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FACTORS AFFECTING RURAL KENTUCKY PATIENTS HOSPITAL CHOICE AND BYPASS BEHAVIOR

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ABSTRACT OF THESIS

FACTORS AFFECTING RURAL KENTUCKY PATIENTS HOSPITAL CHOICE
AND BYPASS BEHAVIOR

This study examines the underutilization of rural hospitals in Kentucky. The authors study hospital and patient characteristics to determine why and how rural patients bypass local rural hospitals and how they make their decision in the hospital choice. A Health Care Service Survey conducted in rural Kentucky and hospital data drew from American Hospital Directory are used. A binary probit model and a conditional logit model are applied. The results suggest that the hospital quality, prior experiences and the satisfaction of the local hospital, along with patients' value of hospital size, reputation and patients' insurance coverage influence rural patients' hospital choice. The study offers seven policy implications to better utilize rural health care institutions.

KEYWORD: Rural hospital, bypass, hospital choice

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April 28th, 2011

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AND BYPASS BEHAVIOR

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THESIS

Xiao He

The Graduate School

University of Kentucky

2011

FACTORS AFFECTING RURAL KENTUCKY PATIENTS HOSPITAL CHOICE
AND BYPASS BEHAVIOR

THESIS

A thesis submitted in partial fulfillment of the requirements for the degree of Master of
Science in the College of Agricultural at the University of Kentucky

By

Xiao He

Lexington, Kentucky

Director: Dr. Alison Davis, Associate Extension Professor of Agricultural Economics

Lexington, Kentucky

2011

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Most of all I thank my family for all of their loving support. I would like to thank my husband for all of the sacrifices he had to make while I was working on this degree. I wish to thank my family in China, who support me emotionally all the time.

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CHAPTER 1 INTRODUCTION

1.1   Background

Rural hospitals provide essential health care services to nearly 54 million people, including 9 million Medicare beneficiaries in the United States (AHA, American Hospital Association). Rural Hospitals usually are smaller, and offer basic health care treatments that are less complex, including, among other things, ambulatory surgery, blood banks, emergency services, and swing beds [1]. They are predominantly owned by local governments or nonprofit organizations and concentrate operations on the delivery of primary health care services rather than specialty care.

Within recent decades data have shown that rural patients bypass rural hospitals and travel further to urban hospitals. Rural hospitals face financial pressures due to low occupancy rates and declining government payments. Rural hospitals have a higher percentage of Medicare patients because of the aging population in rural areas. As a result, rural hospitals are continuing to lose competitiveness and some of them are even struggling to stay open. The rest of the rural hospitals become vitally important for local users and for emergency care. It is important to understand the reasons for underutilization of rural hospitals and rural patients' hospital choice behavior as current health policy will change the landscape of rural health quality and quantity.

Lower occupancy rates in rural hospitals have increased costs and hindered efforts to introduce new technology and services. Decreasing competitiveness, defined as increasing of bypass behavior has resulted in serious consequences for rural hospitals. As

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[1] Swing Bed is a Medicare program designed to provide additional inpatient care to those needing extra time to heal or strengthen before returning home.

a result, rural hospitals are being underutilized which leads to even lower occupancy rates, higher costs, difficulty in retaining qualified health care professionals, and limited revenue for new technologies. This is truly a structural problem: rural residents are concerned about the lack of access to quality and affordable health care services while rural hospitals are facing risks of closure due to low utilization rates.

One would think that rural hospitals could also act as a monopoly because of the small market area and isolated location often defined by political boundary lines (Joskow, 1980; D. E. Farley, 1985; Luft and Maerki, 1984, 1985). However, rural hospitals must compete with larger, urban hospital spanning a large geographic area. As a result many patients regularly travel long distances for what is perceived better quality and desired services (Bronstein and Morrisey, 1991; AHA).

Rural residents may have a greater need for health care services because they tend to be older, poorer and more chronically ill than urban dwellers (Rowland and Lyons, 1989). Requiring long distance and more time travelling to a facilitated hospital sharply decreases the likelihood of rural patients' visit to those hospitals, especially among older residents. Thus it is critical to retain rural hospitals.

The importance of rural healthcare extends beyond the access to quality healthcare. Rural hospitals have a significant impact on a rural communities' economy. First, the local hospital is often the largest employer in a rural community after the school system. Hospitals hire people from the local community at all skill levels at a relatively high wage with benefits. Second, the local community benefits from the flow of additional wealth through indirect and induced effects from a hospital spending. Hospitals make a major contribution to the local and state economy through expenditures

for payroll, supplies, utilities, etc. Third, a highly utilized hospital could attract more patients, which will generate higher revenues and higher incomes for its employees. Higher income regions attract more doctors, physicians and specialists into the community, which will directly benefit rural residents. With income rising in the community, more rural residents could have access to private health insurance and have less financial restrictions on hospital choices.

The Federal Balanced Budget Act of 1997 created the Critical Access Hospital (CAH) to improve access to healthcare services in rural areas. A CAH is a hospital that is certified to receive cost-based reimbursement from Medicare. The reimbursement that CAHs receive is intended to improve their financial performance and thereby reduce hospital closures (Rural Assistance Center, U.S. Department of Health & Human Services). As of July 2009, there were 1,305 certified CAHs located throughout the United States and as of October 28, 2010, there were 29 certified critical access hospitals in Kentucky (Flex Monitoring Team Site[2]). Under this program, CAHs are eligible for cost plus 1percent reimbursement, flexible staffing and services, network with an acute care hospital for support[3], and also access to Flex Program grant money all of which have shown to improve a hospital's financial situation.

Kentucky is a diverse state with many pockets of rural communities. There are 89 rural counties in Kentucky and 42 percent of the population resides in these rural areas

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[2] Flex Monitoring Team Site: The Rural Health Research Centers at the Universities of Minnesota, North Carolina-Chapel Hill, and Southern Maine (the Flex Monitoring Team), are the recipients of a 5-year cooperative agreement award from the Federal Office of Rural Health Policy to continue to monitor and evaluate the Medicare Rural Hospital Flexibility Grant Program (Flex Program).

[3] The CAH and an acute care hospital must have agreements in place to address patient transfer and referral, communication systems, emergency and non-emergency transportation, credentialing, and quality assurance.

(USDA Rural Development). Many of those communities are plagued with low per capita income and low high school graduation rates. Without assuming causation or correlation, low income areas tend to also be less healthy. Thus many rural communities are plagued with high mortality rates, above average cancer rates, and high incidences of diabetes and obesity (State Cancer Profiles, National Cancer Institute, U.S. National Institutes of Health).

To promote the sustainability of rural hospitals in Kentucky, this study was founded by State Office of Rural Healthcare in Kentucky. It is designed to investigate the determinants of hospital choice by examining both hospital attributes and individual characteristics. This study combined the data collected from a health care service survey and from the American Hospital Directory, testing the effects of institutional and individual attributes on rural Kentucky patients' hospital choices. The study verifies a few popular findings in the previous researches ---- hospital quality and reputation, travel time and insurance, from institutional and individual side, respectively.

1.2   Organization

This thesis comprises 5 chapters: a literature review; empirical methods and exploratory models of rural patients' hospital choices. The first model uses residents' preferences for healthcare attributes as well as their perception of the local CAH. A probit model is used to estimate the factors that significantly affect bypass behavior. The second model employs both hospital and individual characteristics as factors affecting hospital choice, using a conditional logit model to estimate the related characteristics that affect their choices. Next, the data and the statistical approaches are explained along with the applicable hypotheses are proposed. Then the empirical results are presented. In the final chapter, discussions and the implications for rural health policy are presented.

CHAPTER 2 LITERATURE REVIEWS

2.1   Bypass Rates

The study of bypass behavior is not new in health care research. The majority of research focuses on micro-analytic models that explore consumer characteristics and hospital choice. In 1969, Kane found that Kentucky rural residents were bypassing the local hospital when he was studying the feasibility of a replacement hospital. Adams and Wright (1991) conducted a study of rural Medicare beneficiaries in rural Minnesota, North Dakota, and South Dakota and they found that 40 percent of the samples bypassed their closest hospital. Radcliff et al. (2003) studied the inpatient discharge data in California, Florida, New York, Maine, Oregon, South Carolina, and Washington in 1991 and 1996. In their study, rural patients were defined as patients whose zip codes are consistent with a nonmetropolitan county, and bypass behavior is defined as discharge from a hospital between 15 and 1,000 miles from the closest facility. The authors analyzed multiple geographic areas, payer-types, and types of diagnosis in an attempt to overcome limitations of previous studies where a single geographic area, type of payer, or type of diagnosis was examined. Through descriptive analysis, they found the overall bypass rate to be 30 percent, with little change between 1991 and 1996. Two similar studies both conducted by Liu et al. in 2007 and 2008 found that approximately 60 percent of survey patients bypassed their local CAHs for inpatient care and a wide range of bypass rates across the sample, ranging from 9.4 percent to 66 percent (Liu et al., 2008), and the other ranging from 16 percent to 70 percent (Liu et al., 2007).

Researchers (Hogan, 1988; Buczko, 1994; Truman et al., 2004) found that the majority of patients bypassed the local hospital for an urban hospital, while a much

smaller percentage of patients visited another rural hospital. A study conducted in New York found that 29 percent crossed county borders for hospitalization, and 19 percent traveled to an urban hospital for treatment (Hogan, 1988). In the first national study, Buczko (1994) found that nearly one-third of rural Medicare beneficiaries who were hospitalized in 1989 bypassed their local rural hospital in favor of admission to an urban hospital. Truman et al. found that the bypass rate for childbirth in rural Alberta women was 39 percent (n=6,032). In two-thirds of cases rural women delivered their babies in metropolitan or urban hospitals.

Some patients bypassed local hospitals in favor of another rural hospitals located further away than the existing rural hospital. In a Medicare beneficiaries study conducted in Minnesota, North Dakota, and South Dakota, Adams and Wright (1991) found that overall, of the 40 percent who went past their closest hospitals, 43 percent went to other rural hospitals. Buczko (1994) also found that half of rural Medicare beneficiaries who bypassed local hospitals in Delaware were admitted to another rural hospital.

2.2   Bypass Reasons & Hospital Choice Related Factors

The reasons for bypass are comprised of hospital attributes, individual characteristics, and policy systems. Although the rural areas across the country face different conditions, eleven factors affecting rural patients' hospital choice were shared based on the findings from previous research.

Figure 2-1: Joint Effects of Hospital Attributes, Patients' Value of Factors, and Individual Characteristics on Hospital Choice

Patients' Value of Factors.

Insurance, Income, Age, Ethnic, Gender, Children.

Specialists, Technologies, Size, Reputation, Ownership, Accessibility.

Hospital Choice
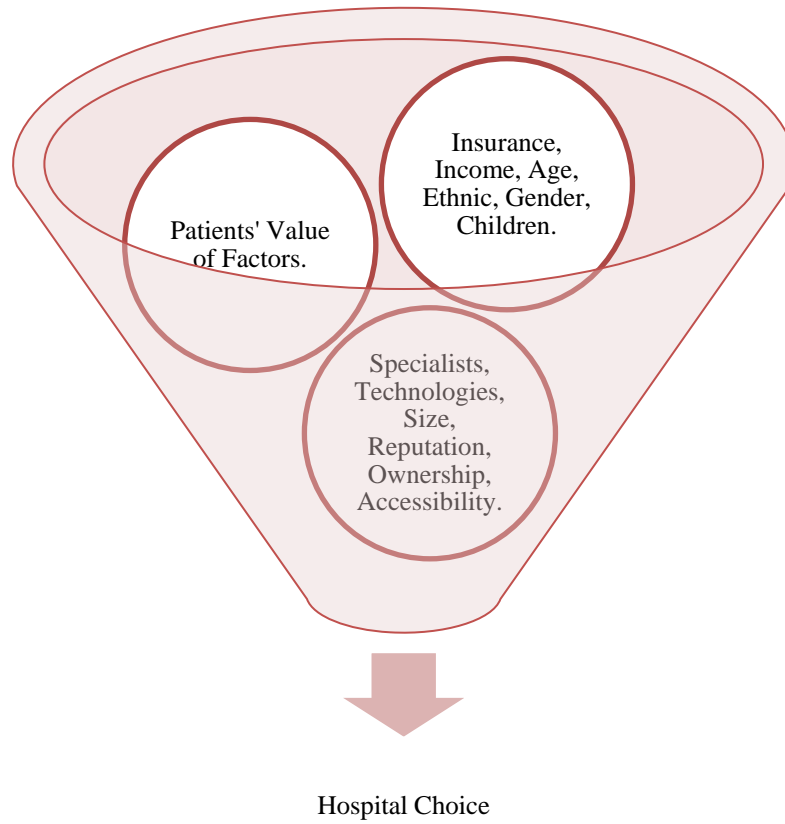
2.2.1 Hospital Attributes

Availability of Services/Specialists

Lack of specialty care including complex surgical treatment or specialists, when patients were severely ill, caused rural patients' bypass behavior (Inguanzo and Harjo, 1985; Adams and Wright, 1991; Buczko, 1994; Williamson et al., 1994; Taylor and Capella, 1996; Radcliff et al., 2003; Tai et al., 2004; Liu et al., 2007; Jintanakul and Otto, 2010).

