The Impact of the Medicare Rural Hospital Flexibility Program on Patient Choice*

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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. The program created a new class of hospital, the Critical Access Hospital (CAH), which receives more generous reimbursement in return for limiting its beds and services. The program's goal is to maintain access to hospital care. Estimates from a patient choice model show that patient utility from visiting a hospital was negatively affected by conversion. While the lower bed capacity appears to play a minor role, the reduction in services results in a 28 percent drop in admission rates.

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

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1 Introduction

In 1997, the U.S. government established the Medicare Rural Hospital Flexibility (Flex) program, which was designed to improve the access of rural residents to hospital care by changing Medicare reimbursement incentives. The Flex program is a voluntary program designed for rural hospitals. Participating hospitals must comply with a number of restrictions, principally limits on their capacity to 25 beds or less; on their patient length-of-stay to prescribed levels; and quality improvement measures. In return, they receive cost-based reimbursements from Medicare that are more generous than under the standard prospective payment system (PPS). Although we are uncertain of the legislative intent in mandating the reduction in beds and services, the mandate limits the financial exposure of the government to paying generous CAH reimbursements.

The Flex program has had a wide-ranging impact on the provision and cost of hospital care for rural residents. In the years since the program was established, about 1,100 rural hospitals (25 percent of all U.S. hospitals) have converted to CAH status. During this period, and likely as a consequence of the program, rural hospitals have, on average, become drastically smaller. In 1996, 14 percent of rural hospitals had 25 beds or less, while that figure rose to 50 percent in 2006. Although the program was designed for small rural hospitals, 98% of hospitals that converted by 2006 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 very costly: it is estimated that the program caused Medicare's payments to CAH hospitals to increase by 35% or $1.7 billion (MedPAC, 2005).

In a series of ongoing papers, we seek to understand the impact of the Flex program on health care access and choice for rural residents. The large scale of the Flex program, its costliness, and the contemporaneous change in capacity among rural hospitals all suggest that an evaluation of the consequences of the Flex program is important. Because the Flex program has likely forestalled exits by rural hospitals, it has improved access to hospital services to rural residents. However, the increase in hospitals comes at the cost of having smaller hospitals that offer fewer services. Thus, the impact of the program on rural residents is far from certain. This paper estimates a discrete choice demand system for hospital services to study how hospital conversions to CAH status affect the access and choice of hospitals by rural residents.

Our patient flow model and resulting identification strategy have several features that are motivated by our data and the specifics of the industry. First, we observe the locations of patients and hospitals. This allows us to include distance and functions of distance in the utility function. This in turn allows us to evaluate how conversion to CAH would differentially affect patients based on location, which is crucial to evaluating the impact of the Flex program on access. Second, our panel dataset starts at a time when there were no CAHs and continues to an environment where CAH hospitals dominate in many rural areas. This allows us to include hospital fixed effects in the model. Our model will then identify the extent to which the CAH status of a hospital affects patient utility and choice by examining the change in hospital patient flow following conversion to CAH status.

2 Data

We combine four different datasets: data on the timing of CAH conversion from the Flex Monitoring Team;[1] data on the number of hospital beds from the Medicare Cost Reports; data on hospital latitude and longitude from the American Hospital Association Annual Survey (AHA); and data on patient discharges from the Centers for Medicare and Medicaid Services (CMS) Health Services Area File. The Flex data also contain accurate information on the number of beds for the hospitals that converted. From the Cost Reports, the definition of beds is "number of beds available for use by patients," which corresponds roughly to the medical concept of a staffed bed.

The CMS Health Services Area File contains the number of Medicare patient discharges by the zip code of the Medicare beneficiary and year. Because the Flex program was aimed at securing access to health care for rural residents, we only consider rural zip codes. We characterize rurality of patients and hospitals by 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 have been used by CMS to target other rural policies, such as ambulance payments. In general, CMS considers all zip codes that have RUCA greater or equal to 4 to be rural, and we adopt the same criterion in this paper.

Our dataset spans thirteen years, from 1994 to 2006. The data are at the level of the zip code-hospital-year and record all such observations where the distance traveled is 150 KM or less. We observe a total of more than 1.5 million zip code-hospital-year observations.

Table 1: Summary Statistics

	1994		2006	
Variable	Mean	S.D.	Mean	S.D.
CAH Status	0.00	.015	0.13	0.33
Market share	0.104	0.171	0.099	0.163
Number of hospitals in choice set	12.7	7.5	13.2	7.6
Beds	234.4	193.9	227.0	217.9
Distance between zip code and hospital	69.7	38.3	72.0	38.1
Dummy for hospital being the closest	0.12	0.32	0.11	0.32
Beds if CAH in 2006	51.9	41.7	23.2	3.37
Share of hospitals > 150 KM	0.110	0.131	0.115	0.142
Number of unique hospitals	4,497		4,157	
Number of unique zip codes	13,118		13,409	
Number of zip code-hospital observations	111,970		119,986	

The unit of observation is: zip code-hospital (rows 1–7), zip code (row 8)

[1] 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 Flex Program, with one of its objectives being the improvement of the financial performance of CAH.

