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The role of continuing care on 9-year cost trajectories of patients with intakes into an outpatient alcohol and drug treatment program

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Abstract

Background—The importance of a continuing care approach for substance use disorders (SUDs) is increasingly recognized. Our prior research found that a Continuing Care model for SUDs that incorporates three components (regular primary care, and specialty SUD and psychiatric treatment as needed) is beneficial to long-term remission. The study builds on this work to examine the cost implications of this model.

Objectives—To examine associations between receiving Continuing Care and subsequent healthcare costs over 9 years among adults entering outpatient SUD treatment in a private non-profit, integrated managed care health plan. We also compare the results to a similar analysis of a demographically matched control group without SUD's.

Study Design—Longitudinal observational study.

Measures—Measures collected over 9 years include demographic characteristics, self-reported alcohol and drug use and Addiction Severity Index, and health care utilization and cost data from health plan databases.

Results—Within the treatment sample, SUD patients receiving all components of Continuing Care had lower costs than those receiving fewer components. Compared to the demographically matched non-SUD controls, those not receiving Continuing Care had significantly higher inpatient costs (excess cost=$65.79/member-month; $p < .01$) over 9 years, while no difference was found between those receiving Continuing Care and controls.

Conclusions—Although a causal link cannot be established between receiving Continuing Care and reduced long-term costs in this observational study, findings reinforce the importance of access to health care and development of interventions that optimize patients receiving those services and that may reduce costs to health systems.

Keywords

continuing care; cost; primary care; longitudinal study

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INTRODUCTION

Increasingly, substance use disorders (SUDs) are being recognized as chronic and relapsing conditions amenable to a disease management approach that includes continuing care, as it does with diabetes, asthma and hypertension.[1, 2] Broadly speaking, the Continuing Care model combines regular primary care (PC) where a disease is monitored, and referrals to specialty care (e.g. endocrinology, cardiology) as needed.[3-6] It relies on PC physicians to coordinate care across the health care system including hospital, specialty outpatient clinics, and community settings. In the case of SUDs, the model might include regular PC and specialty SUD treatment and/or psychiatric treatment as needed. The model's cost implications are highly pertinent to framing health policy around long-term recovery from SUDs as uncoordinated care can lead to poor outcomes and cost inefficiencies that contribute to spiraling health costs.

Health services research in the alcohol and drug field has shown a well-established pattern of high medical care costs prior to SUD treatment entry,[7-11] primarily due to greater use of emergency room (ER) and hospital services compared to demographically similar individuals without SUDs.[9, 10] These service use patterns are partly attributable to higher rates of comorbid medical and psychiatric conditions,[12-15] and acute or critical events such as injuries and overdose[16-19] that precipitate referrals and treatment entry. The spike in pre-treatment costs is typically followed by significantly decreased costs observed within a year or two upon entering treatment.[9, 20-22]

Studies focusing on longer-term health care costs are limited, but indicate that their nature and magnitude varies by patient characteristics such as gender and age,[8, 9] co-occurring psychiatric problems,[23-27] and abstinence status.[28, 29] In particular, patients with psychiatric problems used more hospital services,[23, 25, 26] psychiatric and SUD treatment services,[27] and despite the poor prognosis for abstinence, those receiving services had comparable outcomes relative to those without psychiatric problems.[27, 30] A study conducted in this health plan showed that abstinent patients were likely to have higher PC total costs compared to non-abstinent patients over 5 years.[28] suggesting that maintaining contact with the health care system either in PC settings or via additional contacts with specialty psychiatric and/or SUD treatment programs might be beneficial for sustaining abstinence.

Most studies examining aftercare for SUD patients have focused on specialty SUD services or informal services, such as Alcoholics Anonymous, Narcotics Anonymous, or other 12-step mutual help groups.[31-34] Few studies have examined the long-term patterns of health services use and cost in multiple settings, or examined the role of PC as part of aftercare. One study conducted in this health plan found that ER and inpatient costs decreased, but PC cost increased in the year after intake.[9] Another study[10] showed that for patients with substance-abuse-related medical conditions, providing integrated medical and SUD treatment significantly lowered inpatient costs, which is a major cost-driver. Given the high rates of hospitalizations and ER use pre-treatment, appropriate use of combined PC, specialty SUD and psychiatric treatment services post-treatment might help maintain abstinence or, for relapsing patients, facilitate re-entry into treatment before another ER or hospital encounter.