Inguanzo and Harju's study (1985) asked questions: "other than for an emergency, what factors are most important when choosing a hospital?" Availability of specialists was ranked within the top three of the list. Adams and Wright (1991) analyzed hospital choices made by rural Medicare beneficiaries during 1986, and found that beneficiaries value a greater scope of services (the number, type, and intensity or complexity of services being provided), holding all other factors constant. For two hospitals differing by 10 on the Guttman scale[4], the estimated odds of choosing the one with greater scope of service is 39 percent higher. When increases 1.00 in the Guttman scale, an estimated 3 percent increase of the odds of choosing the more sophisticated hospital. Buczko (1994) found out that the bypass of rural hospitals by rural Medicare beneficiaries is associated with needing specialized care or severity and complexity of illness, often involving the need for surgeries. Williamson et al. (1994) estimated a bypass rate of 44 percent for surgical services among rural residents in Washington. Taylor and Capella (1996) summarized the determinants of consumer's choice of hospitals and described an approach for calculating determinant attributes that rural consumers deem important.

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[4] The Guttman Scale ranks a binary survey question into an order and the order can be transformed into a set of numerical values by assigning numbers with equal steps between two contiguous points.

Radcliff et al. (2003) concluded that, although rural patients perceived local rural hospitals as a viable option for general inpatient care services, they preferred other facilities for more complex treatments. Tai et al. (2004) found in their studies that hospitalizations for a technical-intensive condition, those involving a cardiovascular procedure, and those with more surgical procedures, were all associated with an increased probability of admission to a hospital other than the closest rural hospital. For example, the odds of admission to an urban teaching hospital over the closest rural hospital increased by 48 percent for each additional surgical procedure performed during a hospital stay. Liu et al. (2007) found that severity of illness was strongly associated with bypass. They directly asked respondents why they thought that patients seek health care outside their community. Over half (50.6 percent) identified the lack of specialty services as a major reason people leave the community for care. The most recent study completed by Jintanakul and Otto (2009) found that their indicators for elective (self-selected) and emergency admissions, life threatening diagnosis, and complex procedures were positive influences on bypass behavior, implying that inpatients admitted to a hospital with these issues are more likely to have chosen the nearest urban hospital relative to the nearest rural hospital. The results suggested that the unavailability of desired services is one of the major contributors to bypassing local hospitals.

Availability of Advanced technology/facility

Adams and Wright (1991) found that another important hospital attribute that affects patients' choice was the availability of advanced technology. Tai et al.'s (2004) study indicated that hospitalizations for a technically-intensive condition, those involving a cardiovascular procedure, and those with more surgical procedures were all associated

with an increased probability of admission to a hospital other than the closest rural hospital. They found that for each additional surgical procedure performed during a hospital stay, the odds of admission to an "urban teaching hospital" over their closest rural hospital increased by 48 percent. Patients perceive urban hospitals and teaching hospitals as more advanced facilitates.

Size

The study of outmigration for surgical services by Adams and Wright (1991) suggested that bed quantity positively and significantly affects a patient's choice of hospital. This study measured a hospital's size by the number of acute care beds. It found that patients assume that a hospital with more beds provides better services. They found the effect of bed quantity on hospital choice is fairly stable across specifications and that an increase of 10 beds raises the probability of a hospital being chosen by 1.7 percent, other factors held constant. Goldsteen et al. (1994) found that rural patients are more likely to choose rural hospitals with a larger number of beds over other rural or urban hospitals. The statistical results of a study by Roh and Moon (2005) indicated the number of licensed beds in a hospital, and the number of health care services provided by a hospital, are positively associated with a rural female patient's hospital choice. Hazard ratios[5] indicate that each additional health care service offered increases the probability that a hospital will be chosen by 1.1 percent. Each additional bed increases the likelihood of hospital selection by 0.7 percent. Jintanakul and Otto (2009) tested the model across different procedures, including obstetrical, miscellaneous diagnostic & therapeutic, operations on the musculoskeletal system, operations on the digestive system, and

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[5] Hazard Ratio is commonly used in survival analysis to present the effect of an explanatory variable on the hazard of an event.

operations on the cardiovascular. They found that higher scores for the measures of hospital capacity in the model were associated with a higher probability of choosing a hospital further away instead of the nearest rural hospital.

Reputation

Hospital reputation is another determinant of hospital choice (Burge et al., 2005; Liu et al., 2007).In Liu's study (2007), respondents were asked why they believed that patients seek health care outside their community. Ten possible reasons were offered and respondents could select any that applied. Poor reputation of local service providers (15.3 percent) ranked as the third highest response. In Burge's study (2005) of London patients' behavior, the result suggested that patients place a relatively high negative valuation on the choice, where the reputation of the alternative (shorter waiting times) hospital is either worse than the existing (longer waiting times) hospital or simply unknown. In particular, higher income patients have a negative valuation for a worse reputation which is over one third higher than those with incomes below 10,000 pounds. The result also indicates that patients with a higher socioeconomic status value hospital reputation more in their choice.

Ownership

Bronstein et al. (1990) included hospital ownership as a hospital characteristic in the model and asserted that ownership may be a proxy for willingness to accept indigent patients and that it may serve as a signal of other dimensions of perceived quality.

Hospitals are classed as for-profit, nonprofit, or publicly owned. From previous researches, the type of ownership influences a patient's hospital choice (Luft et al., 1990; Phibbs et al., 1993; Chernew et al., 1998; Sloan, 2001). Luft et al. (1990) examined how

hospital ownership affects hospital choice through seven surgical procedures and five medical diagnoses in three areas of California. Their analysis showed that patients are more likely to bypass the local hospital if they are publicly owned or proprietary. Chernew et al. (1998) found similar patient preferences in their research. Patients strongly preferred private hospitals to public and nonprofit hospitals. They perceive rural public or nonprofit hospitals as smaller, less technologically advanced, with less specialists, and able to provide only basic health care services, whereas for-profit hospitals are perceived to offer higher-quality health care. Phibbs et al. (1993) provided evidence in their study that publicly owned hospital may be less popular to private insurance holders. Sloan (2001) also proved in his study that publicly owned hospitals primarily serve indigent populations and Medicaid or Medicare recipients.

Accessibility

The distance between the hospital and the patient's residence are considered as measures of accessibility to health care. Almost all related studies found a decrease in the prevalence of bypass with the increase in distance to alternative hospitals (Adams et al., 1991; Goldsteen et al., 1994; Piette and Moos, 1996; Goodman, 1997; Radcliff et al., 2003; Tai et al., 2004; Basu, 2005; Pierce et al., 2007; Jintanakul and Otto (2009). The findings by Tai et al. (2004) confirm a strong negative relationship between distance and the choice of a hospital. Jintanakul and Otto (2009) found consistent results. Their spatial distance measure (straight-line distance) has a positive coefficient, implying that, for the rural Iowa patients, a longer distance to the nearest rural hospital is associated with a higher rate of utilizing the nearest urban or other hospitals.

2.2.2 Observed Quality vs. Perceived Quality

The six hospital attributes discussed above include hospital structures, technology, ownership, reputation and accessibility, which all could be considered as hospital quality.

Researchers differentiate quality with observed qualities and perceived qualities (Palmer et al., 1991). The former, focusing merely on structural and process measures, relates to professionally defined standards of care, and refers to whether health care services adhere to these standards. The latter relates to the views of patients (Donabedian, 1980), which is very subjective based on personal conditions and experiences. The focus of recent studies has shifted from addressing structural and procedural concerns to addressing patients' views regarding quality of care (Baltussen et al., 2002). This transition from emphasis on observed to perceived quality has been widely accepted over the last decade. In fact, the World Health Organization has argued that the user perspective is a critical factor in the effort to effectively manage health systems (Atkinson and Haran, 2005).

The techniques used to measure perceived quality of care is still in its infancy, and its measurement tools are often not well described and/or validated (Bryce, et al., 1992; Maynard-Tucker, 1994), with a few exceptions. Most patients cannot technically define what good medical care looks like. To one group of patients who are severely ill, the most important aspect of good medical care might be the availability of specialists and advanced technology; to another group who had bad experiences with nurse practitioners in the past, attitude of the staff will be the first concern; while to a third group that have above average incomes, hospital reputation and comfort might be the overriding factor.

Rural residents usually perceive rural hospitals as inferior to urban hospitals, and there is little research that has empirically tested the effects of perception on hospital choices.

Smith Gooding (1994) made a significant contribution by exploring the central role of consumers' quality perception in health care choice behavior. He cited a survey conducted by 1,680 Illinois Farm Bureau members in 1989, noting that 85 percent of the respondents indicated that they were concerned about the quality of medical care in their community (39 percent were very concerned). Eighty-one percent acted on their perceptions and traveled outside their local community for health care (Illinois Farm Bureau Research and Planning Department, 1989). By analyzing a mail survey of rural residents of southern Illinois, Smith Gooding discovered three critical findings. The first is that consumers do perceive their local hospital to be lower in quality across a wide range of quality-related attributes compared with a more distant alternative. These perceptions of quality are shared by consumers who have and who have not recently used a hospital, validating the importance of communications, particularly in rural areas. The relationship between consumers' hospital choice intentions and past actual hospital choice behavior is not significant, particularly in the case of major medical care. These three findings addressed several shortcomings of previous studies, because Smith Gooding pointed out that if it is the first time for a patient to visit a specific hospital, it is impossible to evaluate the quality. He verified that both a person's own perception and perception of his/her family were important in the decision. He also criticized that in the past, policy makers tried to reform the health care system based on the studies of

consumers' intentions, which did not comport with past behavior, might lead to a wrong direction.

2.2.3   Individual Characteristics

Insurance Type/Payment source

Health care insurance and payment source play a critical role in hospital choice. Different insurances offer different coverage options and directly determine the out-of-pocket expenses for patients.

Dranove et al. (1993) found that Medicaid patients are more likely visit hospitals with lower costs and fewer service offerings. Privately insured patients go to hospitals offering more services, although cost concerns are increasing. It was also indicated in their study that public programs such as Medicare and Medicaid pay hospitals a lower rate for services than commercial insurance companies. Therefore, hospitals would be more willing to accept privately insured patients. Radcliff et al. (2003) found that patients covered by either commercial or managed care insurance have higher bypass rates than other payer types. Worker compensation coverage had the highest bypass rate (approximately 49 percent). Glover et al. (2004) highlight the combined effects lack of health insurance and other factors as amplifying health care concerns among rural minorities.

Roh et al. (2005) found that public program (Medicaid and Medicare) coverage and self-payment are negatively related to the choice of an urban or other rural hospital over the local rural hospital, meaning that public program beneficiaries are less likely to bypass local rural hospitals than those in managed care programs. Statistical results indicate that, compared to those in managed care programs, Medicare recipients are 43.6

percent less likely to bypass local rural hospitals and 58.5 percent less likely to go to other rural or urban hospitals. Compared to those enrolled in managed care programs, Medicaid patients are 20.9 percent less likely to bypass their local rural hospitals and 41.5 percent less likely to go to other rural and urban hospitals.

Income

Studies have supported that bypass behavior is more prevalent among those patients with a higher socioeconomic status (McDaniel, et al., 1992). Socioeconomic status can be measured as insurance type, income, education, and employment. Jintanakul and Otto (2009) found that the coefficients for income and private insurance in the model for cardiovascular procedures were consistent with other models, indicating that higher-resource rural residents with private insurance are more likely to bypass the nearest rural hospitals. In some circumstances, rural patients were required by insurers to go to another hospital. However, Liu et al. (2007) found in their study that patients with income between $20,000 and $40,000 were less likely to bypass compared to those with lower income (less than $20,000).

Age

Holding all other variables constant, older rural Medicare beneficiaries were about 2 percent less likely to choose admission to a hospital alternative ten miles farther from their residence than an otherwise similar hospital (Tai et al., 2004). Goodman et al. (1997), Basu and Cooper (2000), Radcliff et al. (2003) and Basu (2005) found lower rates of bypass among the elderly and higher rates of bypass among working-age males. Transportation issues and difficulty traveling may contribute to low bypass rates among elderly patients. Studies have shown that older rural patients exhibit stronger preferences

for rural versus urban hospitals (Adams et al. 1991; Buczko 1992; Tai et al. 2004), and particularly those 85 years of age and older, are less likely to bypass the closest rural hospital than their younger counterparts. The odds of choosing an ''urban teaching hospital'' over the ''closest rural hospital'' were about 75 percent lower among patients 85 years or older relative to their counterparts between 65 and 74 years old (Tai et al. 2004).

Ethnic, Gender, and Number of Children

Studies suggested that non-white patients were less likely to bypass than white patients (Basu and Cooper, 2000; Basu, 2005). White patients, particularly those with more education were associated with a higher likelihood of choosing an urban teaching hospital or the closest rural hospital alternative over the closest rural hospital (Tai et al. 2004). Women are more likely to use the local hospital than men (Buczko 1992; Hogan 1988) and women tend to use nonteaching hospitals (Cohen and Lee, 1985). Patients with more children in the household were more likely to choose the ''other rural hospital'' over the ''closest rural hospital'' alternative (Tai et al., 2004).

2.3   Literatures Summary

Hospital quality plays a critical role in hospital choice and it consists of many attributes. It is hard to differentiate between the observed quality and perceived quality.. For example, availability of advanced technology should be counted as observed quality by definition, while patients perceive hospitals that with advanced technology as high quality. In this way, the availability of advanced technology is in essence a perceived quality.

The transition in emphasis from observed to perceived quality of care has been widely accepted over the last decade. This study is going to focus on the both side and explore the combined effect of hospital attributes and individual characteristics on the hospital choice.

This study differs from previous studies in several ways. First, this study focuses on CAHs and inpatient care services. In this study, bypass is defined as patients receiving inpatient care services from a hospital located farther away than the local CAH (in the residing county or neighboring county). Therefore, the reference choice, nearest rural hospital, widely used in previous studies becomes the local CAH in this study. This change let us focus on the CAHs in the rural areas. Figure 2-1 shows the locations of rural hospital at CAH status and Non-CAH status in Kentucky.

