ORIGINAL ARTICLES

Effect of Primary Medical Care on Addiction and Medical Severity in Substance Abuse Treatment Programs

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OBJECTIVE: To examine whether the availability of primary medical care on-site at addiction treatment programs or off-site by referral improves patients' addiction severity and medical outcomes, compared to programs that offer no primary care.

DESIGN: Secondary analysis of a prospective cohort study of patients admitted to a purposive national sample of substance abuse treatment programs.

SETTING: Substance abuse treatment programs in major U.S. metropolitan areas eligible for demonstration grant funding from the federal Substance Abuse and Mental Health Services Administration.

RESPONDENTS: Administrators at 52 substance abuse treatment programs, and 2,878 of their patients who completed treatment intake, discharge, and follow-up interviews.

MEASUREMENTS: Program administrators reported whether the program had primary medical care available on-site, only off-site, or not at all. Patients responded to multiple questions regarding their addiction and medical status in intake and 12-month follow-up interviews. These items were combined into multi-item composite scores of addiction and medical severity. The addiction severity score includes items measuring alcohol and drug use, employment, illegal activities, legal supervision, family and other social support, housing, physical conditions, and psychiatric status. The medical severity score includes measures of perceived health, functional limitations, and comorbid physical conditions.

MAIN RESULTS: After controlling for treatment modality, geographic region, and multiple patient-level characteristics, patients who attended programs with on-site primary medical care experienced significantly less addiction severity at 12-month follow-up (regression coefficient, −25.9; 95% confidence interval [95% CI], −43.2 to −8.5), compared with patients who attended programs with no primary medical care. However, on-site care did not significantly influence medical severity at follow-up (coefficient, −0.28; 95% CI, −0.69 to 0.14). Referral to off-site primary care exerted no detectable effects on either addiction severity (coefficient, −9.0; 95% CI, −26.5 to 8.5) or medical severity (coefficient, −0.03; 95% CI, −0.37 to 0.44).

CONCLUSIONS: On-site primary medical care improves substance abuse treatment patients' addiction-related outcomes, but not necessarily their health-related outcomes. Further study is needed to discern the mechanism through which on-site primary care might improve the addiction-related outcomes of substance abuse treatment.

KEY WORDS: delivery of health care, integrated; outcome and process assessment (health care); primary health care; substance abuse treatment centers; substance-related disorders.
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Medical conditions are common among patients who receive substance abuse treatment.[1-3] In addition to reductions in substance use, substance abuse treatment also improves patients' health, social adjustment, criminality, employment, and health care utilization.[1,4-6] Addiction treatment programs traditionally provide rehabilitative services to address substance use, as well as supplemental medical and psychosocial services to address addicted patients' multidimensional life problems. Several studies have suggested that the integration of general medical services into substance abuse treatment might improve these patients' addiction- and health-related outcomes.[7-9] In particular, primary care services provided on-site in substance abuse treatment programs are considered to have the strongest impact on these outcomes.[10,11] Using data from the National Treatment Improvement Evaluation Survey (NTIES),[1] a prospective cohort study of substance abuse treatment programs and their patients, we sought to build on the evidence that primary medical care services improve the addiction- and health-related outcomes of substance abuse treatment patients.[9] We performed a secondary analysis of NTIES data to examine whether patients admitted to addiction treatment programs that had primary medical care

available on- or off-site had better addiction severity and health-related outcomes in the year after treatment than did the patients admitted to programs in which primary medical care was not available.

METHODS

Sample

The National Treatment Improvement Evaluation Survey was a national longitudinal evaluation of administrative and clinical elements of substance abuse treatment programs. All patient interviews were completed between July 1993 and November 1995.[1] Across the 72 treatment programs participating in the patient outcomes study, 13,426 persons were admitted during the enrollment period, and 7,782 (58.0%) met the eligibility criteria and were recruited to participate. Eligibility criteria required completion of an initial unit of treatment, defined as at least 1 outpatient treatment visit or 1 overnight stay in a residential facility. In large programs, a random sample of admissions were approached for enrollment in order to limit the number of subjects from those programs. Approximately half the difference between 13,426 and 7,782 derives from random selection for nonenrollment, and half from noncompletion of an initial unit of treatment.