A study[35] examining the relationship between receiving services and remission from SUDs found that other factors being equal, those with yearly PC visits had 39% higher probability of being remitted from SUDs compared to those without over 9 years. There were significant interactions between specialty service need, service use and remission over time. An empirical model of Continuing Care for SUDs was developed based on the findings. Those receiving all components of a Continuing Care model (yearly PC, and specialty SUD

and psychiatric treatment when needed) had twice the odds of being remitted from SUDs at follow-ups as those without. The current study complements the outcomes findings by examining SUD patient cost trajectories over 9 years, and their relationship to Continuing Care. It is reasonable to assume that if regular contact with the health care system continues over time, as with other chronic diseases, critical events leading to ER or hospital events might be preempted, and relapsing patients identified and persuaded to readmit to treatment earlier. Thus, although we anticipate an increase in some costs (e.g., PC cost) due to on-going service use, we expect to see a decline in ER and inpatient costs in the long run. Specifically, given better SUD outcomes among those receiving Continuing Care, we expect to see average health care costs for this group to be similar to non-SUD patients by 9 years.

METHODS

Study Sample

Drawn from two large randomized studies conducted at the Kaiser Permanente (KP) Chemical Dependency Recovery Program (CDRP) in Sacramento, California, the sample consists of adult SUD patients who entered treatment at the CDRP from April 1994 to April 1996 and from April 1997 to December 1998. Follow-up interviews were conducted at 1, 5, 7, and 9 years after intake with high average response rates (86%, 81%, 84%, and 75% respectively). Details of study recruitment procedures and eligibility have been published.[36, 37]

For all SUD patients, a sample of non-SUD health plan members was drawn from the same catchment area matched on age, gender and length of enrollment. In a successful model of Continuing Care for SUD patients, one could expect critical and acute events to be averted or preempted as they are with other successfully managed chronic conditions. Therefore, comparisons to the non-SUD sample will determine whether the health care costs (particularly ER and inpatient costs) of SUD patients receiving Continuing Care approach those of the non-SUD sample over the long run.

Data Sources and Measures

Baseline and follow-up interviews obtained demographic information and SUD-related problem severity in several domains (alcohol, drug, medical, psychiatric, legal, family, employment) measured by the Addiction Severity Index (ASI).[38] Demographic data, membership, health service utilization and cost over 9 years for the SUD patients and the matched controls, were extracted from KP's databases.[39]

Continuing Care—Continuing Care was defined as receiving three components: a) yearly PC visits (adult medicine, family practice or OB/GYN); b) SUD treatment services during a study interval if a non-zero alcohol or drug ASI score was reported at the beginning of the interval; and c) psychiatric services during a study interval if a non-zero psychiatric ASI score was reported at the beginning of the interval. We note that those with zero psychiatric, alcohol and drug ASI scores were only required to have yearly PC visits to meet Continuing Care criteria. The indicator variable for Continuing Care for each interview period was =1 if individuals received PC services each year and SUD/psychiatric services as needed.[35]

Other Utilization and Cost—Utilization and cost data from KP's databases distinguish between hospitalizations and outpatient visits and were linked to interview data using unique identifiers.[9, 10, 28, 39] We defined dichotomous measures of ER use and hospitalizations (=1 if any use, otherwise) for each time interval. Costs were obtained from KP's cost management information system (CMIS) that allocates general ledger costs to services using activity-based costing methodology. Unit costs of services were calculated and applied to

each patient encounter and service and summarized at the appropriate level of analyses (e.g. at the patient level and for given time periods). Costs for services received outside but authorized and paid by KP were obtained from automated billing systems. Average ER and inpatient costs per member-month were calculated for each time interval.

Data Analysis

We examined the relationship between receiving Continuing Care in a given time interval and subsequent utilization and cost among SUD patients, relative to the matched non-SUD controls. Analyses were conducted among those SUD patients with continuous membership during the 9 years and their matched controls (N=595 and 3852, respectively). Although it may not be representative of all individuals with SUDS in the health plan, this subgroup has important advantages for understanding the relationship between longitudinal patterns of cost and the role of Continuing Care. Findings would provide a benchmark for developing models of Continuing Care since it represents an "ideal" sample. We also replicated our analyses using SUD patients who were members for at least 60% of the study duration as we had done in the related outcomes paper.[35]