Figure 2-2: Rural Kentucky Hospital at CAH Status & Non-CAH Status
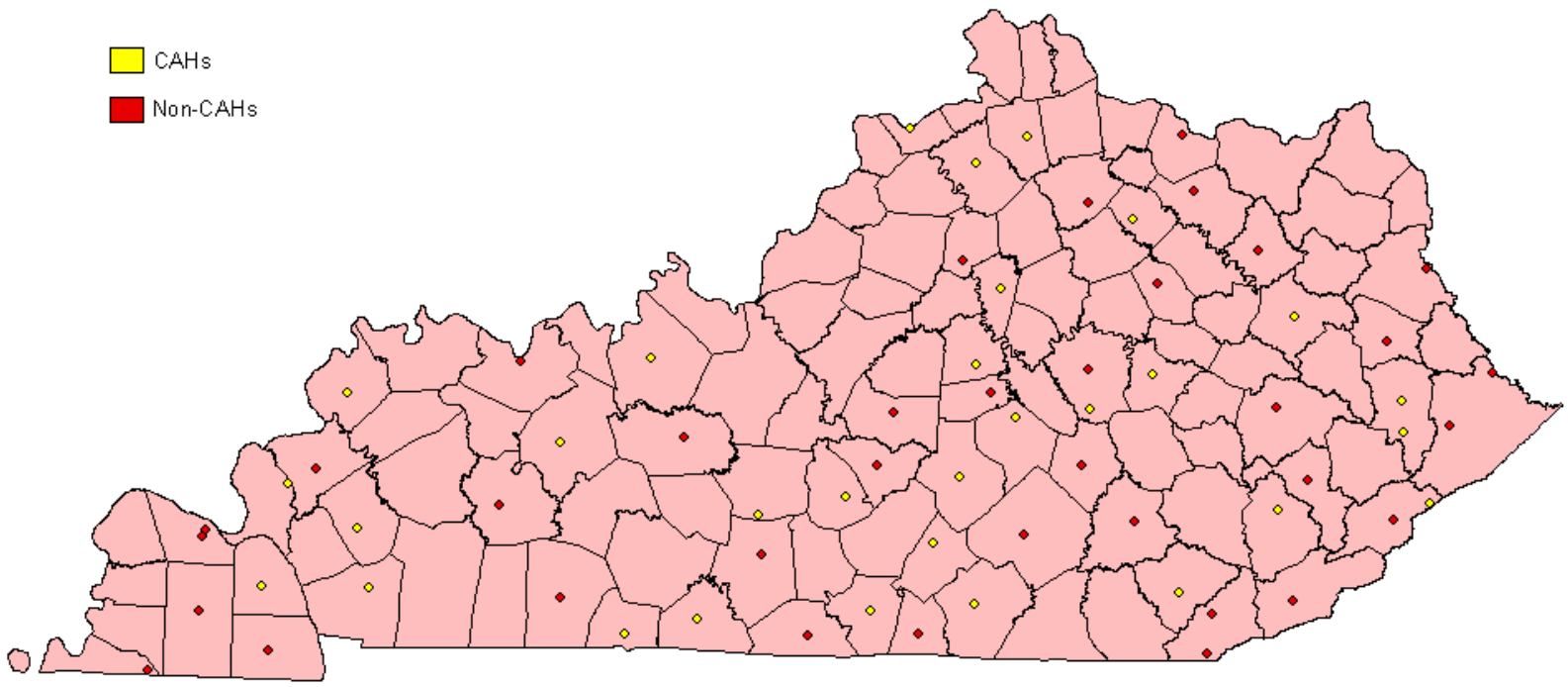
Second, a specifically designed survey instrument was only sent to rural residents that had access to a CAH. We solicited information describing individual opinions on local hospital's attributes, healthcare providers, and demographic information. This survey tool allows us to more precisely collect data in the target area than extracting hospital discharge data from the website of the hospital association. Third, previous studies discovered that rural residents who choose to be treated in urban hospitals do so mainly for two reasons. One reason is for specialized care that is unavailable at the local hospital (Buczko, 2001). The other reason is rural patients bypass local hospitals is because they perceive local hospitals are low quality (Roh and Moon, 2005). In this paper, two sub-models are developed after examining the overall bypass behavior. The sample is separated into two sub-samples according to the reasons just described. The first one is called service bypass sample and the latter one is called quality bypass sample. It is useful to find the unique determinants in hospital choice for each group. Combining the three models gives more complete understanding of why rural patients bypass local CAHs and what affect different groups of patients. Finally, interacted variables of hospital attributes and individual characteristics are created. Including the interacted variables reveal the relationship between how rural patients make their decisions and what their final actions are. The result also suggests whether the information they offered to researchers and how they actually acted are consistent or not.

CHAPTER 3 EMPIRICAL MODEL

Rural Kentucky patients' hospital choice is modeled within a discrete-choice framework. Each patient chooses among two hospitals: the reference choice, the local CAH (the reference choice); and the other choice, another hospital that patients used for inpatient services in last 24 months. Utilizing a random utility model (RUM), the theoretical framework for the ith patient facing J (J=2) hospital choices, the utility associated with choice j is

(1) $U_{ij} = \beta'X_{ij} + \varepsilon_{ij}$

In equation (1), X_{ij} represents characteristics of the jth choice for the ith patient and ε_{ij} is a random disturbance. Considering the observed attributes, equation (1) can be rewritten as

(2) $U_{ij} = V_{ij} (H_j, H_j*P_i, H_j*D_i) + \varepsilon_{ij}$

Where

    H_j represents attributes associated with hospital j

    P_i represents individual i^{th} perceptions of hospital attributes

    D_i represents individual characteristics of patient i

    ε represents the unobserved factors

A patient will choose choice j only if the utility received from choice j is greater than the utility received from choice k. Therefore, the probability of choosing choice j becomes

(3) $Prob(U_{ij}>U_{ik})$ for all $k \neq j$

Assuming identically and independently extreme value error terms, the probability that the patient will choose another hospital, according to a conditional logit model (CL), can be calculated by

(4) $\text{Prob}(Y_i=1) = \dfrac{\exp(\beta' X_{i1})}{\sum_{m=1}^{J} \exp(\beta' X_{ij})}$ J=2

By substituting (2) into equation (4) we can test the significance of the parameters. Although every choice set faced by each patient includes two choices, the choices are different across patients. The dependent variable of this model is a unique choice of each response. As a result, a conditional logit model is more appropriate than a binary probit model.

In this model, the local CAH (the first choice) is set as the base case. A positive (negative) coefficient means that the probability of choosing alternative j increases (decreases) relative to the probability of choosing the local CAH. This interpretation describes the sign of the impact of the independent variables on the response variable but fails to quantify the impact, especially for the continuous variables. Therefore, the marginal effect is computed to provide an intuitive interpretation. Marginal effects can be interpreted as a change of probability for alternative j as a result of a one unit change in the independent variable x_k.

For a continuous variable, the marginal effects can be calculated as

(6) $\text{Marginal Effect} = \dfrac{\partial \text{Prob}(Y_i=1)}{\partial x}$

For dummy variables, the marginal effect can be calculated as

(7) $\text{Marginal Effect}_{\text{dummy}} = \text{Prob}(Y_i=1 \mid D_i=1) - \text{Prob}(Y_i=1 \mid D_i=0)$ (Greene, 2003)

The major drawback of using the conditional logit model in this study is that it relies on the strong assumption that the probability of making any hospital choice is independent of the probabilities of making another choice. Despite this limitation, the conditional logit model is widely used to analyze discrete choice behaviors.

CHAPTER 4 DATA

4.1   Model 1: Rural Patients' Bypass Behavior

The principle data used for this model are collected by a Health Care Service Survey conducted in rural Kentucky. Three-thousand rural Kentucky residents were randomly surveyed by mail. The surveys were distributed to an equal number of households in each county that is served by a CAH, as well as surrounding counties that are often served by CAHs[6]. Respondents were asked if they or any members in their household visited the hospital in the last 24 months as well as which hospital they normally visit for inpatient care. This pre-screen question narrowed the scope to the target population (those who used hospital services). Information on prior hospital choice was collected. Respondents were asked if they had used local primary care physicians, outpatient services or a hospital in the past two years. Then respondents were asked a series of questions designed to determine the relative importance of sixteen factors in the hospital choice and satisfaction of local health care providers. Finally, individual characteristics were collected.

The final sample included 341 respondents, representing an overall response rate of 11.4 percent. Of the 341 respondents, 261 surveys could be used for the study. Respondents without inpatient care provider names were discarded.

4.1.1   Dependent Variable (Bypass)

This model investigates the joint effects of patients' perceptions of the importance of factors in hospital choice, satisfaction of local hospitals and patients' characteristics on bypass behavior. Rural patients who are not hospitalized at the local CAHs are

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[6] Some rural counties do not have CAHs in the communities, but there are other CAHs in the neighboring counties for c convenient distance, which the patients in these counties could reach.

considered "bypasssers" in this study. Local CAH refers to the CAH located in the residing county of the respondent. For the counties that do not have a CAH present, the nearest (smallest radius distance) neighboring county's CAH is counted as the local CAH.

The dependent variable is a dummy variable, where 1 indicates patients bypassed and 0 signifies they stayed local. Using this method, the bypass rate is 84.7 percent, which is relatively high compared to other studies where the average bypass rates ranged from 30 percent to 70 percent. The high bypass rate might be attributable to the definition of bypass. Bypass for the purpose of this study is defined as utilizing non-local CAH.

The data were further divided based on the satisfaction of different attributes of the local hospital. If a respondent ranked any of the following attributes poor/fair (the availability of services, availability of technology or availability specialists), the patient was categorized as a service bypasser. If a respondent ranked any of following attributes poor/fair (quality of hospital, quality of medical care, or reputation), the patient was categorized as a quality bypasser. Thirty-five observations were discarded because individuals responded that they did not bypass but they were categorized either as service bypassers or quality bypassers here. A total of 226 respondents were included in these sub-samples

4.1.2 Independent Variables

This model has three categories of independent variables: the patients' perception of the importance of hospital attributes, the satisfaction with the local hospital (CAH), and individual characteristics. The variables were selected on the basis of the direct or indirect support in the literature cited.

Patients' Value of Factors in the Hospital Choice. The patients ranked the importance of sixteen factors such that: 3 = very important; 2 = somewhat important; 1 = not important. These sixteen attributes are described in Table 4-1. Better quality of medical care is ranked at the top with a mean equal to 2.67, followed by referred by doctor/ nurses, available technology, better reputation, and severity of illness.

Table 4-1: Patients' Value of Factors in the Hospital Choice

Variables	Mean	S.D.	Rank
Patients' Value of Factors in the Hospital Choice			
Better quality of medical care	2.670	0.625	1
Referred by doctor/ nurse	2.644	0.540	2
Available technology	2.625	0.642	3
Better reputation	2.571	0.662	4
Severity of illness	2.563	0.686	5
I prefer the service at this location	2.513	0.642	6
Specific medical service was available only at this location	2.406	0.780	7
Specific service and size	2.356	0.662	8
My family prefer the service at this location	2.314	0.713	9
Specialist only available at this location	2.276	0.770	10
Traveling time	2.195	0.747	11
Traveling cost (gasoline, hotels, etc)	2.142	0.764	12
Payment type	1.966	0.810	13
Insurance require to go to this location	1.893	0.857	14
Relative live at this location	1.598	0.776	15
Available shopping opportunities	1.276	0.582	16

*3 = very important; 2 = somewhat important; 1 = not important.

The following hypotheses are proposed related to the patients' value of factors in the hospital choice:

Hypothesis1: Hospital quality plays an important role when patients choose hospitals. The more a patient considers hospital quality important in the decision, the more likely he/she will bypass the local CAH.

Rural patients perceive CAHs as being inferior. The perception might be built on hospital performances and reputation. If a rural patient believes that hospital quality is very important when choosing hospitals, there is large possibility that the patient will bypass the local CAH.

Hypothesis 2: Rural patients are more likely to choose a larger scope hospital than a small CAH with fewer specialists and special services.

A larger scope of services could be indicated by more special care services, more specialists and more advanced technology. Hospital scope is presumed to have a positive effect on a patient's choice to bypass. The number of beds is a measurement of hospital size widely used by previous studies.

Satisfaction of the Local Hospitals. Patients' satisfaction of the local hospital was rated: 4 = excellent, 3 = good, 2 = fair, 1 = poor (Table 4-2). Of the eleven hospital attributes, the availability of specialists was the least satisfactory with a mean equals to 2.375, followed by reputation, availability of technology, availability of the service, quality of hospital, and quality of medical care.

Table 4-2: Satisfaction Rate of Local Hospital

Variables	Descriptions	Mean (%)	S.D.	Rank
Satisfaction of the Local Hospitals				
Accepts my insurance status	4 = Excellent	3.241	0.803	1
Quality of primary care physicians	3 = Good	3.042	0.887	2
Quality of ambulance service	2 = Fair	3.004	0.792	3
Quality of hospital nurses	1 = Poor	2.966	0.865	4
Quality of health department		2.939	0.742	5
Quality of medical care		2.889	0.915	6
Quality of hospital		2.820	0.890	7
Availability of the service		2.667	0.957	8
Availability technology		2.655	0.934	9
Reputation		2.628	0.986	10
Available specialists		2.375	1.018	11

From the Table 4-2, the following hypothesis is proposed:

Hypothesis 3: The patient's satisfaction of the local CAH negatively affects rural patients' bypass behavior. A rural patient, who is more satisfied with the local CAH, is less likely to bypass it in favor of an urban hospital or a larger hospital.

