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Factors Affecting Care Quality in South Dakota Nursing Homes

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Introduction

Purpose

The purpose of this study is to help clarify how factors such as incidence of antipsychotic, antianxiety and hypnotic medication use, various staffing measures, nursing home size, and local population, relate to quality of care in South Dakota nursing homes. The information allows for transparency to help consumers potentially choose between two or more South Dakota nursing homes based on which factors are important to them.

Significance

This study has significant implications for consumers and nursing home administrators alike. Between 1946 and 1964, the United States experienced a huge population increase during the post WWII economic boom. The generation appropriately dubbed the "Baby Boomers" are turning 65 and becoming eligible for federal retirement benefits between 2011 and 2029, during this 18 year span, a staggering 79 million people are predicted to retire (Zuckerman, 2011). Hidden within this figure is another, equally overwhelming number; by the time all the baby boomers have retired, the number of Americans aged 65 or older who have some type of disability will have risen from 11 million at the onset of their retirement window to 18 million by 2030 (Bragg & Hansen, 2015). In their study, Bragg and Hansen (2015) found that 70% of adults 65 and older need some type of long term service or support (LTSS). The authors acknowledged the relative unpreparedness of healthcare infrastructure and workers for the impending workload increase, citing the Bureau of Labor Statistics which predicts the need for a

49% increase in the number of personal care aids, a 48% increase in home health aides, and a 21% increase in nursing assistants from 2012 to 2022 (Bragg & Hansen, 2015).

Luckily for the retiring boomers, they are retiring in an era of personalized care and continuous quality improvement. In 1998, the Centers for Medicare and Medicaid services began to publicly report the results of health inspections, fire and safety inspections, and quality measures scores, and in 2008 those results and other information began to be compiled into a five star rating system to give consumers a simple way to compare nursing homes (Grabowski & Town, 2011; Werner, Konetzka, & Polsky, 2016). A 2011 study of over 6,000 U.S. nursing homes determined that public reporting improved care quality in nursing homes overall, by increasing demand for high quality nursing homes and increasing the incentive for nursing homes to score well on quality measures (Park, Konetzka, & Werner, 2010). In the study, Park et al. (2010) found that since the implementation of the Nursing Home Compare tool on the Medicare website, facilities who performed well on quality measures and facilities whose score improved from one year to the next performed significantly better financially than before implementation of the tool. In addition to this finding, a separate study published by Grabowski and Town (2011) documented the importance of market competition on the effect of public reporting on nursing home quality. The duo studied the staggered rollout of the nursing home compare tool in the six pilot states of Colorado, Florida, Maryland, Ohio, Rhode Island, and Washington and concluded that the relative competition of a market, as measured by market share, influenced the change in care quality after the onset of public reporting, with more competitive markets prompting larger increases in care quality on average (Grabowski & Town, 2011).

In 2008, the public reporting of quality measures for nursing homes was simplified and condensed into a five star rating system. With the new system, consumers can directly compare the overall quality of multiple nursing homes, as determined by Medicare, at a glance. This makes it faster and easier to ensure that a loved one will receive the best care possible when the need for skilled nursing care arises. In a 2016 study published in the Journal of Health Services Research, Werner et al. (2016) found that after the inception of the simplified five star rating system, nursing homes scoring four or five stars in terms of overall quality saw an increase in the rate of new admissions, while nursing homes with an overall score of only one or two stars saw a decrease in new admissions. While one-star nursing homes lost 8% market share over the period of the study, five-star nursing homes gained 6.4% market share during that time, and three-star nursing homes remained stable both in terms of new admissions and market share (Werner et al. 2016). The bottom line is that consumers use the nursing home compare tool when deciding what nursing home best fits their needs, which provides incentive for nursing homes to provide high quality care to the residents they serve.

Definitions

Medicare is the federal health insurance program for people who are 65 or older, certain younger people with disabilities, and people with end stage renal disease (Centers for Medicare and Medicaid Services [CMS], 2017). Medicare is divided into four parts (A-D), and part A covers hospital, nursing home, and hospice care costs (CMS, 2017).

Antianxiety medications are a class of drugs which help to reduce symptoms of anxiety such as panic attacks and instances of extreme fear or worry (National Institute of Mental Health [NIMH], 2017).

