Nowhere To Go: Psychiatric Bed Reductions and Ambulance Diversions

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Abstract

In the past decade, the fraction of emergency department visits related to mental illness has more than doubled. In order to receive effective treatment, mentally ill patients typically need to be transferred to a psychiatric bed. In 2010, the wait time for a psychiatric bed in California was estimated at over 10 hours. While waiting, patients do not receive adequate psychiatric treatment and limit resources for medical emergencies. If emergency department resources become too strained, ambulances can be diverted away from the hospital. Using hospital level data in California between 2002 and 2012, this paper explores how reductions in psychiatric bed availability impact the amount of time a hospital diverts ambulances from their emergency department. The results show that when the number of psychiatric beds in a hospital’s county increases, ambulance diversion hours decrease significantly. Psychiatric beds are unlikely to be profitable for hospitals, but after factoring in all the social costs of fewer mental health services, policymakers may find increasing psychiatric beds to be cost effective. Between 2009 and 2012, California reduced the state mental health budget by $765 million annually. According to the findings in this paper, reducing funding for mental health services can potentially lead to an increase in overall costs to the government.

JEL Codes: I10, I18, I19
Keywords: mental health care, emergency departments, ambulance diversion

1 Introduction

Ambulance diversion occurs when emergency departments become overcrowded or run out of suitable resources and cannot accept any more patients. Diverting ambulances away from the nearest hospital is costly to both patients and hospitals. Shen and Hsia (2011) show that increases in ambulance diversion hours are related to increased mortality rates of patients with heart attacks. An hour of ambulance diversion is associated with between $1,100 (McConnell et al., 2006) and $8,900 (Falvo et al., 2007) in lost hospital revenue. A number of initiatives have been enacted throughout

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the United States aimed at reducing ambulance diversion hours, including outright bans in some states. Despite these efforts, emergency departments remain crowded and ambulances continue to be diverted, with California hospitals on ambulance diversion for nearly 85,000 hours in 2012.

One of the reasons that emergency departments continue to be overcrowded is due to the increase in visits by psychiatric patients. The fraction of emergency department visits related to mental health complications nearly doubled between 2001 and 2007, increasing from 6.3 percent to 12.5 percent (Owens, et al., 2010). The average amount of time that a patient is in an emergency room bed waiting for an inpatient bed to become available, referred to as boarding time, ranges from seven to 34 hours, depending on the state (Zeller et al., 2013). Despite the excess demand, psychiatric inpatient beds have been falling since the 1950s and have declined noticeably since the mid-1990s. Over $1.6 billion in state mental health funding was cut between 2009 and 2012 (NAMI, 2011) leading to further reductions in beds and mental health services throughout the country.

This paper empirically explores the relationship between inpatient psychiatric beds and ambulance diversion hours. Using hospital level data from California between 2002 and 2012, the annual ambulance diversion hours at a hospital are regressed on the number of psychiatric beds in the hospital’s county, minus the number of psychiatric beds in the hospital. After controlling for county level diversion policies and hospital characteristics, the results show that increases in psychiatric beds are associated with significant decreases in ambulance diversion hours. The negative and significant relationship between psychiatric beds and diversion hours does not depend on the weighting of the regression or whether standard errors are clustered. Results do not substantially change when examining the number of psychiatric beds within 10, 25 and 50 miles of an emergency department.

There are two primary channels through which psychiatric beds can impact ambulance diversion. A reduction in psychiatric beds can directly increase the amount of time individuals with mental emergencies wait in emergency departments because there are no available inpatient beds. This leads to overcrowding in the emergency department and ambulance diversion is more likely. If the regression coefficients only capture this direct relationship, the results show that increases in psychiatric beds are associated with reductions in ambulance diversion.

Ambulance diversion can also increase when a psychiatric hospital shuts down and there is an influx of mentally ill patients in the emergency room. If the regression coefficient is capturing
the direct effect of psychiatric beds and an increase in the fraction of mentally ill patients in the emergency department, then the main results will be biased away from zero. However, additional specifications show that psychiatric beds located in general acute care hospitals are driving the main results. This reduces concerns that the coefficient is picking up the effect of additional mentally ill emergency patients because changes to inpatient psychiatric beds in general hospitals should not impact where an individual goes in the event of an emergency.

When a hospital is on ambulance diversion, it is representative of an overcrowded emergency department. A number of studies have explored the financial and health costs of overcrowded emergency departments. Bayley et al. (2005) find that when patients in crowded emergency departments are boarded for long periods of time, hospital revenue decreases. Wait times for surgery are longer in hospitals with more emergency department patients (Johar and Jones, 2013). Certain conditions, such as septic shock, have lower mortality rates when patients receive specialized care within six hours of arriving at an emergency department, compared to patients who did not receive specialized care (Rivers et al., 2001). The unloading time of patients from an ambulance to an emergency room also increases when emergency departments are crowded (Eckstein and Chang, 2004). Using ambulance diversion hours as a proxy for overcrowding, Sun et al. (2012) estimate the cost of overcrowded emergency departments in California at $17 million annually.

The causes of emergency department overcrowding have also been explored. Many studies conclude that inpatient bed availability is the primary cause of emergency department overcrowding (Derlet and Richards, 2000; Schneider et al, 2001; Trzeciak and Rivers, 2003). Other factors can influence the number of patients in an emergency department, including the rate of insurance (Card et al., 2009; Anderson et al., 2012; Miller, 2012), the severity of illness (Lambe et al., 2003) and the number of emergency departments in a hospital’s vicinity (Schull et al., 2001). Drug prices (Dave, 2006; Dobkin and Nicosia, 1999) can also impact the number of patients treated for drug related conditions in emergency rooms and hospitals. Despite the growth in psychiatric emergency patients (Owens et al., 2010), the reduction in psychiatric inpatient beds (Torrey et al., 2013) and the finding that psychiatric patients have longer lengths of stay in the emergency department than non-psychiatric patients (Nicks and Manthey, 2012), no previous study explores how psychiatric inpatient bed availability is related to emergency department overcrowding. This paper provides evidence that reducing psychiatric inpatient beds near a hospital can increase emergency department
overcrowding and lead to significantly more hours of ambulance diversion.

The results in this paper can be used to estimate the cost effectiveness of psychiatric beds. If there is only a minimal loss in revenue from additional ambulance diversion, hospitals may find it cost effective to eliminate a psychiatric bed. The government, however, is likely to find that additional psychiatric beds are cost effective. The physical and mental health costs from an increase in emergency department overcrowding and fewer mental health services outweigh the financial savings associated with fewer psychiatric beds. Although it may be cost effective for the governments to provide an adequate number of psychiatric beds, over half of the states in United States reduced funding for mental health services between 2009 and 2012 (NAMI, 2011). The initial savings to the state could eventually lead to an overall increase in spending in the long run.

The next section describes trends in ambulance diversion and psychiatric bed availability in California between 2002 and 2012. Section 3 presents summary statistics and initial regression results. After robustness checks are presented in section 4, section 5 discusses the cost effectiveness of psychiatric beds. Concluding remarks are given in the final section.

