The Review of Regional Studies

The Official Journal of the Southern Regional Science Association

Willingness to Pay for Hospital Access in Areas with High Concentrations of Blacks

David Christafore^a and Susane Leguizamon^b

^a*Department of Economics, University of California, Riverside, USA*

^b*Department of Economics, Western Kentucky University, USA*

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 6,093 observations at the census block group level, we find that the 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 nonprofit hospitals. Areas comprised of a relatively large population of black residents value spatial access significantly more and, for higher concentrations, exhibit a positive WTP for all hospital types. This is likely due to increased transportation costs of individuals in minority areas.

Keywords: health care, housing markets, cost-benefit analysis

JEL Codes: I11, I18, R53

1. INTRODUCTION

There are approximately 8,900 hospitals in the United States, with 60 percent of those operating as nonprofits, 20 percent government owned, and the remaining 20 percent 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 through surveys of individuals. 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. The benefit of health-care provision is not limited to utilization, however; it also stems from access to services. Health-care affordability has become synonymous with health-care accessibility, even though access encompasses other considerations as well (Penchansky, 1981).

Christafore is a Visiting Assistant Professor of Economics at the University of California, Riverside, Riverside, CA 92507. Leguizamon is an Assistant Professor of Economics at Western Kentucky University, Bowling Green, KY 42101. *Corresponding Author:* D. Christafore Email: davidchr@ucr.edu

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

Spatial accessibility can be measured by the geographic boundaries that exist between a patient 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 (Fryer et al., 1999; Fortney et al., 1995, 1999; Nattinger et al., 2001; Buchmueller et al., 2006; Schmitta et al., 2003; Hiscock et al., 2008).

In addition to geographic distance, there are noted differences in the type of health care used by minority populations relative to the white population. Hispanics and blacks use emergency-room (ER) services more, but use private and preventive services less than do whites and are more likely to have public health insurance rather than private (Zuvekas and Taliaferro, 2003). This suggests that these groups may value having greater geographic access to hospitals that offer ER services and are more likely to accept public health insurance.

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, not just realized patients. As such, data from stated-preference surveys that focus 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). In this paper, we use the hedonic price method to elicit the social benefit of access to health care services.

The hedonic price method is 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 (WTP) for nonmarket goods by analyzing housing transaction data. The value of the amenity is reflected in higher prices for homes located closer to the amenity. Summing the house price differential across homes in a community provides an approximate value that the community as a whole places on proximity to the amenity. Because hospitals also result in increased traffic, its presence simultaneously creates a disamenity. The net effect of the presence of a hospital 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 6,093 Census block group observations (based on over 90,000 housing transactions from the Brasington Housing Dataset (Brasington, 2005)) and, controlling for individual house and neighborhood characteristics, treat hospital proximity as an amenity and estimate the WTP to live closer to the nearest hospital. When all hospitals are included without distinguishing whether it is public, private, or nonprofit, the influence on house prices is statistically insignificant. But when treated as separate types, private and public hospitals have opposing influences, while nonprofit hospitals continue to yield no statistically significant influence.

We find that living one percent closer to a public hospital is associated with an increase in average house price of approximately 0.05 percent while living one percent closer to a private hospital is associated with a *decrease* in average house prices of approximately 0.01 percent. This suggests that there is a net positive effect of public hospital proximity that is not present with respect to private hospitals, perhaps due to lower utilization rates and consequently lower positive spillover effects, of the latter.

Assuming that a house is located at the average distance from a hospital (0.94 miles) and is in an area in which black residents comprise 10 percent of the population, these effects translate to an increase of about \$385 in associated house prices for houses closer to public hospitals and a decrease of approximately \$155 for improved proximity to private hospitals. Understandably, the influence of spatial proximity is more pronounced for households in areas closer to a hospital and less pronounced for those further away. For households in areas one standard deviation (1.8 miles) closer to the mean and comprised of 10 percent black residents, being one mile closer 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 enhanced proximity. Similarly, the reduction in average house prices for households that move closer to a private hospital is larger than the reduction for households in areas further from the hospital.

We also find that individuals are not homogenous in their revealed WTP for increased access. We interact the share of black residents with proximity to the hospital to derive any increase or decrease in WTP relative to the average. We find that areas with higher shares of black residents are indeed willing to pay even more for improved spatial access to public *and* private hospitals. This is evident from the negative and statistically significant coefficients on the black and distance to hospital interaction terms for all hospital types.

With private hospital access, the differential between black and white WTP is apparent from the smaller decrease in house prices due to improved spatial access. The disamenity of private hospital proximity becomes a net positive amenity for areas with about 31 percent or more of their residents who are black (i.e. proximity increases average house price). This is consistent with previous findings that black households substitute hospitals for preventative care services (Zuvekas and Taliaferro, 2003), and consequently value hospital access more than other households. Such systematic differences in revealed preferences have important policy implications when estimating the total benefits of health care programs and services for different populations.

In addition to exploring the WTP for improved access to particular hospitals, hedonic price models are particularly useful for quantifying the intangible social benefits provided by open-access goods and services. Via our present data, for example, we find that if a flat householder tax was used to pay all hospital construction and maintenance expenses, the resulting \$395 annual payment per household would be less than the net benefits 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.

2. LITERATURE REVIEW

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

² Per household spending is 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.

