The Urban-Rural Disparity in Nursing Home Quality Indicators: The Case of Facility-Acquired Contractures

John R. Bowblis, Hongdao Meng, and Kathryn Hyer

Objective. To identify and quantify the sources of the urban-rural disparity in facility-acquired contracture rates in nursing homes.

Data Sources. Survey inspection data of U.S. nursing homes from 1999 to 2008 and standardized national rural definition file from the Rural-Urban Commuting Area Codes.

Study Design. We estimated regressions of facility-level contracture rate as a function of urban-rural categories (urban, micropolitan, small rural town, and isolated small rural town) and other related facility characteristics to identify size of the urban-rural disparity. We used Blinder–Oaxaca decomposition techniques to determine the extent to which the disparity is attributable to the differences in facility and aggregate resident characteristics.

Principal Findings. Rural nursing homes have higher contracture rates than urban nursing homes. About half of the urban-rural disparity is explained by differences in observable characteristics among urban and rural nursing homes. Differences in staffing levels explain less than 5 percent of the disparity, case-mix explains 6–8 percent, and structure and operational characteristics account for 10–22 percent of the disparity.

Conclusion. While a lower level and quality of staffing are a concern for rural nursing homes, facility structure and funding sources explain a larger proportion of the urban-rural disparity in the quality of care.

Key Words. Quality of care, disparities, rural, nursing homes, contractures, decomposition

As the trends in population aging continues in the United States, the demand for all forms of long-term care is likely to increase in the coming decades. Meeting this rising demand is more challenging for rural areas because rural elderly have greater long-term care needs than their urban counterparts (Fennell and Campbell 2007) and there are well-documented differences in urban and rural long-term care providers (Phillips, Hawes, and Williams

2003; Hutchinson, Hawes, and Williams 2005).¹ One dimension in which there are significant differences between urban-rural providers is in the quality of care provided by nursing homes. A series of papers have generally found that rural nursing homes have lower quality than their urban counterparts after adjusting for case-mix (Buchanan et al. 2004; Phillips et al. 2004; Bolin, Phillips, and Hawes 2006; Kang, Meng, and Miller 2011; Temkin-Greener, Zheng, and Mukamel 2012). While these studies have identified potential sources of these differences in the quality of care, few have investigated the relative importance of these sources in explaining the urban-rural disparity.

This study aims to quantify and further our understanding of the sources of the urban-rural disparity in the quality of care provided by nursing homes. The Blinder–Oaxaca decomposition technique is used to determine the extent to which the disparity is attributable to differences in facility and aggregate resident characteristics between rural and urban nursing homes. Decomposition techniques have been used to study racial and ethnic disparities in a variety of health service settings (Zuvekas and Taliaferro 2003; Grabowski and McGuire 2009; Bowblis and Yun 2010). To our knowledge, this is the first paper that uses decomposition techniques to study urban-rural disparities in the quality of care provided by nursing homes. In this paper, quality of care is defined as the proportion of residents within a facility that acquire a contracture after admission to the nursing home. A contracture is an abnormal muscle shortening and joint fixation commonly seen among persons with immobility or central nervous system disorders (Adams and Victor 1993; Fergusson, Hutton, and Drodge 2007).

There are several reasons for focusing on contractures in this study. First, contractures are considered a measure of quality of care because the development of a contracture is considered a failure on the part of the nursing home to meet federal quality of care standards (§483.25, Centers for Medicare and Medicaid Services (CMS) [CMS] 2010). Also, contractures are often preventable with proper supervision and intervention (Wagner et al. 2008; Jamshed and Schneider 2010). Second, contractures are a highly prevalent condition among nursing home residents. In 1999, 24 percent of nursing home residents had a contracture regardless of its presence at admission, whereas contracture

Address correspondence to John R. Bowblis, Ph.D., Department of Economics and Scripps Gerontology Center, Farmer School of Business, Miami University, 800 E. High Street, Oxford, OH 45056; e-mail: jbowblis@muohio.edu. Hongdao Meng, Ph.D., is with the School of Aging Studies, University of South Florida, Tampa, FL. Kathryn Hyer, Ph.D., M.P.P., is Director of the Florida Policy Exchange Center on Aging, School of Aging Studies, University of South Florida, Tampa, FL.

rates are between 28 and 29 percent for the years 2005 to 2009 (Harrington, Carrillo, and LaCava 2006; Harrington et al. 2010). Third, contractures are an understudied measure of nursing home quality that have not received as much attention as other quality measures (Wagner and Clevenger 2010). In addition, contractures can lead to pain, pressure ulcers, infections, and functional disability, and they have a significant impact on quality of life; therefore, contractures are closely linked with other nursing home quality measures (Kane et al. 2008). Finally, contractures are not directly targeted by Quality Improvement Organizations in the recent quality improvement efforts by the CMS. In summary, this study aims to address the gap in our understanding of an important yet understudied aspect of nursing home quality.

