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Research Paper

Stability in a large drug treatment system: Examining the role of program size and performance on service discontinuation

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A B S T R A C T

Background: Little is known about the stability of public drug treatment in the United States to deliver services in an era of expansion of public insurance. Guided by organizational theories, we examined the role of program size, and performance (i.e., rates of treatment initiation and engagement) on discontinuing services in one of the largest treatment systems in the United States.

Methods: This study relied on multi-year (2006–2014) administrative data of 249,029 treatment admission episodes from 482 treatment programs in Los Angeles County, CA. We relied on survival regression analysis to identify associations between program size, treatment initiation (wait time) and engagement (retention and completion rates) and discontinuing services in any given year. We examined program differences between discontinued versus sustained services in pre- and post-expansion periods.

Results: Sixty-two percent of programs discontinued services at some point between 2006 and 2014. Program size and rates of treatment retention were negatively associated with risk of discontinuing services. Proportion of female clients was also negatively associated with risk of discontinuing services. Compared to residential programs, methadone programs were associated with reduced likelihood of discontinuing services. Two interactions were significant; program size and retention rates, as well as program size and completion rates were negatively associated with risk of discontinuing services.

Conclusions: Program size (large), type (methadone), performance (retention) and client population (women) were associated with stability in this drug treatment system. Because more than 70% of programs in this system are small, it is critical to support their capacity to sustain services to reduce existing disparities in access to care. We discuss the implications of these findings for system evaluation and for responding to public health crises.

Introduction

The stability of the substance use disorder (SUD) treatment system is critical to respond to the high (83%) unmet service need in the United States (Ali, Teich & Mutter, 2015). Less than 12% of people seeking SUD treatment are able to access such care (National Institute on Drug Abuse, 2012b). The SUD treatment system, which is largely composed of small specialty care programs with only two to three counselors each, has struggled to sustain service delivery (Guerrero, 2010; McLellan, Carise & Kleber, 2003). Inconsistent government funding and changing regulation, among many factors, have challenged the capacity of SUD treatment programs to meet performance benchmarks, such as treatment initiation and engagement (Campbell et al., 2019; Yarborough et al., 2018) as well as sustain the delivery of quality of care services (D'Aunno, 2016; Hyde, 2011; Rawson & McLellan, 2010).

Since 2013, the expansion of public insurance (i.e., Medicaid) in the United States, precipitated by the Affordable Care Act (ACA; Hyde, 2011), has provided public funding and client-centered policies to improve treatment initiation (access) and engagement (retention) (Creedon & Cook, 2016; Saloner, Antwi, Maclean & Cook, 2017; Winkelman et al., 2016). By 2014, nationwide, the insured rate among those with a SUD increased by more than 20 percent (McKenna, 2017; Saloner et al., 2017). Specifically, in California, Medicaid (known as Medi-Cal) coverage expanded for more than three million people—mainly Latinos and African Americans (Kaiser Family Foundation, 2015).

The post-ACA Medicaid expansion covering low-income individuals was expected to remove barriers to initiate and engage in treatment as well as increase program revenues by more than 30 percent in California (McKenna, 2017; Rawson & McLellan, 2010). These funding and client-centered policies were also expected to strengthen the delivery of SUD treatment, particularly to underserved populations with a history of disparities in access to care (Guerrero, 2013a; Hyde, 2011; McKenna, 2017). However, there is limited understanding of the extent

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to which program resources and performance play a role in sustaining the delivery of SUD treatment services in an era of public insurance expansion. In this paper, we examine the role of program size (number of clients served), and performance (i.e., rates of treatment initiation (wait time) and engagement (retention and completion)) on the risk of discontinuing services in an era of Medicaid expansion in the United States.

Conceptual framework

Our conceptual framework outlines the role of program resources and performance on the risk of discontinuing services, which is defined as stopping the delivery and billing of treatment services for at least a year within the study period (2006–2014). We draw from population ecology and resource dependence theories to describe the role of program size, performance and funding resources in the risk of discontinuing services, which may lead to and or represent program closure. Population ecology theory emphasizes that environmental factors affect the survivability of organizations. Similar to natural selection in biological organisms, organizations with fewer resources face higher risk of closure (mortality) (Hannan & Freeman, 1977). According to this theory, pressure to survive depends on the density or number of organizations in a system, with legitimacy, recognition, and competition serving as the central mechanism of survival (Braha, Stacey & Bar-Yam, 2011).

This view of the organizational ecological environment provides an important perspective on how SUD-treatment programs may have different risks of discontinuing services, which, in turn, affect the system's stability over time. National studies have showed that larger programs have a lower likelihood of facility dissolution (Johnson & Roman, 2002). In particular, larger organizations with greater service capacity (i.e., more ancillary services and higher caseloads) generally have a longer trajectory and expand over time as a result of larger government grants; thus, increasing demand for their services and giving them greater presence in the communities that they serve (D'Aunno, 2006; Guerrero, 2013a; Wells, Lemak & D'Aunno, 2005). Larger program size, defined as programs serving more clients, may protect treatment programs from discontinuing services. We therefore consider Hypothesis 1: Program size (number of treatment admissions for client population) will be negatively associated with risk of discontinuing services over time (2006–2014).

Program performance (treatment initiation and engagement) and service discontinuation

Another possible contributor to discontinuing services is SUD treatment initiation (i.e., wait time) and engagement (i.e., retention and completion). Effective treatment initiation and engagement are generally considered performance measures used by funders, regulators, and professional accreditations (Appel, Ellison, Jansky & Oldak, 2004; Claus & Kindleberger, 2002; Farabee, Leukefeld & Hays, 1998). These measures have become service benchmarks in an era of performance-based contracting, particularly for Medicaid, the largest payer of SUD treatment (McKenna, 2017; Rawson & McLellan, 2010).

