

**The Economic Impact of the Local Health Care System
On the Boyd County Economy**

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EXECUTIVE SUMMARY

Health care represents an important part of rural economies. In an era when rural economies are struggling to keep pace with their urban counterparts, the health care sector (which includes hospitals, nursing homes, medical personnel and other resources) represents a bright spot in the economic landscape. The health care sector plays four major roles in rural economic development. First, a local health care system keeps health care dollars within a local economy. Second, it attracts external dollars into a community from outside a local area. Third, a local health care system can retain existing businesses as well as attract new industries into a community. Finally, a local health care system can support and promote a healthy and productive workforce within a community.

The health care sector is an important component of Boyd County’s local economy. The health care system expenditures, as well as, the health care employees’ expenditures exert a significant economic impact, and are highlighted in this report by illustrating the linkages the health care sector shares with other local industries. **Table 1** summarizes the impact of the health care sector on Boyd County’s local economy.

Table 1: Economic Impact of the Local Health Care System on Boyd County, Kentucky

Multiplier Type	Direct Impact	Indirect Impact	Induced Impact	Multiplier	Total Impact
Output (Sales)	\$313,107,680	\$38,522,806	\$80,691,214	1.38	\$432,321,707
Labor Income	\$191,139,184	\$15,587,125	\$30,435,430	1.24	\$237,161,735
Employment	3,738 Jobs	485.8 Jobs	1,225 Jobs	1.46	5,448.8 Jobs

Source: changes to reflect the use of Implan: 2000

The \$313,107,680 dollars represents the direct sales from the health care system to suppliers. The indirect impact of \$38,522,806 represents the health care vendors' spending within Boyd County, and the \$80,691,214 signifies the employees' purchases of local goods and services. The employment multiplier shows that the health care sector indirectly created 485.8 jobs and health care employee spending creates 1,225 jobs and that for every health care job an additional 0.46 jobs are created in the local economy. The labor income multiplier indicates the level of local income that is dependent on the health care systems' payroll. The local healthcare sector payroll generated approximately \$191,139,184 in direct labor income, and \$15,587,125 and \$30,435,430 through indirect and induced impacts, respectfully. The income multiplier illustrates that for every one dollar of labor income generated in Boyd County's health care sector, an additional 0.24 cents of income is generated in the local economy. Overall, the results indicate that the economic activities generated by the health care system in Boyd County created 5,448.8 local jobs, \$432,321,707 in local revenues and \$237,161,735 in labor income

This report may be useful when focusing on rural economic development in Boyd County. Community leaders and economic development officials should identify the current economic and financial roles of local health care providers. Second, opportunities for new medical services through network development should be identified and examined for potential growth in the local economy. For example, if the local health care system expands, there will be a broad range of corresponding economic effects throughout the community. New opportunities for local health care services will increase the economic impact on Boyd County and should be examined to enhance the economic role of the local health care system. Further research can determine the feasibility of providing services locally.

PREFACE

This report is being furnished to the citizens and community leaders of Boyd County. The Kentucky Rural Health Works Program (a program of the University of Kentucky Department of Agricultural Economics, University of Kentucky Cooperative Extension Service, Kentucky State Office of Rural Health and University of Kentucky Center for Rural Health) conducted this economic impact study for Boyd County. The Kentucky Rural Health Works Program offers decision-making information to rural health care providers, local community leaders and policymakers regarding health care and its impact on rural economies. This is carried out through market demand studies, feasibility studies, policy research studies and economic impact studies. The Kentucky Rural Health Works Program combines the health care knowledge and strengths of the University of Kentucky Center for Rural Health with economic development expertise of the University of Kentucky College of Agriculture.

Questions or concerns regarding this analysis should be directed to Dr. Eric Scorsone, Assistant Professor of Agricultural Economics at the University of Kentucky College of Agriculture. See the Kentucky Rural Health Works website at www.ca.uky.edu/krhw

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INTRODUCTION

Health Care as an Engine of Growth

Over the last two decades, health care services have become a critical engine of growth in rural Kentucky. In 1980, health care industry earnings represented 6.7 percent of all industry earnings. By the late 1990's, health care's share of industry earnings had risen to 12.3 percent in rural Kentucky. These statistics indicate that health care is the second largest industry category in rural Kentucky trailing only local government. Furthermore, medical transfer payments, such as Medicare and Medicaid, now represent more than 9 percent of rural Kentucky's personal income. In contrast, in 1980 these payments only represented 2.9 percent of personal income.

