Illinois Health Facilities and Services Review Board
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Determinants of Long-Term Care Beds in Illinois

Report prepared

by

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for

The Illinois Long-term Care
Advisory Subcommittee
Data Workgroup

February, 2016

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Table of Contents

Tables

Figures

Report Summary

The increasing demand of Long-Term Care (LTC) policy, planning, and market to improve public access of LTC services calls for a revision of LTC bed need determination.

This study reviewed the literature on policies, population trends, and market forces that explain changes in LTC demands and provide the implications for Institutional LTC. The study also used Pearson Correlation and Hierarchical Linear Regression to analyze the variability of Illinois counties *licensed beds*, using health, economic, and socio-demographic data as explanatory variables.

The literature reviewed showed a *strong policy support of rebalancing LTC from Institutional settings to Home-and Community Services (HCBS) settings* for cost-saving reasons. As a result, LTC bed demands, especially Medicaid-paid beds, in Institutional LTC are expected to decrease.

The statistical analysis revealed a predominant influence of economic variables, such as income, urbanization, and homeownership on the distribution of licensed beds. Correlation analysis showed a negative relationship (-0.189, $p<0.0001$) between disability rates and licensed-bed allocation and a positive relationship (0.266, $p<0.0001$) between per-capita income and licensed beds allocation. These results indicate that *counties with higher per-capita incomes have higher licensed bed numbers and counties with higher disability rates have lower licensed bed numbers*. Among the health indicator category of variables, life expectancy for males aged 65 years and older, disability-free life expectancy for males aged 65 years and older, and disability-free life expectancy for females aged 65 years and older were positively correlated to licensed beds. In the category of economic variables, in addition to per-capita income, median household income and median value of owner occupied housing were positively correlated to licensed beds.

Homeownership rates are negatively correlated to licensed beds. In the socio-demographic category of variables, percentage of persons with bachelor or higher degrees among population aged 25 years and older, percentage of black population, and population per-square mile were positively correlated to licensed beds; whereas percentage of population aged 65 years and older, annual average net migration for males aged 60 years and older, annual average net migration for both sexes aged 60 years and older, and percentage of married females aged 65-74 years with spouse present were negatively correlated with licensed beds.

The regression's *overall model explained 89% of the county licensed beds' variability.* The model provided that licensed beds increase by a factor of 0.22 ($p<0.005$) with 1 unit increase of per-capita income, 0.21 ($p<0.0001$) in urban area (as compared to rural area), 0.85 ($p<0.0001$) with 1 unit increase of population per-square mile; it decreases by a factor of 0.16 ($p<0.011$) with 1 unit increase of homeownership rates, 0.20 ($p<0.016$) with 1 unit increase of bachelor or higher degrees among population aged 25 years and older, and 0.09 ($p<0.05$) with 1 unit increase of percentage of married females aged 65-74 years with spouse present. Licensed beds increase by a factor of 0.83 with 1 unit increase of all these significant predictive variables. Disability rates, interaction of disability rates and per-capita income, percentage of population aged 65 years and older, percentage of black population, and annual average net migration for both sexes aged 60 years and older were not significant predictors of licensed beds' variation.

These findings recommend *use of disability rates as a significant criterion in the LTC bed need determination and CON process. F*urther research may investigate how effective the CON program is at balancing the objectives of both public health and the LTC market.

Introduction

Recent changes in Long-Term Care (LTC) regulations and the demand for LTC beds suggest a review of the Illinois's LTC bed need determination. Adjusting bed supply process to maximize services to the population in most need becomes a priority for the CON program. Moreover, selecting the most significant variables to make this adjustment will allow the CON program attain its objectives.

LTC regulations have undergone significant changes. These predict significant reductions in the use of Institutional LTC. The Deficit Reduction Act (DRA) of 2005, the Strengthening Medicare and Repaying Taxpayers (SMART) Act of 2012, and the Money Follows the Person (MFP) Act, serve to lower the Medicaid budget deficit and sustain the coverage of the growing need of LTC services in Illinois by promoting Home-and Community-Based Services (HCBS). Some studies suggest that "aging in place" saves the government and families money (Grabowski, 2009, 2006; Harrington, Ng, Kaye, & Newcomer, 2009; HUD, 2013). However, the current county LTC bed allocation process may need adjustments to align the CON program with the state LTC policy change.

The current geo-localization of LTC beds results from several years of *arbitration* between public health and business objectives. CON states conduct this arbitration with the main goals of increasing access, containing costs, and improving quality of health care services while helping health care providers maintain the profitability of their facilities. The CON program implemented in 1974 in Illinois approved LTC beds and authorized the construction and operation of LTC facilities through CON application process. The process begins with CON application submission to the Health Facilities and Services Review Board (the Board). These applications respond to a thoughtful business plan that ensures profitability. Indeed, health care

providers must at least cover the operating costs of their facilities to stay in business; therefore the choice of area for building a LTC facility is important. Providers make this choice after considering several marketing factors including socio-economic characteristics of an area, such as health care needs (demand), revenues, and urbanism level. Overlaps between business and public health objectives may occur in some business plans; however, the main objective of any business plan is to make profit.

The Board is responsible for ensuring consideration of public health interests in CON projects. The bed need determination methodology implemented since the inception of the CON program uses historical bed used rates and projected population numbers to project for future bed needs. The Board's publication of bed projection allows LTC providers to submit CON applications to request beds for areas where the projection shows a need. The Board's staff and members review the CON applications using a set of criteria conducive to achieving of the CON program goals. The set of criteria, as provided in the Part 1125 of Illinois's Administrative Codes, include service accessibility (1125.570(a) & (b)), unnecessary duplication and mal-distribution of services (1125.580(a) & (b), impact of project on other area providers (1125.580(c)), etc. The Board will approve the requested beds if the majority of the Board members reach the conclusion that the related project will satisfy the population's LTC need and sustain the LTC delivery in the state. The Illinois Department of Public Health licenses the Board-approved beds, which enter the state inventory.

After forty years of such arbitrations in Illinois, the need to know how well the current LTC bed allocation at the county level served public health and business objectives and paired with population needs becomes important for policy evaluation and public health programs. In this paper, I used the Pearson Correlation and Multiple Hierarchical Linear Regressions (HLR)

model to determine the influence of per-capita income, disability rates and other health and socio-economic variables, such as life expectancy, homeownership rate, education level, sex ratio at age 65, race/ethnicity, net migration, population density, and type of area (urban or rural) on the allocation of LTC beds at the county level. The results of this analysis should yield the determinants of LTC bed allocations and suggest relevant adjustments to bed need determinations for maximizing services to people who need LTC the most, the disabled.

This paper provides a review of literature on LTC policies, LTC transitioning, and LTC need; description of data, data sources, and methodology used to explain the variability of the existing licensed beds in counties; highlights shortcomings; and makes recommendations for the use of the findings, policy change, and further research.