The Healthcare Effectiveness Data and Information Set (HEDIS) has indicators of treatment initiation and engagement that are standardized performance measures (Harris, Bowe, Finney & Humphreys, 2009). These indicators have been explored as access and retention outcomes associated with client characteristics (e.g., race, alcohol and drug use severity) and facility types (e.g., served by non-specialty and integrated primary and addiction care) (Campbell et al., 2019; Yarborough et al., 2018). In particular, racial disparities in initiation (Acevedo et al., 2012) and completion (Mennis, Stahler, Abou El Magd & Baron, 2019) have supported the use of these measures to establish performance-based contracting in diverse treatment systems funded by Medicaid.

SUD treatment programs generally abide by performance benchmarks established by funding and regulatory institutions (D'Aunno, 2006; Guerrero, 2010). This is consistent with resource dependence theory, which posits that high dependence on necessary institutional resources reduces uncertainty and determines an organization's priorities (Pfeffer & Salancik, 1978). Studies have identified public funding, state licensing regulation, and professional accreditation as resource dependent factors associated with treatment programs' survival (D'Aunno, 2006; Knudsen, Abraham & Roman, 2011; Roman, Abraham & Knudsen, 2011; Wells et al., 2005).

Considering program initiation and engagement is critical because these process outcomes are predictors of treatment success and increasingly used for system performance evaluation (Appel et al., 2004; Guerrero et al., 2016; Teruya, 2012). For instance, successful completion of SUD treatment is associated with long-term client outcomes, such as reduced substance use, future criminal involvement, future employment, and fewer readmissions (Evans, Li & Hser, 2009; Ghose, 2008; Mennis et al., 2019; TOPPS-II Interstate Cooperative Study Group, 2003). State-level completion rates are monitored by health administrators and reported annually by the Agency for Healthcare Quality and Research (2014). Under health-care reform legislation these rates may become a standard measure of system-level engagement (Arndt, 2010; Borys, 2011). We therefore consider Hypothesis 2: Program initiation and engagement, as measured by lower wait time, higher retention, and higher treatment completion, would be associated with lower risk of discontinuing services over time (2006–2014).

Program diversity and service discontinuation

Programs serving a higher proportion of racial and ethnic minorities tend to be smaller and have lower service capacity (number and type of services) (Arndt, 2010; Marsh, Cao, Guerrero & Shin, 2009). This lack of resources may make these programs more vulnerable to discontinuing services. For instance, in Los Angeles County, SUD-treatment programs serving Latinos and African Americans are generally small (two to three counselors and serving less than 100 clients a year) and constantly face changes in funding and regulation (Guerrero, 2013b; Guerrero et al., 2016). This leads us to consider Hypothesis 3: Programs' proportions of racial and ethnic minority clients will be positively associated with risk of discontinuing services over time (2006–2014).

Medicaid expansion in post-ACA and service discontinuation

Changes in the health-care policy environment can have a significant impact on SUD treatment stability (Hyde, 2011; Rawson & McLellan, 2010). The Medicaid expansion represented newly eligible Medicaid recipients entering programs early in the implementation phase (2013–2014). The potential increase in client service loads creates interdependencies between Medicaid and programs, and the increased revenue may reduce programs' risk of discontinuing services. This leads to Hypothesis 4: Compared to pre-ACA (2006–2012), programs in the post-ACA era (2013–2014) with higher proportions of Medicaid-eligible clients will be associated with lower risk of discontinuing services.

Methods

Data collection and procedures

This study analyzed a subset of data collected via the Los Angeles County Participant Reporting System (LACPRS). This dataset includes information from all publicly funded substance-abuse treatment programs in the most populous county of the United States (Crèvecoeur, Finnerty & Rawson, 2002). This ongoing system-wide evaluation captures the treatment experiences and immediate outcomes for low-income, racially and ethnically diverse clients. Of the 141 items

in the LACPRS, more than half are standardized scales and questions related to admission, discharge, and health derived from state (i.e., California Outcome Measure System) and federal (i.e., Treatment Episode Data Set) measurement systems. The use of de-identified publicly available data exempted the study from review from an Institutional Review Board.

Analytic sample

The full sample from 2006 to 2014 included administrative data from 249,029 treatment episodes administered by 482 unique treatment programs. Of the total number of treatment admissions, nearly 47% involved outpatient treatment, 11% involved methadone services, and 42% involved residential treatment. For each treatment admission, client race, criminal status, homelessness, mental illness, gender, and Medicaid eligibility were recorded. Only clients who were admitted and discharged during the same year were included to obtain accurate estimates, which accounted for 95 percent of clients.

Among all study participants, 32.2% were non-Hispanic Whites, 36.7% were female, 37.0% had criminal records, 24.3% self-reported a mental illness diagnosis, 21.7% were homeless, and 37.6% were eligible for Medi-Cal. All participants gave informed consent to use anonymized data.

The client-level dataset was aggregated at the treatment program level for the 9-year period. The pre-ACA period was based on data from 2006 to 2012; the post-ACA period included 2013, when Los Angeles County initiated its Bridge to Reform program to expand eligibility, and 2014 (CMS, 2014).

Measures

Dependent variable

To study programs that stopped delivering services during the 9-year period of this study, we created a binary variable referred to as discontinuing treatment service provision ("discontinued" or "discontinuing services"). This variable was coded as 1 if a program did not deliver treatment services during the subsequent year based on LACPRS's list of programs actively providing services. For example, if a treatment program served clients in 2006, but not in 2007, it was coded as 1 for 2006. The "discontinued" variable represented the outcome variable of interest. We examined whether programs that discontinued differed from those that sustained service provision, then we identified variables that significantly influenced the risk of discontinuing services. See Table 1 for a full list of all variables included in this study.