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; Muus and Gibbons, 1995). However, hospitals that are shuttered are typically inefficient, (Capps et al., 2010; McNamara, 1999; Buchmueller et al., 2006), and it is likely those hospitals that remain open generate 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 increased deaths from heart attacks and injuries and that seniors, in particular, are burdened with additional barriers to care after a hospital closure. Interestingly, 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 (Buchmueller et al., 2006). This conflict between hard statistics and survey findings casts further doubt on the viability of employing only survey data to capture the value of health care access.

It is also worth noting that minority populations appear to value spatial access differently than the majority. Zenk et al. (2006) find that while distance to the nearest hospital does influence use 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 that 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, 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, communities with more black residents appear to be more likely to value enhanced spatial access to hospitals relatively more than enhanced 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, as measured by distance. The measured value in these studies is constrained to individuals actually receiving treatment at the hospitals within the time frame studied. No effort appears to have been made to estimate the monetary value received by all individuals living in close proximity to care, whether or not they have recently received services from the hospitals.

Although the monetary value of having spatial access, for current or potential patients, to hospitals has not been considered, attempts have been made to quantify the benefits received from other aspects of health care provision. A stated preference survey is the most popular method used to measure the 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 WTP for numerous treatments of specific health conditions as well as broader provisions.⁴ The method was first employed by Acton (1973) but according to Smith (2002) did not become widely used until the 1990s, when Donaldson (1990), Johannesson et al. (1991), Johannesson and Johansson (1991), and Gafni (1991) used it. Brief summaries of the studies conducted during this time period can be found in Deiner et al. (1998) and Klose (1999).

More recent work has used contingent valuation methods, among others, 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). Although useful in some contexts, contingent valuation methods have considerable drawbacks (Smith, 2002). Individuals are asked either for perceived values, not real out-of-pocket expenses, or to roughly estimate benefits that they received in the past; either way questions of accuracy and consistency of the responses inevitably arise (Blamey et al., 1999). Research has shown that (1) changing question order influences the stated WTP (Stewart et al., 2002), (2) preferences can be inconsistent (Diamond and Hausman, 1994),⁵ and (3) responses may be too vague to quantify (Ryan and 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 nonmarket goods. These goods may be intangible—such as preferences for neighbors of a certain demographic or good air quality—or tangible, 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 nonmarket 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 solutions comparable to those applied to 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 the 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

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 with inconsistent preference rankings. Attempts to address this issue have not been successful to date.

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

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.

3. HEDONIC PRICE APPROACH

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 consumers in the market for housing. Housing can be considered a differentiated product $\mathbf{z}$ with n different characteristics, where $\mathbf{z} = (z_1, z_2, \dots, z_n)$. The price of a property is a function of its characteristics, $P = P(\mathbf{z})$. This function represents a collection of bid and offer functions in the housing market.

The utility of consumers is a function of all housing characteristics $\mathbf{z}$ and all other relevant goods, $\mathbf{x}$. Consumers are assumed to maximize utility, $U = U(\mathbf{x}, \mathbf{z})$, subject to the typical budget constraint $Y = P_x \mathbf{x} + P_z \mathbf{z}$. We can consider the proximity to the nearest hospital as a single of the characteristics of the housing vector, z_i . The general form for the hedonic price equation for this study expresses the housing 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: $\text{Price} = f(\mathbf{s}, \mathbf{l})$ where $\mathbf{s}$ represents the vector of housing structural characteristics and $\mathbf{l}$ the location attributes. Taken together, we can think of a house as a bundle of goods, in which each good influences the house price but has no explicit price separate from the house. 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 that single good. The change in housing price observed can be interpreted as the WTP 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:

$$(1) \quad \mathbf{v} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon},$$

where $\mathbf{v}$ is an $n \times 1$ vector of prices for n houses, $\mathbf{X}$ is the $n \times m$ matrix of m explanatory characteristics of the n observed houses, and $\boldsymbol{\varepsilon}$ is normally distributed with constant variance and zero mean. Similar to Lesage and Pace (2009), we use Bayesian estimation to estimate the influence.⁷

The price of a house is influenced by the quality of the house and the quality of the neighborhood. Here, 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 if the house has more than one story. All other things the same, a house with more amenities should yield a higher price. The vintage of a house can return a positive (if it has historical appeal) or negative (if it will require expensive upkeep) effect.

Private hospitals are likely to locate in well-off areas. Therefore it is imperative that we control for all neighborhood characteristics that may be associated with both hospital location

⁷ All of our regressions are Bayesian estimations of SDM equations. We performed the analysis using James Lesage's Spatial Econometrics Toolbox. All reported coefficients are the total effects estimates.

and house prices. Among others, Gibbons and Machin (2008) suggest that the quality of the school district, average income, racial composition, crime rate, proximity to a pollution source, educational composition, and distance to the central business district (CBD) are influential variables on neighborhood quality. We expect crime rate, percent black, and close proximity to a source of pollution to be variables that are associated with lower house values. On the other hand, we expect school quality, measured by the pass rate on the ninth grade proficiency test (Brasington and Haurin, 2006), average income, and share of population with a bachelor's degree to be associated with higher house prices. 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 believe this variable should have a negative influence on house prices. 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. On the other hand, there are significant negative spillovers in the form of increased congestion and noise that also rise with proximity to hospitals. We observe only the net effect of these two influences, however, and take it to be the overall value-added to households. We measure actual distance to the nearest hospital, but assume a negative exponential decay of its affect.⁸ It is, therefore, transformed using the natural log function—a transformation that we apply to all measures involving distance.