Literature Review

LTC is not a luxury, but a necessary commodity without which life expectancy may shorten. LTC constitutes a set of assistances provided to individuals, mainly aged 65 years and over, who cannot fulfill basic personal tasks of everyday life called Activities of Daily Living (ADLs) and other tasks called Instrumental Activities of Daily Living (IADLs). ADLs include bathing, using the toilet, dressing, transferring (to or from bed or chair), caring for incontinence, and eating. IADLs are broader and include housework, taking medication, preparing and cleaning up after meal, etc. (AHRQ, 2011; DHHS, b). Some old adults experiencing serious health impairment such as mental illnesses, cancer, and chronic obstructive pulmonary disease (COPD), cannot survive without LTC. The difficulty of surviving increases even more for low-income adults. The need of LTC is highly related to disability. LTC residents need help with activities ADLs and IADLs (AHRQ, 2011; DHHS, b) which they cannot do for themselves because of a disability. Disability is therefore a significant predictor of long-term care need and must be incorporated into LTC planning models. In some projections, disability was assimilated to long-term care need (The Levin Group, 2008).

The federal government helps state governments fund the LTC through the Medicaid program to ensure cost coverage of necessary health care for the low-income population (DHHS, b). Medicaid constitutes the main financial funds for LTC (Boyd, 2014; GAO, 2001) and its viability is crucial for the sustainability of the LTC. The Medicaid program incurs a budgetary deficit in most states due to growing needs and expenses of LTC. The major beneficiary population (65 years and older) continues to grow with the retirement of the baby boomers (Easterlin, Schaeffer, & Macunovich, 1993, GAO, 2001) and increase of life expectancy in some states. The Institutional LTC incurred the highest cost for the Medicaid program among the

major LTC programs, as the example of Illinois illustrates. In 2005, although Institutional LTC covered only 6.2% (40,865) of Medicaid older adults, it absorbed 74.4% ($1,078 M) of the total spending. The Community Care program covered 6.2% (40,965) of the persons served and accounted for 17.4% ($251.7 M) of the spending. The Supportive Living facilities covered 87.2% (575,000) and accounted only for 6.1% ($88.2 M) of the total spending (IDA, 2007, p. 9). The continuing deficit of the Medicaid budget seriously threatens the healthcare system and calls for policy changes.

The federal government has modified the Medicaid policies and regulation several times to allow more flexibility to states in defining benefits, services, and eligibility, in response to the budgetary deficit. These efforts led to the enactment of policies such as the Deficit Reduction Act (DRA) of 2005, the Strengthening Medicare and Repaying Taxpayers (SMART) Act of 2012, the Money Follows the Person (MFP) Act, etc. The goal of these policies is mainly to contain the cost of health care services. SMART Act derives from the DRA and targets the Medicaid deficit by granting flexibility to state governments to provide HCBS directly to Medicaid recipients (DHHS, b). The MFP increases the use of HCBS by eliminating state budget restrictions on the use of Medicaid funds to provide LTC to people who choose HCBS or to transition out of institutions for HCBS (Medicaid.gov). The Act also established procedures to improve the quality of HCBS. Some studies support these policy changes with the finding that HCBS saves costs for “governments, health systems, and families” (HUD, 2013, Harrington, Ng, Kaye, & Newcomer, 2009; Grabowski, 2009, 2006). For instance, in 2014, the yearly average cost of Institutional LTC was $87,600 while that of HCBS was $45,800 (Reaves, & Musumaci, 2015). Rebalancing the LTC from Institutional-based to HCBS saves cost per capita but, studies do not evidence savings on the total cost.

Cost-effectiveness of LTC policies gained the interest of most research and literature reviews conducted from 1960 to 2014 on Medicaid. Review of 1960 to 1980 peer-reviewed literatures concluded that HCBS probably reduced Institutional LTC use, but by a small amount as the level of reducible use available was small. Consequently, the "potential for cost reduction was relatively small" (Weissert, Cready, & Pawelak, 1987). Recent literature reviews found no significant reduction in LTC cost when comparing Institutional LTC to HCBS. "HCBS does not reduce the overall growth of total LTC spending" (Avalere Health, 2007, p. i) as the Medicaid policy changes have introduced more flexibility in the eligibility criteria, increasing the number of Medicaid recipients. These changes have been very effective in Illinois, which is of interest for this research.

Illinois, like most states, initiates the LTC rebalancing at the time the government and policymakers urge vast health care cost savings through drastic policies. Efforts include: increasing spending of LTC Medicaid funds for HCBS while decreasing it for Institutional LTC—the increase went from 11.2% to 31.4% from 1997 to 2007 (Grabowski, 2009); restricting Medicaid eligibility for Institutional LTC and reducing state's financial commitment through the implementation of the DRA provisions for LTC; and cutting $1.6 billion from Medicaid spending with the SMART Act (IGNN, 2012). These changes illustrate the government's goal to reorient LTC funding to HCBS, which will result in a drastic decrease in the use of Institutional LTC. A reduction in Institutional LTC patient days observed from 2005 to 2015, which average 4% over 10-year period (Agbodo, 2015), corroborates the reductive effect of LTC rebalancing policy on Institutional LTC. In addition, some studies show an increasing number of older people with disabilities living within the community (Redfoot, 2010).

Projections show a rapid growth of the elderly population with a consequence of an increased need for LTC beds; however, policies may direct most of Medicaid recipients to HCBS while people who can afford the cost of LTC by themselves or through private insurance may opt for Intuitional LTC. At the retirement of the last of the baby boomers in 2030, the number of elderly people is expected to double to reach nearly 70 million in the U.S. The individuals aged 85 years and older will be the fastest-growing segment of the elderly population, as life expectancy is expected to improve (ACLI, 1998, GAO, 2001), particularly in Illinois due to reduction in mortality, and increase in life expectancy (Shahidullah & Agbodo, 2014, 2015). Nearly 70% of people aged 65 years and over, of which one-half of all women and one-third of all men, will need LTC at some point in their remaining lifetime (DHHS, a, Murtaugh, Kemper & Spillman, 1990).

Bed allocations should adjust to the changes occurring in the LTC setting choices to maintain the effectiveness of the CON program. Oversupply of health care services will increase consumer price and reduce the effectiveness of government regulation. CON program aims at ensuring rational allocation of health care resources and controlling total health care spending. The CON regulations have a reductive influence on the growth of LTC beds (Harrington, Swan, Nyman, & Camillo, 1997). The best outcome of this influence should be to balance the number of beds between high income and low-income areas to better account for disability rates and maximize services to the population in most need.