BACKGROUND

The Urban-Rural Disparity

The Institute of Medicine (2002) defines a disparity as a difference in treatment among members of distinct groups that are not justified by the underlying health status or treatment preference of the patient. Applied to urban-rural disparities in the quality of nursing home care, this definition implies that there should be no differences in facility-acquired contracture rates among rural and urban nursing homes after adjusting for differences in risk factors (i.e., case-mix). A limitation of this definition is that it does not account for differences in provider characteristics among rural and urban nursing homes. Facility characteristics, such as staffing levels and ownership, can affect the quality of care provided by nursing homes. It is well documented that rural nursing homes tend to have few beds, lower staffing levels, and are less likely to offer specialized services (Hutchinson, Hawes, and Williams 2005). These differences can potentially affect quality.

The objective of this paper is twofold. First, we quantify the size of the urban-rural disparity by regressing the facility-acquired contracture rate on a set of covariates that explain nursing home quality and a set of indicator variables that identify rural and urban nursing homes. This approach allows for identification of the average difference in the facility-acquired contracture rate between rural and urban nursing homes after adjusting for observable characteristics. Any statistical difference suggests a disparity. Second, we decompose the unadjusted urban-rural disparity using Blinder–Oaxaca decomposition techniques to identify the sources of the disparity with respect to “across facility” variation (i.e., differences in rural and urban characteristics).

The key advantage to this technique is that it provides the percentage of the unadjusted disparity that is explained by differences in the covariates among rural and urban nursing homes.

Nursing Home Quality and Contractures

Any systematic difference in factors that are associated with contracture rates between urban and rural nursing homes can be a source of the urban-rural disparity. In this section, we draw from the nursing home quality literature to determine which factors influence the contracture rate. By comparing the differences in rural and urban nursing homes among these factors, we are able to identify which factors should influence the disparity and in what direction.

The first factor that influences the contracture rate is resident case-mix. Immobility caused by strokes, neuromuscular disorders, and dementia is known to be a major contributor to the risk of developing a contracture.² In addition to affecting the probability of developing a contracture, the level of physical and mental functioning of residents will determine the ability of staff to prevent, improve, or restore function and mobility. This implies that nursing homes that have a greater percentage of residents that are physically dependent, less mobile, and have mental health conditions associated with contractures are more likely to have higher contracture rates. As pointed out by Phillips et al. (2004), rural nursing homes admit residents that have a more dependent mental health case-mix, but they are less dependent in terms of physical functioning. Since both are factors that can influence the development of a contracture, the direction of the urban-rural disparity will depend on the relative importance of physical and mental case-mix in predicting contractures.

Holding case-mix constant, the amount, quality, and organization of staffing is another key determinant of nursing home quality. The majority of nursing home staffing is comprised of nurses and nurse aides: registered nurses (RNs), licensed practical nurses (LPNs), and certified nurse assistants (CNAs). RNs and LPNs are considered licensed nurses. RNs coordinate with a medical director and other physicians as part of a medical practice team that supervise and ensure professional oversight for direct care provided to residents. Some nursing homes do not have medical practice teams and RNs have greater responsibility in this oversight. RNs may have a 2-year associate, 3-year diploma, or 4-year bachelor's degree and must pass a national exam to be licensed. Baccalaureate trained RNs are considered better trained to use their clinical knowledge to direct care, note changes in residents' medical condi-

tions, and evaluate and coordinate care (Institute of Medicine (IOM) 2010). LPNs are usually responsible for administering medications and treatments as prescribed by a physician. LPNs have 1 year of classroom and clinical training through vocational or technical schools and must pass a national exam. In contrast to RNs and LPNs, CNAs provide the majority of direct care by helping residents with the tasks of dressing, bathing, toileting, and eating. Federal standards require CNAs to have at least 75 hours of training, but the labor market for CNAs is characterized by high turnover and wages close to the minimum wage (Munroe 1990; Hyer, Temple, and Johnson 2009).

In addition to nurse staffing, nursing homes can employ specialty staffing, such as physical, occupational, speech, and other types of therapists and therapy assistants. Therapists are trained to evaluate and use interventions to improve or restore function and mobility, relieve pain, and prevent or limit permanent physical disabilities of patients suffering from injuries or diseases. Therapists are required to hold at least a bachelor's degree from an approved program and pass a state licensing exam; many therapists hold masters or doctoral degrees. In addition to therapy staffing, activities staff support therapeutic goals with individual and group activities to encourage physical movement, social interaction, relaxation, and cognitive stimulation. Activity staff is trained in a range of academic programs, including recreational therapy, but few states require licensure.

Higher staff to resident ratios, a greater proportion of licensed nursing staff, and presence of a medical practice team may enable a nursing home to be better able to reduce further physical decline and provide appropriate exercises to improve the range of motion in residents with contractures. However, rural areas are reported to have fewer RNs (Skillman, Doescher, and Rosenblatt 2009) and other health care professionals (Casey, Moscovice, and Davidson 2006; Peterson et al. 2011). Rural areas also have a lower percentage of RNs with baccalaureate degrees (Blustein 2011) and rural nursing homes are less likely to have specialized personnel and training for staff (Morgan et al. 2002). Since more and highly skilled staff can improve quality (Cohen and Spector 1996), the limited availability of highly skilled health workers and lower staffing levels in rural areas is potentially an important source of the urban-rural disparity in contracture rates.