Ross et al. (2011) point out that, alone, distance to the closest occurrence of an amenity cannot accurately estimate the total value that an amenity might offer a location. That is, the same amenity, albeit from one or more alternative sources, could also lie fairly close by the location in some other direction. Not acknowledging the multiple sources of the amenity would lead to biased coefficients and inflated standard errors in all regression parameters. Ross et al. (2011) show that the inclusion of amenity latitude and longitude in quadratic form removes the bias from the independent variable parameters. We follow this logic.

The neighborhood quality measures are taken from the average of each Census block group and the values act as the representative house 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 WTP for an amenity is complicated since house prices affect and are affected by the prices of their neighbors (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, 2009). Although we run a simple OLS estimation, a spatial model that simultaneously estimates the house prices 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 variables and estimate a spatial model known as a spatial Durbin model (SDM). The house-price dependent variable vector is multiplied by a weight matrix representing the spatial relationship in

⁸ 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. There is no centralized record of hospital locations and their founding dates available. We obtained this information from individual hospital websites for hospitals in the sample.

prices. The $\mathbf{W}$ weight matrix is typically constructed as an $n \times n$ symmetric standardized matrix representing a nearest neighbor or distance relationship among 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 nonzero elements in that row. Naturally, the matrix has zeros in the main diagonal since no house is a neighbor to itself.

The SDM hedonic price model takes the form:

$$(2) \quad \text{Ln } \mathbf{p} = \alpha + \rho \mathbf{W} (\text{Ln } \mathbf{p}) + \mathbf{X}\boldsymbol{\beta} + \mathbf{W}\mathbf{X}\boldsymbol{\theta} + \boldsymbol{\varsigma},$$

where $\boldsymbol{\varsigma}$ is a random error term with the $N(0, \sigma^2 \mathbf{I})$ distribution, $\mathbf{X}$ is a matrix of the housing and neighborhood characteristics, and $\mathbf{W}$ is an $n \times n$ spatial weight matrix representing the nearest neighbor relationship between houses within the MSA. Included in $\mathbf{X}$ is the natural log of distance in miles to the nearest hospital and, separately, the interaction terms between proximity to the nearest hospital and the share of the 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). We apply the procedure put forth in Lesage and Pace (2009) and find the optimal number of nearest-neighbor block groups to be seven.⁹ 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, which will further increase house A's price. This simultaneity issue is resolved by solving for the log house price on the left-hand side, yielding the data generating process (Lesage and Pace, 2009):

$$\text{Ln } \mathbf{p} = (\mathbf{I}_n - \rho \mathbf{W})^{-1} (\alpha + \mathbf{X}\mathbf{W}\boldsymbol{\beta} + \mathbf{W}\mathbf{X}\boldsymbol{\theta} + \boldsymbol{\varsigma}).$$

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

$$(3) \quad \begin{aligned} \mathbf{V}(\mathbf{W}) &= (\mathbf{I}_n - \rho \mathbf{W})^{-1} \text{ and} \\ \mathbf{S}_r(\mathbf{W}) &= \mathbf{V}(\mathbf{W})(\mathbf{I}_n \mathbf{B}_r + \mathbf{W}\boldsymbol{\theta}_r), \text{ then} \\ \text{Ln } \mathbf{p} &= \sum_{r=1}^k \mathbf{S}_r(\mathbf{W})\mathbf{x}_r + \mathbf{V}(\mathbf{W})\mathbf{i}_n\alpha + \mathbf{V}(\mathbf{W})\boldsymbol{\varsigma} \end{aligned}$$

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 $\frac{d\ln P_i}{dx_{i,r}} = \mathbf{S}_r(\mathbf{W})_{i,i}$. 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 feeds back into 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 $\frac{d\ln P_i}{dx_{i,j}} = \mathbf{S}_r(\mathbf{W})_{i,j}$. The total effect is the sum of the direct and indirect effects. We focus on the total effects, although the indirect and direct effects are available upon request.¹⁰

⁹ To keep the unit of observation consistent, we treat neighbors as all houses in a Census block group rather than an individual house. Consequently, our analysis includes spatial consideration of the average house prices in the nearest seven Census block groups.

¹⁰ For a more complete discussion of the effects estimates, see Lesage and Pace (2009).

Table 1: Descriptive Statistics

Variable	Description	Mean	Std. Dev.	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 fire place	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 Non Profit Dist.	Natural log of distance from house to nearest nonprofit hospital in miles	1.03	0.82	2.09	3.29
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
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
Authors' 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.	Natural log of distance from house to nearest state university	2.05	0.82	-1.57	3.94
Observations	Number of census block groups in analysis	6093			

Notes: 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.

^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.