We had 3 repeated measures of each outcome variable - ER use, hospital use, average ER and inpatient cost per member-month for the periods of 2-5 years, 6-7 years and 8-9 years after intake. The corresponding covariate of interest is the indicator variable for Continuing Care in the prior time period (i.e., 0-1 year, 2-5 years and 6-7 years after intake), with the matched non-SUD controls as the reference group. For dichotomous outcomes (ER and hospital use), we fitted the mixed-effects logistic regression models. This model can be represented as $log\,[Pr(Y_{ij=1})/(1- Pr(Y_{ij=1}))] = BX_{ij} + \mu_i$ where Y_{ij} =1 if individual i had an ER or hospital visit at time point j, B represents a set of fixed-effect coefficients associated with a vector of covariates X, μ_i denotes the random subject effects distributed with mean 0 and variance σ_μ^2). We first estimate a simple logistic regression model without accounting for correlation between error terms. The parameter estimates from this initial model were then used as starting values for the mixed model to ensure convergence of the likelihood function during estimation. The substantive findings did not differ when examining discrete and continuous measures of time; thus, we presented the results of models with time as a continuous variable. For continuous outcomes (average ER and inpatient hospital cost per member-month for each interval), we fitted linear mixed-effects models which is expressed in general form as: $Y_{ij}= BX_{ij} + \mu_i$. All models controlled for age and gender. Analyses were performed using SAS version 9.1 (SAS Institute Inc., Cary, NC).

RESULTS

Sample Characteristics

The sample of SUD patients was 39% female, 76% white, and mean age was 41 years (std. dev. =10). Compared to those not continuously enrolled, continuous members were more likely to be older (mean age: 41.2 vs. 35.8 years), married (56% vs. 40%), college educated (42% vs. 35%) and employed at baseline (67% vs. 56%), and had higher average alcohol ASI (0.46 vs. 0.40) and lower average drug ASI (0.106 vs. 0.132) composite scores at baseline.

Average 9-Year Post-Treatment Costs by Continuing Care Components

Figure 1 shows the breakdown of average cost components by number of Continuing Care components fulfilled over 9 years post-treatment among the SUD patients. Total costs decreased monotonically as number of fulfilled Continuing Care components increased, ranging from $293.89/member-month for those receiving no Continuing Care to $221.43/ member-month for receiving all three components. This was primarily due to lower average

inpatient cost for this group relative to others (e.g. $75.71 vs. $138.59/member-month, p =. 05). SUD treatment costs were also lower for this group ($10.74/member-month) relative to the non-Continuing Care receiving group ($16.47/member-month), although the difference was not statistically significant. In contrast, psychiatric service costs were the highest for the fully compliant group ($23.88/member-month) relative to the group not receiving Continuing Care ($17.88/member-month). Those receiving at least two Continuing Care components had significantly lower average PC cost than those receiving none ($49.32 versus $63.42/member-month, p < .01). Average ER costs were similar across the four groups.

Health Care Utilization and Receipt of Continuing Care, 9 Years Post-Treatment

Table 1(a) shows the results of mixed-effects multivariate logistic regression examining the relationship between receiving Continuing Care and subsequent hospital use during 9 years post-treatment, relative to the matched non-SUD controls. SUD groups with or without Continuing Care were significantly more likely to have a hospitalization event post-treatment than controls. Those not receiving Continuing Care had almost three times the odds of being hospitalized during follow-ups versus controls (OR=2.76, p< .01), while those receiving Continuing Care had 1.7 times the odds of being subsequently hospitalized versus controls (p<.05). Women were almost twice as likely as men to be hospitalized and those between ages 30-39 and 40-49 were less likely to be hospitalized (OR=.47, p<.01 and OR=. 56, p<.01, respectively) than those in the youngest age group (< 30 years); there was no statistically significant difference between the oldest and youngest age groups. There was a gradual declining trend in hospitalization over 9 years.

Table 1(b) shows that ER use follows a pattern similar to the hospital use pattern. The SUD samples were twice as likely to have ER use during 9 years post-treatment as controls. Women were marginally less likely than men to use the ER (p < .10). As with hospital use, those between ages 30-49 years old were less likely to have ER use than the youngest age group. However, the oldest age group was 26% more likely to use ER than the youngest age group.