2 Background

2.1 Ambulance Diversion

Ambulance diversion was originally proposed in 1990 by Lagoe and Jastremski as a way to reduce wait times at crowded city emergency departments. Instead of ambulances dropping patients off at emergency departments and then waiting an extended period of time for treatment, it can be more efficient to take the patient to an emergency department that is further away, but less crowded. Since 1990, ambulance diversion has become common practice. In California in 2012, the aggregate number of ambulance diversion hours in the state was approximately 85,000 hours, with one hospital on ambulance diversion for nearly 60 percent of the time in 2012 (OSHPD, 2013).

Diversions can occur if patients request treatment at a particular hospital based on their background and preferences. Hospitals will divert ambulances away from the emergency department if the technology or personnel needed to treat an emergency is not available at the hospital (Pham et al., 2006). The most common reason an ambulance is diverted from a hospital is because the
emergency department is too crowded and cannot effectively treat additional emergencies (GAO, 2008). When a hospital is on ambulance diversion, it tends to signal that either the hospital or the health care system as a whole is unable to effectively deliver emergency services.

A long literature exists addressing both the trends and causes of overcrowding in the emergency department. According to the National Hospital Ambulatory Medical Care Survey, visits to the emergency department have increased from 89.9 million in 1992 to 102.8 million in 1999 (Burt and Craig, 2001) and were up to 129.8 million in 2010 (CDC, 2013). The 44 percent growth in emergency department visits is over twice as much as the population growth between 1992 and 2010 (US Census, 2013). In 2002, over 90 percent of hospitals reported that their emergency departments were at least "at capacity" (Lewin, 2002) and the continued increase in emergency room visits since 2002 has aggravated the problem further.

One of the biggest causes of emergency department overcrowding is due to the limited supply of inpatient hospital beds (Derlet and Richards, 2000; Schneider et al, 2001; Trzeciak and Rivers, 2003). When hospitals aim to cut cost, they look to eliminate any inpatient beds that are not used often. This places stress on the emergency department, as patients that need specialized care are boarded in an emergency room and wait for an inpatient bed to become available. The boarded patients in emergency rooms do not receive the care they need and at the same time, limit resources for future emergency department patients. The reduced revenues (Bayley, et al., 2005) and higher costs (Krochmal and Riley, 2004) associated with increased patient boarding can negatively impact hospital profits.

Crowded emergency departments are also associated with delays in diagnosing medical conditions (Derlet, 2002) and increased mortality rates (Gutmann, et al., 2011). If an emergency department is unable to provide adequate care for additional emergency patients, they may divert ambulances away from their hospital. Ambulance diversion is the result of overcrowding, but the quality of emergency care also falls when diversions hours increase. The mortality rate of heart attacks increases when nearby hospitals are on ambulance diversion (Yankovic, et al., 2008; Shen & Hsia, 2011) and patients with severe emergencies requiring a hospital transfer have higher mortality rates when diversion hours increase (Begley et al., 2004).

Because of the documented relationship between ambulance diversion and treatment for emergency patients, policymakers have taken steps to try and reduce ambulance diversion. The most
significant change was when Massachusetts banned ambulance diversion, beginning in 2009. The length of stay for emergency department patients did not increase as a result of the ban, and in some hospitals the length of stay actually decreased (Burke, et al., 2013).

No other state has completely banned ambulance diversion, however, California has experienced a noticeable decrease in ambulance diversion hours since 2002 as a result of countywide bans and successful county level initiatives. Figure 1 shows how ambulance diversion hours have changed in the state of California since 2002 using data from the Office of Statewide Health Planning and Development (OSHPD). Ambulance diversion hours in Los Angeles county are separated from the rest of the state and depicted in black. The remaining counties are shown in gray. Between 2003 and 2005, there were approximately 250,000 diversion hours in the entire state. By 2012, the hours decreased to below 85,000.

![Figure 1: California Ambulance Diversion Hours, 2002-2012](image)

Almost half of the decrease in diversion hours in California is driven by Los Angeles county. In 2006, Los Angeles county limited the number of hours a hospital could go on diversion. The policy reduced the county diversion hours from 163,300 in 2005 to 73,072 in 2007, representing over 80 percent of the ambulance diversion reduction in the state over the two year time period. The large impact of the ambulance diversion policy makes it necessary to control for Los Angeles county after 2006 in the analysis below.
Of the 58 counties in California, 22 have banned ambulance diversions. The majority of the counties with bans are in less populated areas of the state, but the relatively large counties of Monterey (2006), Riverside (2009) and San Bernardino (2009) have recently enacted diversion bans. Other counties reduced diversion hours by requiring that stringent standards be met before a diversion can take place (California HealthCare Foundation, 2009). The combined effect of the bans and increased standards led to the noticeable decrease in diversion hours seen in figure 1.

Even though the state experienced an overall reduction in diversion hours, a number of counties in California increased diversion hours between 2002 and 2012. Orange County diversion hours were 6,101 in 2002, then climbed to 14,011 in 2003 before falling to 4,454 in 2010, then rising again to 7,366 by 2012. Alameda County (Oakland) followed a similar pattern. Of the 36 counties without a ban in 2012, eight of the counties increased diversion hours between 2002 and 2012.

2.2 Psychiatric Emergency Patients and Acute Psychiatric Beds

As mentioned above, a primary reason that emergency departments have become increasingly overcrowded, potentially causing ambulance diversions, is due to a lack of inpatient beds. Patients who need treatment beyond the emergency department must be transferred to an inpatient hospital bed. If no inpatient beds are available, patients are boarded in emergency rooms until a bed becomes available, reducing the ability of the emergency department to effectively treat incoming patients (Bernstein, et al., 2009; Powell, et al., 2012). A number of potential solutions to increase inpatient bed availability have been proposed, such as altering the working hours of staff (Kravet et al., 2007) and the time of the day that surgery is performed (ACEP, 2008a). However, inpatient bed availability remains an issue, with long boarding times prevalent at emergency departments throughout the United States (Hing and Bhuiya, 2012)

Inpatient psychiatric beds specifically can increase emergency department overcrowding and have an observable impact on ambulance diversion. Across the United States, the fraction of emergency department visits related to mental illness in 2007 was 12.5 percent and the number of psychiatric emergency patients approximately doubled between 2001 and 2007 (Owens et al., 2010). More than 50 percent of psychiatric emergency patients are admitted to inpatient psychiatric care (Chang et al., 2011). Salinsky and Loftis (2007) find that 60 percent of emergency department physicians believe that the increase in emergency department visits by mentally ill patients have a negative
impact on emergency medical care. If psychiatric beds do not keep up with the growth in patients, psychiatric bed availability can directly impact emergency department overcrowding and ambulance diversion.

In California, the number of psychiatric inpatient admissions from emergency departments has nearly tripled since 2005. Although data on specific hospitals is unavailable for the entire time series, figure 2 uses data from the OSHPD and shows the number of mental health patients in California that were transferred to psychiatric units from emergency departments between 2005 and 2012. In 2005, 28,778 emergency department patients were transferred to psychiatric inpatient beds, an average of 79 patients per day. Admissions increased by over 25 percent annually in 2006, 2007 and 2008, and by 2012 reached 82,288. An average of 225 emergency department patients per day were transferred to psychiatric beds in 2012.

