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Can Amputation Save the Hospital? The Impact of the Medicare Rural Flexibility Program on Demand and Welfare

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Can Amputation Save the Hospital? The Impact of the Medicare Rural Flexibility Program on Demand and Welfare*

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Abstract

This paper seeks to understand the impact of the Medicare Rural Hospital Flexibility (Flex) Program on rural resident hospital choice and welfare. The Flex program created a new class of hospital, the Critical Access Hospital (CAH), which receives more generous reimbursement in return for limits on capacity and length of stay. We find that conversion to CAH status reduced inpatient admissions by a mean of 5.4%, of which almost all was driven by factors other than capacity. The program increased consumer welfare if it reduced the closure rate by at least 4 percentage points.

Keywords: Hospital Choice, Patient Welfare, Medicare.
JEL Classification: L11, L38, I11, I18

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1 Introduction

Embedded in the Balanced Budget Act of 1997 is a provision that establishes the Medicare Rural Hospital Flexibility (Flex) Program. The Flex program establishes a new class of hospitals under the Medicare program, Critical Access Hospitals (CAH), to which hospitals can convert. Hospitals converting to CAH status must comply with a number of restrictions including limits on their capacity (25 beds or less) and on their patients' average length-of-stay.[1] In return for accepting these constraints, CAH hospitals receive cost-based reimbursements from Medicare that are typically more generous than those under the standard prospective payment system (PPS). The overarching purpose of the Flex program is to improve and sustain access to quality healthcare services for rural residents. One important avenue through which the program seeks to achieve this goal is through increasing the financial stability of rural hospitals which, in turn, is intended to spur quality improvement and reduce the likelihood of closure.

In the 15 years since its implementation, the Flex program has left a large imprint on the structure of rural hospital markets and cost of rural health care. Currently, over 1,300 rural hospitals (25 percent of all U.S. hospitals and over half of rural hospitals) have converted to CAH status. The Flex program caused hospitals to shed significant amounts of capacity so that they could qualify for CAH conversion. In 1996, 14 percent of rural hospitals had 25 beds or less, while that figure rose to 50 percent by 2005. Of the hospitals that converted to CAH status in 2006, 98% had more than 25 beds in 1996. The mean capacity of eventual converters decreased from 42 beds in 1996 to 22 beds in 2006. The program has also been costly: it is estimated that Medicare's payments to CAH hospitals have increased by 35% (MedPAC, 2005). Yet it has enjoyed wide and bipartisan support, with recent proposals for expansion (bob add cite).

[1] The initial legislation required CAH hospitals to be distant from other hospitals, but this requirement could be waived if states deemed the hospital a necessary provider.

The scale of the Flex program, its costliness, and its impact on the size distribution of rural hospitals, all suggest that a policy evaluation of the consequences of the Flex program is an important exercise to undertake. An interesting tension is embedded in the Flex program and it is a tension that can be found in other large scale, federal programs.[2] In order to convert to CAH status, hospitals generally reduced their capacity and altered their service offerings. The lower capacity and constraints on length of stay may deter patients from seeking treatment at CAHs. However, to the extent the Flex program plausibly forestalled some hospital, it increased (or at least prevented a larger decrease in) access to hospital services for rural residents. This dimension of the Flex program likely increased consumer surplus. CAH hospitals are required to have 24-hour emergency rooms. The availability of proximate ER services can impact mortality for some time-sensitive conditions. Thus, given the possible effects of the Flex program, its net impact on rural residents is ambiguous.

In this paper we seek to understand the impact of the Flex program on several dimensions of rural resident welfare. Using detailed patient discharge data, we first examine the impact of CAH conversion on the characteristics of the hospitals' patient population. This allows us to assess the impact of conversion on average patient severity, the number of inpatient services, the distribution of diagnoses and the distribution across insurance arrangements. We then estimate parameters of hospital choice utility function and calculate the impact of conversion on the hospital's demand. We do this across all patients and then we drill down and examine the impact of conversion across patients with different health insurance arrangements and diagnoses. Our data span the pre- and post CAH conversion eras enabling us to use a difference-in-difference identification strategy.[3] Finally, we use the parameter estimates from the demand model to quantify the welfare impact of CAH conversion by calculating the reduction in the hospital exit rate that would be necessary to offset the

[2]For example, agricultural price supports linking government support to the amount produced.

[3]Our data begin in 1998 just after the Flex program was passed but very few hospitals had converted to CAH status at the beginning of our sample period.

static, welfare impact of conversion.

We construct our data set from several different sources. The principal data set is patient discharge records for the states of Colorado, Iowa, North Carolina, Oregon, Washington, West Virginia and Wisconsin spanning the years 1998-2005. These states were selected because of their large rural populations and CAH conversion was common. The discharge data contain the identity of the hospital from which the patient was discharged as well as resident zip code, demographics, diagnoses and health insurance status information. We link these data to information on hospitals characteristics from the American Hospital Association (AHA) and the Center for Medicare and Medicaid Services's (CMS) Healthcare Cost Report Information system (HCRIS). Finally, we merge in data on CAH status and conversion dates from the Flex Monitoring Team. Our data set contains over 7 million patient observations.

Prior to converting, CAH hospitals were different than non-converting hospitals. CAH hospitals treated fewer patients, their patients were less severely ill, they offered fewer services and their patients travelled smaller distances and were more likely to be a Medicare enrollee. After the conversion and with some exceptions, the patient characteristics of CAH hospitals did not significantly change. After conversion the average number of services for which patients received care modestly declined, and CAH hospitals saw a shift in the distribution of the diagnoses of their patients.

The structural demand estimates indicate that CAH conversion reduced the value of the hospital for inpatient treatment which lead to a decline in patient volume. Converting hospitals, on average, experienced a 6% decline in Medicare patients compared to a 5% decline in their privately insured admissions. The impact of CAH conversion also differs across diagnoses. For example, converting hospitals saw a decline of 8.7% for acute myocardial infarction patients but only a 2.8% decline in pneumonia patients.

CAH conversion can affect patient utility through two different pathways. First, bed size restrictions may directly affect hospital demand. For example, reductions in the number

of beds may result in the hospital becoming capacity constrained. Second, independent of bed size restrictions, the CAH designation may impact the attractiveness of the hospital. For example, CAH hospitals also receive cost based reimbursements for outpatient services and and CAH hospitals may emphasize those services. In addition, restrictions on length of stay may cause the hospital to drop services. We decompose the decrease in demand into these two components. We find that virtually all of the decline in demand from conversion is driven by factors that are unrelated to bed size reductions. This is true across the entire patient population but generally holds for patients with different insurance arrangements and different conditions.

Finally, we use our estimates from the hospital choice model to explore the policy tension in the Flex program. The MNL parameters imply that CAH conversion reduces patient utility. However, if the Flex program averted a sufficient number of hospital closures, this effect could overcome the reduction in consumer surplus associated with conversion. We calculate the reduction in the exit rate necessary for the Flex program to increase consumer surplus. We find that the Flex program increases consumer surplus if it forestalls the closure of at least 4% of converting hospitals.

The paper proceeds as follows. Immediately below we dicuss the related literature. In Section 2 we describe the institutional features of the Flex program. Section 3 describes our data and provides summary statistics. Section 4 presents our empirical model. Section 5 presents the estimates of the impact of the Flex program on hospital demand and performs the welfare analysis. Section 6 concludes.