Hypothesis 3 tests the relationship between the local hospitals' performances and the rural residents' bypass behavior. Satisfaction variables and attitudes toward local shopping were reported significant in a number of studies, with attitudes toward shopping locally based on factors such as perceptions of quality, affordability, ease of access, the array of services, and friendliness of the staff (Hawes and Lumpkin, 1984; Andrus and Kohout, 1985). Usually, if a patient is satisfied with the local hospital, it is less likely for him/her to bypass the local hospital.

Patients' Characteristics. Patient characteristics include household income, educational attainment, gender, age, insurance type, self-reported health status and other characteristics. Self-reported health status is a dummy variable that is equal to 1 if the respondent or a member in the household has a history of one or more of the following four diseases: diabetes, heart disease, high blood pressure and high cholesterol. Dummy variables were created for age (older than 65 = 1), ethnicity (non-white = 1) and income (annual household income less than 20,000 = 1). The prior use of local hospitals was included in the model. Respondents were asked whether his/ her last hospital visit was an emergency visit and whether he/she used local primary care physician, outpatient service and local hospital in the last 24 months. The variables of prior use of local hospitals are dummy variables, where 1= yes and 0= no. The last variable is whether the patient resides in the metropolitan area in Kentucky. This area refers to the triangular shaped

area outlined by Lexington (KY), Louisville (KY) and Cincinnati (OH). Based on the question of prior use of local hospital (not include the visit of local primary care physician or local outpatient service), of the 261 sample respondents, 60 percent of people visited the local hospital in the past 24 months and 29 percent of the individuals' last visit was an emergency visit.

Table 4-3: Variable Description (Individual Characteristics)

Variables	Descriptions	Mean	S.D.
DEPENDENT VARIABLE			
Bypass	1 = bypass local CAH	0.847	0.361
	0 = did not bypass local CAH	0.153	
INDEPENDENT VARIABLE			
Socioeconomic & Demographic Characteristics			
Metropolitan	1 = Sample person reside in golden triangle, 0 = Otherwise	0.295	0.457
Gender	1 = Female, 0 = Male	0.513	0.500
Age		55.389	15.405
Ethnic	1 =Non-White, 0 = White	0.019	0.137
Annual household income		50842.912	33330.487
Education			
No high school	1 = No high school diploma, 0 = Otherwise	0.103	0.305
Some college	1 = Some college, 0 = Otherwise	0.632	0.483
College	1 = College, 0 = Otherwise	0.107	0.310
Pose college	1 = Post college, 0 = Otherwise	0.157	0.365
Employment	1 = Currently work, 0 = Otherwise	0.529	0.500
Number of household members		2.475	1.220
Number of kids in household		0.318	0.467
Marital Status	1 = Married or member of an unmarried couple, 0 = Otherwise	0.724	0.448
Insurance type			
Pure Private	1 = Pure private, 0 = Otherwise	0.586	0.493
Pure Government	1 = Pure government, 0 = Otherwise	0.211	0.408
Government/Private	1 = Government or Private, 0 = Otherwise	0.153	0.361
Uninsured	1 = Uninsured, 0 = Otherwise	0.050	0.218
Self-Reported Health Status			
Diabetes	1 = Sample person or family member have a history of diabetes, 0 = Otherwise	0.306	0.462
Heart disease	1 = Sample person or family member have a history of heart disease, 0 = Otherwise	0.337	0.474
High blood pressure	1 = Sample person or family member have a history of high blood pressure, 0 = Otherwise	0.567	0.496
High cholesterol	1 = Sample person or family member have a history of high cholesterol, 0 = Otherwise	0.575	0.495
Prior Use			
Emergency	1 = Sample person's last visit was an emergency visit, 0 = Otherwise	0.287	0.453
Local primary care physician	1 = Sample person used local primary care physician in the last 24 months	0.797	0.403
Local outpatient service	1 = Sample person used local outpatient service in the last 24 months	0.563	0.497
Local hospital	1 = Sample person used local hospital in the last 24 months	0.602	0.491

Table 4-3: Variable Description (continued)

*Education:

No high school diploma = not a high school graduate

Some college = High school, Some college without a degree, Associate degree, and Technical school

College = Bachelor degree

Post college = Master degree, and Doctorate

*Employment:

Currently Employed: Part time, Full time, Student, and Other (Self-employed)

Currently Unemployed: Retired, Not currently employed, Do unpaid work from home/homemaker, and Unable to work

*Insurance Type:

Pure private = Private

Pure Government = Medicare, Medicaid, or Medicaid & Medicare

Government/Private = Private & Medicare

Uninsured = Uninsured

The following hypothesis is proposed related to individual characteristics:

Hypothesis 4: Demographic characteristics play a role in the bypass behavior.

It is proved by antecedent studies that age, income, employment and many other socioeconomic and demographic characteristics play roles in bypass behavior. We will test the effect of these variables on rural Kentucky patients' choices.

Service Bypass and Quality Bypass. Seventy percent of patients had bypassed for either service or quality in the past two years. Twenty-three percent of patients had only bypassed for service and fifteen percent patients had only bypassed for quality. Patients weigh attributes differently and this affects bypass behavior. The following hypothesis is proposed:

Hypotheses 5: Different hospital attributes and individual characteristics affect service bypass and quality bypass.

The importance of hospital attributes for service bypassers and quality bypassers are different when choosing hospitals. Some rural patients regularly bypassed local CAHs, like quality bypassers, who probably would not use the local CAHs even if the desired services are available. Some rural patients bypassed local CAHs occasionally, like service bypassers, who would bypass local CAHs when the desired services are not available.

4.2   Model 2: Rural Patients' Hospital Choice

Besides the survey, hospital information was acquired from American Hospital Directory (AHD). The AHD provides data and statistics about more than 6,000 hospitals nationwide. Hospital information from AHD includes both public and private sources such as Medicare claims data, hospital cost reports, and commercial licensors. Key

statistics summarized by hospital, state, and the nation. It also collects the quality report of hospital performances from other sources (Hospital Compare) and the report includes process of care measures, outcome measures, and survey of patient hospital experiences.

4.2.1 Dependent Variable (Hospital Choice)

This model investigates the joint effects of hospital attributes and individual characteristics on hospital choice. The dependent variable has two choices, indicating if an individual has been hospitalized at a local CAH, or at another hospital (either another rural hospital or another urban hospital). The special feature of this study is that every patient is facing a unique choice set. Each choice set has a base choice, the local CAH. The other choice differentiates very much across the counties.

4.2.2 Independent Variables

The independent variables are categorized three ways: hospital attributes, patient characteristics and patient perceptions of important factors in the hospital choice.

Hospital attributes. Hospital attributes includes hospital size, if the hospital is located in an urban or rural county, the availability of special care services, inpatient routine cost[7], net income for 2005, 2006, 2007, and 2008, evaluation of left ventricular systolic (LVS) score[8], timing of antibiotic prophylaxis (AN) score[9], and Medicare inpatient ratio. Table 4-4 summarizes the dependent variable and independent variables of hospital attributes. It compares the statistics between the CAHs and the entire sample.

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[7] Impatient routine cost: Inpatient Routine Service Daily Cost is summed up by (General Med/Surg, Intensive Care Unit, Coronary Care Unit, Burn ICU, Surgical ICU, Neonatal ICU, Psych Subprovider and Nursery).
[8] Evaluating of Left Ventricular Systolic (LVS): Substantial scientific evidence indicates that the process of LVS represents the best practices for the treatment of heart failure. This process is to check whether the left side of your heart is pumping properly. Higher scores are better.
[9] Hospitals can prevent surgical wound infections by making sure patients get antibiotics within the hour before their surgery.

Table 4-4: Variable Description (Hospital Attributes)

Variables	Mean			S.D.		
	Sample	CAH	Non-CAH	Sample	CAH	Non-CAH
DEPENDENT VARIABLE						
Hospital choice	1 = used this hospital for inpatient service in last 24 months					
	0 = did not use this hospital for inpatient service in last 24 months					
INDEPENDENT VARIABLES						
Hospital Attributes						
General Medical/Surgical Beds	122.000	23.552	218.570	156.110	2.440	172.610
Cardiac Surgery (1 = Operate Cardiac Surgery; 0 = Not)	0.255	0.000	0.510	0.429	0.000	0.490
Number of Special Care Services	1.005	0.210	1.780	1.105	0.410	1.040
Special Care Inpatient Daily Cost	794.944	787.760	797.180	346.514	402.250	139.180
Annual Net Income 2008	849365	-335856	2519407	14041599	4290302	18965623
Annual Net Income 2007	6794579	397526	13011841	11501766	1074913	13598930
Annual Net Income 2006	7036803	361640	13542328	13740285	667950	17079707
Annual Net Income 2005	5314449	621723	9957713	9136710	2213246	10903315
LVS Score (Hospital)	88.562	78.140	94.930	17.486	22.470	7.400
LVS Score (Hospital-Nation)	-1.438	-11.860	4.930	17.486	22.470	7.400
LVS Score (Hospital-State)	0.319	-9.860	6.660	17.384	22.470	7.400
AN Score (Hospital)	93.864	93.450	94.010	5.044	5.610	4.520
AN Score (Hospital-Nation)	0.864	0.450	1.010	5.044	5.610	4.520
AN Score (Hospital-State)	-0.161	-0.550	-0.030	5.033	5.610	4.500
Medicare Inpatient Ratio	0.976	1.000	0.940	0.089	0.040	0.060

Figure 4-1: Annual Net Income: CAHs vs. Non-CAHs

Annual Net Income 2005-2008
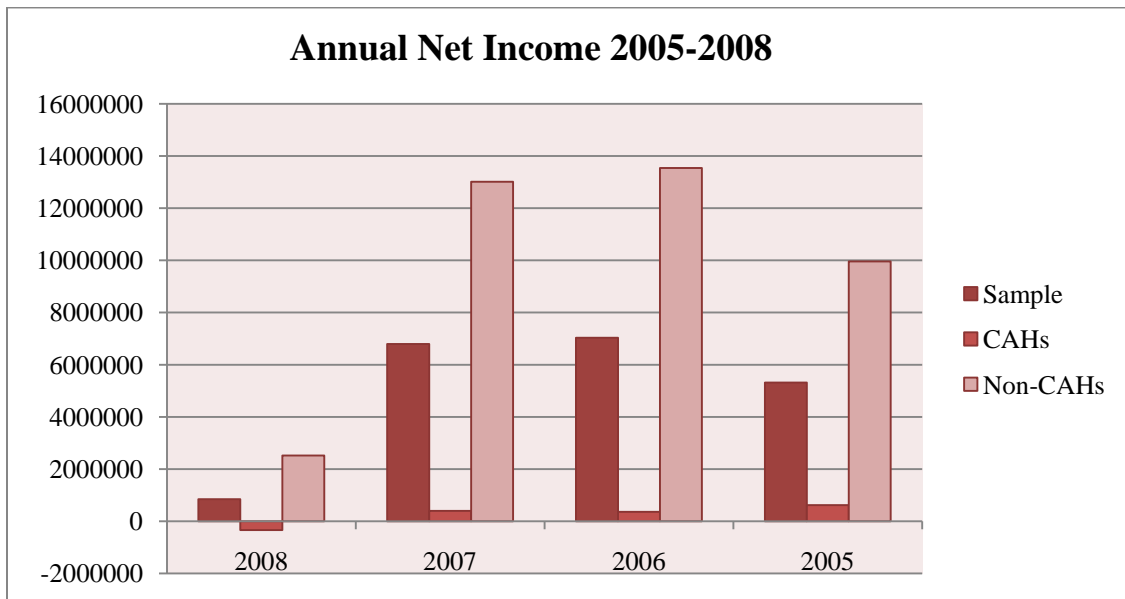
Hospital size is measured by the number of general medical/surgery beds. Hospital scope is measured as the number special care services offered. Special care usually includes coronary intensive care (CCU), intensive care (ICU), burn intensive care (BICU), neonatal intensive care (NICU) and surgical intensive care (SICU). Larger hospitals usually provide these five special care services, while rural hospitals are usually able to provide CCU and ICU. Most CAHs do not have any of the five services. LVS and AN scores include national average, state average and hospital scores. (Hospital score – State average score) and (Hospital score – National average score) were computed, clearly indicating the hospital performance. Medicare inpatient ratio is calculated by dividing the total number of Medicare inpatients to the total number of discharges.

The descriptive statistics in table 4-4 indicate that there are large differences between the local CAH and patients' choice. CAHs in rural Kentucky have, on average, 25 beds while non-CAHs have 218 beds on average. All CAHs are located in rural regions and none performs cardiac surgery or provides radiology care services. CAHs rarely offer special care services, only ICU is present. The average daily routine cost of non-CAHs is almost the same as the average cost of the CAHs. The larger hospitals deliver more services with the same costs and are more efficient, which may attributes to the economics of scale. The CAHs' average score of LVS is 10 percent lower than the sample's average score of LVS. The variation of LVS scores within CAHs is high. CAHs in rural area have a higher volume of Medicare patients.

> *Hypothesis 6: The Medicare inpatient ratio has a negative effect on rural patients' hospital choice. Patients are more willing to use a hospital with lower Medicare inpatient ratio.*

Defined by Medicare and Medicaid Services (CMS) of U.S. Department of Health & Human Service, Medicare is available only to individuals who are 65 years of age or older or disabled. Rural patients who use the public program as the priority payment method are usually not wealth. A possible reason for avoiding these hospitals could be the perception that they are designed to serve relatively disadvantaged persons.

Individual Characteristics. Individual characteristics include socioeconomic status and demographic information. Patient socioeconomic status was specified for education, employment condition, annual household income and insurance coverage. Patients' demographic variables were specified for gender, age, ethnic, household members, marital status, and self-reported health status.

