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Racial Differences in Willingness to Pay for Hospital Access

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Abstract

We estimate the willingness to pay (WTP) of individuals to have increased spatial access to hospitals using a spatial hedonic price model. Employing a dataset of over 90,000 detailed housing observations, we find that WTP of individuals to live one mile closer to a hospital is positive if the hospital is a designated public hospital, lower for private hospitals and insignificant for non-profit hospitals. Areas comprised of a relatively large population of black residents value spatial access significantly more and, for higher concentrations, exhibit a positive willingness to pay for all hospital types. This is likely due to increased transportation costs of individuals in minority areas.

JEL Classification: I11, I18, R53
Keywords: Health Care, Housing Markets, Cost-Benefit Analysis

1 Introduction

There are approximately 8,900 hospitals in the United States, with 60% of those operating as non-profits, 20% government owned, and the remaining 20% are for profit.[1] Due to market failures in health care provision, it is generally accepted that some degree of government intervention is desirable. Typically, government intervention policies are deemed a good investment if the social benefits are at least as great as the costs. While the monetary cost of health care provision is a relatively straightforward calculation, quantifying the benefits in the absence of explicit prices is a difficult task for researchers.

Current methods focus on deriving a monetary value of health care provided from patients who receive treatment. This ranges from questionnaires given to current or former patients of a particular hospital or program, to surveys that ask participants to estimate the value of services under hypothetical scenarios. However, the benefit of health care provision is not limited to utilization, but also stems from access to services. Affordability of health care has become synonymous with access to health care, even though access encompasses other considerations as well (Penchansky, 1981). Spatial accessibility can be measured by the geographic boundaries that exist between patients and the nearest provider. Sometimes referred to as "potential utilization", geographic access is an important determinant of many types of health care outcomes (Guagliardo, 2004). Distance to the nearest provider in particular has been shown to influence the probability of receiving cancer screenings, enrolling in alcohol and substance abuse programs, obtaining less invasive treatments for severe conditions and, most concernedly, surviving a heart attack or stroke (Fyer et al., 1999; Fortney et al., 1995, 1999; Nattinger et al., 2001; Buchmueller et al., 2006; Schmitta et al., 2003; Hiscock et al., 2008).

Measuring the value of spatial accessibility is complicated by the fact that having increased access to a health care provider likely provides a benefit to all potential patients,

[1]This information is obtained from the *Centers for Medicare and Medicaid Services: Annual Cost Report* (2011).

not just realized patients. As such, stated preference survey data which focuses only on the benefits received from treatment itself will understate the total benefits provided. Furthermore, survey data has many shortcomings that limit the ability to accurately obtain value estimates on a large scale (Smith, 2002).We instead consider the hedonic price method to elicit the social benefit of access to health care services.

The hedonic price method offers a useful alternative to stated preference survey data. Commonly employed to measure the value of environmental goods and characteristics, the method approximates a willingness to pay for non-market goods by analyzing housing transaction data. The value of the amenity is reflected in a higher price for houses located closer to the amenity. An aggregation of the house price differential provides an approximate value the community places on the having the amenity in close proximity. This net effect is the sum of the positive amenity a hospital provides (increased spatial access) and the negative amenity of congestion and noise.

We use a rich dataset of over 90,000 housing transactions and, controlling for individual house and neighborhood characteristics, treat hospital proximity as an amenity and estimate the willingness to pay to live closer to the nearest hospital. When all hospitals are included without distinguishing whether it is public, private or non-profit, the influence on house prices is statistically insignificant. However, when treated as separate types, private and public hospitals have opposing influences, while non-profit hospitals yield a statistically insignificant influence.

We find that living one percent closer to a public hospital is associated with an increase in average house price of approximately .05% while living one percent closer to a private hospital is associated with a *decrease* in average house prices of approximately .01%. This suggests that there is a net positive to public hospital proximity that is not present with respect to private hospitals, perhaps due to lower utilization rates, and consequently lower positive spillovers, of the latter.

Assuming that a house is located at the average distance from a hospital and is in an area in which black residents comprise 10% of the population, these effects translate to an increase of $385 in associated house prices for houses closer to public hospitals and a decrease of approximately $155 for increased proximity to private hospitals. Understandably, the influence of spatial proximity is more pronounced for households in areas closer to the hospital and less pronounced for those further away. For households in areas one standard deviation closer from the mean and comprised of 10% black residents, a one mile increase in proximity to a public hospital is associated with a $1,756 increase while average house prices in areas one standard deviation further from the mean experience an increase of $216 from increased proximity. Similarly, the reduction in average house prices for households closer to a private hospital is larger than the reduction for household in areas further from the hospital.