4. DATA

Data is drawn from a variety of sources. Information on housing transactions and characteristics for the Columbus, Cleveland, Cincinnati, Toledo, Youngstown, Dayton, and Akron MSA's comes from Brasington (2004), Brasington and Hite (2005), and the summary files of the 2000 Census. The housing data includes transactions and house features for those sold in the year 2000. The neighborhood characteristic variables are at the census block group level, so we averaged all of the house specific variables within each census block group to create a representative house observation per block group. 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 that contains detailed information of costs and services provided. It, however, includes just the 6,000 member hospitals of that association. A more extensive, and publicly available, list of 8,506 hospitals is available from the Centers for Medicare and Medicaid Services website. Of the 8,506 hospitals, 315 are located in Ohio. Since the focus is distance to the nearest hospital, we included all hospitals in the sample without concern that outliers might unduly influence the results. Hospital addresses were geocoded to obtain x,y coordinates and used to calculate the Euclidean distance to each house 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 the distance of each house to the nearest hospital to keep the measures consistent with the level of observation for those characteristics.

5. RESULTS

We consider several specifications using the spatial Durbin model. The first four estimate the influence of distance to the nearest hospital with varying considerations for the type of hospital and the neighborhood population. We then consider a specification that allows for the influence of the second nearest hospital. All reported estimated effects are the total effects.

We first consider the effect of distance to the nearest hospital. These results, found in the first column of Table 2, are generally as expected. The size of the house, size of the lot, school quality, percent of residents with a college degree, and average income are positive while percent black is negative. Distance to the central business district is positive while the distance to the nearest public university is negative and significant as expected. Distance to the nearest hospital is statistically insignificant.

The second column of Table 2 contains the results when we include an interaction for the effect of distance from the nearest hospital and percent of the area that is comprised of black residents. Similar to the first specification, we find that the effect of distance to the hospital and the distance interacted with percent black is negative, but statistically insignificant.

Zuvekas and Taliaferro (2003) find 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 when we interact the percent of residents in the area that are black with distance to the nearest hospital type. Now, there is a negative and significant influence of an increased distance from public hospitals, suggesting that geographic access to these hospitals is an amenity.

Table 2: SDM Results with the Closest Hospital

	(1)	(2)	(3)	(4)
Latitude	-1.454631	-1.552645	1.015818	1.336529
Latitude Squared	0.018616	0.019800	-0.012000	-0.016001
Longitude	2.753177	2.629258	2.142428	2.698460
Longitude Squared	0.016738	0.015987	0.012947	0.016299
Ln City Center Dist.	0.027587**	0.029796***	0.043843***	0.033398***
House Age	-0.030366	-0.038215	-0.060693	-0.032959
House Age Squared	-0.112591	-0.101314	-0.106637	-0.119106
Building Size	0.561941***	0.572699***	0.582741***	0.552591***
Building Size Squared	-0.045820***	-0.048454***	-0.047706***	-0.046486***
Lot Size	0.018148***	0.017335***	0.016115***	0.015646***
Lot Size Squared	-0.000083***	-0.000077**	-0.000076***	-0.000075***
Central Air	0.037053	0.040080	0.032879	0.000073
Fireplace	-0.036757	-0.031372	-0.032415	-0.044774
Garage	0.034203	0.034966**	0.030969	0.030309
Deck	0.059481	0.059281	0.032497	0.032279
Pool	0.293490	0.274863	0.258873	0.213145
One Story	0.203583***	0.209544***	0.197654***	0.214313***
Full Bath	-0.132769***	-0.133885***	-0.131177***	-0.111097***
Partial Bath	0.022998	0.018126	0.028211	0.041399
Proficiency Test	0.001170**	0.001136***	0.001204***	0.000984**
Family Income	0.071271***	0.072729***	0.068305***	0.070990***
Ln Hazard Dist.	-0.002037	-0.002837	-0.001056	-0.004151
Crime	-0.000202	-0.000204	-0.000277	-0.000229
Bachelor's Degree	0.012638***	0.012478***	0.011864***	0.012551***
Black	-0.001098***	-0.000959***	-0.001486***	0.001685**
Ln University Dist.	-0.026264***	-0.029505***	-0.016072	0.001685
Ln Hospital Dist.	-0.007815	-0.004641		
Ln Public Hospital Dist.			-0.053251***	-0.042401***
Ln Private Hospital Dist.			0.010350	0.021746***
Ln Non Profit Hospital Dist.			-0.001983	0.001578
Black * Ln Hospital Dist.		-0.000277		
Black * Ln Public Hosp. Dist.				-0.000754***
Black * Ln Private Hosp. Dist.				-0.000824***
Black * Ln Non Profit Hosp. Dist.				-0.000286
Spatial Correlation (ρ)	0.557886***	0.558900***	0.544026***	0.538860***
Observations	6093	6093	6093	6093

Note: All specifications include MSA binary variables. Reported are the total effects estimates from Bayesian estimations of SDM equations. We performed the analysis in MATLAB using James Lesage's Spatial Econometrics Toolbox. *** is significance at the 1 percent level, and ** at the 5 percent level. The MATLAB output for total effects reports 95 percent and 99 percent confidence intervals rather than standard errors. These confidence intervals are unreported and available upon request.

In terms of the black and hospital distance interactions, detailed in column 4, we find a negative and statistically significant coefficient on both the black/public hospital distance and black/private hospital distance interactions. This indicates that residents in areas with a higher concentration of blacks value increased hospital access for both types of hospitals. Interestingly, we also find that the coefficient on the distance to the nearest private hospital (when it is not interacted with percent black) is positive, suggesting that for these types of hospitals, the disamenity created by congestion outweighs the value of increased access.