Health care services include a wide range of resources, from facilities such as nursing homes to personnel such as physicians. Why are health care services growing so quickly? The health care industry is in part responding to the growing levels of retirement and medical transfer payments from Social Security and Medicare in rural Kentucky.

Very few rural communities have realized the full potential of local health care as an economic and community development tool. Rural communities have an extraordinary opportunity to improve their local economies and develop health care as a local business. The "warms you twice" adage of wood chopping also can be applied to health care. Every health care service provided locally benefits the rural community twice. First, it improves people's health and second, it improves the health of the local economy.

This report documents the economic impact of Boyd County's health care system. This impact is measured by the number of jobs and income directly and indirectly associated with the local health care system. This study is divided into five major sections. The first section describes the role of health care in rural economic development. The second section examines the current status of the local economy and the relative place of the health care industry. The third section demonstrates the direct and indirect economic impact of the health care system on

the local economy. The fourth section provides a summary of the economic impact on Boyd County due to the local health care system. Finally, the appendix explains the methodology used in this report and provides a review of the literature on the economic role of rural health care.

THE ROLE OF RURAL HEALTH CARE IN ECONOMIC DEVELOPMENT

The role of health care in economic development is based on financial and non-financial linkages with the rest of the local economy. Financial linkages are based on the link between the health care providers' expenditures and revenues and other local firms' expenditures and revenues. The health care sector and other industries often mutually support one another through purchases and sales. These financial linkages create a larger local economy.

Non-financial linkages are based on the health care sector's role in retaining local physicians, promoting a more productive workforce, and attracting new businesses and retaining existing ones. Although these may be measured through financial outcomes, generally the link is more indirect. Nevertheless, a strong health care system can promote economic development in a variety of non-financial ways.

Financial Linkages

Health Care: Keeping Local Dollars At Home

The most important financial role for the local health care system is to "keep local health care dollars at home". There are many sources of local health care dollars including private insurance, consumer out-of-pocket payments, and Medicare and Medicaid transfer payments. If these expenditures leave the community, they represent a real loss of potential jobs and income to local residents. Out-shopping, that is, payment for services that are outside of the local area, remains an important issue for many rural health care providers and rural communities.

However, it is not only health care jobs that are at stake. Health care employers and employees are important purchasers of goods and services, which in turn support many local business establishments. Health care providers (such as nurses, physicians, dentists, pharmacists and other allied health care providers) represent an important source of income for other members of the community who may work in housing construction, retail establishments, restaurants and other local services. Hospitals and other health care facilities are also important purchasers of local inputs, that is, goods and services, such as laundry and waste management services. Increased employment in health care and other areas depends upon capturing the private and public sources of local medical expenditures.

Health Care as a Basic (Exporting) Industry

If health care providers can attract patients from outside their community, the health care industry can act as an export industry. In essence, the local health care industry exports its reputation and services, while attracting outside patients and outside dollars into the local community. This “exporting” may be based on, for example, a state-of-the art facility or a physician’s reputation. Regardless, “export” or external dollars from these outside patients represent an in flow of new dollars into the community’s economy. These export dollars then allow a community to purchase a wider variety of goods and services from other communities. The spending linkages created by these export or external dollars in turn generate new jobs and sources of income in the community.

Health Care: Closing the Supply-Demand Gaps

Identification of a community’s supply-demand gap will assist a community in “keeping health care dollars at home”. A supply-demand gap occurs when a local economy does not supply (provide) the goods or services demanded (needed or wanted) by an individual or a community. Consequently, residents are then forced to out-shop and make purchases outside

their own community. The non-local purchases represent leakages (a loss) from the local economy and reduce the potential employment and income opportunities in a community. In some cases, a community cannot provide these goods or services because of market or financial limitations. However, there may be circumstances that allows local businesses to provide the demanded goods or services locally, which would close the supply-demand gap and keep local dollars at home. A community should examine the supply-demand gaps within their local community to determine if opportunities are being missed. This may be especially true when key demographic or economic changes occur. These changes can generate new opportunities that did not exist in the community previously.

Non-Financial Linkages

Health Care: Attracting and Recruiting Industry

An important aspect of the health care system in economic development is its ability to attract and recruit firms based on community services. Company surveys reveal that managers often look at health care as an important issue in locating facilities. The existence of a strong health care network can lower health care costs for firms and their employees, and provide value-added services for firms such as occupational health. In addition, retirees and workers are more likely to choose a location that has access to quality health care services.