Furthermore, we find that individuals are not homogenous in their revealed willingness to pay for increased access. We interact the percent of black residents with proximity to the hospital to derive any increases or decreases in willingness to pay relative to the average. Our results suggest that areas with a higher percent of black residents are indeed willing to pay even more for increased spatial access to public *and* private hospitals. Evidence for this is provided by the fact that we find negative and statistically significant coefficients on the black and distance to hospital interaction terms for all hospital types.

With private hospital access the differential is apparent with a smaller decrease in house prices from increased spatial access. The disamenity of private hospital proximity becomes a net positive amenity for areas that have approximately 31% or more black residents (i.e. proximity increases average house price). This is consistent with previous findings that black households use hospitals more than preventative care services (Zuvekas and Taliaferro, 2003), and consequently value hospital access more than other households. These systematic differences in revealed preferences may have important policy implications when estimating the total benefits of health care programs and services for different populations.

In addition to exploring the willingness to pay for increased access to particular hospitals, hedonic price models are particularly useful for quantifying the intangible social benefits provided by open access goods and services. For the data in question, for example, the yearly per household expenditure on hospital construction and maintenance of $395 financed through taxes appears to provide a net benefit greater than the expenditure for all but the furthest households.[2] This is particularly true for areas with a higher percent of black residents and suggests that further investment in increased hospital access is justified.

Literature Review

Value of Health Care

Penchansky (1981) describes access to health care as availability, accessibility, affordability, acceptability and accommodation. The spatial component of accessibility has received less attention than the financial component, but is recognized as an important indicator of health care utilization and outcomes (Cohen and Lee, 1985; Dranove et al., 1993; Hadley and Cunningham, 2004). A large literature, summarized in Panellia et al. (2006), is devoted to detailing the significant role that geography plays in health care access in rural areas. The effect of hospital closures on health care utilization is typically invoked as a measure of value of spatial access (Liu et al., 2001; K. Muus and Gibbons, 1995). However, hospitals which close are typically inefficient, (Capps et al., 2010; McNamara, 1999; Buchmueller et al., 2006), and it is likely that hospitals which remain open generate a greater value to the surrounding community. All studies note the importance of distance on various measures of health care utilization in rural areas.

The importance of spatial access in urban areas has received considerably less attention. Buchmueller et al. (2006) find that a hospital closure in Los Angeles is associated with

[2] Per household spending obtained from the U.S. Census Bureau. Naturally, total government expenditure on health care is significantly higher but that consideration is a cost-benefit analysis for each patient in particular rather than the entire community. Included in the average expenditure is the maintenance and new construction of hospitals that are government financed.

increased deaths from heart attacks and injuries and seniors in particular face additional barriers to care after a hospital closure. Interestingly, they find that when questioned, individuals do not report any significant difference in health care utilization as a result of the urban hospital closure even though the mortality numbers indicate otherwise. The latter finding casts further doubt on the validity of employing survey data alone to capture the value of health care access.

It is also worth noting that minority populations may value spatial access differently than the majority. Zenk et al. (2006) find that while distance to the nearest hospital does influence utilization of preventative services, it does not do so equally to all populations. Neighborhoods with large numbers of blacks are less influenced by distance than other neighborhoods and, most troubling, this influence matters less in neighborhoods which would benefit the most from preventative care (Zenk et al., 2006). Although some of this disparity is caused by differences in income and health care insurance coverage, it is estimated that a significant difference in usage rates would remain even if income and insurance differences were eliminated (Weinick et al., 2000). On the flip side, Zuvekas and Taliaferro (2003), find that use of hospitals rather than preventive care, is much higher for blacks in general. Taken together, areas with more black residents are likely to value increased spatial access to hospitals relatively more than access to preventative care services.

Several additional studies, summarized in Higgs (2009), detail the importance of distance on utilization rates of patients undergoing various treatments. Utilization rates in all cases are positively related to geographic access, measured by distance. However, whether concerned with the value of urban or rural access to hospitals, the measured value in these studies is constrained to individuals receiving treatment within the time frame studied. No efforts have been made to estimate the monetary value received by all individuals living in close proximity to care, other than in terms of health benefits received by treatment.

Although the monetary value of having spatial access, for current or potential patients, to hospitals has not been considered, attempts have been been made to quantify the benefits received from other aspects of health care provision. Stated preference survey data is the most popular method of measuring value of health care. Contingent valuation surveys ask individuals, directly or indirectly, how much they are willing to pay for the service or attribute in question. This dollar amount is taken as a proxy for the value generated by that good or attribute in the absence of a traditional market.[3] Contingent valuation methods have been used to elicit a willingness to pay (WTP) for numerous treatments of specific health conditions as well as broader provisions.[4] The method was first employed in the 1970's (Acton, 1973) but did not become widely used until the 1990's (Smith, 2002), with the work of Donaldson (1990), Johannesson et al. (1991), Johannesson and Johansson (1991), and Gafni (1991) initiating use. A brief summary of the studies conducted during this time period can be found in Deiner et al. (1998) and Klose (1999).