Antipsychotic medications are a class of drugs which help to manage symptoms of psychosis, or conditions affecting the mind, in which there is some loss of contact with reality (NIMH, 2017).

Review of Literature

Staffing Levels, Education, and Training

Thanks to public reporting and information availability, there exists a fair amount of literature on the topic of nursing home care quality and the many factors which may be influential. Previous studies have examined the relationship between various staffing measures, such as overall staffing rates, and education levels of staff, but regional discrepancies exist, making it difficult to draw any definitive conclusions (Kirkevold & Engedal, 2008; Rolland, Mathieu, Piau, Cayla, Bouget, Vellas, & Barreto, 2016). For the purposes of this study, it has been hypothesized that higher staffing levels and higher education levels of those staff will exhibit a positive relationship with care quality. The reasoning behind this is straightforward; having more staff on hand means a nursing home can dedicate more individual attention to a resident in need, which could potentially eliminate situations in which residents struggle without any help, resulting in falls, pressure ulcers, pain, incontinence, etc. Similarly, it is expected that more educated staff are better able to assess the needs of a resident in distress and provide for those needs. In one study, sponsored by the Norwegian Center for Dementia Research, Kirkevold & Engedal, (2008) demonstrated an association between higher total staffing levels and improved quality of care. In a survey of over 1500 nursing home residents, the researchers were able to tease out a correlation between different types of units and the quality of care as well, with the more highly staffed special care units having a positive effect on function and behavior in dementia patients when compared to the regular units (Kirkevold & Engedal, 2008). Other studies which have focused on staff education and training rather than just the amount of staff available have also linked care quality to

education and support interventions for staff. A 2016 study, aimed at improving the quality of care for long-stay nursing home residents in France, found that the risk of pressure ulcers and prevalence of residents transferred to hospital emergency rooms decreased significantly with the introduction of an audit/feedback program aimed at educating staff through meetings with geriatric physicians (Rolland et al., 2016). Similarly, Legg (2007) detailed the ways in which staff training programs have helped to reduce miscommunication between staff and residents, resulting in fewer deficiencies for the nursing homes included in the pilot.

Thus far the link between informal, on-the-job training and care quality has been demonstrated, but the role of formal education for staff is lacking. Surprisingly, Malmedal, Hammervold, & Saveman (2014) found that higher education levels of staff correlated with increased incidence of inadequate care of a physical or emotional character in Norwegian nursing homes. This phenomenon held true both for staff educated at the university level and high school level compared to their colleagues lacking a formal education at the high school level. This finding directly opposes one of the hypotheses of this study; that increased staff education results in better care quality. However, the findings are contradictory in nature because they also found that registered nurses, a university-educated group, held a more positive attitude towards nursing home residents than did less educated staff. Malmedal et al. (2014) also discovered a link between job satisfaction and the provision of inadequate care, which may suggest a possible explanation for the negative association between staff education and care quality. The researchers did not analyze the relationship between staff education levels and job satisfaction, but there is evidence to suggest that more highly educated staff were

more selective about some aspects of their jobs (Malmedal et al., 2014). Therefore, a link between staff education level and job satisfaction could be the explanatory variable in the link between staff education and care quality.

Antianxiety, Hypnotic, and Antipsychotic Medications

Antianxiety medications are a class of drugs which help to reduce symptoms of anxiety such as panic attacks and instances of extreme fear or worry (NIHM, 2018). Antipsychotic medications, on the other hand, are a class of drugs aimed at managing psychosis, or conditions affecting the mind, in which there is some loss of contact with reality (NIMH, 2018). Psychosis is often marked by delusions and hallucinations which are common symptoms of schizophrenia. Although there is no official definition of what constitutes a chemical restraint, both antianxiety and antipsychotic medications, as well as other classes of drugs, commonly fall under this blanket term. For Medicare purposes, another class of drugs, hypnotics, which are used to treat insomnia and induce sleep, are grouped in with antianxiety medications and used as a quality control measure (CMS, 2017; NIMH, 2018).

