

**THE IMPACT OF THE MENTAL HEALTH SERVICES ACT
ON EMERGENCY INTERVENTIONS AND
INVOLUNTARY HOSPITALIZATIONS**

Petris Report # 2010-4

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Summary

Whether or not a comprehensive mental health intervention among seriously mentally ill (SMI) individuals has an effect on emergency interventions and involuntary hospitalizations is a critical test of the effectiveness of that intervention. In this study we examined whether longer tenure in the Full Service Partnership (FSP) program reduced rates of mental-health related emergency room admissions compared to those not participating in the FSP program. We also examined the characteristics of individuals participating in the FSP program to understand which characteristics may be associated with the degree to which mental-health/substance abuse related emergency interventions are used. Finally, we examined whether the number of involuntary civil commitments decreased overall after the implementation of the Mental Health Services Act (MHSA). Our findings can be collapsed into six major points. Note that emergency room services are a subset of emergency interventions. Emergency interventions includes emergency room services, crisis stabilization unit services and other emergency services.

Emergency Room Services: FSP vs. non-FSP

- 1) Participants in the FSP program experience 64% higher odds of using a mental health related emergency room (ER) intervention in the first month after entering the FSP program (relative to consumers not participating in the FSP program). After this period, the odds of an ER intervention are similar to non-FSP participants up to month seven.
- 2) Participation in the FSP program reduces the odds of using ER services relative to those not participating in the FSP program starting in month eight, with the odds being reduced by 57%. By eighteen months in the FSP program the odds are reduced by 78%.

Emergency Interventions (Emergency Rooms, Crisis Stabilization Unit, etc.) for FSP Participants

- 1) There are no significant changes in the odds of an emergency intervention occurring during the first three months of FSP participation, and then the odds of an emergency intervention occurring drop below the one-month FSP participation level from 31% to 62%.
- 2) Living independently, in supervised placement, in justice placement, or being on probation, are all associated with a reduction in the number of emergency interventions.
- 3) Having schizophrenia or a personality disorder, having a current substance abuse problem, and having a payee and/or a conservator are all associated with an increase in the number of emergency interventions.

Involuntary Admissions to Psychiatric Facilities

- 1) At the county level, involuntary 14-day intensive treatments, but not involuntary 72-hour holds, fall below expected values following the disbursement of MHSA funds.

In summary, FSP programs are highly effective at reducing the need for emergency interventions.

Chapter 1: Introduction

In November 2004, Californians approved the ballot measure Proposition 63 (which became the Mental Health Services Act) to expand public mental health funding and services. This report focuses on one subcomponent of MHSA, Full Service Partnerships (FSP), which is part of Community Services and Supports (CSS) component of MHSA. The CSS component provides funding for direct services and supports to people with a serious mental illness (SMI) or a serious emotional disturbance (SED).

Full Service Partnerships, according to the California Code of Regulations (Title 9, § 3620, 2010), may include the following services for adults:

Full Service Partnership Service Category.

(a) The County shall develop and operate programs to provide services under the Full Service Partnership Service Category. The services to be provided for each client with whom the County has a full service partnership agreement may include the Full Spectrum of Community Services necessary to attain the goals identified in the Individual Services and Supports Plan (ISSP). The services to be provided may also include services the County, in collaboration with the client, and when appropriate the client's family, believe are necessary to address unforeseen circumstances in the client's life that could be, but have not yet been included in the ISSP.

(1) The Full Spectrum of Community Services consists of the following:

(A) Mental health services and supports including, but not limited to:

- (i) Mental health treatment, including alternative and culturally specific treatments.*
- (ii) Peer support.*
- (iii) Supportive services to assist the client, and when appropriate the client's family, in obtaining and maintaining employment, housing, and/or education.*
- (iv) Wellness centers.*
- (v) Alternative treatment and culturally specific treatment approaches.*
- (vi) Personal service coordination/case management to assist the client, and when appropriate the client's family, to access needed medical, educational, social, vocational rehabilitative and/or other community services.*
- (vii) Needs assessment.*
- (viii) ISSP development.*
- (ix) Crisis intervention/stabilization services.*
- (x) Family education services.*

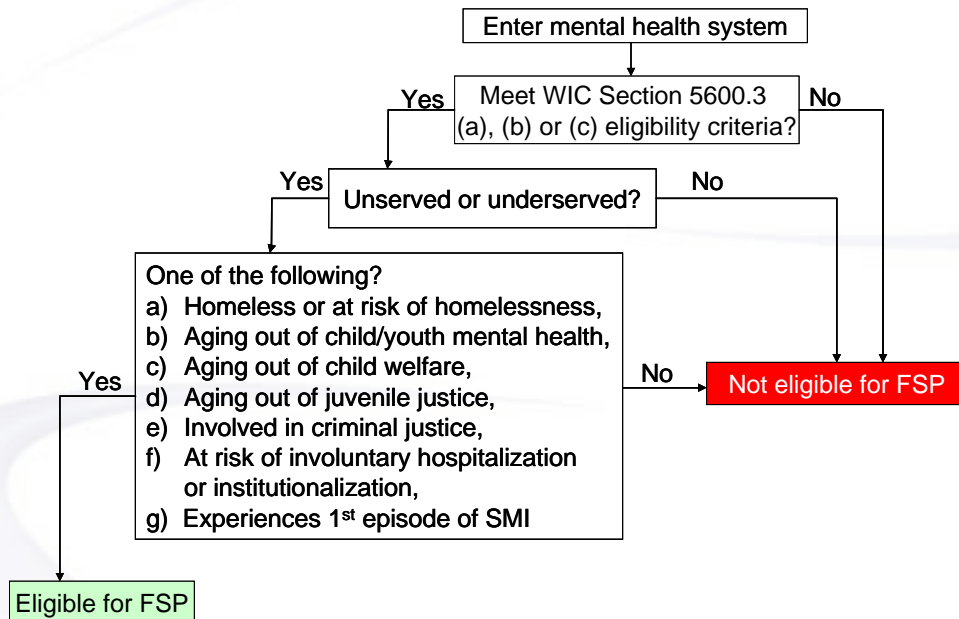
(B) Non-mental health services and supports including, but not limited to:

- (i) Food.*
- (ii) Clothing.*
- (iii) Housing, including, but not limited to, rent subsidies, housing vouchers, house payments, residence in a drug/alcohol rehabilitation program, and transitional and temporary housing.*
- (iv) Cost of health care treatment.*
- (v) Cost of treatment of co-occurring conditions, such as substance abuse.*
- (vi) Respite care.*

(C) Wrap-around services to children in accordance with WIC Section 18250 et. seq.

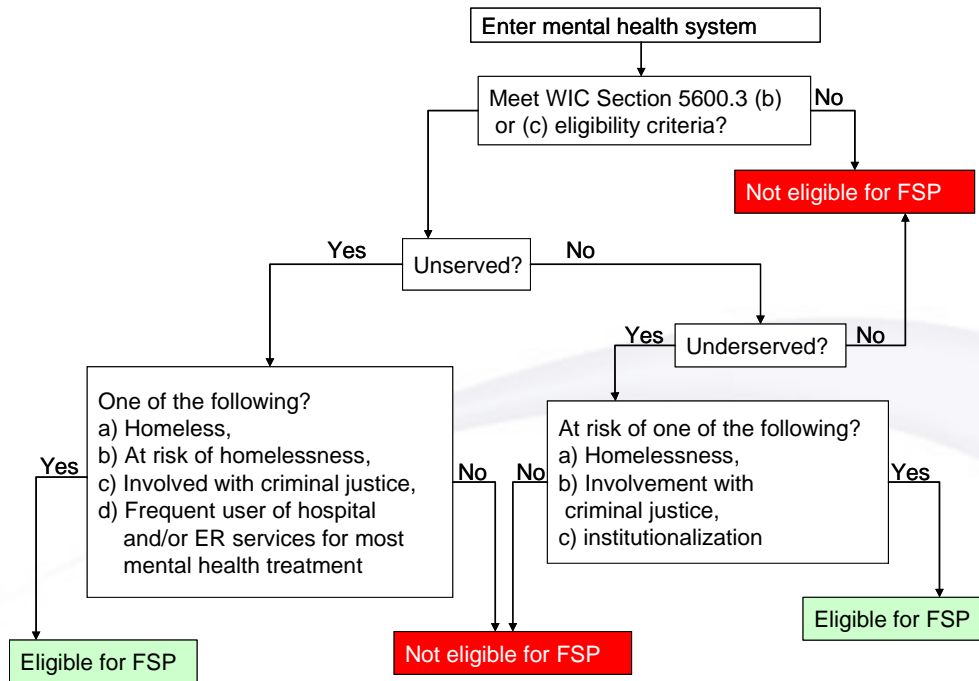
Figures 1.1, 1.2 and 1.3 show the criteria for admission into FSPs for transition age youth, adults and older adults respectively. First, a person must meet the eligibility criteria for mental health services as defined in WIC Section 5600.3 (a), (b) or (c). Next, an individual must be unserved or underserved. Unserved is defined as someone with an SMI or SED who is not receiving mental health services. People who have only had emergency or crisis-oriented contact and/or services are considered unserved. The definition of underserved is extremely broad, including anyone with an SMI or SED who does not receive services to support their wellness, recovery or resilience (California code of regulations, Title 9, § 3200.300, 2010). The last criteria that participants must meet varies by age group but can include: homelessness, at risk of homelessness, involvement or at risk of involvement with the criminal legal system, at risk of institutionalization, frequent users hospitals and/or emergency room treatment for mental health care, or for transition age youth, aging out of the child and youth mental health system, child welfare system or juvenile legal system (California code of regulations, Title 9, § 3620.05, 2010).