Health Care Costs and Receipt of Continuing Care, 9 Years Post-Treatment

Tables 2(a) and 2(b) show the excess inpatient and ER cost per member-month of the SUD patients (receiving and non-receiving Continuing Care) vis-à-vis controls. Those receiving Continuing Care had similar inpatient costs as controls during subsequent follow-ups (excess cost=$18.02/member-month; p > .10). However, those not receiving Continuing Care had significantly higher inpatient costs than controls (excess cost=$65.79/member-month; p < .01); this was observed among both men and women and among those aged 30-49. ER costs for both groups of SUD patients were higher relative to controls although gender and age differences were less pronounced (p<.10) in comparisons between those receiving Continuing Care and controls. In comparing the group not receiving Continuing Care to the controls, both men and women had significantly higher ER costs during follow-ups than their demographically matched counterparts in the controls group. The difference in ER costs between SUD patients not receiving Continuing Care and controls was significantly different across age groups starting from age 30 years, although the difference was progressively smaller with age. The excess ER cost of patients not receiving Continuing Care to those receiving Continuing care was not significant (2.78, p > .10), while the excess inpatient cost was marginally significant (47.78; p=0.06). Analyses of utilization and costs for the 60% sample were substantively the same as for continuous members including the subgroup analyses by gender and age.

DISCUSSION

This study examined the relationship between Continuing Care and long-term patterns of health care utilization and costs for a sample of SUD patients. Our definition of Continuing Care was similar to that used in the management of other chronic health conditions such as diabetes and hypertension. We found that SUD patients with service patterns fulfilling all components of Continuing Care had lower overall health care costs compared to those fulfilling fewer or none. Although the study cannot assume a causal link between Continuing Care and health care costs, one possible explanation is that those who are more motivated to maintain positive outcomes are also more likely to seek continuing care services. Alternatively, it may be that SUD patients who maintain regular system contact address medical needs, which improves outcomes and reduces inappropriate ER and hospital costs. Regardless of the mechanism, study findings suggest that integrating care across the health plan, as with other chronic conditions, might be an economically viable option for SUD patients, and provide good health outcomes, assuming fewer hospitalizations are a proxy for good health. Although when Continuing Care was compared to non-Continuing Care the study found no significant differences in excess costs, the more robust comparisons to the non-SUD sample and findings from the related outcomes study support a PC-based model for long-term management of SUDs, and may help promote future research and interventions.

The findings regarding cost and receiving Continuing Care are encouraging. Although rates of ER and hospital use remained higher for the SUD patients than for controls, the severity of these admissions, as reflected in the costs, is much higher among those not receiving Continuing Care. Days of hospitalization and ER visit rates were lower for those receiving at least two components of Continuing Care relative to those who received only one or none respectively. Receipt of Continuing Care among SUD patients was negatively related to inpatient cost. ER costs for those not receiving Continuing Care were higher compared to the demographically matched group. However, we reiterate that due to the observational nature of the study, we cannot assume a causal link between receiving Continuing Care and reduced long-term costs.

When SUD patients received routine PC and specialty SUD and psychiatric treatment services as needed, they became more similar to non-SUD patients with similar demographic characteristics. Although this study sample of those with continuous membership may not be representative of all individuals with SUDs in the health plan, it presents a “best case” scenario for health care access and is likely to have increasing relevance as more individuals are likely to have continuous health care access as health care reform is rolled out. Even within this group, a large group of patients did not access all the services they needed, although they were available.[35, 40] For example, the percentage of patients receiving yearly PC was less than 50% and the percent of patients receiving all components of Continuing Care was < 20% in each study interval. This is a big challenge with SUD patients. Health services research has shown that SUD patients are more likely to use ER services than PC than non-SUD members. Providing PC linkage for these patients has been shown to be beneficial.[37] Strategies facilitating PC linkage in the treatment of SUDs as in other disease management programs, have the potential for large benefits to patient health and the health plan.

Post-hoc analyses showed that those who completed initial SUD treatment were more likely to receive Continuing Care. Thus, an important lesson for health policy is to promote strategies for engaging SUD patients in treatment. SUD treatment may also be a good place to teach patients to use health services effectively and appropriately. Another important finding from our post-hoc analyses was that SUD and psychiatric severity was negatively

related to receiving subsequent Continuing Care. This suggests that although these patients have full access to SUD treatment (no annual or lifetime benefit limits for SUD or psychiatric treatment), this vulnerable group is not receiving care as needed. This calls for strategies of improving system contacts.