From 2005 to 2011, the incidence of antipsychotic drug use in nursing homes rose from 15.9% to 23.9% (Ellis, Molinari, Dobbs, Smith, & Hyer, 2014; Lam et al., 2017). This rate of growth does not coincide with the rate of diagnoses of schizophrenia (3.6%) and serious mental illness (~10%) in nursing homes, which are the approved conditions for which an antipsychotic medication is appropriate. The disparity between the number of appropriately diagnosed conditions and the rate of prescription of antipsychotic medications implies off-label use of these antipsychotic medications, or, the use of a drug for purposes outside the FDA approved drug label (Ellis et al., 2014) In an 11 year

observational study of chemical restraint use in Hong Kong nursing homes, Lam et al. (2017) found that the top reasons for imposing chemical restraints were to ensure safety of residents and staff, to facilitate treatment, and to compensate for understaffing. A lack of staff knowledge on the issue is likely a reason for continuous chemical restraint usage. Not only have chemical restraints not been shown to prevent harm, they've even been tied to negative effects such as decline in physical functioning, increased risk of falls, contractures, pressure ulcers, delirium, pain, mental health problems, and death (Lam et al., 2017). A survey of 168 nursing staff found that only 19% believed that good alternatives to restraint were available to them, and as a whole, the staff underestimated the physical and psychological effects of restraint on their residents (Lam et al., 2017).

In light of the growing concern over chemical restraints, knowing why nursing homes are using more of these medications is not enough; we must also ask what the barriers to their discontinuation are in order to gain a better understanding of the problem. In a study by Azermai, Stichele, Bortel, & Elseviers (2013) Belgian nurses and physicians were surveyed about their views regarding antipsychotic discontinuation. They found that; recurrence of the initial behavioral problem, hindrance to others, risk of harm to the resident, and a higher workload/closer observation of the resident were popular barriers to discontinuation of antipsychotic medications (Azermai et al., 2013). Additionally, a low shared willingness to discontinue antipsychotic medications in a specific resident between nursing home staff and the prescribing physician complicated the struggle (Azermai et al., 2013). Above all, though, was the concern for potentially lowering the quality of life for a resident. The mindset of palliative care is a focus on

quality, rather than quantity of life, which led to the continuation of antipsychotic medication use in Belgian nursing home residents (Azermai et al., 2013).

In 2012, the Centers for Medicare and Medicaid Services launched the National Partnership to Improve Dementia Care in nursing homes (Ellis et al., 2014). The goal of the initiative was to cut down the rate of antipsychotic medication use by 15% over 18 months. Thus far, the initiative has been largely unsuccessful in achieving its goal, although in a 2013 survey of Florida nursing home administrators, 181 of 276 respondents (66%) indicated that new policies were in place with the goal of reducing the incidence of antipsychotic medication use (Ellis et al., 2014). Common themes in the new policies included; frequent review of residents and medication regimens, reduction in the number of medications or dosage, and nonpharmacological interventions (Ellis et al., 2014).

Size of Nursing Home (Number of Certified Beds)

Compared to staffing levels and chemical restraint usage, less is known about the effects of nursing home size on the quality of care received there, and what little information does exist on the subject is contradictory. For the purposes of this study it is hypothesized that care quality will exhibit an inverse relationship with the size of a nursing home as measured by the number of beds. In other words, more beds will lead to lower quality of care. The reasoning for this hypothesis is that fewer beds will result in more individual attention for each resident in much the same way higher staffing levels would promote better care. This line of reasoning is noted in the 2008 study conducted by the Norwegian Center for Dementia Research. Kirkevold & Engedal (2008) considered the effect of ward size on their results; concluding that the smaller number of beds which

led to higher staffing levels was a contributing factor to the greater quality of care received in the special care units when compared to the regular units.

Elsewhere, studies have seemingly proven the opposite; Malmedal et al. (2014) reference several instances of care quality declining along with a decline in nursing home size. For example, in Canada, inadequate care was found to be especially prevalent among nursing homes with forty beds or less, with 20% of residents in these homes receiving inadequate care (Malmedal et al., 2014). Similar results were found in Israel, where the majority of maltreatment incidents came from smaller nursing homes, and in Ireland acts of physical abuse were 6X as likely to occur in smaller nursing homes (Malmedal et al., 2014). The authors were able to replicate these results in their own study in Norway, where they found that staff in nursing homes containing less than 30 certified beds were more likely to commit acts of inadequate care of a physical nature compared to their peers in larger homes (Malmedal et al., 2014). The results of the study confirmed their hypothesis that nursing home size significantly influences the probability of inadequate care occurring, however, the group did recognize the legitimacy of contradictory studies which claimed that higher incidence of maltreatment is associated with larger patient populations (Malmedal et al., 2014).