Figure 1.1: FSP Criteria for Transition Age Youth



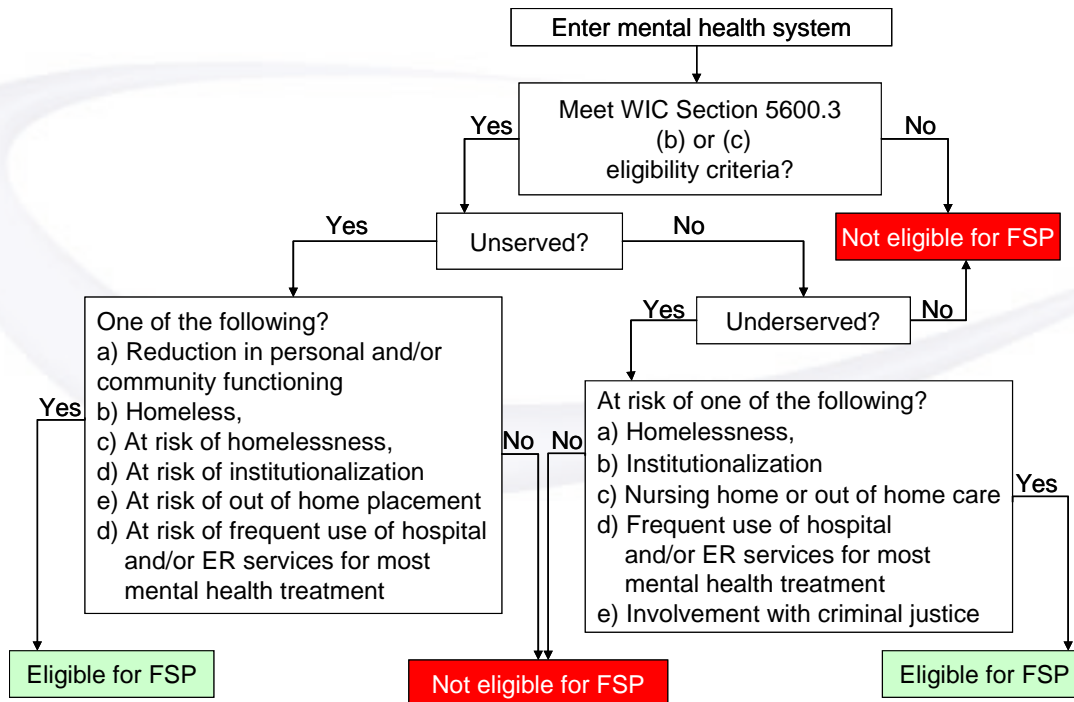
Notes: Petris Center Analysis of the California Code of Regulations, Title 9, Section 3620.05. FSP: Full Service Partnership.

Figure 1.2: FSP Criteria for Adults



Notes: Petris Center Analysis of the California Code of Regulations, Title 9, Section 3620.05. FSP: Full Service Partnership.

Figure 1.3: FSP Criteria for Older Adults



Notes: Petris Center Analysis of the California Code of Regulations, Title 9, Section 3620.05. FSP: Full Service Partnership.

The Impact of the Mental Health Services Act on Emergency Interventions and Involuntary Hospitalizations

A key measure of the effectiveness of comprehensive programs for the seriously mentally ill (SMI) is their effect on emergency interventions. To understand emergency interventions, we answer the following questions:

- (1) Does longer tenure in the Full Service Partnership (FSP) program reduce the rate of mental-health related emergency room (ER) admissions compared to those not participating in the FSP program?
- (2) Among consumers using ER services, does a longer tenure in the FSP program reduce rates of repeated ER admissions compared to those not participating in the FSP program?
- (3) What socio-demographic and other characteristics among consumers participating in FSP programs are associated with increased/decreased incidence of mental health/substance abuse related emergency interventions?
- (4) Has the number of involuntary civil commitments decreased since the implementation of the Mental Health Services Act?

The answers to these questions will assist policymakers and providers in (1) determining whether FSP programs are effective with respect to reducing the need for emergency interventions and (2) identifying those consumers who are more/or less likely to require an emergency intervention.

Chapter 2: Comparison of Participation in Full Service Partnerships to Participation in Usual Care on Emergency Room Admissions

This chapter evaluates the effect of participation in the Full Service Partnership (FSP) program on admissions to emergency rooms relative to participation in usual care in the public mental health system. We present the data sources, statistical methodology, and results of our analysis.

Data

Emergency room admission data, along with socio-demographic and medical history information, were obtained from the Short-Doyle/Medi-Cal files (SD/MC). This information was matched to the DCR (Data Collection and Reporting System), which contained information about whether consumers were participating in a FSP program and their starting date in a FSP program. All systems are maintained by the California Department of Mental Health. We divided the data into three-month intervals, creating a longitudinal panel dataset by which we are able to evaluate changes over time among FSP participants and non-FSP participants.

The time period of the analysis begins spans from January 1st, 2007 to June 30th, 2008. We examined the probability of an emergency room (ER) admission and the number of ER admissions for consumers who participated in the FSP program versus those who have never participated (or participated for a very short time before dropping out) in the FSP programs.

Sampling

All consumers appearing in the SD/MC system were included in our analyses. We first stratified monthly counts of ER admissions by county to see which counties had consistent reporting patterns of ER admissions for the period from July 1st, 2000 to June 30th, 2008. Some counties reported no ER admissions for lengthy periods of time and other counties would switch between reporting a positive number of urgent care admissions and reporting no ER admissions, and vice versa. While there may be legitimate administrative and programmatic reasons for these reporting patterns, we excluded such counties from our analysis in order to avoid mistaking what may have be administrative artifacts of the data reporting process for effects of the FSP program. Of the 58 counties in California, we found that only seven counties had data free of administrative anomalies such that the data were suitable for our analyses: Humboldt, Los Angeles, Sacramento, San Diego, San Francisco, San Mateo, and Santa Clara. Our results are only generalizable to individuals residing in these counties who are receiving mental health services under Medi-Cal.

We included all individuals over the age of 18. We determined if a consumer was participating in the FSP program by matching the SD/MC record to the DCR record. We matched records based on linking variables that were available in both datasets and used strict criteria to match datasets as accurately as possible.

Statistical Methods

Effect of Length of Time in FSP Programs on the Odds of at Least One ER Admission

We used conditional fixed-effects logistic regression to see if there was a difference between those participating in the FSP programs for various lengths of time relative to those never using FSP services. Conditional fixed effects logistic regression was used to control for each person's baseline characteristics. This method takes into account all characteristics of a consumer at baseline, including medical and mental health history, socioeconomic status, family background, *etc.* The only variables needed in the analysis are thus *FSP status*, *time in FSP*, and *study time period*. Additional information can be found in Technical Appendix 1.

Effect of Length of Time in the FSP Programs on the Number of ER Admissions, Given at Least One ER admission

We used conditional fixed-effects Poisson regression to evaluate whether there was a difference between FSP participants versus non-FSP participants with respect to the number of times they used ER services in three-month intervals. As with conditional logistic regression, this method takes into account all characteristics of a consumer at baseline, including medical and mental health history, socioeconomic status, family background, *etc.* The cohort used in this portion of the analysis was restricted to only include individuals who used ER services at some point during the time period of the study. The same variables that were included in the conditional logistic regression model above were used in the conditional fixed effects Poisson regression. Additional information can be found in Technical Appendix 1.