![Figure 2: California Inpatient Psychiatric Admissions from Emergency Departments, 2005-2012](image)

Despite the increase in psychiatric patient transfers from emergency departments, the number of psychiatric beds in California has fallen since 2002. Figure 3 reports the trends in psychiatric beds using data from the California OSHPD’s annual hospital utilization data.\(^1\) The black bar represents all the psychiatric beds in the state, the dark gray bar is the total psychiatric beds in

\(^1\)Hospitals are also required to fill out financial audit reports. The financial audit data contains information about the number of psychiatric beds in a facility, but not ambulance diversion hours. The first year of financial audit data is in 2003 and provides one less year of data than the utilization dataset. The number of beds do not perfectly match between the datasets, but the correlation between the two datasets is 0.89 and the main findings and conclusions in the paper are unchanged when using the financial data.
general acute care hospitals (GACHs) and the light gray bar is the combined number of psychiatric beds from acute psychiatric hospitals and psychiatric health facilities. State mental health hospitals are excluded from the analysis.\(^2\)

The number of total psychiatric beds fluctuates between 6,400 and just under 6,900 between 2002 and 2012. Psychiatric beds are at their highest in 2003, at 6,849 and decreased to 6,432 by 2012. The majority of psychiatric beds in the state are located in GACHs. In 2002, 418 GACHs housed 4,224 psychiatric beds, 64 percent of the total psychiatric beds in the state. After increasing to 4,452 in 2003, the number of psychiatric beds in GACHs decreased to 3,499 in 2012, a 21.4 percent reduction.

Psychiatric beds in 24-hour acute psychiatric hospitals increased from 2,001 in 26 hospitals in 2002 to 2,537 in 30 hospitals in 2012. Similar to psychiatric hospitals, psychiatric health facilities provide 24-hour inpatient services for mental illness, but in a non-hospital setting that allows for different staffing and facility requirements. In 2002, there were 15 psychiatric health facilities, which housed 330 psychiatric beds. There was an increase in both total beds and facilities by 2012, with 22

\(^2\)California has five large state mental health hospitals that also contain psychiatric beds, but the state hospitals only accept patients through the criminal system, not hospitals or emergency departments. Although the state hospitals are an important element of mental health system in California, they are excluded from the analysis below, as they are not relevant to decisions made in emergency departments.
facilities providing 396 beds. Overall, psychiatric beds in acute psychiatric hospitals and psychiatric health facilities increased from 2,397 in 2003 to 2,933 in 2012, a 22 percent increase.

There are a number of possible reasons for the overall decline in psychiatric beds. Since the 1950s, there has been a push to deinstitutionalize psychiatric patients in the United States and move patients back into the local community. This has decreased the number of inpatient psychiatric beds in the country from 524,878 in 1970 to approximately 43,000 in 2010 (Torrey, et al., 2013). There is also evidence that hospitals are not adequately reimbursed for mental health care and converting psychiatric beds to medical beds could help recover losses from treating mental illness (Salinsky and Loftis, 2007).

State budget cuts have also impacted mental health services. In response to the Great Recession in 2008, over $1.6 billion in state mental health funding was cut between 2009 and 2012 throughout the United States. California reduced their mental health budget by $765 million, the largest nominal reduction in the country and the seventh largest in percentage terms. The recent cuts to the state mental health budgets impact a variety of services, including state hospitals, community mental health and substance abuse programs, acute psychiatric beds and psychological consultants (NAMI, 2011). Psychiatric beds decreased by five percent between 2009 and 2012 in California.

If the number of psychiatric beds in California meet the demand for psychiatric patients, boarding times for psychiatric emergency patients will be limited. Information on boarding times is sparse, but available survey data suggest that emergency departments are burdened by psychiatric patients. In California psychiatric emergency patients have an estimated boarding time between seven (Baraff et al., 2006) and 10 hours (Stone et al., 2012). If psychiatric bed availability decreases or psychiatric emergency patients increase, emergency departments may board patients for longer periods of time and become more crowded. Overcrowding is difficult to measure and boarding time data is not widely available, but ambulance diversion hours are available and a direct consequence of overcrowding. The next section explores how ambulance diversion hours in a hospital change in response to nearby psychiatric bed availability.

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3The boarding time in Georgia averages 34 hours (Tuttle, 2008) and one psychiatric patient in South Carolina was boarded for 38 days (Bloomberg, 2013).
3 Empirical Analysis

3.1 Regression Specification

The previous section shows that both ambulance diversion and psychiatric bed availability decreased in California between 2002 and 2012. The direct relationship is unexpected, but the decrease in ambulance diversion can be partially attributed to county level ambulance diversion policies, which may have occurred at the same time as reductions in psychiatric beds. To accurately identify the relationship between psychiatric beds and ambulance diversion, it is necessary to control for county level policies, as well as other hospital characteristics that can impact ambulance diversion.

In order to empirically isolate the relationship between ambulance diversion hours and psychiatric bed availability, begin with equation (1):

\[ A_{i,c,t} = \gamma_1 EDHrs_{i,c,t} + \gamma_2 Pop_{i,c,t} + \gamma_3 Law_{c,t} + \gamma_4 A_{i,c,t} + \phi_i + \tau_t + \xi_{i,c,t}. \]  

In equation (1), the number of ambulance diversion hours, \( A \), in hospital \( i \), in county \( c \), during year \( t \) is the dependent variable. The variable \( EDHrs \) is the aggregate number of hours that patients are in the emergency department at hospital \( i \) in year \( t \). The variable directly captures the amount of resources needed in the emergency department and when the number of hours increases, emergency departments are more likely to be overcrowded and ambulance diversion hours are expected to increase.

If the OSHPD reported the length of stay, the value of \( EDHrs \) could be quickly calculated using the number of emergency department patients and the average length of stay. Because the length of stay is not available, total emergency department hours are proxied for using the number of psychiatric beds in the hospital’s county, \( Beds_{c,t}^{Psych} \), the number of non-psychiatric beds in the hospital’s county, \( Beds_{c,t}^{Non-Psych} \), and the number of emergency department patients, \( ED Patients_{i,c,t} \). Ideally, \( ED Patients \) would be broken down into psychiatric and non-psychiatric patients, but this information is not available at the hospital level over the time period analyzed.

Before substituting \( Beds_{c,t}^{Psych} \), \( Beds_{c,t}^{Non-Psych} \) and \( ED Patients_{i,c,t} \) into equation (1), it is important to note that hospitals may change the number of inpatient beds in response to diversion hours, biasing the coefficients on \( Beds_{c,t}^{Psych} \) and \( Beds_{c,t}^{Non-Psych} \). Therefore, it is necessary to subtract inpatient beds in hospital \( i \) from the number of inpatient beds in the county. The preferred
regression specification then becomes:

\[ A_{i,c,t} = \beta_1 Beds_{-i,c,t}^{Psych} + \beta_2 Beds_{-i,c,t}^{Non-Psych} + \beta_3 EDPatients_{i,c,t} + \beta_4 Pop_{i,c,t} + \beta_5 Law_{c,t} + \beta_6 A_{i-c,t} + \phi_i + \tau_t + \varepsilon_{i,c,t}. \] (2)

In equation (2), the main variable of interest, \( Beds_{-i,c,t}^{Psych} \), is the number of psychiatric beds in county \( c \), minus the number of psychiatric beds in hospital \( i \), during year \( t \). If reductions in psychiatric beds are associated with an increase in diversion hours, the coefficient of interest, \( \beta_1 \), will be negative.