Of the 7,782 patients enrolled, 4,526 (58.2%) in 72 treatment programs completed the entire set of intake, treatment discharge, and 12-month follow-up interviews. The current analysis excluded 10 programs whose administrators did not provide information regarding the availability of primary medical care and 10 correctional facility programs. Analyses with and without the correctional programs did not substantively change our results.

The analytic file for the current analysis thus included 2,878 patients in 52 noncorrectional substance abuse treatment programs. These 52 programs had a range of 1 to 201 respondents per program who had completed all 3 interviews, with a median of 40 such respondents. Although targeted as 12-month follow-up, abbreviation of the follow-up period at the end of the study compressed follow-up to a median of 11 months.

Measures

Program-level. *Primary medical care availability* in the treatment program, the primary explanatory variable, was determined from questionnaires completed by program administrators. This variable was dummy-coded to indicate whether (1) on-site care was available through the program, (2) only off-site care was available through the program, or (3) no primary medical care was available through the program (the referent category). We validated these administrator-level measures with patient reports of whether and where they received primary medical services during treatment.

Treatment modality, an indicator of the program's treatment philosophy and patient selection,[12] was also determined from the administrative questionnaires. Dummy variables indicated whether a patient attended a methadone, short-term residential, or long-term program. Outpatient nonmethadone program was the referent modality. Because the program-level methadone modality was highly correlated with patient-level methadone status at 12-month follow-up (see below), the program-level indicator variable for methadone modality was dropped from the multivariable models.

Geographic region is the area of the United States in which the program was located: Northeast, South, Midwest, or West. The western region was the referent.

Patient-level. *Addiction severity score,* one of the primary outcomes, was a multidimensional composite measure similar to the validated Addiction Severity Index.[1,13] Because NTIES did not include a validated multidimensional instrument to measure addiction severity, we developed this composite score to provide a comprehensive measure of the totality of problems from which the substance-abusing patient suffered. In addition to the domains of alcohol and drug use, employment, illegal activities, family and other social support, medical conditions, and psychiatric status included in the Addiction Severity Index, our addiction severity score incorporated legal supervision status and housing information. Reports of behavior and subjective ratings were combined and standardized into scale values that could range from 0 to 100 in each domain. Cronbach α tests of internal consistency for these domains ranged from 0.61 to 0.66 at follow-up and 0.31 to 0.45 at intake.

The dependent variable, addiction severity score at follow-up, was developed with the recognition that a comprehensive measure might lack internal reliability. This dependent variable was the sum of the component domain scales to a maximum value of 900. The resultant addiction severity score had Cronbach α coefficients of 0.66 at follow-up and 0.41 at intake, which reflect the heterogeneity of its components.[14] Addiction severity score at intake ranged from 53 to 677, and addiction severity score at follow-up ranged from 0 to 653, with higher score indicating greater impairment. We also developed a version of this score with components related to medical severity excluded so that we could include the remaining domains of addiction severity as an explanatory variable in the model predicting medical severity score at 12-month follow-up.

Medical severity score, the other primary outcome, is a composite measure of perceived health, functional limitations, and comorbid physical conditions. Because NTIES did not include a standard instrument to measure health status and illness burden, we derived this composite score from a principal component analysis of 9 survey items. The 9 items are: (1) general health ("In general, would you say your health is excellent, good, fair or poor?"); (2) health limits on work ("Right now, how much does your health limit the kind of work you can do? Would you say

not at all, somewhat, or very much?"); and 7 areas of comorbid physical conditions: "Have you had any of problems with …" (1) "your sight, that is, you've had difficulty seeing even with glasses or contact lenses?"; (2) "your hearing, that is, you've had difficulty hearing even with a hearing aid?"; (3) "a serious heart or blood condition, including high blood pressure, or anemia?"; (4) "another serious internal condition, such as stomach ulcers, sugar diabetes, or kidney or liver or female problems?"; (5) "a serious bone or muscle condition, such as being paralyzed, bad arthritis, limping, or bursitis?"; (6) "a serious nerve condition, such as convulsions, epilepsy, or migraine headaches? Please do not include any mental health problems"; and (7) "Other than anything you've told me about, since (date 30 days ago), has any other health problem caused you pain, limited your activities, or caused you any other problems?"

