Integrating Primary Medical Care With Addiction Treatment

A Randomized Controlled Trial

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Context The prevalence of medical disorders is high among substance abuse patients, yet medical services are seldom provided in coordination with substance abuse treatment.

Objective To examine differences in treatment outcomes and costs between integrated and independent models of medical and substance abuse care as well as the effect of integrated care in a subgroup of patients with substance abuse–related medical conditions (SAMCs).

Design Randomized controlled trial conducted between April 1997 and December 1998.

Setting and Patients Adult men and women (n=592) who were admitted to a large health maintenance organization chemical dependency program in Sacramento, Calif.

Interventions Patients were randomly assigned to receive treatment through an integrated model, in which primary health care was included within the addiction treatment program (n=285), or an independent treatment-as-usual model, in which primary care and substance abuse treatment were provided separately (n=307). Both programs were group based and lasted 8 weeks, with 10 months of aftercare available.

Main Outcome Measures Abstinence outcomes, treatment utilization, and costs 6 months after randomization.

Results Both groups showed improvement on all drug and alcohol measures. Overall, there were no differences in total abstinence rates between the integrated care and independent care groups (68% vs 63%, *P*=.18). For patients without SAMCs, there were also no differences in abstinence rates (integrated care, 66% vs independent care, 73%; *P*=.23) and there was a slight but nonsignificant trend of higher costs for the integrated care group ($367.96 vs $324.09, *P*=.19). However, patients with SAMCs (n=341) were more likely to be abstinent in the integrated care group than the independent care group (69% vs 55%, *P*=.006; odds ratio [OR], 1.90; 95% confidence interval [CI], 1.22-2.97). This was true for both those with medical (OR, 3.38; 95% CI, 1.68-6.80) and psychiatric (OR, 2.10; 95% CI, 1.04-4.25) SAMCs. Patients with SAMCs had a slight but nonsignificant trend of higher costs in the integrated care group ($470.81 vs $427.95, *P*=.14). The incremental cost-effectiveness ratio per additional abstinent patient with an SAMC in the integrated care group was $1581.

Conclusions Individuals with SAMCs benefit from integrated medical and substance abuse treatment, and such an approach can be cost-effective. These findings are relevant given the high prevalence and cost of medical conditions among substance abuse patients, new developments in medications for addiction, and recent legislation on parity of substance abuse with other medical benefits.

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THE PREVALENCE OF MEDICAL and psychiatric conditions is high among individuals with alcohol and other drug disorders. Medical conditions related to substance use include hypertension, coronary artery disease, chronic liver disease, and hepatitis C[1-6]; psychiatric conditions include depression and anxiety disorders.[7-11] However, medical care, even screening, is seldom provided as part of substance abuse treatment, and medical and substance abuse services are most often separate and largely uncoordinated.[12-18] Most addiction treatment is "carved out" of health plans, ie, provided by contracted behavioral health organizations. Even in health plans in which addiction treatment is provided internally, it is not often integrated with medical care.

Studies have suggested that medical services may benefit substance abuse treatment outcomes if medical staff are knowledgeable about addiction disorders and involved in treatment.[19] Ease of access and more appropriate medical care may facilitate more, or more effective, services to the patient. However, the value of integrating medical

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and addiction services has not been rigorously examined. Studies[20,21] to date, focusing primarily on integrating primary care within methadone maintenance programs, have shown higher health care utilization but often have not assessed outcomes. One related study of older alcohol-dependent men with severe alcohol-related medical illnesses examined a primary care low-intensity intervention in a Veterans Affairs setting. The study found higher rates of alcohol abstinence and better alcohol treatment compliance in those who received integrated care, with only a small incremental cost.[22]

The potential for better outcomes from integrating treatment is relevant to current health policy.[23] There has been increased interest in expanding the physician's role in treating addiction for several reasons, including the high number of medical conditions among substance abuse patients, development of new medications, and research showing sustained brain changes in individuals with addiction. Furthermore, because recent federal and state legislation requires parity between behavioral and other medical benefits,[24] health plans are increasingly interested in knowing the outcomes and costs of integrating substance abuse treatment with primary care. An examination of the effectiveness of integrating care is critical to these issues.

We randomized patients entering a chemical dependency program of a group-model health maintenance organization (HMO) to an integrated services model, where primary health care is provided along with substance abuse treatment within the unit, or to an independent treatment-as-usual model, where medical care is received in primary care clinics independently from substance abuse treatment. We hypothesized that those in integrated services would have higher levels of abstinence at 6 months than those in independent services, and that integrated services would be cost-effective. We also expected that those with substance abuse–related medical conditions (SAMCs) in particular would benefit from integrated rather than independent services, and that such treatment would be cost-effective.