Related literature

Despite the importance of the Flex program, there have been few national level evaluations of the program and even fewer papers that employ credible identification to assess the program's impact. In preliminary analysis using zipcode level data from Medicare's Health Services

Area File (HSAF), Gowrisankaran et al. (2011) found that conversion to CAH lead to a precipitous decline in inpatient demand. However, further analysis revealed that the data likely contain non-random measurement error which likely explains the magnitudes of the estimated decline.

Recently, Joynt et al. (2011) document that CAH hospitals are less likely to have intensive care units, cardiac catheterization labs and electronic medical records. Furthermore, they find that patient outcomes are worse at CAH hospital relative to all other hospitals. Joynt et al. (2011, p. 51) also refer to a number of recent studies finding negative to mixed impacts of CAH conversion on quality of care. **?** find that rural CAH hospitals perform significantly worse than urban hospitals in 7 out of 12 hospital quality indicators. Using data from Iowa, Li et al. (2007) find that CAH conversion had a mixed impact on patient safety outcomes. The papers above identify the impact of conversion using cross-sectional information. We complement this body of research by accounting for the likely endogeneity of CAH conversion and comparing only rural hospitals. As we show here, CAH hospital are meaningfully different from non-CAH prior to their conversion thus cross sectional analysis is prone to biased inferences regarding the causal relationship between CAH status and hospital performance. We further take into account distance hospital characteristics like bed capacity and distance to the patient. Stensland et al. (2003) and Stensland et al. (2004) study the financial effects of CAH conversion and find that conversion led to an increase in Medicare revenue and profit margins. Casey and Moscovice (2004) study the quality improvement initiatives of two CAHs after conversion, and conclude that the cost-based payments help the hospitals to fund activities that would improve quality of care such as additional staff, staff training and new medical equipment. Finally, McNamara (1999) studies the pre-Flex program impact of rural hospitals closures on consumers' surplus and finds that the average compensating variation for the closure of the nearest rural hospital is about $19,500 (1988 dollars) per sample hospitalization.

2 The Flex Program

The Medicare Rural Hospital Flexibility Program was authorized by section 4201 of the Balanced Budget Act of 1997 (BBA).[4] Designated CAHs receive cost-based Medicare reimbursements for inpatient, outpatient post-acute (swing bed) and laboratory services. Currently these payments are set to 101% of average accounting costs. The legislation required hospitals must be 35 miles from a primary road and 15 miles by a secondary road to the nearest hospital. However, this distance requirement was not initially binding. Hospitals could (and often did) get the restriction waived by having themselves declared a necessary provider by the state. Most CAHs are less than 25 miles from a neighboring hospital. In 2006, the distance requirement became binding. The initial 1997 BBA legislation specified that CAHs can have a maximum of 15 acute inpatient beds and 25 total beds including swing beds, and the length of stay was limited to a maximum of 4 days. A swing bed is used to provide post-acute care. Although the legislation did not specify the intent of these limitations, the likely purpose was to limit the financial exposure of the government and to limit the CAHs to treat low acuity conditions for quality of care reasons.

CAHs are required to provide inpatient, laboratory, emergency care and radiology services. One of the goals of the Flex program is to maintain emergency department access for rural residents. Although they have an important role in providing emergent care, CAHs must keep their average length of stay to less than 96 hours. For these reasons (among others), CAHs must develop agreements with an acute care hospital related to patient referral and transfer, communication, and emergency and non-emergency patient transportation. The CAH may also have an agreement with their referral hospital for quality improvement or choose to have that agreement with another organization. Lastly, the CAH legislation provides resources for hospitals to hire consultants to project revenues and costs under the

[4]Much of the information in the section is culled from MedPAC (2005), which contains much more background then we provide.

Flex program to determine whether a conversion strategy would be optimal for the hospital given its objectives.

The program's rules have been modified several times since its inception. Table 1 summarizes the important legislative and regulatory changes in the program. The most important of these changes are: 1) The Balanced Budget Reconciliation Act (BBRA) of 1999 changed the length of stay requirement and allowed states to designate hospitals in Metropolitan Statistical Areas 'rural' for CAH classification; 2) The Budget Improvement and Protection Act of 2000 extended cost-based reimbursements to patients in swing beds; 3) The Medicare Prescription Drug, Improvement and Modernization Act (MMA) of 2003 increased the acute inpatient limit from 15 to 25 acute patients and increased the payments from 100 to 101 percent of costs. Allowing the treatment of post-acute care patients to be reimbursed on a cost basis dramatically increased the profitability of caring for those patients. According to MedPAC (2005), "The shift from receiving SNF rates for post-acute patients to receiving estimated costs (which assume post-acute routine costs equal acute routine costs) resulted in a dramatic increase in post-acute care payments from $259 per day before conversion to $1,016 per day after conversion."[5] These changes to the Flex program provide variation in the benefits to CAH conversion which we can exploit within the study period.

Since the intent of the CAH policy is to maintain access to hospital care for rural residents, it is useful to examine the change in rural hospital structure since the implementation of the policy. We define rurality using Rural-Urban Commuting Areas (RUCA) version 2.0.[6] Out of the 4,779 hospitals in the U.S. in 1994, 49.3% (or 2,355 total) are rural. Figure 1 shows the rate of CAH conversion and the fraction of CAH hospitals among rural hospitals.[7]

Figure 1 shows the rate of CAH conversion among all rural, general acute care hospitals

[5] p. 163

[6] These measures are developed collaboratively by the Health Resources and Service Administration, the Office of Rural Health Policy, the Department of Agriculture's Economic Research Service, and the WWAMI Rural Health Research Center.

[7] All facts and figures in this section are derived from the linked AHA, HCRIS and Flex Monitoring Team data discussed in more detail in Section 3.

Table 1: Relevant Policy Changes for CAH

Legislation	Key Aspects of CAH Legislation and Regulation
BBA 1997	• Flex program established. • Hospitals should operate no more than 15 acute beds and no more than 25 total beds, including swing beds. • All patients' length of stay (LOS) limited to 4 days. • Only government and NFP hospitals qualify. • Hospitals must be distant from nearest neighboring hospital, at least 35 miles by primary road and 15 by secondary road. • States can waive the distance requirement by designating "necessary providers."
BBRA 1999	• LOS restriction changes to an average of 4 days. • States can designate any hospital to be "rural" allowing CAHs to exist in MSAs. • FP hospitals allowed to participate.
BIPA 2000	• Payments for MDs "on call" are included in cost-based payments. • Cost-based payments for post-acute patients in swing beds.
MMA 2003	• Inpatient limit increased from 15 to 25 patients. • Psychiatric and rehabilitation units are allowed and do not count against the 25 bed limit. • Payments are increased to 101 percent of cost. • Starting in 2006, states can no longer waive the distance requirement.

Source: MedPAC (2005)

in the U.S. Conversion rates were very low until 1999.[8] Starting in 2000 and through 2004, roughly 150 hospitals per year converted to CAH status. We believe that the delay between the enactment of BBA in 1997 and the timing of conversion is due to the complexity and uncertainty in the application process, which requires large amounts of paperwork, inspection visits and CMS approval.[9] By 2005, over 40% of rural hospitals and 25% of all U.S. hospitals had adopted CAH status. Conversion rates declined after 2006, when the minimum distance requirements became mandatory (see MedPAC, 2005).

Figure 2 shows a histogram of rural bed sizes for hospitals in 1996 and 2005, with the

[8] A few conversions occurred prior to 1997 due to pilot programs.

[9] For example, in the state of Wisconsin, the application process has 18 steps, detailed at http://www.worh.org/pdf_etc/AppFlowChart.pdf .