Nursing home administrators are constrained by the resources they can devote to improving quality. Larger facilities and those that are part of a multifacility chain have more residents, and these facilities can use economies of scale to improve quality. For example, larger facilities may be more likely to hire specialized personnel because the cost of this staff is spread across a

large number of residents. Another example is having resources to devote to special care units (SCUs). SCUs are dedicated beds that have specially trained staff to handle a specific need or diagnosis. Presence of an SCU brings specialized staff to the nursing home that could improve quality throughout the nursing home. Urban-rural disparities may arise because rural facilities tend to be smaller, operated independently, and may not have enough demand or be able to find specially trained staff required to invest in a SCU. However, rural nursing homes are more likely to be operated by a not-for-profit or government organization. Since the primary objective of these organizations is unlikely to be purely profit driven, rural nursing homes may devote more resources to counteract these other structural effects.

Nursing homes need to have the financial resources to pay for quality improvement efforts. Care provided at a nursing home can be paid for by Medicare, Medicaid, and private-pay sources, with each reimbursing at different rates. Since Medicaid is the least generous of these funding sources, nursing homes with a greater proportion of Medicaid reimbursed residents may have lower quality of care (Grabowski 2004). Additionally, facilities with higher occupancy rates are considered to have higher levels of operational efficiency (Sloan, Ostermann, and Conover 2003). Since rural areas have lower overall demand for nursing home care and are more reliant on Medicaid (Hutchinson, Hawes, and Williams 2005), it is expected that operational characteristics can explain some of the urban-rural disparity in the quality of care.³

METHODS

Data Sources and Study Population

The primary data source is the Online Survey Certification and Reporting (OSCAR) System. OSCAR is a uniform database of yearly regulatory surveys required of all nursing homes that receive payments from CMS. Surveys are conducted by state regulators every 9–15 months, with an average of 12 months between surveys (Centers for Medicare and Medicaid Services [CMS] 2010). Variables in OSCAR data have been found to be appropriate for research purposes (Feng et al. 2005; Intrator et al. 2005) and contain information on facility characteristics, aggregate resident characteristics, and staffing levels.

The empirical analysis in this study uses all OSCAR surveys from January 1, 1999 to December 31, 2008 for the 48 contiguous states that are at least 10 days apart. These surveys are assembled into a panel dataset with the

unit of observation being a nursing home survey. The study sample includes 152,356 surveys from 17,953 unique nursing homes.

Outcome Measures

The outcome measure is the proportion of residents with facility-acquired contractures. The facility-acquired contracture rate is defined as the proportion of residents with contractures, minus those residents who had contractures upon admission to the nursing home. Since residents may have a contracture prior to entering the nursing home, the facility-acquired contracture rate is the more appropriate measure of quality.

Definition of Rural Nursing Homes

Zip codes obtained for each nursing home are merged with Rural-Urban Commuting Area (RUCA) Codes to identify the urban/rural continuum where each nursing home is located. For this analysis, Categorization A is used. Categorization A aggregates zip codes into four distinct urban-rural categories: urban focused, large rural/town (micropolitan) focused, small rural town focused, and isolated small rural town focused. The percentage of the U.S. population in each category is 81.0, 9.6, 5.2, and 4.2 percent, respectively (WWAMI Rural Health Research Center [RHRC] 2010). Of the 17,953 nursing homes in the study sample, 11,677 (65.0 percent) are urban focused, 2,576 (14.3 percent) are micropolitan focused, 2,068 (11.5 percent) are small rural town focused, and 1,662 (9.3 percent) are isolated small rural town focused.

Additional Explanatory Variables

Additional explanatory variables are included that may impact the facility-acquired contracture rate and are broadly broken into the following categories: nursing home structure, facility operational characteristics, SCUs, case-mix, and staffing levels. Table 1 provides summary statistics for the explanatory variables.

The structure of the nursing home is measured by ownership status, size of the facility, membership in a multifacility organization, and an indicator for hospital-based nursing home. Ownership status is defined as for-profit, not-for-profit, and government ownership. Size of the facility is the number of beds.