More recent work has, among other things, used contingent valuation methods to estimate the relative value of different programs and treatments (O'Shea et al., 2002; Shackley and Donaldson, 2000; Olsen and Donaldson, 1998; Ryan, 1998; Ryan et al., 1997), WTP for informal health care provision and access (van den Berg et al., 2005), and WTP for health insurance in rural areas (Asgary et al., 2003). However, although useful in some contexts, contingent valuation methods have considerable drawbacks (Smith, 2002). Individuals are asked opinions about a perceived value that they do not have to pay for and in some cases have already received, prompting the question of how accurate and consistent these responses may be (Blamey et al., 1999). It has been found that the ordering of questions may influence the stated willingness to pay for a good (Stewart et al., 2002), preferences can be inconsistent (Diamond and Hausman, 1994),[5] and responses may be too vague to quantify (Ryan and

[3]An alternative method is the use of Quality-Adjusted Life-Year (QALY) to estimate the costs of one quality-adjusted year of life. This method is typically used to conduct cost-benefit analysis of different treatments to a patient rather than the direct willingness to pay for health care provisions. As such, it falls outside the scope of this paper but issues with this method have been detailed in Bobinac et al. (2012).

[4]A summary of early contingent valuation studies can be found in Mitchell and Carson (2000), and more recently in Klose (1999).

[5]See (Shackley and Donaldson, 2002) for a discussion of issues surround inconsistent preference rankings. Attempts to address this issue have not been successful to date.

Watson, 2009).[6]

The hedonic price method, described below, provides an attractive alternative to contingent valuation surveys. Hedonic markets have been used to estimate the value of many non-market goods. These goods may be intangible goods, such as preferences for neighbors of a certain demographic or good air quality, or tangible goods like parks or a nearby airport. Environmental economists routinely use the hedonic price method in conjuncture or in lieu of contingent valuation measures. These include estimating the value of environmental characteristics such as air quality, water quality, hazardous waste sites and noise pollution (Brasington and Hite, 2005; Kim et al., 2003). Additionally, the value of environmental amenities such as national parks (Pearson et al., 2002), forests (Mansfield et al., 2005; Thorsnes, 2002), urban trees and ponds (Luttik, 2000), open spaces (Anderson and West, 2006), wetlands (Mahan et al., 2000) and green spaces (Cho et al., 2006; Tajima, 2003) have been estimated as well. Like health care, these non-market goods are often considered public goods with significant social benefits and government funding sources.

Estimating the value of health care provision and access poses similar problems and arguably should consider similar solutions as environmental features (Hanley et al., 2003). While the environmental field has relied heavily on the hedonic price method, the health field has yet to adopt a similar framework. It is true that hedonic markets cannot convey the value of all things we care about with respect to health care, but it can provide a small part of the value of many different components. Rather than providing a distinct alternative to current methods, the hedonic price method offers an additional tool for health economists concerned with cost-benefit analysis. In addition to providing an initial estimate of the value of spatial access to hospitals, this paper serves as one example of the many potential uses of hedonic price models to quantify the benefits of health care services, access and programs.

[6] A comprehensive discussion of issues with contingent valuation in the health care literature can be found in Jones (2006).

Hedonic Price Methodology

Hedonic market valuation relies on the theory first developed by Rosen (1974). Following Rosen (1974), Palmquist (1984), and Freeman et al. (1993), later summarized by Michael et al. (2000), the hedonic-price function is developed from the interaction of producers and consumer in the market for housing. Housing can be considered a differentiated product 'Z' with characteristics, where Z = (z_1, z_2, ... z_n). The price of a property is a function of its characteristics, P = P(Z). This function represents a collection of bid and offer functions in the housing market.

The utility of consumers is a function of all 'Z' housing characteristics and all other relevant goods, 'X'. Consumers then are assumed to maximize utility, U = U(X, z_1, z_2,....z_n), subject to the typical budget constraint Y = P_xX + P_zZ(z_1, z_2,....z_n). We can consider the proximity to the nearest hospital as z_i. The general form for the hedonic-price equation for this study expresses the sale price as a function of property characteristics. There is not a single specification detailed as the proper one in the literature (Michael et al., 2000), but it generally follows: Price = f(S, L) where S represents the housing structural characteristics and L the location attributes. Taken together, we can think of a house as a bundle of goods where each "good" has an influence on the house price but no explicit price itself. With a large enough sample size it is possible to hold all but one of the housing goods constant and observe the average change in housing price from changing the single good. The change in housing price can be interpreted as the willingness to pay for that good. This can be done for all goods, the sum of which is the total price of the house in equilibrium.