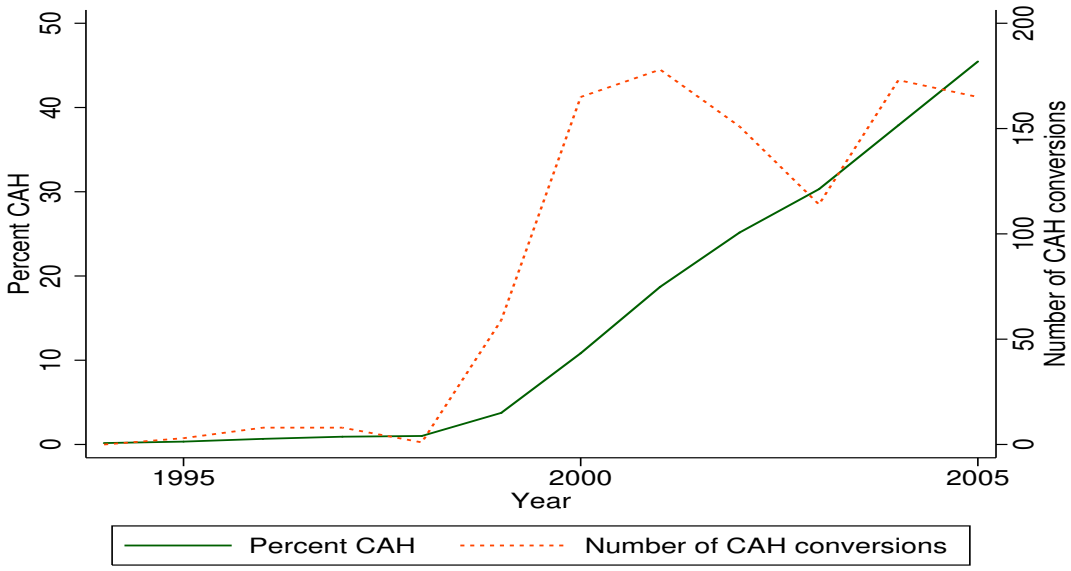


Figure 1: Conversion rates and percent CAH among U.S. rural hospitals

maximum truncated to 125. The movement to CAH hospitals has also been accompanied by large drops in the bed size of rural hospitals. In 1996, the median bed size was 54. By 2005, the median bed size had dropped to 36 while the mean bed size went from 72 to 56. Even more striking is that many hospitals dropped in bed size to exactly 25 – the upper-limit of the level allowed by the Flex program. By 2005, 21% of rural hospitals had exactly 25 beds.

3 Data

To construct the principal, analytical dataset, we link together information from from several sources. The primary data is state inpatient discharge (SID) information. The SID data, which were acquired through the Agency for Healthcare Quality and Research's Health Care Utilization Project, are discharge level information for virtually the universe of patients admitted to to a hospital in that state. Each observation contains information on the discharging hospital, patient's home zip code, age, gender, primary payer, dates of admission and discharge, Diagnostic Related Group (DRG), principal diagnosis and procedure codes.

Figure 2: Size of rural hospitals, 1996 and 2005

The DRG are clusters of related diagnoses that use similar resources. Medicare uses DRGs to determine prospective payment for non-CAH hospital admissions. Roughly, the hospital is paid the base rate times the DRG weight plus some adjustments. We also merge in the DRG weight information.

We focus on seven states: Colorado, Iowa, North Carolina, Oregon, Wisconsin, Washington State and West Virginia. These states were selected because they have sizable rural populations and a large number of CAH hospital conversions. Within these states, we extract the sample of patients residing in rural areas. We focus on rural residents as the goal of the Flex program is to improve health care access to those residents. The Colorado, Iowa, Washington State and Wisconsin data span 1998 to 2005, the North Carolina and Oregon data are available from 2000 to 2005, and the West Virginia data begin in 2001 and end in 2005.[10] Within these states, our analysis sample is patients residing in rural zip codes.

We characterize rurality of patients using the Rural-Urban Commuting Area Codes (RUCA), version 2.0. These measures of rurality are based on the size of cities and towns and their

[10]To be included in the sample, a hospital must have at least 100 discharges over the 1998 to 2008 time frame.

functional relationships as identified by work commuting flows, and have been used by CMS to target other rural policies, such as the ambulance payments. CMS considers all zip codes that have RUCA greater or equal to four to be rural, and we adopt the same criterion in this paper.

We link in data from the American Hospital Association (AHA), Healthcare Cost Report Information System (HCRIS), Census Bureau and the Flex Monitoring Team to the SID information. From the AHA we pull in information on the hospital location's latitude and longitude and from the HCRIS data we link in hospital bed size information.[11] Zip code centroid latitude and longitude data are pulled from the Census Bureau. Data on the timing of CAH conversion comes from the Flex Monitoring Team.[12] In addition, the Flex Monitoring Team data contains accurate information on the number of beds for the hospitals that converted.

CAH conversion may affect the range of services offered by the hospital as well as altering the types of providers working in the hospital. These types of effects suggest that CAH conversion will differentially affect patient choice according to their diagnoses. The detail in the patient discharge data allow us to analyze the impact of CAH conversion by specific diagnoses, Medical Diagnoses Category (MDC) and by types of insurance (Medicare and Privately Insured). MDCs are formed by assigning the principal diagnoses codes into one of the 25 mutually exclusive categories corresponding to single organ system or etiology and, in general, are associated with a particular medical specialty.

Our data set contains over 7 million patient discharges. Because of the size of the data set, it is impractical to estimate the parameters for some of our demand models. Therefore, in order to generate parameter estimates in a reasonable amount of time and maintain precision,

[11]The AHA also has information on bed size but the HCRIS data appears to be more accurate.

[12]The Flex Monitoring Team is a collaborative effort of the Rural Health Centers at the Universities of Minnesota, North Carolina and Southern Maine, under contract with the Office of Rural Health Policy. The Flex Monitoring Team monitors the performance of the Medicare Rural Hospital Flexibility Program (Flex Program), with one of its objectives being the improvement of the financial performance of CAH.

we take random draws of the relevant data set so that the sample used to estimate the parameters has approximately 10 million hospital/patient observations.[13]

The summary statistics for the sample years 1998 and 2005 are presented in Table 2.[14] The percentage of patients admitted to a CAH facility increased from essentially zero to 15% by 2005. Approximately half of the patients were admitted to the hospital closest to their home. Patients traveled 33.7 km to the hospital in 1998 and the average distance travelled in our data declined slightly by 2005. There was a large decline in the percentage of privately insured patients and the percentage of Medicare patients rose two percentage points. The average size of rural hospitals declined over this period.

4 Empirical Model

We model the discrete hospital choice decision of the patient conditional on deciding to receive inpatient treatment. Each period t, there is a set of patients $\mathbf{I_t} = \{1, \ldots, I_t\}$. Individual patients denoted by $i \in \mathbf{I_t}$ seek inpatient treatment for their illnesses. Patients differ by their diagnoses, demographics, insurance status and location. Each patient (potentially in consultation with their physician) observes the characteristics of the available hospitals and makes a discrete choice among all available hospitals in order to maximize their ex ante utility. The patient choice set is all hospitals within 85 km of her location and they can select the outside option which corresponds to choosing a hospital outside of this radius.

More precisely, patient i's utility of an inpatient admission to hospital j with diagnosis d

[13] We selected 10% of the entire sample, 25% of the Medicare population and privately insured population, 50% of obstetrics and circulatory MDC and 25% of the 'other' MDC category.