Health Care: Promoting a Healthy and Productive Workforce

In today's economy, a productive workforce is critical to businesses, and is vital in the recruitment of new firms and retention of existing firms. The health status of local workers can be an important ingredient in productivity. Local health care providers can improve the health and productivity of the local workforce by promoting preventive care, thus leading to long-term economic benefits. On the contrary, if a community's workforce is substantially less healthy than other communities, this may be considered a cost burden by some industries.

The combination of changing demographics, growth in health care service employment and the increase in medical transfer payments implies that the health care system will be a major player in future economic development for rural Kentucky. This fact was recognized in the Kentucky Appalachian Commission's strategic plan, "State Goal 5.2: Kentucky will recognize health care as a substantial economic sector and pursue strategies to grow the sector" (Kentucky Appalachian Commission, 2000). Economic development agencies, businesses groups and local governments should play a more active role in promoting the health care sector as a key partner and primary sector in generating new economic opportunities.

BOYD COUNTY LOCAL ECONOMY

An examination of the sources of personal income in the community can lead to a better understanding of the potential sources of revenue for local health care providers. **Table 2** indicates that 58.8 percent of the total personal income for Boyd County was from total earnings. Total earnings were adjusted to reflect earnings by place of residence. **Table 2** also shows that 21.4 percent of the total personal income was from transfer payments, such as Social Security, Medicare and Medicaid. Of the total personal income for the year 2000, retirement based transfer payments contributed 44.0 percent while medical payments contributed 37.7 percent.

**Table 2: Economic Data for Boyd County, the State of Kentucky and the Nation
(Thousands of Dollars)**

Source of Income, Earnings Transfer Payments	County Total (\$)	County Percent (%)	State Percent (%)	National Percent (%)
Total Personal Income (2000)	1,201,407	-----	-----	-----
Earnings by Place of Residence	706,161	58.8	65.2	69.0
Transfer Payments	256,553	21.4	17.1	13.0
Total Earnings by place of work (2000)	1,117,297	-----	-----	-----
Wages and Salaries	878,753	78.6	79.2	80.0
Proprietor's Income	53,976	4.8	10.7	12.0
Other Labor Income	184,568	16.5	10.1	9.0
Transfer Payments (2000)	256,553	-----	-----	-----
Retirement and Disability	113,000	44.0	41.0	40.0
Medical Payments	96,758	37.7	38.2	40.0
Other transfer payments	1,265	0.5	0.8	0.5

Source: Bureau of Economic Analysis (2000 Data)

Table 3 indicates that the 2000 average per capita income for Boyd County was \$24,196 as compared to \$24,085 for the State of Kentucky and \$29,469 for the nation. A disparity in per capita income between the region, state and the nation suggests that the local health sector may be smaller than expected given the population base of the county. However, growth in per capita income, particularly driven by Medicare and Medicaid, may potentially lead to higher medical expenditures in the community. Growth in industry and private earnings may also lead to greater medical expenditures depending on private insurance coverage.

Table 3: Per Capita Income for Boyd County, the State of Kentucky and the Nation (2000)

Source	County Total (\$)	State Total (\$)	National Total (\$)
Per Capita Income	\$24,196	\$24,085	\$29,469

Source: Bureau of Economic Analysis (2000 Data)

The Boyd County economy is comprised of a diverse group of industries including manufacturing, retail and wholesale trade, finance, transportation and services. **Table 4** indicates the industries that are present in Boyd County and the personal income by industry for the county. Boyd County's local economy is largely dependent upon the Service industry with \$307,924,000, the Manufacturing industry with \$258,122,000, the Health Care industry with \$169,119,000 and the Government with \$139,644,000. The Service sector is the largest industry in the local economy. The Health Care industry is comprised within and is part of the Service sector. Over the past decade, the Services industry has grown by 97.1 percent while the Health Care sector increased by 89.5 percent.