This study examined a cohort that entered treatment in the mid-1990s. As with any longitudinal study, this continuing care study which has a long-term follow-up, requires data from a cohort gathered several years earlier. Analyses comparing the study cohort to a more recent cohort of SUD patients showed that gender, age, race, and medical/psychiatric co-occurring conditions were similar across both periods but the drug dependence rate, particularly prescription drug dependence was slightly higher in the recent cohort. However, the structure of the health care system studied, which has significant impact on how patients use services, has remained stable over time, and is representative of systems being developed as part of health care reform. Therefore, the study findings have valid and meaningful implications for health policy.

We note that SUD patients may be getting psychiatric or SUD services in PC that we could not measure at the time of this study. The health plan now has an Electronic Medical Record system that will provide more details on the content of PC contacts in future studies. Our use of a dichotomous measure of the need for specialty SUD or psychiatric services in defining Continuing Care may be limiting. Future research in this area may lead to refinement of the definition of Continuing Care used in this study. However, this observational study makes an important contribution in presenting a new paradigm for long-term management of SUDs, which can in turn inform intervention studies.

The study sample consists of SUD patients who are insured members of an integrated health plan, and results may not be generalizable to uninsured populations or other types of health plans.[41] However, we believe that non-closed fee-for-service care systems have incentives for developing a Continuing Care approach, because they also incur the costs of hospitalizations and ER use. Additionally, the system studied here will be more generalizable under health care reform which promotes integrated health services. Our findings for costs can be considered conservative since those without insurance, or with intermittent insurance, are even less likely to have on-going system contacts including routine PC.

This observational study is also not free from self-selection bias, although we believe that such a bias is somewhat unavoidable, because continuing care is, in itself, the recommended standard of care. It would be unfeasible and unethical to conduct a study where individuals are randomized to receiving Continuing Care versus no Continuing Care. Although causal links between receiving Continuing Care and reduced long-term costs cannot be established in this observational study, the study's goal of determining whether Continuing Care is related to effective of health services utilization that reduces overall health care cost is important, and it provides insight into what an intervention might entail. Study findings that regular primary care and specialty psychiatric and SUD services when needed are related to positive outcomes and reduced long-term costs reinforce the importance of access to health care, and the development of interventions that optimize patients receiving those services. The results appear to support a PC-based health home model that is possibly beneficial for achieving good health outcomes for SUD patients, and reduced costs for the health systems.