It is necessary to include a number of controls in equation (2). Overcrowding is controlled for by the including the number of emergency department patients, \( EDPatients_{i,c,t} \), general acute care inpatient beds in hospital \( i \)'s county, \( Beds_{-i,c,t}^{Non-Psych} \) and county population, \( Pop_{i,c,t} \).

The variable \( Law_{c,t} \) is a binary variable that is equal to one when a county has an ambulance diversion ban in place. In 2012, 22 counties in California had an ambulance diversion ban. Of the 22 counties, 14 had bans in place by 2003. In 2006, Mendocino, Sonoma and Monterey counties enacted bans. Contra Costa enacted a ban in 2007. Inyo, Mono, San Bernardino and Riverside counties all enacted bans in 2009. An additional control is added for Los Angeles after 2006. Although Los Angeles did not ban diversions, the ambulance diversion policy in the county was responsible for a significant decrease in diversion hours, as is seen in figure 1.

Equation (2) also controls for the number of diversion hours at nearby hospitals, \( A_{i-c,t} \). If hospital \( X \) goes on diversion, the nearest hospital (hospital \( Y \)) is expected to receive an influx of emergency patients. If hospital \( Y \) also goes on diversion, the patients will continue to be diverted, straining resources in the next closest emergency department. This situation is controlled for by including the number of diversion hours in hospital \( i \)'s county, minus the diversion hours in hospital \( i \).

Fixed effects for the hospital and year are also necessary. Hospital fixed effects, \( \phi_i \), capture a hospital’s historical attitude towards ambulance diversion. Other time invariant factors, such as the infrastructure of the hospital, as well as unchanging county level attributes, are also contained in \( \phi_i \). Year fixed effects, \( \tau_t \), control for any statewide ambulance diversion trends.

In order for \( \beta_1 \) to be unbiased, the unobserved determinants of diversion hours cannot be systematically related to psychiatric beds in a hospital’s county, \( Beds_{-i,c,t}^{Psych} \). If a county enacts a policy
that simultaneously reduces diversion hours and psychiatric beds, this could bias the estimates in equation (2). Because psychiatric beds and diversion hours are expected to have an inverse relationship, policies that decrease both beds and diversion hours will bias $\beta_1$ towards zero. In this situation, the true relationship between $A_{i,c,t}$ and $Beds_{c-i,t}^{Psych}$ will be stronger than the reported coefficient.

A more serious issue in equation (2) arises because detailed information on the fraction of psychiatric emergency patients in a hospital is not available. If an acute psychiatric hospital with an emergency department shuts down, psychiatric beds will decrease and psychiatric patients will not be able to go to the hospital in the event of an emergency. If the closest emergency department is located in a general acute care hospital (GACH), the GACH may experience an increase in the fraction of psychiatric patients in the emergency department and a decrease in the availability of psychiatric beds. In this case, $\beta_1$ will be biased away from zero since it is capturing the combined effect of psychiatric bed availability and psychiatric emergency patients on ambulance diversion. The potential bias is not as serious if $\beta_1$ is determined by changes in psychiatric beds at GACHs. Reducing the number of psychiatric beds may impact emergency department outcomes, but should not influence where an individual goes in the event of a psychiatric emergency. When ambulance diversion hours are regressed on psychiatric beds in GACHs, psychiatric hospitals and psychiatric health facilities separately, the coefficient on psychiatric beds in GACHs is arguably unbiased.

### 3.2 Data and Summary Statistics

The majority of the data used in the analysis comes from the California Office of Statewide Health Planning and Development (OSHPD). As mentioned above, the OSHPD has published the number of psychiatric beds and ambulance diversion hours at each licensed health care facility since 2002 in the annual utilization report. The utilization data from the OSHPD also contains information on the total number of emergency department patients and the exact location of the facility.

Information on ambulance diversion bans in California counties are found in the California Emergency Department Diversion Project (CHCF, 2009). Details on county level policies are confirmed at the local emergency service area websites. County level population data used in the analysis is from the US Census. The dependent variable only includes the ambulance diversion hours at general acute care hospitals that have an active emergency department.
Table 1 presents initial evidence that ambulance diversion hours and psychiatric beds may be related. The table shows how the diversion hours and psychiatric beds changed for different subsets of counties between 2002 and 2012. In the first column, the values for the entire state are shown. In 2002, there were 202,523 ambulance diversion hours in California. The hours decreased to 84,918 by 2012, a 58.07 percent decrease. The number of psychiatric beds decreased by 1.88 percent, the number of general acute beds increased by 11.12 percent and the population increased by 9.09 percent over the same time period.

The second column shows that nearly half of the reduction in diversion hours in California is driven by Los Angeles county. Los Angeles county diversion hours fell by 49,115, 41.8 percent of the total decrease in the state. Psychiatric beds decreased by 12.29 percent in Los Angeles county and general inpatient beds decreased by 1 percent, suggesting that the changes in ambulance diversion policies in 2006 had a significant impact on diversion hours, irrespective of inpatient bed availability.

Statistics are reported for the 18 counties (excluding Los Angeles) that decreased ambulance diversion hours between 2002 and 2012 in the third column. These counties reduced ambulance diversion hours by 85.18 percent, while psychiatric beds in the counties increased by 6.55 percent. General inpatient beds increased by 20.47 percent, so it is possible that changes in general beds could be driving the decrease in diversion hours.

The fourth column shows that in the eight counties where diversion hours increased, psychiatric beds decreased by 1.20 percent. The counties experienced a 20.87 percent increase in diversion hours, even though general beds also increased by 13.29 percent. The final column shows that in the 31 counties where there was no change in diversion hours, psychiatric beds increased by 10.09 percent and general beds increased by 12.80 percent. Many of the counties in the final column had ambulance diversion bans throughout the analysis.
Table 1: Ambulance Diversion Hours, Psychiatric Beds and Population, 2002-2012

<table>
<thead>
<tr>
<th>California Counties</th>
<th>All Counties</th>
<th>Los Angeles County</th>
<th>Diversion Decreases*</th>
<th>Diversion Increases</th>
<th>No Change in Diversion</th>
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<tbody>
<tr>
<td>Ambulance Diversion Hours</td>
<td></td>
<td></td>
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<tr>
<td>Total in 2002</td>
<td>202,523</td>
<td>110,179</td>
<td>82,753</td>
<td>9,591</td>
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<tr>
<td>Total in 2012</td>
<td>84,918</td>
<td>61,064</td>
<td>12,261</td>
<td>11,593</td>
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<td>-70,492</td>
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<tr>
<td>Percent Change, 2002-2012</td>
<td>-58.07%</td>
<td>-44.58%</td>
<td>-85.18%</td>
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<td>Psychiatric Beds</td>
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<tr>
<td>Total in 2002</td>
<td>6,555</td>
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<td>Total in 2012</td>
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<tr>
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<td>-309</td>
<td>166</td>
<td>-14</td>
<td>34</td>
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<td>-12.29%</td>
<td>6.55%</td>
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<td>General Acute Beds</td>
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<td>Total in 2002</td>
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<tr>
<td>Change, 2002-2012</td>
<td>3.17</td>
<td>0.25</td>
<td>2.12</td>
<td>0.59</td>
<td>0.18</td>
</tr>
<tr>
<td>Percent Change, 2002-2012</td>
<td>9.09%</td>
<td>2.57%</td>
<td>15.16%</td>
<td>7.50%</td>
<td>5.39%</td>
</tr>
<tr>
<td>Number of GACHs in 2002</td>
<td>328</td>
<td>81</td>
<td>119</td>
<td>71</td>
<td>67</td>
</tr>
<tr>
<td>Number of GACHs in 2012</td>
<td>343</td>
<td>75</td>
<td>130</td>
<td>74</td>
<td>64</td>
</tr>
<tr>
<td>Number of Counties</td>
<td>58</td>
<td>1</td>
<td>18</td>
<td>8</td>
<td>31</td>
</tr>
</tbody>
</table>

Notes: *Los Angeles is excluded from the "Diversion Decrease" column.

