depend on the specifics of the care process.

We hypothesized that these quality indicators would be associated with mortality among SUD patients for three rea-

sons. First, the relationships of other quality indicators with mortality among SUD patients receiving residential SUD treatment or intensive outpatient treatment and among SUD patients with co-occurring mental health conditions who receive inpatient or outpatient SUD treatment suggest that care processes are more generally associated with mortality. The Washington Circle continuity of care quality indicator (Garnick et al., 2002), which assesses the proportion of pa-

FIGURE 1. Sensitivity analysis of the potential impact of an unobserved confounder, U , on the association of quality indicators and mortality. P0: Prevalence of U among those not receiving the quality measure. P1: Prevalence of U among those receiving the quality measure. Shaded areas represent combinations of P1, P0, and $OR(U)$ that would result in a loss of significance of the quality indicator-mortality association. From darkest to lightest gray: $OR(U) = 2.14, 1.59, 1.41, 1.14$. Areas with no shading remained significant for selected $OR(U)$ values.

tients having an outpatient SUD treatment encounter within 14 days after discharge from residential SUD treatment, and an indicator of discharge from residential SUD treatment not occurring within 1 week of treatment entry, were associated with significantly lower 2-year mortality among veterans receiving residential SUD treatment from the VA (Harris et al., 2015b). In an elderly inpatient Medicare sample of patients with SUDs, prompt outpatient mental health care, including psychotherapy, was associated with lower mortality among patients with drug disorders (Brennan et al., 2001). Receipt of at least 1 week of a VHA intensive outpatient program for SUD was associated with lower 24-month mortality, as well as reduced substance use and higher treatment utilization (Schmidt et al., 2016).

Second, previous findings suggest associations between SUD treatment initiation and engagement with improvement in other patient outcomes, including arrests and incarcerations among participants in an outpatient program (Garnick et al., 2007). Others have found a modest association of the SUD treatment initiation indicator and improved Addiction Severity Index drug composite scores at the patient level, but not significant associations at the facility level (Harris et al., 2007).

Third, associations between mortality and treatment initiation, engagement, quarterly visits, psychosocial treatment for any condition, and psychotherapy for any condition are significant for veterans with SUDs and at least one of four co-occurring mental health conditions (schizophrenia, post-traumatic stress disorder, major depressive disorder, and bipolar disorder) (Watkins et al., 2016).

The associations of our quality indicators with lower 12- and 24-month mortality are consistent across indicators, with the estimated mortality risk across the analyses 9%–25% lower among those receiving the indicated care. The significant overall associations of quality indicators and mortality validate the use of these quality indicators to encourage providers to deliver the care summarized by the indicators. Our within-service area analyses show that the overall process-mortality links are not explained by differences across service areas, providing support for monitoring these indicators at the service area level for accountability programs such as public reporting or pay-for-performance.

The strengths of this study include a population-based administrative database with SUD diagnosis information that was large enough to support examining mortality. The relatively low percentages of mortality at 12 and 24 months in the SUD treatment population imply that relatively large sample sizes are required for having sufficient statistical power to conduct tests of association, as compared with outcomes that occur with more frequency.

The study has several limitations. Data were limited to veterans receiving care from the VHA in FY2007, so the generalizability of the findings beyond the VHA is unclear. However, treatment models used by the VHA are similar

to those used in the public and private sectors. Similar to publicly funded treatment providers in the United States, the majority of SUD treatment in our study population was provided outside the residential setting. The psychosocial and psychotherapy indicators do not capture the type of intervention offered and reflect a minimal standard of just one psychosocial or psychotherapeutic session. Although psychosocial visits and psychotherapy could be directly linked with mortality, it is also possible that these process-outcomes relationships arise under an alternative mechanism. These indicators could be markers of increased health care utilization that could lead to better health. The majority of health care utilization among patients being treated in the VHA for SUD and/or serious mental health conditions is for services with a non-mental health primary diagnosis (Watkins et al., 2011). Treatment may also result in decreased alcohol and drug use, which is associated with lower mortality risk (Roerecke et al., 2013; Scott et al., 2011). Although the administrative data do not contain measures of physical or mental health functioning, we included the Charlson comorbidity index to address the former and adjusted for a co-occurring serious mental illness to address the latter. We did not control for concurrent medication therapy, but its effect is likely small: In FY2008, 372,069 patients received care for SUD (Sorbero et al., 2010), 9,610 patients received opiate-agonist therapy (Oliva et al., 2012), and 3.0% of VA patients with alcohol use disorder received pharmacotherapy in FY2007 (Harris et al., 2010).

There are differences between the HEDIS specification and the one examined here for the SUD treatment initiation and engagement indicators. Unlike HEDIS, we excluded emergency room visits. Following from the process used to develop the technical specifications for the indicators including an advisory group composed of representatives from VHA Patient Care Services and VHA Office of Mental Health, we used a 5-month clean period rather than the HEDIS 60-day period for SUD treatment initiation and engagement to reduce the chance of including in the denominator patients in maintenance treatment versus the active treatment phase (Horvitz-Lennon et al., 2009). Another limitation when comparing the treatment initiation and engagement indicators used here to the HEDIS specification or to other specifications used by VHA is that alternative denominator specifications could alter process-outcomes associations. We required one inpatient or two outpatient visits for any condition to be included in the denominator. However, this criterion was used in lieu of the HEDIS measure requirement for a 105-day period of continuous enrollment, a requirement developed for health plans.

Finally, our study involved observational data analysis. Data that do not arise from a randomized controlled clinical trial are vulnerable to the existence of an unobserved covariate that accounts for significant effects. Our sensitivity analyses showed that an unobserved confounder would have to be

larger than any observed confounder effect for the treatment initiation and engagement indicators to render findings not significant, supporting the robustness of these analyses. However, the findings for the two descriptive indicators of psychosocial treatment and psychotherapy are less robust to unobserved confounding.

Our study addresses the lack of validated quality indicators for SUD care; very few of the measures endorsed by National Quality Forum, other than tobacco, are related to SUD, and none of them have been strongly linked to clinical outcomes (National Quality Forum, 2016). The consistent associations of quality indicators with mortality overall and within facility service area demonstrate the importance of the care reflected by these indicators. These findings support prioritizing these indicators above others lacking process-outcome associations for monitoring the quality of care. Although improvements in patient outcomes are the ultimate goal, process indicators provide actionable guidance about the types of care most strongly associated with improved patient outcomes.

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