The medical severity composite score used the factor-based method. The result was validated using a separate factor-score–based approach, which revealed that the modeling results were stable.[15] The medical severity score had a Cronbach α of 0.71 at follow-up and 0.72 at intake, which indicates sufficient internal consistency.[14] Both intake and follow-up medical severity scores ranged from 2 to 14, with higher score indicating greater impairment.

Depressive symptom status was defined on the basis of 4 items in the NTIES intake patient surveys: (1) "Have you had a period of 2 weeks or longer when you have felt either very sad or depressed?"; (2) "Have you had a period of 2 weeks or more when you lost interest and pleasure in things you care about?"; (3) "Have you thought seriously about committing suicide?"; and (4) "Have you tried to commit suicide?" Questions (3) and (4) were combined into a dummy variable to indicate whether a patient had suicidal thoughts or behavior. A second dummy variable, created from questions (1) and (2), indicates whether a patient reported depressive symptoms only.

Drug injection in the past 12 months, a sign of more advanced addiction and possibly of more need for medical care, is a binary variable that indicates whether the patient had "used a needle, even one time, to inject drugs to get high or for other nonmedical effects" in the past 12 months (0 = no, 1 = yes). The patient could have injected him- or herself, or been injected by someone else.

Treatment duration, the number of days of treatment divided by 30, is a continuous variable measuring the approximate number of months the respondent spent in drug treatment. This variable was included because a longer duration of treatment might provide a greater opportunity to access needed services. Treatment duration was derived from a combination of information from the treatment discharge questionnaire and patient record abstraction. For some respondents, primarily methadone maintenance patients, treatment duration is a measure of the duration of treatment up to administration of the 12-month follow-up. Treatment duration

ranged from 0.033 to 24.4 months, and varied greatly by modality.

Methadone status at 12-month follow-up indicates whether the patient remained in methadone maintenance, had completed withdrawal from methadone treatment (i.e., detoxification), or received treatment other than methadone (the referent group). This dummy-coded variable is included because a need for methadone, particularly for methadone maintenance, might indicate patients with greater severity of addictive problems, as well as those for whom the program had greater opportunity to facilitate delivery of needed services.

Age, race/ethnicity, education, and marital status, taken from the intake questionnaire were included as demographic characteristics, in the form shown in Table 1.

Statistical Methods

The primary analyses tested the hypothesis that patients admitted to addiction treatment programs with primary medical care available on- or off-site would have better addiction and medical severity outcomes at the 12-month follow-up than would patients admitted to programs in which primary medical care was not available. Primary care availability was dummy-coded to indicate whether (1) any on-site primary medical care was available in the addiction treatment program, (2) only off-site primary medical care was available, or (3) no primary medical care was available through the program. The group of programs that had no primary medical care was the referent.

Because referral patterns and admission policies may cause patients within programs to be more similar to each other than patients across programs, clustering of patients within programs is said to be present. Such clustering may lead to violations of the independence assumption necessary for standard statistical tests, which may underestimate standard errors. Thus, these analysis used mixed effects linear regression models that took into account the clustering of patients within treatment programs.[16,17] All statistical tests were 2-tailed.

