

TITLE: Provider-level Influences on Receipt of Aftercare Services: A Multilevel Hazard Model

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ABSTRACT

Objective: Previous research on determinants of aftercare service use for youth with mental health or substance abuse disorders has focused on patient level characteristics. However, providers can influence whether or not a youth receives such services. This study examines both patient- and provider-level determinants of aftercare services for youth with mental health and substance abuse disorders following inpatient hospitalizations.

Study Design: This study uses Tennessee Medicaid claims data from 1996 to 2001. The data include information on 9,181 youth aged 12-21 discharged from 170 facilities. We estimate the hazard of receiving aftercare services using a multilevel discrete-time event history model. Covariates include patient characteristics (gender, race, etc.), facility characteristics (type, specialty), episode characteristics (length of stay prior to discharge, year, child's qualification for Medicaid, age, and diagnosis) and duration from discharge until receipt of follow-up services.

Results: Twelve percent of youth in our sample received aftercare services within four months of discharge. Relative to youth with mental health problems, the hazard of receiving aftercare services was 26 percent lower for youth with substance abuse problems. Relatively little (9%) the variation in aftercare services was determined at the facility level, and 16 percent was explained by patient and family characteristics.

Conclusion: A relatively small percentage of youth discharged from inpatient facilities received the appropriate level of aftercare services. Further research should examine factors that could improve this low rate. Because relatively little of the variation in aftercare is determined at the facility level, these results call into question the use of aftercare receipt as a measure of quality of care provided by a facility.

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The National Committee on Quality Assurance recommends patients receive follow-up care within a week of discharge from an inpatient stay related to a mental health disorder (National Committee for Quality Assurance (NCQA), 2003). Such aftercare provides an opportunity to monitor a patient's progress after discharge; patients who are not faring well can have their medications adjusted or treatment modified.

Research has linked aftercare services to lower readmission rates and better treatment outcomes. For instance, for youth with substance abuse problems, receipt of aftercare services reduces the likelihood of relapse (Kelly, Myers, & Brown, 2000; Kennedy & Minami, 1993; Whitney, Kelly, & Meyers, 2002; Daniel, Goldston, Harris, Kelley, & Palmes, 2004). In turn, substance abuse problems have been linked to problems maintaining employment and premature death (Hu, Manning, Rice, Schuttinga, & Sindelar, 2001). Thus ensuring youth receive appropriate follow-up services has the potential for great public cost savings.

Nevertheless, only limited research exists as to whether youth leaving inpatient psychiatric institutions receive aftercare services. As discussed below, this research focuses on the role of patient and family characteristics and neglects the role of providers. This gap is surprising given that research in other areas of health services have shown the importance of such factors. For example, Gifford and Foster (2005) find that roughly 40 percent of the variation in length of stay among youth with mental health and substance abuse disorders is determined at the facility level. This compares with only 4 percent of the variation being explained by patient level characteristics.

The role of the provider in ensuring compliance with treatment recommendations such as receipt of aftercare services may be particularly important for youth mental health and substance abuse disorders. The nature of these disorders may impede the individual's ability to seek services. Continuity of care is especially important for chronic conditions, such as mental disorders, where failure to treat the disorder in a timely fashion may lead to more severe episodes of illness.

This article examines determinants of receiving aftercare services following discharge from an overnight medical visit among youth with mental health and/or substance abuse disorders. Data for these analyses were collected as part of the Tennessee Impact Study. This article has five sections. First, we review prior studies of determinants of aftercare service use among youth with mental health and/or substance abuse problems and discuss the limitations of these studies. Then we describe the Tennessee Impact Study data and the sample used in our analyses. Next, we describe the multilevel event history model used to examine differences in the timing of receiving aftercare services and then present the results of our analyses. Finally, the implications of our findings are described.

PRIOR RESEARCH

A recent review of the scientific literature in MEDLINE or Psycinfo published between January 1992 and August 2003 identified only 21 articles that examined aftercare services for children with mental health or substance abuse disorders (Daniel, Goldston, Harris, Kelley, & Palmes, 2004). Only eight studies examined determinants of aftercare use among youth who have been discharged. Only four of these studies focused on the timing of the initiation of aftercare services (Foster, 1998; Goldston, 2003; Kelly, Myers, & Brown, 2000; Parmelee, Cohen, Nemil, & al., 1995).