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References

1. McLellan AT, Lewis DC, O'Brien CP, et al. Drug dependence, a chronic medical illness: implications for treatment, insurance, and outcomes evaluation. JAMA. 2000; 284:1689–1695. [PubMed: 11015800]
2. Dennis M, Scott CK. Managing addiction as a chronic condition. Addict Sci Clin Pract. 2007; 4:45–55. [PubMed: 18292710]
3. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. JAMA. 2002; 288:1775–1779. [PubMed: 12365965]
4. Von Korff M, Gruman J, Schaefer J, et al. Collaborative management of chronic illness. Ann Intern Med. 1997; 127:1097–1102. [PubMed: 9412313]
5. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. Milbank Q. 1996; 74:511–544. [PubMed: 8941260]
6. Wagner EH, Austin BT, Von Korff M. Improving outcomes in chronic illness. Manag Care Q. 1996; 4:12–25. [PubMed: 10157259]
7. Holder HD, Blose JO. Typical patterns and cost of alcoholism treatment across a variety of populations and providers. Alcohol Clin Exp Res. 1991; 15:190–195. [PubMed: 2058794]
8. Blose JO, Holder HD. The utilization of medical care by treated alcoholics: longitudinal patterns by age, gender, and type of care. J Subst Abuse. 1991; 3:13–27. [PubMed: 1821272]
9. Parthasarathy S, Weisner C, Hu TW, et al. Association of outpatient alcohol and drug treatment with health care utilization and cost: revisiting the offset hypothesis. J Stud Alcohol Drugs. 2001; 62:89–97.
10. Parthasarathy S, Mertens J, Moore C, et al. Utilization and cost impact of integrating substance abuse treatment and primary care. Med Care. 2003; 41:357–367. [PubMed: 12618639]
11. Goodman AC, Holder HD, Nishiura E, et al. An analysis of short-term alcoholism treatment cost functions. Med Care. 1992; 30:795–810. [PubMed: 1518312]
12. Chou SP, Grant BF, Dawson DA. Medical consequences of alcohol consumption--United States, 1992. Alcohol Clin Exp Res. 1996; 20:1423–1429. [PubMed: 8947320]
13. Stein MD. Medical consequences of substance abuse. Psychiatr Clin North Am. 1999; 22:351–370. [PubMed: 10385938]
14. Sikkink, J.; Fleming, MF. Adverse health effects and medical complications of alcohol, nicotine, and drug abuse. In: Fleming, MF.; Barry, KL., editors. Addictive Disorders: A Practical Guide to Treatment. St. Louis: Mosby-Year Book Primary Care Series; 1992. p. 145-168.
15. Mertens JR, Lu YW, Parthasarathy S, et al. Medical and psychiatric conditions of alcohol and drug treatment patients in an HMO: comparison with matched controls. Arch Intern Med. 2003; 163:2511–2517. [PubMed: 14609789]
16. Watt K, Purdie DM, Roche AM, et al. Risk of injury from acute alcohol consumption and the influence of confounders. Addiction. 2004; 99:1262–1273. [PubMed: 15369564]
17. Cherpitel CJ, Ye Y. Drug use and problem drinking associated with primary care and emergency room utilization in the US general population: data from the 2005 national alcohol survey. Drug Alcohol Depend. 2008; 97:226–230. [PubMed: 18499355]
18. Cherpitel CJ. Alcohol and injuries: a review of international emergency room studies since 1995. Drug Alcohol Rev. 2007; 26:201–214. [PubMed: 17364856]
19. Cherpitel CJ, Ye Y, Bond J. Attributable risk of injury associated with alcohol use: Cross-national data from the emergency room collaborative alcohol analysis project. Am J Public Health. 2005; 95:266–272. [PubMed: 15671463]
20. Holder HD, Blose JO. Alcoholism treatment and total health care utilization and costs: a four-year longitudinal analysis of federal employees. JAMA. 1986; 256:1456–1460. [PubMed: 3747063]
21. Holder HD, Hallan JB. Impact of alcoholism treatment on total health care costs: a six-year study. Adv Alcohol Subst Abuse. 1986; 6:1–15. [PubMed: 3101439]
22. Holder HD, Blose JO. The reduction of health care costs associated with alcoholism treatment: a 14-year longitudinal study. J Stud Alcohol. 1992; 53:293–302. [PubMed: 1619923]