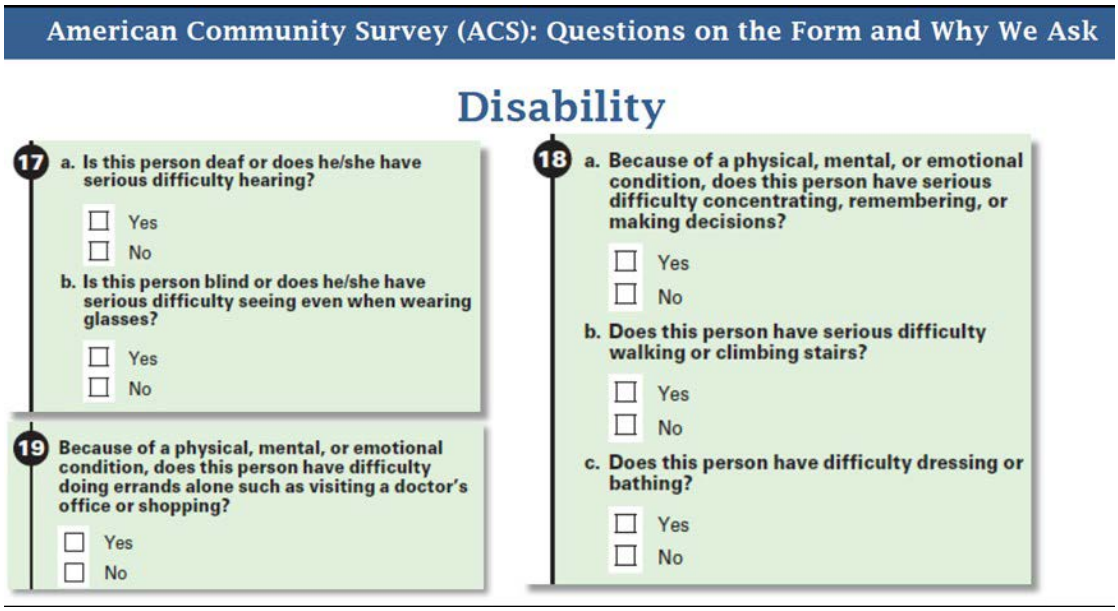
Data and Methods

Data used in this study were collected from multiple sources. I obtained the licensed beds from the Illinois Department of Public Health (IDPH) for the years 2010 to 2014, computed the average, and used the average as the explained variable. The explanatory variables included the American Community Survey's (ACS) 5-years estimates of county disability rates, per-capita money income, homeownership rates, education level, race/ethnicity, and population density for the period 2009-2010. We also have in this group of variables Net Migration for male, female and both sex, which are three-decade averages computed from the Internal Revenue Service's migration data for the period 1980-2010; life expectancy computed using death and birth data received from the Illinois Center for Health Statistics (ICHS) and the 2010 census population data; sex ratio at age 65, using 2010 census population data, and type of area (urban or rural), as determined by Census 2010.

License bed numbers vary within a given year as the Board and the IDPH Licensure issues new beds or approve the discontinuation of existing beds. I used 3-years average as the analysis variable to improve the representativeness of the annual values. I also used the logarithmic values of the average values to better visualize the data on graphs. We should expect the logarithmic transformation to return missing values for counties that have zero licensed beds.

The American Community Survey's (ACS) data are 5-year estimates computed from representative samples sophistically drawn to allow for result extrapolation. In other words, ACS proportion or percentage estimates reflect the population values. ACS defined "disability" as functional limitations that include one or a combination of the following six health issues: hearing, vision, cognitive, ambulatory, self-care, and independent living difficulties (figure1).

Figure 1: ACS disability measurement questions



I measure the relationships between the explained and explanatory variables using the Pearson Correlation method. Pearson Correlation Coefficient (Pearson's r) measures linear correlation (the degree of linear dependence) between two variables. It takes a value between +1 and -1, where 1 indicates total positive correlation, 0 implies absence of correlation, and -1 means total negative correlation. A negative value of Pearson Coefficient indicates that when one variable increases the other variable decreases and a positive value indicates that both variables increase simultaneously. I accept these values to be statistically significant from zero when their p-values are less than 0.05. Pearson's r is sensitive to outliers; therefore, I will remove outliers from the data before computing the Pearson's r to increase its accuracy. I also measure the predictive power of the three categories of explanatory variables on the licensed bed variability among the counties, using the Hierarchical Linear Regression (HLR) method. The HLR method allows successive comparison of regression models and the determination of the contribution of additional independent variables in explaining the variability of the dependent variable. I built a first model where selected health indicator variables were used to explain licensed-bed

variability. I then entered economic variables into this first model to have a second model and evaluate the influence of these new variables on the previous explanation of licensed-bed variability. I finally entered socio-demographic variables and proceeded to evaluate their influence on the overall model. Explanatory variables are considered significant predictor of licensed-bed variability if their coefficients in model are significant at the 95% confidence level.

Results

Descriptive Variations

Number of licensed beds (LBs) varied widely between counties, ranging from 0 to 41,707 beds with an average of 1,117 (±4,182). Cook County had the highest number of LBs accounting for 37% of the state's total LBs. Pulaski and Putnam counties have had no LBs since 2010.

The descriptive analysis covers some key variables, some of which were used in the models as explanatory variables. Table 1 provides the statistics of all the variables. Health indicators vary between counties with values nearing the averages; significant variations were observed between genders. The disability rates (DR) ranged from 66.0 to 298.8 per 1,000 (‰) populations with an average of 139.7 ‰ (±37.1). Cook County's DR neared 103.6‰ falling in the top 10 lowest DR in state. Whereas Pulaski's DR was 223.4‰ falling among the top-5 DR in state. Putnam's DR was 119.4‰, which was higher than Cook County's DR. The minimum life expectancy (LE) for male aged 65 years and over was 15.6 years, the maximum was 19.6 years, and the average was 17.49 (±0.94) years. Counties such as Clay, Brown, Greene, Pulaski, etc., had LE value nearing the minimum; LE values nearing the maximum were observed in counties such as Jo Daviess, Hardin, Lake, Kane, DuPage, Mercer, Champaign, etc. Years free of disability (DFL) for males ranged from 6 years (Hardin County) to 13.8 years (Lake, Jo Daviess, and DuPage) with an average of 11(±1.5) years. Females had higher LE and DFL than males. The LE for females aged 65 years and over ranged from 16.2 to 24.4 years with an average of 20.2 (±1.1) years. The Minimum value was observed in Hardin County and the maximum value was in Putnam. The DFL for females ranged from 8.4 to 17.2 years with an average of 12.8 (±1.5) years. Hardin had the minimum value and Putnam had the maximum value.