RESULTS

In the 52 substance abuse treatment programs, on-site primary care was available at 20 programs that served 1,387 patients; 13 programs with 493 patients had off-site primary care, and 19 programs with 998 patients delivered no medical care (Table 1). The availability of primary medical care differed across the treatment modalities. On-site primary care was available at 50% of methadone, all short-term residential, 47% of long-term residential, and 16% of nonmethadone outpatient programs. No methadone or short-term residential programs offered only off-site primary care, but primary care was available only off-site at one third of long-term residential, and 32% of nonmethadone outpatient programs. No medical care was available at half of methadone, 20% of

Table 1. Program- and Patient-level Characteristics by Primary Medical Care Availability

Variables	Overall	Primary Medical Care Availability*		
		On-site Care Available	Only Off-site Care Available	No Primary Care Available
Program-level				
Total number of programs	52	20	13	19
Treatment modality, $n^\dagger$				
Methadone	6	3	0	3
Short-term residential	6	6	0	0
Long-term residential	15	7	5	3
Nonmethadone outpatient	25	4	8	13
Geographic region, $n^\ddagger$				
Northeast	16	4	6	6
South	10	9	0	1
Midwest	12	3	3	6
West	14	4	4	6
Patient-level				
Total number of patients	2,878	1,387	493	998
Addiction severity at intake, mean (SE)	349 (5.8)	358 (8.9)	320 (11.8)‡	358 (9.0)
Addiction severity at 12-mo follow-up, mean (SE)	166 (5.8)	162 (9.1)	151 (12.2)	178 (9.3)
Medical severity at intake, mean (SE)	4.6 (0.1)	4.7 (0.2)	4.0 (0.2)†	4.9 (0.2)
Medical severity at 12-mo follow-up, mean (SE)	4.3 (0.1)	4.3 (0.2)	3.9 (0.2)	4.5 (0.2)
Depressive symptoms, n (%)				
Suicidal thoughts/behavior	289 (10.0)	102 (7.4)†	46 (9.3)	141 (14.1)
Depressive symptoms only	806 (28.1)	349 (25.1)	149 (30.2)	308 (30.9)
No depressive symptoms	1,783 (62.0)	936 (67.5)	298 (60.5)	549 (55.0)
Drug injection in the past 12 months, n (%)				
Yes	644 (22.4)	375 (27.0)	56 (11.4)	213 (21.3)
No	2,234 (77.6)	1,012 (73.0)	437 (88.6)	785 (78.7)
Treatment duration, mean mo (SE)	5.5 (0.5)	5.9 (0.8)	4.8 (1.0)	5.6 (0.8)
Methadone status at 12-mo follow-up, n (%)				
Methadone maintenance	195 (6.8)	123 (8.9)	0§	72 (7.2)
Withdrawn from methadone	174 (6.1)	83 (6.0)	0§	91 (9.1)
Treatment other than methadone	2,509 (87.2)	1,181 (85.2)	493 (100)	835 (83.7)
Ethnicity/race, n (%)				
Non-Hispanic black	1,558 (54.1)	816 (58.8)	224 (45.4)	518 (51.9)
Non-Hispanic white	843 (29.3)	390 (28.1)	218 (44.2)†	235 (23.6)
Other	477 (16.6)	181 (13.1)	51 (10.3)	245 (24.6)
Age in years, n (%)				
≤20	295 (10.3)	69 (5.0)	142 (28.8)	84 (8.4)
21 to 30	941 (32.7)	523 (37.7)	145 (29.4)	273 (27.4)
31 to 40	1,145 (39.8)	556 (40.1)‡	143 (29.0)§	446 (44.7)
≥41	497 (17.3)	239 (17.2)	63 (12.8)‡	195 (19.5)
Marital status, n (%)				
Currently married at intake	603 (21.0)	323 (23.3)	73 (14.9)	207 (20.8)
Ever married	469 (16.3)	234 (16.9)	59 (12.0)	176 (17.7)
Single	1,800 (62.7)	828 (59.8)	359 (73.1)	613 (61.6)
Educational attainment, n (%)				
At least high school graduate	1,385 (48.1)	730 (52.6)	208 (42.2)	447 (44.8)
Did not graduate from high school	1,493 (51.9)	657 (47.4)	285 (57.8)	551 (55.2)

* For patient-level variables, bivariate linear and multinomial logistic mixed effects regression models test the significance of differences between the "on-site" group and "off-site" group versus the "no primary medical care" group. These models adjust for the clustering of patients within programs.
† $P < .01$.
‡ $P < .05$.
§ $P < .001$.

long-term residential, and 52% of nonmethadone outpatient programs. In terms of geography, the programs selected in the South appeared to deliver more on-site primary medical care.

