

The Economic Impact of the Health Sector on the Economy of Morgan County, Colorado



Prepared by:

National Center for Rural Health Works
Oklahoma Cooperative Extension Service, Oklahoma State University

December 2009

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of Morgan County, Colorado**

Prepared for:

Horizon Council
and the Residents
of Morgan County, Colorado

Prepared by:

Cheryl F. St. Clair, Associate State Extension Specialist
Email: cheryl@okstate.edu

Pamela S. Hartman, Extension Associate
Email: pamela.hartman@okstate.edu

Gerald A. Doeksen, Extension Economist
Email: gad@okstate.edu

National Center for Rural Health Works
Oklahoma Cooperative Extension Service
Oklahoma State University
(405) 744-6083

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Medical facilities have a tremendous medical and economic impact on the community in which they are located. This is especially true with health care facilities, such as hospitals and nursing homes. These facilities not only employ a number of people and have a large payroll, but they also draw into the community a large number of people from rural areas that need medical services and may also attract visitors to the area through tourism activities. The overall objective of this study is to measure the economic impact of the health sector on Morgan County, Colorado. The specific objectives of this report are to:

1. Review national health trend data;
2. Review demographic and economic data for Morgan County, Colorado, and the State of Colorado;
3. Summarize the direct economic activities of the health sector in Morgan County;
4. Present concepts of community economics and multipliers; and
5. Estimate the economic impact of the health sector on Morgan County, Colorado.

No recommendations will be made in this report.

National Health Trend Data

The health care sector is an extremely fast-growing sector in the United States, and based on the current demographics, there is every reason to expect this trend to continue. Data in **Table 1** provide selected expenditure and employment data for the United States. Several highlights from the national data are:

- In 1970, health care services as a share of the national gross domestic product (GDP) were 7.2 percent and increased to 16.2 percent in 2007;
- Per capita health expenditures increased from \$356 in 1970 to \$7,421 in 2007;
- Employment in the health sector increased over 324.0 percent from 1970 to 2007; and

Table 1
United States Health Expenditures and Employment Data
1970-2007; Projected for 2008, 2011, 2014 & 2017

Year	Total Health Expenditures (\$Billions)	Per Capita Health Expenditures (\$)	Health as % of GDP (%)	Health Sector Employment (000)	Ave. Annual Increase in Employment (%)
1970	\$74.9	\$356	7.2%	3,052	^a
1980	253.4	1,100	9.1%	5,278	^a 7.3%
1990	714.1	2,814	12.3%	7,814	^a 4.8%
2000	1,353.2	4,789	13.8%	10,858	^a 3.9%
2001	1,469.4	5,149	14.5%	11,188	^a 3.0%
2002	1,602.3	5,560	15.3%	11,536	^a 3.1%
2003	1,734.9	5,967	15.8%	11,817	^b N/A
2004	1,854.8	6,319	15.9%	12,055	^b 2.0%
2005	1,980.6	6,687	15.9%	12,314	^b 2.1%
2006	2,112.7	7,062	16.0%	12,602	^b 2.3%
2007	2,241.2	7,421	16.2%	12,946	^b 2.7%
Projections					
2008	2,394.3	7,868	16.6%		
2011	2,905.1	9,322	17.4%		
2014	3,523.6	11,043	18.4%		
2017	4,277.1	13,101	19.5%		

SOURCES: U.S. Department of Labor, Bureau of Labor Statistics (www.bls.gov [November 2009]); U. S. Department of Commerce, Bureau of Economic Analysis (www.bea.gov [November 2009]); U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services, National Health Expenditures 1970-2007 and National Health Expenditure Projections 2007-2017 (www.cms.hhs.gov [January 2009]).

N/A - Not Available.

^a Based on Standard Industrial Classification (SIC) codes for health sector employment.