The economic indicators vary significantly from the averages. The Per Capita Money Income (PCI) ranged from $13,619 to $38,570 with an average of $24,781.4 (±$3,907.6). the minimum value was observed in Alexander County and the Maximum in DuPage and Lake Counties. Cook County had a value of $30,183, Putnam's value was $27,074 and Pulaski's value was $19,867, which was below the average. The Median Household Income (MHI) ranged from $26,972 to $81,765 with an average of $49,112.1 (±10,001.6). The Median Value of Owner Occupied Housing (MVOOH) ranged from $54,400 to $286,500 with an average of $108,611.8 (±44,317.2). Homeownership Rates (HR) ranged from 53.4% to 84.0% with an average of 75.3% (±6.0%). Highest HRs were observed in Jasper, Kendall, Will, and Boone counties. Lowest HRs were in Jackson and Champaign counties. Percentage of Persons Below Poverty Level (PPBPL) ranged from 4.8% (Kendall county) to 31.6% (Alexander county) with an average of 14.0 (±4.5%).

Socio-demographic indicators also varied significantly between counties. The Percentage of Persons with Bachelor's or Higher Degree among Population aged 25 years and older (PPBHD) ranged from 8.4% (Alexander county) to 46.3% (DuPage) with an average of 19.5 (±7.7%).

Table 1: Descriptive statistics of analysis variables

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Average Licensed Beds, 2010-2014	102	.00	41707.60	1117.2353	4181.60461
Disability Rate per 1000, 2010	102	66.0	298.8	139.704	37.1246
Life Expectancy for Males Aged 65+ Years, 2010	102	15.6	19.6	17.492	.9409
Life Expectancy for Females Aged 65+ Years, 2010	102	16.2	24.4	20.214	1.1492
Disability-free Life Expectancy for Males Aged 65+ Years, 2010	102	6.0	13.8	10.962	1.4977
Disability-free Life Expectancy for Females Aged 65+ Years, 2010	102	8.4	17.2	12.801	1.5184
Per capita money income in past 12 months, 2009-2013	102	13619	38570	24781.44	3907.605
Median Household Income, 2009-2013	102	26972	81765	49112.14	10001.630
Median Value of Owner Occupied Housing, 2009-2013	102	54400	286500	108611.76	44317.159
Homeownership Rates, 2009-2013	102	53.4	84.0	75.317	6.0454
Percentage of Persons Below Poverty Level, 2009-2013	102	4.80	31.60	14.0441	4.53234
Percentage of of Persons with Bachelor's or Higher Degrees Among Population Aged 25+ Years, 2009-2013	102	8.4	46.3	19.449	7.7350
Percentage of Persons with High School or Higher Degrees Among Population Aged 25+ Years, 2009-2013	102	74.6	94.4	87.853	3.4623
Percentage of Population Aged 65+ Years Old, 2013	102	8.70	23.50	17.3735	3.05934
Sex Ratio for Population Aged 65+ Years Old, 2010	102	.64	1.01	.7647	.05241
Percentage of Black Population, 2013	102	.2	36.1	5.234	6.9570
Average Net Migration for Females Aged 60+ Years, 1980-2010	102	-6690	417	-60.90	665.275
Annual Average Net Migration for Males Aged 60+ Years, 1980-2010	102	-6290	145	-70.28	627.018
Annual Average Net Migration for Both Sexes Aged 60+ Years, 1980-2010	102	-12980	562	-131.19	1290.470
Percentage of Married Males Aged 65-74 Years with Spouse Present, 2010-2014	102	.54	.89	.7484	.06815
Percentage of Married Males Aged 75+ Years with Spouse Present, 2010-2014	102	.46	.82	.6348	.06350
Percentage of Married Females Aged 65-74 Years with Spouse Present, 2010-2014	102	.41	.80	.5981	.07012
Percentage of Married Females Aged 75 Years with Spouse Present, 2010-2014	102	.14	.49	.2870	.06102
Population Per Square Mile, 2010	102	12.10	5495.10	196.2196	629.60409
Valid N (listwise)	102				

Correlations

Correlation analysis revealed a negative relationship between disability rates (DR) and License Beds (LBs) allocation (figure 2) and a positive relationship between per-capita income (PCI) and LBs allocation (figure 3). These correlations have Pearson coefficients of -0.189 ($p<0.0001$) and 0.266 ($p<0.0001$) significant at the 95% confidence level (table 2), which indicate increase of LBs as per-capita income increase and decreases of LBs as disability rate increases. In both figures, Cook County isolates itself from the other counties with particular characteristics: lower DR, higher LBs and higher PCI, higher LBs.

Figure 2. Relationship between county licensed bed numbers and disability rates

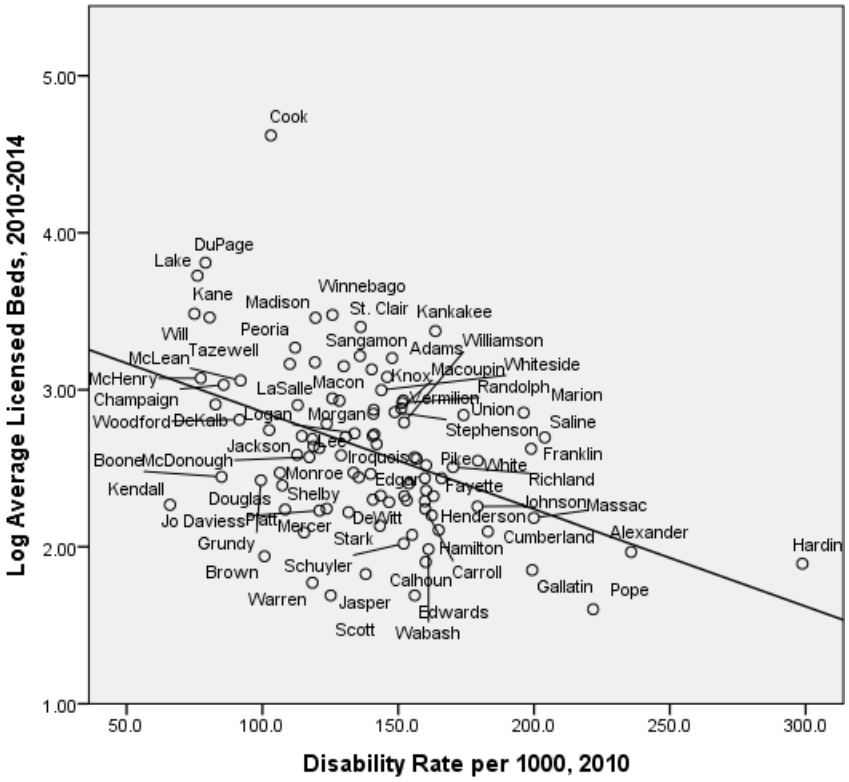


Figure 3. Relationship between county licensed bed numbers and per-capita money income