Programs with primary medical care available on-site had patients with relatively fewer depressive symptoms and slightly more young adult patients than programs with no primary care (Table 1). In addition to differences in addiction and medical severity at intake (described below), programs with off-site primary medical care had fewer drug injecting or methadone patients, more white patients and more young adult patients than did programs with no

primary care available. Marital status and educational background at intake did not differ significantly by primary care availability.

Addiction Severity

The mean pre- to post-treatment reduction in addiction severity across all the groups was 183 ± 14 on a 900-point scale. In bivariate analyses, mean addiction severity at intake was identical between patients in programs with on-site primary medical care and patients in programs with no primary care available (Table 1). At 12-month follow-up, addiction severity appeared lower in the group with on-site primary medical care, but the difference did not reach statistical significance in bivariate analysis. Addiction severity at intake was lower among patients in programs with off-site primary care than among patients in programs without primary care (P = .014), but this difference did not remain significant at 12-month follow-up.

Multivariable analyses of addiction severity supported the hypothesis that patients admitted to programs with primary medical care available on-site would have better addiction severity outcomes at the 12-month follow-up than would patients admitted to programs in which primary medical care was not available (Table 2). The exclusive availability of primary care off-site did not appear to influence addition severity outcome. Not surprisingly, higher (i.e., worse) addiction severity at intake, worse depressive symptoms, drug injection in the past 12 months, and briefer treatment duration also predicted worse follow-up addiction severity. Other intake patient characteristics that predicted higher addiction severity at follow-up included black race and younger age. Patients who were currently married or who had graduated from high school had lower addiction severity at follow-up.

Patient-level indicator variables for methadone withdrawal (i.e., detoxification) and methadone maintenance were also associated with worse addiction severity at follow-up, compared with having received other types of treatment. To explore the areas in which methadone and the primary care linkage variables might be exerting influence, we performed 9 multivariable procedures to regress separately the 9 domains of the addiction severity score against the variables in the final model. The methadone findings persisted in models for most of these domains. Patients who were withdrawn from methadone tended to have worse subscores at 12-month follow-up than patients who received nonmethadone treatment in the domains of drug use (P < .0001), alcohol use (P = .11), illegal activities (P < .0001), legal supervision (P = .005), employment (P = .06), medical (P = .16), psychiatric (P = .01), family and other social support (P = .02), and housing (P = .03). Similarly, patients receiving methadone maintenance at 12-month follow-up displayed worse subscores than patients who received nonmethadone

Table 2. Independent Effect of Primary Care Availability in the Substance Abuse Treatment Program on Patients' Addiction Severity at 12-month Follow-up

Explanatory Variables	Regression Coefficients (95% CI)*
Fixed effects	
Program-level	
Primary medical care availability	
On-site care available	−25.88 (−43.24 to −8.52)[†]
Only off-site care available	−9.01 (−26.49 to 8.47)
No primary care available through the program	Referent
Treatment modality	
Short-term residential	3.67 (−18.89 to 26.23)
Long-term residential	7.22 (−8.09 to 22.53)
Outpatient drug-free	Referent
Geographic region	
Northeast	−13.62 (−31.40 to 4.17)
South	9.01 (−11.65 to 29.69)
Central	−7.55 (−26.71 to 11.60)
West	Referent
Patient-level	
Addiction severity at intake	0.236 (0.196 to 0.276)[‡]
Depressive symptoms	
Suicidal thoughts/behavior	35.08 (23.17 to 47.00)[‡]
Depressive symptoms only	8.94 (0.94 to 16.93)[§]
No depressive symptoms	Referent
Drug injection in the past 12 mo	33.21 (22.71 to 43.70)[‡]
Treatment duration, per mo in treatment	−2.31 (−3.21 to −1.41)[‡]
Methadone status at 12-mo follow-up	
Methadone maintenance	64.38 (40.48 to 88.28)[‡]
Withdrawn from methadone	76.78 (53.58 to 99.98)[‡]
Treatment other than methadone	Referent
Ethnicity/race	
Non-Hispanic black	15.94 (3.68 to 28.19)[§]
Non-Hispanic white	2.05 (−9.93 to 14.02)
Other	Referent
Age category, in years	
≤20	19.27 (3.28 to 35.26)[§]
21 to 30	Referent
31 to 40	−1.07 (−7.79 to 9.94)
≥41	−1.28 (−13.30 to 10.75)
Marital status	
Currently married	−12.95 (−22.42 to −3.47)[†]
Past married	−1.22 (−12.11 to 9.67)
Never married	Referent
Educational attainment	
At least high school graduate	−22.61 (−30.01 to −15.20)[‡]
Did not graduate from high school	Referent
Constant	87.07 (63.07 to 111.07)[‡]
Random effects	
Program-level variance (SE)	204.2 (97.5)[§]
Patient-level variance (SE)	7,664.4 (222.1)[‡]
−2 Log-likelihood	28,701.7