Explanatory variables

We considered three categories of variables that may significantly predict the likelihood of programs discontinuing treatment services. These variables included: (a) organizational variables; (b) client variables; and, (c) performance variables.

Organizational variables involved the organizational attributes of a treatment program during a given year. We investigated two organizational variables: (a) number of treatment admissions delivered per year, which is a proxy for size and resources of a treatment program; and, (b) the type of treatment provided, i.e., methadone (also referred to as narcotic treatment by the state of California), outpatient, residential, or programs offering two or more of these types of care. We applied a log base 2 transformation to the size variable to improve the skewness in the distribution of the number of treatment admissions, improve the calibration of the models, and reduce the influence of extreme points. We chose base 2 for the log transformation to facilitate interpretation of model coefficients for the effects of number of yearly treatment admissions. (Details of the log transformation are available upon request.)

Client variables refer to the population profile of individuals served by treatment programs. We were interested in investigating the effects of diverse groups of clients on the risk of discontinuing services during the 9-year study period. We examined six variables indicating the percentage of admissions: (a) homeless; (b) mentally ill; (c) female; (d) non-White; (e) Medicaid-eligible; and, (f) criminally involved clients. Each population composition variable is a continuous variable ranging from 0% to 100%.

Performance variables referred to initiation and engagement indicators that describe the treatment process (McCarty, 2007). The measures used in this study are conceptually similar to the HEDIS, but we argue that our measures provide a broader sense of initiation and engagement. The HEDIS measures are dichotomous, whereby initiation is measured as the first visit, and engagement is measured as two visits within a month (Agency for Healthcare Research and Quality (2015). We considered three continuous scales that have been used in addiction health services research, and represent initiation or access and engagement or retention and completion: (c) average waiting time to receive treatment in days is measured as average number of days clients reported waiting to initiate treatment; (b) average treatment retention in days is measured as the number of days clients stayed in treatment from intake until discharge; and, (c) average treatment completion percentage is measured as the percentage of clients whose counselor successfully discharged them after completing all treatment goals. Shorter wait time reflects better initiation experience, while higher retention and completion rates represent better engagement (Guerrero et al., 2016; NIATx, 2001; Teruya, 2012). Because treatment retention and completion rates vary for different levels of care; that is, whether clients received outpatient, inpatient or residential care, we accounted for level of care as suggested in the literature (Harris et al., 2009; Stahler, Mennis & DuCette, 2016).

Data analysis

We compared the characteristics of programs that discontinued services with those that continued or sustained services. We relied on *t*-tests and chi-square tests to compare continuous and discrete variables across the two groups of treatment programs. In this analysis, we inferred the difference in organizational, population, and engagement attributes of treatment programs at the year that the programs discontinued services.

For hypothesis testing, we relied on a survival regression analysis to examine the hazards related to discontinuing services within the 9-year period. To obtain less biased estimates of hazards and survival, we included only programs that were operational (served clients) in 2006 (N = 280 programs) from 482 unique treatment programs in the system. In an exploratory approach, we constructed nonparametric estimates of program survival and groupings to investigate the effects of size and level of care on program survival. We assessed effects visually by grouping programs into yearly admissions quartile categories and levels of care. We then fitted the data to a Cox proportional hazards base model that included all independent variables (organizational, population, and engagement). Because retention expectations vary across treatment types (e.g. outpatient, methadone, residential or multilevel (2 or more of these types), we conducted an interaction model (retention*type of treatment) as well. (Tests related to meeting the proportionality assumption of the Cox models and estimate robustness are available upon request).

Every year that a program provided services was considered an observation. There were 293 observations of the discontinuation of services. These included observations for programs that discontinued services permanently during the study period and programs that discontinued then resumed services later. Similarly, there were 2300 observations that indicated that programs sustained service provision. For example, a program that provided services in 2006, 2007, 2008, but was marked as discontinued in 2009 (because it no longer served patients in 2010) contributed three observations to the sustained group and one observation to the discontinued group. A program that

Table 1
Comparative analysis of program characteristics (Discontinued vs. Sustained), 2006–2014.

	All *M* (*SE*) or *n*	Discontinued (*n* = 314) *M* (*SE*) or *n* (% of discontinued)	Sustained (*n* = 2376) *M* (*SE*) or *n* (% of sustained)	*p*-value
Organizational variables Size (# admitted clients				
<10 clients	545	165 (52.55%)	380 (15.99%)	<0.001*
10–49 clients	910	98 (31.21%)	812 (34.18%)	<0.001*
50–99 clients	471	26 (8.28%)	448 (18.73%)	<0.001*
≥100 clients	764	25 (7.96%)	739 (31.10%)	<0.001*
Engagement variables				
Average wait time (days)	2.38 (0.12)	1.55 (0.45)	2.49 (0.13)	0.0074*
Average completion (%)	22.29% (0.50%)	17.46% (2.54%)	22.93% (0.45%)	<0.001*
Average completion Residential (%)	29.46% (0.67%)	16.60% (3.07%)	29.34% (0.68%)	<0.001*
Average completion Outpatient (%)	20.68% (0.48%)	8.83% (1.29%)	22.45% (0.51%)	<0.001*
Average completion Methadone (%)	5.35% (0.54%)	0% (0%)	5.42% (0.55%)	0.12
Average completion Multilevel (%)	22.51% (0.91%)	8.02% (3.00%)	24.09% (0.92%)	<0.001*
Average retention (days)	86.70 (2.41)	76.34 (18.17)	86.93 (1.31)	0.0793
Type of treatment				
Residential	1002	69 (22.12%)	933 (39.23%)	<0.001*
Outpatient	1704	222 (70.70%)	1482 (62.37%)	0.004*
Methadone	298	4 (1.27%)	294 (12.37%)	<0.0001*
Multilevel (2+ types)	528	52 (16.67%)	476 (20.02%)	0.145
Average retention Residential (days)	81.34 (1.73)	42.50 (3.87)	84.20 (1.80)	<0.001*
Average retention Outpatient (days)	88.62 (2.88)	64.28 (18.47)	92.26 (1.81)	<0.001*
Average retention Methadone (days)	75.45 (2.94)	61.29 (3.58)	75.64 (2.98)	0.2877
Average retention Multilevel (days)	91.66 (2.84)	41.97 (8.54)	97.09 (2.91)	<0.001*
Client variables				
Female	43.59% (0.67%)	44.05% (3.21%)	43.52% (0.63%)	0.4012
Medi-Cal eligible	56.74% (1.59%)	88.68% (11.64%)	52.52% (0.91%)	<0.001*
Criminal record	34.90% (2.03%)	52.23% (16.11%)	32.61% (0.85%)	0.001*
Homeless at admission	21.95% (0.56%)	13.92% (1.63%)	23.01% (0.59%)	0.015*
Non-White	75.39% (46.42%)	80.87% (1.56%)	74.67% (0.48%)	<0.001*
Mental illness	24.08% (0.55%)	25.03% (2.72%)	23.96% (0.50%)	0.2659