METHODS

We conducted a randomized controlled trial comparing integrated and independent delivery of substance abuse and primary medical care. Patients in the integrated services group received primary medical care within the substance abuse program. For this study, 3 physicians with specialty training in substance abuse (1.25 full-time equivalents), 1 medical assistant (1 full-time equivalent), and 2 nurses (1.8 full-time equivalents) were made available for primary care. Patients in the independent services group received the same set of substance abuse services, but medical care was provided by the HMO's primary care clinics. These clinics are located close to the chemical dependency program but services are not coordinated, and medical staff may not know that the patient is receiving substance abuse services. This is the "treatment-as-usual" model currently in effect in most health care plans.

Study Site and Program

The study site was Kaiser Permanente's Chemical Dependency Recovery Program (CDRP) in Sacramento, Calif, a "carved-in" program where substance abuse services are provided within the same organization. The CDRP provided a traditional outpatient and a day treatment program; the content of services was the same in both programs, but day treatment included 4 times the amount of services. Both programs were group based and lasted 8 weeks, with 10 months of aftercare available. Both included supportive group therapy, education, relapse prevention, and family-oriented therapy, with individual counseling available as needed. Patients were expected to attend 12-step meetings. A description of the programs and staff has been provided elsewhere.[25] The proportion of patients in day treatment did not differ between the 2 study arms (of the full sample, 72% in the integrated services group and 68% in the independent services group; of the SAMC subgroup, 78% in the integrated services group and 77% in the independent services group). Pharmacotherapy was available from CDRP physicians for integrated services patients and through primary care physicians for independent services patients. Patients were referred to methadone maintenance clinics when appropriate; heroin and other opiate addiction was also treated within the program.

Sample

Subjects were adult men and women meeting criteria for alcohol or other drug abuse or dependence admitted to the CDRP between April 1997 and December 1998. This HMO's membership is insured primarily through employment; income and employment levels are higher and addiction severity is somewhat lower than in the general population.[11,26] The 6 most prevalent substances of dependence were alcohol, amphetamines, marijuana, narcotic analgesics, cocaine, and sedatives/hypnotics. As in many private programs, the prevalence of heroin use was low (1.4%). Pregnant women were admitted to the program; only 3% of women were pregnant.

Procedures

Medical staff examined 747 prospective patients to determine medical readiness for treatment and alcohol and other drug disorder status. For those ready to begin treatment (after detoxification when needed), research staff explained the 2 medical treatment options, asked patients to accept random assignment, obtained written informed consent, and administered the baseline instrument; 654 (88%) consented. Blocked, stratified (by sex and Addiction Severity Index [ASI] psychiatric severity score) randomization procedures were used. Integrated services were available only to those randomized to this treatment arm; independent services were the standard care. Patients with psychosis and dementia (<5%) were ineligible. Research staff

helped patients randomized to the independent services group obtain a primary care physician if they did not have one. Patients in both study conditions made their own medical appointments but could request assistance from CDRP staff (with a CDRP physician for integrated care patients or their primary care physician in usual care for independent care patients).

Follow-up telephone interviews were conducted 6 months after randomization by the Division of Research in Oakland, Calif. Institutional review board approval was obtained from the Kaiser Research Foundation Institute and University of California, San Francisco. Of the 654 patients, 592 (91%) were successfully followed up and included in our analysis.

Measures

Substance Abuse–Related Medical Conditions. We identified a list of medical conditions from the literature described as "conditions related to drug and alcohol abuse."[1-10,27-33] Kaiser Permanente physicians (members of the American Society of Addiction Medicine) helped refine the list. We identified those acute or chronic physiologic or behavioral conditions related to alcohol or other drug abuse or that had higher prevalence in our sample than in a sample of health plan individuals matched on age, sex, and length of enrollment without substance abuse diagnoses or treatment. These conditions are depression, injury and poisonings/overdoses, anxiety and nervous disorders, hypertension, asthma, psychoses, acid-peptic disorders, ischemic heart disease, pneumonia, chronic obstructive pulmonary disease, cirrhosis, hepatitis C, diseases of the pancreas, alcoholic gastritis, toxic effects of alcohol (ethyl and unspecified), alcoholic neuropathy, alcoholic cardiomyopathy, excess blood alcohol level, and perinatal alcohol and drug dependence (*International Classification of Diseases, Ninth Revision* codes available on request). Tobacco dependence was included because of its higher prevalence among substance abusers. Although the program discourages the use of tobacco, it is not a focus of treatment. These conditions include many of the most costly conditions to the health plan.[34] We used the health plan's Outpatient Summary Clinical Record and admissions/discharges/transfers automated diagnostic databases[35] to identify patients diagnosed as having these disorders in Kaiser hospitals or outpatient clinics during the year before treatment entry. Subjects diagnosed as having any of these conditions during that year were categorized as having SAMCs. Human immunodeficiency virus (HIV) was not included, because less than 0.01% of our sample had this diagnosis and because of extraordinary health plan confidentiality of HIV data. A total of 341 patients (57% of sample) had at least 1 condition categorized as an SAMC. Of these, 27.9% had only psychiatric, 36.4% had only medical, and 35.7% had both types of SAMC diagnoses.