* *From multivariable mixed effects linear regression models controlling for the variables displayed, and adjusted for the clustering of patients within programs. Regression coefficients provide the adjusted mean difference in the addiction severity score between a particular category and the referent category.*
[†] *P < .01.*
[‡] *P < .001.*
[§] *P < .05.*

treatment in the domains of drug use ($P < .0001$), alcohol use ($P = .04$), illegal activities ($P = .02$), legal supervision ($P = .44$), employment ($P = .05$), medical ($P = .0005$), psychiatric ($P = .006$), family and other social support ($P = .66$), and housing ($P = .18$).

On-site primary medical care appeared to exert modest individual effects on these 9 domains at 12-month follow-up: drug use ($P = .20$), alcohol use ($P = .67$), illegal activities ($P = .22$), legal supervision ($P = .28$), employment ($P = .08$), medical ($P = .09$), psychiatric ($P = .52$), family and other social support ($P = .004$), and housing ($P = .47$). No single domain appeared to explain the influence of on-site primary care availability on the overall addiction severity score.

Medical Severity

The mean pre- to post-treatment reduction in medical severity across all the groups was small, only 0.3 ± 0.17 on a 14-point scale. We detected no bivariate differences in medical severity at intake or at 12-month follow-up comparing patients in programs with on-site primary medical care and those in programs with no primary care available (Table 1). Patients in programs with off-site primary care had lower medical severity at intake than did patients in programs with on-site care ($P = .018$) or no primary care available ($P = .0045$); their medical severity was not significantly lower at follow-up.

Multivariable analyses did not detect a stable effect of primary medical care delivery on- or off-site on patients' medical severity outcomes at the 12-month follow-up (Table 3). Patients in programs in the Northeast and Central regions appeared to experience lower (i.e., better) medical severity at 12-month follow-up. Higher medical severity at intake, worse depressive symptoms, methadone maintenance, older age, and lower educational attainment were significant predictors of worse medical severity at 12-month follow-up. For example, suicidal thoughts or behavior worsened medical severity at follow-up by 0.65 points, while depressive symptoms only worsened medical severity by 0.20 points on a 14-point scale at 12-month follow-up.

DISCUSSION

As expected, the availability of primary care services on-site in the substance abuse treatment program improved patients' addiction severity at follow-up. This finding is consistent with a report that substance-related outcomes improved among patients with medical issues who were randomized to primary health care integrated into an addiction treatment program compared with patients in an independent treatment-as-usual model.[18] The 26-point change in addiction severity attributable to on-site primary care represents 14% of the average pre- to post-treatment improvement in addiction severity. Put another way, assuming the average benefits of on-site primary medical care are distributed uniformly across all patients, the magnitude of the effect of on-site primary care might be

Table 3. Independent Effect of Primary Care Availability in the Substance Abuse Treatment Program on Patients' Medical Severity at 12-month Follow-up