Table 4: Boyd County Economy

Personal Income by Industry (Thousands of Dollars)

Industry Category	1990 Income (\$)	2000 Income (\$)	Percent Change (%)
Private Industry	813,363	977,570	20.2
Agriculture	1,560	N/A	N/A
Mining	39,863	N/A	N/A
Construction	82,249	66,937	-18.6
Manufacturing	317,592	258,122	-18.7
Transportation	83,243	96,037	15.4
Wholesale	38,739	72,396	86.9
Retail	71,904	119,957	66.8
Finance	21,984	40,615	84.7
Services	156,229	307,924	97.1
<i>Health Care</i>	89,256	169,119	89.5
Government	87,113	139,644	60.3
TOTAL	900,476	1,117,214	24.1

Source: Bureau of Economic Analysis (2000), N/A = Not Available

Table 5 shows Boyd County's transfer payments by type for 1990 and 2000. Comparing **Table 4** to **Table 5**, it is evident that the growth in private industry was less than the growth in federal and state transfer payments to individuals. While private industry grew by 20.2 percent, total transfer payments for the County increased by 79.9 percent. The increase in transfer payments is primarily driven by Social Security, Medicare and Medicaid payments. Of the total transfer payments, the medical payments, which include Medicare and Medicaid, increased by 149.9 percent. Once again from **Table 2**, transfer payments represent 21.4 percent of total personal income. The rapid growth of medical transfer payments signifies the potential for health care expansion and represents an important source of revenue for local health care providers and the community.

Table 5: Boyd County Transfer Payments (thousands of Dollars)

Transfer Payment	1990 (\$)	2000 (\$)	Percent Change (%)
Medical payments	38,722	96,758	149.9
Retirement benefits	75,745	113,000	49.2
Income (welfare) benefit	12,709	24,162	90.1
Unemployment insurance	2,908	4,111	41.4
Total transfer payments	142,583	256,553	79.9

Source: Bureau of Economic Analysis (2000)

ECONOMIC IMPACT ANALYSIS

Inflows and Outflows: Local and Non-local Purchases

A local economy can be conceived of as a barrel with inflows and outflows of monies into and out of a community. The inflows represent external dollars coming into the community that expand the size and strength of the region's economy. Inflows of external dollars represent, for example, federal and state expenditures, money spent by tourists and other people from outside the community who spend within the local economy. The outflows represent leakages (or a loss) out from the economy, which reduces job creation or local

income. Outflows include state and federal taxes, non-local purchases of goods and services, people traveling to other sites for vacation and out-shopping for medical services in another county or urban area. Local taxes do not represent an outflow; taxes are spent on creating local public goods such as roads, schools, and police and fire protection.

The economic impact of the health care sector on a local community is dependent on a number of factors. In general, the two major economic impact determinants are local purchases and non-local purchases. In effect, non-local purchases represent a leakage (a loss) from the local economy. For health care providers, many purchases by necessity must be made from distant locations. The complex technology and equipment of modern medicine is subject to large economies of scale and is only produced in a few places in the nation. This equipment might include x-ray machines, MRI equipment and other surgical equipment. Pharmaceutical supplies and drugs are also subject to these same forces. In addition, some types of audit, legal and accounting services must be purchased from urban regions due to the complexity of services.

However, the local health care system purchases many goods and services from within the local area, which in turn, positively impacts the community. Therefore, health care employees and professionals are a major source of economic impact in the local economy. These health care employees and professionals, turned consumers, spend large amounts of their income in local retail outlets, housing, automobiles and other services. These consumer (health care employees and professionals) expenditures support a large number of local resident service jobs such as mechanics, retail clerks, real estate agents and bankers.

Economic Impact Multipliers

The impact of local health care system and health care employee expenditures are called multiplier effects. Multiplier effects are a simplified and compact way of representing these economic effects in a local economy. The multiplier is interpreted as the impact of a one-

unit change in sales, employment or labor income that results in an “X” impact on the local economy. In essence, the multiplier represents the recycling of local dollars and income in the community. This recycling process creates new job opportunities and higher wages for individuals. Leakage of dollars and income out of the community, via taxes or non-local spending, reduces the size of the multiplier effect and the potential size of the local economy.

There are three multiplier effects based on the type of economic impact analysis: direct effect, indirect effect and induced effect (see **Table 6**). The direct multiplier effect is based on an industry’s initial economic impact on the community. For example, if a manufacturing plant has revenue of 5 million dollars, then this figure becomes the direct economic impact on the community. The indirect multiplier effect is based on industry-to-industry transactions only. For example, health care providers may purchase laundry, food, landscaping and floral services from local businesses. It is important to note that the indirect multiplier does not include the effect of employee spending on retail and service sectors in the community. Alternatively, the induced multiplier effect includes both the industry-to-industry transactions and household purchases, which includes employee spending. The total economic impact is defined as the direct plus indirect plus induced economic effects.