Note. Of the 482 unique treatment programs, 314 discontinued services at least for one year during the 9-year period (hence 314 observations). The 2331 observations of programs continuing services correspond to each year that each program continue services. *P*-values were derived using *t*-tests for continuous variables and chi-square tests for discrete variables.
** n is for a count of program-year observations for each category.

operated without interruption from 2006 to 2014 contributed nine observations to the sustained group.

Results

Of the 482 unique treatment programs, 314 (65%) discontinued services for at least one year during the 9-year period from 2006 to 2015 (65%). Among the 314 discontinued programs, 252 programs discontinued once, while 41 discontinued and resumed service provision again at least once.

Table 1 shows results of a comparative analysis based on programs that discontinued services. Treatment programs that discontinued services during this period reported fewer treatment admissions per year ($p < .01$). In addition, programs that discontinued services were more likely to offer outpatient services (71% for discontinued compared to 62% for sustained, $p < .001$) and less likely to offer methadone services (1% vs. 12%, $p < .001$) or residential services (22% vs. 39%, $p < .05$). Programs that discontinued services were disproportionately less likely to offer two or more levels of care (i.e., outpatient and residential treamtents) (16% for discontinued compared to 20% for sustained programs, $p < .05$).

Average rates of treatment retention were not statistically different across the two groups (discontinued vs. sustained services). However, programs that discontinued had shorter average waiting times (1.55 days vs. 2.49 days, $p < .001$) and lower treatment completion rates (17.5% vs. 22.9%, $p < .01$). Table 1 shows that programs with less than 10 clients had the highest percentage of closing (52.5%), while programs with more than 100 clients had the lowest (8%).

Programs that discontinued services served smaller proportions of homeless clients (14% homeless clients vs. 23%, $p < .001$). Programs that discontinued services also reported a larger proportion of Medicaid-eligible non-White clients compared to their sustained counterparts (88.7% vs. 52.5%, $p < .001$). However, these relationships were not statistically significant when accounting for other factors in the regression models.

The survival regression analysis results are shown in Table 2. Fig. 1 depicts the estimated 9-year survival curve for treatment programs. The nonparametric Kaplan-Meier program survival curve shows the 9-year survival rate was 45% (95% CI = 39%, 51%). Fig. 2 depicts the survival curve for treatment programs based on the quantiles of yearly number of treatment admissions, which illustrates the effect of size on survival estimates for each quartile group. Findings support the notion that treatment programs serving fewer clients in a year (smaller size) were at a higher risk of discontinuing services. Fig. 3 illustrates the survival curve for the quartiles of average treatment retention. This figure visually verifies that programs with the lowest rate of retention were at the highest risk of discontinuing services.

Table 3 shows the comparative analysis of pre- and post-ACA differences showing significant increase in clients served in the post-ACA period as expected. Rates of wait time, retention and completion were all lower in programs that discontinued services compared to those that sustained in both pre- and post-ACA periods.

Hypotheses testing

Our findings supported Hypothesis 1, which posited that program size (number of treatment admissions for client population) would be negatively associated with risk of discontinuing services over time (2006–2014). The number of yearly treatment admissions was associated with lower risk of discontinuing services (hazard ratio [HR] = 0.671; 95% CI = 0.620, 0.727). In other words, the likelihood of discontinuing services for a treatment program was 67.1% that of an otherwise-identical program that reported half of the treatment admissions in a given year ($p < .001$). Please see Table 2 for findings

Table 2
Cox regressions on discontinuing services, 2006–2014.

	Base Model HR (95% CI)	*p*	*Interaction Model* HR (95%)	*p*
Organizational variables				
Size (# admitted clients)	0.671 (0.620, 0.727)	< 0.001*	0.681 (0.668, 0.762)	<0.001*
Performance variables				
Average wait time (days)	0.969 (0.931, 1.001)	0.11	0.979 (0.939, 1.022)	0.340
Average completion (%)	1.035 (0.489, 2.192)	0.927	1.349 (0.619, 2.936)	0.451
Average retention (days)[b]	0.989 (0.931, 0.994)	<0.001*	0.997 (0.992, 1.002)	0.275
Size * Avg. wait time			0.988 (0.971, 1.006)	0.195
Size * Avg. retention			0.996 (0.994, 0.998)	<0.001*
Size * Avg. completion			0.681 (0.475, 0.969)	0.033*
Type of treatment[a]				
Outpatient	1.012 (0.59, 1.74)	0.96	0.907 (0.524, 1.572)	0.73
Methadone	0.294 (0.109, 0.793)	.016*	0.239 (0.0876, 0.651)	0.005*
Multilevel	1.487 (0.755, 2.926)	0.25	1.25 (0.621, 2.515)	0.533
Client variables				
Female	0.616 (0.393, 0.966)	.035*	0.572 (0.359, 0.912)	0.019
Medi-Cal eligible	1.433 (0.863, 2.380)	0.16	1.179 (0.710, 1.959)	0.523
Criminal history	1.217 (0.754, 1.966)	0.13	1.092 (0.668, 1.786)	0.725
Homeless at admission	0.517 (0.251, 1.064)	0.073	0.573 (0.283, 1.162)	0.123
Non-White	0.754 (0.394, 1.443)	0.39	0.801 (0.421, 1.522)	0.497
Mental illness	1.27 (0.730, 2.212)	0.4	1.195 (0.689, 2.073)	0.526
Log Likelihood	−713.51		−694.07	
LR Chi2	232.82		271.7	
DF	13		16	
LR Chi2	<0.0001		<0.0001	