The standard hedonic model follows the vector form econometric model:

$$\nu = X\beta + \varepsilon, \tag{1}$$

where ν is an $n \times 1$ vector representing the housing price, X is the $n \times m$ vector of m explanatory characteristics of the observation and ε is normally distributed with constant variance and zero mean. The price of a house is influenced by the quality of the house and the quality of the neighborhood. We assume that the quality of a house is measured by the house size, lot size, number of partial and full bathrooms, age of the house, and the existence of a central air conditioner, pool, deck, fireplace, garage, and more than one story. An increase in amenities should yield a higher price while the age of the house may have a positive impact (if it has historical appeal) or negative (if it will require expensive upkeep). Additionally, literature suggests that the quality of the school district, average income, the racial composition, the crime rate, proximity to a pollution source, the educational composition, and distance to the central business district (CBD) are influential variables on neighborhood quality (Gibbons and Machin, 2008).

It is expected that the crime rate, percent of population that is black and closer proximity to a source of pollution are associated with lower house values, and consequently, have a negative effect. It is expected that higher school quality, measured by the pass rate on the 9th grade proficiency test (Brasington and Haurin, 2006), will be associated with higher house prices while distance to the CBD is assumed to have a negative effect. Although there is no explicit geographic area designated as the CBD, we measure the distance of each house to the center of the downtown area. We also include the distance to the nearest public university to account for amenities associated with colleges.

Proximity to the nearest hospital provides an obvious benefit to those who value increased spatial access to the services provided. However, there are significant negative spillovers in the form of increased congestion and noise that are also increasing in proximity. We observe the net effect of these two influences which is taken to be the overall value-added to households. Distance to the nearest hospital is routinely mentioned and simply proxied by distance to the CBD (often used as a catch-all for access to many types of amenities). While this is a reasonable assumption for many amenities, there is reason to doubt the accuracy of this assumption for hospitals in particular. Most hospitals were founded at least 50 years ago, with many over 100 years ago, long before the extensive development of a bustling downtown area.[7] We include distance to the nearest hospital, as well as all our other distance variables, in natural log form to account for dwindling influence as distance increases.

The neighborhood quality measures are taken from averages of census block groups and the values act as representative for houses within that group. While the housing price and characteristic measures are taken from each house specifically, we average these at the census block group level as well to facilitate the spatial nature of our analysis (Brasington and Hite, 2005). The use of a hedonic model to measure willingness to pay for an amenity is complicated by the fact that housing prices are interrelated. An increase in the price of one house will increase the neighboring house values (Anselin, 1988). An inclusion of the average price of the nearest neighbors' house is possible in the Ordinary Least Squares framework, but likely biased (Lesage and Pace, 1988). Although we run a simple OLS estimation, a spatial model which simultaneously estimates the house prices with maximum likelihood estimation is more appropriate.

To properly address the spatial dependence of house prices, we include the average housing prices and average characteristics of neighboring houses as additional independent variable, known as a Spatial Durbin Model (SDM). The house price dependent variable vector is multiplied by a weight matrix representing the spatial relationship in prices. The **W** weight matrix is typically constructed as an $n \times n$ symmetric standardized matrix representing a nearest neighbor or distance relationship between housing observations. This matrix is constructed by placing a one in the matrix if two houses neighbor each other and then dividing across each row by the number of non-zero elements in that row. Naturally, the matrix has zeros in the main diagonal since no house is a neighbor to itself.

The spatial durbin hedonic price model takes the form:

$$LnP = \alpha + \rho W(LnP) + WX\beta + \epsilon_i, \text{ where } \epsilon \text{ is } N(0, \sigma^2 I), \tag{2}$$

[7] There is no centralized record of hospital locations and their founding dates available. We obtained this information from individual hospital websites for hospitals in sample.

where X is a matrix of the housing and neighborhood characteristics, and W is an $n \times n$ spatial weight matrix representing the nearest neighbor relationship between houses within the MSA. Included in X is the log distance in miles to the nearest hospital and, separately, the interaction terms between proximity to the nearest hospital and the percent of population that is black.

Choosing the optimal number of nearest neighbors is fairly arbitrary and usually ranges from 5-20 with respect to hedonic modeling (Sedgley et al., 2008). I follow the procedure put forth in Lesage and Pace (1988) and find the optimal number of nearest neighbors to be 7.[8] Consequently, the matrix is constructed using the nearest seven neighbors. The natural log of house prices appearing on the right hand side captures the endogeneity of house prices. If, for example, the price of house A increases, the price of neighboring house B will also increase. A feedback mechanism implies that the increase in house B's price will further increase house A's price. This simultaneity issue is resolved by solving for the log house price on the left hand side using Maximum Likelihood Estimation, yielding the data generating process (Lesage and Pace, 1988):

$$LnP = (I_n - \rho W)^{-1}(\alpha + X\beta) + (I_n - \rho W)^{-1}\epsilon$$

The spatial model allows us to calculate the direct, indirect, and total effects for each of the independent variables. Let

$$\begin{aligned} V(W) &= (I_n - \rho W)^{-1} \text{ and} \\ S_r &= V(W)(I_n * \beta_r), \text{ then} \\ LnP &= \sum_{r=1}^{k} S_r(W)x_r + V(W)i_n\alpha + V(W)\epsilon \end{aligned} \tag{3}$$

[8]To keep the unit of observation consistent, we treat neighbors as the census block group rather than the individual house. Consequently, our analysis includes spatial consideration of the average house prices in the nearest 7 census block groups.