[14] In 1998 we have data on only 5 of the 7 states in our sample and for that reason differences in means between 1998 and 2005 reflect differences in the composition of states rather than underlying trends. Hospitals in the states that are added to the sample around 2000 are bigger. We therefore separately report summary statistics for only those states for which the data were available from 1998 on.

Table 2: Summary Statistics

	1998		2005	
Variable	Mean	S.D.	Mean	S.D.
Hospital Characteristics– Entire Sample				
Number of Beds	107.0	107.9	110.9	133.87
CAH	.002	.049	.420	.494
Not-for-profit	.631	.483	.634	.482
For-profit	.040	.197	.054	.226
Admissions per Hospital	1,483.7	4,317.5	2,072.7	6,098.7
Number of Hospitals	420	–	500	–
Hospital Characteristics – For Hospitals in States in Sample for Entire Period				
Number of Beds	107.0	107.9	95.66	113.51
CAH	.002	.049	.490	.500
Not-for-profit	.631	.483	.649	.477
For-profit	.040	.197	.040	.197
Admissions per Hospital	1,483.7	4,317.5	1,730.3	6,852.4
Number of Hospitals	420	–	396	–
Patient Characteristics				
Admitted CAH	.0006	.000	.155	.362
Age	50.1	28.8	51.4	28.0
Female	.582	.493	.583	.493
Length of Stay	4.01	5.21	4.15	5.41
DRG Weight	1.15	1.13	1.19	1.19
Number of Diagnoses	4.77	2.72	5.82	2.78
Bed Size of Admitting Hosp.	121.1	124.4	160.0	185.0
Distance to Admitting Hosp. (km)	33.7	29.7	32.6	29.0
Closest	.483	.500	.481	.500
Private Insurance	.372	.483	.303	.460
Medicare	.439	.496	.456	.498
Medicaid	.114	.318	.171	.377
Patient Obs	623,146		1,036,361	

is given by,[15]

$$u_{ijtd} = \xi_{jd} + w_{ijtd}\beta + \upsilon_{ijtd}. \tag{1}$$

Where ξ_{jd} is the hospital time-invariant unobserved effect, w_{ijtd} is a vector of hospital/patient characteristics. The utility shock, υ_{ijtd}, is a mean zero shock and follows an $i.i.d.$ Type I extreme value distribution. Patients select the hospital in their choice set that generates the highest utility. The utility of the outside good (admission to a hospital greater than 85 km away) is normalized to 0.

We include a parsimonious set of variables in w_{ijtd} that capture the impact of conversion on patient preferences. Table 3 lists the variables included in w_{ijtd}. The impact of CAH conversion on patient utility is captured through the CAH indicators and their interactions as well as through the impact on bed size in so far as that is impacted by conversion. We include interactions of whether the hospital ever converts with distance and an indicator of whether the hospital was the closest to control for pre-conversion differences between CAH and non-CAH hospitals. Importantly, we include interaction between the indicator of whether the hospital ever converted with the time trend to control for differential trends between CAH and non-CAH hospitals.[16]

Table 3: Variables in utility function

Variables		
CAH status	Distance (km)	Distance^2
Bed size	DRG Weight $\times$ Beds	Closest hospital
Distance $\times$ Beds	Distance $\times$ Closest	CAH Status $\times$ Distance
CAH Status $\times$ Closest	Ever CAH $\times$ Distance	Ever CAH $\times$ Closest
Ever CAH $\times$ Trend	Year Indicators	

Note: "Ever CAH" is an indicator for whether the hospital ever converted to CAH status.

[15]In practice, the patient's choice of hospital is also influenced by the patient's physician preferences over hospitals. Under the assumption that the physician acts as an agent of the patient, the parameter estimates reflect patient preferences.

[16]We explored whether to include higher-order trends interacted with and indicator for whether the hospital ever converted and found that the coefficients on the high-order terms were very small and insignificant.

Let $\delta_{ijdt} = \xi_{jd} + w_{ijtd}\beta$ denote the "mean utility" from being admitted to hospital j. Given the Type I assumption on the errors, we can write the choice probabilities for patients as

$$Pr_{ijdt} = \frac{\exp(\delta_{ijdt})}{1 + \sum_{k \in C_{it}} \exp(\delta_{ikdt})} \tag{2}$$

where C_{it} denotes patient i's choice set.

Price does not enter the patient's utility. There are two reasons for this. First, hospital prices for our broad set of hospitals is not available. Second, a majority of rural patients are covered by Medicare and do not face any price variation. While the privately insured patients may face some cost sharing arrangements, the net amount of cost sharing is very low.

Given the distributional assumption on υ_{ijtd}, it is straightforward to estimate the parameters using maximum likelihood. The consumer utility parameters will be identified from the geographic variation in patient and hospital locations and the extent to which consumers choose hospitals based on characteristics such as distance, CAH status and hospital size. Because we allow for hospital fixed-effects, the effects of CAH status and bed size changes will be identified from the difference-in-difference. Of course, if CAH conversion is correlated with unobservable hospital characteristics which is likely given the high correlation with observable characteristics, failure to include hospital fixed-effects will bias the parameters estimates.

Conversion implies that hospitals must abide by limitations on the number of available beds and the average length-of-stay. These limitations may have broad implications for hospital operations. Reducing capacity may diminish the scope economies of the hospital and as a consequence they may focus on more common, lower acuity conditions. If this is the case, then patients with more complex illnesses could be made worse off by CAH conversions as hospitals shed high acuity, low prevalence services. Because some conditions such as acute myocardial infarctions (AMIs) both require urgent care but also often necessitate

complex medical treatments, the impact of the Flex program for patients with these illnesses is even more ambiguous. We evaluate how CAH conversion affects patient demand for hospitals, allowing for that demand to vary on the basis of illness. In addition, the impact of conversion may differ by the type of health insurance as CAH conversion changes the reimbursements for Medicare patients but does not directly affect payments for the privately insurance population. In order to investigate the impact of CAH conversion along these different dimensions we estimate the utility parameters for different populations defined by insurance status, specific diagnoses and Medical Diagnostic Category (MDC).

We focus on five specific diagnoses: AMI, heart failure, hip fracture, pneumonia and stroke. These diagnoses were chosen because in-hospital mortality is high and thus they are important conditions to monitor and with the exception of hip fracture they are relatively common afflictions. The conditions are defined using the principal ICD-9CM[17] diagnoses field in listed in the discharge data. We also analyze the seven most common MDCs: circulatory system, digestive system, injuries, mental diseases, musculoskeletal system, obstetrics/newborns and respiratory system and group the remaining MDCs into the 'other' category.

4.1 The Impact of Conversion on Patient Volume

We calculate the impact of CAH conversion on the volume of discharges using the parameters estimates from the multinomial logit. To do this calculation, we compare the change in expected volume of the CAH hospital from converting assuming the hospital would remain at its pre-conversion size and holding the CAH status of all other hospitals fixed. That is, we are calculating the average treatment effect on those hospitals that select into treatment (conversion).

Given the parameter estimates, the expected volume of patients as a function of CAH

[17]International Classification of Diseases, Ninth Revision, Clinical Modification

status and bed size is given by

$$EVol_{jt}(CAH_{jt}, Beds_{jt}) = \sum_{i=1}^{I} Pr_{ijdt}. \tag{3}$$

We calculate the mean impact of hospital j's CAH conversion (for the converters) as:

$$\Delta_{jt}^{CAH} = EVol_{jt}(CAH_{jt} = 1, Beds_{jt}) - EVol_{jt}(CAH_{jt} = 0, Beds_{jt}^{pre-CAH}) \tag{4}$$

where $Beds_j^{pre-CAH}$ is the beds size of the hospital prior to conversion. For these calculations we hold the characteristics of the other hospitals constant.