Results

Effect of Length of Time in the FSP Programs on the Odds of at Least One ER Admission

We found that the time in the FSP program strongly predicts the use of ER services. FSP participants had 64% higher odds of using ER services relative to non-FSP participants for the first month after entering a FSP program. See Table 2.1. However, after this initial increase, the odds of using ER services decline, beginning at month three. The odds of FSP participants using ER services remain statistically equivalent to the use of ER services by consumers not participating in a FSP program for months four through seven. Starting with month eight in the FSP programs, the odds of using ER services among FSP participants are 57% to 78% lower as compared to participants in usual care.¹ Note that this data does not allow us to determine which ER visits led to involuntary hospitalization.

A graphical representation of the relationship between months in the FSP program and the probability of being admitted into an ER is shown in Figure 2.1. This figure closely resembles what is shown in Table 2.1. The shaded area represents 95% confidence limits.

Using the coefficients in Table 2.1, we calculated the odds of consumers entering the ER at various time points (detailed calculations are described in Technical Appendix 1). A consumer in the FSP program for six months has 73% greater odds of using ER services than a consumer in the FSP program for twelve months. A consumer who has never been in the FSP program has 300% greater odds of using ER services as compared to a consumer in the FSP program for 18 months. The magnitude of our odds ratio estimates emphasizes the impact the FSP program has on reducing the odds of using ER services.

¹ The odds-ratio in month 17 is statistically insignificant, which is likely due to a small cell size.

Effect of Length of Time in the FSP Programs on the Number of ER Admissions, Given at Least One ER admission

We found that among those who used ER services, FSP participants returned to the ER less frequently compared to non-FSP participants. See Table 2.2. Given that a consumer has used ER services at any point during the study period, consumers staying in a FSP program for eighteen months or more use fewer ER services relative to someone who has been in a FSP program for zero days. These results follow a pattern similar to that shown in Table 2.1. There was an initial spike early on as people participating in the FSP program for less than three months used about 50% more ER services compared to non-FSP participants. However, the odds of using repeated ER services gradually began to decrease as consumers used FSP services for longer periods of time. Consumers who have been in the FSP program for more than eighteen months experience a 60% reduction in number of ER visits compared to non-FSP participants.

Discussion

Our analysis of the effect of FSP program participation on the use of ER services shows that FSP program participation is strongly related to a decrease in the use of ER services which occurs after approximately seven months of care. For those individuals who still use ER services after this time, the intensity of ER service use declines after 18 months of care.

Chapter 3: Emergency Interventions among Full Service Partnership Participants

This chapter focuses solely on Full Service Partnership (FSP) participants and the characteristics of such participants that are associated with being more or less likely to require emergency interventions. In this chapter emergency interventions include more than emergency room admissions. Here emergency interventions can also include the use of Crisis Stabilization Units, *etc.* We present the data sources, statistical methodology, and results of our analysis.

Data

The data for this analysis come from several sources. The main source of information is the Data Collection and Reporting System (DCR). Supplementary data are from the Consumer and Service Information (CSI) System. All systems are maintained by the California Department of Mental Health. All results are for transition age youth, adults and older adults in Full Service Partnerships (FSPs).

Data from the DCR are collected using three forms: the Partnership Assessment Form (PAF), the Key Event Tracking Form (KET), and the Quarterly Assessment Form (3M). The PAF records a consumer's history and baseline information for the following categories: residential status, education status, employment status, sources of financial support, legal status, emergency interventions, health status, and substance abuse information. The KET is used whenever a consumer changes his or her status with regard to the following categories: discontinuation or reestablishment of the program, residential setting, education, employment, financial support, legal status, and emergency interventions. The 3M is filled out every quarter and assesses sources of financial support, legal issues, health status, and substance abuse regardless of whether there have been any changes (California Department of Mental Health, 2007). In sum, the PAF consists of baseline information, while the KET and the 3M provide follow-up information for each consumer (California Department of Mental Health, 2008). Age, gender, and educational background are also available from the DCR.

Other data used in our analysis included each consumer's psychiatric diagnoses which were obtained from the CSI. Psychiatric diagnoses are determined when an individual seeks services at a county mental health facility. The diagnostic codes use the formats from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (American Psychiatric Association, 2000). All psychiatric diagnoses were collapsed into the following categories: schizophrenia, substance abuse including alcohol abuse, attention deficit hyperactivity disorder (ADHD) or conduct disorders, personality disorders, anxiety and anxiety related disorders, bipolar disorder, depression, and other or unable to diagnose. These categories were determined in consultation with Dr. Neal Adams, the collaborating psychiatrist for this project. All past psychiatric diagnoses were included in the analysis. This approach attempts to capture comorbid psychiatric conditions (Ciapparelli *et al.*, 2007; Pulay *et al.*, 2009; Tamam, Karakus, & Ozpoyraz, 2008; Uwakwe & Gureje, 2010).

Sampling

Our analysis included transition age youth (TAY), adults and older adults per their PAF on record. Individuals in the TAY category range from ages 16-25, adults range from ages 26-59, and older adults are 60 years of age or older. We used DCR data from 2005-2008. At the time of this analysis, data was only available for 43 of California's 58 counties: Butte, Calaveras, Colusa, Contra Costa, Del Norte, El Dorado, Fresno, Glenn, Humboldt, Imperial, Inyo, Kern, Lake, Los Angeles, Madera, Mariposa, Merced, Mono, Napa, Nevada, Orange, Plumas, Sacramento, San Benito, San Bernardino, San Diego, San Francisco, San Joaquin, San Luis Obispo,

San Mateo, Santa Clara, Santa Cruz, Shasta, Sierra, Siskiyou, Stanislaus, Trinity, Tulare, Tuolumne, Ventura, Yolo, and Sutter/Yuba. The results of this study are generalizable to consumers residing in the remaining 15 counties to the extent that the consumers and FSP programs in the excluded counties are similar to the average consumer and average FSP program, respectively, in the included counties.

Outcomes and Individual Characteristics

The primary outcome of interest in this analysis is whether the length of time that individuals participate in the FSP program reduces their expected incidence of mental-health related emergency room visits and crisis stabilization unit visits (and other emergency interventions) during their first 12 months of participation. We predict this outcome using the following information (independent variables): demographics (age, gender, educational background), psychiatric diagnoses (schizophrenia, substance abuse including alcohol abuse, attention-deficit hyperactivity disorder (ADHD) and conduct disorders, personality disorders, anxiety and anxiety-related disorders, bipolar disorder, depression, other or unable to diagnose), residential status (independent living, emergency shelter, homeless, supervised residential, medical hospital, psychiatric hospital, licensed residential, justice placement (various types of incarceration), other setting), education involvement status, employment status, financial support, legal status (probation, conservatorship, payee), and substance abuse (currently has a substance abuse problem, receiving substance abuse treatment).

Variables that can change over time (time-dependent covariates) include residential status, education involvement status, employment status, financial support, legal status, and substance abuse information. The reference group is made of consumers who were ages 16 to 25, male, with no high school diploma or an unknown degree, where time is at the first month of participation in the FSP program.

All variables were coded as dummy variables (either 0 or 1), with the exception of the outcome variable (emergency interventions were coded as count variables in some analyses). For example, during each of the 12 months of follow-up, homeless status was coded as 1 if a consumer was homeless at any given month; otherwise the dummy variable was 0. Education status, employment status and financial support were coded as binary variables rather than as multilevel categorical variables. Consumer education status included two categories: no current involvement and involvement in any kind of education. Consumer employment status also included two categories: unemployment and any type of employment, (including supported employment and volunteer work). Similarly, consumers were coded either as having any kind of financial support or as having none. Finally, race/ethnicity and parole status were excluded from the model due to a large number of missing values.²

Statistical Methods

We used a number of statistical methods. Both conditional fixed-effects logistic regression and conditional fixed-effects Poisson regression were used to determine the overall effect of tenure in FSP programs on the odds of an emergency intervention occurring and the number of interventions occurring given at least one emergency intervention. Conditional logistic regression and conditional Poisson regression were used previously in our analysis of FSP participants relative to usual care participants and are described in detail in Chapter 2 of this report. These models both control for all characteristics of FSP participants at the first month in FSP.