The direct effect is the average effect that a change in the independent variable of an observation has on its own dependent variable and can be described as $\frac{\partial LnP_i}{\partial x_{i,r}} = S_r(W)_{i,i}$. This coefficient includes the initial impact of the change in an independent variable on its dependent variable as well as feedback in the system. This feedback occurs when the change in the dependent variable causes changes in the other observations through the spatial weight matrix, which in turn feedback onto the initial observation. The indirect effect represents the average spatial spillover effect that a change in one observation has on all other observations, excluding its own observation and can be describes as $\frac{\partial LnP_i}{\partial x_{j,r}} = S_r(W)_{i,j}$. The total effect is the sum of the direct and indirect effects. To isolate the associated effect of an increase in distance to the nearest hospital on the the house in question, we focus on the direct effects, although the indirect and total effects are available upon request.[9]

Data

Data is drawn from a variety of sources. Information on housing transactions and characteristics comes from the data used in Brasington (2004), Brasington and Hite (2005) and the summary files of the 2000 Census. Transaction data and features are from the metropolitan statistical areas of Ohio and include all houses sold in the year 2000. The average characteristics and prices can be found in Table 1.

There are two main sources of information on hospital locations. The American Hospital Association conducts an annual survey of all member hospitals which contains detailed information of costs and services provided. However, it only includes the 6,000 hospitals that are members. A more extensive, and publicly available, list is obtained from the Centers for Medicare and Medicaid Services website. This includes 8,506 hospitals in the United States which take Medicaid and Medicare payment methods.

Of the 8,506 hospitals, 315 are located in Ohio. Since we are interested in distance to the nearest hospital, all hospitals are included in the sample without worry that outliers will

[9] For a complete discussion of the effects estimates, see Lesage and Pace (1988).

unduly influence the results. Hospital addresses were geocoded to obtain x,y coordinates and used to calculate the Euclidean distance to each household in miles. When considering the interaction specification, we use the average distance of houses within a census block group to the nearest hospital rather than distance of each house to the nearest hospital to keep the measures consistent with the level of observation for those characteristics.

Results

We consider three specifications using OLS and the spatial model. The initial specification does not distinguish between different hospital types while the second designates hospitals as public, private or non-profit. A final specification includes this designation as well as an interaction term between hospital type and percent of black residents in the area.

We first consider the simple OLS model with all control variables and distance to the nearest hospital without designating hospital type.[10] Results, found in the first column of Table 2, are generally as expected. Age of the house is negative while house size and lot size are positive. Housing amenities, school quality, percent of residents with a college degree and average income are positive while crime rate and percent black are negative. Distance to the central business district and the nearest public university, which controls for access to amenities associated with the downtown area, is negative and significant as expected. Distance to the nearest hospital is statistically insignificant.

Found in the second column of Table 2 are the results for separating hospitals by type. This separation yields a negative and statistically significant influence of distance to the nearest public hospital and a positive statistically significant influence of distance to the nearest private hospital. In terms of magnitude, the results suggest a one percent increase in distance from the nearest hospital reduces house prices by .05% for public hospitals and increases house prices by .01% for private hospitals. These findings imply that the net benefit

[10]Note that our variable is in terms of distance rather than proximity and the negative term, consequently, implies a net positive amenity to the community.

to increased proximity is positive for public hospitals but negative for private hospitals.

Zuvekas and Taliaferro (2003) finds that minority populations use hospital services to a greater extent relative to private health care services than the majority. Therefore, in column 3 of Table 2 are the results of interacting the percent of the residents in the area that are black with distance to the nearest hospital type. The results for distance to the nearest hospital are similar to those found in the absence of the interaction. In terms of the black and hospital distance interactions, we find a negative and statistically significant coefficient on both the black/public hospital distance and black/private hospital distance interactions, indicating that blacks place a higher value on hospital access than do others. Since the coefficient on the distance to the nearest private hospital is positive and the coefficient on the black/private hospital distance is negative, we can calculate the percent black needed in a community for proximity to a private hospital to become an amenity, which is calculated to be approximately 89% black.

To check for the robustness of our OLS results, we estimate the SDM specification using Maximum Likelihood Estimation, detailed in Table 3. The influence of neighbor house prices, ρ, is positive and significant, confirming suspicions that an OLS estimation will be biased. The most noticeable difference from the OLS results is that the magnitude (in absolute value) of most of the coefficients on the distance variables is lowered. The only exception is that the hospital distance interactions with percent black all increase in magnitude, with the negative coefficient on the black/non-profit hospital distance interaction becoming statistically significant. The percent black required for proximity to a private hospital to be an amenity for a community is reduced from the OLS estimation to 31% black.