Explanatory Variables	Regression Coefficients (95% CI)*
Fixed effects	
Program-level	
Primary medical care availability	
On-site care available	−0.28 (−0.69 to 0.14)
Only off-site care available	0.034 (−0.37 to 0.44)
No primary care available through the program	Referent
Treatment modality	
Short-term residential	−0.0077 (−0.55 to 0.53)
Long-term residential	0.15 (−0.21 to 0.51)
Outpatient drug-free	Referent
Geographic region	
Northeast	−0.43 (−0.85 to −0.02)†
South	−0.27 (−0.75 to 0.21)
Central	−0.80 (−1.24 to −0.35)‡
West	Referent
Patient-level	
Medical severity at intake	0.43 (0.39 to 0.46)‡
Addiction severity at intake without medical domain	−0.0005 (−0.001 to 0.0004)
Depressive symptoms, *n* (%)	
Suicidal thoughts/behavior	0.65 (0.41 to 0.88)‡
Depressive symptoms only	0.20 (0.04 to 0.35)†
No depressive symptoms	Referent
Drug injection in the past 12 mo	0.06 (−0.15 to 0.27)
Treatment duration, per mo in treatment	0.003 (−0.016 to 0.021)
Methadone status at 12-mo follow-up	
Methadone maintenance	0.72 (0.18 to 1.26)§
Withdrawn from methadone	0.30 (−0.23 to 0.83)
Treatment other than methadone	Referent
Ethnicity/race	
Non-Hispanic black	−0.077 (−0.33 to 0.17)
Non-Hispanic white	−0.051 (−0.29 to 0.19)
Other	Referent
Age category, in years	
≤20	−0.30 (−0.64 to 0.031)
21 to 30	Referent
31 to 40	0.22 (0.04 to 0.39)†
≥41	0.83 (0.59 to 1.07)‡
Marital status	
Currently married	0.13 (−0.06 to 0.32)
Past married	0.13 (−0.09 to 0.34)
Never married	Referent
Educational attainment	
At least high school graduate	−0.22 (−0.37 to −0.08)§
Did not graduate from high school	Referent
Constant	2.62 (2.10 to 3.15)‡
Random effects	
Program-level variance (SE)	0.15 (0.06)§
Patient-level variance (SE)	2.95 (0.09)‡
−2 Log-likelihood	9,633.2

* From multivariable mixed effects linear regression models controlling for the variables displayed, and adjusted for the clustering of patients within programs. Regression coefficients provide the adjusted mean difference in the medical severity score between a particular category and the referent category.
† P < .05.
‡ P < .001.
§ P < .01.

sufficient to compensate for the poorer addiction severity outcome associated with not graduating from high school, for example.

However, we could not detect a stable effect of on-site primary care on these patients' medical severity outcomes. That we did not find an effect does not mean it does not exist—the small overall improvement in pre- to post-treatment medical severity provided little margin for detection of an effect. Measurement error in the medical severity scale might have made it more difficult to reject the null hypothesis. Furthermore, the medical severity scale may have had limited responsiveness to change in the underlying domain. It is thus possible that this result derives not from a lack of effect of on-site primary care, but rather from limitations in measurement. Nonetheless, should the findings from this purposive sample generalize to the drug abuse treatment population, they would suggest that primary medical care in addiction treatment might not exert a strong influence on addiction treatment patients' subsequent health perception, functional limitations, and comorbid physical conditions. They would further imply that improvements in these health-related domains might not mediate the observed salubrious effect of on-site primary care services on addiction severity. If the implication of these results is correct and health-related improvements do not explain the effect of on-site primary care services on addiction severity, future research should consider other ways that primary medical care might mitigate addiction problems.