Returning a bit closer to home, a 2006 study of Iowa nursing homes found that an increase in the number of certified beds was significantly associated with an increase in incident rates, reporting rates, and substantiation rates of abuse (Jogerst, Daly, Dawson, Peek-Asa, Schmuch, 2006). With so much disagreement between seemingly similar studies from around the world, clearly there is no universally accepted effect of nursing home size on care quality. With this in mind, it’s important to remember that the results

gained from this study will be specific to the state of South Dakota. Also worth remembering is the unique definition of care quality employed here which is the overall nursing home quality score determined by Medicare. This definition of care quality differs from the popular measure of deficiencies or instances of inadequate care utilized by the aforementioned foreign studies, because Medicare is specifically an American construct.

Population

The effects of population on the delivery of healthcare in an area are broad in scope and highly variable, which poses a challenge to drawing firm conclusions. Complicating the study of population effects are the different relative definitions of urban and rural between inherently urban and rural areas. For the purposes of this study, definite urban and rural definitions will not be used. Instead, relationships between population and other factors affecting care quality in nursing homes will be analyzed, so that relationships between the increase or decrease in population and other factors may be established, without drawing a line between South Dakota's arbitrary urban and rural areas. In a study published in The Gerontologist, authors Temkin-Greener, Zhang, & Mukamel (2012) identified some key differences between the end-of-life experience in urban and rural areas across the United States. The researchers found that, compared to their rural counterparts, Americans living in urban areas spent more time in the hospital, more time in the ICU, and were seen by more doctors during the last six months of their lives (Temkin-Greener et al., 2012). These differences implied that more aggressive care occurred in urban areas; there was no difference found between urban and rural death

rates, however, which indicated that the care quality discrepancy between urban and rural areas was insignificant.

While the hospital-specific study found no evidence of a relationship between population and differential care quality, a study published in the Journal of Health Services Research acknowledged a quality disparity between 18,000 urban and rural nursing homes in the United States (Bowblis, Meng, & Hyer, 2012). In the study, Bowblis et al. (2012) noted the general consensus regarding care quality in nursing homes to be that higher quality care was generally found in urban areas. The unique design of the study focused on contractures, abnormal muscle shortening which led to joint fixation, as a measure of care quality. The study found a significant relationship between the incidence of contractures and the distance from an urban area. The authors also noted that this trend was mirrored by the relationship between population and staffing rates, especially for highly trained or specialized staff such as registered nurses and occupational therapists (Bowblis et al., 2012). Outside of staffing, Bowblis et al. (2012) concluded that structural and operational characteristics of nursing homes, government ownership, affiliation with a multi-facility chain, payer mix, and case mix were other factors contributing to the disparity in care quality between urban and rural nursing homes. Rural nursing homes were more often government-owned, less often part of a chain, more often relied on Medicaid instead of Medicare, and had more mental disabilities and fewer physical disabilities than their urban counterparts (Bowblis et al., 2012).

Malmedal et al. (2014) examined population effects on care quality and found that staff in rural nursing homes in Norway were better at providing care when measured by

incidence of pressure ulcers, urinary incontinence, and neglect, but performed worse than urban staff when it came to inadequate care of an emotional or physical character. These findings suggest that neither urban nor rural nursing homes are truly better than the other when it comes to overall quality of care, but instead have separate strengths and weaknesses that may be shaped by the context of their workload. This makes sense in light of the findings of Bowblis et al. (2012) which highlight the differences between the resident populations of urban and rural nursing homes. Indeed, Malmedal et al. (2014) seem to arrive at this conclusion as well, speculating that the nursing home-bound population in rural areas has less competition for and therefore easier access to nursing homes. The result of this is that the residents of rural nursing homes enter with less functional impairment than their urban counterparts, and are subsequently less likely to receive as much skilled care for lack of necessity (Malmedal et al., 2014). The authors also speculated that more skilled staff may be drawn to more urban areas where their skills are in higher demand (Malmedal et al., 2014). While urban nursing homes may attract more specialized staff, the familiarity and potentially long-standing relationships between staff and residents of more rural nursing homes should not be overlooked. Indeed, it may be these unmeasurable qualities that contributed to the surprising effect of facility size observed in the study of Iowa nursing homes (Jogerst et al., 2006).