In Table 4 we use the estimated elasticities in Tables 2 and 3 to calculate the effect of a one mile increase in distance from the nearest hospital on the price of a house. A specific house price, distance from the nearest hospital, and percent black of the neighborhood must be used in each calculation. For distance we use the mean distance from the nearest hospital in the sample, and one standard deviation below and above this mean. Also, we include the results for neighborhoods with 10%, 25%, 50%, 75%, and 90% black, using for house price the average in each of these types of neighborhoods.

Focusing on the SDM results for public hospitals, we find that a one mile increase in distance from the nearest public hospital for a house located at the mean distance (11 miles) in a 10% black neighborhood reduces house prices by $385. The same change in a 90% black neighborhood reduces house prices by $497. The negative impact of moving one mile farther away is significantly larger for a house that is located close to a public hospital. In 10% black neighborhoods the reduction of house prices is $1756 and in 90% black neighborhoods it is $2256. This large difference in impact based on the starting distance of the house from the nearest public hospital comes from the logged nature of our hospital distance variable.

These numbers can be used to analyze the economic impact of hospital openings and closures. As an illustration, if there is a 10% black community of 1000 households located at the mean distance from the nearest public hospital, then an investment in a new hospital that reduces distance for all households by one mile increases total house values by $385,000. In a 90% black neighborhood this impact increases to $497,000. The true impact of the investment could be greater than these estimates depending on the actual reduction in distance for each house, the current location of houses in relation to the nearest hospital, and the number of houses that are affected.

Conclusion

Research efforts to estimate the value generated by health care provision and consumption have largely relied on survey data CV estimates. Excluded from these measures is the value generated to those that may never seek treatment from a hospital but value having access to one. Access to health care services often refers to the ability of individuals to financially afford services needed but this is only one dimension of accessibility. Geographic, or spatial, access has received less attention but is an important component in health care outcomes (Buchmueller et al., 2006).

We employ data from Ohio to estimate the social value generated by increased spatial access to a hospital using a hedonic price method. After controlling for housing features, neighborhood characteristics and access to the CBD, we find that households are willing to pay as much as $2,300 to live one mile closer to the nearest public hospital, although specifications on the lower end yield a willingness to pay for increased access around $220. Private hospitals, on the other hand, can have an associated negative or positive effect on house price from increased proximity. Areas comprised of 10% black residents experience a negative willingness to pay of as much as $700 to live one mile closer to a private hospital, while areas made up of 90% black residents have a positive willingness to pay of as much as $1,000. These findings are consistent with previous findings suggesting that black households may value proximity to hospitals to a greater extent due to higher relative utilization of hospitals rather than preventative care services. This discrepancy in value to households is important to exam when engaging in policy decisions regarding health care resource allocation.

In addition to providing an estimate of social value of hospital proximity, the estimations detailed here illustrate the usefulness of the hedonic price method to extract revealed preferences for health care provisions and access. In addition to the value of spatial access, it is possible to use the hedonic price method to estimate the value of many important health care considerations. These may include, but by no means are limited to, the difference in WTP in different regions of the country, the difference in WTP for access to government versus private hospitals, access to hospitals versus primary care practices, the social value generated by building or closing a hospital, the change in value of health care access over time and to conduct a more detailed analysis of the willingness to pay for access among communities with different racial, age and income composition.