In Table 3, we consider the effect of the second nearest hospital on house prices. Overall, these results are largely consistent with the findings in Table 2. We find a negative influence from an increased distance to the nearest public hospital and all hospital types when interacted

Table 3: SDM Results with the Second Closest Hospital

	(1)	(2)	(3)	(4)
Latitude	-1.313852	-1.538308	2.667365	3.099860**
Latitude Squared	0.016821	0.019594	-0.032728	-0.038063**
Longitude	2.912933	2.774507	3.517705**	3.519830**
Longitude Squared	0.017702	0.016877	0.021224**	0.021237**
Ln City Center Dist.	0.029995**	0.031639**	0.028791**	0.016800
House Age	-0.037320	-0.025921	-0.054160	-0.008258
House Age Squared	-0.109483	-0.117565	-0.139222	-0.167639
Building Size	0.576313***	0.572635***	0.556279***	0.536041***
Building Size Squared	-0.048505***	-0.049142***	-0.045841***	-0.046388***
Lot Size	0.017824***	0.017637***	0.016204***	0.015586***
Lot Size Squared	-0.000079**	-0.000079**	-0.000075**	-0.000070***
Central Air	0.038260	0.038004	0.031710	0.036667
Fireplace	-0.034749	-0.033088	-0.037974	-0.044743
Garage	0.031503	0.031912	0.033095**	0.033838**
Deck	0.060000	0.060515	0.036458	0.044602
Pool	0.296798	0.259239	0.260343	0.189541
One Story	0.201985***	0.200378***	0.182856***	0.196894***
Full Bath	-0.134832***	-0.129991***	-0.107191***	-0.092212***
Partial Bath	0.020327	0.020808	0.019090	0.031955
Proficiency Test	0.001099***	0.001134***	0.001315***	0.001114***
Family Income	0.072173***	0.073110***	0.070305***	0.072115***
Ln Hazard Dist.	-0.002914	-0.002634	-0.000721	-0.004756
Crime	-0.000220	-0.000194	-0.000157	-0.000128
Bachelor's Degree	0.012428***	0.012294***	0.011815***	0.012301***
Black	-0.001141***	-0.000980***	-0.001476***	0.001552**
Ln University Dist.	-0.027751***	-0.029197**	-0.000249	0.007753
Ln Hospital Dist.	-0.007932	-0.004737		
Ln 2nd Hospital Dist.	-0.003453	-0.003958		
Ln Public Hospital Dist.			-0.072079***	-0.059384***
Ln 2nd Public Hospital Dist.			0.070398***	0.064193***
Ln Private Hospital Dist.			0.020669**	0.029420***
Ln 2nd Private Hospital Dist.			0.002832**	0.010858
Ln Non Profit Hospital Dist.			-0.007570	-0.004834
Ln 2nd Non Profit Hospital Dist.			0.008787	0.017010
Black * Ln Hospital Dist.		-0.000281		
Black * Ln Public Hosp. Dist.				-0.000773***
Black * Ln Private Hosp. Dist.				-0.000716***
Black * Ln Non Profit Hosp. Dist.				-0.000389
Spatial Correlation (ρ)	0.559166***	0.560568***	0.534382***	0.534648***
Observations	6093	6093	6093	6093

Note: All specifications include MSA Dummies. Reported are the total effects estimates from Bayesian estimations of SDM equations. We performed the analysis in MATLAB using James Lesage's Spatial Econometrics Toolbox. *** is significance at the 1 percent level and ** at the 5 percent level. The MATLAB output for total effects reports 95 percent and 99 percent confidence intervals rather than standard errors. These confidence intervals are unreported and available upon request.

with percent black. However, it appears that the effect of being closer to a second public hospital and second private hospital are negative (since distance is positive). This makes sense since the value of being close to a hospital might outweigh the negative effect due to congestion, but for a second hospital, it simply adds to congestion without providing additional access.

In Table 4, we use the estimated elasticities in column 4 of 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 a one standard deviation below and above this mean. Also, we

include the results for neighborhoods with 10 percent, 25 percent, 50 percent, 75 percent, and 90 percent black, using for house price the average price in each of these types of neighborhoods.

Focusing on the results when considered separately by hospital type, but without a second hospital, 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 percent black neighborhood reduces house prices by \$542. The same change in a 90 percent black neighborhood reduces house prices by \$621.

The negative impact of moving one mile farther away is larger for a house that is located close to a public hospital. In 10 percent black neighborhoods, the reduction of house prices is \$2,432 and in 90 percent black neighborhoods it is \$2,832. 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. When we include distance to a second hospital, the estimated marginal willingness to pay estimates to live one mile closer (to the nearest hospital) are a little larger. These estimates can also be found in Table 4.

These numbers can be used to analyze the economic impact of hospital openings and closures. As an illustration, if there is a 10 percent black community of 1,000 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 \$542,000. In a 90 percent black neighborhood, this impact increases to \$621,000. 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.