Table 1: Summary Statistics

	<i>Entire Sample</i>	<i>Urban</i>	<i>Metropolitan</i>	<i>Small Rural Town</i>	<i>Isolated Small Rural Town</i>
Facility-acquired contracture rate	11.237 (15.446)	9.628 (14.286)	12.735* (15.976)	14.671* (17.545)	15.447* (17.457)
Rural/urban (Ref = Urban)					
Metropolitan focused	0.145 (0.352)				
Small rural town focused	0.118 (0.323)				
Isolated small rural town focused	0.097 (0.296)				
Nursing home structure					
Not-for-profit ownership	0.279 (0.449)	0.280 (0.449)	0.269* (0.443)	0.242* (0.428)	0.331* (0.470)
Government ownership	0.061 (0.239)	0.031 (0.173)	0.075* (0.264)	0.121* (0.326)	0.164* (0.370)
Number of beds	108.483 (73.311)	120.183 (81.101)	99.266* (57.288)	88.809* (48.763)	68.928* (33.742)
Multifacility chain	0.529 (0.499)	0.538 (0.499)	0.554* (0.497)	0.526* (0.499)	0.442* (0.497)
Hospital-based facility	0.111 (0.314)	0.087 (0.282)	0.133* (0.340)	0.166* (0.372)	0.166* (0.372)
Operation characteristics					
Percentage reimbursed by Medicaid	61.083 (25.299)	59.264 (27.143)	62.187 (24.036)	66.238* (19.910)	65.167* (17.845)
Percentage reimbursed by Medicare	14.582 (19.968)	16.272 (20.890)	16.002* (22.689)	10.122* (14.790)	6.734* (9.399)
Occupancy rate	82.126 (18.301)	82.799 (18.559)	80.667* (18.667)	79.908* (18.020)	82.562 (15.878)
Special care units					
AIDS	0.002 (0.048)	0.003 (0.058)	0.000* (0.018)	0.000* (0.021)	0.000* (0.008)
Alzheimer's	0.177 (0.382)	0.181 (0.385)	0.186 (0.389)	0.178 (0.383)	0.140* (0.347)
Dialysis	0.003 (0.050)	0.003 (0.056)	0.002 (0.048)	0.001* (0.036)	0.000* (0.018)
Disabled children/young adults	0.004 (0.060)	0.005 (0.069)	0.003* (0.053)	0.001* (0.031)	0.001* (0.026)
Head trauma	0.003 (0.051)	0.003 (0.057)	0.002* (0.040)	0.001* (0.039)	0.001* (0.032)
Hospice	0.012 (0.108)	0.012 (0.107)	0.013 (0.114)	0.011 (0.105)	0.012 (0.109)
Huntington's disease	0.001 (0.034)	0.001 (0.036)	0.000* (0.022)	0.002 (0.040)	0.001 (0.030)
Respiratory/ventilator care	0.019 (0.136)	0.026 (0.159)	0.009* (0.094)	0.005* (0.074)	0.003* (0.051)
Other specialized rehabilitation	0.026 (0.160)	0.034 (0.180)	0.019* (0.136)	0.011* (0.105)	0.008* (0.089)

continued

Table 1. *Continued*

	<i>Entire Sample</i>	<i>Urban</i>	<i>Metropolitan</i>	<i>Small Rural Town</i>	<i>Isolated Small Rural Town</i>
Case-mix					
Percentage with dementia	43.931 (19.687)	43.272 (20.501)	43.322 (18.895)	45.348* (17.610)	47.469* (17.117)
Percentage with psychiatric illness	18.299 (16.865)	18.028 (17.272)	18.461* (16.241)	18.979* (15.774)	19.017* (16.288)
Percentage with depression	42.925 (22.371)	41.042 (22.127)	44.454* (22.662)	46.215* (22.232)	49.066* (21.970)
Percentage developmentally disabled	2.973 (6.242)	2.566 (6.425)	3.512* (6.861)	3.723* (4.640)	3.944* (5.443)
Acuindex	10.143 (1.642)	10.280 (1.727)	10.079* (1.474)	9.921* (1.426)	9.598* (1.385)
Percentage bedfast	4.746 (7.755)	4.742 (7.880)	5.357* (7.965)	4.812 (7.698)	3.777* (6.468)
Percentage chairfast	53.646 (21.496)	54.260 (22.443)	52.570* (21.025)	53.406* (19.058)	51.480* (18.130)
Staffing levels					
Registered nurse HPRD	0.423 (0.583)	0.465 (0.624)	0.404* (0.614)	0.312* (0.427)	0.313* (0.329)
Licensed practical nurse HPRD	0.762 (0.497)	0.779 (0.515)	0.798* (0.539)	0.713* (0.422)	0.652* (0.364)
Certified nurse aides HPRD	2.074 (0.830)	2.105 (0.858)	2.054* (0.817)	2.000* (0.761)	1.993* (0.720)
Occupational therapy staff HPRD	0.106 (0.175)	0.123 (0.187)	0.104* (0.183)	0.066* (0.119)	0.046* (0.086)
Physical therapy staff HPRD	0.160 (0.254)	0.177 (0.268)	0.161* (0.272)	0.117* (0.200)	0.099* (0.146)
Activities staff HPRD	0.184 (0.190)	0.185 (0.204)	0.178* (0.173)	0.175* (0.165)	0.195* (0.139)
Medical practice team [†]					
Medical director or physicians with extenders	0.235 (0.424)	0.269 (0.444)	0.177* (0.382)	0.152* (0.359)	0.195* (0.396)
No medical director or physicians	0.172 (0.377)	0.124 (0.330)	0.215* (0.411)	0.274* (0.446)	0.298* (0.458)
Number of observations	152,356	97,550	22,032	18,011	14,762

Notes: Variables that start with word "percentage" refer to the percentage of residents. Standard deviation in parentheses. Summary statistics for year, state, and unreliable staffing indicators not shown. Statistical tests compare differences in the each rural category to the urban category.