Table 1 presents summary statistics on the first and last years of our data which correspond to years before and after the implementation of the Flex program. From Table 1, CAH status accounted for 13% of all hospital-zip codes in the choice set in 2006 and virtually none in 1994.[2] Other statistics are very similar across the two years. The average market share of a hospital in a zip code is about 10 percent.[3] The average number of beds decreased modestly from 234 to 227 beds. The average distance to a hospital in the choice set was roughly 70 KM across zip codes. The average capacity among hospital-zip codes that ultimately converted to CAH status decreased from 52 beds in 1994 to 23 beds in 2006. Approximately 12 percent of hospital-zip code observations were listed as being the closest. The average probability of choosing a hospital further than 150 KM was 11% across zip codes. Our dataset contains 4,497 unique hospitals and 13,118 unique zip codes in 1994 and 4,157 and 13,409 respectively in 2006.

3 Model

We model patient choice as follows. Each period t, there is a set of Medicare patients $i = 1, \ldots, I_t$ who seek treatment for their illnesses. Patients are geographically dispersed and select a hospital for their care based on its distance and the characteristics of the hospital. Each patient makes a discrete choice from the available hospitals that are within 150 KM of her location, or the outside option, which corresponds to choosing a hospital outside of this radius. More precisely, the patient's utility of an inpatient admission is given by

$$u_{ijt} = \bar{\xi}_j + w_{ijt}\beta + \xi_{jt} + \upsilon_{ijt}. \tag{1}$$

Here, $\bar{\xi}_j$ is the hospital time-invariant fixed effect, w_{ijt} is a vector of hospital/patient characteristics including an indicator whether the hospital has converted to CAH status, the straight-line distance from the patient's zip code to the hospital, distance squared, an indicator for the closest hospital, hospital size in terms of number of beds, and interactions of these variables. Unobserved time-varying hospital desirability is captured by ξ_{jt}. The utility shock υ_{ijt} is a mean zero shock.

We consider two variants of the model. First, we assume that υ_{ijt} is distibuted *i.i.d.* extreme value. Second, that it is distributed with a nested logit structure (see Cardell, 1997). In this case, it is the sum of two terms, an *i.i.d.* type I extreme value unobservable multiplied by a parameter ρ and a term distributed $C(\rho)$ that is common across hospitals within a type. We model three types of hospitals: CAHs, non-CAHs and the outside option. We do not model the price of the hospital in our patient utility model since Medicare patients do not face any price variation across inpatient admissions.

We observe locations of consumers at the zip code level for each year. We assume that there are enough patients in every zip code that hospital shares at the zip code level are observed without error. A "market" in this framework corresponds to a zip code and year

[2] A few hospitals had CAH status in 1994 due to a pilot program.

[3] Shares are based on the universe of patients from the zip code including those who travel more than 150 KM.

combination. Let s_{jt} be hospital j's market share in year t in a zip code. Similarly, let s_{0t} be the share of patients in a zip code choosing the outside option. Under these assumptions, Berry (1994) shows that the random utility model in (1) implies that the logit model yields the linear estimating equation

$$\log(s_{jt}) - \log(s_{0t}) = \bar{\xi}_j + w_{jt}\beta + \xi_{jt} \tag{2}$$

and the nested logit model

$$\log(s_{jt}) - \log(s_{0t}) = \bar{\xi}_j + w_{jt}\beta + (1-\rho)\log(s_{j|type}) + \xi_{jt}, \tag{3}$$

where $s_{j|type}$ denotes the market share of hospital j among all hospitals of the same type. This specification allows us to treat ξ_{jt} as an econometric residual and estimate the demand parameters using OLS for the logit case. Because the within-group market share $s_{j|CAH}$ will be correlated with the residual ξ_{jt}, we estimate (3) by instrumental variables. We use the mean number of beds, mean distance and mean number of firms within group as instruments for log within-group share.

The consumer utility parameters will be identified from the extent to which consumers choose hospitals based on characteristics such as location, 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 the relative change in attractiveness of hospitals that convert to CAH status or change their number of beds.

4 Results

Table 2 presents the fixed effects logit and IV-fixed effects nested-logit estimates of the parameters of the utility function in equation (1). The parameters all are sensible and precisely estimated. All else equal, patients prefer hospitals that are closer and larger. Importantly, CAH conversion reduces the desirability of the hospital. The nested logit estimates indicate that there is significant within-type correlation in the errors – the estimate of $1-\rho$ is .55 and is very precisely estimated. We focus in our interpretation on the nested logit model.