In our framework, conversion can affect volume through two pathways. First, most hospitals reduced bed size in order to qualify for the program. Reductions in capacity may, in turn, affect the attractiveness of the hospital. Smaller hospitals may reduce the range of services they provide, and they may be more likely to be capacity constrained. Second, conversion may affect the patient's perception of the quality of the hospital which may differ by patient characteristics. CAH hospitals receive cost-based reimbursements for outpatient services and CAH hospitals may emphasize those services. We parse the changes in demand from CAH conversion into these two pathways. Specifically, we decompose the impact of CAH conversion into a 'Beds' and 'CAH' effect. To isolate the CAH effect, we replace $Beds_{jt} = Beds_j^{pre-CAH}$ in (4) and recalculate Δ_{jt}^{CAH}. The 'Capacity' effect is similarly computed. For the 'Capacity' effect, we set $CAH_{jt} = 0$ and recalculate Δ_{jt}^{CAH}.

4.2 Welfare Analysis

A focus of this paper is on quantifying the welfare impact of the Flex program. This program imposes an implicit policy trade-off. Hospitals receive more generous payments but must agree to generally binding constraints on their capacity and average length-of-stay. Statically,

these constraints almost surely weakly reduce consumer welfare. A principal policy goal of the program is that the increased payments will provide financial stability and reduce the number of rural hospital exits. Reducing hospital exit likely increases consumer surplus. The net impact of the program on consumers depends on whether the gain of forestalled hospital exit outweighs the welfare loss from the loss of utility from CAH conversion.

Given the utility parameter estimates in (1), it is relatively straightforward to construct the consumer surplus loss from CAH conversions. We can use these estimates to explore the welfare consequences of the program under different counterfactuals which make explicit the policy trade-offs of the program. The multinomial logit specification implies the following closed form solution for the consumer surplus as shown in Small and Rosen (1981):

$$CS_{it} = \ln \sum_{j=0}^{J} \exp(\delta_{ijt}) \tag{5}$$

The loss in welfare from the requirements placed on converting hospitals is given by

$$\Delta CS_t = \sum_i (CS_{it}^{NoCAH} - CS_{it}) \tag{6}$$

where where CS_t^{NoCAH} calculates consumer surplus setting the CAH indicators equal to 0 and the bed size to pre-conversion levels (for converting hospitals).

We then compare ΔCS_t to the amount consumer surplus lost from different, counterfactual exit rates. We simulate hospital exit rates from 0 to 15% where for a given exit rate we randomly draw the hospitals that are treated as exiters. We then calculate the expected consumer surplus for that exit rate using (5). In order to get a sense of the welfare impact of the Flex program, we compare the welfare effects of CAH conversion to consumer surplus loss from differential exit rates from a counterfactual world in which CAH hospitals do not exist.

5 Results

5.1 Summary Evidence of the Impact of CAH Conversion

Table 4 presents summary statistics in 1998 and 2005 for the rural hospitals in our sample broken down by those institutions that eventually converted during our sample time frame and for those hospitals that did not.[18] There are two important themes that emerge from these statistics. First, converting hospitals are very different than non-converting hospitals along several dimensions prior to their conversion. Second, conversion reduces the volume of patients (relative to non-converters) and changed the mix of patients in the hospital.

Converting hospitals were significantly smaller (measured by admissions and bed size) prior to their conversion than non-converting hospitals. These hospitals had, on a patient weighted basis, 3.2 times fewer beds (46 v. 150 beds) than hospitals that did not convert. Future CAHs also treated approximately 2.7 times fewer patients than non-converting hospitals prior to their conversion. Converting hospitals offered fewer services as measured by the number of unique DRGs treated. On average, future CAH's patients were diagnosed with 59 unique DRGs while non-converters' patients spanned 101 unique DRGs.[19]

In addition to the converters and non-converters differing in size and span of services in the first year of our sample, the characteristics of the patient populations meaningfully differed between these two hospital classes. Patients admitted to hospitals that were to become CAHs had 30% shorter mean length-of-stays and and a 39% lower average DRG weight. Future CAH hospitals treated relatively more Medicare and less privately insured patients. The more generous payments that come with CAH conversion only apply to Medicare patients and thus it is not surprising that converting hospitals admit more Medicare patients prior to conversion. Patients admitted to non-converting hospitals, on average, traveled much further

[18] Here we limit the analysis to patients admitted to hospitals that are continuously in our sample from 1998 to 2005.

[19] The fewer unique DRGs could also be a consequence of the size of the patient population. However, controlling for the number of patients, future converters patients spanned significantly fewer DRGs.

(42 v. 17 km) and were much more likely to by-pass a closer hospital on their path to the admitting hospital. For hospitals that would eventually convert, 75% of their patients were admitted to the closest hospitals, while for the non-converters, only 35% of their patients were they being admitted to their closest hospital.

Not only are converting hospitals meaningfully different than non-converting hospitals prior to their conversion, the summary statistics also suggest that conversion affected the size of the hospital and the distribution of the patient population (along a few dimensions) relative to non-converting hospitals. Not surprisingly, the mean bed size of the converting hospital dropped by approximately 50%. The volume of patients was virtually unchanged after CAH conversion while non-converters saw a large increase in their volumes. Converting hospitals experienced a modest decline in the number services provided while non-converting hospitals showed a large increase in the number of unique DRGs over this period.[20]

In Table 5 we present the distribution of diagnoses and MDCs for converting and non-converting hospitals for the first and last year of our sample. Prior to conversion, CAHs treated a greater percentage of patients with pneumonia and heart failure and less patients with suffering from AMI. CAH also had a greater percentage of their patient load in the Digestive Track and Respiratory MDC and smaller percentage in the Mental Health and Muscular-Skeleton MDC than non-converters in 1998. Interestingly, after converting CAH hospitals experience a large relative decline in AMI patients (45%) and a modest rise in pneumonia patients. Correspondingly, there is a notable decline in the Circulatory System MDC for CAH hospitals.

In sum, CAH hospitals were different from non-CAH hospitals prior to their conversion. Conversion lead to a large decline in mean bed size, a decline in their relative volume, a relative reduction in the number of services offered and a reduction in the number of

[20]Again, it is possible that the relative decline in number of unique DRGs is driven by the decline in volume. We have estimated the impact of CAH status on the mean number of diagnoses in a fixed effects framework controlling for the volume of patents and this finding is robust.

Table 4: Patient Characteristics – By 2005 CAH Status

	1998		2005	
Variable	Mean	S.D.	Mean	S.D.
CAH in 2005				
Number of Hospitals	171		171	
Mean Admissions	775	533	773	525
Bed Size of Admitting Hosp.	45.8	16.1	24.1	2.60
Age	52.2	30.5	54.4	30.4
Female	.60	.49	.62	.49
Length of Stay	3.27	3.68	3.25	3.77
Length of Stay > 4 Days	.20	.40	.18	.39
DRG Weight	.88	.59	.87	.56
DRG Weight > 1.5	.10	.30	.085	.28
Number of Unique DRGs	60.1	33.0	57.8	31.3
Number of Diagnoses	4.61	2.67	5.37	2.76
Distance to Admitting Hosp.	16.9	18.7	17.1	19.0
Closest	.75	.44	.75	.43
Private Insurance	.33	.47	.27	.44
Medicare	.49	.50	.52	.50
N	132,626		132,129	
Not CAH in 2005				
Number of Hospitals	166		166	
Mean Admissions	2,098	5,637	3,046	7,574
Bed Size of Admitting Hosp.	149.5	139.6	129.1	144.4
Age	49.6	28.2	51.4	27.8
Female	.57	.50	.57	.49
Length of Stay	4.35	5.77	4.21	5.87
Length of Stay > 4 Days	.29	.45	.26	.44
DRG Weight	1.26	1.28	1.33	1.34
DRG Weight > 1.5	.22	.42	.26	.44
Number of Unique DRGs	107.6	80.8	114.2	83.2
Number of Diagnoses	4.87	2.75	5.76	2.81
Distance to Admitting Hosp.	41.6	30.8	45.3	31.4
Closest	.35	.48	.32	.47
Private Insurance	.39	.50	.35	.48
Medicare	.42	.49	.44	.50
N	397,167		443,720	

Note: Mean Admissions are unweighted across hospitals. Sample consists of patients residing in states that are in the data for all years.