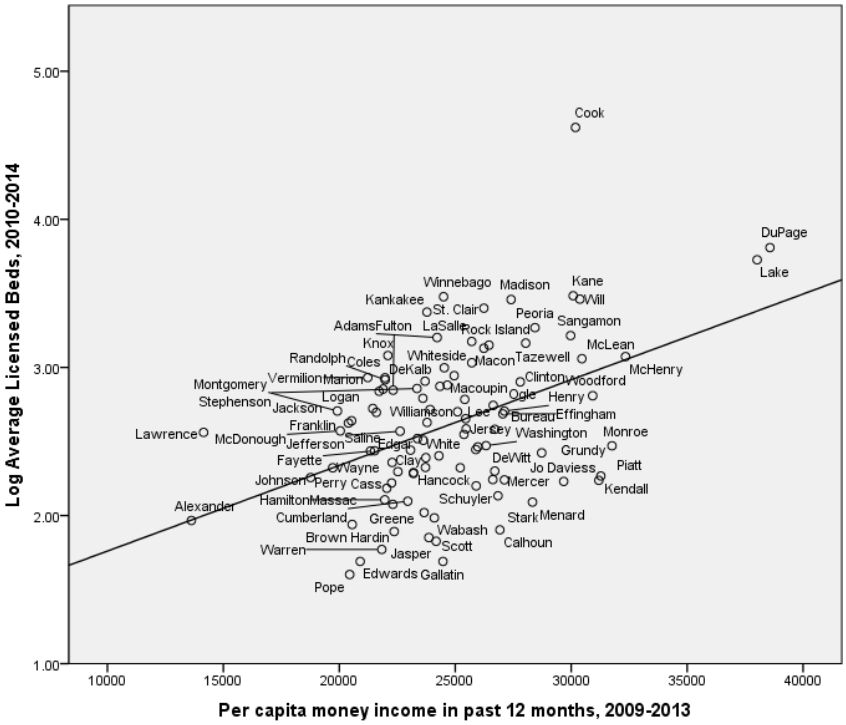


Table 2 reports other significant correlations. Among the health indicator category of variables, Life Expectancy for Males aged 65 years and older (LEM65), Disability-free Life Expectancy for Males aged 65 years and older (DFLEM65), and Disability-free Life Expectancy for Females, 65 aged years and older (DFLEM65) were positively correlated to LBs. In the category of economic variables, in addition to PMI, Median Household Income (MHI) and Median Value of Owner Occupied Housing (MOOH) were positively correlated to LBs. Homeownership Rates (HR) is negatively correlated to LBs. In the Socio-demographic category of variables, Percentage of Persons with Bachelor or Higher Degrees among population aged 25 years and older (PPBHD), Percentage of Black Population (PBP), and Population per Square Mile (PSM) were positively correlated to LBs. Whereas, Percentage of Population aged 65 years and older (PP65), Annual Average Net Migration for Males aged 60 years and older (ANMM60), Annual Average Net Migration for Both Sexes aged 60 years and older

(ANMBS60), and Percentage of Married Females aged 65-74 years with Spouse Present (PPMF6574) were negatively correlated with LBs. Other variables in table 1 not listed above were not significantly correlated with LBs.

Table 2. Correlation between County Licensed Bed Numbers and Selected explanatory variables

Variables (N=99)	Pearson's r	P-value
Health Indicator Variables		
Disability Rate per 1000 Population,	-0.392	0.000**
Life Expectancy for Males, 65+ years	0.254	0.011*
Life Expectancy for Females, 65+ years	0.163	0.107
Disability-free Life Expectancy for Males, 65+ years	0.408	0.000**
Disability-free Life Expectancy for Females, 65+ years	0.227	0.024*
Economic Variables		
Per Capita Money Income	0.557	0.000**
Median Household Income, 2009-2013	0.500	0.000**
Median Value of Owner Occupied Housing	0.685	0.000**
Homeownership Rates	-0.251	0.012*
Percentage of Persons Below Poverty Level	-0.129	0.202
Socio-Demographic Variables		
Percentage of Persons with Bachelor or Higher Degrees, 25+ years	0.614	0.000**
Percentage of Persons with High School or Higher Degree, 25+ years	0.157	0.122
Percentage of Population Aged 65+, 2013	-0.484	0.000**
Sex Ratio for Population Aged 65+	-0.185	0.066
Percentage of Black Population, 2013	0.321	0.001**
Annual Average Net Migration for Females Aged 60+, 1980-2010	-0.083	0.412
Annual Average Net Migration for Males Aged 60+, 1980-2010	-0.727	0.000**
Annual Average Net Migration for Both Sexes Aged 60+, 1980-2010	-0.519	0.000**
Percentage of Married Males Aged 65-74 years with Spouse Present, 2010-2014	-0.063	0.536
Percentage of Married Males Aged 75+ years with Spouse Present, 2010-2014	-0.043	0.672
Percentage of Married Females Aged 65-74 years with Spouse Present, 2010-2014	-0.314	0.002**
Percentage of Married Females Aged 75+ years with Spouse Present, 2010-2014	-0.133	0.189
Population per Square Mile, 2010/Population Density	0.894	0.000**

*** Correlation is significant at the 0.01 level (2-tailed)*

** Correlation is significant at the 0.05 level (2-tailed)*

Regressions

We use Hierarchical Linear Regression (HLR) techniques to assess the influence of health, economic, and socio-demographic variable on the allocation of long-term care licensed beds (LBs) among Illinois counties. All explanatory variables introduced into each of the four proposed model were selected upon verification of regression modeling assumptions. For example, variables that are not correlated to LBs (the explained variable) were not considered in any of the models. We also removed influential points, which included Cook, Putnam, and Pulaski counties. The overall model included 99 counties and 11 variables and explains 89% of the variability in the long-term care licensed beds (LBs) between counties.

Model 1 explains the variability at 15% with the distribution of Disability Rates (DR) among counties. In this model, the relationship between LBs and DR is negative; LB decreases by a factor of 0.39 ($p<0.0001$) when DR decreases by one unit. For example, a county that have a DR of 100‰ will have 39 less beds than a county with a DR of 1‰.

In Model 2, in addition to DR variable, we introduced Per Capita Income (PCI) and its interaction factor with DR which increased the predictive power of the model to 40%. In this model, LB decreases by a factor of 0.19 ($p<0.073$) when DR increases by 1 unit; this relationship is not significant at the 0.5 confidence level. LBs increase by a factor of 0.33 ($p<0.0001$) when PCI increases by 1 unit. The interaction of PCI and DR (DRxPCI) decreases LB by a factor of 0.36 ($p<0.0001$) with 1 unit increment. PCI and DR are negatively correlated ($r=-0.626$, $p<0.0001$), which means DR decrease when PCI increase. The overall effect of 1 unit increment of DR, PCI, and DRxPCI will result in decrease of LBs by a factor of 0.22. This means that LBs increase with an increase of PCI higher than DR.