Interaction Variables. Interaction variables were created using three groups of independent variables. First, we created variables describing hospital attributes and patients' perception of important attributes. By including the interaction variables in the model, it is better to understand the behavior of rural patients. For example, it tells us if those patients who claimed hospital size was very important actually chose the larger size hospital. Essentially we are measuring if the patients' perceptions and actions were consistent? Second, variables of hospital attributes and individual characteristics are interacted. Jintanakul and Otto (2009) suggested that rural patients with private insurance were more likely to choose urban hospitals and dissatisfaction with the availability of health care was positively associated with bypassing closest rural hospital (Tai et al., 2004). In each of these studies the authors failed to provide the specific attributes of those hospitals that patients are interested in. For example, if a rural patient with private insurance chooses an urban hospital, then what is the specific attribute of that urban

hospital that attracts the private insured patient? Is it the size, scope, or reputation? Model Two attempts to better understand this question.

Before creating interaction variables, a factor analysis was conducted using SPSS. The purpose of the factor analysis was to categorize the same types of independent variables into groups to decrease the number of combinations.[10] The software begins by finding a linear combination of variables (a factor) that accounts for as much variation in the original variables as possible. It then finds another factor that accounts for as much of the remaining variation as possible and is uncorrelated with the previous factor, continuing in this way until there are as many factors as original variables. Usually, a few factors will account for most of the variation, and these factors can be used to replace the original variables. For the data used in this model, three factors of hospital attributes, and four factors of patients' perception were generated by SPSS. Two hospital attribute factors, size/scope and reputation were selected due to the significant effect of the dependent variable. For every choice, the attribute index was standardized and the average value was taken as the factor score. For example, factor 1 (hospital size/scope) is comprised of number of beds, urban or rural status, and number of special care services. The values of three variables were standardized and the mean is derived. The mean is the hospital size/scope score of choice 1 for patient i. All four factors of patients' perception of important attributes, size/scope, insurance/payment type, reputation, and travel time were selected. The same procedure was used to draw the factor scores for each choice. The factor score associated with hospital attributes varies across the choices and is

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[10] Originally, 6 hospital attributes and 16 individual characteristics (patients' value of factors in the hospital choice) were used and it would create 48 interacted variables, which is way too many for the model. Factor analysis combines the variables that capture the approximately similar information and decreases the dimensions of the data.

different for the two choices for the same patient. Table 4-5 shows a piece of process for generating factor score of each interaction variable. As indicated by SPSS, approximately 20 percent of variance left over that is unexplained, which suggests that 20 percent of the information is left after the factors have been extracted (Please see detailed information in Appendices 1).

Table 4-5: Factor Score Generating

ID	Choice	Bed	Standardized Value	Special Care	Standardized Value	Urban	Standardized Value	Factor Score (size/scope)
Mean		**121.600**		**1.006**		**0.246**		
S.D.		**156.112**		**1.105**		**0.428**		
i=1	1	322	1.284	2	0.900	1	1.760	1.315
	0	25	-0.619	0	-0.910	0	-0.574	-0.701
i=3	1	367	1.572	5	3.614	1	1.760	2.316
	0	25	-0.619	0	-0.910	0	-0.574	-0.701
.								
.								
.								
i=340	1	51	-0.452	1	-0.005	0	-0.574	-0.344
	0	25	-0.619	0	-0.910	0	-0.574	-0.701
i=341	0	154	0.208	1.5	0.447	1	1.760	0.805
	1	18	-0.664	0	-0.910	0	-0.574	-0.716

For the impact of individual characteristics, Hypothesis 7 was proposed:

Hypothesis 7: Insurance plays an important role in rural patients' hospital choices. Uninsured rural patients are less likely to choose larger size/scope hospitals or reputated hospitals.

Payment types and insurances requirements might play restrictions on rural patients from the financial perspective. Patients claim these two factors are not that important in the decision (Payment type and insurance requirements rank 13th and 14th in the patients' perception of important level of attributes.) By testing hypothesis 8, the role insurance plays in hospital bypass behavior among rural patients can be identified.

Hypothesis 8: Rural patients with higher education and income level are more likely to choose larger hospitals for better perceived quality.

Compared to other rural patients, for those who have higher socioeconomic status, larger size hospitals and hospitals with good reputation are more attractive. This may be explained by less financial burden.

Hypothesis 9: Travel time has a negative effect on rural patients' hospital choice. A rural patient who considers travel time and cost as important factors when choosing a hospital is less likely to choose the larger hospitals.

Local CAHs are small and located in rural areas and large hospitals are usually further away for rural patients. Other studies (Adams et al., 1991; Goldsteen et al., 1994; Piette and Moos, 1996; Goodman, 1997; Radcliff et al., 2003; Tai et al., 2004; Basu, 2005; Pierce et al., 2007; Jintanakul and Otto, 2009) have provided evidence that long travel times sharply decreases the probability of choosing urban hospitals holding other variables constant.

4.3 Summary

The study applied a binary probit model and a conditional logit model to test totally nine hypotheses, which highly relate to hospital performances and individual characteristics. The variables utilized in the models are derived from a health care survey and a hospital statistics website AHD. The attributes of CAHs and patients' preferred choices were compared, indicating the smaller size and scope of the CAHs, and lower efficient of service delivering. The statistical results from the two models are reported and discussed in the following section.

CHAPTER 5 EMPIRICAL RESULTS AND DISCUSSIONS

5.1   Model 1: Bypass Behavior

In this chapter, multiple regression results of the bypass model (probit model) and the hospital choice model (conditional logit model) are presented. The bypass model incorporates patients' value of factors with the individual characteristics, identifying the reasons that rural Kentucky patients bypassed local CAHs. The hospital choice model identifies individual and institutional attributes that contribute to variation in hospital choice. All hypotheses that proposed before were proved or partially proved. Table 5-1 details estimated coefficients and marginal effects of hospital bypass behavior in rural Kentucky.

Table 5-1: Binary Results of Bypass Behavior in Rural Kentucky

Model 1-1: Local CAH Bypass Model		
Independent Variables	*Coefficient (S.E.)*	*Marginal Effects*
Patients' Value of Factors in the Hospital Choice		
Severity of Illness	0.297*	0.046
	0.182	
Insurance Requirement	-0.128	-0.020
	0.154	
Better Quality of Medical Care	-0.720**	-0.111
	0.335	
Better Reputation	0.609**	0.094
	0.299	
I prefer the service available at this location	0.505**	0.078
	0.204	
Traveling Time	-0.368**	-0.057
	0.178	
Available Shopping Opportunities	0.097	0.015
	0.208	
Satisfactions of the Local Hospital		
Quality of Hospital	-0.436*	-0.067
	0.226	
Available Technology	0.209	0.032
	0.206	
Quality of Medical Care	-0.43*1	-0.067
	0.239	
Reputation	0.110	0.017
	0.223	
Available Specialists	0.497**	0.077
	0.170	
Prior Use		
Emergency	-0.267	-0.045
	0.252	
Primary Care	-0.262	-0.037
	0.359	
Outpatient	0.437	0.071
	0.272	
Local Hospital	-0.759***	-0.108
	0.293	

Table 5-1: Binary Probit Results of Bypass Behavior in Rural Kentucky (continued)

Model 1-1: Local CAH Bypass Model		
Independent Variables	*Coefficient (S.E.)*	*Marginal Effects*
Individual Characteristics		
Metropolitan	0.054	0.008
	0.269	
Employment	-0.473	-0.072
	0.284	
Children	0.473*	0.066
	0.274	
Married	0.450*	0.080
	0.243	
Private Insurance	0.317	0.051
	0.291	

N	261
1	Bypass Local CAH
0	Use Local CAH

***Significant at under 1% level; **Significant at under 5% level; *Significant at under 10% level.

In a probit model, only the sign of the estimated coefficients can be interpreted meaningfully. A positive (negative) sign suggests an estimated positive (negative) effect of the independent variable on the dependent variable.

For the first part, patients' value of factors in the hospital choice, a positive (negative) coefficient means if patients value that factor in the hospital choice, this factor will have a positive (negative) effect on his/her bypass behavior. Severity of illness is positive, indicating that if severity of illness is important in a rural patient's hospital choice, he/she will be more likely to bypass the local CAH. This result is consistent with the previous studies. It can be explained in terms of lack of services and specialists locally when patients are severely ill. Better quality of medical service has negative effect on bypass behavior, which suggests that the more a rural patient value good quality of care, the less likely he/she will bypass the local CAHs. If this stands, we would expect a lower bypass rate. Patients' intention to use local CAHs by their good quality was challenged. The positive coefficient associated with better reputation indicates that if a patient values a better reputation in hospital choice, he/she is more likely to bypass the local CAH. This does not suggest that the local CAH provides low quality medical care. However, it is for the nature of rural areas for bad news to disseminate faster than in communities serviced by urban hospitals. The significantly positive coefficient associated with "I prefer the service available at this location" indicates that the more important a rural patient consider personal preferences in hospital choice, the more likely he/she will bypass the local CAH. The result suggests that rural patients bypass the local CAH maybe because they had a tie with physicians in a specific hospital, might also suggest bypass history. This preference could also reflect the patient favoring the environment of

the hospital. The traveling time coefficient is significantly negative, indicating that a patient who value traveling time in the hospital decision will be less likely to bypass the local CAH. It verifies hypothesis 9 that long traveling time reduces visits to urban hospitals.

If a coefficient is significantly positive for any of the local hospital satisfactory factors this indicates a negative (positive) effect on the dependent variable (bypass). It is expected that a patient who is more satisfied with the performance of the local hospital is less likely to bypass the local CAH as well. Those that are satisfied with the local hospital quality and medical care quality decrease the likelihood of bypassing the local CAH. A rural patient, who is less satisfied with the hospital and medical care quality, is more likely to bypass the local CAH. The result verifies the hypothesis 3.

For the third part, we explored the impact of the patient's prior use of local hospitals. A positive (negative) coefficient indicates a negative (positive) effect on bypass rates. Previous use of the local hospital has a significantly negative effect on bypass behavior, indicating that rural patients are less likely to bypass the local CAHs if they have used the local hospital within the last two years. However, previous use of local outpatient service has a positive effect on bypass behavior indicating that rural patients will be more likely to bypass the local CAHs if they had experiences with local outpatient service, which suggests that rural patients might be using local CAHs for basic health care services, including ambulatory surgery, blood banks, and emergency services, but when complicated surgical services were needed, they travelled to urban hospitals.

The estimated employment coefficient is negative, suggesting that a patient who is currently employed is more likely to utilize the local hospital. This could be explained

by employer sponsored insurance. Rural patients who are offered health insurance through their employers might be required to use specific health care suppliers, many of which are likely located in the local community. A second possible reason might be that some non-profit hospitals that located outside of the community do not have a relationship with specific insurance companies so that do not have a relationship with the local employers either. The last possibility might be that employed people are more likely to have work related accidents that be sent to the closest emergence room. Therefore, employed rural patients have lower bypass rates instead. The metropolitan variable is not significant in this model which suggests that a rural patient who resides in the Golden Triangle area of Kentucky is not more likely to go to the hospitals out of the county into the big cities**.** From the Figure 2 below, a trend of high bypass rates among rural counties that near three metropolitan areas is indicated. However, the average bypass rate in rural Kentucky is relatively high and the effect of the metropolitan variable is weakened.

Figure 5-1: CAHs Bypass Rates in Rural Kentucky

CAHs
Bypass Rate: 1
Bypass Rate: 0.75 - 1
Bypass Rate: 0.5 - 0.75
Bypass Rate: 0 - 0.5
Golden Triangle
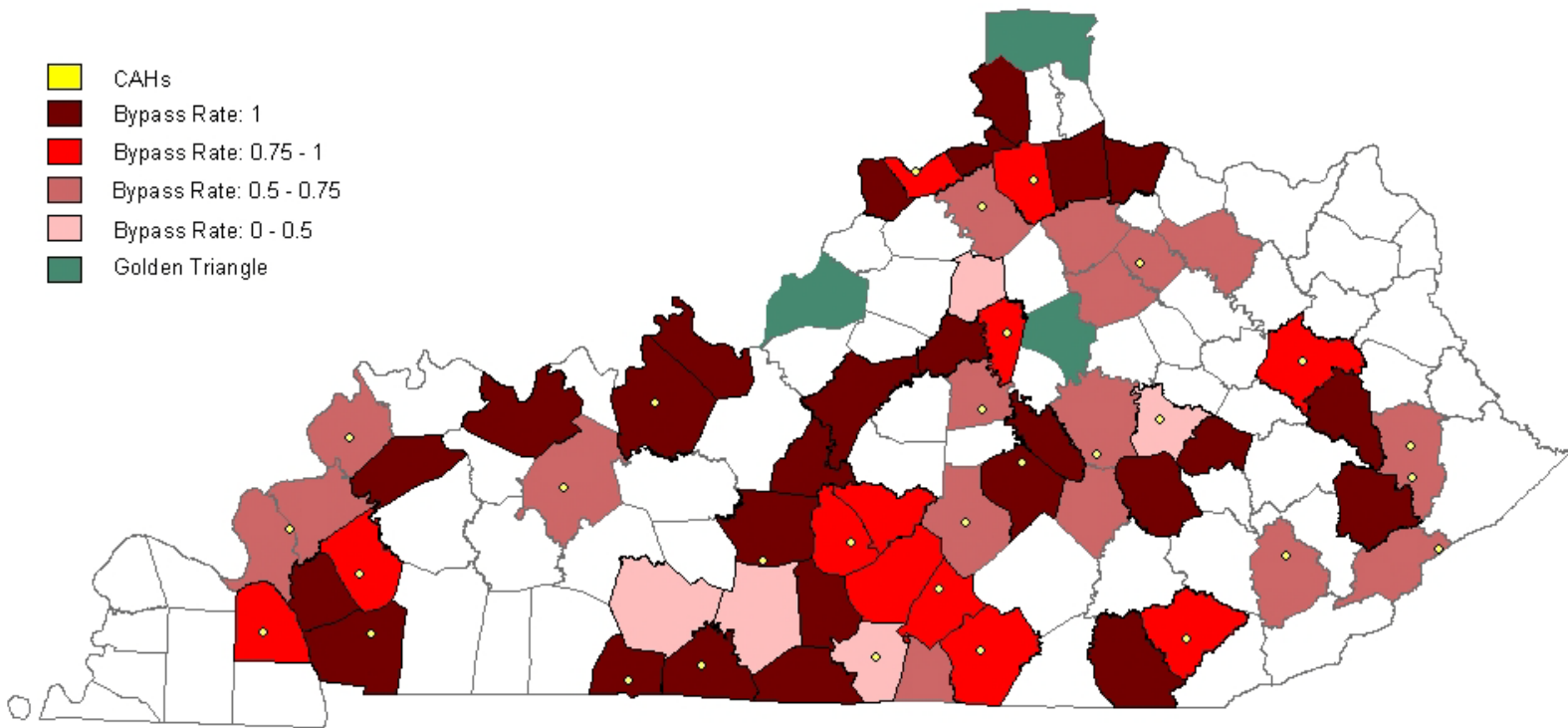
Rural patients with children are more likely to bypass the local CAHs in this study. Children might need specialized pediatricians that are usually available in the urban hospitals, and parents are willing to travel more to find better health care for their children. Similarly, a rural patient who is married or is a member of an unmarried couple is more likely to bypass the local CAHs. The patients are precious by spouses that try to provide better health care service. Transportation convenience is another important factor increasing the chance of bypassing, under the condition that the patient is in poor health having to assist in transporting.