6. CONCLUSION

Research efforts to estimate the value generated by health care provision and consumption have largely relied on survey data contingent valuation estimates. Excluded from these measures is the value generated to those that may never seek treatment from a hospital but

Table 4: Price Effects

	10% Black	25% Black	50% Black	75% Black	90% Black
SDM					
Public (Close Distance)	-\$2,473.52	-\$2,943.40	-\$2,267.44	-\$2,613.73	-\$2,832.38
Public (Mean Distance)	-\$542.44	-\$645.48	-\$497.24	-\$573.19	-\$621.14
Public (Far Distance)	-\$304.62	-\$362.49	-\$279.24	-\$321.89	-\$348.82
Private (Close Distance)	\$363.55	\$29.93	-\$299.29	-\$575.00	-\$731.75
Private (Mean Distance)	\$91.89	\$7.56	-\$75.64	-\$145.33	-\$184.95
Private (Far Distance)	\$52.59	\$4.33	-\$43.29	-\$83.18	-\$105.85
SDM With 2nd Closest Hospital Included					
Public (Close Distance)	-\$3,324.22	-\$3,782.71	-\$2,775.49	-\$3,100.56	-\$3,313.26
Public (Mean Distance)	-\$729.00	-\$829.54	-\$608.66	-\$679.95	-\$726.59
Public (Far Distance)	-\$409.39	-\$465.85	-\$341.81	-\$381.84	-\$408.04
Private (Close Distance)	\$599.19	\$300.86	-\$98.15	-\$348.56	-\$488.91
Private (Mean Distance)	\$151.44	\$76.04	-\$24.81	-\$88.10	-\$123.57
Private (Far Distance)	\$86.68	\$43.52	-\$14.20	-\$50.42	-\$70.72

Note: Authors' calculations 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 by the estimated total effect (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 percent black is \$123,822, less than 25 percent black is \$120,137, more than 50 percent black is \$70,768, more than 75 percent black is \$66,036, and more than 90 percent black is \$64,220.

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 \$2,800 to live one mile closer to the nearest public hospital, although specifications on the lower end yield a willingness to pay (WTP) for increased access of around \$500. Private hospitals, on the other hand, can have a negative or positive effect on house price from enhanced proximity; the direction of effect depends on the percentage of residents that are black. Areas with 10 percent of inhabitants identifying themselves as black experience a negative WTP of as much as \$360 to live one mile closer to a private hospital, when as many as 90 percent identify as black they receive a positive WTP as high as \$730 to live a mile closer to that same hospital.

These results are consistent with previous findings, which suggest that black households appear to value proximity to hospitals more than do whites because of their apparent higher relative utilization of emergency room services as opposed to preventative care services. This discrepancy in value to households is important to examine when engaging in policy decisions regarding health care resource allocation.

In addition to providing an estimate of the 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 the value of health care access over time, and to conduct a more detailed analysis of the WTP for access among communities with different racial, age, and income compositions.

REFERENCES

- Acton, Jan. (1973) "Evaluation of Public Programs to Save Lives: The Case of Heart Attacks," Report R950RC, The RAND Corporation. Available online in August 2015 at <http://www.rand.org/pubs/reports/R0950.html>.
- Anderson, Soren and Sarah West. (2006) "Open Space, Residential Property Values and Spatial Context," *Regional Science and Urban Economics*, 36, 773–789.
- Anselin, Luc. (1988) *Spatial Econometrics: Methods and Models*. Springer: Dordrecht, Netherlands.
- Asgary, Ali, Ken Willis, Ali Akbar Taghvaei, and Mojtaba Rafeian. (2003) "Estimating Rural Households Willingness to Pay for Health Insurance," *European Journal of Health Economics*, 3, 209–215.
- Blamey, Russell, Jeff Bennett, and Mark Morrison. (1999) "Yea-Saying in Contingent Valuation Surveys," *Land Economics*, 75, 126–141.

- Bobinac, Ana, N. Job van Exel, Frans Rutten, and Werner Brouwer. (2012) "GET MORE, PAY MORE? An Elaborate Test of Construct Validity of Willingness to Pay per QALY Estimates Obtained through Contingent Valuation," *Journal of Health Economics*, 31, 158–168.
- Brasington, David. (2004) "House Prices and the Structure of Local Government: An Application of Spatial Statistics," *Journal of Real Estate and Finance Economics*, 29, 211–220.
- Brasington, David and Diane Hite. (2005) "Demand for Environmental Quality: A Spatial Hedonic Analysis," *Regional Science and Urban Economics*, 35, 57–82.
- Brasington, David and Donald Haurin. (2006) "Educational Outcomes and House Values: A Test of the Value-Added Approach," *Journal of Regional Science*, 46, 245–268.
- Buchmueller, Thomas, Mireille Jacobson, and Cheryl Wold. (2006) "How Far to the Hospital? The Effect of Hospital Closures on Access to Care," *Journal of Health Economics*, 25, 740–761.
- Capps, Cory, David Dranove, and Richard Lindrooth. (2010) "Hospital Closure and Economic Efficiency," *Journal of Health Economics*, 29, 87–108.
- Centers for Medicare and Medicaid Services: Annual Cost Report (2011). Available online in August 2015 at <https://www.cms.gov/Research-Statistics-Data-and-Systems/Downloadable-Public-Use-Files/Cost-Reports/?redirect=/CostReports/>.
- Cho, Seong-Hoon, Michael Bowker, and William Park. (2006) "Measuring the Contribution of Water and Green Space Amenities to Housing Values: An Application and Comparison of Spatially Weighted Hedonic Models," *Journal of Agricultural and Resource Economics*, 31, 485–507.
- Cohen, Morris and Hau Lee. (1985) "The Determinants of Spatial Distribution of Hospital Utilization in a Region," *Medical Care*, 23, 27–38.
- Deiner, Alan, Bernie O'Brien, and Amiram Gafni. (1998) "Health Care Contingent Valuation Studies: A Review and Classification of the Literature," *Health Economics*, 7, 313–326.
- Diamond, Peter and Jerry Hausman. (1994) "Contingent Valuation: Is Some Number Better than No Number?," *Journal of Economic Perspectives*, 8(4), 45–64.
- Dranove, David, William White, and Lawrence Wu. (1993) "Segmentation in Local Hospital Markets," *Medical Care*, 31, 52–64.
- Fortney, John, Brenda Booth, Frederic Blow, and Janice Bunn. (1995) "The Effects of Travel Barriers and Age on the Utilization of Alcoholism Treatment Aftercare," *American Journal of Drug and Alcohol Abuse*, 21, 391–406.
- Fortney, John, Kathryn Rost, Mingliang Zhang, and James Warren. (1999) "The Impact of Geographic Accessibility on the Intensity and Quality of Depression Treatment," *Medical Care*, 37, 884–893.
- Freeman, Myrick, Joseph Herriges, and Catherine Kling. (1993) *The Measurement of Environmental and Resource Value: Theory and Methods*. RFF Press: Abingdon, Oxon, UK.