Model 3 provided 23% more explanation to the variability of LBs, improving the predictive power of the model to 63%. In this model, we maintained all previous variables and introduced Type of Area (TA) where urban counties were coded into the explanatory group and the rural counties were classified in the reference group. LBs decrease by a factor of 0.06 ($p<0.506$) with 1 unit increment in DR, increase by a factor of 0.20 ($p<0.022$) with 1 unit increment of PCI, decrease by a factor of 0.25 (0.0001) with 1 unit increment of DRxPCI, and increase by a factor of 0.55 ($p<0.0001$) with 1 unit increment of TA. The non-significance of the relationship between LB and DR in this model may be attributed to mediation effect of TA variable. At one increment of each of these explanatory variables, PCI will increase by a factor of 0.54, mostly dictated by TA. A urban county with DR of 100‰ will have 55 more LBs than a rural county with the same DR. Urban area attracts most of LBs regardless of disability rates and income level consideration.

Model 4 added 25% more explanation, increasing the overall explanation of the LBs variability to 89%. This model maintained all the previous variables and added socio-demographic variables such as the Percentage of Population Aged 65 Year and Older (PP65) in county total population, Homeownership Rates (HR), Percentage of Persons with Bachelor or Higher Degree (PPBHD) among population aged 25 years or older, Percentage of Black Population (PBP), Annual Average Net Migration for Both Sexes (ANMBS), Percentage of Married Females Aged 65-74 Years (PMF6574) living with their spouses, and Population Per Square Mile (PPSM). DR, DRxPCI, PP65, PBP, and ANMBS are not significant predictor of LBs variation. LBs increase by a factor of 0.22 ($p<0.005$) with 1 unit increment of PCI, 0.21 ($p<0.0001$) with 1 increment of TA, 0.85 ($p<0.0001$) with 1 unit increment of PPSM. It decreases by a factor of 0.16 ($p<0.011$) with 1 increment of HR, 0.20 ($p<0.016$) with 1 unit

increment of PPBHD, and 0.09 ($p<0.05$) with 1 unit increment of PMF6574. LBs increase by a factor of 0.83 with 1 unit increment of these significant predictive variables.

The final predictive model of LBs variability is:

$$LBs = 0.224\,PCI + 0.214TA + 0.846PPSM - 0.163HR - 0.204PPBD - 0.085PMF6574$$

Table 3. HL Regressions of Licensed Bed Numbers on selected economic and socio-demographic variables

Explanatory Variables	Model 1			Model 2			Model 3			Model 4		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Disability Rates	-10.91	2.60	-0.39**	-5.25	2.90	-0.19	-1.55	2.32	-0.06	0.47	1.94	0.017
Per Capita Income				0.09	0.03	0.33**	0.05	0.02	0.20*	0.07	0.02	0.224**
DR x PCI				-0.002	0.000	-0.36**	-0.001	0.000	-0.25**	.001	0.00	0.101
Area Type (Urban =1, Rural =0)							1447.4	184.9	0.55**	562.05	150.58	0.214**
Percent. of Population Aged 65+ years										10.34	23.42	0.031
Homeownership Rates										-28.15	10.90	-0.163**
Percentage of Black Population										11.50	9.09	0.070
Percent. of Persons with BS or Higher Degree										-27.17	11.05	-0.204**
Annual Average Net Migration for Both Sexes										0.53	0.41	0.064
Percent of Married Females Aged 65-74 years with spouse present										-1338.6	683.25	-0.085*
Population per square mile										2.491	0.207	0.846**
Constant	2250.6**	374.8	--	NS	--	--	NS	--	--	2020.48	937.2*	--
R-square		0.153			0.420			0.649			0.901	
Adjusted R-square		*0.145***			*0.402***			*0.634***			*0.889***	
R-square Change		0.153			0.266			0.229			0.252	

*** Correlation is significant at the 0.01 level (2-tailed)*

** Correlation is significant at the 0.05 level (2-tailed)*

Discussions and Limitations

Discussions

The statistical analyses suggest a dominance of market factors in explaining the variability of Licensed beds (LBs) among Illinois counties. We provide here a discussion of this finding to direct policy, research, and managerial use of these results.

The comparison of LBs allocation and DR levels in Cook, Putnam, and Pulaski counties revealed a disproportion of bed allocation and disability prevalence. Cook, Pulaski, and Putnam counties constitute influential data points and were dismissed in the correlation and regression analyses. In the absence of these influential points, the Pearson Correlation established the aforementioned observation as state-wide trend which the regression analysis confirmed as causal event. CON application and Board application approval preceded bed licensure; therefore, we can attribute the causal determination of bed allocation to these two events. Disability rate is not part of CON criteria the Board uses to evaluate and approve CON applications; however, the purpose of CON criteria is to ensure LBs accessibility to population in need of long-term care.

The negative correlation existing between LBs and the percentage of population aged 65 and over (PP65) suggests that the allocation of LBs is not proportional to PP65. Moreover, the overall model shows that PP65 is not a significant determinant of LB. This observation goes against the objectives of the CON program.

LBs need increases with increased LE; as the more people age, the more incidence of disability occurs, thus increasing the prevalence of disability (DR). Most of people with disability seek LTC; this is especially true for unmarried males or males who lost the care of their spouses through separation, divorce, or death. The negative correlation of LBs to DR, the positive correlation of LBs to DFLE for males, and the negative correlation of LBs to sex-ratio

(significant at the 10% level) are problematic and unveil abnormality in long-term care accessibility. This trend suggest that counties with higher disability rates, where males live with lower DFLE and with less care of their spouse have less LBs.

On the other hand, the significant positive correlation of LBs to Per-capita Income (PCI) and Median Household Income (MHI) suggests that higher number of LBs were attributed to counties with high incomes. Financial sustainability of LTC care facilities depends on the profitability of their facilities; therefore locating in high income areas is important. These trends lead to the conclusion that the influence of the market is dominant on bed allocation. The existence of the CON program may have attenuated that dominance but not sufficiently enough to have a balance between public health and business interests.

In sum, LBs increases when PCI increases higher than DR. TA has proportionally higher effect on LBs, which may mean that urban counties attract most of LBs probably because they concentrate higher revenue. LBs increase by a factor of 0.22 ($p<0.005$) with 1 unit increment of PCI, 0.21 ($p<0.0001$) with 1 increment of TA, and 0.85 ($p<0.0001$) with 1 unit increment of PPSM; it decreases by a factor of 0.16 ($p<0.011$) with 1 increment of HR, 0.20 ($p<0.016$) with 1 unit increment of PPBHD, and 0.09 ($p<0.05$) with 1 unit increment of PMF6574. LBs increase by a factor of 0.83 with 1 unit increment of all these significant predictive variables. DR, DRxPCI, PP65, PBP, and ANMBS are not significant predictor of LBs variation.