Table 5: Distribution of Specific Diagnoses and MDCs – By 2005 CAH Status

	CAH in 2005		Not CAH in 2005	
	1998	2005	1998	2005
Specific Diagnoses				
AMI	.020	.011	.025	.025
Heart Failure	.041	.040	.025	.025
Hip Fracture	.0027	.0029	.0020	.0020
Pneumonia	.077	.087	.036	.034
Stroke	.029	.022	.028	.023
MDCs				
Circulatory	.15	.13	.17	.17
Digestive	.12	.11	.086	.088
Injury	.011	.010	.012	.014
Muscular-Skeleton	.060	.065	.11	.12
Mental Health	.027	.018	.054	.034
Obstetrics	.23	.23	.21	.20
Respiratory	.15	.16	.088	.093
Other	.25	.28	.26	.28

patients with high severity illnesses, despite the emergency room requirement. Next, we estimate the demand parameters to more precisely quantify the volume impact and the welfare consequences of conversion.

5.2 MNL Demand Estimates

The summary statistics presented above suggested that conversion reduced hospital demand. Of course, these reduced form estimates are not robust to shifts in population or changes in the characteristics of other hospitals which could plausibly be correlated with CAH conversion. In this section we estimate parameters of the utility function for inpatient hospital choice for rural residents from the MNL model discussed in Section 4. This exercise serves three purposes. First, we use the parameter estimates to quantify the impact of CAH conversion on the demand for inpatient services. We do this for all patients in our (random) sample, by

type of insurance, by specific diagnoses and MDCs. Second, the parameter estimates allow us to decompose the demand changes into a 'CAH' effect and a capacity change effect. Third, estimating the utility parameters allows use to perform welfare analysis of the impact of the CAH program.

Table 6 presents the parameter estimates for the entire sample, the Medicare and privately insurance populations. For the sake of brevity, we present the MNL parameter estimates for the specific conditions and the MDCs in the Appendix. The coefficient estimates closely align with expectations and the results from the hospital choice literature. Increasing distance to the hospital reduces utility by the impact is concave. Patients also have a strong preference for the hospital that is closest to them and the more severely ill the patient is (as measured by the DRG weight) the greater is their utility from larger hospitals. For the entire sample and for the private pay patients, patient utility for hospitals that eventually converted were declining prior to conversion. The coefficients on Ever CAH $\times$ Trend is negative and significant. However, for Medicare enrollees, this parameter is not significantly different from zero. The interactions between CAH status and bed size with the different variables make interpreting the coefficients challenging. For this reason, we use the MNL parameter estimates to calculate the impact of conversion on patient volume.

Table 7 presents the average impact of conversion on the percent change in the number of admissions by insurance type and specific disease, and Table 8 presents the same information by MDC. Here we calculate the relative change in volume for CAH hospitals that is attributable to their conversion based on the coefficient estimates from the MNL in 2005. These tables have three columns corresponding to a different approach to calculating the change in volume. The first column presents the percentage change in volume assuming that all CAH hospitals converted simultaneously. The second column calculates the change in volume from converting assuming that no other hospital converted. The third column calculates the change in volume from converting assuming that the hospitals maintain their

Table 6: MNL Parameter Estimates

	Patient Sample		
	All	Medicare	Private
CAH status	0.00238	0.0282	0.00734
	(0.0280)	(0.0262)	(0.0266)
Distance	-0.0946	-0.105	-0.0880
	(0.000392)	(0.000384)	(0.000362)
Distance^2	1.67e-04	2.53e-04	1.09e-04
	(4.32e-06)	(4.20e-06)	(3.95e-06)
Closest Hospital	0.385	0.465	0.283
	(0.00736)	(0.00731)	(0.00682)
Bed Size	-0.000761	-0.00116	-0.000162
	(0.000128)	(0.000130)	(0.000109)
Beds×Dist	2.96e-05	3.38e-05	2.60e-05
	(7.71e-07)	(7.71e-07)	(6.86e-07)
CAH×Dist	-0.00218	-0.00267	-0.00121
	(0.000559)	(0.000517)	(0.000539)
Beds×DRG Weight	8.66e-04	9.87e-04	8.79e-04
	(8.79e-06)	(8.75e-06)	(8.08e-06)
CAH×Closest	-0.0464	-0.101	-0.0715
	(0.0223)	(0.0208)	(0.0216)
Ever CAH×Dist	0.0112	0.0113	0.0125
	(0.000399)	(0.000385)	(0.000362)
Ever CAH×Closest	0.617	0.709	0.594
	(0.0156)	(0.0152)	(0.0143)
Ever CAH×Trend	-0.014	-0.0039	-0.024
	(0.0027)	(0.0026)	(0.0025)
Patients × Choices	10,414,483	11,473,575	12,375,764

Note: Standard errors in parentheses

pre-conversion bed size and holding the characteristics of the hospital hospitals at their pre-conversion levels.

Tables 7 and 8 show that CAH conversion significantly reduced patient volume and those reductions differ across payer class, diagnoses and MDC. On average, conversion significantly reduced volume. Across all patients CAH conversion reduces admissions, on average, by 5.4% holding the characteristics of all hospitals fixed at their pre-CAH conversion levels. If no hospital were allowed to convert, CAH hospitals' volume would increase 4.7%. In general, the difference between the two approaches to calculating the impact of CAH conversion is small – approximately one percentage point.

The impact of conversion differs by the principal payer and specific condition. On average, conversion reduces the demand for Medicare patients approximately 6% and 5% for privately insured patients. Across the specific diagnoses, the largest reduction from conversion occurred in AMI patients and the smallest reduction was for pneumonia patients. These results aligns with the goals of the program to direct more acutely ill patients requiring more aggressive medical interventions away from CAH hospitals. Most AMI patients are treated with reperfusion therapy, such as percutaneous coronary intervention (PCI) or clot busting drugs. PCI requires the presences of cardiac cathertization lab and the procedure is performed by an interventional cardiologist nether of which are available to most CAHs. Of course, the treatment of AMI is time sensitive and it is possible that rural AMI patients are traveling further to receive care because of CAH conversion. Across MDCs, there is also significant variation in the volume response to conversion. The largest conversion response is for Injuries (a 14% decline) and the smallest decline is for Respiratory MDC (3.5% decline).

The third columns of Tables 7 and 8 present the impact of conversion holding the capacity at pre-conversion levels. This allows us to decompose the decrease in demand for conversion into a "CAH effect" and a "Capacity effect." For all payer populations, specific diagnoses and MDCs, the decline in demand associate with conversion is almost entirely driven the

"CAH effect." That is, the bed size restrictions do not meaningfully impact utility. This is consistent with our discussions with rural hospital experts who note that most CAH hospitals had excess capacity prior to conversion.