These studies examined receipt of aftercare following discharge from an inpatient facility in a range of populations. Parmelee et al (1995) followed 79 youths for six months after discharge from a state psychiatric facility. Foster (1998) examined 204 youth discharged from psychiatric facilities whose parents were members of the military. These youth were divided between two groups. Youth were followed for 60 days post discharge. Kelly and colleagues (2000) examined 99 youth with substance abuse problems discharged from two private hospitals in San Diego. Attendance at 12-step meetings was monitored for 6 months following discharge. Goldston et al (2003) examined the experiences of 180 adolescents who were discharged from an inpatient psychiatric facility in North Carolina. Youth were followed for up to one year.

Together, this literature identifies a series of individual and family characteristics that predict the use of aftercare. A higher probability of receipt of aftercare service use was associated with younger age (Foster 1998, Goldston 2003), higher caregiver educational attainment (Foster, 1998), lower socioeconomic status (Foster, 1998), presence of a biological parent or grandparent (Goldston et al 2003, Parmelee et al 1995, Foster, 1998), substance use severity (Kelly et al 2000), comorbid psychiatric disorder (Goldston et al 2003), higher levels of objective caregiver burden (Foster 1998), lower levels of internalizing or externalizing burden of care (Foster 1998) and higher levels of functioning (Foster, 1998). Prior experience with the health system also was related to the care that youth received. Higher rates of receiving aftercare were observed for youth who had ongoing patient therapy prior to hospitalization (Goldston et al, 1998 and Parmelee 1995), were voluntarily admitted to the hospital (Parmelee et al 1995), were exposed to a coordinated network of providers (Foster, 1998) and who did not have multiple previous hospitalizations (Foster, 1998).

For some characteristics, findings were inconsistent across studies. For instance, Foster (1998) found that minority youth were less likely to receive aftercare services. In contrast, Goldston (2003) found no link between race and service use. Foster (1998) found conduct disorder was associated with an increase in the hazard of receiving aftercare services at the demonstration site. However, Goldston et al (2003) did not find a statistically significant association between receipt of aftercare and conduct disorder.

These studies suffered from a variety of limitations. First, and most importantly, none of the studies examined whether provider level factors may encourage or discourage receipt of aftercare services. Each study focused on no more than a handful of facilities or providers. This limits the generalizability of findings from one study. Second, all of the studies were based on small samples with the largest having 204 observations. Small sample size limits the researcher's ability to examine the effects of the large number of factors known to affect the probability of receipt of health services. Moreover, inconsistencies across studies—both in findings and in methodology—make it difficult to synthesize findings across studies.

METHODS

The current study examines determinants of receipt of follow-up services using a multilevel hazard model. This model allows one to model both the nature of the dynamic process shaping the use of aftercare as well as the multilevel determinants of service use. In particular, this study examines the degree to which provider-level factors affect the probability that a youth will receive aftercare services. The sample for these analyses includes a large number of youth who received care from many facilities from a single state. All youth in our sample are insured through the Medicaid program. Receipt of aftercare services is modeled as a function of child's age, gender, race/ethnicity, eligibility for the Medicaid program, diagnosis, length of stay of the most recent discharge, type of facility from which they were discharged, the primary specialty of the facility, and the year that the child entered services.

Data

The Tennessee Impact Study provided the data for these analyses. That study is part of a multi-site investigation of the effect of managed care on the use of health services by children and adolescents and is funded by the United States Department of Health and Human Services, Substance Abuse and Mental Health Services Administration. Researchers at Vanderbilt University's Institute for Public Policy Study (VIPPS) obtained and processed the Medicaid claims used in these analyses.

The data provide information on service use from July 1996 until December 2001 for youth aged 12-21. Our sample includes all discharges from an inpatient stay related to a mental health and/or substance abuse disorder. For patients who had multiple discharges from multiple facilities, we limited the sample to include only discharges from a single facility. Individuals with mental retardation were excluded from these analyses.

These data contain information on all services that the youth received which were paid for by Medicaid. This includes information such as the dates when the child was admitted, discharged and received subsequent services. The data also provide details such as whether the service was inpatient or outpatient and the child's diagnosis for at the time of service use. Moreover, these data provide information on the child's race, gender, age, and how the child qualified for TennCare. Another important feature of this data is that they include the ICD-9 diagnosis code for the youth's mental health and substance abuse problem.