* $p < .01$.

[†]The reference group is medical practice teams with a medical director or other physicians without physician extenders.

HPRD, hours per resident day.

Facility operational characteristics include payer-mix and occupancy rate. Payer-mix is defined as the proportion of residents on Medicaid, Medicare, and other payment sources. Occupancy rate is defined as the proportion of beds occupied by residents. Nursing homes can also have SCUs. Indicator variables for presence of any beds dedicated to SCUs are constructed for AIDs, Alzheimer's disease, dialysis, disabled children/young adults, head trauma, hospice, Huntington's disease, respiratory care, and other specialized rehabilitation SCUs.

Case-mix adjusts for risk factors associated with contractures. Without adjusting for case-mix, nursing homes with residents who have greater need would have higher contracture rates. Case-mix is measured using various mental health and physical acuity measures. Mental health case-mix is measured as the proportion of residents with dementia, psychiatric diagnosis, depression, and developmental disability. Physical acuity is measured by the proportion of residents who are chair and bedridden, and the Acuiindex (Cowles 2003).

Staffing is the primary input in the production of nursing home services. Separate staffing-level variables are constructed for nurse staffing (RNs, LPNs, and CNAs), occupational therapy, physical therapy, and activities staff.⁴ Staffing is measured in terms of hours per resident day (HPRD) and reflects the hours reported in OSCAR for staff without administrative duties. Occasionally, improvable HPRD may exist in OSCAR due to coding errors; these observations are identified for each staff type with an indicator variable for improbable staffing value and the staffing level variable is coded as zero HPRD (Bowblis 2011a). Additionally, indicator variables are included for type of medical practice team: (1) medical director or other physicians teamed with physician extenders (i.e., physician assistants or nurse practitioners), (2) medical director or other physicians without physician extenders, and (3) no medical director or physicians.

Analytical Methods

Multivariate reduced form regression models are estimated to determine the impact of urban/rural location on the contracture rate. The facility-acquired contracture rate is regressed on the three indicator variables for urban/rural location of the nursing home, explanatory variables discussed above, year indicator variables, and state fixed effects. All models adjust for heteroscedasticity and clustering of facilities within a state. To understand the source of the urban-rural disparity, Oaxaca decompositions are performed that compare

nursing homes in each rural category to urban nursing homes (Blinder 1973; Oaxaca 1973). This approach allows for the disparity to be broken into a characteristic and coefficient effect. The characteristic effect is amount of the disparity (i.e., difference in the facility-acquired contracture rate) between rural and urban nursing homes that can be explained by differences in the average observable characteristics of these two groups. That is, it identifies the share of the urban-rural disparity that can be explained if the average characteristics are the same in rural and urban nursing homes. The coefficient effect identifies how much of the disparity can be explained by variation in the coefficient estimates for nursing homes in each urban-rural category. Since there is no simple interpretation for why coefficient estimates may be different for each group, the coefficient effect is sometimes referred to as the unexplained effect.

RESULTS

The facility-acquired contracture rates increased between 1999 and 2003, and slightly declined from 2003 to 2008 (Figure 1). The more isolated the nursing home was from an urban environment, the higher the contracture rates and the greater the increase in rates over the study period. For example, urban nursing homes had contracture rates of 7.4 percent in 1999 and 9.6 percent in 2008, corresponding to a 2.2 percentage point increase. During this same

Figure 1: Residents with Facility-Acquired Contractures

Source: OSCAR data 1999–2008

period, nursing homes in small isolated rural towns experienced an increase of 3.2 percentage points (11.4–14.6 percent).

Summary statistics for the entire sample and by each urban-rural category are shown in Table 1. The majority of explanatory variables are statistically different in rural compared to urban nursing homes. Staffing levels, which are viewed as an important determinant of quality, are 88.3 percent of the level in isolated small rural towns compared to urban areas for total nurse staffing, 37.4 percent of the level for occupational therapy, and 55.9 percent for physical therapy. This implies the unadjusted urban-rural disparity does not account for differences in factors that may influence the contracture rate and justify the use of multivariate regressions. These regression results are reported in Table 2 and confirm the finding that rural nursing homes have higher contracture rates. Compared to urban nursing homes, micropolitan, small rural towns, and isolated small rural towns had 1.4, 2.7, and 2.9 percentage point higher facility-acquired contracture rates.

To identify the potential sources of the urban-rural disparity, decomposition analysis compared urban nursing homes to those in each rural category. The first row of Table 3 reports the unadjusted urban-rural disparity, whereas the next two rows report the aggregate effects. The aggregate characteristic effect explains 46–57 percent of the disparity. This implies if the average characteristics of rural and urban nursing homes are the same, the disparity would be reduced by about half. The remainder of Table 3 reports the characteristic effects for subaggregate categories and select explanatory variables. Since which factors explain the disparity are generally similar across rural categories, the discussion in the remainder of this section focuses on the decomposition that compares urban nursing homes to those in isolated small rural towns.