23. Blow FC, Barry KL, BootsMiller BJ, et al. Longitudinal assessment of inpatient use and functioning of seriously mentally ill veterans with and without co-occurring substance use disorders. J Psychiatr Res. 1998; 32:311–319. [PubMed: 9789210]
24. Lennox RD, Scott-Lennox JA, Bohlig EM. The cost of depression-complicated alcoholism: health-care utilization and treatment effectiveness. J Ment Health Adm. 1993; 20:138–152. [PubMed: 10128444]
25. Hoff RA, Rosenheck RA. Long-term patterns of service use and cost among patients with both psychiatric and substance abuse disorders. Med Care. 1998; 36:835–843. [PubMed: 9630125]
26. Hoff RA, Rosenheck RA. The cost of treating substance abuse patients with and without comorbid psychiatric disorders. Psychiatr Serv. 1999; 50:1309–1315. [PubMed: 10506299]
27. Chi FW, Satre DD, Weisner C. Chemical dependency patients with cooccurring psychiatric diagnoses: service patterns and 1-year outcomes. Alcohol Clin Exp Res. 2006; 30:851–859. [PubMed: 16634854]
28. Parthasarathy S, Weisner C. Five-year trajectories of health care utilization and cost in a drug and alcohol treatment sample. Drug Alcohol Depend. 2005; 80:231–240. [PubMed: 15916868]
29. Zywiak WH, Hoffmann NG, Stout RL, et al. Substance abuse treatment cost offsets vary with gender, age, and abstinence likelihood. J Health Care Finance. 1999; 26:33–39. [PubMed: 10497749]
30. Boden MT, Moos R. Dually diagnosed patients' responses to substance use disorder treatment. J Subst Abuse Treat. 2009; 37:335–345. [PubMed: 19540699]
31. Kaskutas LA, Ammon L, Delucchi K, et al. Alcoholics Anonymous careers: patterns of AA involvement five years after treatment entry. Alcohol Clin Exp Res. 2005; 29:1983–1990. [PubMed: 16340455]
32. McKay JR, Lynch KG, Shepard DS, et al. The effectiveness of telephone-based continuing care for alcohol and cocaine dependence: 24-month outcomes. Arch Gen Psychiatry. 2005; 62:199–207. [PubMed: 15699297]
33. Godley SH, Godley MD, Wright KL, et al. Contingent reinforcement of personal goal activities for adolescents with substance use disorders during post-residential continuing care. Am J Addict. 2008; 17:278–286. [PubMed: 18612882]
34. Dennis M, Scott CK, Funk R. An experimental evaluation of recovery management checkups (RMC) for people with chronic substance use disorders. Eval Program Plann. 2003; 26:339–352.
35. Chi FW, Parthasarathy S, Mertens JR, et al. Continuing care and long-term substance use outcomes in managed care: initial evidence for a primary care based model. Psychiatr Serv. 2011; 62:1194–2000. [PubMed: 21969646]
36. Weisner C, Mertens J, Parthasarathy S, et al. The outcome and cost of alcohol and drug treatment in an HMO: day hospital versus traditional outpatient regimens. Health Serv Res. 2000; 35:791–812. [PubMed: 11055449]
37. Weisner C, Mertens J, Parthasarathy S, et al. Integrating primary medical care with addiction treatment: a randomized controlled trial. JAMA. 2001; 286:1715–1723. [PubMed: 11594896]
38. McLellan AT, Kushner H, Metzger D, et al. The Fifth Edition of the Addiction Severity Index. J Subst Abuse Treat. 1992; 9:199–213. [PubMed: 1334156]
39. Selby JV. Linking automated databases for research in managed care settings. Ann Intern Med. 1997; 127:719–724. [PubMed: 9382386]
40. Chi, FW.; Parthasarathy, S.; Mertens, J., et al. Continuing care and long-term substance use outcomes in managed care. 33rd annual scientific meeting of the Research Society on Alcoholism; San Antonio, TX. 2010.
41. Weisner C, McLellan AT, Hunkeler EM. Addiction severity index data from general membership and treatment samples of HMO members. One case of norming the ASI. J Subst Abuse Treat. 2000; 19:103–109. [PubMed: 10963921]