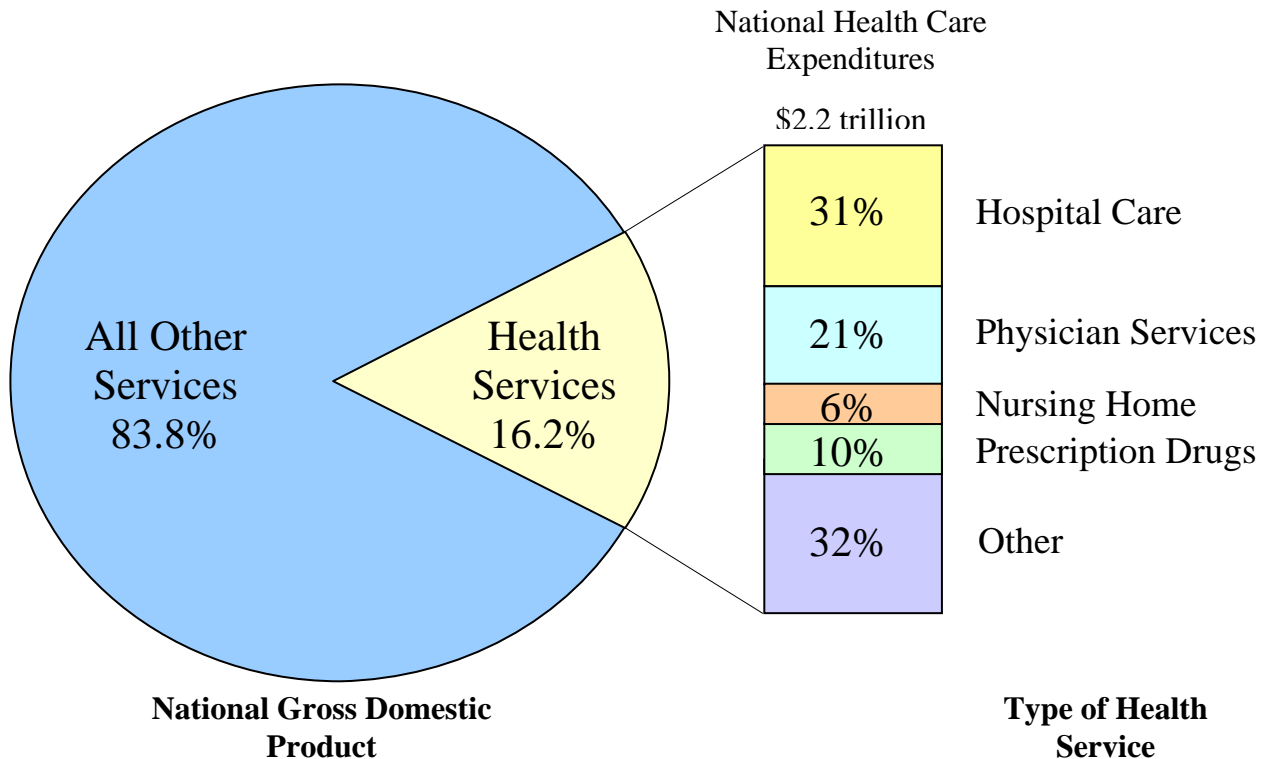
^b Based on North American Industry Classification System (NAICS) for health sector employment.

- Annual increases in employment from 2003 to 2007 ranged from 2.0 percent to 2.7 percent.

In addition, the Bureau of Labor Statistics projects substantial increases in health care expenditures from 2008 through 2017. In fact, the U. S. Department of Health and Human Services, Centers for Medicare and Medicaid Services, predicts that health care expenditures will account for 18.4 percent of GDP by 2014 and increase to 19.5 percent of GDP in 2017. Per capita health care expenditures are projected to increase to \$11,043 in 2014 and to \$13,101 in 2017. Total health expenditures are projected to increase to almost \$4.3 trillion in 2017.

Figure 1 illustrates 2007 health expenditures by percent of gross domestic product and by type of health service. The largest health service type was hospital care, representing 31.0 percent of the total. The next largest type of health services was physician services with 21.0 percent of the total.

Figure 1
National Health Expenditures as a Percent of Gross Domestic Product
and by Health Service Type, 2007



Morgan County Demographic and Economic Data

Morgan County is located in northeast Colorado. Data in **Table 2** show the populations for the cities and towns, Morgan County and the State of Colorado for census years 1990 and 2000 and census estimated 2008 population. The largest population center in Morgan County is Fort Morgan city with a 2000 Census population of 11,034. From the 1990 to the 2000 Census, Morgan County population increased by 23.8 percent. Morgan County population was estimated to increase by 2.3 percent from Census 2000 to the 2008 Census estimate. The State of Colorado showed an increase of 30.6 percent from 1990 to 2000 and a 14.8 percent increase from 2000 to 2008.