The direct, indirect and induced multiplier effects can be classified as output (sales), employment and labor income multipliers (see **Table 6**). Output (sales) multipliers represent the change in local sales or revenue due to a change in an industry. Economic output is measured as a change in total sales for a new or existing business or institution in a region. Employment multipliers are the impact of a one million dollar change in economic output on the number of jobs in a local economy. Labor income multipliers represent a one-unit change in economic output on local income.

Table 6: Health Care Related Economic Impact Multipliers

Multiplier Type	Direct Impact	Indirect Impact	Induced Impact
Employment	Health care jobs	Health care supplier jobs	Local retail and service jobs related to health care employee spending
Income	Health care employee income	Health care supplier employee income	Local retail and service income related to health care employee spending
Output (Sales)	Health care revenue	Health care supplier revenue	Local retail and service revenue related to health care employee spending

Economic Impact Results

The Boyd County health care system is an important component of the local economy. This importance can be measured via the linkages the health care sector shares with other local industries. When there is an increase in health care revenue or in the number of health care employees within a community, these changes feed through the rest of the local economic system. For example, more supplies may be purchased through local vendors or new employees may purchase homes and spend money in local stores. The expenditures from the health care system, health care employees, and health care professionals are important pieces of the economic puzzle.

The economic impact of health care on the Boyd County economy is illustrated through three different multipliers and presented in the following order: 1) output or sales multiplier 2) employment multiplier 3) labor income multiplier. The output (sales), employment and labor income impact analysis is summarized in **Tables 7, 8** and **9** below.

The output (sales) multiplier represents the amount of local sales or revenue generated in the local economy due to the impact of the Boyd County health care system (see **Table 7**). This revenue represents sales from vendors to the health care providers. The \$313,107,680 in **Table 7** represents the direct sales from the health care system to suppliers and is the direct multiplier effect. Health care vendors are supplied by other dealers and wholesalers, thus

creating more employment and income opportunities. Subsequently, the indirect impact of \$38,522,806 represents the health care vendors' spending within the Boyd County. Finally, the \$80,691,214 generated from the induced impact is associated with health care employees' purchases of goods and services locally. Based on the output (sales) multiplier, the Boyd County health care sector had a total economic impact of 432,321,707 dollars.

Table 7: Boyd County Health Care Sector Economic Impact on Local Output (Sales)

Direct Impact On Output (Sales)	Indirect Impact On Output (Sales)	Induced Impact On Output (Sales)	Output (Sales) Multiplier	Total Impact On Output (Sales)
\$313,107,680	\$38,522,806	\$80,691,214	1.38	\$432,321,707

Source: changes to reflect the use of Implan: 2000

The employment multiplier demonstrates the relationship between the health care system expenditures and employment creation in the local community. The health care sector directly created 3,738 jobs, indirectly produced 485.8 jobs, and through health care employee spending, generated 1,225 jobs in Boyd County (see **Table 8**). The health care sector had an employment multiplier of 1.46 in the 2000. The employment multiplier illustrates that for every health care job, an additional 0.46 jobs are created in Boyd County's local economy. In 2000, a total of 5,448.8 jobs in Boyd County were directly or indirectly tied to the local health care system finances.

Table 8: Boyd County Health Care Sector Economic Impact on Local Employment

Direct Impact On Employment	Indirect Impact On Employment	Induced Impact On Employment	Employment Multiplier	Total Impact On Employment.
3,738 Jobs	485.8 Jobs	1,225 Jobs	1.46	5,448.8 Jobs

Source: changes to reflect the use of Implan: 2000

Table 9 illustrates the labor income impact of health care sector on Boyd County's economy during 2000. The income multiplier indicates the level of county income that is dependent on the local health care system's payroll. Boyd County health care employee payroll generated approximately 191,139,184 dollars. This \$191,139,184 represents the direct impact of health care on the county's economy. This income translates into more local spending, job creation, and consequently, more income in the community. The indirect impact from the labor income was estimated to be \$15,587,125. The induced impact was \$30,435,430 and the total labor income impact was \$237,161,735 for the County. The income multiplier was 1.24 meaning that for every dollar of labor income generated in the health care sector, additional 0.24 cents of income was generated in the rest of the local economy.