Relatively few observations had any item nonresponse. We excluded 109 admissions (less than one percent of the total) from our analyses due to incomplete information on eligibility for the Medicaid program (n=89) or facility identification number (n=20). Of the observations that contain complete information there were 11,884 discharge from 9,181 patients in 170 facilities.

The data contain a facility identifier that can be used to link individuals discharged from the same facility. The data also include information on the type of facility in which the service occurred (detox facility, residential treatment center or inpatient facility) and the primary specialty of the facility (mental health, community mental health center, or other center).

Statistical Model

The hazard of receiving aftercare services was modeled using a multilevel discrete-time event history model to examine whether there were provider level effects on duration until

follow-up services (Steele, Goldstein, & Browne, 2003). Equation 1 represents the hazard of receiving services. It is a function of facility, child and discharge characteristics. The hazard rate also has a discharge-level variance term, $\varepsilon_{f,c,d}$. Equation 2 indicates that the mean for a facility and child, $\beta_{f,c}$, is a function of the facility-level mean, β_f and a child-level mean, β_c . Equation 3 implies that the facility mean is a function of observed facility characteristics, X_f , and unobserved characteristics, δ_f . Similarly, Equation 4 implies that the child mean is a function of observed child characteristics, X_c , and an unobservable term, δ_c .

$$h_{f,c,d} = \exp(\beta_{f,c} + \beta X_{f,c,d} + \varepsilon_{f,c,d})$$

$$\beta_{f,c} = \beta_f + \beta_c$$

$$\beta_f = \gamma X_f + \delta_f$$

$$\beta_c = \eta X_c + \delta_c$$

The X_f matrix consists of two variables that describe facility-level characteristics, the type of facility in which the episode occurred (residential facility, detox facility vs inpatient hospital) and the primary specialty of the facility (Community Mental Health Center, other vs mental health).

The X_c matrix consists of two variables that are constant within child, the child's race (white vs nonwhite) and gender.

The $X_{f,c,d}$ matrix contains 6 variables are specific to the discharge. These include the child's age at admission, the child's eligibility status within the TennCare program (SSI, Medically Needy, Foster Care, cash assistance, other state program, other poverty related vs uninsured), and the child's diagnosis during his or her inpatient stay (substance abuse only, substance abuse and mental health vs mental health only), the length of the inpatient visit preceding the discharge and the year during which the admission occurred. The $X_{f,c,d}$ matrix also includes a measure of the amount of time between discharge and follow-up is measured in weeks.

Estimation

The data were organized in a person-day format. Spells were right-censored at 120 days or approximately 4 months. There are both theoretical and practical reasons for censoring. Theoretically, it is difficult to know whether an outpatient visit observed four months post discharge is related to the original episode of care. For practical computational reasons, censoring at some arbitrary cutoff was necessary in order to keep the dataset sufficiently small so that the computer could estimate the model. The resulting sample included 478,729 person days. The dependent variable was a dichotomous variable indicating whether patient received aftercare services on that day.

One aim of this study was to partition the variance across various levels. Typically researchers calculate what is known as a variance partition coefficient. This coefficient represents the variance explained at the level of interest divided by the total variance. In order to partition the variance, we used the latent variable approach (Browne, Subramanian, Jones, &

Goldstein, 2003). This approach assumes that the underlying distribution of the dependent variable is continuous. In the model of receipt of aftercare services we have assumed the dependent variable follows a logistic distribution. The variance of a logistic distribution is a constant ($\pi^2/3$). This value is substituted for the variance of the lowest level, the discharge level ($\epsilon_{f,c,d}$). The total variance is the sum of $(\pi^2/3)+\delta_f+\delta_c$.

It is important to note that the interpretation of coefficients from hazard models differs from those obtained from ordinary least squares regression. The interpretation of the coefficients depends upon the specific type of hazard model used. Hazard ratios were used to interpret the coefficients from the model presented here. A hazard ratio represents the effect of a unit change in the value of X_j on the hazard rate. A hazard ratio can be calculated by exponentiating the coefficient of interest. Models were estimated in MLWin using the iterative generalised least squares algorithm.

RESULTS

Table 6.1 contains descriptive statistics of the sample discharges. Following discharge, 12 percent of patients received aftercare services within 4 months post. The other 88% of discharges were censored at 4 months. The mean and median time from discharge until receipt of aftercare services was 7.1 and 6.3 weeks respectively.