One can speculate several possible mechanisms. First, the primary care physician's focus on physical health problems, particularly sequelae of substance abuse, might add an important motivational element to substance abuse treatment. This consideration is consistent with a prior study that found that addiction treatment patients who recalled that a physician warned them about the effects of their substance abuse had better addiction treatment outcomes.[19] Second, the patient-physician relationship as a source of counseling or social support may add to the therapeutic milieu of the addiction treatment program. The significant effect of on-site primary medical care on the addiction severity domain of "family and other support" supports this possibility. In explaining their finding of improved addiction outcomes among patients with substance-abuse–related medical conditions who were assigned to integrated primary care, Weisner et al. noted that "...the difference in outcomes was due more to the content of the patient-physician interaction than to higher utilization of primary care."[18] Those authors further suggested that on-site physicians' facilitation of treatment engagement might explain both the higher rates of individual therapy visits and better addiction-related outcomes they observed among patients in the integrated care group.[18]

Third, the on-site primary care physician and medical staff might facilitate assessment and referral for psychosocial services that could improve addiction-related outcomes.[20] Relatedly, a therapeutic environment responsive to patients' needs, of which integrated primary care would be one element, might improve patients' engagement and retention in treatment.[21] Finally, if delivery of primary medical care within the treatment program is merely a marker for a higher quality program, then this study's primary care finding may only reflect confounding from unmeasured better program quality. Indeed, if this unmeasured confounder denotes quality addiction care, but not quality medical care, it would explain why attending a program that delivered on-site primary care was associated with better addiction but not medical outcomes.

Methadone patients reported worse addiction severity at follow-up, compared to those in other treatment modalities. On the surface, this result appears to contradict the rigorous evidence from randomized trials and observational studies that methadone maintenance improves addiction-related outcomes.[12] We suspect that this finding results from referral bias and unmeasured case-mix—only patients with the most refractory addictive diatheses, those who have failed multiple attempts at abstinence, are referred for methadone treatment, and of these patients, only the most severe patients will tolerate the inconvenience and stigma associated with methadone maintenance treatment as practiced in the United States. Though strong and consistent with other comparative results covering multiple modalities of treatment,[2] these results should be interpreted with caution because they were not the result of primary, a priori hypotheses. At the very least, these exploratory findings suggest that patients in nonmethadone treatment might experience greater improvements in several domains than do patients who receive methadone, and that the benefits of nonmethadone treatment may be underappreciated in relation to those of methadone treatment.

This study has several limitations. First, the great majority of on-site primary care occurred in short-term residential programs and most off-site care in long-term residential and nonmethadone outpatient programs. Hence, the potential confounding effect of program modality is the greatest threat to the validity of these findings. The overall similarity of outcomes across most modalities and the large size of the NTIES sample lent sufficient cases in most smaller cells to permit discrimination between modality and the primary care variable; off-site care in methadone or short-term residential programs, in which zero cells precluded any conclusions, was the exception. In the case of the methadone modality, the relatively even distribution of on-site and no primary medical care was statistically reassuring. Second, the use of a purposive sample may limit generalizability, especially since NTIES enrolled treatment units that had received federal funding to increase services, including primary medical care. That said, the NTIES sample likely provides externally valid information regarding stable urban programs whose patients may be most in need of linkage to primary medical

care. Third, managed care has altered the health care system since these data were collected in the early 1990s. Nonetheless, a recent report has suggested that primary medical care integrated into addiction treatment likely functions in a similar manner in managed care.[18] Fourth, although the measures of addiction and medical severity have face validity and adequate psychometric properties, they have not been tested for correlative or criterion validity against established measures. HIV infection, which is of great concern in the substance-using population, was not directly measured in NTIES, but to the extent that it made patients perceive poor health, functional limitations, or comorbid symptoms, it should be reflected in the measure of medical severity. Relatedly, these measures may not have adjusted fully for the confounding effects of case-mix at intake. Fifth, self-report data present their own concerns, but are reasonably valid in most domains, including addiction-related outcomes.[1,5] Finally, analyses comparing administrative reports of on-site care with reports of physician and nurse staffing were reassuring with regard to the validity of the on-site primary care measure. However, primary care was not a primary focus of NTIES, which did not include measures of the quality or quantity of primary care services. Future studies would benefit from more detailed process measures of the quality of medical care.

We nonetheless conclude that delivery of primary care medical services on-site in the organizational context of a substance abuse treatment program improves patients' addictive problems in the year subsequent to addiction treatment. Future research should discern the active ingredients of primary medical care for addicted patients, and the cost-effectiveness of its provision in addiction treatment programs.

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