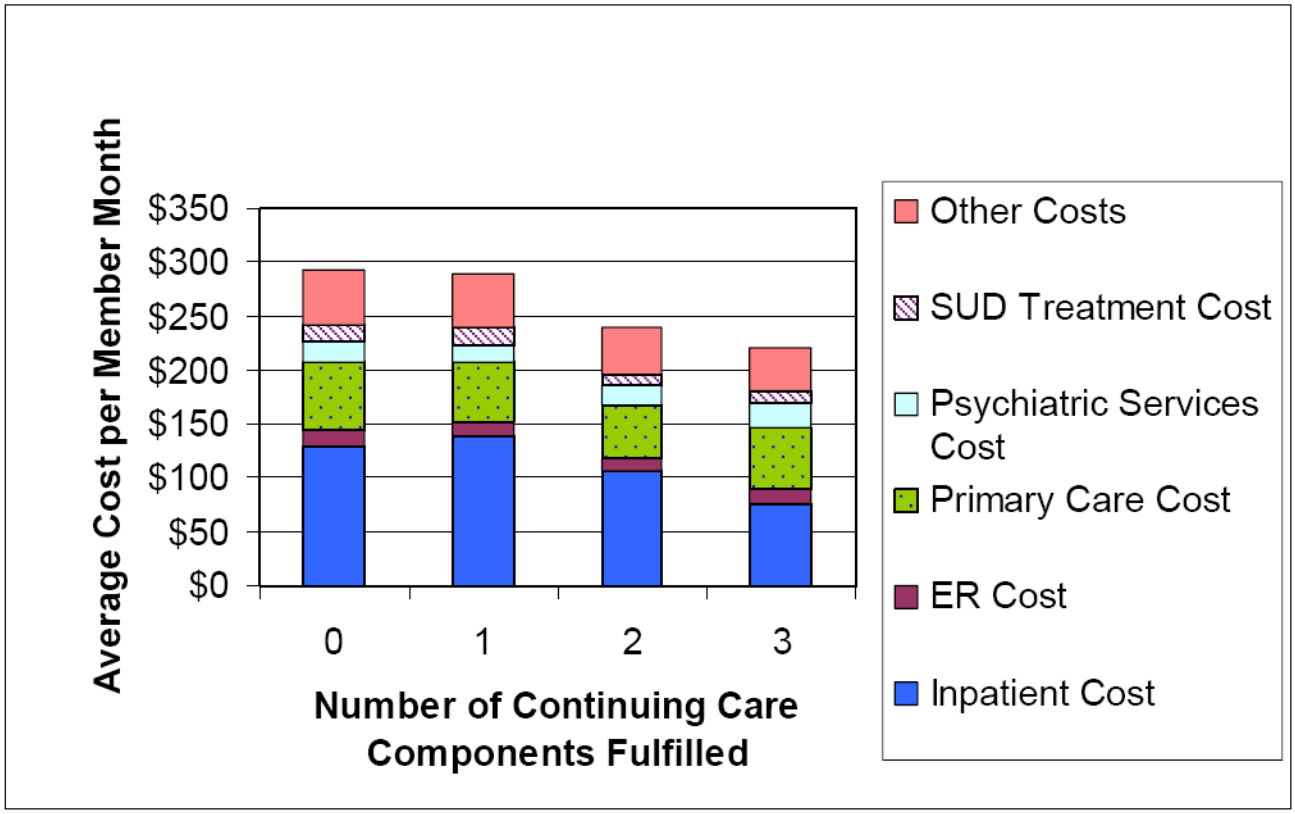

FIGURE 1.
Average Costs by Number of Continuing Care Components Fulfilled

TABLE 1

(A). Mixed-Effect Logistic Regression of Hospital Use among SUD Patients With and Without Continuing Care (CC), Versus Matched Controls

			95% Confidence Interval	
	Coefficient	**Odds Ratio**	**Lower Limit**	**Upper Limit**
Intercept	-2.23	0.11	0.08	0.14***
Time	-0.62	0.54	0.47	0.62***
Time Squared	0.11	1.12	1.08	1.16***
Continuing Care (Reference Group = Controls)				
Received CC in prior time point (1=yes)	0.54	1.72	1.02	2.90**
Did not receive CC in prior time point (1=yes)	1.01	2.76	2.25	3.38***
Female Gender (Reference Group=Male)	0.65	1.92	1.65	2.24***
Age (Reference Group=18 - 29 years)				
Age 30_39	-0.75	0.47	0.37	0.61***
Age 40_49	-0.59	0.56	0.43	0.71***
Age 50+	0.23	1.26	0.96	1.64

(B). Mixed-Effect Logistic Regression of ER Use among SUD Patients with and without Continuing Care (CC), versus Matched Controls

			95% Confidence Interval	
	Coefficient	Odds Ratio	Lower Limit	Upper Limit
Intercept	-0.61	0.54	0.45	0.66***
Time	-0.67	0.51	0.47	0.57***
Time Squared	0.12	1.12	1.10	1.15***
Continuing Care (Reference Group = Controls)				
Received CC in prior time point (1=yes)	0.77	2.16	1.45	3.22***
Did not receive CC in prior time point (1=yes)	0.87	2.39	2.03	2.81***
Female Gender (Reference Group=Male)	-0.11	0.89	0.80	1.00*
Age (Reference Group=18 - 29 years)				
Age 30_39	-0.20	0.82	0.68	1.00**
Age 40_49	-0.23	0.80	0.66	0.97**
Age 50+	0.23	1.26	1.02	1.56**

*** = p <.01;

** = p < .05;

* = p < .10

TABLE 2

(A). Excess Inpatient Cost per Member Month among SUD Patients with and without Continuing Care (CC), versus Matched Controls

	SUD Patients with CC versus Controls	SUD Patients without CC versus Controls
Full Model	$18.02	$65.79***
Stratified by Gender		
Women	$25.91	$66.72**
Men	$13.24	$74.20***
Stratified by Age		
Age < 30	$(39.75)***	$49.44
Age 30 -39	$31.08	$114.67***
Age 40 -49	$16.32	$81.75***
Age 50+	$49.79	$36.02

(B). Excess ER Cost per Member Month among SUD Patients With and Without Continuing Care (CC), versus Matched Controls

	SUD Patients with CC versus Controls	SUD Patients without CC versus Controls
Full Model	$5.76**	$8.54***
Stratified by Gender		
Women	$6.38	$10.19***
Men	$4.18*	$7.02***
Stratified by Age		
Age < 30	$(2.88)*	$11.14*
Age 30 -39	$10.00*	$10.31***
Age 40 -49	$2.84	$8.12***
Age 50+	$7.96	$4.95

*** = p <.01;

** = p < .05;

* = p < .10