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Table 1: Descriptive Stats

Variable	Description	Mean	St. Deviation	Min	Max
Brasington Data[a]					
Ln Price	Natural log of price of house	11.50	0.47	10.31	13.92
House Age	Age of house in hundreds of years	0.53	0.25	0.00	1.40
House Size	Building size of house in thousands of square feet	1.53	0.46	0.66	6.23
Lot Size	Lot size of house in ten thousands of square feet	2.28	4.00	0.07	95.31
Central Air	House has AC	0.21	0.32	0.00	1.00
Fireplace	House has a fireplace	0.37	0.32	0.00	1.00
Garage	House with a garage	0.59	0.39	0.00	1.00
Deck	House with a deck	0.10	0.16	0.00	1.00
Pool	House with a swimming pool	0.02	0.05	0.00	1.00
One Story	House with only one story	0.45	0.32	0.00	1.00
Full Bath	Number of full baths in house	1.34	0.37	0.00	4.00
Partial Bath	Number of partial baths in house	0.36	0.31	0.00	2.00
Proficiency Test	Pass rate on 9th grade proficiency test in school district	58.28	20.73	19.60	98.00
Crime	Offenses per thousand persons in police district	71.39	42.14	0.97	735.34
Ln Hazard Dist.	Natural log of distance from house to nearest pollution source in miles	-0.30	0.86	-5.23	2.08
Hospital Data[b]					
Ln Hospital Dist.	Natural log of distance from house to nearest hospital in miles	0.94	0.81	-2.28	2.82
Ln Public Hospital Dist.	Natural log of distance from house to nearest public hospital in miles	2.10	0.88	-2.28	3.83
Ln Private Hospital Dist.	Natural log of distance from house to nearest private hospital in miles	2.57	0.90	-1.31	4.08
Ln Non Profit Hospital Dist.	Natural log of distance from house to nearest non-profit hospital in miles	1.03	0.82	-2.09	3.29
Census Variables[c]					
Family Income	Family median income in the block group in ten thousands of dollars	5.21	2.24	0.00	20.00
Bachelor's Degree	Percent of individuals 25 + years old with Bachelor's degree in block group	14.43	10.74	0.00	60.47
Black	Percent of black individuals in block group	16.51	28.32	0.00	100.00
Author's Calculations					
Ln City Center Dist.	Natural log of distance from house to city center of MSA in miles	2.05	0.88	-2.44	3.93
Ln University Dist.	Naturla log of distance from house to nearest state university	2.05	0.82	-1.57	3.94
Observations	Number of block groups with housing transactions in Brasington data	6093			

[a] Variables from the Brasington Housing Transaction Data Set for 2000.
[b] The authors' calculated the distance from each house to the nearest hospital.
[c] Variables come from the 2000 Census Summary File.
Note: All distance variables and variables coming from the Brasington Housing Transaction Data Set are first calculated at the individual house level and then averaged at the census block group level.

Table 2: OLS Estimates

	(1)	(2)	(3)
Ln City Center Dist.	0.02906***	0.04632***	0.04352***
	5.09	7.79	7.12
House Age	-0.13524***	-0.16396***	-0.15700***
	-3.30	-3.97	-3.77
House Age Squared	-0.03844	-0.02665	-0.03141
	-1.26	-0.87	-1.02
House Size	0.30543***	0.30330***	0.29969***
	12.91	12.96	12.79
House Size Squared	-0.00101	-0.00091	-0.00052
	-0.23	-0.21	-0.12
Lot Size	0.00968***	0.00938***	0.00934***
	10.90	10.68	10.62
Lot Size Squared	-0.00002**	-0.00002**	-0.00002**
	-2.29	-2.21	-2.18
Central Air	0.02030**	0.02304**	0.02452**
	2.13	2.43	2.59
Fireplace	0.07629***	0.07965***	0.07776***
	6.95	7.34	7.16
Garage	0.05447***	0.05151***	0.05197***
	7.21	6.89	6.90
Deck	0.09334***	0.08170***	0.08199***
	6.06	5.34	5.37
Pool	0.21598***	0.20109***	0.19631***
	4.60	4.33	4.22
One Story	0.09993***	0.09818***	0.09976***
	9.87	9.75	9.89
Full Bath	0.03664***	0.03781***	0.03883***
	3.12	3.25	3.34
Partial Bath	0.11750***	0.11836***	0.12075***
	10.41	10.58	10.77
Proficiency Test	0.00234***	0.00242***	0.00238***
	12.63	13.19	12.90
Family Income	0.03405***	0.03364***	0.03379***
	18.83	18.85	18.94
Ln Hazard Dist.	0.00776**	0.00670**	0.00628**
	2.54	2.22	2.07
Crime	-0.00015*	-0.00019**	-0.00019**
	-1.86	-2.36	-2.27
Bachelor's Degree	0.00867***	0.00834***	0.00847***
	25.44	24.57	24.73
Black	-0.00158***	-0.00179***	-0.00101***
	-15.98	-17.66	-3.28
Ln University Dist.	-0.04136***	-0.03013***	-0.02890***
	-7.45	-5.41	-5.03
Ln Hospital Dist.	0.00181		
	0.55		
Ln Public Hospital Dist.		-0.04975***	-0.04337***
		-11.61	-8.85
Ln Private Hospital Dist.		0.01285***	0.01515***
		3.28	3.52
Ln Non Profit Hospital Dist.		0.00260	0.00211
		0.79	0.57
Black * Ln Public Hosp. Dist.			-0.00029***
			-2.93
Black * Ln Private Hosp. Dist.			-0.00017*
			-1.78
Black * Ln Non Profit Hosp. Dist.			0.00004
			0.31
Observations	6093	6093	6093
R Squared	0.8761	0.8790	0.8793

Note: *** is significance at the 1% level, ** at the 5% level, and * at the 10% level. T-statistics from robust standard errors are reported below coefficients. All specifications include MSA Dummies.