By retaining the broad, general definition of care quality through the Medicare quality score index, this study seeks to eliminate arbitrary and context-dependent results and deliver an unbiased, accurate estimate of the relationship between population and the quality of care received in nursing homes across South Dakota.

Methods

Data Collection

Data pertaining to the population of various cities throughout South Dakota was collected from the 2010 U.S. census (U.S. Census, 2012). Information regarding specific nursing homes such as number of beds, care quality, incidence of use of various drug classes, and staffing measures came directly from the Medicare Nursing Home Compare tool on the Medicare website (CMS, 2017). The Medicare Nursing Home Compare tool collects and analyzes data from all Medicare certified nursing homes nationally. The tool accounts for information from state inspections, complaint investigations, health inspections, and billing claims to score nursing homes on their performance in various categories. In addition to population information, the Medicare scored categories that will be the focus of this study include; incidence of antianxiety/hypnotic medication use, incidence of antipsychotic medication use, various specific staffing measures, and the size of each nursing home as determined by the number of licensed beds. There are 109 skilled nursing facilities recognized by Medicare in the state of South Dakota, all of which are included in the data analysis (n = 109) with the exception of analysis pertaining to staffing measures (n= 107), which excludes Milbank Care and Rehab Center and the SD Human Services Center Geriatric Program for a lack of available staffing information. They are listed in alphabetical order along with their care quality score and the town in which they are located in Appendix A.

Data Analysis

Relationships between potentially influential factors and care quality were measured and tested for significance using the regression tool as part of Microsoft

Excel's Data Analysis toolpak®. The regression analysis tool utilizes the method of least squares to find the line of best fit to represent the relationship between two variables. A completed regression analysis yields many regression statistics which are descriptive of the data and the relationship between the explanatory and response variables. For the purposes of this study the P-value will be the focus of interpretation.

The P-value is commonly used in statistical hypothesis testing. To test a hypothesis, the researcher must designate a null hypothesis and an alternative hypothesis. The null hypothesis in this case would state that there is no relationship between an explanatory and response variable, while the alternative hypothesis would state that the relationship between the two variables is anything other than zero. The P-value measures confidence in the slope of the line achieved from the regression analysis. Specifically, the P-value is the probability of obtaining a data set like the one observed under the assumption of the null hypothesis; that the true relationship between explanatory and response variables is zero. A lower P-value denotes a higher level of confidence in the resulting regression model. If the P-value gives the probability of achieving the same result under the null hypothesis, then [1 – (P-value)] gives the probability of a correct rejection of the null hypothesis. For the purposes of this study, the traditional cutoff of a P-value < 0.05 (95% confidence in rejecting the null hypothesis) will help to determine the significance of a result. In a few instances, the reported significance of a relationship between variables does not achieve the $P < 0.05$ mark, but comes close, and is worth mentioning.

Results

Factors tested for relationship with quality of care
Incidence of antianxiety and hypnotic medication use
Incidence of antipsychotic medication use
Various staffing measures
Local population size
Size of nursing home (number of beds)

Of the five factors studied, only antipsychotic medication use and population exhibited a significant relationship with care quality. While the total licensed nurse staffing measure (registered nurses + licensed practical nurses) did not produce significant results when compared to the overall quality of care received, when registered nurses and licensed practical nurses are treated as separate measures, they are both revealed to significantly relate to care quality, although in opposite manners. Additionally, the size of a nursing home, as determined by the number of beds, exhibits an interesting relationship with both the quality of care as well as with the population of the town in which it is found, possibly providing explanation for the relationship observed between care quality and population.

The results of the regression analysis will be presented in the following order; incidence of antianxiety or hypnotic medication use, incidence of antipsychotic medication use, staffing factors, population factors, and nursing home size. The relationship between each factor and the overall quality of care received is measured by regression analysis, along with analysis of more specific staffing and population factors. Staffing levels are measured by adding up the man-hours for all staff per day and dividing that number by the number of residents, yielding the unit "minutes per resident per day." For example, 30 minutes per resident per day means that a nursing home has

enough staff for each resident to receive 30 minutes of one-on-one attention from staff each day.