In sum, CAH conversion reduces the value that patients place on those hospitals. The impact is heterogenous across patients with different health insurance arrangements and diagnoses. This is surprising as we found only minor changes in relevant statistics like length of stay and DRG weights in our descriptive analysis in Table 4. The negative impact of CAH conversion must thus be driven by the negative perception of quality of treatment in converted hospitals due to the findings in the medical literature (e.g. Joynt et al. (2011) and Lutfiyya et al. (2007)). Our results show that these findings are confirmed by patient choice data taking into account the heterogeneity of hospitals prior to conversion.

To understand the net impact of the Flex program requires comparing this static welfare loss to any potential consumer surplus gained from the program forestalling exit. We explore that question next.

Table 7: Predicted Percentage Change in Volume from De-Converting CAH Hospitals

Sample	De-converting All CAHs Simultaneously	De-converting Holding Other Hospitals Fixed	"CAH Effect"
All	-4.66	-5.40	-5.84
Medicare	-5.20	-6.02	-6.46
Private	-4.53	-4.93	-5.53
		Specific Diagnoses	
AMI	-8.15	-8.67	-8.96
Heart Failure	-3.93	-4.96	-4.89
Pneumonia	-1.99	-2.80	-2.98
Hip Fracture	-3.95	-5.06	-5.16
Stroke	-4.61	-5.18	-5.64

Note: "CAH Effect" is the impact of conversion with bed size set at pre-conversion levels.

Table 8: Predicted Percentage Changes in Volume for Eventual CAH Hospitals by MDC

Sample	De-converting All CAHs Simultaneously	De-converting Holding Other Hospitals Fixed	"CAH Effect"
Circulatory	-6.64	-7.31	-7.56
Digest	-3.39	-3.90	-4.33
Injuries	-12.18	-14.19	-14.40
Muscular-Skeleton	-5.38	-5.28	-5.83
Mental Diseases	-4.24	-4.93	-7.15
Obstetrics	-4.69	-5.11	-4.44
Respiratory	-2.89	-3.54	-3.75
Other	-7.30	-8.87	-9.10

Note: "CAH Effect" is the impact of conversion with bed size set at pre-conversion levels.

5.3 Welfare Effects of the Flex Program

One of the principal goals of the Flex program is to prevent rural hospital exit. As we shown above, converting hospitals reduce the utility that patients receive from being admitted to them. In our first welfare analysis, we quantify the loss in welfare from CAH conversion using a distance metric. The policy tension in the Flex program is between the increase in consumer surplus attributable to maintaining access to these hospitals by preventing exit and the decrease in consumer surplus associate with CAH conversion. In our second welfare analysis, we calculate the reduction in entry rates necessary for the Flex program to increase rural resident welfare.

We first compute the distance that yields the same utility in (1) given our estimates for a Non-CAH hospital with a capacity of 42 beds (the mean size of hospitals prior to conversion) and a CAH hospital of otherwise the same characteristics. Specifically, we find the change in distance, $\Delta dist$, that make patient indifferent between admission to a CAH and a non-CAH hospital for a given set of hospital characteristics. That is, we find the $\Delta dist^*$ that solves $\hat{u}(CAH = 1, dist, x^{CAH}, Beds = 25) = \hat{u}(CAH = 0, dist - \Delta dist^*, Beds = 42)$ where $\hat{u}$ is the fitted utility values given the MNL estimates.

On average, patients would are indifferent between a CAH and non-CAH hospital if the CAH hospital is between .87 km (if the non-CAH hospital is 10 km away) and 1.4 km (if the non-CAH hospital is 25 km away). That is, according to this distance metric the welfare loss from conversion is modest but meaningful.

To implement our second and principal welfare analysis, using our parameter estimates of (1) from the entire sample, we calculate the mean consumer surplus under different hospital exit rates for hospitals that converted. As we are interested in comparing the welfare under the Flex program to the counterfactual in which the Flex program was not enacted, we assume there are no CAH hospitals and converting hospitals are assigned their pre-conversion capacity. We assume that the likelihood of exit is random across CAH hospitals for a given exit rate.[21] In this exercise we also calculate the mean distance to the closest hospital and average distance traveled to the chosen hospital. We then compare the consumer surplus and distance measures under the different exit rates to those values under the Flex program.[22]

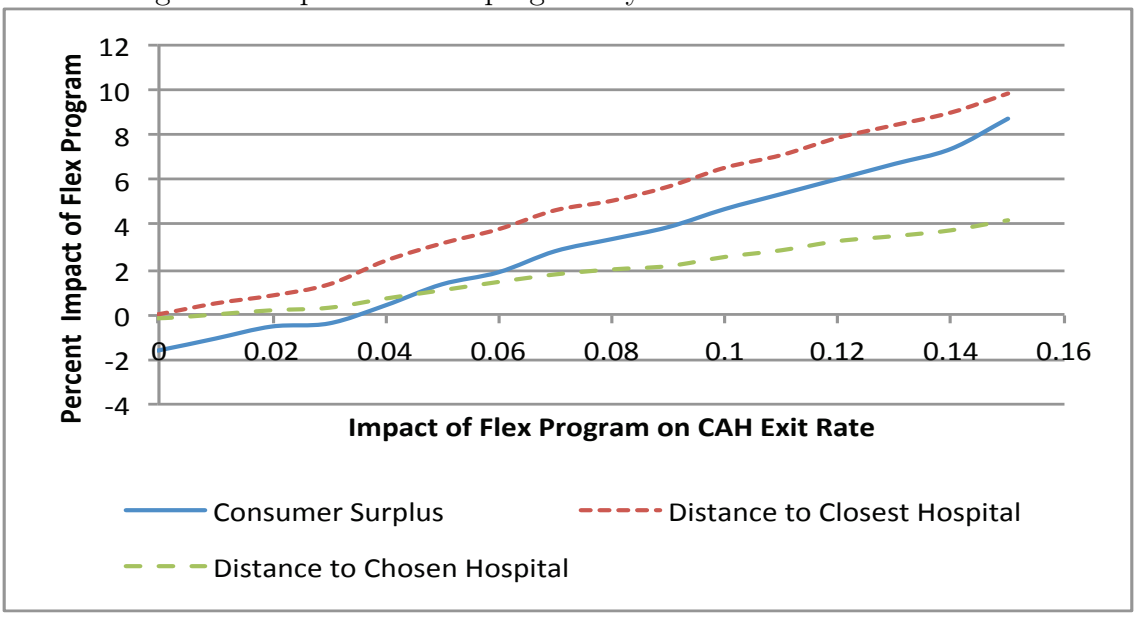
The results from this welfare analysis are presented in Figure 3. In the figure, we graph the percentage change consumer surplus, closest hospital and distance to chosen hospital relative to those values under the Flex program. The results in Figure 3 highlight the policy tension in the Flex program. The break-even point for consumer surplus is an exit rate of approximately .04. If the Flex program, reduced the exit rate for converters by .03 or less, the program reduced rural patient welfare. Of course, the converse holds as well. If the Flex program prevented more than 4% of converting hospitals from exiting then the program was consumer surplus improving. Determining the counterfactual exit rate is challenging and requires solving for the dynamic oligopoly exit game played by rural hospitals. A task beyond the scope of this paper but one we take up in companion work (Gowrisankaran et al. (2010)).

[21] Because we assume exit is random across CAH hospitals, the results from this exercise can be viewed as a conservative estimate of the necessary exit rate reduction as the likely exiters will also likely be the hospitals that are the least valued from the patient's perspective.