The results in Table 5-2 are used to understand the determinants of service bypass behavior and quality bypass behavior. Three determinants are shared by service bypassers and quality bypassers: payment type, traveling time, and age. Three unique reasons were also found.

Table 5-2: Binary Probit Results of Service Bypass Behavior & Quality Bypass Behavior

Model 1-2: Service Bypass & Quality Bypass		
Independent Variables	*Coefficient (S.E.)*	*Marginal Effects*
Service Bypass		
Local outpatient service	-0.3860*	-0.1512
	0.2062	
Payment type	0.2192*	0.0866
	0.1165	
Relative live at this location	0.2540*	0.1004
	0.1335	
Traveling time	-0.5394***	-0.2132
	0.1415	
Age	-0.0125**	-0.0049
	0.0059	
Marital	-0.4848**	-0.1852
	0.2152	
Quality Bypass		
Payment type	0.3561**	0.1420
	0.1189	
My family prefer the service at this location	-0.3246**	-0.1295
	0.1359	
Traveling time	-0.4649***	-0.1854
	0.1287	
Age	-0.0201***	-0.0080
	0.0062	
Diabetes	-0.4676**	-0.1836
	0.2025	
Pure Private	-0.3654	-0.1450
	0.2607	
Pure Government	-0.1575	-0.0626
	0.3037	
Uninsured	-1.0429***	-0.3546
	0.5092	

***Significant at under 1% level; **Significant at under 5% level; *Significant at under 10% level.

As traveling time increases, the probability of bypassing local CAHs decreases sharply, either for desired service or better quality of care. Payment type plays an important role. If payment type is valued in the hospital choice, the patients will be less likely to bypass the local CAHs. The importance of payment type does not suggest a strong influence in the general bypass model, but it clearly affects patients' choice in the two separate models. Age has a negative effect for both types of bypass, which indicates that older patients are less likely to bypass the local CAHs, either for service or for quality. The difficulty associated with transportation and are loyal to local hospitals are the possible reasons that make them visit their local hospitals.

There are several specific factors that influence quality and service bypass. For service bypassers, the previous use of local outpatient service has a negative effect on bypassing local CAHs, indicating that rural patients who had utilized local outpatient service in the past will be less likely to bypass the local CAHs for service. It's likely these patients are aware of the local hospital and the services it provides and they will probably choose the local CAHs first if required services are available. The value associated with having relatives live near the hospital has a positive effect on service bypass. Having relatives who are familiar with the local area makes rural patients more willing to pick the hospital in that area. Further verified the result in the general bypass model, married couples and members of unmarried couples, are more likely to bypass the local CAHs for desired services.

For quality bypassers, three variables were significant. First, the variable reflecting family preferences is negative, indicating a family prefers a specific service at one location the patient will be less likely to bypass the local CAH. This result suggests

that rural patients might have a tie with local health care providers and these ties will affect family members when making decisions. Second, having a family history of diabetes has a negative effect on quality bypass, indicating that the diabetes patients are less likely to bypass the local CAH for quality issues. Patients with this chronic disease need regular treatment which does not necessarily require advanced medical care. Local CAHs can operate it successfully and also have the location advantage. Thus, rural patients would likely to stay in the communities. The last, uninsured patients are less likely to bypass the local CAHs for quality purposes. Uninsured rural patients can utilize the emergency department services just the same in a rural CAH than a large urban hospital and travel less.

5.2   Model 2: Hospital Choice

5.2.1   Coefficient

The hospital choice model employs a conditional logit regression model to identify hospital and individual characteristics that contribute to different hospital choices among rural Kentucky patients. The estimated coefficients for another hospital patients chose are reported with local CAH serving as the reference choice. In a conditional logit model a positive (negative) coefficient means that the independent variable has a positive (negative) effect on the dependent variable with respect to the reference choice (local CAH). The marginal effect of significant variables reflects the probability of choosing another hospital in terms of the local CAH. Table 5-3 summarizes the logit results describing how hospital attributes affect the probability of hospital choice.

Table 5-3: Conditional Logit Results of Hospital Choice (With Hospital Attributes Only)

Model 2-1: Hospital Choice with Hospital Attributes Effect		
Independent Variables	**Coefficient (S.E.)**	**Marginal Effects**
Hospital Attributes		
General medical/surgical Bed Number	-0.0008	-0.0120
	0.0013	
Urban	0.0777	1.1540
	0.4583	
Special Care Service Number	0.2549	3.7840
	0.1867	
Daily Cost	0.0001	0.0020
	0.0004	
LVS(Hospital Score-National Score)	-0.0216**	-0.3210
	0.0102	
Antibiotics*(Hospital Score-National Score)	0.0556	0.8250
	0.0379	
Medicare Inpatient Ratio	-4.9280*	-73.1740
	2.8866	
N = 251		
Pseudo R-square = 0.0194		

***Significant at under 1% level; **Significant at under 5% level; *Significant at under 10% level.

* Marginal effect is multiplied by 100.

The hospital attributes that are included in this model are general medical/surgical bed number, urban/rural status, special care services number, LVS and Antibiotics scores (hospital score – national score), and Medicare inpatient ratio. The statistical results indicate that the LVS score and Medicare inpatient ratio are negatively associated with a rural patient's choice to choose another hospital over the local CAH. The marginal effects indicate that each additional unit score increase in the LVS score will decrease the possibility that the hospital be chosen by 0.32 percent. This is contradictory to what we expected. One possible reason might be the fact that the number of cases is too small (n<25) in the CAHs for a reliable prediction. For each measure, the rate is displayed as a percent of the patients for whom the measured treatment is appropriate. For hospitals with small numbers of patients during the reporting period (fewer than 25 patients), the calculated rate may not be predictive of the hospital's future performance. Another reason could be that patients measure the hospital quality with other treatments instead of these two.

A negative Medicare inpatient ratio coefficient suggests that a high Medicare inpatient ratio has a negative effect on choosing another hospital instead of the local CAH. For an additional unit increase in the Medicare inpatient ratio, the possibility of choosing another hospital decreases by 0.73 percent. This may be attributable to the fact that rural patients perceive the hospitals with more public programs enrolled patients offer inferior health care services. These hospitals are designed to serve relatively disadvantaged and uninsured patients.

Table 5-4 summarizes the results from the joint test associated with Model 2-2: Hospital Choice with Joint Effect of Institutional and Individual Characteristics. The institutional characteristics are the hospital attributes and the individual characteristics include patients' value of factors in the hospital choice and patients demographic information. The results suggest that eight variables are statistically significant.

Table 5-4: Conditional Logit Results of Hospital Choice (Joint Effects of Institutional and Individual Characteristics)

Model 2-2: Hospital Choice with Joint Effect of Institutional and Individual Characteristics		
Independent Variables	**Coefficient (S.E.)**	**Marginal Effects**
Hospital Attributes		
Size/Scope	-0.3206	-3.9420
	0.7582	
Reputation	-0.7682	-9.4470
	1.2469	
Interactions		
*(Hospital Attributes) * (Patients' Value of Factors)*		
Hospital *(size/scope)* * Value of *(reputation)*	0.5717**	7.0310
	0.2609	
Hospital *(size/scope)* * Value of *(travel time/cost)*	-1.1211***	-13.7870
	0.2963	
Hospital *(size/scope)* * Value of *(insurance/payment type)*	0.3978**	4.8920
	0.1939	
Hospital *(reputation)* * Value of *(travel time/cost)*	0.4955	6.0930
	0.5557	
Hospital *(reputation)* * Value of *(insurance/payment type)*	-0.7574*	-9.3140
	0.4218	
*(Hospital Attributes) * (Individual Characteristics)*		
Hospital *(size/scope)* * employment	-0.4867*	-5.9850
	0.2637	
Hospital *(size/scope)* * married	0.5568**	6.8480
	0.2837	
Hospital *(reputation)* * household income	0.0000**	0.0000
	0.0000	
Hospital *(reputation)* * children	-0.5966	-7.0910
	0.6043	
Hospital *(reputation)* * uninsured	-5.6071*	-68.9530
	3.0151	

N = 251
Pseudo R-square = 0.1169

***Significant at under 1% level; **Significant at under 5% level; *Significant at under 10% level.
* Marginal effect is multiplied by 100.

The statistics show that five interactions variables of hospital attributes and patients' value of factors are significant at least at 10% level.

- Hospital *(size/scope)* * Value of *(reputation):* The statistical result indicates that if the rural patients value hospital reputation in the hospital decision, the patients are more likely to choose hospitals with larger size and scope over the local CAH. As mentioned in the literature review, hospital reputation is perceived as hospital quality; therefore, rural patients chose larger hospital pursuing better quality.

- Hospital *(size/scope)* * Value of (*travel time/cost*): The estimated coefficient for the interaction variable hospital size/scope * travel time/cost is negative, suggesting that the more patients value travel time and costs the less likely they will choose other hospitals over local CAHs.

- Hospital *(size/scope)* * Value of (*insurance/payment*): The statistical result shows that the more important the patients perceive insurance and payment type in the hospital choice, the more likely they will choose hospitals with larger size and scope, relative to the local CAHs. This result is a little surprising but it may be attributed to the fact that larger hospitals usually have better systems that accept different kinds of insurance. Therefore, rural patients prefer to use larger hospitals to reduce out of pocket payments.

- Hospital *(reputation)* * Value of (*insurance/payment*): The interaction variable of hospital reputation and patients' value of insurance/payment type is negative, suggesting that the more patients value insurance and payment type in hospital choice, the less likely they will choose a reputatable hospital, relative to the local CAHs. Health insurance indicates the rural patients' financial accessibility of health care

systems. Rural patients usually enroll in the public health programs and are concerned more about financial pressure when choosing hospitals. Therefore, they will move according to the insurance acceptance instead of hospital reputations.

For the interaction variables of hospital attributes and individual characteristics, four of them are statistically significant.

- Hospital *(size/scope)* * employment: Consistent with the general bypass result, the interaction variable of hospital size/scope and employment status is negative, indicating that employed rural patients are less likely to choose larger hospitals over local CAHs. The employer plans for the patients who are currently employed might be an explanation for this result.

- Hospital *(size/scope)* * Married: Variable married positively influences the choice of a larger hospital. This may be attributed to the relative ease of transportation with having another member in the household and the spouse precious the patients more and try to provide better health care for them.

- Hospital *(reputation)* * household income*: Although household income is positively related to the choice of reputable hospitals, its effect is very small. The statistical result suggests that there is a trend that patients with higher household incomes are more likely to access hospitals with a strong reputation over local CAHs, which supports part of the hypothesis 8. However, generally low household income and small differences among rural populations might be related to the result that the effect is not significant among rural patients.

- Hospital *(reputation)* * uninsured*: The statistics also support the hypothesis that insurance plays an important role in patients' hospital decisions. Uninsured patients

are less likely to choose larger hospitals or reputable hospitals. Uninsured patients are less flexible than other patients regarding hospital choice.

5.2.2 Marginal Effects

A marginal effect reflects the rate of change in one variable relative to the rate of change in another variable. In this choice model, a marginal effect is interpreted as the change in probability of choosing the hospital that patient chose in the past 24 months, given a unit change in an independent variable, ceteris paribus. Marginal effect of the conditional logit model here is an absolute value. Within 250 respondents, 50 respondents chose local CAHs, 100 respondents chose an urban hospital, and 100 respondents chose another rural hospital. Therefore, 80 percent of the patients chose another hospital over the local CAH. It is easier to interpret the marginal effect as the change in probability of choosing another hospital over the local CAH, given a unit change in an independent variable, ceteris paribus.

The marginal effect of the interaction variables are directed derived from the software. Then the marginal effect of the continuous variable in the interactions is verified equaling to marginal effect of the interactions multiples to the sample mean of factor score (Table 5-5) differences between the two choices (please see Appendix 2 for detailed process).