To understand the economic significance of CAH conversion and size reductions we first exposit two figures. First, we calculate the minimum distance a patient would be willing to travel for admission to a non-CAH hospital with 25 beds rather than a CAH hospital that is located at zero distance to the patient but otherwise identical.[4] Our estimates imply that patients are willing to travel 25 kilometers extra for admission to a non-CAH rather than a CAH hospital. Second, we calculate the minimum distance a patient is willing to travel for admission to a non-CAH hospital of the average pre-conversion capacity of 42 beds rather

[4] After cancelling terms, we solve for the minimum distance x such that

$$\beta_{CAH} + \beta_{CAH\times Closest} = \beta_{Distance} \cdot x + \beta_{Distance^2} \cdot x^2 + \beta_{Distance\times Closest} \cdot x + \beta_{Beds\times Distance} \cdot 25 \cdot x.$$

Table 2: Parameter Estimates with Hospital Fixed Effects

	Logit		Nested Logit	
Variable	Coefficient	S.E.	Coefficient	S.E.
Beds	.0014456	.0000321	.0007796	.0000224
Distance	-.0696679	.0001632	-.0318895	.0001427
Closest	1.05212	.007183	.5418695	.005138
Distance^2	.0002525	9.87e-07	.0001038	7.67e-07
Distance $\times$ Closest	.0003418	.0002022	-.006852	.0001418
Beds $\times$ Distance	-7.27e-06	2.00e-07	-3.78e-06	1.39e-07
CAH	-.5799228	.0136762	-1.5042	.0097588
CAH $\times$ Distance	.0068226	.0002103	-.0007641	.0001475
CAH $\times$ Closest	.1198072	.0133283	.5838418	.0093456
$1-\rho$			.5508988	.0012585
Constant	2.460298	.008838	2.846575	.00622
N	1,533,111		1,533,111	

than a non-CAH hospital at zero distance of the average post-conversion capacity of 22.[5] Here our estimates imply that a patient will only travel 0.40 kilometers further to visit a larger hospital.

Table 3 presents more evidence of the economic magnitude of our findings by examining the effect of CAH conversion and capacity changes on patient volume. The first row provides the year 1997 predicted volume for the 1,083 hospitals that eventually converted to CAH. These volumes are the product of the the market size (total patient volume) and the market shares predicted by our demand model (using the estimated logit or nested logit parameters and the 1997 values of ξ_{jt}) aggregated over all the markets in which the hospital participates. According to the nested logit model, eventual converters were admitting an average 370 Medicare patients in 1997. The second row shows the effect of CAH conversion for these hospitals and is computed by solving for the predicted volume if a hospital unilaterally converted to CAH. The nested logit model implies a 28 percent drop, from 370 to 265 inpatient admissions. We similarly compute the changes in volume from unilateral changes in capacity to 25 beds and find that changing capacity to 25 beds (the CAH bed limit) only reduces inpatient admissions by about 2 percent. These results indicate that patients' choices were sharply reduced by the conversion per se, but much less so by the reduction in capacity.

There are several possible reasons for this large relative decline in admissions at converting hospitals. Converting hospitals may now be more likely to be capacity constrained – a large fraction of CAH hospitals have exactly 25 beds which is consistent with this hypothesis. CAH hospitals face length-of-stay restrictions which may cause them to reduce the types

[5] In this case, we solve for the minimum x such that

$$\beta_{Beds} \cdot 22 = \beta_{Beds} \cdot 42 + \beta_{Distance} \cdot x + \beta_{Distance^2} \cdot x^2 + \beta_{Distance \times Closest} \cdot x + \beta_{Beds \times Distance} \cdot 42 \cdot x.$$

of inpatient services. They may have reduced the number and types of inpatient services in order to focus available resources on outpatient and long-term care services. Conversion may have also affected physician admitting and referral patterns shifting their admissions away from CAH hospitals to larger non-converting hospitals. Future work will explore these possibilities in greater detail.

Table 3: Predicted Changes in Volume for Eventual CAH Hospitals

	Logit		Nested Logit	
Variable	Mean	S.D.	Mean	S.D.
Baseline	369.9	278.4	369.9	278.4
CAH Conversion	293.0	221.2	264.6	186.1
Capacity is 25 Beds	362.9	265.5	361.9	263.5
N	1,083		1,083	

5 Conclusions

This paper estimated a patient choice model to examine the effect of the CAH program on patient choice. We find that patients are willing to travel significant distances to avoid visiting a CAH hospital. We find that CAH conversion reduces the volume of patients admitted by 28%. The reduction of bed capacity to fullfill the CAH bed limit of 25 beds appears to have affected patient choice only in a minor fashion.

In related ongoing research, Gowrisankaran et al. (2009) examine to what extent the impact of CAH conversion varies by condition, as patients with different conditions may face different tradeoffs regarding the timeliness of care. We believe that understanding the reasons for the drop in volumes caused by conversion to CAH status are necessary to better understand the impact of the Flex program and also for helping guide future modifications in the program. Finally, Gowrisankaran et al. (2010) specify a dynamic oligopoly model with hospital investment in capacity, exit and conversion to CAH status. The aim is to compute counterfactual equilibrium market structures to examine the impact that the Flex program had on access to hospitals and patient welfare.

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