² 40.96% of observations were missing values for race/ethnicity and 73.64% of observations were missing values for parole status.

In addition to the above models, we also estimate a model that allows us to determine the independent association of individual characteristics and other factors with emergency mental health interventions among FSP participants. We used the generalized linear mixed effects model (GLMM) with time-variant and time-invariant covariates. Socio-demographic measures (age, gender, educational background, residential setting, education status, employment status, financial support status), psychiatric diagnoses, as well as substance abuse treatment and legal status were all included in this model.

Results

The conditional fixed effects logistic regression results show no statistically significant effects on the use of emergency interventions for the first three months. It then shows a statistically significant reduction of 31% to 62% below what occurred in month one in the odds of using an emergency intervention depending on the number of months an individual has been participating in the FSP program (results not shown). Similarly, the conditional fixed effects Poisson model shows no statistically significant effect for the first two months. It then shows a statistically significant reduction of 31% to 62% below what occurred in month one in the odds of using an emergency intervention depending on the number of months an individual has been participating in the FSP program (results not shown).

Results in Table 3.1 describe individual patterns. This model simply examines the number of emergency interventions experienced by any consumer in the FSP program. The number of emergency interventions decreases as consumers' time in the FSP program increases. Consumers in their 12th month of the FSP program experience a 73% reduction in the number of emergency interventions compared to consumers in their first month of the FSP program.

The effect of residency on number of emergency interventions was also explored. The FSP participant who is in independent living, supervised residential, or justice placement has fewer emergency interventions. On the other hand, FSP participants in medical hospitals or psychiatric hospitals have more emergency interventions.

Interestingly, consumers who are on probation also have fewer emergency interventions. We suggest that individuals who have someone monitoring their progress (such as a probation officer) are less likely to encounter situations in which emergency interventions are necessary, although more research is needed to clarify this. On the other hand, consumers who are in need of a conservator or a payee have an increased risk of having an emergency intervention. Not surprisingly, consumers with a current substance abuse problem have 31% more emergency interventions compared to consumers with no current substance abuse problem. Finally, consumers with a history of schizophrenia and/or personality disorder use more ER services.

Discussion

There are important differences in the types of individuals who require emergency intervention services. Individuals in the FSP programs are less likely to need emergency intervention services when they live independently, in supervised residential settings, or are in justice placement. In keeping with the latter finding, individuals on probation are also less likely to need emergency intervention services. Finally, consumers with a history of schizophrenia and/or personality disorder use more emergency interventions. These findings should be explored further to determine if these findings are actually due to the condition of the consumers who fall into the categories listed above or whether these findings are due to unexamined treatment variations experienced by consumers who fall into the categories listed above.

Chapter 4: Evaluation of Involuntary Hospitalization after the Implementation of the Mental Health Services Act

This chapter analyzes the effect of the beginning the disbursement of monies from the Mental Health Services Act (MHSA) on involuntary hospitalizations. Involuntary treatment of individuals with serious mental illness (SMI) generally occurs in two stages. The first stage is an involuntary psychiatric hold, which is governed by the California Welfare and Institutions Code, section 5150:

When any person, as a result of mental disorder, is a danger to others, or to himself or herself, or gravely disabled, a peace officer, member of the attending staff, as defined by regulation, of an evaluation facility designated by the county, designated members of a mobile crisis team provided by Section 5651.7, or other professional person designated by the county may, upon probable cause, take, or cause to be taken, the person into custody and place him or her in a facility designated by the county and approved by the State Department of Mental Health as a facility for 72-hour treatment and evaluation . . .

The second stage is an extension of the first stage and extends the involuntary hold for an additional 14 days. This procedure is governed by California Welfare and Institutions Code, section 5250

If a person is detained for 72 hours under the provisions of Article 1 (commencing with Section 5150), or under court order for evaluation pursuant to Article 2 (commencing with Section 5200) or Article 3 (commencing with Section 5225) and has received an evaluation, he or she may be certified for not more than 14 days of intensive treatment related to the mental disorder or impairment by chronic alcoholism . . .

Data

We obtained quarterly counts of involuntary 72-hour holds and 14-day psychiatric treatments for California counties from the California Department of Mental Health for the period July 2000 to June 2007. All systems are maintained by the California Department of Mental Health. We excluded counties with more than 3 consecutive missing quarters of data. This process left us with data on the following 28 counties: Alameda, Butte, Contra Costa, El Dorado, Fresno, Humboldt, Kern, Marin, Merced, Orange, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus, Ventura, Yolo, and Sutter/Yuba. Data on involuntary hospitalizations is only available in an aggregate format, so we are unable to make direct comparisons between individuals in the Full Service Partnership (FSP) programs and those receiving usual care.

Statistical Analysis and Results

We used fixed-effects regressions, a standard econometric approach for analyzing time-series data. We find that involuntary 14-day intensive treatments, but not involuntary 72-hour holds, fall below expected values after disbursement of MHSA funds.

Discussion

Our results suggest that funds from the MHSA may be providing consumers in crisis with important voluntary treatment options which they are able to access after their initial crisis and involuntary hospitalization. This suggests that the MHSA is helping to prevent unnecessary involuntary hospitalizations.

Chapter 5: Conclusion

The results of our analyses can be collapsed into six major points. These points are grouped into three categories.

Emergency Room Services: FSP vs. non-FSP

- 1) Participants in the FSP program experience 64% higher odds of using a mental health related emergency room (ER) intervention in the first month after entering the FSP program (relative to consumers not participating in the FSP program). After this period, the odds of an ER intervention are similar to non-FSP participants up to month seven.
- 2) Participation in the FSP program reduces the odds of using ER services relative to those not participating in the FSP program starting in month eight, with the odds being reduced by 57%. By eighteen months in the FSP program the odds are reduced by 78%.

Emergency Interventions (Emergency Rooms, Crisis Stabilization Unit, etc.) for FSP Participants

- 1) There are no significant changes in the odds of an emergency intervention occurring during the first three months of FSP participation, and then the odds of an emergency intervention occurring drop below the one-month FSP participation level from 31% to 62%.
- 2) Living independently, in supervised placement, in justice placement, or being on probation, are all associated with a reduction in the number of emergency interventions.
- 3) Having schizophrenia or a personality disorder, having a current substance abuse problem, and having a payee and/or a conservator are all associated with an increase in the number of emergency interventions.

Involuntary Admissions to Psychiatric Facilities

- 1) At the county level, involuntary 14-day intensive treatments, but not involuntary 72-hour holds, fall below expected values following the disbursement of MHSA funds.

In summary, the FSP programs are highly effective at reducing the need for emergency interventions.

Tables and Figures

Table 2.1: Comparison of the Use for Mental Health Related Emergency Room Services among FSP Participants Relative to non-FSP Participants

Variable	Coefficient	p-value	Standard Error	Odds-Ratio (95% Confidence Interval)
<i>FSP status</i>				
No	-----	-----	-----	1.00
Yes	0.374	0.080	0.214	1.45 (0.97, 2.21)
<i>Time in FSP</i>				
0 months (No FSP)	-----	-----	-----	1.00
1 month	0.494	0.011	0.195	1.64 (1.12, 2.40)
2 months	-0.034	0.893	0.252	0.97 (0.59, 1.59)
3 months	-0.578	0.040	0.281	0.56 (0.32, 0.97)
4 months	-0.554	0.077	0.313	0.57 (0.31, 1.06)
5 months	-0.480	0.098	0.291	0.62 (0.35, 1.09)
6 months	-0.566	0.066	0.308	0.57 (0.31, 1.04)
7 months	-0.547	0.087	0.320	0.58 (0.31, 1.08)
8 months	-0.839	0.011	0.330	0.43 (0.23, 0.82)
9 months	-0.829	0.013	0.333	0.44 (0.23, 0.84)
10 months	-0.726	0.032	0.339	0.48 (0.25, 0.94)
11 months	-1.018	0.003	0.338	0.36 (0.19, 0.70)
12 months	-1.106	0.005	0.394	0.33 (0.15, 0.72)
13 months	-1.046	0.005	0.371	0.35 (0.17, 0.73)
14 months	-1.179	0.004	0.408	0.31 (0.14, 0.68)
15 months	-1.358	0.003	0.450	0.26 (0.11, 0.62)
16 months	-1.009	0.014	0.411	0.36 (0.16, 0.82)
17 months	-0.843	0.107	0.523	0.43 (0.15, 1.20)
18 months or more	-1.502	<0.001	0.416	0.22 (0.09, 0.50)
<i>Three-month interval</i>				
Jan 1 st – Mar 31 st , 2007	-----	-----	-----	1.00
Apr 1 st – Jun 30 th , 2007	0.035	0.188	0.027	1.03 (0.98, 1.09)
Jul 1 st – Sep 30 th , 2007	0.097	<0.001	0.027	1.10 (1.04, 1.16)
Oct 1 st – Dec 31 st , 2007	0.050	0.073	0.028	1.05 (1.00, 1.11)
Jan 1 st – Mar 31 st , 2008	0.170	<0.001	0.028	1.18 (1.12, 1.25)
Apr 1 st – Jun 30 th , 2008	0.127	<0.001	0.028	1.14 (1.07, 1.20)
Observations: 88, 128				

SE = Robust Standard Error estimate

OR = Odds Ratio

95% CI = 95% Confidence Interval

MP = Marginal Probability

Note: conditional fixed effects logit drops observations where the dependent variable does not vary as these observations do not contribute to estimating the parameters.