Addiction Severity. To assess substance problem severity at admission and follow-up, we used an abbreviated form of the ASI, a validated and reliable instrument that measures type and severity of substance use; employment; and medical, psychiatric, family or social, and legal problems in the patient's lifetime and past 30 days and provides a continuous score from 0 to 1.0.[36]

Medical Status. To determine medical problem severity, we used the physical and mental health scales from the 12-Item Short-Form Health Survey of the Medical Outcomes Study.[37,38]

Dependence. Questions from the Diagnostic Interview Schedule for Psychoactive Substance Dependence were used to provide a *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*[39] diagnosis for alcohol and other drug (13 substance types) dependence and abuse.

Outcome. We used alcohol and drug abstinence at follow-up as the main outcome measure. All ASI questions on alcohol and drug use during the prior 30-day period had to be reported negative. We also measured each patient's longest period of abstinence from alcohol and other drugs since admission.

Health Care Utilization. We measured health care utilization using visit data from Kaiser's automated databases.[35] Treatment was defined as services provided for substance use disorders and any primary care services. All patients received addiction treatment at the CDRP. Integrated services patients received primary care in the CDRP, although they were not prohibited from seeking care in other clinics. For independent services patients, primary care was provided only in the department of medicine. Included in our definition of treatment are visits to the CDRP for treatment of addiction problems (CDRP treatment) and all other visits for primary medical care (within CDRP and primary care clinics).

The Treatment Services Review[40] was administered at 2, 4, and 6 weeks during the rehabilitation phase of treatment and at 12 weeks and 6 months after treatment during follow-up to measure out-of-plan addiction treatment and medical (inpatient and outpatient) health services utilization. We collected information on all services, including self-help groups such as Alcoholics Anonymous and Narcotics Anonymous.

Treatment Costs. We used activity-based costing[25,41,42] to determine unit cost of services. Direct costs (eg, salaries and benefits) were allocated in proportion to provider time spent on activities such as individual and group therapy. Overhead costs (such as rent and clerical staff salaries) were allocated in proportion to direct costs.

Costs of visits outside the CDRP were obtained from Kaiser's Cost Management Information System, which integrates medical and general ledger data to provide fully allocated costs by medical center, patient, or service. Unit costs (for different types of visits) were derived by allocating actual CDRP expenses to the weighted activity volumes provided by the department. Service weights were developed for Kaiser's operations. Overhead costs were allocated to unit costs via step-down accounting methods.[25]

Cost per encounter data were obtained by applying the unit cost of services to their actual use. The Cost Management Information System allocates costs at the department level and does not adequately assign relative weights to programs and types of visits "within" departments. Our method incorporates the same method and allows determination of costs for different programs (eg, day treatment) and visits (eg, individual counseling, medical visits) within the CDRP.[25]

Table 1. Baseline Characteristics by Treatment Condition and Sample for Those Followed Up*

Characteristics	Randomized Full Sample		Randomized SAMC Sample	
	Integrated (n = 285)	Independent (n = 307)	Integrated (n = 169)	Independent (n = 172)
Sex, %				
Women	46	44	54	52
Men	54	56	46	48
Age, mean (SD), y	37.7 (10.7)	37.4 (10.0)	38.5 (11.3)	37.6 (9.6)
Ethnicity, %				
White	73	74	76	76
Black	9	10	7	11
Hispanic/Latino	11	8	10	7
Other	6	8	7	6
Employment, %				
Full/self-employed/military	55	64	50	59
Part-time	7	6	7	5
Student/retired/homemaker	12	9	13	9
Employer mandated treatment, %	11	15	10	10
Education, %				
<High school	15	11	16	10
High school graduate	29	27	30	24
Some college	56	62	54	66
Income ≥$40 000, %	32	31	32	29
Married/living as married, %	42	41	42	39
Substances of dependence, %				
Alcohol	55	59	55	63
Amphetamines	27	24	25	22
Marijuana	17	18	20	23
Narcotic analgesics	9	9	13	13
Cocaine	8	11	8	9
Sedatives/hypnotics	4	4	5	3
Dependence type, %				
No dependence	11	12	9	10
Alcohol only	39	38	38	37
Other drug only	34	29	36	27
Alcohol and other drug	16	22	17	26
ASI score, mean (SD)†				
Alcohol	0.374 (0.30)	0.362 (0.31)	0.373 (0.30)	0.382 (0.31)
Drug	0.135 (0.14)	0.133 (0.13)	0.143 (0.15)	0.150 (0.13)
Employment	0.407 (0.23)	0.398 (0.24)	0.402 (0.22)	0.412 (0.24)
Medical	0.221 (0.33)	0.203 (0.31)	0.288 (0.37)	0.282 (0.34)
Legal	0.100 (0.19)	0.082 (0.17)	0.075 (0.17)	0.073 (0.15)
Family/social‡	0.381 (0.26)	0.327 (0.27)	0.407 (0.26)	0.338 (0.28)
Psychiatric	0.421 (0.26)	0.383 (0.27)	0.494 (0.25)	0.468 (0.27)
Self-reported health status as excellent/very good, %	36	30	29	23
SF-12 composites, mean (SD)				
Physical composite	49.6 (10.5)	49.9 (9.9)	47.8 (10.8)	48.1 (10.3)
Mental composite summary	33.5 (13.0)	34.1 (13.3)	30.6 (11.9)	30.7 (12.0)
Prior treatment episodes, %	42	43	47	41
Started treatment, %	97	96	98	97
Length of stay, mean, wk	11.8	11.2	12.4	12.1