Table 9: Boyd County Health Care Sector Economic Impact on Local Labor Income

Direct Impact On Labor Income	Indirect Impact On Labor Income	Induced Impact On Labor Income	Labor Income Multiplier	Total Impact On Labor Income.
\$191,139,184	\$15,587,125	\$30,435,430	1.24	\$237,161,735

Source: changes to reflect the use of Implan: 2000

SUMMARY

In 2000 alone, the Boyd County's health care sector created \$432,321,707 in sales, 5,448.8 in the number of jobs and \$237,161,735 in local income. Further, the local health care system represents 9 percent of private economic activity. This percentage compared favorably with other industries in the community. Health care has been called the "main economic engine" of the next decade. Boyd County is in a position to capture many of the economic and financial benefits of this engine.

This report should be used to stimulate economic development discussions that focus on the integration of the health care sector in Boyd County's strategic and community planning process. For instance, a county should identify the economic and financial roles of their health care industry. Second, supply-demand gaps should be examined to find potential opportunities for new or expanded medical services within the Boyd County. Seeking out new opportunities for health care services will increase the economic impact of health care system on Boyd County's local economy. Health care network development and related activities should be examined to enhance the economic role of the local health care system and further simulate local growth. Further research or market demand analysis can determine the feasibility of providing services locally or regionally.

APPENDIX

Literature Review

A wide variety of health care services are available to community. These services may include, for example, hospitals, physicians, dentists, pharmacies, health clinics and nursing homes. Each of these services contributes to the local economy with hospitals generally supplying the largest portion of the impact. The literature on the economic impact of health care services on regional and local economies indicate that 1) health care services contribute as export industries for regions in which they are located, and 2) health care services reduce the region's imports by providing services to local residents, who would otherwise seek services outside the region or local area. Both effects of decreasing imports and increasing exports, stimulate and increase local and regional income. The direct impact of the health care sector to local and regional economies is measured through wages paid to employees, through inputs purchased by the health sectors and through the spending generated through the multiplier effect.

Among the recent studies is the impact of health care on a regional economy by Lichty et al. (1986) where a simulation model using input-output was used to assess the health care sector impact on Arrowhead (a seven county area) region in Northeast Minnesota. The model estimated the impact of removing an entire health care sector as well as the impact of closing one hospital. Obviously, the elimination of the entire health sector had a far more dramatic impact on the region, indicating a loss of 42 percent, from 121,305 to 70,004 of total employment over a period of six years in the baseline if the medical sector was removed. Also, regional gross output declined by 22 percent from \$ 4,962,141 000 to \$3,866,211,000. A more modest impact was that of a closing hospital with a loss of 1,200 employees and a decline in gross output of 2.1 percent (from \$4,962,141,100 to \$4,855,977,000) from the baseline, by 1990.

A similar study was done by McConner and Wellever (1989) that examined the impact of a hospital sector on a state economy. An input-output model was used to examine the impact of a Montana hospital on employment, household income, and the level of goods and services produced in the state of Montana. The study revealed a significant hospital impact on total state revenues, salaries and wages and on total employment. Total revenues had a 1.60 multiplier from business spending totaling \$402,131,432 million in 1987. Similarly, salaries for professionals and employment had 1.61 and 1.30 multipliers that totaled indirect impacts of \$196,664,645 and 9,000 respectively.

In terms of a base industry, rural hospitals depend heavily on reimbursements from Medicare and Medicaid and the impact of these federal dollars into the rural communities is very significant. Lee et al. (1988) found that for each state dollar spent on Medicaid there is a federal match of \$3.69 in Mississippi. From the \$4.69 Medicaid expenditure, \$3.05 was spent on income in terms of wages and salaries. He also applied the state income multiplier of 2.172 to generate a total income impact of \$6.62 on the economy concluding that Medicaid dollars from outside the state economy had significant impact of the overall economy of Mississippi.

An earlier study by Moore (1974) measured the impact of the Upstate Medical Center on the community of Syracuse, New York, where he estimated an income multiplier of 2.63 indicated that each dollar of direct expenditure by the medical center produced \$2.63 of total expenditure. Moore concluded that large public institutions, such as hospitals have the potential to generate millions of dollars in employment and personal income through, in effect, interregional trade.

Extensive studies have indeed indicated the importance of health care to regional and local economies, especially hospitals. More recent studies have measure the impact of hospitals particularly in rural areas. McDermott et al. (1991) measured the impact of four small rural hospitals in Utah on their local economies. He found that these hospitals contributed between 4.0 to 9.0 percent of the average employment in their local, both directly and indirectly.