Table 2
Census Population, Population Estimates, and Percent Changes
for Morgan County Cities and Towns,
Morgan County, and the State of Colorado

	<u>Census</u>		<u>Census</u> <u>Estimate</u>	<u>10 Years</u>	<u>8 Years</u>
	1990	2000	2008	'90-'00	'00-'08
Brush city	4,165	5,117	5,332	22.9%	4.2%
Fort Morgan city	9,068	11,034	10,539	21.7%	-4.5%
Hillrose town	169	254	270	50.3%	6.3%
Log Lane Village town	667	1,006	973	50.8%	-3.3%
Wiggins town	499	838	945	67.9%	12.8%
Balance of Morgan County	<u>7,371</u>	<u>8,922</u>	<u>9,745</u>	21.0%	9.2%
Morgan County	<u>21,939</u>	<u>27,171</u>	<u>27,804</u>	<u>23.8%</u>	<u>2.3%</u>
State of Colorado	<u>3,294,394</u>	<u>4,301,261</u>	<u>4,939,456</u>	<u>30.6%</u>	<u>14.8%</u>

SOURCE: U.S. Census Bureau; 1990 & 2000 Census population; 2008 Census population estimates (www.census.gov [December 2009]).

Table 3 presents 2000 Census population and population projections from 2010 to 2035 for Morgan County and the State of Colorado. From 2000 to 2010, Morgan County is projected to increase in population by 6.6 percent, while the State of Colorado is projected to increase by 20.2 percent. From 2000 to 2035, Morgan County is projected to increase in population by 75.5 percent, while the State of Colorado is projected to increase by 79.0 percent from 2000 to 2035. This is a projected average increase of 2.2 percent per year for Morgan County and 2.3 percent per year for the State of Colorado over the thirty-five years.

Table 3
Population, Projected Population and Projected Percent Changes
for Morgan County and the State of Colorado

	<u>Census</u>	<u>Projected</u>					
	<u>Population</u>						
	2000	2010	2015	2020	2025	2030	2035
Morgan County	27,171	28,953	31,477	35,362	39,434	43,477	47,697
State of Colorado	4,301,261	5,171,798	5,632,137	6,186,161	6,718,452	7,227,385	7,699,126
		<u>Percent Change</u>					
		<u>10 Years</u>	<u>15 Years</u>	<u>20 Years</u>	<u>25 Years</u>	<u>30 Years</u>	<u>35 Years</u>
		'00-'10	'00-'15	'00-'20	'00-'25	'00-'30	'00-'35
Morgan County	--	6.6%	15.8%	30.1%	45.1%	60.0%	75.5%
State of Colorado	--	20.2%	30.9%	43.8%	56.2%	68.0%	79.0%

SOURCE: 2000 Census Population, U.S. Census Bureau (www.census.gov [December 2009]); Colorado State Demography Office, Report date of October 2008 (http://dola.colorado.gov/demog/pop_colo_forecasts.html [November 2009]).

Table 4 presents the 2008 Census population estimates by age and gender for Morgan County. The largest proportions of the population are the 5-9 and 10-14 age groups with 7.8 percent each, followed closely by the 45-49 age group with 7.4 percent. The population of the 0-19 age groups is 30.2 percent of the total population and the 65 and older age groups comprise 13.9 percent.

Table 4
Age Groups and Gender
for Morgan County, Colorado

Age	Male	Female	Total	% of Total
2008 Estimated Population				
0-4	1,008	1,010	2,018	7.3%
5-9	1,125	1,042	2,167	7.8%
10-14	1,108	1,047	2,155	7.8%
15-19	1,106	916	2,022	7.3%
20-24	968	841	1,809	6.5%
25-29	1,061	953	2,014	7.2%
30-34	764	730	1,494	5.4%
35-39	844	831	1,675	6.0%
40-44	911	919	1,830	6.6%
45-49	1,066	983	2,049	7.4%
50-54	951	853	1,804	6.5%
55-59	822	786	1,608	5.8%
60-64	635	644	1,279	4.6%
65-69	455	496	951	3.4%
70-74	420	470	890	3.2%
75-79	322	441	763	2.7%
80-84	261	346	607	2.2%
85+	214	455	669	2.4%
Total	<u>14,041</u>	<u>13,763</u>	<u>27,804</u>	<u>100.0%</u>

SOURCE: U.S. Census Bureau, 2008 county population estimates (www.census.gov [December 2009]).

Table 5 shows the population by race and ethnic groups for the 1990 and 2000 Census years and for the 2008 Census estimates. From 1990 to 2000, the white race group increased from 88.1 percent to 97.3 percent and the race group “other” decreased from 11.1 percent to 0.4 percent for Morgan County. For the state, the white race group increased from 88.2 percent to 90.7 percent and the race group “other” decreased from 6.9 percent to 2.4 percent. From 2000 to 2008, the white and the “other” race groups remained at a similar percent for both the county and the state. The Hispanic origin ethnic group increased from 18.4 percent to 31.2 percent from 1990 to 2000 and further increased to 34.5 percent in 2008; the state followed the same trend but at a much lower level, from 12.9 percent in 1990 to 17.1 percent in 2000 to 20.2 percent in 2008.