Note. N = 283 programs that existed in 2006. Analyses of non-left-censored data (i.e., programs that started service after 2006) produced consistent results. CI = confidence interval; HR = hazard ratio.
[a]Residential care was the reference category.
[b] *Average retention duration was centered around its mean of 74.68 days.*

related to hypotheses 1–3.

Our findings partially supported Hypothesis 2, which posited that program initiation and engagement, as measured by lower wait time, higher retention, and higher treatment completion, would be associated with lower risk of discontinuing services over time (2006–2014). Only treatment retention was negatively associated with risk of discontinuing services (HR = 0.989; 95% CI = 0.931, 0.994). The hazard of discontinuing services for a treatment program was 98.9% that of an otherwise-identical treatment program with an average treatment retention that was a day shorter (p < .01).

Our findings partially supported Hypothesis 3, which posited that programs' proportion of racial and ethnic minority clients would be positively associated with risk of discontinuing services over time (2006–2014). The bivariate comparative analysis showed that programs that discontinued services reported a higher rate of non-White clients compared to their sustained counterparts (81% vs. 74%, a 7% difference, p < .001). However, Cox regressions did not show a statistically significant relationship between proportion of non-White clients and risk of discontinuing services. Proportion of female clients was negatively associated with risk of discontinuing services (HR = 0.616, 95% CI = 0.393, 0.966, p < .03). Other variables related to client population had no statistically significant effects on the likelihood of discontinuing services.

Our findings did not support Hypothesis 4, which posited that, compared to pre-ACA (2006–2012), programs in the post-ACA era (2013–2014) with higher proportions of Medicaid-eligible clients would be associated with lower risk of program discontinuing services. As shown in Table 3, during both periods, programs that discontinued services had higher proportions of Medicaid-eligible clients than their sustained counterparts (pre-ACA: 64% vs. 52%; post-ACA: 98% vs. 50% respectively). Medicaid-eligible clients constituted almost all clients in programs that discontinued services during the post-ACA period compared to 64% of Medicaid eligible clients in the pre-ACA period, contrary to what we hypothesized.

We found two important associations between program type and discontinuing services and tested exploratory interactions between program size and performance measures. Compared to residential programs, methadone programs were associated with reduced likelihood of discontinuing services (HR = 0.294, 95% CI = 0.109, 0.793, p < .02). Two interactions were significant; the interaction between program size and retention rate (HR = 0.996, 95% CI = 0.994, 0.998, p < .01) and the interaction between program size and completion rates (HR = 0.681, 95% CI = 0.475, 0.969, p < .03) were negatively associated with risk of discontinuing services.

Discussion

Overall, our study expanded prior research examining organizational stability in the SUD treatment system (Wells et al., 2005) by advancing the understanding of the relationship between program size, engagement rates and risk of discontinuing services. In this study, we examined system stability by analyzing program factors associated with discontinuing services among publicly-funded SUD treatment programs in Los Angeles, California. Given prior research indicating that larger programs tend to have more support, resources, and stability (D'Aunno, 2006; Guerrero, 2013b; Johnson & Roman, 202l; McKenna, 2017) and that greater program performance may reduce disruption of services, we examined the role of program size, treatment initiation (wait time) and engagement (retention and completion) on risk of discontinuing services.

Our findings may have critical implications for disparities in access to care during public heath crises. Because access to care is limited to less than 12% of those seeking care (National Institute on Drug Abuse, 2012b) and the collision of the opioid epidemic and COVID-19 pandemic is exacerbating disparities in access to SUD treatment (Volkow, 2020), it is critical to understand which programs are most vulnerable to stopping service delivery. Our findings may also inform policy development, stimulate research, and guide the effective distribution of taxpayer resources to promote sustained services to respond to the current public health crises.

Our most striking result suggests an unstable SUD-treatment system, with 62% of programs discontinuing services at some point during the 9-year study period (2006–2014). Compared to residential treatment, outpatient programs that generally serve more than 70% of all clients (D'Aunno, 2006) reported the highest risk of discontinuing services. This inconsistent pattern of service provision in one of the largest SUD-