Differences in structural and operational characteristics of nursing homes explain 11.3 percent and 11.2 percent of the urban-rural disparity, respectively (Table 3). The largest statistically significant factors that contribute to the disparity are government ownership (5.8 percent), multifacility chain (1.2 percent), and payer-mix. Rural nursing homes are more likely than urban nursing homes to be government owned, not part of a multifacility chain, and have a lower percentage of residents on Medicare (Table 1). Each of these factors is associated with higher contracture rates (Table 2).

The third biggest subaggregate factor that explains the urban-rural disparity is case-mix (8.0 percent). Rural and urban nursing homes vary in two distinct ways when it comes to case-mix. Mental illness is more prominent in rural nursing homes, whereas residents in urban nursing homes are more

Table 2: Regression Results

	<i>Facility Acquired- Contracture Rate</i>
Rural/urban (Ref = Urban)	
Micropolitan focused	1.436*** (0.289)
Small rural town focused	2.748*** (0.360)
Isolated small rural town focused	2.860*** (0.374)
Nursing home structure	
Not-for-profit ownership	2.042*** (0.252)
Government ownership	2.061*** (0.403)
Number of beds	-0.002 (0.003)
Multifacility chain	-0.662*** (0.232)
Hospital-based facility	-0.236 (0.309)
Operation characteristics	
Percentage reimbursed by Medicaid	0.002 (0.006)
Percentage reimbursed by Medicare	-0.069*** (0.006)
Occupancy rate	-0.007 (0.005)
Special care units	
AIDS	-2.164*** (0.722)
Alzheimer's	-0.116 (0.247)
Dialysis	0.991 (0.759)
Disabled children/young adults	-2.240** (1.112)
Head trauma	-2.160** (0.886)
Hospice	-0.263 (0.482)
Huntington's disease	1.131 (1.227)
Respiratory/ventilator care	-2.214*** (0.399)
Other specialized rehabilitation	-0.204 (0.364)
Case-mix	
Percentage with dementia	-0.006 (0.009)
Percentage with psychiatric illness	0.025** (0.011)
Percentage with depression	0.133*** (0.007)
Percentage developmentally disabled	0.068* (0.038)
Acuindex	1.491*** (0.145)
Percentage bedfast	-0.143*** (0.014)
Percentage chairfast	-0.028*** (0.008)
Staffing levels	
Registered nurse HPRD	-0.522*** (0.184)
Licensed practical nurse HPRD	-0.457** (0.224)
Certified nurse aides HPRD	0.060 (0.153)
Occupational therapy staff HPRD	-0.801* (0.446)
Physical therapy staff HPRD	-0.352 (0.320)
Activities staff HPRD	-1.290*** (0.335)
Medical practice team [†]	
Medical director or physicians with extenders	-0.362** (0.145)

continued

Table 2. *Continued*

	<i>Facility Acquired- Contracture Rate</i>
No medical director or physicians	0.210 (0.147)
Constant	-7.584*** (1.940)
R-squared	0.139
Number of observations	152,356

Notes. Variables that start with word “percentage” refer to the percentage of residents. Models are estimated using linear regression that also includes year, state, and unreliable staffing indicators. Robust standard errors that adjust for clustering at the state level are reported in parentheses.

*** $p < .01$, ** $p < .05$, * $p < .1$.

†The reference group is medical practice teams with a medical director or other physicians without physician extenders.

HPRD, hours per resident day.

physically dependent (Table 1). If rural nursing homes had similar mental health case-mix as their urban counterparts, the disparity would become smaller with the largest single factor being the difference in the proportion of residents with depression. In contrast, if rural nursing homes had similar acuity levels, the disparity would increase by 16.2 percent.

The percentage of nursing homes that invest in SCUs vary greatly among urban and rural nursing homes (Table 1) and the presence of an SCU is found to be associated with significantly lower contracture rates for AIDS, disabled children/young adults, head trauma, and respiratory care SCUs (Table 2). Differences in the investment in SCUs across rural and urban areas account for about 1 percent of the urban-rural disparity, with most of this explained by differences in AIDS and respiratory care SCUs (Table 3).

Staffing is one of the most important factors in the production of nursing home care. Rural nursing homes have fewer HPRD of staff and are less likely to be part of a medical practice team (Table 1). Activities staffing is U-shaped with urban facilities having more staff than the middle rural categories, but fewer HPRD than the most isolated rural nursing homes. As shown in Table 2, each staffing variable has negative coefficient estimates except CNAs, whereas more complete medical practice teams are associated with a lower proportion of residents with contractures. This indicates higher staff levels and more integrated medical practice teams are associated with better nursing home quality. Interestingly, staffing levels only explain 3.8 percent of the urban-rural disparity, whereas medical practice teams explain about 1.0 percent (Table 3). Specific staff levels with a statistically significant effect in explaining the disparity are RNs and occupational therapists.