Table 6 utilizes County Business Pattern data from the U. S. Census Bureau to compare the employment and payroll for the health services sector to the total employment and payroll for all sectors for both Morgan County and the State of Colorado. From the data, health services employment increased by 4.4 percent from 1999 to 2007 in Morgan County, while total county employment increased by 4.5 percent. Health services as a percent of total county employment were 13.3 percent for both 1999 and 2007, compared to the state’s health services portion of state employment increasing from 10.3 percent in 1999 to 11.4 percent in 2007.

Health services payroll in Morgan County increased by 60.3 percent from 1999 to 2007, while the total county payroll increased by 42.5 percent. Health services as a percent of total county payroll increased from 12.3 percent in 1999 to 13.8 percent in 2007, compared to the state’s health services portion of state payroll increasing from 9.3 percent to 11.2 percent.

Table 5
Population by Race and Ethnic Groups
for Morgan County and the State of Colorado

Race/Ethnic Group	Morgan County		State of Colorado	
	Number	Percent	Number	Percent
1990 Census				
White	19,320	88.1%	2,905,474	88.2%
Black	61	0.3%	133,146	4.0%
Native American ¹	124	0.6%	27,776	0.8%
Other ²	2,434	11.1%	227,998	6.9%
Two or more Races ³	NA	NA	NA	NA
Hispanic Origin ⁴	4,034	18.4%	424,302	12.9%
2000 Census				
White	26,434	97.3%	3,903,166	90.7%
Black	136	0.5%	173,417	4.0%
Native American ¹	272	1.0%	49,570	1.2%
Other ²	119	0.4%	104,285	2.4%
Two or more Races ³	210	0.8%	70,823	1.6%
Hispanic Origin ⁴	8,473	31.2%	735,601	17.1%
2008 Census Estimate				
White	26,771	96.3%	4,432,376	89.7%
Black	288	1.0%	211,249	4.3%
Native American ¹	330	1.2%	60,375	1.2%
Other ²	146	0.5%	138,553	2.1%
Two or more Races ³	269	1.0%	96,903	2.0%
Hispanic Origin ⁴	9,599	34.5%	997,062	20.2%

SOURCE: U.S. Census Bureau, 1990 & 2000 Census data, 2008 Census estimates (www.census.gov [December 2009]).

¹ Native American includes American Indians and Alaska Natives.

² Other is defined as Asian Americans, Native Hawaiians, Pacific Islanders and all others.

³ Two or more races indicates a person is included in more than one race group; it was introduced as a new category in the 2000 Census.

⁴ Hispanic population is not a race but rather a description of ethnic origin; Hispanics are included in the five race groups.

NA = Not Available.

Table 6
Employment and Payroll Trends for
Morgan County and the State of Colorado

Employment				
Based on NAICS ¹	Health Services Employment	Total County Employment	Health Services as a % of Total County Employment	Health Services as a % of Total State Employment
1999	1,084	8,140	13.3%	10.3%
2000	1,106	8,291	13.3%	10.0%
2001	1,126	8,290	13.6%	9.9%
2002	1,371	8,438	16.2%	10.4%
2003	1,188	8,452	14.1%	11.1%
2004	1,166	8,444	13.8%	11.3%
2005	1,197	8,628	13.9%	11.5%
2006	1,133	8,515	13.3%	11.4%
2007	1,132	8,505	13.3%	11.4%
% Change '99 - '07	4.4%	4.5%		

Payroll				
Based on NAICS ¹	Health Services Payroll (\$1,000s)	Total County Payroll (\$1,000s)	Health Services as a % of Total County Payroll	Health Services as a % of Total State Payroll
1999	22,934	186,800	12.3%	9.3%
2000	24,408	195,511	12.5%	8.8%
2001	27,606	207,727	13.3%	9.2%
2002	31,402	213,439	14.7%	10.4%
2003	29,875	211,097	14.2%	10.8%
2004	31,176	220,072	14.2%	11.0%
2005	32,448	230,120	14.1%	11.0%
2006	33,719	245,500	13.7%	10.7%
2007	36,768	266,277	13.8%	11.2%
% Change '99 - '07	60.3%	42.5%		

Source: U.S. Census Bureau, County Business Patterns; 1999-2007 data (www.census.gov [December 2009]).