Table 6.1 Descriptive Statistics of Discharge Characteristics

	Median	Mean	SD
Time until aftercare received (in weeks)	6.3	7.1	5.1
Length of stay prior to discharge (in days)	6.0	12.5	19.2
	N	Percent	
Total	11884	100%	
Received follow-up	1,478	12%	
<u>Race/Ethnicity</u> (omitted category: nonWhite)			
White	9,126	77%	
<u>Gender</u> (omitted category: Male)			
Female	5156	43%	
<u>age</u> (omitted category: 12-15 years)			
16-18 years	4,231	36%	
19-21 years	1,797	15%	
<u>Diagnostic Category</u> (omitted category: Mental health Only)			
Substance Abuse Only	694	6%	
Comorbidity	1,320	11%	
<u>Eligibility Category</u> (omitted category: Uninsured)			
SSI	3,148	26%	
Medically Needy	1,257	11%	
Foster Care	1,532	13%	
Temporary Aid to Needy Families	2,410	20%	
Poverty Related	536	5%	
Other State Program	174	1%	
<u>Facility Type</u> (omitted category: Inpatient)	10,478	88%	
Detox	219	2%	
Residential Treatment Facility	1,187	10%	
<u>Primary Specialty</u> (Omitted category: Mental Health)			
Community Mental Health Center	9,410	79%	
Other facility	261	2%	
<u>Year</u> (Omitted category: 1996)			
	1997	2,178	18%
	1998	2,081	18%
	1999	2,443	21%
	2000	2,262	19%
	2001	1,390	12%
Source: Authors' tabulations of the Tennessee Impact Study			

About three quarters of the sample was white (77%). A slightly smaller proportion of girls had discharges for substance abuse and/or mental health problems (43% vs 57%). The majority of the sample (57%) had a mental health diagnosis at admission. Six percent of the sample had a diagnosis of a substance abuse disorder and 11 percent had a comorbid condition. Youth qualified for the Medicaid program in a variety of ways. Roughly a quarter of discharges were made by individuals who qualified for the Supplemental Security Income Program (SSI). Another quarter of the discharges involved individuals who would have been uninsured were they not covered by Medicaid. The remaining individuals qualified via their status in foster care (11%), participation in TANF (20%), other poverty related reasons (5%) or through the state run program (1%). Regarding facility type, 88 percent of discharges were from an inpatient facility. One tenth of discharges were from a residential treatment facility and 2 percent were from a detox facility. The primary specialty for 79 percent of discharges was a community mental health center, a mental health center for 19 percent and 2 percent came from facilities with other specialties.

Table 6.2 contains the hazard ratios from the multilevel discrete-time hazard model. Females were 14 percent more likely than males to receive aftercare services. Relative to youth aged 12-15, the hazard of receiving aftercare services was 35 percent lower for youth aged 16-18 and 51 percent lower for youth aged 19-21. Probability in receiving aftercare services varied by how an individual qualified for the Medicaid program. Relative to other children in the Medicaid program, youth in foster care had a 52 percent lower hazard of receiving aftercare services and youth who qualified for other state programs had an 80 percent lower hazard of receiving aftercare services. Youth discharged from an inpatient facility had 35 percent higher hazard rate of receiving aftercare services than youth discharged from a detox facility. Youth treated in community mental health centers had a 19 percent higher hazard rate for receiving aftercare services than youth treated in a mental health facility. The likelihood of aftercare receipt rose over time: relative to youth admitted in 1996, for those admitted in 1998, 1999 and 2000, the hazard rate for receiving aftercare services was 20, 51 and 44 percent higher respectively.

Estimates from the reduced multilevel discrete time logistic regression model suggest that 9 percent of the variance in the hazard of receiving aftercare is attributable to the facility level and 16 percent is attributable to the individual-level. Because the distribution of estimated variance components is often quite different than the normal distribution, significance levels were determined using the posterior distribution. The posterior mean for the variance of both the facility-level and patient-level random effects were statistically significantly different than zero ($p < .05$).