*Differences were not significant at $P<.05$ unless indicated otherwise. SAMC indicates substance abuse–related medical condition; SF-12, 12 Item Short-Form of the Medical Outcomes Study.[35,36]
†Addiction Severity Index (ASI) scores ranged from 0 to 1.0.
‡$P = .01$ for full sample and $P = .02$ for SAMC sample.

Statistical Analysis

We used χ^2 tests for categorical variables and t tests for continuous variables to identify differences in baseline characteristics by treatment group and follow-up status. Logistic regression was used to determine the independent effect of treatment modality on abstinence, controlling for baseline alcohol and other drug addiction severity. We examined the effect of treatment modality on abstinence within the SAMC subgroup using logistic regression, controlling for baseline severity. An ordinary least squares regression model was used to examine the effect of integrated services on longest period of abstinence since admission.

Logistic regression was used to determine the combined effect of integrated services and SAMCs on abstinence, controlling for baseline alcohol and other drug severity and including variables for treatment group (=1 if integrated services) and medical condition (=1 if SAMC) and a treatment × medical interaction term. All statistical analyses were performed using SAS version 6.12 (SAS Institute Inc, Cary, NC).

Cost-effectiveness

The CDRP and medical costs per patient were summarized for 6 months following randomization. The t tests compared differences in CDRP treatment and medical costs by treatment group. We adjusted for length of posttreatment membership by using member-months as denominators. We used total abstinence as the clinical outcome measure and the sum of addiction and primary care costs in computing the cost-effectiveness ratio. The incremental cost-effectiveness ratio (ICER) is the difference in predicted cost between the 2 programs divided by the difference in predicted abstinence rates. The param-

eter estimates from the logistic regression on outcome were used to compute the predicted probability of abstinence. Ordinary least squares regression of treatment cost on the same set of predictors used in the outcome model were used to predict treatment costs. All outcomes and costs were calculated at the mean alcohol and other drug severity levels.

Uncertainties inherent in the ICER were addressed using traditional 1-way and 2-way sensitivity analysis techniques,[43,44] wherein some critical component(s) in the ICER calculation is changed by a meaningful amount or varied from worst to best case. Sensitivity analysis methods were supplemented with another approach to account for the fact that the ICER is the ratio of 2 random variables. We used the bootstrap method[45] to obtain the empirical sampling distribution of the ICER. This distribution allows construction of confidence intervals (CIs) around the point estimate of the ICER and quantification of the probability for potential values of a maximum acceptable ICER.[46]

RESULTS

Patient Characteristics

TABLE 1 presents baseline patient characteristics, treatment initiation status, and length of stay by treatment condition for the full sample and SAMC subgroup followed up at 6 months. Within both the full sample and SAMC subgroup, only 1 of the 28 characteristics (family or social problem severity) was statistically significantly different and was higher in the integrated services group.

Loss to Follow-up

We successfully followed up 91% of the sample (FIGURE 1). Patients in the integrated services group who were followed up (90%) had lower employment and legal ASI scores than those not followed up. Patients in the independent services group who were followed up (91%) were older, were less likely to rate their health as "very good," were more likely to be categorized as having SAMCs, and had higher ASI medical scores. For both treatment conditions, those followed up had longer treatment stays than those not followed up. All analyses were replicated controlling for baseline variables on which the nonrespondents differed; results remained consistent.