Table 2.2: Comparison of the Frequency of Mental Health Related Emergency Room Services Used among FSP Participants Relative to non-FSP Participants, Given at Least One Mental Health Related Emergency Room Service was Used.

Variable	Coefficient	p-value	Standard Error*	Incidence Rate Ratio (95% Confidence Interval)*
<i>FSP status</i>				
No	-----	-----	-----	1.00
Yes	0.159	0.378	0.217	1.17 (0.82, 1.53)
<i>Time in FSP</i>				
0 months (No FSP)	-----	-----	-----	1.00
1 month	0.342	0.050	0.251	1.41 (1.00, 2.00)
2 months	0.138	0.553	0.266	1.15 (0.73, 1.81)
3 months	-0.467	0.057	0.157	0.63 (0.38, 1.02)
4 months	-0.394	0.143	0.184	0.67 (0.40, 1.15)
5 months	-0.153	0.535	0.207	0.86 (0.53, 1.38)
6 months	-0.444	0.104	0.176	0.64 (0.37, 1.10)
7 months	-0.350	0.282	0.226	0.70 (0.38, 1.32)
8 months	-0.363	0.266	0.221	0.70 (0.37, 1.30)
9 months	-0.534	0.058	0.167	0.59 (0.34, 1.03)
10 months	-0.417	0.233	0.238	0.66 (0.32, 1.33)
11 months	-0.485	0.124	0.198	0.62 (0.33, 1.16)
12 months	-0.387	0.381	0.309	0.68 (0.28, 1.65)
13 months	-0.513	0.132	0.209	0.60 (0.30, 1.19)
14 months	-0.500	0.231	0.256	0.61 (0.26, 1.39)
15 months	-0.585	0.217	0.262	0.56 (0.22, 1.40)
16 months	-0.674	0.055	0.188	0.51 (0.25, 1.05)
17 months	-0.397	0.416	0.315	0.67 (0.27, 1.69)
18 months or more	-0.915	0.023	0.160	0.40 (0.18, 0.88)
<i>Three-month interval</i>				
Jan 1 st – Mar 31 st , 2007	-----	-----	-----	1.00
Apr 1 st – Jun 30 th , 2007	0.029	0.262	0.027	1.03 (0.98, 1.08)
Jul 1 st – Sep 30 th , 2007	0.065	0.016	0.030	1.07 (1.01, 1.13)
Oct 1 st – Dec 31 st , 2007	0.026	0.344	0.029	1.03 (0.97, 1.08)
Jan 1 st – Mar 31 st , 2008	0.171	<0.001	0.032	1.19 (1.13, 1.25)
Apr 1 st – Jun 30 th , 2008	0.107	<0.001	0.031	1.11 (1.05, 1.18)
Observations: 88, 344				

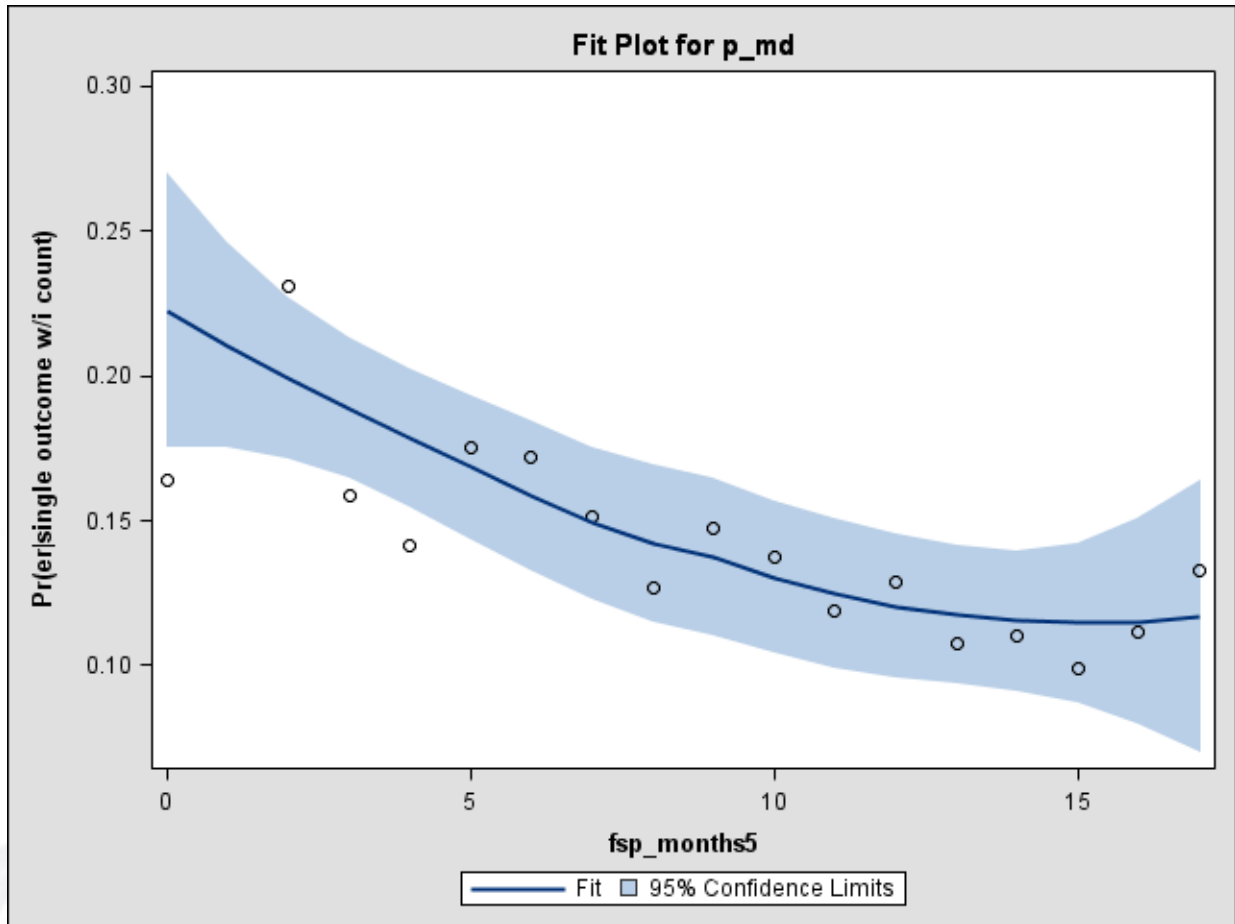
*Estimates for Confidence Intervals based on resampling 1000 times using nonparametric bootstrapping techniques.

IRR = Incidence Rate Ratio (similar interpretation as Odds Ratios)

95% CI = 95% Confidence Interval

MP = Marginal Probability

Figure 2.1: Probability of Using Mental Health Related Emergency Room Services versus Time in the Full Service Partnership (FSP) Program (in months)



Notes: The blue line indicates individuals in the FSP program. The vertical axis represents the probability of using a mental health related emergency room service. The horizontal axis represents the time in the FSP program in months.

Table 3.1. Estimates from Conditional Mixed Effects Log-Linear Regression Model for ER Intervention.