Generated by SPSS, hospital attributer size/scope is comprised by bed number, urban, and special care. We standardized the value of each independent variable and took the mean of them to derive the factor score of size/scope. The factor score between two choices that in each choice set various, and the sample mean of 0.77 was derived,

suggesting that in general, the hospitals that rural Kentucky patients usually visit is 0.77 unit larger than the local CAHs.

The following equation presents the way that marginal effect of a single variable in an interaction was calculated. For example, we try to calculate the ME (marginal effect) of patients' value of reputation in the hospital choice:

(9) ME of [patients' value of (*reputation*)]

= ME of [Hospital Attribute *(size/scope)* * Patients' value of (*reputation*)] * (sample mean of the factor score difference *(size/scope)*)

Table 5-6 presents the results of the marginal effects of individual variables.

Table 5-5: Calculation of Factor Score Differences

ID	Choice	Bed	Standardized	Special Care	Standardized	Urban	Standardized	Factor Score (size/scope)	Factor Score Difference (Choice patient chose - Choice patient did not choose)
Mean		**121.6003**		**1.0055**		**0.246**			
S.D.		**156.112**		**1.1052**		**0.4283**			
i=1	1	322	1.2837	2	0.8998	1	1.7604	1.3147	
	0	25	-0.6188	0	-0.9098	0	-0.5744	-0.7010	2.0156
i=3	1	367	1.5719	5	3.6143	1	1.7604	2.3156	
	0	25	-0.6188	0	-0.9098	0	-0.5744	-0.7010	3.0165
.									
.									
i=340	1	51	-0.4522	1	-0.0050	0	-0.5744	-0.3439	
	0	25	-0.6188	0	-0.9098	0	-0.5744	-0.7010	0.3571
i=341	0	154	0.2075	1.5	0.4474	1	1.7604	0.8051	
	1	18	-0.6636	0	-0.9098	0	-0.5744	-0.7159	-1.5211
Sample Mean of Factor Score (size/scope) Difference									**0.7726**

Table 5-6: Marginal Effect of Conditional Logit Model

Interaction Variables	Marginal Effects	Individual Variable	Marginal Effects
*(Hospital Attributes) * (Patients' Value of Factors)*		*Patients' Value*	
(Size/Scope) * (reputation)	7.0310	Patients' Value of Reputation	5.4323
(Size/Scope) * (Travel Time/Travel Cost)	-13.7870	Patients' Value of Travel time and cost	-10.6522
(Size/Scope) * (Payment/Insurance)	4.8920	Patients' Value of Insurance and payment (holding size constant)	3.7797
(Reputation) * (Payment/Insurance)	-9.3140	Patients' Value of Insurance and payment (holding reputation constant)	-0.0978
*(Hospital Attributes) * (Individual Characteristics)*		*Individual Characteristics*	
(Size/Scope) * (Employment)	-5.9850	Employment	-0.0633
(Size/Scope) * (Marital Status)	6.8480	Married	0.0689
(Reputation) * (Household Income)	0.0000	Income	0.0000
(Reputation) * (Uninsured)	-68.9530	Uninsured	-0.0002

* Marginal effect is multiplied by 100.

Interaction with Hospital Attribute (size/scope)

- The marginal effect of <u>Hospital Attribute *(size/scope)* * Patients' value of *(reputation)*</u> is 7.031, and the mean difference of factor score is 0.77. The marginal effect of Patients' value of *(reputation)* is 5.43 (7.031*0.77). The interpretation of the result is that, by holding hospital size/scope difference between the two choices at 0.77, for 100 units increase of patients' value of hospital reputation in their decision, the probability for the patient to choose another hospital over local CAH increases by 5.43.

- The marginal effect of <u>Hospital Attribute *(size/scope)* * Patients' Value of *(travel time/cost)*</u> is -13.79, and the mean difference of factor score is 0.77. The marginal effect of Patients' Value of *(travel time/cost)* is -10.65 (-13.79*0.77). The result suggests that by holding hospital size/scope difference between the two choices at 0.77, for 100 units increase of patients' value of travel time/cost in their decision, the probability for the patient to choose another hospital over local CAH decrease by 10.65. The sharp decrease indicates that convenient and ease to access is a determinant factor in rural patients' hospital choice, and it is a good opportunity for CAHs to gain the local market since they have big location advantage.

- The marginal effect of <u>Hospital Attribute *(size/scope)* * Patients' Value of *(insurance/payment)*</u> is 4.89, and the mean difference of factor score is 0.77. The marginal effect of patients' value of *(insurance/payment)* is 3.78 (4.89*0.77), indicating that by holding hospital size/scope difference between the two choices at 0.77, for 100 units increase of patients' value of insurance/payment type in their decision, the probability for the patient to choose another hospital over local CAH

increases by 3.78. A possible reason is that larger hospitals usually accept more insurance and payment types than the CAHs, therefore reduce the financial burden of rural patients.

For dummy variables, marginal effect is calculated using equation (5) in the chapter 3 and was calculated in the Excel.

- The marginal effect of employment is negative, indicating that by holding hospital size/scope difference between the two choices at 0.77, the probability for an employed patient to choose another hospital over local CAH is 0.06 smaller than an unemployed patient. This may be attributable to the employer sponsored insurance, which is consistent with the result of the bypass model above.

- Married patient is more likely to choose another hospital instead of local CAH. By holding hospital size/scope difference between the two choices at 0.77, the probability for a married or a member of an unmarried couple patient to choose another hospital is 0.069 bigger than a patient who is alone in the household. Ease to transport with a partner in the household and the spouse is more precious the patient might be the reasons of this difference.

Interaction of Hospital Attribute (reputation)

Work at the same way, we calculated the sample mean of the score difference of hospital attribute (reputation) equals to 0.01, indicating generally, urban hospitals and other rural hospitals that patients chose have a little better reputation than the local CAHs.

- The marginal effect of <u>Hospital Attribute *(reputation)* * Patients' Value of *(insurance/payment)*</u> is -9.31, and the mean difference of factor score is 0.01. The marginal effect of patients' value of *(insurance/payment)* is -0.09 (-9.31*0.01). The

result suggests that by holding the hospital reputation difference between two choices at 0.01, for 100 units increase of patients' value of insurance and payment type in the hospital decision, the probability for the patient to choose another hospital over local CAH decrease by 0.09.

- The marginal effect of uninsured variable is negative. It suggests that by holding the hospital reputation difference between two choices at 0.01, the probability for an uninsured rural patient to choose another hospital over the local CAH is 0.0002 lower than an insured patient.

Either the continuous variable of patients' value of insurance and payment type, or the dummy variable of the patients' characteristics of insurance coverage, suggests that insurance and payment types place restrictions on rural patients when they choose hospitals. Uninsured patients and patients who value more of insurance and payment types in their decision are less likely to choose an urban hospital or another rural hospital over the local CAHs, which verifies the hypothesis 8 that insurance plays an important role in rural patients' hospital choices.

5.3   Proved Hypotheses

The following table summarizes the hypotheses we proposed in Chapter 4. Almost all the hypotheses proposed have been verified by the study, except hypothesis 3 and 8, which are partially verified.

Table 5-7: Testify Hypotheses

No.	Hypothesis	Significance
1	Hospital quality positively affects bypass of local CAH	Support
2	Hospital size and available specialists negatively affects bypass of local CAH	Support
3	Patients' satisfaction of local hospital negatively affects bypass of local CAH	Partially support (except availability of specialists)
5	Service and quality bypassers have different bypass reasons	Support
6	Patients prefer hospitals that serve less Medicare patients	Support
7	Insurance coverage positively affects bypass of local CAH	Support
8	Higher education and income levels positively affect bypass of local CAH	Partially support (income)
9	Travel time negatively affects bypass of local CAH	Support

5.4   Summary

The binary probit model explores the bypass behavior among Kentucky rural patients, using patients' intention data and the demographics information; the conditional logit model explores the hospital choice behavior by including the hospital attributes and patients' real action in the recent two years into the model. By including the interaction variable into the conditional model, the marginal effect of patients' perception of important factor in the decision and the individual characteristics are explored. Because these two variables are constant within a choice set, making interaction variables is the best way to test their effects on the dependent variable. The two models highly relate to each other and verify the consistency of patients' intention and action.

CHAPTER 6 CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Conclusions

This study utilizes survey responses from Kentucky rural patients and American Hospital Directory hospital attributes to examine how institutional and individual characteristics affect the choice of hospitals for rural patients in Kentucky. A binary probit model and a conditional logit model were used to evaluate factors affecting the choice of local CAHs versus other hospitals.

Consistent with previous studies, the results from this study suggest that the severity of illness and quality of medical service are important factors in rural patients' hospital choice and positively influence bypass behavior. The satisfaction with the local hospital decreases the likelihood of bypass behavior. Previous outpatient utilization of the local hospital positively affects the bypass behavior while the previous utilization of local hospital negatively affects the bypass behavior. Larger hospitals and better hospital reputation increase the probability that the hospital will be chosen by the patients. Patients with higher household income hold private insurance or married are more likely to choose large and reputable hospitals.

6.2 Policy Implications

The results of this study have implications for rural health care policy and rural hospital management. The following seven approaches could address rural health care concerns.

Explore residents' awareness of the local health care supplier. In this study, 10 percent of the respondents failed to provide information about their satisfaction with their local hospital. Of those who did not respond some stated that they never used the local

hospital before. It is reasonable to assume that others who failed to give feedback also lack exposure to their local hospitals. It is unknown to what degree patients do not use their local hospital because they are not aware of the available services at the local hospital. Increasing awareness regarding the services provided within the local hospital among local residents may assist in the effort to attract and retain local patients. The local CAHs may not have enough financial support to do promotion on the television or radio like larger hospitals. They may hand out the flies in the communities and keep local residents updated about the latest news of themselves. Conduct seminars about chronic diseases and prevent approaches in the communities and build up the relationships with local residents. CAHs in the local communities should take advantage of the location and try to retain as many local patients as possible.

The CAHs in rural Kentucky should establish their own database to monitor bypass rates at CAHs on a longitudinal basis. Based on the patients' home address or work address, CAHs could easily identify bypass behavior. A clear system should be established step by step timely. CAHs can use these data to track changes in bypass behavior, and future researchers can access to these data and collect more precise information for specific hospitals for their research objectives. The hospital could also collect better patient satisfaction measures. This would allow rural CAHs to start building quality measurement capacity and publish and share these results with the community. This is another useful way to raise the residents' awareness.

Create both horizontal networks with same type of members (CAH hospitals) and vertical networks with different types of members (larger hospitals, urban hospitals and other health care providers), or access an existing collaboration among rural hospitals.

This method (Moscovice et al., 1995) could address several quality-related problems for rural hospitals. There are two critical advantages associated with creating networks. First, CAHs can use limited resources to their fullest advantage by networking with other hospitals. This could improve access to primary and specialty physicians by utilizing a visitation program or through telemedicine. Telemedicine outreach programs have proven successful in the areas of internal medicine, cardiology, mental health, and dermatology (Forkner et al., 1996; Zahlmann et al., 1997; Aucar et al., 1998; and Callahan et al., 1998). Consulting with specialists via distance methods may help to more effectively triage patients and to direct them to the most appropriate care location. Campbell et al. (2000) defined quality of care as "whether individuals can access the health structures and processes of care which they need and whether the care received is effective." When desired services are not available CAHs can still be quite useful serving as a conduit by promptly referring patients to a facility in more urban areas. Network not only saves the cost of investing in expensive specialty clinics, but also improves the reputation and patients' confidence in the quality of local rural health care.

Therefore, CAHs in the rural Kentucky should start networking if they haven't, and keep network if they already established the relationship.

Actually, arrangement with another CAH or a private organization is required when the rural hospital transfers to a CAH status. CAH must have arrangements with respect to quality assurance. The state office of rural healthcare should keep tracking the implementation of this requirement among CAHs to assure the purpose of this requirement is reached (Rural Assistance Center).

Conduct case studies with those CAHs with very low bypass rates to understand what they are doing/have done to improve their services and their communications with patients. Since CAHs usually have similar structures and systems, it will be more effective for the CAHs study from each other.

Increase preventive services. Rural communities usually have more uninsured patients with lower income. Individuals who do not invest in preventive, primary or ongoing care often result in more trips to the emergency room which is associated with higher costs both to the patient and to the hospital. In addition, those that don't seek preventive care will likely result in higher rates of chronic diseases, for example, diabetes, heart disease, high blood pressure and high cholesterol. Once there is an emergency, CAHs will often be forced to refer the patients outside the community which results in higher bypass rates.

Improve the relationship between physician and patients. The results from this study suggest that family preference is a unique reason for quality bypass. Rural patients will be more likely to choose local CAHs if they have a tie with the local physicians and staff. Due to limited resources and financial abilities, it is unrealistic for CAHs to facilitate themselves like urban hospitals. Therefore, it will be more efficient to retain the quality bypassers in the local community. The physicians-patients-tie is one of the ways. With less specialists who is normally overwhelmed by the large population of the patients every day, be patient with the patients and be considerate of the financial depress among rural patients are highly expected in the CAHs. This requirement is related to the next implication that how to retain the professionals that who is sincerely enjoy serving for the CAHs.

Recruit and retain of medical professionals. Lack of services and specialists are one of the determinants of bypass in rural communities. The professionals in rural hospitals have to provide services with fewer resources than those in urban areas. It is difficult for rural hospitals to recruit and sustain an adequate workforce. A study (Daniels, et al., 2007) identified factors associated with recruitment and retention of health professional graduates from a public university in the southwest United States. The results from study suggested that loan forgiveness and rural training programs appear to support recruitment. Retention efforts must focus on financial incentives, professional opportunity, and desirability of rural locations.