Out-of-Plan Health Services Utilization

Treatment Services Review data showed that less than 5% of the sample accessed any medical, psychiatric, or addiction services outside the health plan 6 months after randomization, with no differences between study arms for the full or SAMC samples. There were no differences in Alcoholics Anonymous or Narcotics Anonymous participation rates (integrated services, 92.3%; independent services, 91.2%) or mean number of visits (integrated services, 46.6; independent services, 42.5) in the full sample or SAMC subgroup.

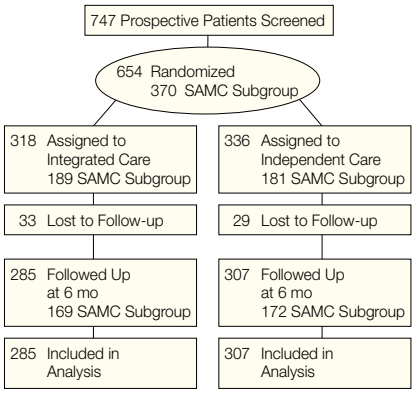
Self-report Data Validity

We examined the validity of self-report data using urinalysis (for alcohol, barbiturates, benzodiazepines, cocaine, cannabis or tetrahydrocannabinol, opiates, phencyclidine, and amphetamines) in 361 patients randomly selected at follow-up. Comparisons yielded rates of "reporting no use but testing positive for a substance" of 2.5% for alcohol and between 0.9% (barbiturates) and 5.8% (marijuana) for other substances. The results for marijuana are conservative; it was the most commonly reported, and the test detects a tetrahydrocannabinol compound level of 40 ng/mL. Individuals can test positive for 30 days after use, but the self-report question asked before the test measures 3 days. We replicated our models among those whose urinalysis results were consistent with their self-report data, and results were similar.

Treatment Outcome

Full Sample. Subjects in both groups showed significant improvement at 6-month follow-up on alcohol and other drug severity scores. TABLE 2 presents 30-day abstinence rates at follow-up by treatment condition for the full sample and the SAMC subgroup. In the full sample, although there was a trend for higher abstinence, no significant differences were found between integrated services and independent services in total (68% vs 63%, $P=.18$), alcohol (77% vs 71%, $P=.07$), and other drug abstinence (82% vs 80%, $P=.41$). In a logistic regression model controlling for baseline severity, integrated care was slightly but not significantly associated with total abstinence (odds ratio [OR], 1.28; 95% CI, 0.91-1.80) (TABLE 3). For patients without SAMCs , there were no differences between patients in integrated services and independent services for total, alcohol, and other drug abstinence (66% vs 73%, $P=.23$; 73% vs 78%, $P=.41$; 84% vs 87%, $P=.50$, respectively).

Figure 1. Randomized Sample Flow



SAMC indicates substance abuse–related medical condition.

SAMC Subgroup. Integrated care patients had significantly higher total (69% vs 55%, $P=.006$) and alcohol (80% vs 65%, $P=.002$) abstinence rates than independent care patients (Table 2). We used logistic regression, with a dummy variable for integrated services, to predict 30-day abstinence, controlling for baseline substance abuse severity (Table 3). Patients with SAMCs in the integrated services group were more likely to achieve total abstinence (OR, 1.90; 95% CI, 1.22-2.97) and alcohol absti-

nence (OR, 2.22; 95% CI, 1.35-3.64) relative to patients with SAMCs in the independent services group.

We also conducted a regression model on the full sample, including an interaction term between SAMC and integrated services, with total abstinence as the dependent variable (controlling for baseline severity). The OR for the interaction term (OR, 2.60; 95% CI, 1.29-5.26; $P=.008$) indicated that the odds of total abstinence in integrated services were 2.6 times larger in the SAMC than the non-SAMC subgroup. We found similar results when we replicated all models controlling for variables on which nonresponders differed within each treatment condition and when using longest period of abstinence as the outcome.

We replicated the analysis examining the importance of integrated services for patients with psychiatric SAMC diagnoses and found results similar to those in the larger SAMC group (OR, 2.10; 95% CI, 1.04-4.25). We also replicated the analysis among patients with any medical or psychiatric condition (n=463), not confined to SAMC, but found no treatment effect.

To examine whether the effect was independent of psychiatric SAMCs, we replicated the outcome analysis using an interaction of medical SAMC with integrated services. We found a greater effect for integrated services than in the full SAMC analysis (interaction OR, 3.38; 95% CI 1.68-6.80; $P=.001$ for total abstinence; OR, 2.27; 95% CI, 1.07-4.84; $P=.03$ for alcohol abstinence; and OR, 3.56; 95% CI, 1.51-8.44; $P=.004$ for drug abstinence). Thus, integrated services were related to all abstinence measures for the medical SAMC subgroup.