Parameters	Estimate	(Std. Error)	IRR	(95% CI)	
Fixed Part					
Intercept	-5.630	0.308			***
Time					
Month 2	-0.282	(0.145)	0.75	(0.57 , 1.00)	
Month 3	-0.472	(0.153)	0.62	(0.46 , 0.84)	**
Month 4	-0.559	(0.157)	0.57	(0.42 , 0.78)	**
Month 5	-0.723	(0.170)	0.49	(0.35 , 0.68)	***
Month 6	-0.515	(0.163)	0.60	(0.43 , 0.82)	**
Month 7	-0.654	(0.171)	0.52	(0.37 , 0.73)	**
Month 8	-0.733	(0.179)	0.48	(0.34 , 0.68)	***
Month 9	-0.840	(0.192)	0.43	(0.30 , 0.63)	***
Month 10	-0.776	(0.187)	0.46	(0.32 , 0.66)	***
Month 11	-0.775	(0.195)	0.46	(0.31 , 0.67)	***
Month 12	-1.306	(0.242)	0.27	(0.17 , 0.44)	***
Residential Information					
Independent Living	-0.573	(0.156)	0.56	(0.42 , 0.76)	**
Emergency Shelter	-0.282	(0.207)	0.75	(0.50 , 1.13)	
Homeless	0.180	(0.222)	1.20	(0.78 , 1.85)	
Supervised Placement	-0.319	(0.156)	0.73	(0.54 , 0.99)	*
Acute Medical Hospital	1.006	(0.303)	2.73	(1.51 , 4.95)	**
Psychiatric Hospital	1.336	(0.150)	3.80	(2.84 , 5.10)	***
Residential Program	0.036	(0.176)	1.04	(0.73 , 1.46)	
Justice Placement	-0.828	(0.345)	0.44	(0.22 , 0.86)	*
Other/Unknown	-0.659	(0.318)	0.52	(0.28 , 0.97)	*
Education Involvement	-0.015	(0.221)	0.98	(0.64 , 1.52)	
Employment	-0.021	(0.210)	0.98	(0.65 , 1.48)	
Financial Support	0.009	(0.164)	1.01	(0.73 , 1.39)	
Legal Issues/Designations					
Probation	-0.345	(0.150)	0.71	(0.53 , 0.95)	*
Conservatorship	0.365	(0.182)	1.44	(1.01 , 2.06)	*
Payee	0.569	(0.132)	1.77	(1.36 , 2.29)	***
Substance Abuse					
Current Substance Abuse Problem	0.271	(0.123)	1.31	(1.03 , 1.67)	*
Receiving Substance Abuse Treatment	-0.188	(0.131)	0.83	(0.64 , 1.07)	
Age					
Age 26 – 39	0.098	(0.175)	1.10	(0.78 , 1.55)	
Age 40 – 59	-0.267	(0.168)	0.77	(0.55 , 1.06)	
Age 60 - Older	-0.229	(0.219)	0.80	(0.52 , 1.22)	
Gender					
Female	0.040	(0.120)	1.04	(0.82 , 1.32)	
Educational Background					
High School Diploma/GED	-0.116	(0.138)	0.89	(0.68 , 1.17)	
College/Associate/Vocational Degree	-0.123	(0.152)	0.88	(0.66 , 1.19)	
Bachelor/Master/Doctoral Degree	-0.254	(0.287)	0.78	(0.44 , 1.36)	
Psychiatric Diagnosis					
Schizophrenia	0.307	(0.142)	1.36	(1.03 , 1.79)	*
Substance/Alcohol Abuse	-0.197	(0.132)	0.82	(0.63 , 1.06)	
ADHD/ODD/Conduct Disorder	0.213	(0.315)	1.24	(0.67 , 2.30)	
Personality Disorder	0.746	(0.150)	2.11	(1.57 , 2.83)	***
Anxiety Disorder	-0.132	(0.151)	0.88	(0.65 , 1.18)	
Bipolar Disorder	0.184	(0.118)	1.20	(0.95 , 1.51)	
Depression Disorder	-0.078	(0.124)	0.93	(0.72 , 1.18)	
Other/Undiagnosable	0.193	(0.133)	1.21	(0.94 , 1.57)	

<i>Random Part</i>	
Variance (Ψ)	2.889 (0.274)
<i>IRR</i> _{median}	4.264

*** <.0001 **<.01 *<.05

ML estimation based on 100-point adaptive Gaussian quadrature.

Participants utilized: 6,260 (out of 9,888 FSP clients).

Observations used: 60,921.

IRR: Incidence Rate Ratio

CI: Confidence Interval

ER: Emergency Room



Technical Appendix 1: Analysis of the Use of Emergency Room Services between FSP and non-FSP Participants

This technical appendix describes the details of the methodology used to derive the estimates presented in chapter two.

Data

We estimated our models using balanced panels. Balanced panels, where each individual has the same number of observations, have analytic advantages over unbalanced panels, where the number of observations varies with each individual (Singer JD & Willett JB, 2003). Estimates from a balanced panel are more precise, and the models tend to converge more easily.

To create a balanced panel, we restricted our period of analysis to eighteen months, from January, 2007 to June, 2008. We included only individuals in the Short-Doyle/Medi-Cal (SD/MC) dataset who had received some mental health service during this time period. In addition, the data was broken into 3 months intervals. These were as follows:

1. Period 1: January 1st, 2007 – March 31st, 2007
2. Period 2: April 1st, 2007 – June 30th, 2007
3. Period 3: July 1st, 2007 – September 30th, 2007
4. Period 4: October 1st, 2007 – December 31st, 2007
5. Period 5: January 1st, 2008 – March 31st, 2008
6. Period 6: April 1st, 2008 – June 30th, 2008

There were two main outcomes in our study. Both were obtained from the SD/MC dataset. The first is whether an individual was seen for an emergency room (ER) service during the three-month time period (1/0 for yes/no, respectively). We wanted to capture ER services ($ER = 1$) in comparison to all other types of services used by Medi-Cal consumers ($ER = 0$). The second main outcome measures the number of ER visits ($count_{er}$) during a three-month period, given the individual had an ER visit during those three months.

The main focus of our study was to examine mental-health related emergency room admissions among consumers who were receiving FSP services versus consumers who were not. From the DCR dataset, we decided to include a variable that describes *time in FSP*. Time in FSP was calculated as days, and in determining time in FSP, we considered discontinuation/ reestablishment of FSP consumers over the time periods. Time spent outside the FSP programs as a result of discontinuation was not accrued in our total time in FSP calculation. On the other hand, time spent in FSPs after being reestablished into the program was accrued in our total time in FSP calculation. For our analysis, we converted duration in FSPs into months and collapsed all those with a longer duration than 18 months into one category for two reasons. One, our study spanned 18 months, so we were limited by our ability to extrapolate our results to longer than 18 months. Secondly, because of the small number of consumers in the FSP programs with durations longer than 18 months, we decided to collapse it into one group. We also decided to use a variable called *FSP status* (yes/no), which indicates whether the consumer was participating in FSP services during the three-month interval.

Determination of FSP status

We derived two variables to indicate whether someone was in a FSP program during the three-month interval. The reasoning behind this was that consumers can enter and exit the FSP programs all within days of

each other, so we wanted to make sure we captured their status as accurately as possible. The first variable we derived (*FSP_mid*) determined status based on the midpoint of the interval (45 days). Consumers in a FSP program at that time were considered to be in a FSP program for the entire interval. On the other hand, consumers that were not in a FSP program, either because they exited or because they have not yet entered the program, were classified as not in a FSP program for the entire interval.

The second variable we derived (*FSP_random*) by choosing a random date within the three-month interval to determine the FSP status of a consumer. Similar to the midpoint date, consumers who were in a FSP program on this random date were considered to be in a FSP program for the entire three-month interval. However, consumers not in a FSP program on this random date were classified as not in a FSP program for the entire three-month interval.

The importance of having two variables was to compare the results of each against the other as a measure of sensitivity. If the two variables produced very similar results, we could say with confidence that our method was reliable in determining the FSP status of a consumer.

Time Fixed Effects

Included in the model were also dummy variables indicating each three-month period, or time fixed effects. These variables control for all factors that would affect everyone in the study and vary over time.

Fixed effects analysis

Fixed effects models, commonly used with longitudinal data, have a benefit of controlling for all stable characteristics of an individual (including all past history), whether these characteristics are actually measured or not (Allison, 2005). For fixed effects models, we include only variables that vary over time since the onset of our study. Unfortunately, models that have the intent of identifying which non-time-varying predictors significantly contribute to an outcome cannot utilize fixed effects methods. However, since we are only focused on comparing FSP consumers to non-FSP consumers in the first part of this study, we can use fixed effects methods to determine whether participation in a FSP program reduces the odds of using ER services.