¹ The Health Care and Social Assistance NAICS sector comprises establishments providing health care and social assistance for individuals. The sector includes both health care and social assistance because it is sometimes difficult to distinguish between the boundaries of these two activities. Industries in this sector are arranged on a continuum starting with those establishments providing medical care exclusively, continuing with those providing health care and social assistance, and finally finishing with those providing only social assistance. The services provided by establishments in this sector are delivered by trained professionals. All industries in the sector shared this commonality of process, namely, labor inputs of health practitioners or social workers with the requisite expertise. Many of the industries in the sector are defined based on the educational degree held by the practitioners included in the industry.

The Direct Economic Activities

Employment and payroll are the important direct economic activities created by the health services in Morgan County. The health sector is divided into the following components:

- Hospitals
- Physicians, dentists & other health professionals
- Long term care facilities
- Pharmacies
- Other health and medical services

The total health sector in Morgan County employs 1,162 full- and part-time employees with total wages, salaries, benefits, and proprietors' income (defined as "income") of \$54.5 million (**Table 7**). The hospital component has 412 total full- and part-time employees with income of \$27.0 million. The hospital component includes two hospitals, Colorado Plains Medical Center and East Morgan County Hospital. Physicians, dentists and other health professionals and their office staffs represent 174 full- and part-time employees with income of \$9.7 million. This component includes eight primary care physician practices, one podiatrist, ten dental clinics, four chiropractic practices, and four optometric practices.

The long term care facilities include 456 full- and part-time employees with income of \$12.5 million. This component includes three nursing homes and two assisted living facilities. The pharmacies' component includes five pharmacies with total full- and part-time employment of 33 and total income of \$2.2 million. The other health and medical services' component includes 87 full- and part-time employees with an income of \$3.0 million. This component includes the hospice, a mental health facility, an outpatient physical therapy practice, the county health department and the emergency medical services (medical transports).

Table 7
Direct Economic Activities of Health Services
on the Economy of Morgan County, Colorado

Health Service	Total Employment ¹	Total Income ²
Hospitals (Includes two hospitals, Colorado Plains Medical Center and East Morgan County Hospital)	412	\$27,016,590
Physicians, Dentists & Other Health Professionals (Includes 8 primary care physician practices; one podiatrist; 10 dental practices; 4 chiropractic practices; and 4 optometric practices)	174	\$9,691,813
Long Term Care Facilities (Includes three nursing homes and two assisted living facilities)	456	\$12,552,505
Pharmacies (Includes 5 pharmacies)	33	\$2,181,921
Other Health & Medical Services (Includes hospice, mental health, outpatient physical therapy, county health department, and EMS)	<u>87</u>	<u>\$3,026,525</u>
Total Health Services	<u>1,162</u>	<u>\$54,469,354</u>

SOURCE: Local employment and income data used when available; all other income estimated from state average salaries from U. S. Department of Labor, Bureau of Labor Statistics, May 2008 State Occupational Employment and Wage Estimates for Pennsylvania (December 2009, [www.bls.gov]).

¹ Employment is defined as total full- and part-time employees.

² Income is defined as all personal income including wages, salaries, proprietor income, and benefits.