The established association suggests the hypothesis that market objectives have predominated in the CON application approval process and the current distribution of beds do not respond proportionally to LTC need at county levels. This observation calls for a review of bed need termination process and integration of health indictor factors in the decision-making process.

Limitations

One may argue that if counties that have higher number of LBs are adjacent to counties with lower number of LBs, the problem of mal-distribution of LBs will not be dramatic. While the closeness of LBs still needs to be investigated to evaluate this argument, having nursing beds close to the residents of the families of the people who need those beds is economically efficient. This closeness also will increase family visits to their beloved ones, maintain the family bond, and improve the moral of the LTC facilities residents.

ACS data are self-reported data collected from samples. Disability rates for instance may bear sampling biases and response errors intrinsic to survey data. However, ACS sampling and surveying methods are sophisticated enough to minimize such errors.

Conclusion and Recommendations

Conclusion

This report investigated the factors responsible for the variability of long-term care licensed beds (LBs) among Illinois counties and established that economic variables, such as income, urbanization, and homeownership affected the distribution of LBs to the advantage of market objectives than health indicators did to the advantage of public health. This finding raises the question of the effectiveness of CON process to balance both market and public health interests to better serve the population in need of long-term care, particularly the disabled. For this purpose, we make the following recommendations to the Health Facilities and Services Review Board, the long-term care subcommittees, and LTC researchers:

Recommendations

- Bed need methodology and CON criteria should incorporate disability rates and percentage of population aged 65 years and older;

- CON application process should integrate disability rate and disability-free life expectancy and prioritize counties with higher disability rate lower disability-free life expectancy in future bed allocation to close the gap between bed supply and bed demand and improve long-term care access to the population in most need;
- The CON program should define a measure of long-term care access that includes Disability Rates, Disability-free Life Expectancy, Life Expectancy for benchmark and policy evaluation;
- The CON program should continue to ensure non-duplication of services to prevent unnecessary competition in the long-term care industry to ensure profitability of long-term care facility and optimal level of long-term care;
- Community planning should extend its interest on construction of long-term care facilities to ensure its economical distributions;
- Further research may investigate:
    - the mediation effect of Per-capita Income and type of area on Disability Rates;
    - the influence of the neighborhood counties with high and low number of Licensed Beds on long-term care access; and,
    - the effectiveness of CON program to balance both long-term care market and public health interests.

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Appendix

Model Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.392[a]	.153	.145	939.49653	.153	17.578	1	97	.000	
2	.648[b]	.420	.402	785.84553	.266	21.820	2	95	.000	
3	.806[c]	.649	.634	614.64730	.229	61.291	1	94	.000	
4	.949[d]	.901	.889	339.01322	.252	31.713	7	87	.000	1.460

a. Predictors: (Constant), Disability Rate per 1000, 2010

b. Predictors: (Constant), Disability Rate per 1000, 2010, Ctr_PCI_Ctr_DR, Per capita money income in past 12 months, 2009-2013

c. Predictors: (Constant), Disability Rate per 1000, 2010, Ctr_PCI_Ctr_DR, Per capita money income in past 12 months, 2009-2013, Urban Areas, 2014

d. Predictors: (Constant), Disability Rate per 1000, 2010, Ctr_PCI_Ctr_DR, Per capita money income in past 12 months, 2009-2013, Urban Areas, 2014, Annual Average Net Migration for Both Sexes Aged 60+ Years, 1980-2010, Percentage of Married Females Aged 65-74 Years with Spouse Present, 2010-2014, Homeownership Rates, 2009-2013, Percentage of Black Population, 2013, Percentage of Population Aged 65+ Years Old, 2013, Population Per Square Mile, 2010, Percentage of Persons with Bachelor's or Higher Degrees Among Population Aged 25+ Years, 2009-2013

e. Dependent Variable: Average Licensed Beds, 2010-2014

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15515628.42	1	15515628.42	17.578	.000[b]
	Residual	85617410.90	97	882653.721		
	Total	101133039.3	98			
2	Regression	42465485.06	3	14155161.69	22.921	.000[c]
	Residual	58667554.26	95	617553.203		
	Total	101133039.3	98			
3	Regression	65620656.89	4	16405164.22	43.424	.000[d]
	Residual	35512382.43	94	377791.302		
	Total	101133039.3	98			
4	Regression	91134132.64	11	8284921.149	72.087	.000[e]
	Residual	9998906.680	87	114929.962		
	Total	101133039.3	98			

a. Dependent Variable: Average Licensed Beds, 2010-2014

b. Predictors: (Constant), Disability Rate per 1000, 2010

c. Predictors: (Constant), Disability Rate per 1000, 2010, Ctr_PCI_Ctr_DR, Per capita money income in past 12 months, 2009-2013

d. Predictors: (Constant), Disability Rate per 1000, 2010, Ctr_PCI_Ctr_DR, Per capita money income in past 12 months, 2009-2013, Urban Areas, 2014

e. Predictors: (Constant), Disability Rate per 1000, 2010, Ctr_PCI_Ctr_DR, Per capita money income in past 12 months, 2009-2013, Urban Areas, 2014, Annual Average Net Migration for Both Sexes Aged 60+ Years, 1980-2010, Percentage of Married Females Aged 65-74 Years with Spouse Present, 2010-2014, Homeownership Rates, 2009-2013, Percentage of Black Population, 2013, Percentage of Population Aged 65+ Years Old, 2013, Population Per Square Mile, 2010, Percentage of Persons with Bachelor's or Higher Degrees Among Population Aged 25+ Years, 2009-2013