Statistical Methods

Conditional Fixed Effects Logistic Regression

The command *clogit, vce(robust)* was used in STATA to indicate a conditional fixed effects logistic regression model with a robust estimation of standard errors. The conditional logistic regression was estimated for all individuals in the data during the time period of interest. The variables used in our conditional fixed effects logistic regression included only those that had the potential to change values from 2007 to 2008. These were *FSP status*, *time in FSP*, and an indicator informing us of the period services were utilized (*period1*, *period2*, *period3*, *period4*, *period5*, & *period6*). Other potential variables in the SD/MC dataset included socio-demographic factors such as gender, race, and ethnicity, as well as history of psychiatric diagnoses. However, since none of these remaining variables available in the SD/MC dataset varied over time, they were not included in our regression model and are accounted for by the fixed effects.

The equation for conditional fixed-effects logistic regression is shown below:

$$\log\left(\frac{p_{it}}{1-p_{it}}\right) = \mu_t + \beta\chi_{it} + \gamma Z_i + \alpha_i \quad (1)$$

where Z_i is the column vector of variables that describe the individuals but do not vary over time, and x_{it} is the column vector of variables that vary over both individuals and over time for each individual. In this equation, u_t is an intercept that can vary over time, and β and γ are row vectors of coefficients. Moreover, α_i represents all differences between persons that are stable over time but not accounted for by Z_i .

Applying some algebra to equation 1 and using the independence assumption (individual, y_{i1} , is independent of the other individual, y_{i2}), we arrive with the following equation:

$$\log\left(\frac{\Pr(y_{i1} = 0, y_{i2} = 1)}{\Pr(y_{i1} = 1, y_{i2} = 0)}\right) = (\mu_2 - \mu_1) + \beta(x_{i2} - x_{i1}) \quad (2)$$

The equation for our model used to estimate the coefficients in Table 2.1 is as follows:

$$\log\left(\frac{p_{it}}{1 - p_{it}}\right) = \beta_0 + \beta_1 x_{ij} + [\beta_2 x_{ij} + \dots + \beta_7 x_{ij}] + [\beta_8 x_{ij} + \dots + \beta_{12} x_{ij}] \quad (3)$$

where β_0 represents the constant, intercept term, β_1 represents the FSP status term (yes/no), β_2 through β_7 represent the duration of FSP term (0 days, less than three months, 3-6 months, 6-9 months, 9-12 months, 12-18 months, 18+ months, respectively), and β_8 through β_{12} represent the three-month period variables.

Conditional fixed-effects Poisson regression

The command *xtpoisson, fe* was used in STATA to indicate that we wanted to estimate a conditional fixed effects Poisson regression model. This model was only estimated on individuals who had at least one ER visit.

The Poisson distribution, used normally when we are dealing with count data (as opposed to dichotomous 0/1 data in logistic regression), can be used to determine probability using the equation below:

$$\Pr(y_{it} = r) = \frac{\lambda_{it}^r e^{-\lambda_{it}}}{r!}, r = 0, 1, 2, \dots \quad (4)$$

where r is the count value, y_{it} is the individual, and λ_{it} is the parameter of the Poisson distribution. The equation for the Poisson regression equation is as follows:

$$\log \lambda_{it} = \mu_t + \beta x_{it} + \gamma z_i + \alpha_i \quad (5)$$

In the cases where the outcome is rare, and with a little bit of algebraic manipulation, equation 5 becomes a binomial distribution similar to equation 2. The equation for our model used in Poisson regression is shown below:

$$\log(\lambda_{it}) = \beta_0 + \beta_1 x_{ij} + [\beta_2 x_{ij} + \dots + \beta_7 x_{ij}] + [\beta_8 x_{ij} + \dots + \beta_{12} x_{ij}]$$

We decided to use Poisson regression because we had an outcome variable that was a count measure (number of ER visits). Poisson regression performs well with equally dispersed or slightly underdispersed data.

Equally dispersed data means that the outcome variable (number of times ER was used in a three-month interval) has the same mean and variance. Testing our outcome variable, we found that the mean was 0.32 and the variance was 0.88, indicating that we had slightly overdispersed data, a problem when using Poisson regression. Overdispersion can result in downward bias to standard errors of our estimates, which in turn will affect our *p*-values and confidence intervals (Allison, 2001).

An alternative method which account for overdispersion in the dependent variable is the negative binomial model. However, fixed-effects in the negative binomial are not true fixed-effects and do not control for all stable covariates (Rabe-Hesketh S & Skrondal A, 2008). In addition, non-conditional fixed effects negative binomial models also have the problems of producing biased standard errors that must be corrected. Therefore, we used Poisson regression with fixed effects and simply corrected the standard errors using nonparametric bootstrapping with 1000 replications (Palmer A, Losilla JM, Vives J, & Jimenez R, 2007).

Checking assumptions and fit of the model

The biggest assumption inherent to conditional logistic regression is that any continuous independent variable needs to be linear with the log of the outcome measure in order to be included in the analysis. We did not include any continuous variables in our analyses so this assumption is not violated.

Regarding the Poisson model, in addition to the dispersion of the outcome variable, there are several other assumptions that need to be considered. The first assumption is similar to that found in logistic regression: the log of the outcome variables change linearly with equal increment increases in the exposure variable. Since we did not include any continuous variables in our analysis, this assumption is not violated. The second assumption is that changes in the rate from the combined effects of different exposures or risk factors are multiplicative. We tested this assumption by combining the odds ratios of different exposures and found that it was multiplicative.

Diagnostics

We conducted diagnostic testing by examining residuals, leverage, and influence values for our models. This was done to check for any outlying observations that may have been present in our data. After running these tests, we determined that although there were several outliers, their impact on our results was not large enough to bias our results; therefore we decided to keep these observations and use our original results.

Results

Sensitivity check of FSP status variables

We created two models: one with *FSP_random* and one with *FSP_mid*, and compared results from our conditional fixed effects logistic models and conditional fixed effects Poisson models. We found virtually no difference in the estimates obtained, suggesting that our method used for specifying the FSP status of a consumer was reliable. Ultimately, we decided to use *FSP_random*, because it performed slightly better under diagnostic testing compared to *FSP_mid*. See Table 2.1 for the parameter estimates of the conditional fixed effect logistic model. See Table 2.2 for the parameter estimates of the conditional effects Poisson model.

The results from the Poisson regression were similar to the results from logistic regression. This was not surprising because the Poisson distribution closely resembles the binomial distribution when the outcome (ER utilization) is rare, which is the case here.

The Odds of an Emergency Room Admission

We found that when consumers enter a FSP program, they were comparable to non-FSP participants in their usage of ER services after controlling for all prior history and characteristics (see Table 2.1). This suggests that the fixed effects were effective at controlling for differences between FSP participants and non-FSP participants at baseline.

To compare two people in the study where the first person was a FSP participant for six months while the second person was a FSP participant twelve months, we would use the following equation (based on information in Table 2.1) (each person was present in the data set for 6 months):

$$\hat{OR} = \left(\frac{e^{(0.374 - 0.566 + 0.035)}}{e^{(0.374 - 1.11 + 0.035)}} \right) = \mathbf{1.73}$$

Similarly, if we wanted to compare how much more likely someone who was never in the FSP program but who was in the study for one year compared to someone who was in the FSP program for more than 18 months but in the study for one year was to use ER services. We would use the following equation: equation is shown below:

$$\hat{OR} = \left(\frac{e^{(0.050)}}{e^{(0.374 - 1.50 + 0.050)}} \right) = \mathbf{3.08}$$

The Rate of Emergency Room Admissions

We use the same examples of comparing the incidence rate ratio (IRR) of consumer A to the IRR of consumer B, using methods similar to the one above. Recall in our second example detailed above, both ER usage of both consumer A and consumer B were being compared for 12 months after the onset of our study. The equation to calculate the IRR estimate is shown below:

$$\hat{IRR} = \left(\frac{e^{(0.026)}}{e^{(0.343 - 0.915 + 0.026)}} \right) = \mathbf{1.77}$$

In other words, consumer A (never in the FSP program) is expected to have an ER usage rate of 1.77 compared to consumer B (in the FSP program for 18 months).

Technical Appendix 2: Analysis of Emergency Interventions among Consumers in FSP Programs

This technical appendix describes the details of the methodology used to derive the estimates presented in chapter three.