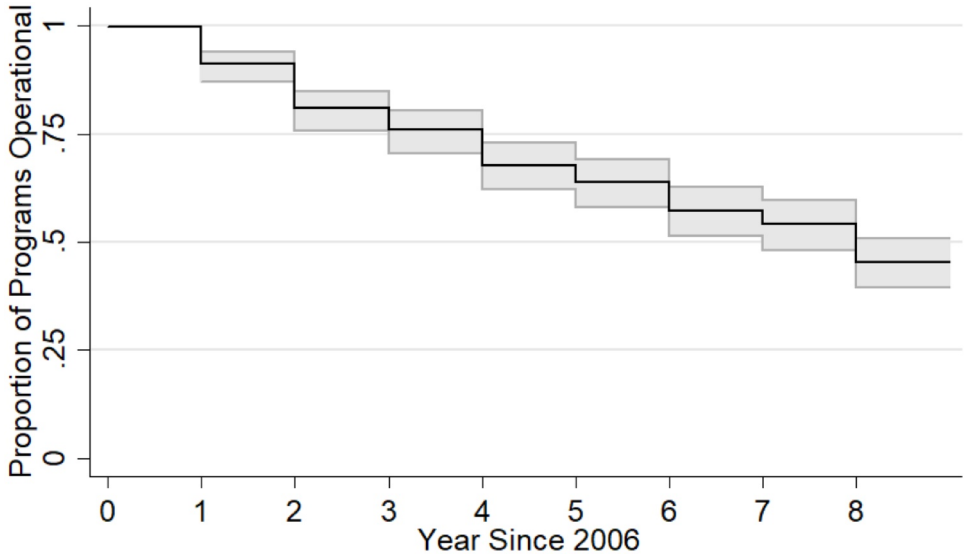

Fig. 1. Kaplan-Meier Survival Estimate with Confidence Interval *Note.* Nine-year survival curve for programs that sustained services starting in 2006 (n = 283 programs). The estimated 9-year survival rate was 45.23% (95% CI = 39%, 51%).

treatment systems in the United States is significant. Our findings partially supported our hypotheses. Most significantly, program size (i.e., total number of treatment admissions per program and levels of care provided) and client retention (i.e., number of days in treatment) play major roles in system stability (sustained service provision). These findings are crucial because it provides evidence of organizational characteristics associated with system stability in one of the largest treatment systems in the U.S. Programs that served more clients were associated with a lower risk of discontinuing services. By delivering services to more clients, larger programs may have more revenue, less variability in service costs, and consequently less risk to discontinue service provision. Furthermore, larger programs that offer different level of care (e.g., outpatient and inpatient) were most stable during the study period.

Further exploration shows that larger programs with higher retention as well as larger programs with higher completion rates were both associated with the lower risk of discontinuing services compared to smaller programs with lower retention and smaller programs with lower completion rates. The smallest programs, serving an average of seven clients per program, had the lowest completion rates, and nearly three in four of these programs discontinued services at one point during the nine-year period.

The relationship between size, as a proxy for program resources, as well as engagement, as a proxy for performance and service stability, supports the overall premise of organizational ecology (Hannan & Freeman, 1977) and resource dependence (Pfeffer & Salancik, 1978) theories, respectively. Smaller programs may not be as institutionalized or highly embedded in public funding and regulation, which may increase their risk of discontinuing services (D'Aunno, 2006; Wells et al., 2005). In this system, small size is a liability, potentially due to a reduced flow of clients and revenue related to a lack of expansion in client load (Pollack, D'Aunno & Lamar, 2006; Wells et al., 2005). With more than half of all programs discontinuing services at some point during the 9-year study period and smaller program being at the highest risk, service discontinuation is a common event.

Programs with lower client retention were associated with a higher risk of discontinuing services. Although it is expected that lower engagement (treatment retention) leads to lower revenue and potentially financial instability, this finding underscores that poor engagement may affect program stability in the long term. Emerging research has

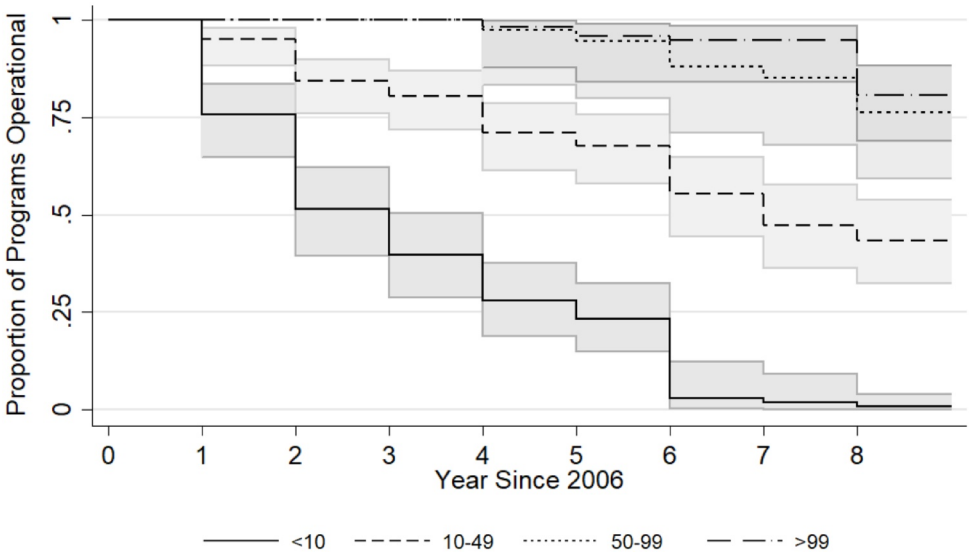

Fig. 2. Kaplan-Meier Survival Estimate Based on Yearly Number of Clients Served *Note.* Survival curves illustrate the effect of number of yearly clients on survival estimates. A visual check reveals that treatment programs serving fewer clients in a year were at a significantly higher risk of discontinuing services. Nine-year survival for programs that serve less than 10 clients a year is 0.078% (95% CI: 0.06%, 4.12%), for programs that serve between 10 and 49 clients a year is 43.33% (95% CI: 32.33%, 53.83%), for programs serving between 50 and 99 clients a year is 76.24% (95% CI: 59.23%, 86.89%), and for programs serving over 100 clients each year is 80.65% (95% CI: 68.85%, 88.35%).