Table 6.2 Multilevel Logistic Event History of Receipt of Aftercare Services

	Hazard Ratio	T-score	Significance ^a
Weeks following discharge	0.80	-75.33	--
Length of Stay	1.00	-4.00	--
Diagnostic Category			
Substance Abuse	0.74	-3.40	--
Comorbidity	0.93	-1.38	
Race/Ethnicity			
White	1.03	0.63	
Gender			
Female	1.14	4.06	+
age			
16-18 years	0.65	-12.53	--
19-21 years	0.49	-14.18	--
Eligibility Category			
SSI	0.97	-0.70	
Medically Needy	0.86	-2.70	--
Foster Care	0.38	-17.44	--
TANF	0.96	-1.02	
Other Poverty Related	1.01	0.09	
Other State Program	0.20	-10.18	--
Facility Type			
Inpatient	1.35	2.31	-
Residential Treatment Facility	1.15	0.99	
Primary Specialty			
Community Mental Health Center	1.19	3.38	++
Other facility	1.22	1.63	
Year			
1997	1.03	0.58	
1998	1.20	2.86	++
1999	1.51	6.19	++
2000	1.44	5.41	++
2001	1.10	1.21	
Variance Estimates			
Facility			
Variance estimate	0.36	5.37	
% of total (unexplained) variance	8%		
Patient			
Variance estimate	0.69	26.50	
% of total (unexplained) variance	16%		
Discharge			
Variance estimate	3.29	NA	
% of total (unexplained) variance	76%		
N			
Person days at risk	478729		
Number of Failures	1478		

Source: Authors' tabulations of the Tennessee Impact Study
a This column indicates hazard ratios of p<.01 as "++" or "--" and p<.05 as "+" or "-" depending upon whether the corresponding characteristic increases or decreases the hazard of aftercare services.

DISCUSSION

Our results suggest many youth are not receiving the recommended levels of care. Our sample is limited to a Medicaid population where patients do not bear out of pocket expenditures. Since cost of care is often a barrier to care, one might expect compliance to be higher in a Medicaid population than in other low-income populations.

A key question this study asks is whether the hazard of receiving services differs across providers as well as across patients. The random effects for both facility and patients was significantly different than zero suggesting that the hazard rate for receiving aftercare depends on factors at both the facility and individual levels.

However, the facility-level component explained only 9 percent of the total variance. This finding could imply several things. The overall rate of receipt of aftercare services was relatively low in our sample. This could imply that all facilities were generally providing poor quality care or were not using strategies that could improve follow-up rates. Other studies of various populations (low-income pediatric populations, adults with chronic conditions, veterans discharged from substance abuse clinics, etc.) have found that follow-up rates improve if facilities implement strategies such as helping patients schedule appointments and reminding patients of when their appointments are (Bodenheimer, Wagner, & Grumbach., 2002; Lozano, Grothaus, Finkelstein, Hecht, Farber, & Lieu, 2003; Quattlebaum, Darden, & Sperry, 1991; Wagner, Austin, Davis, Hindmarsh, Schaefer, & Bonomi, 2001).

A second explanation as to why facilities had little effect on receipt of aftercare services may be that individual characteristics are stronger determinants than facility level factors. Even if that is the case, then providers may wish to identify individual characteristics that are associated with low compliance with recommended treatment. Better identifying which individuals are least likely to comply with treatment recommendations may help providers target hard to reach populations. This possibility implies that future research could explore whether there is an interaction between provider and individual characteristics.

Limitations

The observed rate of aftercare service use in our study was 12 percent. This rate is substantially lower than the rate of about two thirds seen in most studies of aftercare receipt (Daniel, Goldston, Harris et al., 2004). This finding is particularly surprising given that our study followed patients for up to four months post-discharge. One explanation for this is that our data come from one payment source, Medicaid claims data. It is possible that some youth received follow-up services that were paid for by another source such the Drug and Alcohol Treatment Block grant, private insurance or out of pocket payment or another service sector such as the school system or the juvenile court system.

A second limitation of this study is that we lack information on individual and family characteristics known to be related to receipt of aftercare services such as socioeconomic status, family structure, substance use severity, or caregiver characteristics such as burden of care.

Conclusion

This is the largest study to consider the determinants of aftercare services. Unlike previous studies, this study is able to examine post-discharge care from a large sample of

individuals who sought care in many different facilities. Although our study did not find large provider-level effects, our results suggest that few youth are receiving appropriate follow-up treatment. Providers have the potential to improve the percent of youth who receive services. Further research could explore which patient level characteristics are most important determinants of receipt of aftercare services and what provider-level strategies improve patient compliance for those who are least likely to comply.

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