We examined medical outcomes by comparing integrated care and independent care on 12-month health care utilization and cost offset. For both conditions, there was a trend toward reduced emergency department use ($P=.08$) after randomization. Among integrated services SAMC patients, the inpatient rate decreased significantly (from 0.139 per member-month to 0.058, $P=.03$); independent SAMC patients showed only a downward trend (from 0.127 to 0.0756, $P=.17$). Average medical costs (excluding addiction treatment) decreased from $313.50 to $200.08 ($P=.04$) among the full integrated services sample, whereas there was no significant reduction in the independent services sample. Among SAMC patients, medical costs for integrated services decreased from $470.39 to $226.86 ($P=.006$), and for independent services, from $356.96 to $301.51 ($P=.04$).

Treatment Utilization, Costs, and Cost-effectiveness. TABLE 4 summarizes utilization and cost by treatment condition for the 6 months after randomization. Integrated services patients had higher addiction treatment ($384.39 vs $337.99, $P=.02$) and total treatment ($428.87 vs $382.81, $P=.03$) costs per member-month than independent services patients . This was primarily due to higher visit rates and costs for individual therapy (counseling by licensed social workers or psychologists) for integrated services relative to independent services. For non-SAMC patients, there were no significant differences in treatment utilization; there was a slight but not significant trend of higher costs for the integrated services group ($367.96 vs $324.09, $P=.19$) due to individual psychotherapy ($150.43 vs $121.76, $P=.07$) and psychiatric services ($27.39 vs $14.77, $P=.07$) costs. SAMC patients had a similar but not significant pattern ($470.81 vs $427.95, $P=.14$). Overall, SAMC patients had higher ($P<.001$) costs than non-SAMC patients. For the SAMC subgroup, the ICER was $1581 per additional person abstinent in integrated services relative to independent services.

We conducted sensitivity analyses among SAMCs, allowing costs and effects to vary by ±1 and 2 SDs and re-

Table 2. Thirty-Day Abstinence Rates at Follow-up by Treatment Group and Sample for Those Followed Up*

	Randomized Full Sample			Randomized SAMC Sample		
	Integrated (n = 285)	Independent (n = 307)	*P* Value	Integrated (n = 169)	Independent (n = 172)	*P* Value
30-Day abstinence rates, %						
Alcohol and other drugs	68	63	.18	69	55	.006
Alcohol	77	71	.07	80	65	.002
Other drugs	82	80	.41	81	74	.11
Longest period of abstinence, mean (SD), d	131 (58)	129 (62)	.76	135 (55)	122 (65)	.05

*SAMC indicates substance abuse–related medical condition.

Table 3. Logistic Regression Models Predicting 30-Day Abstinence at 6 Months for Full Randomized Sample and SAMC Subgroup*

	Total Abstinence		Alcohol Abstinence		Other Drug Abstinence	
	Odds Ratio (95% CI)	*P* Value	Odds Ratio (95% CI)	*P* Value	Odds Ratio (95% CI)	*P* Value
Randomized sample (n = 592)						
Baseline ASI alcohol composite score	0.71 (0.40-1.25)	.24	0.69 (0.37-1.27)	.23	1.30 (0.65-2.60)	.47
Baseline ASI drug composite score	0.56 (0.15-2.03)	.38	1.88 (0.45-7.84)	.39	0.07 (0.02-0.34)	.001
Integrated care (vs independent care)	1.28 (0.91-1.80)	.16	1.43 (0.99-2.08)	.06	1.23 (0.81-1.88)	.33
Randomized SAMC patients (n = 341)†						
Integrated care (vs independent care)	1.90 (1.22-2.97)	.005	2.22 (1.35-3.64)	.002	1.58 (0.94-2.66)	.09

*CI indicates confidence interval; ASI, Addiction Severity Index; and SAMC, substance abuse–related medical condition.
†Models for randomized SAMC patients controlled for baseline ASI alcohol score and drug severity.