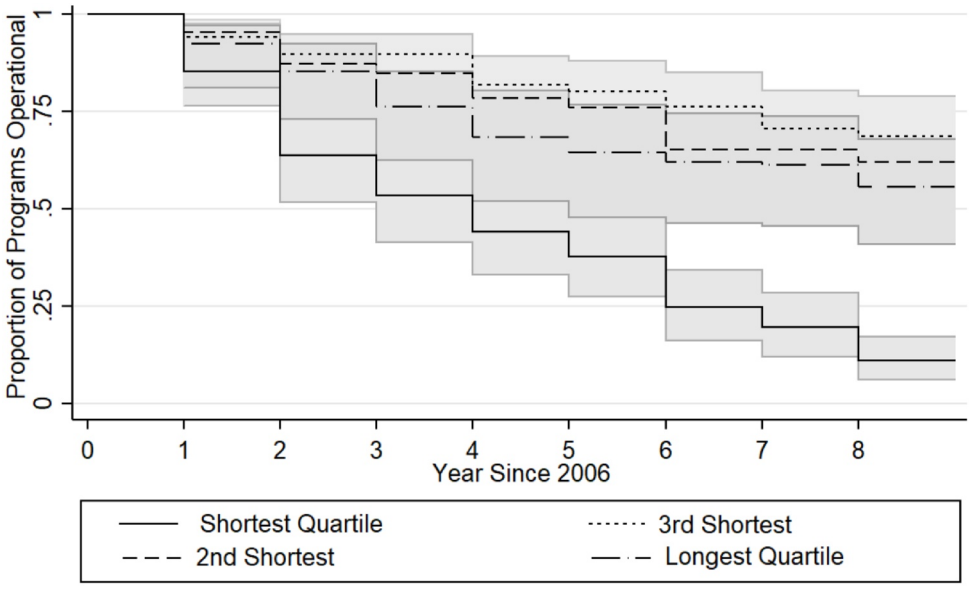

Fig. 3. Kaplan-Meier Survival Estimate Based on Quantiles of Average Treatment Retention
Note. Survival curves illustrate the effect of average retention on survival estimates for each quartile group. Programs with the lowest quartile of treatment retention had steeper survival curves compared to programs with longer average retention.

suggested that, compared to smaller programs, larger programs are more consistent in employing systematic treatment protocols to improve access to and engagement in care (D'Aunno, 2006; Guerrero, Aarons & Palinkas, 2014, 2014; Pollack et al., 2006). The causal relationship among program size, engagement, and risk of discontinuing services warrants further investigation. Finally, about 30% of programs that discontinued services resumed services 2 to 3 years later; although unstable, this treatment system is also highly dynamic. This dynamic trend highlights the need for additional research.

When comparing programs that discontinued versus sustained services in pre- and post-ACA periods, programs that discontinued services reported higher percentages of Medicaid-eligible and non-Latino White clients than programs that sustained services within each of the two periods (See Table 3). These relationships were not statistically significant in regression models that considered all years and accounted for many other factors, whereas there were robust associations between programs with higher proportion of female clients and reduced risk of discontinuing services. Albeit conjectural, these findings may suggest that regardless of the expansion of insurance coverage, programs serving mostly Medicaid-eligible Latino or African American males may still not accept Medicaid payments. The challenge for SUD treatment providers to accept Medicaid because of significant billing and reporting burdens is well documented (Andrews, 2014).

Table 3
Comparative analysis of program characteristics based on discontinuing and sustaining during Pre- and Post-ACA Eras.

	Pre-ACA (2006–2012)			Post-ACA (2013–2014)		
	Discontinued (n = 227)	Sustained (n = 1926)		Discontinued (n = 87)	Sustained (n = 450)	
	M (SE) or n (%)	M (SE) or n (%)	P	M (SE) or n (%)	M (SE) or n (%)	p
Organizational variables						
Size (# admitted clients)	14.57 (1.58)	105.44 (5.80)	< 0.001*	83.74 (17.37)	144.94 (14.02)	.0314*
<10 clients	143 (63.00%)	342 (17.76%)	<0.001*	22 (25.29%)	38 (8.44%)	<0.001*
10–49 clients	71 (31.28%)	684 (35.51%)	<0.001*	27 (31.03%)	128 (28.44%)	<0.001*
50–99 clients	9 (3.96%)	350 (18.17%)	<0.001*	17 (19.54%)	95 (21.11%)	<0.001*
≥100 clients	4 (1.76)	550 (28.56%)	<0.001*	21 (24.14%)	189 (42.00%)	<0.001*
Engagement variables						
Average wait time (days)	1.49 (0.28)	2.25 (0.13)	0.024*	0.24 (0.098)	3.378 (0.373)	< 0.001*
Average retention (days)†	60.85 (3.91)	88.66 (1.31)	<0.001*	25.07 (3.98)	72.80 (2.23)	<0.001*
Type of treatment						
Residential	37 (16.30%)	737 (38.27%)	< 0.001*	32 (36.78%)	196 (43.56)	0.242
Outpatient	146 (64.32%)	1235 (64.12%)	0.954	76 (87.36%)	247 (54.89%)	< 0.001*
Methadone	4 (1.76%)	206 (10.70%)	< 0.001*	0 (0.00)	88 (19.56%)	< 0.001*
Multilevel	16 (7.05%)	382 (19.83%)	<0.001*	36 (41.38%)	94 (20.89%)	<0.001*
Average completion (% of episodes)†	19.1% (2.12%)	23.06% (0.50%)	0.008*	3.49% (1.27%)	21.68% (0.91%)	< 0.001*
Client variables (% of episodes)						
Female	41.66% (3.24%)	43.62% (0.69%)	0.20	50.29% (7.95%)	43.14% (1.50%)	0.14
Medi-Cal eligible	63.73% (2.88%)	52.48% (0.91%)	< 0.001*	97.76% (1.39%)	49.67% (1.62%)	< 0.001*
Criminal record	39.75% (2.74%)	35.04% (0.77%)	0.025*	5.95% (1.79%)	19.20% (1.33%)	<0.001*
Homeless	16.81% (2.08%)	22.24% (0.65%)	0.004*	6.65% (2.19%)	26.14% (1.42%)	< 0.001*
Non-White	80.04% (1.93%)	74.78% (0.54%)	0.001*	84.17% (2.34%)	74.39% (1.07%)	< 0.001*
Mental illness	22.39% (2.14%)	23.60% (0.56%)	0.45	21.31% (3.17%)	24.53% (0.97%)	0.11