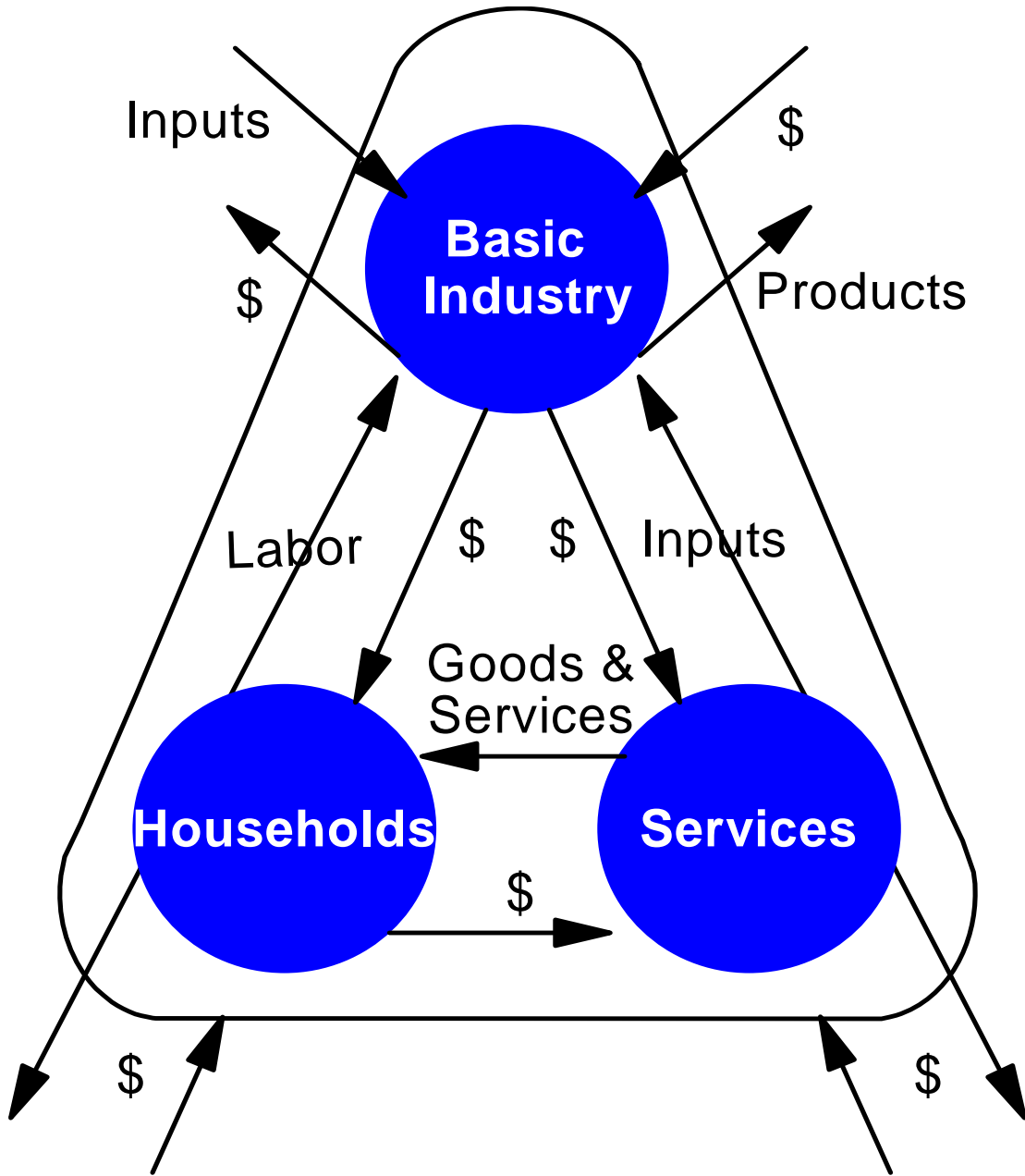
In summary, the health sector is vitally important as a county employer and important to the economy of Morgan County. The health sector definitely employs a large number of residents. The health sector and the employees in the health sector purchase a large amount of goods and services from businesses in Morgan County. These impacts are referred to as secondary impacts or benefits to the economy. Before the secondary impacts of the health sector are discussed, basic concepts of community economics will be discussed.

Some Basic Concepts of Community Economics and Income and Employment Multipliers

Figure 2 illustrates the major flows of goods, services, and dollars of any economy. The foundation of a community's economy is those businesses which sell some or all of their goods and services to buyers outside of the community. Such a business is a basic industry. The flow of products out of, and dollars into, a community are represented by the two arrows in the upper right portion of **Figure 2**. To produce these goods and services for "export" outside the community, the basic industry purchases inputs from outside of the community (upper left portion of **Figure 2**), labor from the residents or "households" of the community (left side of **Figure 2**), and inputs from service industries located within the community (right side of **Figure 2**). The flow of labor, goods, and services in the community is completed by households using their earnings to purchase goods and services from the community's service industries (bottom of **Figure 2**). **Figure 2** illustrates the interrelationship between a change in any one segment of a community's economy, resulting in reverberations throughout the entire economic system of the community.

Consider, for instance, the closing of a hospital. The services sector will no longer pay employees and dollars going to households will stop. Likewise, the hospital will not purchase goods from other businesses and dollar flow to other businesses will stop. This decreases income in the "households" segment of the economy. Since earnings would decrease, households decrease their purchases of goods and services from businesses within the "services" segment of the economy. This, in turn, decreases these businesses' purchases of labor and inputs. Thus, the change in the economic base works its way throughout the entire local economy. The total impact of a change in the economy consists of direct, indirect, and induced impacts. Direct impacts are the changes in the activities of the impacting industry, such as the closing of a

Figure 2.
Community Economic System



hospital. The impacting business, such as the hospital, changes its purchases of inputs as a result of the direct impact. This produces an indirect impact in the business sectors. Both the direct and indirect impacts change the flow of dollars to the community's households. The households alter their consumption accordingly. The effect of this change in household consumption upon businesses in a community is referred to as an induced impact.

A measure is needed that yields the effects created by an increase or decrease in economic activity. In economics, this measure is called the multiplier effect. Multipliers are used in this report. An employment multiplier is defined as:

“...the ratio between direct employment, or that employment used by the industry initially experiencing a change in final demand and the direct, indirect, and induced employment.”