Table 4. Distribution of Treatment Costs and Visits by Treatment Condition*

	Average Cost Per Member-Month, Mean (95% CI), $			Average Visit Rate Per Member-Month, Mean (95% CI), No.		
	Integrated Care	Independent Care	*P* Value	Integrated Care	Independent Care	*P* Value
			Full Sample (n = 592)			
Group therapy	179.42 (165.43-193.41)	172.09 (158.55-185.63)	.46	11.70 (10.78-12.62)	11.23 (10.34-12.12)	.47
Individual therapy	169.25 (154.78-183.70)	131.32 (117.33-145.31)	<.001	1.04 (0.95-1.13)	0.88 (0.79-0.97)	.01
Psychiatric therapy	35.72 (29.10-42.34)	34.58 (28.17-40.99)	.81	0.22 (0.18-0.26)	0.21 (0.17-0.25)	.68
Substance abuse	384.39 (354.97-413.81)	337.99 (309.55-366.43)	.02	12.96 (11.96-13.96)	12.32 (11.35-13.29)	.36
Medical treatment	44.48 (36.21-52.75)	44.82 (36.82-52.82)	.95	0.24 (0.19-0.29)	0.28 (0.25-0.33)	.08
All treatment	428.87 (397.63-460.11)	382.81 (352.59-413.03)	.03	13.20 (12.20-14.20)	12.60 (11.63-13.57)	.40
			SAMC Subgroup (n = 341)			
Group therapy	191.50 (173.23-209.77)	184.09 (166.02-202.16)	.57	12.49 (11.30-13.68)	12.01 (10.83-13.19)	.57
Individual therapy	182.19 (163.04-201.34)	138.66 (119.72-157.62)	.002	1.12 (1.00-1.24)	0.92 (0.81-1.03)	.01
Psychiatric therapy	41.46 (31.99-50.93)	49.82 (40.45-59.19)	.22	0.27 (0.21-0.33)	0.30 (0.24-0.36)	.44
Substance abuse	415.15 (376.05-454.25)	372.57 (333.88-411.26)	.13	13.88 (12.57-15.19)	13.23 (11.94-14.52)	.48
Medical treatment	55.66 (43.15-68.17)	55.38 (43.01-67.75)	.97	0.29 (0.23-0.35)	0.36 (0.30-0.42)	.14
All treatment	470.81 (429.65-511.97)	427.95 (385.24-470.66)	.14	14.17 (12.86-15.48)	13.59 (12.30-14.88)	.54

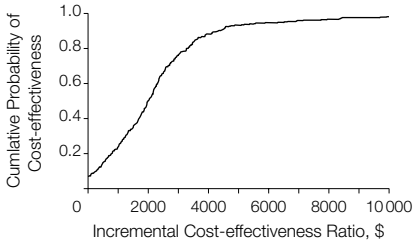
*CI indicates confidence interval; SAMC, substance abuse–related medical condition. Individual therapy included counseling provided by licensed social workers or psychologists. Psychiatric therapy included sessions provided by psychiatrists.

calculated the ICER. Increasing incremental effectiveness by 1 SD had no impact. When the integrated services average cost was increased by 2 SDs (to $514), the ICER increased to $3957. Reducing the integrated services cost by 2 SDs resulted in a negative incremental cost, implying that integrated services was cost-effective for any nonnegative effect size (not shown).

We supplemented the sensitivity analysis with analyses examining the sampling distribution of the ICER. We used nonparametric bootstrap methods, since the nature of the ICER sampling distribution is unknown. The bootstrap method involves sampling with replacement of 169 cost-effect pairs from integrated services patients and calculating the bootstrap estimates of average treatment cost and abstinence rate, repeating the process with independent services patients (n=172), and calculating the ICER for each resample. Based on 2000 replications, we found that integrated care had higher abstinence rates than independent care in only 0.75% of the cases. The overall probability of a negative ICER was 0.07.

Based on the empirical sampling distribution of the ICER, we determined the proportion of bootstrap replications that lie above and below various thresholds (FIGURE 2). For a maximum acceptable ICER of $2900, the probability that integrated care will be cost-effective (ie, ICER below $2900) is 75%. Similarly, if the maximum is $5600, the probability is 95%. With a maximum acceptable threshold of $2000 per additional abstinent patient, our point estimate of $1581 for the SAMC subgroup would be considered cost-effective.

Figure 2. The Empirical Sampling Distribution of the Incremental Cost-effectiveness Ratio



Why Were Integrated Services More Effective for SAMC Patients?

To understand the mechanism by which integrated care benefited SAMC patients, we conducted analyses to address the influence of having a primary care physician, whether the SAMC integrated services group received more services, or whether the patient-physician interaction itself affected outcomes. Results were not affected by low rates of having a primary care physician in the independent group; we found that 92% had one after randomization. There was no difference between patients in integrated services and independent services in having at least 1 primary care visit (60% vs 59%) or in those having at least 1 visit to a mental health specialist (37% for each arm). For the SAMC subgroup, integrated services vs independent services had slightly higher average days of drug (0.14 vs 0.02, *P*=.07) and alcohol detoxification medication (0.09 vs 0, *P*=.02) and numbers of radiography, computed tomography, and magnetic resonance imaging (0.17 vs 0.10, *P*=.08) (data not shown).

To address the influence of the patient-physician interaction, we examined the proportion of patients in each program with newly diagnosed SAMC and 12 other common or costly conditions.[34] Significantly more integrated services patients were newly diagnosed during treatment as having 4 kinds of conditions (which are included among the 10 most costly): arthritis, headache, injuries and poison-

ings/overdoses, and anxiety disorders. Independent services patients had only higher rates of acid-peptic disorders as a new condition.