- Fryer, George, Jody Drisko, Richard Drugman, Carol Vojir, Allan Prochazka, Thomas Miyoshi, and Marie Miller. (1999) "Multi-method Assessment of Access to Primary Medical Care in Rural Colorado," *Journal of Rural Health*, 15, 113–121.
- Gafni, Amiram. (1991) "Willingness-to-Pay as a Measure of Benefits: Relevant Questions in the Context of Public Decision Making about Health Care Programs," *Medical Care*, 29, 1246–1252.
- Gibbons, Stephen and Stephen Machin. (2008) "Valuing School Quality, Better Transport, and Lower Crime: Evidence from House Prices," *Oxford Review of Economic Policy*, 24, 99–119.
- Guagliardo, Mark. (2004) "Spatial Accessibility of Primary Care: Concepts, Methods and Challenges," *International Journal of Health Geographics*, 3.
- Hadley, Jack and Peter Cunningham. (2004) "Availability of Safety Net Providers and Access to Care of Uninsured Persons," *Health Services Research*, 39, 1528–1546.
- Hanley, Nick, Mandy Ryan, and Robert Wright. (2003) "Estimating the Monetary Value of Health Care: Lessons from Environmental Economics," *Health Economics*, 12, 3–16.
- Higgs, Gary. (2009) "The Role of GIS for Health Utilization Studies: A Literature Review," *Health Services and Outcome Research Methodology*, 9, 84–99.
- Hiscock, Rosemary, Jamie Pearce, Tony Blakely, and Karen Witten. (2008) "Is Neighborhood Access to Health Care Provision Associated with Individual-Level Utilization and Satisfaction?," *Health Services Research*, 43, 2183–2200.
- Johannesson, Magnus and Per-Olov Johannson. (1991) "Quality of Life and WTP for an Increased Life Expectancy at an Advanced Age," *Journal of Public Economics*, 65, 219–228.
- Johannesson, Magnus, H. Åberg, Lars Agréus, Lars Borgquist, and Bengt Jönsson. (1991) "Cost-benefit Analysis of Non-pharmacological Treatment of Hypertension," *Journal of Internal Medicine*, 230, 307–312.
- Jones, Andrew. (2006) *The Elgar Companion to Health Economics*. Edward Elgar Publishing: Northampton, MA.
- King, Chong Won, Tim Phipps, and Luc Anselin. (2003) "Measuring the Benefits of Air Quality Improvement: A Spatial Hedonic Approach," *Journal of Environmental Economics and Management*, 45, 24–39.
- Klose, Thomas. (1999) "The Contingent Valuation Method in Health Care," *Health Policy*, 47, 97–123.
- Lesage, James and Kelley Pace. (2009) *Introduction to Spatial Econometrics*. Chapman and Hall/CRC: Boca Raton, FL.
- Liu, Liyan, Joanne Hader, Bonnie Brossart, Robin White, and Steven Lewis. (2001) "Impact of Rural Hospital Closures in Saskatchewan, Canada," *Social Science and Medicine*, 52, 1793–1804.
- Luttik, Joke. (2000) "The Value of Trees, Water and Open Space as Reflected by House Prices in the Netherlands," *Landscape and Urban Planning*, 48, 161–167.