An earlier study by Christianson and Faulkner (1981) examined single-hospital rural counties from Montana, Nebraska, Nevada, Idaho, North Dakota, South Dakota, Wyoming and Utah to measure the importance of a rural hospital to the community's income in each respective county. They found that income associated with hospital salaries generated, on average a 1.36 percent of direct benefit to the total county income, and had a multiplied income effect from hospital expenditures ranging from 1.54 to 2.37 percent of total county income. The loss from a hospital closer was less significant ranging from 1.53 to 2.29 percent of total county income.

A recent study by Doeksen and Altobelli (1990) also measured the change in local economic activity in three Texas communities of Crowell, Breckenridge and Graham if there was a hospital closure. They found that employment would decrease by 1.1 to 3.0 percent for the baseline for 1994. Similarly, income and retail sales would drop by almost a percent under the same circumstances. This, they concluded, would be detrimental to the local economy.

Methodology

The IMPLAN model was used to generate the economic impact of Boyd County health care. IMPLAN is an input-output model that can be used to examine the economic impact of new industries, loss of an existing industry, fiscal impact analysis and the existence of supply demand gaps. Model version 2.17 was used in this study with the 2000 Kentucky data and structural matrices.

An input-output model is a set of linear equations expressed in matrix form. The so-called Leontief inverse of this matrix reveals "multipliers". Multipliers express in compact form, the relationship between sectors of an economy. In essence, a change in an industry, household, or government expenditure pattern gets reflected through the study economy.

A number of important assumptions underlie input-output analysis. First, prices are fixed in the model. This implies that no relative price changes occur in the economy that would affect resource allocation. Typically, economies assume that a price change affects the relative number of quantities or goods in an economy. Second, supply of factors, such as labor and capital, is always available at the same price. Again, whatever capital or labor is needed by the healthcare sector will be available to a rural community.

IMPLAN industries are based on a relationship called a production function. A production function specifies the dollar value of inputs used by an industry to create its output. The production function is specified as a series of coefficients, called gross absorption coefficients that reflect the percentage of total inputs coming from a particular industry. In essence, these coefficients reflect the recipe for an industry. Industry ingredients, capital and labor, are combined to create a certain dish or output. In this case, lab supplies, surgical equipment, nursing home beds, nurses and doctors and other factors are combined to create the output called health care.

IMPLAN production functions originally exist based on a national data set. Hospitals and other health care providers from across the nation, both urban and rural, are surveyed by the Census Bureau to determine their expenditure purchasing patterns. These national purchasing patterns are used by IMPLAN to create a regional version of a county's health care production function. However, often this national purchasing pattern is quite different from what actually occurs in a rural health care setting.

This production function is also modified to reflect local versus external purchases of inputs. The distribution of local versus external expenditures is called the regional purchase coefficient. The coefficient is a number between zero and one reflecting the percentage of goods and services bought locally. If an industry purchases an input from outside the community, this purchase is not reflected as an expenditure in other local industries. For example, if a health care provider purchases waste management services from a local provider

that industry in turn expands and hires workers. If waste services are purchased outside the community, the expenditure is lost or leaked out of the local economy. Again, these local versus external purchasing patterns are based on aggregate national conditions and may not accurately reflect local purchasing patterns. It is critical to properly account for local production functions and local purchases by the health care sector.

For this study, it was felt important to capture the nature of Boyd County Health care purchasing patterns as opposed to the use of national standard production function. After the initial model for Boyd County was developed, the expenditure records for the health care were reviewed to determine health care spending patterns. Where available, other health care provider records were examined to determine expenditure patterns. These patterns were in some cases significantly different from the original IMPLAN health care expenditure patterns. Also, the regional purchase coefficients were significantly different in some cases between the original IMPLAN model and the revisions based on Boyd county records. The revisions of local spending correspond with findings from other studies that rural health care providers generally affect wholesale and retail trade activities in the county.

Once these revisions are made to the IMPLAN model, the impact of the health care sector is generated. Employment, output and value added multipliers are calculated for the hospital, nursing home, doctor's office and other health care provider sector in the community. These multipliers represent Boyd County health care sector indirect and induced economic impact on the community. Again, this impact is based on a positive change in the health care sector and its impact on other local economic sectors. The economic impact was calculated by removing the newly created health care sector through the Impact screen and determining the loss in employment, labor income and output.

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