Data

The data was analyzed with the following assumptions and processes:

1. Any observations with missing identifiers (ID)³ were deleted.
2. Any duplicate records with regards to ID in the Partnership Assessment Form (PAF) were deleted, and only the last record was kept.
3. The discontinuation and reestablishment of participation in a Full Service Partnership (FSP) program were taken into account and coded as missing during the period of discontinuation.
4. Any records with incorrect or inconsistent entry/exit sequences were excluded.
5. When a Key Event Tracking form (KET) for either an entry into or exit from an education program was duplicated consecutively with different dates, the observation from only the first instance was kept and all subsequent multiple entries or exits were deleted (e.g., if a KET for entry was followed by another KET for entry without a KET for exit, or if a KET for exit is followed by another KET for exit without a KET for entry, the second duplicated record was deleted).
6. If a KET was filed on the same day that a consumer started a FSP program, the record was included.
7. Consumers under 16 years of age at the time of entry into a FSP program were excluded from the analysis.
8. If a participant was in a FSP program for less than 12 months, the last values were coded as missing. For instance, if a consumer participated in a FSP program for only 8 months, the values for the months 9 to 12 would be considered missing.
9. The PAF, KET and 3M were merged by ID to calculate the duration of any specific status, and also to calculate the status at any given month for each consumer.
10. The FSP dataset was merged with CSI dataset, which records the consumers' psychiatric diagnoses, by ID.⁴
11. The status for the month was determined by whether or not a client meets the criteria for employment status, residential status, *etc.* for at least 15 days. For instance, if a client changed their employment status from unemployed to employed and remained employed for at least 15 days, then the employment status was assigned a value of 1, otherwise 0. Consequently, if the consumer changed his/her employment status several times within a given month, a random value would be assigned.

³ All IDs were encrypted.

⁴ About 20% of the population in FSP did not have matching information in the CSI dataset.

12. A person-period data set, in which there is one record per observation, including the time-dependent covariates, was constructed for the study (Singer *et al.*, 2003).
13. If a KET for discontinuation-interruption of participation in a FSP was not filed, it was assumed that the consumer was still in a FSP.
14. The various residential settings were collapsed in the following manner:
 - 1) Independent Living:
 - a. In an apartment/house alone/with spouse/partner/minor children/other dependents/roommate-must hold lease or share in rent /mortgage.
 - b. With one or both biological/adoptive parents
 - c. With adult family member(s) other than parents
 - d. Single room occupancy (must hold lease)
 - e. Foster home (with relatives)
 - f. Foster home (with non-relatives)
 - 2) Shelter:
 - a. Emergency shelter/temporary housing (includes people living with friends but pay no rent)
 - 3) Homeless:
 - a. Homeless (includes people living in their cars)
 - 4) Supervised Residential:
 - a. Unlicensed but supervised individual placement (includes paid caretakers, personal care attendants)
 - b. Assisted living facility
 - c. Unlicensed but supervised congregate (includes group living homes, sober living homes)
 - d. Licensed community care facility (Board and Care)
 - 5) Medical Hospital
 - 6) Psychiatric Hospital:
 - a. Acute psychiatric hospital/psychiatric health facility (PHF)
 - b. State psychiatric hospital
 - 7) Residential Program:
 - a. Licensed residential treatment (includes crisis, short-term, long-term, substance abuse, dual diagnosis residential programs)
 - b. Skilled nursing facility (physical)
 - c. Skilled nursing facility (psychiatric)
 - d. Long-term institutional care [Institution for Mental Disease (IMD), Mental Health Rehabilitation Center (MHRC)]
 - e. Group home (level 0-11)
 - f. Group home (level 12-14)
 - g. Community treatment facility
 - 8) Justice Placement:
 - a. Jail
 - b. Prison
 - c. Juvenile hall/camp/ranch
 - d. Division of juvenile justice
 - 9) Other:
 - a. Other
 - b. Unknown

Statistical analysis⁵

The variance inflation factor (VIF) was used to check for multicollinearity which occurs when two or more independent variables are highly correlated with one another (Allison, 2001). If a high VIF or prior knowledge indicated that the variables were imparting similar information to the models, dropping one of the variables was explored. There was a correlation between residential status and who referred the client to a FSP program so the variable “referral” was dropped from the analysis. The variable “currently has a substance abuse problem” from the DCR and the variable “substance abuse diagnosis” from CSI were both included because the “currently has a substance abuse problem” variable from the DCR provided the information on current substance abuse problems, while the substance abuse diagnosis from the CSI only gives a history of substance abuse rather than the current status. The low VIF⁶ also indicated that the two variables could be in the model because they were not correlated. Variables such as age, gender, educational background, education, employment, financial support, and substance abuse treatment were included in the model although they are not statistically significant because of their importance for making policy decisions and to avoid unnecessary omitted variable bias.

Since we expect variation among consumers with regard to the number of emergency interventions, the generalized linear mixed effects model (GLMM) was explored. The GLMM considers heterogeneity among clients, which allows us to account for the problem of over-dispersion and also to make the correct adjustment for missing or drop-out values (Fitzmaurice *et al.*, 2004, Rabe-Hesketh *et al.*, 2008). A random-intercept Poisson regression model estimated the probability of client-specific effects as a function of covariates. The covariance structures were tested using the GLIMMIX procedure that provides model fit statistics (SAS Institute Inc., 2009). The adaptive quadrature maximum likelihood estimation method was used with 100 quadrature points for the approximation. The estimates of expected rate ratios derived from the random-intercept Poisson regression model were obtained assuming the unstructured correlation structure with the log link function. The model can be written as: $\mu_{ij} = E(y_{ij} | x_{ij}, \zeta_j) = \exp(\zeta_j) \exp(\beta_1 + \beta_2 x_{2ij} + \beta_3 x_{3j} + \beta_4 x_{4ij})$, where $\zeta_j | x_{ij} \sim N(0, \psi)$ and ζ_j independent across consumer j , yielding a random-intercept Poisson regression model. β_1 is intercept, β_2 , β_3 , and β_4 are the vector of coefficients, x_{2ij} represents time at any given month i ($2 \leq i \leq 12$), x_{3j} represents the vector of time-invariant covariates, and x_{4ij} denotes time-dependent predictors (Rabe-Hesketh *et al.*, 2008). A similar model, which included the number of emergency interventions at baseline, was explored to see whether the expected incidence rates of emergency interventions was reduced after the FSP programs were implemented⁷. Also, the median incidence-rate ratio was calculated based on $IRR_{median} = \exp\left\{\sqrt{2 * \psi_{11}} * \Phi^{-1}(3/4)\right\}$ for the heterogeneity among consumers (Rabe-Hesketh *et al.*, 2008).

All SAS procedures for data management and analyses were performed with SAS 9.2 (SAS Institute Inc., 2007; SAS Institute Inc., 2009) and Stata/MP 10.1 for Windows (StataCorp LP, 2009). Statistical significance throughout was defined $\alpha < 0.05$.

⁵ Refer to the Technical Appendix 1 for a discussion of the conditional fixed effects logistic regression and conditional fixed effects Poisson regression.

⁶ The value of VIF was 1.14.

⁷ The offset was included into the model to accommodate the different length of time between the baseline and the follow-up periods. However, the number of emergency interventions at baseline, which indicated the number of emergency interventions the partner had during the past 12 months, was excluded from our main model due to the possible recall bias.

Results

The data from the 6,260 participants were utilized. Of these consumers, 60,921 observations were used. The estimated variance of the random intercept in the random-intercept Poisson regression model was 2.89, and the estimated median incidence-rate ratio was 4.26, given the subject-specific random intercept and the covariates. This implies that the heterogeneity among consumers is considerably large, and there is substantial consumer-to-consumer variability in terms of baseline of the number of emergency interventions. For instance, half of the time the ratio of the expected number of emergency intervention will be in the range from 0.23 to 4.26, and the other half of the time the ratio will lie outside that range.

The results suggest that a major strength of the FSP programs would be that it tailors interventions to the individual's needs. Also even if the model describes individual patterns, the results are generalizable to the entire study population of the FSP participants (Rabe-Hesketh *et al.*, 2008).

Limitations

There are a number of limitations in this study. First, 15 days was used as a threshold to determine the monthly status of some of the variables. Second, the dataset showed a wide range of characteristics among the consumers, indicating that there were a number of outliers which can bias the results. Finally, the estimated covariance parameter was large, indicating substantial heterogeneity among consumers and that caution be exercised when making inferences (Rabe-Hesketh *et al.*, 2008).

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