According to table 1, counties that increased diversion hours between 2002 and 2012 had a slight reduction in psychiatric beds. In counties that reduced diversion hours, psychiatric beds increased. Both subsets of counties increased general inpatient beds. The table is not conclusive, but it does contain evidence showing that psychiatric beds in a county may be inversely related to ambulance diversion hours. Because counties are aggregated into large groups, the table does not provide any information about the behavior of emergency departments in response to psychiatric bed availability in the surrounding area.
Summary statistics for the variables of interest in 2012 are reported in table 2. The first column reports the averages for all GACHs located in counties without an ambulance diversion ban in 2012. The next two columns show how the averages differ based on whether the hospital had any hours of ambulance diversion or not. The final column contains averages for hospitals located in counties that had a diversion ban in place in 2012.

<table>
<thead>
<tr>
<th>Variables</th>
<th>No Diversion Ban</th>
<th>Diversion Ban</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All GACHs</td>
<td>GACHs with Diversions</td>
</tr>
<tr>
<td>Ambulance Diversion Hours</td>
<td>339.11 (759.94)</td>
<td>550.50 (907.04)</td>
</tr>
<tr>
<td>Psychiatric Beds</td>
<td>9.04 (18.98)</td>
<td>12.22 (22.21)</td>
</tr>
<tr>
<td>General Acute Inpatient Beds</td>
<td>217.56 (147.89)</td>
<td>248.31 (144.01)</td>
</tr>
<tr>
<td>County Psychiatric Beds</td>
<td>838.62 (917.42)</td>
<td>1,097.18 (929.55)</td>
</tr>
<tr>
<td>Emergency Department Patients</td>
<td>36,621.41 (23,555.24)</td>
<td>39,672.39 (22,850.62)</td>
</tr>
<tr>
<td>County Population</td>
<td>3,961,832 (4,051,545)</td>
<td>5,153,409 (4,053,770)</td>
</tr>
<tr>
<td>N</td>
<td>250</td>
<td>154</td>
</tr>
</tbody>
</table>

Notes: Standard deviations are reported in parentheses. Average values between GACHs with and without diversion are significantly different at the 1% level for all variables.

In 2012, the average number of ambulance diversion hours in a GACH located in a county without a diversion ban was 339.11. The average GACH had 9.04 psychiatric beds, 217.56 general acute inpatient beds and treated 36,621.41 emergency patients. The average number of psychiatric beds in the counties that GACHs are located in was 838.62 and the population in the county was just under four million.

Conditional on having positive ambulance diversion hours in 2012, GACHs averaged 550.50 diversion hours, 12.22 psychiatric beds, 248.31 general acute beds and 39,672.39 emergency patients.
The number of psychiatric beds in the GACH’s county averaged 1,097.18 and the county population was over 5.1 million. The averages are all significantly larger compared to GACHs without diversions in the third column.

The last column reports the averages for GACHs with active emergency departments in counties with ambulance diversion bans. The small, but positive, average on ambulance diversion hours is the result of three hospitals in banned counties having a total of 17 hours of ambulance diversion in 2012. It is unclear whether the reported diversion hours is due to limited enforcement of the ban, a typo in reporting or some other factor. The small number of diversion hours in the banned counties does suggest that hospitals appear to adhere to the ban and the relatively few diversion hours coming from the three hospitals do not change the results below.

### 3.3 Initial Regression Results

Table 2 provides information about the attributes of hospitals with and without ambulance diversion, but the table does not contain any details about individual hospital behavior. Table 3 reports the regression results from equation (2) and provides insight into the relationship between ambulance diversion in hospital $i$ and psychiatric bed availability in hospital $i$’s county.

All regressions in table 3 are weighted by the total number of emergency department patients in the hospital during the year and standard errors are clustered at the county level. Columns (1) and (2) do not include hospital or year fixed effects. Column (1) uses the number of psychiatric beds in hospital $i$, $Beds_{i,c,t}^{Psych}$, as the variable of interest. The large and significant coefficient, 18.9, implies that hospitals with more psychiatric beds have more ambulance diversion hours.

In column (2), the psychiatric beds in hospital $i$ are subtracted from the county beds and the coefficient of 0.64 shows that hospitals in counties with more psychiatric beds have a higher number of ambulance diversion hours. This finding is consistent with the positive relationship between psychiatric beds and diversion hours observed at the state level in the previous section. Columns (3) and (4) add hospital and year fixed effects and the coefficients on $Beds_{i,c,t}^{Psych}$ and $Beds_{c-i,t}^{Psych}$ become negative and insignificant.
Table 3: Ambulance Diversion Hours and Psychiatric Beds

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Beds_{i,c,t}^{Psych}$</td>
<td>18.9***</td>
<td>-3.10</td>
<td>-1.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(6.76)</td>
<td>(3.95)</td>
<td>(2.41)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Beds_{c-i,t}^{Psych}$</td>
<td>0.64***</td>
<td>-0.045</td>
<td></td>
<td>-0.86***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.030)</td>
<td>(0.49)</td>
<td></td>
<td>(0.30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Beds_{c-i,t}^{Non-Psych}$</td>
<td></td>
<td>-0.16**</td>
<td>-0.064</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.069)</td>
<td>(0.078)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td>-0.00026</td>
<td>-0.00057</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00054)</td>
<td>(0.00064)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency Department Patients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0030</td>
<td>0.0036</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0024)</td>
<td>(0.0029)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_{c-i,t}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.016*</td>
<td>0.016*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0087)</td>
<td>(0.0087)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

County Level Diversion Policies Included
- No
- No
- No
- No
- Yes
- Yes

Hospital and Year Fixed Effects
- No
- No
- Yes
- Yes
- Yes
- Yes

N | 3,704 | 3,704 | 3,704 | 3,704 | 3,704 | 3,704 |
$R^2$ | 0.252 | 0.125 | 0.744 | 0.745 | 0.772 | 0.771 |

*** p<0.01, ** p<0.05, * p<0.1
Standard errors clustered at the county level are reported in parentheses.
All regressions are weighted by hospital emergency department patients.