Table 3: Decomposition of Facility-Acquired Contracture Rate

	<i>Urban versus Metropolitan</i>		<i>Urban versus Small Rural Town</i>		<i>Urban versus Isolated Small Rural Town</i>	
	<i>Estimate</i>	<i>Share (%)</i>	<i>Estimate</i>	<i>Share (%)</i>	<i>Estimate</i>	<i>Share (%)</i>
Unadjusted rural-urban disparity	3.107		5.044		5.818	
Aggregate effect						
Characteristics effect	1.693***	54.49	2.343***	46.46	3.283***	56.43
Coefficient effect	1.414***	45.51	2.701***	53.55	2.535***	43.57
Select subaggregate characteristics effects						
Nursing home structure	0.080	2.57	0.219*	4.34	0.655***	11.26
Not-for-profit ownership	-0.023	-0.74	-0.075	-1.49	0.106	1.82
Government ownership	0.101***	3.25	0.219***	4.34	0.338***	5.81
Number of beds	0.034	1.09	0.078	1.55	0.131	2.25
Multifacility chain	-0.011	-0.35	-0.008	-0.16	0.071***	1.22
Operation characteristics	0.057	1.83	0.438***	8.68	0.650***	11.17
Percentage reimbursed by Medicaid	0.025	0.80	0.044	0.87	0.044	0.76
Percentage reimbursed by Medicare	0.017	0.55	0.380***	7.53	0.605***	10.40
Case-mix	0.236	7.60	0.308*	6.11	0.468*	8.04
Percentage with dementia	0.0001	0.00	0.001	0.02	-0.003	-0.05
Percentage with depression	0.460***	14.81	0.699***	13.86	1.060***	18.22
Percentage developmentally disabled	0.081*	2.61	0.093**	1.84	0.107*	1.84
Acuindex	-0.275**	-8.85	-0.515***	-10.21	-0.940***	-16.16
Percentage bedfast	-0.089	-2.77	-0.010	-0.20	0.149*	2.56
Percentage chairfast	0.055**	1.77	0.029	0.57	0.094**	1.62
Special care units	0.047***	1.51	0.048***	0.95	0.059***	1.01
AIDS	0.008**	0.26	0.006**	0.12	0.008**	0.14
Alzheimer's	-0.001	-0.03	0.001	0.02	0.005	0.09
Respiratory/ventilator care	0.029***	0.93	0.039***	0.77	0.042***	0.72

continued

Table 3. Continued

	Urban versus Metropolitan		Urban versus Small Rural Town		Urban versus Isolated Small Rural Town	
	Estimate	Share (%)	Estimate	Share (%)	Estimate	Share (%)
Staffing levels	0.046*	1.48	0.181***	3.59	0.222***	3.82
Registered nurse HPRD	0.024**	0.77	0.080**	1.59	0.079***	1.36
Licensed practical nurse HPRD	-0.007	-0.23	0.029	0.57	0.059	1.01
Certified nurse aides HPRD	-0.0003	-0.01	-0.003	-0.06	-0.010	-1.72
Occupational therapy staff HPRD	0.014	0.45	0.051**	1.01	0.070**	1.20
Physical therapy staff HPRD	0.008	0.26	0.029	0.57	0.036	0.62
Medical practice teams	0.056***	1.80	0.065**	1.29	0.058*	1.00

Notes. Estimates are calculated as difference in the proportion of residents with contractures between urban facilities and rural facilities that can be explained by the characteristic and coefficient effects. The share is the percentage of the unadjusted disparity between rural and urban facilities. Negative values indicate an increase in the disparity. Subaggregate characteristic effects for state, year, unreliable staffing, and constant are not reported. Characteristic effects for select variables are reported under the each subaggregate characteristic effect category. Variables that start with word “percentage” refer to the percentage of residents.

*** $p < .01$, ** $p < .05$, * $p < .1$.
HPRD, hours per resident day.

DISCUSSION AND CONCLUSION

This study has the advantage of using national data over 10 years to identify the urban-rural disparity in the quality of nursing home care with a focus on the facility-acquired contracture rate. By using RUCA codes instead of metropolitan statistical areas, a more refined definition of rurality allows for stratification of rural nursing homes into multiple categories based on their isolation from an urban environment. The results of this study indicate between 1999 and 2008, there is a significant urban-rural disparity in the quality of nursing home care, and this disparity is larger the more isolated the nursing home. In addition to documenting the disparity, the results also show that nearly one-half of the disparity is explained by differences in the average characteristics of the nursing home in urban and rural areas.

Rural nursing homes have a significantly different organizational structure and different funding sources than their urban counterparts. These differences can account for 10–22 percent of the disparity. Rural facilities are smaller, more likely to be independently owned and operated by a not-for-profit or government organization, and have a payer-mix that is more reliant on Medicaid for funding. Each of these factors reduces the amount of financial and non-financial resources available to the nursing home to invest in quality. Smaller, independently operated nursing homes have fewer workers on a full-time equivalent basis, and their smaller size reduces their ability to use economies of scale to improve quality and limits their ability to hire specialized staff that may prevent contractures. These homes are less likely to have the ability to keep abreast of newer practices and to develop training protocols and policies that reflect the most up-to-date clinical knowledge. Further, nursing homes are required to provide the same level of care to all residents regardless of payer source (Grabowski, Gruber, and Angelelli 2008), but being more reliant on Medicaid provides fewer financial resources for rural nursing homes to improve overall quality and less ability to hire specialized staff or invest in SCUs. These findings are consistent with prior work that rural nursing homes have less specialized personnel and training for staff (Morgan et al. 2002).