Note. The post-ACA period started in 2013 and includes 2014 because Los Angeles County initiated its Bridge to Reform program to expand eligibility in 2013. Of the 482 unique treatment programs, 314 discontinued service during the 9-year period. Observations of sustained programs correspond to years of operation of the 168 programs that remained open throughout the 9-year period and years of operation of the 314 programs that discontinued (i.e., 1926 pre-ACA and 450 post-ACA observations). P-values were derived using t-tests for continuous variables and chi-square tests for discrete variables.

† An analysis repeated for each form of care reveals consistent trends Pre- and Post-ACA as shown in observed in Table 1.

Implications

Current policy efforts in Los Angeles County rely on changes in the financial and organizational structure of SUD-treatment services that may sustain treatment programs. By increasing reimbursement rates and expanding reimbursing of services and practices (e.g. case management, billing and data entering) that were not paid in the past, the Drug Medi-Cal Organized Delivery System Waiver may increase programs' operational revenue and help reduce the risk of service disruptions (Centers for Medicare & Medicaid Services, 2014).

As performance-based contracting becomes common among publicly funded health-care systems (Borys, 2011; Briggs & McBeath, 2009; Brucker & Stewart, 2011; CSAT, 2016; Stewart, Horgan, Garnick, Ritter, & McLellan, 2012), administrators should consider including retention as a performance measure in SUD treatment. Other financing strategies that support the indirect cost of services are also encouraged to strengthen the capacity of this treatment system to effectively respond to public health crises.

Finally, researchers should include additional program performance measures in their studies to assess the effectiveness of their specific treatment system (e.g., service engagement, health, satisfaction) within the context of health care reform (Andrulis, Siddiqui, Purtle & Duchon, 2010). Refinement of performance measurement can improve understanding of how funding types, regulatory policies, payment systems allow programs to avoid service disruptions.

Limitations

The limitations and strengths of this study are both based on characteristics of the LACPRS dataset. Using large, multiyear, and system-wide client-level information from LACPRS to evaluate treatment engagement is an important strength of this study. But, we recognize that our administrative data measures on treatment initiation and engagement may have some issues of fidelity in reporting and in their recording. These measures are consistently used in addiction health services research (Mennis et al., 2019; SAMSA, 2009); furthermore, our initiation and engagement rates are consistent with other studies (Arnd, 2010; Kraemer et al., 2019; SAMHSA, 2009; Stahler et al., 2016). Our data is also limited in identifying programs under a parent organization. Regardless of whether programs have support from a larger organization, discontinuing service provision equally affect the stability of the SUD treatment system.

The LACPRS data were also limited in terms of the information collected on program resources related to contraction, mergers or expansion, reliance on public or private funding, and other theory-informed program-capacity factors. Specific measures of sustained services, staff-client ratios, age, and Medicaid and other main revenue sources could provide evidence of the resilience of programs in an ecological environment. These indicators could also allow us to test resource-dependency hypotheses on the role of the source and amount of financial dependency on private and/or public means to continue service provision. The lack of such indicators could lead to omitted-variable bias in our current models; although, our examination of the pattern of residuals found no apparent bias. Our multiyear data also did not allow us to conduct a traditional examination of longitudinal trends. However, our conceptualization and basic operationalization of program size is consistent with a prior study (Wells et al., 2005) and the examination of patterns in the full system across nine years seems adequate to mitigate these weaknesses.

We also recognize that our definition of discontinuing service provision may be problematic because ceasing service delivery could have different causes, including contract termination, program consolidation or merger. Our study was limited to examining internal program factors associated with discontinuation, rather than external and market-driven factors. Finally, our data did not allow us to determine whether the program closed, but that was most likely the case as fewer than 10 programs either continued services without a contract or consolidated and/or merged. Another shortcoming of these data is the limited number of service measures, which prevented analysis of the intensity and quality of treatment (Garnick, Lee, Horgan, Acevedo & Workgroup, 2009). Also, findings regarding program engagement should be interpreted with caution because they represent program-level aggregate measures reported to an administrative system database.

Despite these limitations, this study addressed a key research question regarding system stability (Wells et al., 2005) using administrative county data. This represents the only examination of system-wide stability in one of the largest SUD-treatment systems in the United States. As such, it offers preliminary information about ways in which to maximize the use of existing large-scale administrative data to evaluate system stability and protect the public health system from service disruptions, particularly to underserved populations.

Conclusions

Small programs represent more than 70 percent of all programs in LA County, similar to other large treatment systems in the United States (D'Aunno, 2006; McLellan et al., 2003). As such, the stability of this treatment system requires significant investments in funding and technical assistance. Policy makers, health administrators and program managers should invest resources to improve performance rates, reduce variation in quality of care and reduce the risk of service disruption, particularly to prepare this system to respond to public health crises.

Author statement

Dr. Guerrero reviewed the research literature, framed the scope of the paper, was the primary text author, and with Dr. Alibrahim analyzed the data. Drs. Howard, Wu and D'Aunno provided additional literature resources and supported the writing of the manuscript, including revisions. All authors interpreted the data and reviewed and approved the final draft.

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Declaration of Competing Interest

Erick Guerrero declares that he has no conflict of interest. Abdullah Alibrahim declares that he has no conflict of interest. Daniel Howard declares that he has no conflict of interest. Shinyi Wu, declares that she has no conflict of interest. Tom D'Aunno declares that he has not conflict of interest.

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