6.3   Contribution to Hospital Choice Researches

This study's contribution to the research of hospital choice among rural patients are follows: First, it focuses on the local CAHs proved the popular bypass behaviors in counties that do not have a CAH present, and also located around the golden triangle that is constructed by Louisville, Lexington, and Cincinnati. Patients resided in the counties that near urban areas are more likely to travel to the urban hospitals. Second, by separating the bypass model in to service bypass and quality bypass, we found out that the two groups of patients share three factors and also has three unique factors affecting their bypass behavior. For rural hospitals, it is unrealistic to keep the same size and scope as urban hospitals. Therefore, retain the target patients, like the quality bypassers, will be an efficient approach to retain as many local patients as possible. The unique factors that affect patients' bypass of local CAHs for quality issues is more helpful to the local CAHs. Finally, the interpretation of the marginal effect of interaction variables indicates the relationship between the stated preferences and the revealed preferences among rural

Kentucky patients, which provide reliable information to the policy makers and hospital management.

6.4   Drawbacks of the Study and the Future Researches

The data and the model used in this study certainly have some limitations. First, the straight line distance that was used between the location of a hospital and a patient's home might not be the best way to calculate traveling time and travelling costs. Under many situations, traveling time and costs largely depend on the road conditions. Second, the separation of service bypass and quality bypass was not based on a direct statement by respondents. A respondent was classified as a quality bypasser when any one of the attributes that are related to quality was rated poor by this respondent. The randomization of the answer may lead to statistical bias. Future research should solicit more specific information on this topic and have a more precise separation. Rural hospital administrators would be very interested in recognizing the specific hospital attributes that local users are pursuing, especially those identified by individuals bypassing for quality reasons. Third, the work zip code was requested in the survey but the response rate was surprisingly low. Rural residents might commute to urban areas to work and use the hospitals near their work places, which might also explain the high bypass rate. Future studies should collect this information and test the relationship.

APPENDICES 1

Factor Analysis for Hospital Attributes Variables

Rotated Component Matrix: Hospital Attributes			
	Component		
	1	**2**	**3**
	hospital size/scope	**performance**	**hospital reputation**
Bed Number	0.899		
Number of Special Care	0.890		
Urban	0.880		
Antibiotic (hospital-national) Scores		0.918	
LVS (hospital-national) Scores		0.784	
Inpatient Daily Routine Cost			0.859
Medicare Ratio			0.595

Extraction Method: Principal Component Analysis.

The rotation of the factor structure has clarified things considerably: there are three factors and variables load very highly onto only one factor. In this matrix, bed, special care, and urban load highly onto component 1, which named hospital size/scope in the study. LVS and Antibiotic scores load highly onto component 2, which initially named performances. However, the variable is tested without effect on the dependent variable and was discarded. Inpatient Daily Routine Cost and Medicare Ratio load highly onto component 3, which named reputation in the study.

APPENDICES 1(continued)

Factor Analysis for Patients' Value of Factors in Hospital Choice

	Rotated Component Matrix			
	Component			
	1	**2**	**3**	**4**
	value of reputation	**value of size/scope**	**value of travel time / cost**	**value of insurance / payment**
My family prefers the service at this location	0.813			
I prefer the service available at this location	0.809			
Better reputation	0.738			
Better quality of medical care	0.708			
Available technology	0.572			
Specific services and size	0.522			
Specific specialist I need is not available elsewhere		0.776		
The specialist I need is not available elsewhere		0.736		
Severity of illness		0.665		
Referred by my doctor/nurse practitioner		0.525		
Traveling cost (gasoline, hotels, etc)			0.849	
Traveling time			0.848	
Relatives live at this location			0.723	
Available shopping opportunities			0.518	
My insurance requires me to go to this location				0.849
Payment type				0.819

Extraction Method: Principal Component Analysis.

The rotation of the factor structure has clarified things considerably: there are six factors and variables load very highly onto only one factor. Four components were created and named as value of reputation, value of size/scope, value of travel time/cost, and value of insurance/payment.

APPENDICES 2

Marginal Effect of Individual Variable in the Interacted Variable

$$U_{ij} = \beta_1 * H_1 + \beta_2 * H_1 * B_1 + \beta_1 * H_1 * D_1 + \varepsilon_{ij}$$

For patient 1

$$U_{11} = \beta_1 * H_1 + \beta_2 * H_1 * B_1 + \beta_1 * H_1 * D_1 + \varepsilon_{ij}$$

$$U_{10} = \beta_1 * H_0 + \beta_2 * H_0 * B_1 + \beta_1 * H_0 * D_1 + \varepsilon_{ij}$$

Where

H1 represents attributes associated with choice 1

H0 represents attributes associated with choice 0

H1≠H0

B1 represents patient 1's perceptions of importance levels of different factors in hospital choices

D1 represents patient 1's demographic characteristics

B1 and D1 do not vary within the choice set.

ε represents the unobserved factors

Therefore

$$\text{Prob}(Y_i=1) = \frac{\exp(\beta' X_{i1})}{\sum_{m=1}^{J} \exp(\beta' X_{ij})} \qquad J=2$$

$$= \frac{\exp(\beta 1*H1 + \beta 2*H1*B1 + \beta 1* H1*D1)}{\exp(\beta 1*H1 + \beta 2*H1*B1 + \beta 1* H1*D1)+\exp(\beta 1*H0 + \beta 2*H0*B1 + \beta 1* H0*D1)}$$

Set

$$\text{Exp}(U_{11})=\exp(\beta_1*H_1+ \beta_2*H_1*B_1 + \beta_1* H_1*D_1)=\text{expA}$$

$$\text{Exp}(U_{10})=\exp(\beta_1*H_0+ \beta_2*H_0*B_1 + \beta_1* H_0*D_1)=\text{expB}$$

The marginal effect of the interacted variable H1D1 equals to

$$\frac{\partial Prob(Y1 = 1)}{\partial H1D1}$$

$$= \frac{\partial \frac{expA}{expA+expB}}{\partial H1D1}$$

$$= \frac{\beta 3 expA(expA+expB) - expA(\beta 3 expA + 0)}{(expA+expB)^2}$$

$$= \frac{\beta 3 (expA)^2 + \beta 3 \exp(A+B) - \beta 3 (expA)^2}{(expA+expB)^2}$$

$$= \frac{\beta 3 \exp(A+B)}{(expA+expB)^2}$$

The marginal effect of individual variable D1 equals to

$$\frac{\partial Prob(Y1 = 1)}{\partial D1}$$

$$= \frac{\partial \frac{expA}{expA+expB}}{\partial D1}$$

$$= \frac{\beta3H1(expA+expB)-expA(\beta3H1expA+\beta3H2expB)}{(expA+expB)\wedge2}$$

$$= \frac{\beta3H1(expA)^2+\beta3H1\exp(A+B)-\beta3H1(expA)^2-\beta3H2\exp(A+B)}{(expA+expB)\wedge2}$$

$$= \frac{\beta3\exp(A+B)(H1-H2)}{(expA+expB)\wedge2}$$

$$= \frac{\beta3\exp(A+B)}{(expA+expB)\wedge2} * (H_1\text{-}H_2)$$

Therefore, it is proved that the marginal effect of the individual variable equals to the factor score differences of two choices * marginal effect of the interacted variables (for continuous variables only).

APPENDICES 3

University of Kentucky

Health Care Service Survey

This study is examining where people receive their health care services and the reasons why they make their choices. Your response is very important and will be used by hospital administrators to improve health care quality and accessibility. Thank you very much for your time in completing this survey. If you have questions about the study or the results, please contact Dr. Alison Davis, Alison.davis@uky.edu, (859) 257-7260.

We would like to start by learning where you currently receive your health care services.

A1. Have you been to the doctor in the last 12 months?

☐ Yes   ☐ No

A2. Where do you usually go for your doctor appointments?

Name of the hospital/clinic/health care center

_____

City and/or County where it is located

_____

A3. Have you had an outpatient medical service in the last 12 months?

☐ Yes   ☐ No

A4. Where do you usually go for outpatient medical services?

Name of the hospital/clinic/health care center

_____

City and/or County where it is located

_____

A5. Have you been in the hospital in the last 24 months?

☐ Yes   ☐ No

A6. If your answer to the last question (A5) is Yes, how many times? _____

A7. What hospital did you visit?

Name of the hospital/clinic/health care center

_____

City and/or County where it is located

_____

A8. Was your last hospital visit:

☐ An emergency visit   ☐ A non-emergency visit

A9. If this is not typically the hospital you use, which hospital would you normally visit?

Name of the hospital/clinic/health care center

_____

City and/or County where it is located

_____

A10. In case your last medical visit was an emergency visit and an ambulance took you to the hospital, did you choose to which hospital to go?

☐ Yes   ☐ No

A11. What is the name of the hospital where you were taken?

_____

A12. If it applies, had any of the members in your family/household (other than you) been to the doctor in the last 12 months?

☐ Yes   ☐ No

A13. Where does your family or the members in your household (other than you) usually go to receive their health care services?

Medical Treatment	Name of the hospital/clinic/health care center	City or county where it is located
Doctor appointments		
Outpatient medical services		
Hospital stays		

A14. Have you used a local (County or neighboring county) primary care physician in the last 2 years?

☐ Yes ☐ No

A15. Have you used a local (County or neighboring county) outpatient service in the last 2 years?

☐ Yes ☐ No

A16. Have you used your local (County or neighboring county) hospital in the last 2 years?

☐ Yes ☐ No

Now we would like to know about the reasons why you made those choices.

B1. How important was each of the following when choosing which hospital to visit?

Please, check all that apply:

Very Important (VERY)

Somewhat Important (SOME)

or Not Important (NOT)

Referred by my Doctor/Nurse Practitioner	☐ VERY	☐ SOME	☐ NOT
Local service of this type was not available	☐ VERY	☐ SOME	☐ NOT
The specialist I need is not available elsewhere	☐ VERY	☐ SOME	☐ NOT
Severity of illness	☐ VERY	☐ SOME	☐ NOT
Specific services and size	☐ VERY	☐ SOME	☐ NOT
My insurance requires me to go to this location	☐ VERY	☐ SOME	☐ NOT
Payment type	☐ VERY	☐ SOME	☐ NOT
Available technology	☐ VERY	☐ SOME	☐ NOT
Better quality of medical care	☐ VERY	☐ SOME	☐ NOT
Better reputation	☐ VERY	☐ SOME	☐ NOT
I prefer the service available at this location	☐ VERY	☐ SOME	☐ NOT
My family prefers the service at this location	☐ VERY	☐ SOME	☐ NOT
Relatives live at this location	☐ VERY	☐ SOME	☐ NOT
Traveling time	☐ VERY	☐ SOME	☐ NOT
Traveling cost	☐ VERY	☐ SOME	☐ NOT
Available shopping opportunities	☐ VERY	☐ SOME	☐ NOT

B2. If you have any other reason for choosing which hospital to visit, please explain

_____

_____

_____

B3. How would you rate the following aspects of local medical care in THE COUNTY WHERE YOU LIVE? For each item, please check:

<u>Excellent (EXC), Good (GOOD), Fair (FAIR), or Poor (POOR).</u>

Quality of hospital   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Quality of ambulance service   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Quality of Health Department   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Availability of the service I need   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Available technology   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Quality of medical care   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Quality of hospital nurses   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Reputation   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Quality of primary care physicians   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Available Specialists   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

Accepts my insurance status   ☐ EXC ☐ GOOD ☐ FAIR ☐POOR

B4. Is there any aspect of the local medical care not included in the last question that you find important? Please, explain

_____

Lastly, we would like to know a bit more about yourself.

C1. What is your gender?

☐ Female   ☐ Male

C2. What is your age?   _____ Years

C3. What is your ethnic background?

☐ White

☐ Black or African American

☐ Hispanic

☐ Asian

☐ Other _____

C4. What is your annual household income before taxes?

☐ under $15,000   ☐ $50,000 - $74,999

☐ $15,000 - $24,999   ☐ $75,000 - $99,999

☐ $25,000 - $34,999   ☐ $100,000 - $125,000

☐ $35,000 - $49,999   ☐ above $125,000

C5. What is the highest level of school you completed?

☐ not a high school graduate   ☐ technical school

☐ high school only   ☐ bachelor degree

☐ some college, no degree   ☐ master degree

☐ associate degree   ☐ doctorate

C6. Which of the following categories best represents your employment status?

☐ part time

☐ full time

☐ retired

☐ student

☐ Other _____

☐ not currently employed

☐ do unpaid work from home/homemaker

☐ unable to work

C7. How many members are in your household, including yourself?

_____

C8. How many children are in your household?

☐ None

☐ 0-4   how many? _____

☐ 5-11   how many? _____

☐ 12-17   how many? _____

C9. What is your marital status?

☐ Married

☐ Single

☐ Member of an unmarried couple

☐ Widowed

☐ Divorced/Separated

☐ Other

C10. What is your ZIP code?

Home ZIP code _____   Work ZIP code _____

C11. Do you or members in your household have a history of…?

Diabetes	☐ Yes	☐ No
Heart disease	☐ Yes	☐ No
High blood pressure	☐ Yes	☐ No
High cholesterol	☐ Yes	☐ No

Other (please, specify) _____

C12. What kind of insurance do you have?

☐ Private

☐ Medicare

☐ Medicaid

☐ Uninsured

☐ Other (please, specify) _____

C13. Is your insurance through?

☐ Your employer or spouse's or dependent's employer

☐ A private independent plan that you buy on your own

Thank you!

Please, if you have any comments or questions on this survey use the following space to let us know about it

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