While case-mix explains about 6–8 percent of the urban-rural disparity, differences in the physical and mental functioning of residents in urban and rural facilities affect the disparity in opposite directions. Rural facilities have residents with higher physical functioning. Making rural facilities have residents of similar physical functioning as urban facilities would increase the disparity. This would suggest that rural facilities may not have the staffing mix that provides the best clinical expertise to identify and prevent contractures in

residents with high levels of physical need. However, rural facilities also tend to have a greater proportion of residents with mental illnesses and perform better than urban facilities in this dimension. This is a positive for rural nursing homes as residents with serious mental illness can cause significant caregiver burden, leading to passive neglect, and thus to contracture formation (Resnick et al. 2009).

Access to training, and availability of specialized staffing and medical care practice teams are a concern for rural nursing homes. For example, in the sample, rural areas are found to have lower staffing levels for all types of staff. Among nurse staffing, total nurse staffing levels in isolated small rural towns are only 88.3 percent of urban areas, whereas RN staffing is only 67.3 percent of the levels of urban areas. Given that prior work has shown that higher staffing to resident ratios and a mix of staff toward more licensed staff is associated with higher nursing home quality (Cohen and Spector 1996; Konetzka, Stearns, and Park 2008; Hyer et al. 2011), it is expected that nurse staffing would explain a large proportion of the disparity. Interestingly, differences in staffing levels between rural and urban areas explain less than 4 percent of the disparity.

The small effect staffing and medical practice teams play in the total disparity is somewhat surprising, and we speculate it is because the staffing level variables are not capturing differences in skills and education of workers in the same discipline. Although we demonstrate staffing levels are lower in rural areas, the total number of staff from different disciplines working in the nursing home may be an important consideration captured by the effect for facility structure. This may suggest that a larger number of workers allow nursing homes to hire and train persons who specialize in select areas of care and may create positive externalities that allow workers to better coordinate care. However, this hypothesis cannot be directly assessed with our study design. Additionally, the skills of staff, determined by the level of education and training within the discipline, may play an important role in shaping the ability of nursing homes to implement protocols and deliver high-quality care levels. The lower level of education among RNs (Blustein 2011), and lack of more integrated medical practice teams in rural areas, may make the supervision and training of other staff more challenging.

Although approximately one-half of the disparity in the quality of care can be explained by differences in average characteristics, the other half is largely unexplained. Decomposition analysis identifies the source of the disparity based on observable characteristics that are available in the OSCAR dataset. For example, one factor that can influence quality and is not available in OSCAR is staffing turnover (Castle and Engberg 2005). If turnover rates

vary by urban-rural continuum, then staffing may be found to have a larger effect on the disparity. Further, OSCAR only provides aggregate measures of resident characteristics. Although case-mix is adjusted for in the regression models, the facility-acquired contracture rate may not be properly adjusted for health status of residents that predict contractures (i.e., stroke, neuromuscular disorders). Even if it is possible to control for additional facility and resident characteristics, there are still unobserved factors that can influence quality, such as facility culture and care practice patterns. Therefore, further research is needed to tease out these effects and to address other limitations.

The results of this study are novel because they show how the size of the urban-rural disparity in the quality of nursing home care is larger depending on how isolated of a rural area a facility is located. In addition, this disparity can be decomposed into the characteristic and coefficient effects. Some of the characteristics that explain the disparity are modifiable and efforts tailored toward addressing these areas can improve the quality in rural areas. For example, since rural nursing homes are more reliant on Medicaid, differentiated Medicaid payments that provide higher reimbursement to rural facilities may allow nursing homes to invest in more staff and other quality improvement efforts. In addition, federal and state efforts to increase the staffing levels at rural facilities could enhance rural nursing home quality. Efforts such as minimum licensed and direct care staffing laws could play some role by mandating the levels and type of staff rural nursing homes must employ (Park and Stearns 2009; Bowblis 2011b). Even with these efforts, improving quality is a challenge given the need for more and better trained health care professions, especially in rural areas.

ACKNOWLEDGMENTS

Joint Acknowledgment/Disclosure Statement: An earlier version of this paper was presented at the 2011 Academy Health Annual Research Meeting.

NOTES

1. Rural elderly are older and make up a greater percentage of the population than urban elderly. In addition, rural elderly are less likely to have access to formal alternatives to nursing home care (Hutchinson, Hawes, and Williams 2005).

2. Souren, Franssen, and Reisberg (1995) find in their sample of patients with dementia who lost the ability to walk that more than three-quarters manifest contractures. Similarly, Sackley et al. (2008) find 73 percent of their sample of patients with a severely disabling stroke developed a contracture within 1 year.
3. Demand for nursing home care is higher in rural areas on a per capita basis, but given the smaller population in rural areas, overall demand is lower.
4. Each nursing staff type of RN, LPN, and CNA is entered into the model separately. This indirectly captures the effect of total staffing levels and the relative mix of nursing staff.

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