[22] The exit rate for CAH hospitals is less than .01 (Gowrisankaran et al. (2010)).

The impact of the Flex program on travel time to the chosen hospital is less dramatic than its impact on consumer surplus. Of course, for all non-zero exit rates, the Flex program will result in a reduction in the mean distance to the closest hospital, and for all exit rates above .01 the Flex program reduces the mean distance to the chosen hospital. The impact of the Flex program on distance to hospital chosen is less dramatic than that to nearest hospital. This stems from the fact that patients are willing to travel longer distance to avoid CAH hospitals.

Figure 3: Impact of CAH program by Counterfactual Exit Rate



6 Conclusions

This paper estimated the impact of the Medicare Rural Flexibility Program on the demand for inpatient services. We find that patients are willing to travel significant distances to avoid visiting a CAH hospital that faces length of stay restrictions and consequently specializes in a limited range of services. The reduction of bed capacity to fulfill the CAH bed limit of 25 beds appears to have affected patient choice only in a minor fashion. We examine to

what extent the impact of CAH conversion varies by condition and type of health insurance arrangement. The results suggest that while the magnitude of the CAH effect varies by condition, CAH conversion reduces the desirability of a hospital across most conditions and health insurance arrangements. We calculate that the welfare loss from CAH conversion will offset only if the counterfactual exit rate is .04. However, changes in the quality of care provided by these hospitals may swamp the dimensions of welfare we consider here. In future research, we examine the quality consequences of the Flex program. Finally, Gowrisankaran et al. (2010) specify a dynamic oligopoly model with hospital exit and conversion to CAH status. The aim is to compute counterfactual equilibrium market structures to examine the impact of eliminating and modifying the Flex program on access to hospitals and patient welfare.

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7 Appendix

Table 9: MNL Parameter Estimates – Specific Diagnoses

	AMI	Heart Failure	Pneumonia	Hip Fracture	Stroke
CAH status	-0.0718	0.00652	0.0463	0.0766	-0.0247
	(0.0774)	(0.0495)	(0.0375)	(0.198)	(0.0617)
Distance	-0.0827	-0.131	-0.156	-0.135	-0.106
	(0.000881)	(0.000795)	(0.000750)	(0.00330)	(0.000817)
Distance^2	-1.55e-05	-3.82e-04	6.26e-04	4.64e-04	2.07e-04
	(9.67e-06)	(8.89e-06)	(7.93e-06)	(3.57e-05)	(9.10e-06)
Closest Hospital	0.729	0.367	0.152	0.342	0.531
	(0.0185)	(0.0139)	(0.0121)	(0.0614)	(0.0155)
Bed Size	-0.00345	-0.00250	-0.000918	-0.00239	-0.000976
	(0.000267)	(0.000268)	(0.000263)	(0.00118)	(0.000265)
Beds×Dist	4.62e-05	4.56e-05	3.37e-05	5.25e-05	4.58e-05
	(1.56e-06)	(1.61e-06)	(1.68e-06)	(6.46e-06)	(1.54e-06)
CAH×Dist	-0.000121	-0.000256	-0.00144	-0.00429	-0.00159
	(0.00156)	(0.000995)	(0.000743)	(0.00396)	(0.00123)
Beds×DRG	1.25e-03	8.81e-04	6.58e-04	1.07e-03	5.35e-04
	(1.48e-05)	(1.84e-05)	(2.08e-05)	(6.46e-05)	(1.74e-05)
CAH×closest	-0.0397	-0.162	-0.122	-0.0643	-0.0270
	(0.0630)	(0.0381)	(0.0282)	(0.155)	(0.0491)
Ever CAH×Dist	0.00437	0.0140	0.0180	0.0149	0.0112
	(0.00100)	(0.000789)	(0.000644)	(0.00312)	(0.000862)
Ever CAH×Closest	0.768	0.639	0.532	0.641	0.725
	(0.0402)	(0.0286)	(0.0221)	(0.116)	(0.0335)
Ever CAH×Trend	-0.0814	-0.0111	0.000268	0.0218	-0.00664
	(0.00617)	(0.00516)	(0.00428)	(0.0203)	(0.0055)
Patients × Choices	2,429,930	3,235,314	4,344,669	1,914,86	2,664,897

Standard errors in parentheses

Table 10: MNL Parameter Estimates – MDCs

	Circulatory system	Digestive system	Injuries	Mental diseases	Musculoskeletal system	Respiratory system	Other
CAH Status	0.0685	-0.00818	0.0864	-0.288	0.0993	0.0159	0.0604
	(0.0350)	(0.0274)	(0.0877)	(0.0662)	(0.0345)	(0.0252)	(0.0344)
Distance	-0.0939	-0.115	-0.0983	-0.0649	-0.0825	-0.130	-0.0974
	(0.000441)	(0.000432)	(0.00112)	(0.000682)	(0.000404)	(0.000425)	(0.000476)
Distance^2	1.06e-04	2.83e-04	2.11e-04	9.20e-05	1.42e-04	4.11e-04	1.96e-04
	(4.91e-06)	(4.74e-06)	(1.25e-05)	(7.07e-06)	(4.31e-06)	(4.67e-06)	(5.24e-06)
Closest Hospital	0.559	0.367	0.523	0.398	0.418	0.313	0.435
	(0.00871)	(0.00769)	(0.0209)	(0.0140)	(0.00782)	(0.00727)	(0.00911)
Bed Size	-0.00258	-0.000497	-0.00106	0.00423	-0.000248	-0.00137	-0.00122
	(0.000137)	(0.000147)	(0.000382)	(0.000201)	(0.000129)	(0.000145)	(0.000158)
Beds×Dist	4.27e-05	3.79e-05	3.66e-05	-7.18e-06	1.98e-05	3.64e-05	3.68e-05
	(8.14e-07)	(8.92e-07)	(2.16e-06)	(1.17e-06)	(7.47e-07)	(8.90e-07)	(9.10e-07)
CAH×Dist	-0.00354	-0.000512	-0.00514	-0.000900	-0.00238	-0.000979	-0.00501
	(0.000709)	(0.000550)	(0.00170)	(0.00121)	(0.000664)	(0.000503)	(0.000681)
Beds×DRG Weight	1.15e-03	4.96e-04	4.88e-04	5.16e-04	6.27e-04	7.68e-04	6.28e-04
	(7.37e-06)	(9.35e-06)	(2.54e-05)	7.01e-05)	(1.16e-05)	(9.21e-06)	(1.13e-05)
CAH×Closest	-0.137	-0.0724	-0.254	0.432	-0.165	-0.101	-0.111
	(0.0282)	(0.0216)	(0.0703)	(0.0554)	(0.0282)	(0.0194)	(0.0275)
Ever CAH×Dist	0.00889	0.0145	0.0164	0.0109	0.00786	0.0147	0.0127
	(0.000492)	(0.000415)	(0.00119)	(0.000699)	(0.000449)	(0.000402)	(0.000494)
Ever CAH×Closest	0.746	0.609	0.812	0.790	0.877	0.581	0.710
	(0.0194)	(0.0155)	(0.0481)	(0.0348)	(0.0189)	(0.0145)	(0.0197)
Ever CAH×Trend	-0.0440	0.609	-0.0211	0.0643	-0.0171	-0.0177	0.00695
	(0.00325)	(0.0155)	(0.00821)	(0.0056)	(0.00305)	(0.00267)	(0.00333)
Patients × Choices	8,9751,17	9,813,739	1,310,445	4,1686,76	9,582,748	1,117,3801	7,019,073

Standard errors in parentheses