Controls for general acute beds in the county, emergency department patients, county population, ambulance diversion hours in the county and binary variables for hospitals located in counties with an ambulance diversion ban and the Los Angeles ambulance diversion policy are added in columns (5) and (6). The coefficient on the number of psychiatric beds in a hospital remains negative and insignificant in column (5). In column (6), the preferred specification, the coefficient on county psychiatric beds is negative and significant at the one percent level. Specifically, when the number of psychiatric beds in a hospital’s county increases by one, the diversion hours in the hospital significantly decrease by 0.86.

In column (6), general inpatient beds are negatively related to ambulance diversion hours, but the relationship is insignificant. More emergency department patients are associated with an insignificant increase in ambulance diversion hours. The positive coefficient suggests that busier emergency departments have more diversion hours, but the lack of significance may indicate that some hos-
hospitals become more efficient as they become busier. When ambulance diversion hours increase in hospital i’s county, ambulance diversion hours increase by 0.16. The coefficient is significant at the 10 percent level.

4 Robustness Checks

4.1 Sensitivity to Weighting and Clustering

Column (6) of table 3 shows that there is a negative and significant relationship between psychiatric beds in a hospital’s county and ambulance diversion hours. To have confidence in the results, it is necessary to show that the coefficient of interest does not fluctuate based on the weighting of the regression or the clustering of the standard errors. In table (3), the regressions are weighted by the emergency department patients in a hospital, placing more importance on hospitals with larger and busier emergency departments. If one believes that all hospitals in a county should have equal weight, it is more appropriate to weight ambulance diversion by the county population. Likewise, standard errors are clustered at the county level in table (3), but if the variation in ambulance diversion is dependent on specific hospital behavior, clustering at the hospital level may be more appropriate.

Table 4 reports the value of the $Beds_{c-i,t}^{Psych}$ coefficient for nine regressions that differ only in weighting and clustering. All regressions in table 4 use the preferred specification from above, column (6) from table 3, and include controls and hospital and year fixed effects. The cell in the first row and first column of table 4 shows that when the preferred specification above is unweighted and robust standard errors are used, the coefficient becomes -0.56 and is significant at the 5 percent level. Moving from left to right in the first row shows how clustering at different levels changes the standard error. Clustering at the county level in the second column increases the standard error slightly and the coefficient is significant at the 10 percent level. The coefficient is significant at the 5 percent level when clustering at the hospital level in the third column.

The second row weights the regression by the total emergency department patients, the same weighting as table 3. Using robust standard errors, the coefficient of -0.86 is significant at the ten percent level. Clustering at the county level in the second column yields the same highly significant
coefﬁcient as column (6) of table 3. Clustering at the hospital level in the third column increases the standard error compared to county level clustering, but the coefﬁcient remains signiﬁcant at the ﬁve percent level.

<table>
<thead>
<tr>
<th></th>
<th>Level of Clustering</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None (Robust)</td>
</tr>
<tr>
<td></td>
<td>County</td>
</tr>
<tr>
<td></td>
<td>Hospital</td>
</tr>
<tr>
<td>None</td>
<td>-0.56**</td>
</tr>
<tr>
<td></td>
<td>(0.28)</td>
</tr>
<tr>
<td>Weighting</td>
<td></td>
</tr>
<tr>
<td>Total Emergency Patients</td>
<td>-0.86*</td>
</tr>
<tr>
<td></td>
<td>(0.47)</td>
</tr>
<tr>
<td>County Population</td>
<td>-0.83**</td>
</tr>
<tr>
<td></td>
<td>(0.35)</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1. Standard errors are reported in parentheses. All cells report the regression coefﬁcient for psychiatric beds in hospital ‘s county minus the hospital’s psychiatric beds. All regression include controls and hospital and year ﬁxed effects.

The third row weights regressions by the county population and only changes the coefﬁcient by 0.03 compared to emergency department patient weighting. The coefﬁcient is signiﬁcant at the ﬁve percent level using robust standard errors and signiﬁcant at the one percent level when standard errors are clustered at the county and hospital level. The relative stability and signiﬁcance of the results in table 4 provides additional evidence that the relationship between county psychiatric beds and hospital diversion hours found in table 3 is not driven by speciﬁc weighting or clustering.

4.2 Emergency Departments and the Proximity to Psychiatric Beds

In California, some of the counties are unusually large. The land area in San Bernardino county is larger than nine states in the country and both San Diego and Los Angeles county are only twenty percent smaller than Connecticut. It is possible that ambulance diversion hours in a hospital on one side of a county will not respond to changes in psychiatric beds at the opposite end of the county. Because the utilization data provides the geographical coordinates of each licensed health facility, the number of psychiatric beds within a radius of an emergency department can be used instead of the number of psychiatric beds in a county.
Using the geographic information systems software, ArcGIS, the locations of all licensed hospitals are geocoded, along with the information on psychiatric beds, general acute inpatient beds and ambulance diversion hours. By drawing rings around each emergency department, the aggregate number of beds and diversion hours within various distances, \( r \), from the hospital are gathered. The information is merged with the utilization dataset and equation (3) is run:

\[
A_{i,c,t} = b_1 \text{Beds}_{r-i,t}^{Psych} + b_2 \text{Beds}_{r-i,t}^{Non-Psych} + b_3 \text{EDPatients}_{i,c,t} + b_4 \text{Pop}_{i,c,t} + \\
\quad b_5 \text{Law}_{c,t} + b_6 \text{A}_{r-i,t} + Z_i + T_t + \varepsilon_{i,c,t}. \tag{3}
\]

In equation (3), the dependent variable remains the ambulance diversion hours in a particular hospital. The main variable of interest is \( \text{Beds}_{r-i,t}^{Psych} \), the number of psychiatric beds within radius \( r \) of hospital \( i \), minus the number of beds in hospital \( i \). The number of general inpatient beds within radius \( r \), minus the number of beds in hospital \( i \), \( \text{Beds}_{r-i,t}^{Non-Psych} \), replaces the number of inpatient beds in the county in equation (2). County level polices are also included, along with the set of controls \( X_{i,c,t} \) which contain the county population and the annual number of emergency department patients at the hospital. The variable \( \text{A}_{r-i,t} \) controls for the number of diversion hours in the radius around hospital \( i \), minus hospital \( i \)'s diversion hours. Hospital and year fixed effects are included in the analysis, standard errors are clustered at the county level and the regression is weighted by the annual number of emergency department patients at hospital \( i \).

In column (1) of table 5, the psychiatric beds in a hospital are the main variable of interest, which is the same result as column (5) of table 3. The negative and insignificant coefficient of -1.16 suffers from a bias if hospitals respond to ambulance diversion hours by altering psychiatric beds. When a five mile radius is drawn around a hospital in column (2), the coefficient on psychiatric beds in the radius is positive, but relatively small in magnitude and insignificant. The bias may still exist in a five mile radius of hospital \( i \) if hospitals near one another tend react to ambulance diversion and psychiatric beds similarly.
Table 5: Ambulance Diversion Hours and nearby Psychiatric Beds

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hospital</th>
<th>5 Mile</th>
<th>10 Mile</th>
<th>25 Mile</th>
<th>50 Mile</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{Beds}_{r-i,t}^{\text{Psych}} )</td>
<td>-1.16</td>
<td>0.34</td>
<td>-1.19***</td>
<td>-1.16***</td>
<td>-0.79**</td>
<td>-0.86***</td>
</tr>
<tr>
<td></td>
<td>(2.41)</td>
<td>(0.56)</td>
<td>(0.26)</td>
<td>(0.33)</td>
<td>(0.36)</td>
<td>(0.30)</td>
</tr>
<tr>
<td>( N )</td>
<td>3,704</td>
<td>3,704</td>
<td>3,704</td>
<td>3,704</td>
<td>3,704</td>
<td>3,704</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.771</td>
<td>0.769</td>
<td>0.775</td>
<td>0.769</td>
<td>0.770</td>
<td>0.772</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1
Standard errors clustered at the county level are reported in parentheses.