An employment multiplier of 3.0 indicates that if one job is created by a new industry, 2.0 jobs are created in other sectors due to business (indirect) and household (induced) spending.

Secondary Impacts of the Health Sector on the Economy of Morgan County

Employment and income multipliers for Morgan County have been calculated by use of the IMPLAN model. IMPLAN was developed by the U.S. Forest Service and is a model which allows for development of county multipliers. Additional information on IMPLAN is included in **Appendix A**.

The employment multipliers for the components of the health sector are shown in **Table 8**. The employment multiplier for the hospitals' component is 1.46. This indicates that for each job created in that sector, a 0.46 job is created throughout the area due to business (indirect) and household (induced) spending. The employment multipliers for the other health sector components are also shown in **Table 8**.

Table 8
Employment Impact of Health Services
on the Economy of Morgan County, Colorado

Health Service	Number of Employees*	Employment Multiplier	Secondary Impact	Total Impact
Hospitals	412	1.46	190	602
Physicians, Dentists & Other Health Professionals	174	1.37	64	238
Long Term Care Facilities	456	1.20	91	547
Pharmacies	33	1.29	10	43
Other Health & Medical Services	<u>87</u>	1.33	<u>29</u>	<u>116</u>
Totals	<u>1,162</u>		<u>384</u>	<u>1,546</u>

SOURCE: Local employment data for all health services; multipliers from IMPLAN 2008 data, Minnesota IMPLAN Group, Inc. (December 2009, www.implan.com].

* Employment is defined as total full- and part-time employees.

Applying the employment multipliers to the employment for each of the health sector components yields an estimate of each component's employment impact on Morgan County (**Table 8**). For example, the hospitals' component has employment of 412 employees; applying the employment multiplier of 1.46 to the employment of 412 brings the total employment impact of the hospital to 602 ($412 \times 1.46 = 602$). The secondary impact of the hospital is 190 employees ($412 \times 0.46 = 190$); these are the jobs created in other industry sectors in the economy of Morgan County as a result of the spending of the hospital and the spending of the hospital employees. All the employment multipliers are applied to the health sector components in **Table 8**, resulting in a total employment impact of the health services in Morgan County of 1,546 employees and a secondary employment impact of 384 employees.

The income multiplier for the hospitals' component is 1.25 (**Table 9**). This indicates that for each dollar created in that sector, \$0.25 is created throughout the area due to business (indirect) and household (induced) spending. To apply the income multiplier, multiply the total income for the hospital of \$27.0 million times the income multiplier of 1.25, resulting in total income impact for the hospital of \$33.8 million. The secondary impact from the hospital is \$6.8 million. The income multipliers for the other health sector components are also given in **Table 9**.

Table 9
Income Impact of Health Services
on the Economy of Morgan County, Colorado

Health Service	Direct Income*	Income Multiplier	Secondary Impact	Total Impact
Hospitals	\$27,016,590	1.25	\$6,754,148	\$33,770,738
Physicians, Dentists & Other Health Professionals	\$9,691,813	1.22	\$2,132,199	\$11,824,012
Long Term Care Facilities	\$12,552,505	1.20	\$2,510,501	\$15,063,006
Pharmacies	\$2,181,921	1.24	\$523,661	\$2,705,582
Other Health & Medical Services	<u>\$3,026,525</u>	1.23	<u>\$696,101</u>	<u>\$3,722,626</u>
Totals	<u>54,469,354</u>		<u>\$12,616,610</u>	<u>\$67,085,964</u>

SOURCE: Local employment data for all health services; multipliers from IMPLAN 2008 data, Minnesota IMPLAN Group, Inc. (December 2009, www.implan.com).

* Income is defined as all personal income including wages, salaries, proprietor income, and benefits.

Applying the income multipliers to the income for each of the health sector components yields an estimate of each component's income impact on Morgan County (**Table 9**). All the health services in Morgan County had a total income impact of \$67.1 million and generated \$12.6 million in secondary income in other industries in Morgan County. The bottom line is that

the health sector not only contributes greatly to the medical health of the county, but also to the economic health of the county.

Summary

The economic impact of the health sector upon the economy of Morgan County is tremendous. The health sector employs a large number of residents, similar to a large industrial firm. The secondary impact occurring in the county is extremely large and measures the total impact of the health sector. If the health sector increases or decreases in size, the medical health of the county as well as the economic health of the county are greatly affected. For the attraction of industrial firms, businesses, and retirees, it is crucial that the area have a quality health sector. Often overlooked is the fact that a prosperous health sector contributes to the economic health of Morgan County.