- Mahan, Brent, Stephen Polasky, and Richard Adams. (2000) "Valuing Urban Wetlands: A Property Price Approach," *Land Economics*, 76, 100–113.
- Mansfield, Carol, Subhrendu Pattanayaka, William McDow, Robert McDonald, and Patrick Halpin. (2005) "Shades of Green: Measuring the Value of Urban Forests on the Housing Market," *Journal of Forest Economics*, 11, 177–199.
- McNamara, Paul. (1999) "Welfare Effects of Rural Hospital Closures: A Nested Logit Analysis of the Demand for Rural Hospital Services," *American Journal of Agricultural Economics*, 686–691.
- Michael, Holly, Kevin Boyle, and Roy Bouchard. (2000) "Does the Measurement of Environmental Quality Affect Implicit Prices Estimated from Hedonic Models," *Land Economics*, 76, 283–298.
- Mitchell, Robert and Richard Carson. (2000) *Using Surveys to Value Public Goods: The Contingent Valuation Method*. RFF Press: Washington, D.C.
- Muus, Kyle, Richard Ludtke, and Brad Gibbens. (1995) "Community Perceptions of Hospital Closure," *Journal of Community Health*, 20, 65–73.
- Nattinger, Ann, Ronald Kneusel, Raymond Hoffmann, and Mary Gilligan. (2001) "Relationship of Distance from a Radiography Facility and Initial Breast Cancer Treatment," *Journal of National Cancer Institute*, 93, 1344–1346.
- Olsen, Jan and Cam Donaldson. (1998) "Helicopters, Hearts and Hips: Using Willingness to Pay to Set Priorities for Public Sector Health Care Programmes," *Social Science and Medicine*, 46, 1–12.
- O'Shea, Eamon, Jennifer Steward, Cam Donaldson, and Phil Shackley. (2002) "Eliciting Preferences for Resource Allocation for Health Care," *Economic and Social Review*, 32, 217–238.
- Palmquist, Raymond. (1984) "Estimating the Demand for the Characteristics of Housing," *Review of Economics and Statistics*, 66, 394–404.
- Panellia, Ruth, Lou Gallagher, and Robin Kearns. (2006) "Access to Rural Health Services: Research as Community Action and Policy Critique," *Social Science and Medicine*, 62, 1103–1114.
- Pearson, Leonie, Clement Tisdell, and Allan Lisle. (2002) "The Impact of Noosa National Park on Surrounding Property Values: An Application of the Hedonic Price Method," *Economic Analysis and Policy*, 32, 155–171.
- Penchansky, Thomas. (1981) "The Concept of Access," *Medical Care*, 19, 127–140.
- Rosen, Sherwin. (1974) "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," *Journal of Political Economy*, 82, 34–55.
- Ross, Justin, Michael Farmer, and Clifford Lipscomb. (2011) "Inconsistency in Welfare Inferences from Distance Variables in Hedonic Regressions," *Journal of Real Estate Finance and Economics*, 43, 385–400.
- Ryan, Mandy. (1998) "Valuing Psychological Factors in the Provision of Assisted Reproductive Techniques Using the Economic Instrument of Willingness to Pay," *Journal of Economic Psychology*, 19, 179–204.

- Ryan, Mandy and Verity Watson. (2009) "Comparing the Welfare Estimates from Payment Card Contingent Valuation and Discrete Choice Experiments," *Health Economics*, 18, 389–401.
- Ryan, Mandy, Julie Ratcliffe, and Janet Tucker. (1997) "Using Willingness to Pay to Value Alternative Models of Antenatal Care," *Social Science Medicine*, 44, 371–380.
- Schmitta, Susan, Ciaran Phibbsa, and John Piette. (2003) "The Influence of Distance on Utilization of Outpatient Mental Health Aftercare Following Inpatient Substance Abuse Treatment," *Addictive Behaviors*, 28, 1183–1192.
- Sedgley, Norman, Nancy Williams, and Frederick Derrick. (2008) "The Effect of Educational Test Scores on House Prices in a Model with Spatial Dependence," *Journal of Housing Economics*, 17, 191–200.
- Shackley, Phil and Cam Donaldson. (2000) "Willingness to Pay for Publicly-financed Health Care: How Should We Use the Numbers?," *Applied Economics*, 32, 2015–2021.
- . (2002) "Should We Use Willingness to Pay to Elicit Community Preferences for Health Care? New Evidence from Using a Marginal Approach," *Journal of Health Economics*, 21, 971–991.
- Smith, Richard. (2002) "Construction of the Contingent Valuation Market in Healthcare: A Critical Assessment," *Health Economics*, 12, 609–628.
- Stewart, Jennifer, Eamon O'Shea, Cam Donaldson, and Phil Shackley. (2002) "Do Ordering Effects Matter in Willingness-to-Pay Studies of Health Care?," *Journal of Health Economics*, 21, 585–599.
- Tajima, Kayo. (2003) "New Estimates of the Demand for Urban Space: Implications for Valuing the Environmental Benefits of Boston's Big Dig Project," *Journal of Urban Affairs*, 25, 641–655.
- Thorsnes, Paul. (2002) "The Value of a Suburban Forest Preserve: Estimates from Sales of Vacant Residential Building Lots," *Land Economics*, 78, 426–441.
- Van den Berg, Bernard, Han Bleichrodt, and Louis Eeckhoudt. (2005) "The Economic Value of Informal Care: A Study of Informal Caregivers' and Patients' Willingness to Pay and Willingness to Accept for Informal Care," *Health Economics*, 14, 363–376.
- Weinick, Robin, Samuel Zuvekas, and Joel Cohen. (2000) "Racial and Ethnic Differences in Access to and Use of Health Care Services, 1977 to 1996," *Medical Care Research and Review*, 57, 36–54.
- Zenk, Shannon, Elizabeth Tarlov, and Jiaming Sun. (2006) "Spatial Equity in Facilities Providing Low- or No-fee Screening Mammography in Chicago Neighborhoods," *Journal of Urban Health*, 83, 195–210.
- Zuvekas, Samuel and Gregg Taliaferro. (2003) "Pathways to Access: Health Insurance, The Health Care Delivery System and Racial/Ethnic Disparities, 1996-1999," *Health Affairs*, 22, 139–153.