All regressions are weighted by hospital emergency department patients and includes all controls from previous regressions and hospital and year fixed effects.

The regression result using a 10 mile radius is reported in column (3). The coefficient on psychiatric beds within 10 miles of the hospital is highly significant and larger in magnitude than previous regressions. When the number of psychiatric beds within 10 miles of hospital \( i \) increases by one, the annual diversion hours decreases by 1.19. The coefficient on psychiatric beds within 25 miles is -1.16 in column (4) and remains highly significant. In column (5), the 50 mile regression has a smaller, but significant, coefficient of -0.79. Column (6) reports the results from the preferred specification above using psychiatric beds in a county as the variable of interest. The county psychiatric bed coefficient of -0.86 falls between the 25 mile and 50 mile coefficient.

The point estimates in table 5 show that hospitals respond more strongly to changes in psychiatric bed availability 10 and 25 miles away compared to 50 miles away. At the same time, the coefficients in columns (3) through (6) are near one another, suggesting that hospitals do respond to psychiatric bed availability over a large geography. This is not an unreasonable finding as the isolated locations of some emergency departments means that the closest psychiatric bed may be relatively far away.

4.3 Psychiatric Bed Source and Ambulance Diversion

If the fraction of psychiatric patients in an emergency department is related to changes in psychiatric bed availability and a determinant of ambulance diversion, the coefficient of interest in the results above will be biased away from zero. In the summary statistics above, the reduction in statewide psychiatric beds is driven by GACHs. Changes to psychiatric beds in GACHs will not di-
rectly impact psychiatric visits to the emergency department if psychiatric patients do not consider how many psychiatric beds are housed in a hospital when deciding where to go in the event of an emergency. A reduction in GACH psychiatric beds may increase boarding times and lead to more overcrowding in emergency departments, but only changes to psychiatric beds at acute psychiatric hospitals and psychiatric health facilities will directly impact where psychiatric patients go in an emergency.

Table 6 presents regression results that show how specific psychiatric beds are related to ambulance diversion. Similar to the previous regressions, only GACHs with active emergency departments are used, all controls and fixed effects are included, regressions are weighted by total emergency department patients and standard errors are clustered at the county level. In column (1), the number of psychiatric beds housed in GACHs, minus the psychiatric beds in hospital $i$, is the variable of interest and the other psychiatric bed types are omitted. When GACH psychiatric beds increase, ambulance diversion hours decrease by 0.41 and the coefficient is significant at the 10 percent level.

### Table 6: Ambulance Diversion and Specific Types of Psychiatric Beds

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Beds_{c-t}^{Pych, (GACH)}$</td>
<td>-0.41*</td>
<td>-0.86***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Beds_{c-t}^{Pych, (Acute Psychiatric)}$</td>
<td>-1.23</td>
<td>-1.63*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.92)</td>
<td>(0.93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Beds_{c-t}^{Pych, (PHF)}$</td>
<td>3.57</td>
<td>2.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.43)</td>
<td>(3.32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$N$</td>
<td>3,704</td>
<td>3,704</td>
<td>3,704</td>
<td>3,704</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.772</td>
<td>0.772</td>
<td>0.772</td>
<td>0.773</td>
</tr>
</tbody>
</table>

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Standard errors clustered at the county level are reported in parentheses.

All regressions are weighted by hospital emergency department patients and includes all controls from previous regressions and hospital and year fixed effects.

In column (2), acute psychiatric hospital beds are the variable of interest and the coefficient is larger in magnitude than the GACH regression, but not significant. Psychiatric health facility beds have a positive and insignificant coefficient in column (3). Because psychiatric health facilities only housed six percent of psychiatric beds in California in 2012, the coefficient is determined by a small number of observations.

Column (4) includes the three types of psychiatric beds in one regression. The results show
that an additional GACH psychiatric bed in a hospital’s county is associated with a 0.86 decrease in diversion hours. The result is highly significant. An additional acute psychiatric hospital bed is related to 1.63 fewer ambulance diversion hours, but the coefficient is only significant at the ten percent level. Even though the psychiatric hospital bed coefficient is nearly twice as large as the GACH, the coefficients are not significantly different from one another. Psychiatric health facility beds remain positive and insignificant.

The coefficient on psychiatric beds in GACHs does not suffer from the same bias that may be influencing the coefficients for beds in psychiatric hospitals and psychiatric health facilities. The size of the GACH psychiatric bed coefficient in column (4), -0.86, is the same value found in the preferred specification above. This suggests that the previous regressions are driven by changes in psychiatric beds in GACHs and the findings are not altered by the potential bias from beds in psychiatric hospitals and psychiatric health facilities. Tables 3 through 6 provide strong evidence that psychiatric bed availability is significantly related to ambulance diversion hours.

5 Discussion: The Cost Effectiveness of Psychiatric Beds

In an attempt to balance the state budget, California reduced annual state mental funding by $765 million between 2009 and 2012, a 21 percent reduction. The state mental health budget funds a number of mental health services in addition to psychiatric inpatient beds, and it is possible that the yearly savings from budget cuts could lead to greater costs due to increases in mental health patients in emergency departments. The results above can be used to determine whether reductions in psychiatric beds are cost effective and provide insight as to whether cuts to mental health budgets are an effective way to reduce total spending.

A lower bound on the cost of reductions in psychiatric beds can be determined by finding the amount of foregone hospital revenue resulting from increased ambulance diversion. Studies have estimated that the lost revenue from ambulance diversion is between $1,100 (McConnell et al., 2006) and $8,900 (Falvo et al., 2007) per hour. In the analysis above, there are an average of 6.14 hospitals per county. Decreasing the number of psychiatric beds in a county will increase ambulance diversion hours by 0.86 across the 6.14 hospitals, for a total of 5.28 hours annually. Using the values from McConnell et al. (2006) and Falvo et al. (2007), one less psychiatric bed in the county reduces
hospital revenue by a minimum of $5,808 and a maximum of $46,995.

For simplicity, initially assume that the lost hospital revenue from ambulance diversion is the only cost of eliminating a psychiatric bed. Under this assumption, the lost revenue from ambulance diversion can be compared to the profit or loss from operating a psychiatric bed. If the lost revenue from ambulance diversion is less than the amount of money that hospitals lose from operating a psychiatric bed, eliminating the psychiatric bed is cost effective.

The best source for calculating the cost of a psychiatric bed is found in Steensland et al. (2012), who use data on charges, costs and reimbursement rates for psychiatric patients at 418 community hospitals throughout the United States in 2006. Using the information in Steensland et al. (2012), hospitals lose an average of $535 per psychiatric patient covered by Medicaid, but make $907 per privately insured psychiatric patient. Medicare reimbursement amounts are not available. Medicare and Medicaid patients make up approximately 55 percent of psychiatric patients, while private patients are 31 percent of total psychiatric patients. Uninsured and self pay patients make up the remaining amount. If hospitals are not reimbursed for any costs associated with self pay or uninsured patients and the reimbursement rate of Medicare is assumed to be the same as Medicaid, hospitals lose approximately $862 on the average psychiatric patient.