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APPENDIX A

Model and Data Used to Estimate Employment and Income Multipliers

Appendix A

Model and Data Used to Estimate Employment and Income Multipliers

A computer spreadsheet that uses state IMPLAN multipliers was developed to enable community development specialists to easily measure the secondary benefits of the health sector on a state, regional or county economy. The complete methodology, which includes an aggregate version, a disaggregate version, and a dynamic version, is presented in Measuring the Economic Importance of the Health Sector on a Local Economy: A Brief Literature Review and Procedures to Measure Local Impacts (Doeksen, et al., 1997). A brief review of input-output analysis and IMPLAN are presented here.

A Review of Input-Output Analysis

Input-output (I/O) (Miernyk, 1965) was designed to analyze the transactions among the industries in an economy. These models are largely based on the work of Wassily Leontief (1936). Detailed I/O analysis captures the indirect and induced interrelated circular behavior of the economy. For example, an increase in the demand for health services requires more equipment, more labor, and more supplies, which, in turn, requires more labor to produce the supplies, etc. By simultaneously accounting for structural interaction between sectors and industries, I/O analysis gives expression to the general economic equilibrium system. The analysis utilizes assumptions based on linear and fixed coefficients and limited substitutions among inputs and outputs. The analysis also assumes that average and marginal I/O coefficients are equal.

Nonetheless, the framework has been widely accepted and used. I/O analysis is useful when carefully executed and interpreted in defining the structure of a region, the interdependencies among industries, and forecasting economic outcomes.

The I/O model coefficients describe the structural interdependence of an economy. From the coefficients, various predictive devices can be computed, which can be useful in analyzing economic changes in a state, a region or a county. Multipliers indicate the relationship between some observed change in the economy and the total change in economic activity created throughout the economy.

MicroIMPLAN

MicroIMPLAN is a computer program developed by the United States Forest Service (Alward, et al., 1989) to construct I/O accounts and models. Typically, the complexity of I/O modeling has hindered practitioners from constructing models specific to a community requesting an analysis. Too often, inappropriate U.S. multipliers have been used to estimate local economic impacts. In contrast, IMPLAN can construct a model for any county, region, state, or zip code area in the United States by using available state, county, and zip code level data. Impact analysis can be performed once a regional I/O model is constructed.

Five different sets of multipliers are estimated by IMPLAN, corresponding to five measures of regional economic activity. These are: total industry output, personal income, total income, value added, and employment. Two types of multipliers are generated. Type I multipliers measure the impact in terms of direct and indirect effects. Direct impacts are the changes in the activities of the focus industry or firm, such as the closing of a hospital. The focus business changes its purchases of inputs as a result of the direct impacts. This produces indirect impacts in other business sectors. However, the total impact of a change in the economy consists of direct, indirect, and induced changes. Both the direct and indirect impacts change the flow of dollars to the state, region, or county's households. Subsequently, the households alter their consumption accordingly. The effect of the changes in household consumption on businesses in a

community is referred to as an induced effect. To measure the total impact, a Type II multiplier is used. The Type II multiplier compares direct, indirect, and induced effects with the direct effects generated by a change in final demand (the sum of direct, indirect, and induced divided by direct). IMPLAN also estimates a modified Type II multiplier, called a Type III multiplier that also includes the direct, indirect, and induced effects. The Type III multiplier further modifies the induced effect to include spending patterns of households based on a breakdown of households by nine difference income groups.

Minnesota IMPLAN Group, Inc. (MIG)

Dr. Wilbur Maki at the University of Minnesota utilized the input/output model and database work from the U. S. Forest Service's Land Management Planning Unit in Fort Collins to further develop the methodology and to expand the data sources. Scott Lindall and Doug Olson joined the University of Minnesota in 1984 and worked with Maki and the model.

As an outgrowth of their work with the University of Minnesota, Lindall and Olson entered into a technology transfer agreement with the University of Minnesota that allowed them to form MIG. At first, MIG focused on database development and provided data that could be used in the Forest Service version of the software. In 1995, MIG took on the task of writing a new version of the IMPLAN software from scratch. This new version extended the previous Forest Service version by creating an entirely new modeling system that included creating Social Accounting Matrices (SAMs) – an extension of input-output accounts, and resulting SAM multipliers. Version 2 of the new IMPLAN software became available in May of 1999. For more information about Minnesota IMPLAN Group, Inc., please contact Scott Lindall or Doug Olson by phone at 651-439-4421 or by email at info@implan.com or review their website at www.implan.com.