Table 3: SDM

	(1)	(2)	(3)
Ln City Center Dist.	0.02188*	0.03471***	0.02816**
	1.87	2.88	2.31
House Age	-0.04554	-0.08149	-0.01653
	-0.39	-0.72	-0.14
House Age Squared	-0.05486	-0.04395	-0.08630
	-0.62	-0.50	-0.98
Building Size	0.49908***	0.49588***	0.45232***
	5.72	5.89	5.38
Building Size Squared	-0.04140**	-0.04039**	-0.03593**
	-2.44	-2.42	-2.18
Lot Size	0.01390***	0.01292***	0.01221***
	4.58	4.62	4.31
Lot Size Squared	-0.00002	-0.00002	-0.00002
	-0.70	-0.74	-0.65
Central Air	0.02292	0.02695	0.02980
	1.01	1.21	1.43
Fireplace	-0.05677	-0.04628	-0.05596
	-1.53	-1.26	-1.53
Garage	0.02098	0.01828	0.02144
	1.15	1.01	1.27
Deck	0.08883*	0.06891	0.06114
	1.92	1.53	1.39
Pool	0.47980***	0.37612**	0.34273*
	2.64	2.08	1.93
One Story	0.20996***	0.20203***	0.21313***
	7.16	7.14	7.13
Full Bath	-0.10688**	-0.10468**	-0.08814**
	-2.59	-2.46	-2.08
Partial Bath	0.06520	0.06584	0.09635**
	1.45	1.52	2.31
Proficiency Test	0.00108**	0.00118***	0.00097**
	2.34	2.66	2.31
Family Income	0.07236***	0.07098***	0.07202***
	10.77	11.04	11.39
Ln Hazard Dist.	-0.00067	-0.00196	-0.00530
	-0.09	-0.28	-0.71
Crime	-0.00030	-0.00037*	-0.00031
	-1.41	-1.79	-1.50
Bachelor's Degree	0.01457***	0.01392***	0.01450***
	13.95	13.26	14.01
Black	-0.00093***	-0.00121***	0.00164**
	-4.10	-5.37	2.39
Ln University Dist.	-0.02647**	-0.01617	-0.01077
	-2.41	-1.47	-0.95
Ln Hospital Dist.	-0.00075		
	-0.10		
Ln Public Hospital Dist.		-0.04323***	-0.02887***
		-5.31	-2.92
Ln Private Hospital Dist.		0.01205	0.02117**
		1.54	2.49
Ln Non Profit Hospital Dist.		0.00178	0.01018
		0.25	1.28
Black * Ln Public Hosp. Dist.			-0.00066***
			-3.08
Black * Ln Private Hosp. Dist.			-0.00068***
			-3.27
Black * Ln Non Profit Hosp. Dist.			-0.00059**
			-2.13
Spatial Correlation (ρ)	0.52795***	0.51996***	0.50298***
	10.65	2.62	3.93
Observations	6093	6093	6093
R Squared	0.89110	0.89280	0.89410

Note: *** is significance at the 1% level, ** at the 5% level, and * at the 10% level. T-statistics from robust standard errors are reported below coefficients. All specifications include MSA Dummies.

Table 4: Price Effects

	10% Black	25% Black	50% Black	75% Black	90% Black
OLS					
Public (Close Distance)	-$2,291.70	-$2,432.53	-$1,638.14	-$1,720.11	-$1,784.55
Public (Mean Distance)	-$502.57	-$533.45	-$359.24	-$377.22	-$391.35
Public (Far Distance)	-$282.23	-$299.57	-$201.74	-$211.84	-$219.77
Private (Close Distance)	$362.04	$284.67	$102.31	$34.45	-$2.09
Private (Mean Distance)	$91.51	$71.95	$25.86	$8.71	-$0.53
Private (Far Distance)	$52.37	$41.18	$14.80	$4.98	-$0.30
SDM					
Public (Close Distance)	-$1,756.29	-$2,179.04	-$1,749.95	-$2,068.12	-$2,265.17
Public (Mean Distance)	-$385.15	-$477.86	-$383.76	-$453.53	-$496.75
Public (Far Distance)	-$216.29	-$268.36	-$215.51	-$254.69	-$278.96
Private (Close Distance)	$710.44	$196.98	-$367.31	-$793.78	-$1,035.12
Private (Mean Distance)	$155.80	$43.20	-$80.55	-$174.07	-$227.00
Private (Far Distance)	$87.49	$24.26	-$45.24	-$97.76	-$127.48

Note: Authors' calculation using regression coefficients. Close and long distance represent distances that are one standard deviation below and above the mean distance to the nearest hospital. The calculations are performed by multiplying the percentage change that a one mile increase in distance from a chosen distance represents by the average house price and elasticity (divided by 100) for areas with varying concentrations of blacks. The average house price used is dependent on percent black of the neighborhood. The average house price for neighborhoods with less than 10% black is $123822, less than 25% black is $120137, more than 50% black is $70768, more than 75% black is $66036, and more than 90% black is $64220.