In Steensland et al. (2012), the average hospital had 627 psychiatric patients per year and an average length of stay of 7.58 days, meaning that hospitals need an average of 13 beds to meet the demand. Reducing the number of beds from 13 to 12 reduces the number of patients that can be treated by 48, resulting in a savings of approximately $41,376 per year.

Determining whether psychiatric beds are cost effective depends on which estimate is being used to calculate lost revenue from ambulance diversion. Using the annual lost revenue from ambulance diversion hours from Falvo et al. (2007), it is not cost effective to eliminate a psychiatric bed in a county. One less psychiatric bed will reduce revenue by $46,995, but only increase savings by $41,376. If the lost revenue from ambulance diversion is closer to the estimate of $1,100 per hour in McConnell et al. (2006), the foregone emergency department revenue from additional ambulance diversion hours of $5,808 is less than the savings from treating fewer psychiatric patients, and it is cost effective to eliminate a psychiatric bed.

This calculation does not consider the direct savings to the government that comes from treating fewer psychiatric patients covered by Medicare and Medicaid. The government reimburses hospitals
$5,567 on average for each psychiatric patient covered by Medicaid. One less psychiatric bed will result in approximately 27 fewer psychiatric patients covered by Medicare and Medicaid. Again, assuming that Medicare patients are reimbursed at the same rate as Medicaid patients, eliminating a bed will result in a savings of approximately $150,309 for the government. The overall savings to the government and the hospital of one less psychiatric bed is then equal to roughly $191,685.

The savings for both the government and the hospital from one less psychiatric bed is larger than the annual foregone revenue from the additional ambulance diversion hours ($5,808 to $46,995). However, the true value of additional ambulance diversion hours includes more than the foregone revenue to the hospital. Ambulance diversion has potentially significant health consequences and also represents overcrowding in an emergency department that can reduce the quality of emergency services being delivered. Depending on which estimate of lost revenue from ambulance diversion is used, if the value of the additional health costs are greater than $144,690 or $185,877, reductions in psychiatric beds will not be cost effective.

Most studies on the health consequences of ambulance diversion focus on mortality as an outcome. In a study of 13,860 Medicare patients in California between 2000 and 2005, Shen and Hsia (2011) find that the 30-day, 90-day and 1-year mortality rates are three percent higher for heart attack patients on days that the nearest hospital has at least 12 hours of ambulance diversion. Sun et al. (2012) find that when patients are admitted to hospitals that are in the top quartile of daily ambulance diversion hours for the facility, mortality is five percent higher, the length of stay is 0.8 percent higher and costs increase by one percent. They estimate the cost of emergency department crowding at $17 million in California in 2007.

Fewer psychiatric beds will also impact psychiatric patients. Providing treatment for mentally ill patients can have a significant impact on productivity. Earnings for people with a serious mental illness are $16,306 lower per year than those without a serious mental illness (Kessler et al., 2006). Marcotte and Wilcox-Gok (2001) estimate that over five million workers in the United States cannot find employment due to mental illness. These studies do not consider the improvements to quality-of-life from mental health treatment, which will further increase the value of a psychiatric bed.

Any estimate of the value of the physical and mental health benefits that come from an additional psychiatric bed will depend on a number of factors. The physical health benefits rely on the value-of-a-statistical life, which can vary widely depending on the patient in the analysis. Aldy and
Viscusi (2008) estimate the value-of-a-statistical life to be between $3.4 and $9.7 million, and small reductions in mortality due to reduced ambulance diversion hours can be highly valued by emergency patients. Improved mental health can be captured using labor market outcomes, but the increased quality-of-life also needs to be considered. After incorporating all the health benefits into the analysis, it is possible that the cost of eliminating a psychiatric bed is significantly more than the potential savings of $191,685 by hospitals and government.

Additional psychiatric beds are even more likely to be cost effective after revisiting the assumption that the government saves money by treating fewer mentally ill patients covered by Medicare and Medicaid. The calculations above imply that when a mentally ill individual is unable to receive treatment, they will not financially burden the government in any other way. Given that there are more mentally ill patients in jails than hospitals (Torrey et al., 2013), failing to deliver adequate mental health care likely shifts the cost of mental health treatment from hospitals to other government institutions. When this occurs, the total savings of one less psychiatric bed will be less than $191,685 because the savings to the government through fewer Medicare and Medicaid payments is at least partially offset by increased costs elsewhere. After considering the decreased savings to the government from reduced psychiatric beds, it is unlikely that eliminating psychiatric beds is cost effective.

Reducing mental health funding in order to balance state budgets was popular among states following the Great Recession. Overall, states cut annual mental health budgets by a total of $1.6 billion. Hospitals may find it in their best interest to reduce the number of psychiatric beds, but it is not a cost effective policy for the government after all the health costs from fewer psychiatric beds are considered. States may save money in the short run, but could find themselves in a deeper budget crisis in the future as a result of their short-term budget decision. It is necessary to make cuts to important services when there is a financial crisis, but because reductions to mental health services can potentially lead to an increase in overall total costs, the government should reduce spending in other areas before cutting funding for mental health care.
6 Conclusion

When policy makers are forced to balance budgets, they look to eliminate costly services that are considered less important and meaningful to society. Mental health services may initially appear to only serve the mentally ill population, however, reductions in mental health services can impact non-psychiatric patients significantly. If mentally ill patients increasingly seek treatment in emergency departments, resources in the emergency department will be inefficiently allocated and the emergency department will become more crowded. If the emergency department becomes overcrowded, ambulances can be diverted, directly impacting health outcomes for emergency patients and reducing revenue for the hospital.

This paper uses data from California between 2002 and 2012 and finds that reductions in psychiatric beds in a hospital’s county are associated with a significant increase in ambulance diversion hours. Although the results of this study are robust to a number of specifications, the results rely on the assumption that unobserved determinants of ambulance diversion are unrelated to psychiatric bed availability. The assumption is arguably valid, but in order to more accurately determine the relationship between psychiatric beds and ambulance diversion, future studies should look for large, random shocks to psychiatric bed availability. An exogenous change in beds would provide researchers with an opportunity to better understand the total impact of psychiatric beds on a number of outcomes, and provide policymakers with additional insight on the cost effectiveness of mental health funding.

The findings in this paper suggest that psychiatric beds are likely not cost effective from the perspective of the hospital. However, if policymakers consider all the health care costs associated with psychiatric bed reductions, it is in their best interest to increase funding for psychiatric beds. Psychiatric beds in general acute care hospitals decreased over 20 percent between 2003 and 2012, making it increasingly important for the government to provide funding for additional psychiatric beds. The recent cuts to the mental health budget in California will initially save the state $765 million annually, but it is possible that the reductions in funding will increase total costs for the state. Not all of the cuts were focused on inpatient beds, but any policy change that increases emergency room visits for psychiatric patients can increase the total cost for both psychiatric and non-psychiatric patients.
References