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2250.607	374.819		6.005	.000		
	Disability Rate per 1000, 2010	-10.907	2.601	-.392	-4.193	.000	1.000	1.000
2	(Constant)	-864.018	1006.132		-.859	.393		
	Disability Rate per 1000, 2010	-5.250	2.898	-.189	-1.811	.073	.564	1.774
	Per capita money income in past 12 months, 2009-2013	.087	.028	.334	3.062	.003	.514	1.946
	Ctr_PCI_Ctr_DR	-.002	.000	-.355	-4.172	.000	.844	1.184
3	(Constant)	-741.673	787.099		-.942	.348		
	Disability Rate per 1000, 2010	-1.548	2.316	-.056	-.668	.506	.540	1.851
	Per capita money income in past 12 months, 2009-2013	.053	.023	.202	2.326	.022	.495	2.022
	Ctr_PCI_Ctr_DR	-.001	.000	-.248	-3.659	.000	.810	1.234
	Urban Areas, 2014	1447.430	184.884	.552	7.829	.000	.750	1.333
4	(Constant)	2020.485	937.200		2.156	.034		
	Disability Rate per 1000, 2010	.470	1.941	.017	.242	.809	.234	4.277
	Per capita money income in past 12 months, 2009-2013	.058	.020	.224	2.861	.005	.186	5.377
	Ctr_PCI_Ctr_DR	.001	.000	.101	1.803	.075	.362	2.762
	Urban Areas, 2014	562.049	150.578	.214	3.733	.000	.344	2.905
	Percentage of Population Aged 65+ Years Old, 2013	10.335	23.422	.031	.441	.660	.229	4.367
	Homeownership Rates, 2009-2013	-28.146	10.900	-.163	-2.582	.011	.287	3.488
	Percentage of Black Population, 2013	11.496	9.088	.070	1.265	.209	.374	2.674
	Percentage of Persons with Bachelor's or Higher Degrees Among Population Aged 25+ Years, 2009-2013	-27.168	11.052	-.204	-2.458	.016	.164	6.086
	Annual Average Net Migration for Both Sexes Aged 60+ Years, 1980-2010	.530	.405	.064	1.309	.194	.477	2.099
	Percentage of Married Females Aged 65-74 Years with Spouse Present, 2010-2014	-1338.556	683.246	-.085	-1.959	.053	.599	1.670
	Population Per Square Mile, 2010	2.491	.207	.846	12.051	.000	.231	4.332

a. Dependent Variable: Average Licensed Beds, 2010-2014

Correlations

		Disability Rate per 1000, 2010	Per capita money income in past 12 months, 2009-2013	Life Expectancy for Males Aged 65+ Years, 2010	Homeowners hip Rates, 2009-2013	Percentage of Persons with Bachelor's or Higher Degrees Among Population Aged 25+ Years, 2009-2013	Sex Ratio for Population Aged 65+ Years Old, 2010	Percentage of Population Aged 65+ Years Old, 2013	Percentage of Black Population, 2013	Annual Average Net Migration for Both Sexes Aged 60+ Years, 1980-2010	Percentage of Married Females Aged 65-74 Years with Spouse Present, 2010-2014	Population Per Square Mile, 2010	Percentage of Married Males Aged 75+ Years with Spouse Present, 2010-2014
Disability Rate per 1000, 2010	Pearson Correlation	1	-.626**	-.349**	.081	-.645**	.215*	.674**	.013	.055	-.107	-.399**	-.177
	Sig. (2-tailed)		.000	.000	.423	.000	.033	.000	.901	.589	.290	.000	.079
	N	99	99	99	99	99	99	99	99	99	99	99	99
Per capita money income in past 12 months, 2009-2013	Pearson Correlation	-.626**	1	.516**	.200*	.687**	.013	-.337**	-.197	-.267**	.166	.600**	.102
	Sig. (2-tailed)	.000		.000	.047	.000	.897	.001	.050	.008	.101	.000	.317
	N	99	99	99	99	99	99	99	99	99	99	99	99
Life Expectancy for Males Aged 65+ Years, 2010	Pearson Correlation	-.349**	.516**	1	.031	.471**	.363**	-.106	-.165	-.129	.189	.300**	.136
	Sig. (2-tailed)	.000	.000		.764	.000	.000	.294	.103	.205	.062	.003	.181
	N	99	99	99	99	99	99	99	99	99	99	99	99
Homeownership Rates, 2009-2013	Pearson Correlation	.081	.200*	.031	1	-.368**	.408**	.352**	-.549**	.218*	.425**	-.077	.069
	Sig. (2-tailed)	.423	.047	.764		.000	.000	.000	.000	.030	.000	.449	.495
	N	99	99	99	99	99	99	99	99	99	99	99	99
Percentage of Persons with Bachelor's or Higher Degrees Among Population Aged 25+ Years, 2009-2013	Pearson Correlation	-.645**	.687**	.471**	-.368**	1	-.141	-.676**	.181	-.268**	-.127	.629**	.129
	Sig. (2-tailed)	.000	.000	.000	.000		.163	.000	.073	.007	.209	.000	.204
	N	99	99	99	99	99	99	99	99	99	99	99	99
Sex Ratio for Population Aged 65+ Years Old, 2010	Pearson Correlation	.215*	.013	.363**	.408**	-.141	1	.261**	-.148	.111	.254*	-.072	-.051
	Sig. (2-tailed)	.033	.897	.000	.000	.163		.009	.143	.273	.011	.479	.617
	N	99	99	99	99	99	99	99	99	99	99	99	99
Percentage of Population Aged 65+ Years Old, 2013	Pearson Correlation	.674**	-.337**	-.106	.352**	-.676**	.261**	1	-.419**	.036	.302**	-.457**	.022
	Sig. (2-tailed)	.000	.001	.294	.000	.000	.009		.000	.722	.002	.000	.832
	N	99	99	99	99	99	99	99	99	99	99	99	99
Percentage of Black Population, 2013	Pearson Correlation	.013	-.197	-.165	-.549**	.181	-.148	-.419**	1	-.178	-.539**	.173	-.126
	Sig. (2-tailed)	.901	.050	.103	.000	.073	.143	.000		.078	.000	.086	.215
	N	99	99	99	99	99	99	99	99	99	99	99	99
Annual Average Net Migration for Both Sexes Aged 60+ Years, 1980-2010	Pearson Correlation	.055	-.267**	-.129	.218*	-.268**	.111	.036	-.178	1	.126	-.582**	-.039
	Sig. (2-tailed)	.589	.008	.205	.030	.007	.273	.722	.078		.215	.000	.702
	N	99	99	99	99	99	99	99	99	99	99	99	99
Percentage of Married Females Aged 65-74 Years with Spouse Present, 2010-2014	Pearson Correlation	-.107	.166	.189	.425**	-.127	.254*	.302**	-.539**	.126	1	-.176	.125
	Sig. (2-tailed)	.290	.101	.062	.000	.209	.011	.002	.000	.215		.082	.218
	N	99	99	99	99	99	99	99	99	99	99	99	99
Population Per Square Mile, 2010	Pearson Correlation	-.399**	.600**	.300**	-.077	.629**	-.072	-.457**	.173	-.582**	-.176	1	.023
	Sig. (2-tailed)	.000	.000	.003	.449	.000	.479	.000	.086	.000	.082		.825
	N	99	99	99	99	99	99	99	99	99	99	99	99
Percentage of Married Males Aged 75+ Years with Spouse Present, 2010-2014	Pearson Correlation	-.177	.102	.136	.069	.129	-.051	.022	-.126	-.039	.125	.023	1
	Sig. (2-tailed)	.079	.317	.181	.495	.204	.617	.832	.215	.702	.218	.825	
	N	99	99	99	99	99	99	99	99	99	99	99	99

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).