COMMENT

We examined outcomes and costs of integrated medical and drug treatment in a randomized study. Our work was conducted in a "real world" setting in a large HMO that can transfer research to practice across multiple clinics. Among non-SAMC patients, although integrated services costs were not significantly higher, there were no differences in abstinence between the 2 programs. However, SAMC patients randomized to integrated services had higher abstinence rates and longer periods of abstinence, and their costs were not significantly higher relative to patients in the independent services group. Importantly, we found positive benefits of integrated services for individuals with psychiatric conditions and also those with medical SAMCs. We found important 12-month medical outcomes as well: significant reductions in inpatient use for SAMC integrated services but not independent services, and for average medical costs for the full integrated services but not independent services. The findings suggest that patients with physiologic or behavioral conditions related to substance abuse can benefit from having their medical and addiction treatment integrated.

The additional cost of providing integrated services to achieve abstinence in an additional person was $1581 for SAMC patients. We used a bootstrap analysis to quantify the uncertainty of the ICER distribution, and the results were consistent with those of sensitivity analysis. The sampling distribution obtained from such analyses can be used to make decisions regarding cost-effectiveness in terms of a maximum acceptable ICER and has applicability to other studies that examine incremental cost-effectiveness. The average cost for a primary care visit was greater for integrated care than independent care (Table 4). All other average costs per visit were similar by treatment conditions, suggesting that if there is inefficiency in the CDRP clinic, our conclusions for the SAMC subgroup would be conservative. It is possible that improving efficiency (decreasing average visit costs) would result in a lower ICER for integrated services. As the sensitivity analysis shows, even a 10% decrease in integrated services costs would make this approach cost-effective for any positive incremental outcome effect.

We examined explanations for the integrated services effect among SAMC patients. We found similar proportions with a primary care physician, and SAMC patients in integrated services did not have more visits. We also found a higher rate of new medical conditions identified in integrated services than in independent services, suggesting that patients may have had attention paid to disorders overlooked in independent primary care. Two prominent disorders were pain related, which may have been associated with misuse of prescription drugs. Identifying and relieving anxiety also may have improved outcomes for integrated care patients. Our findings suggest that the difference in outcomes was due more to the content of the patient-physician interaction than to higher utilization of primary care. Physicians within the addiction program may be more knowledgeable about their patients' substance abuse and program status and accordingly adjust medical evaluations and treatment. Thus, they may have provided some yet-to-be-measured benefits, including more attention to related medical problems and facilitating greater engagement in substance abuse services (reflected in higher rates of individual therapy visits). These potential benefits have been increasingly recognized in the literature.[19]

How applicable is an integrated model of care across health organizations and patients? Although it may be logistically easier and perhaps less costly to provide in a health plan where physicians work in the same organization and can be shared across departments, having a sufficiently large caseload to support a medical practice may be the most critical dimension. At the same time, given the lack of significant treatment outcome improvements for non-SAMC patients in integrated services and the slightly higher cost, our findings do not recommend integrated treatment for non-SAMC patients. We note, however, that in this insured population, 57% of the sample had at least 1 SAMC; in uninsured populations who may have less health care, the proportion is likely higher and such integration may be particularly important.

The study has several limitations. Medical conditions in general, and some in particular, may be underestimated in the HMO's diagnostic database, but there is no reason to expect bias between the randomized groups. We studied an HMO whose members are insured, and results may not be generalizable to uninsured populations.[11] At the same time, research is lacking on insured populations, and we can find no indication in the literature that the results regarding the importance of integrating medical care and drug treatment would differ for less advantaged individuals. Moreover, these results of a mixed-sex drug- and alcohol-dependent population are consistent with those of less advantaged alcohol-dependent men with severe alcohol-related medical conditions.[22]

The study's randomization rate was higher than might be expected in this health plan, where choice of physician is valued by members.[47] However, addiction patients use more emergency department and inpatient services and fewer outpatient services than other members.[48] Thus, they may be less likely to have a relationship with a primary care physician. Research staff providing assistance in obtaining primary care physicians for independent services patients reported that having a particular provider was not a compelling issue for patients; patients found it convenient to have a physician in the substance abuse clinic. Physicians' perceptions were that patients found it comfortable to receive care from someone who knew about their substance abuse treatment and preferable to discussing their problem with someone whose reaction would be unknown.

These results are also important given that studies in primary care have found positive outcomes from screening and brief interventions for individuals at lower substance abuse addiction levels.[49] Our findings on integrated medical care demonstrate the importance of substantive medical linkage also for individuals who require specialty addiction services.

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