Staffing measures have been further broken down into hours logged by registered nurses (RNs), hours logged by licensed practical nurses (LPNs), hours logged by certified nurse assistants (CNAs), and proportion of total nursing performed by RNs($\frac{RN}{RN+LPN}$). Additionally, hours logged by RNs and LPNs are examined against each other in search of a relationship. Population of the city or town in which each nursing home is found will also be examined thoroughly against several specific staffing measures and rates of use for the classes of drugs previously mentioned. The summary outputs of individual regression analyses which contain specific P-values can be found in Appendix B and are listed in the same order as the results presented below.

Care Quality vs Incidence of Antianxiety/Hypnotic Medication Use

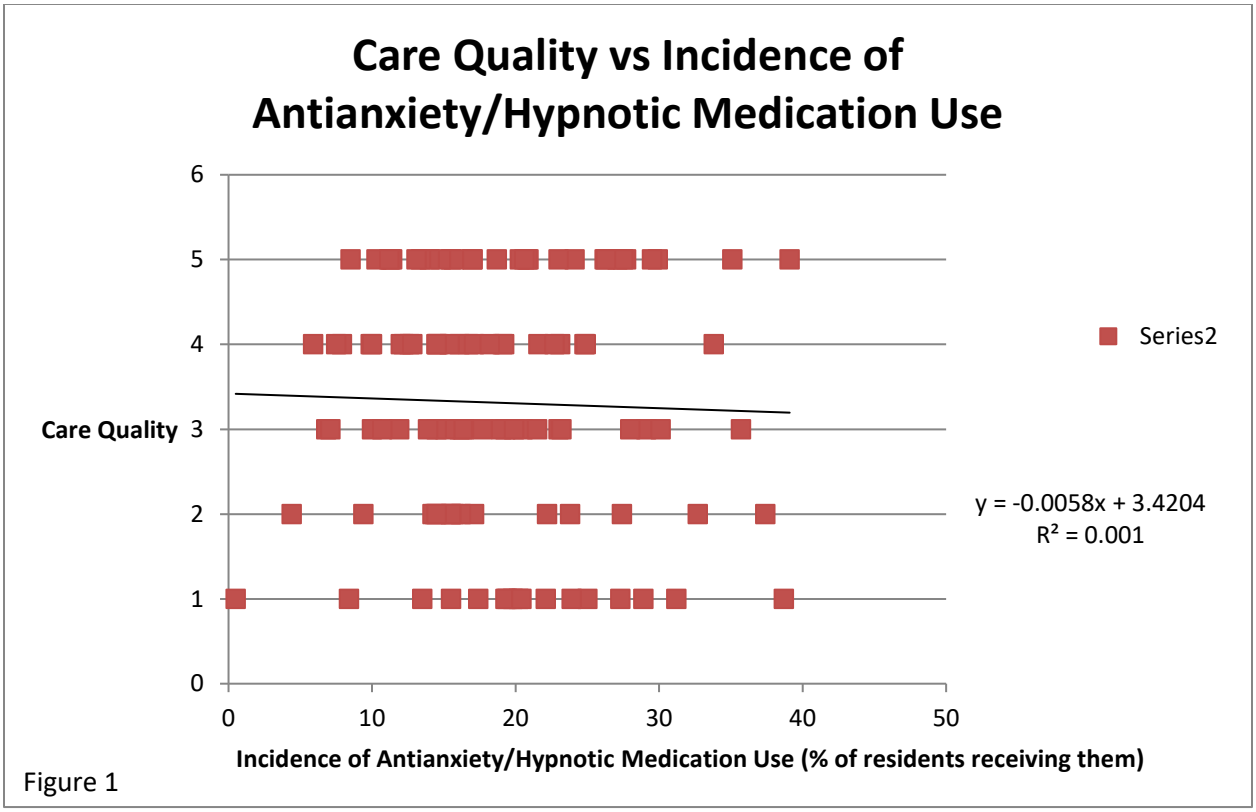

Figure 1

With a P-value of 0.74 (insignificant) and an unremarkable slope of the regression line, there isn't much to be said for a relationship between care quality and the incidence of antianxiety or hypnotic medication use in nursing homes.

Care Quality vs Incidence of Antipsychotic Medication Use

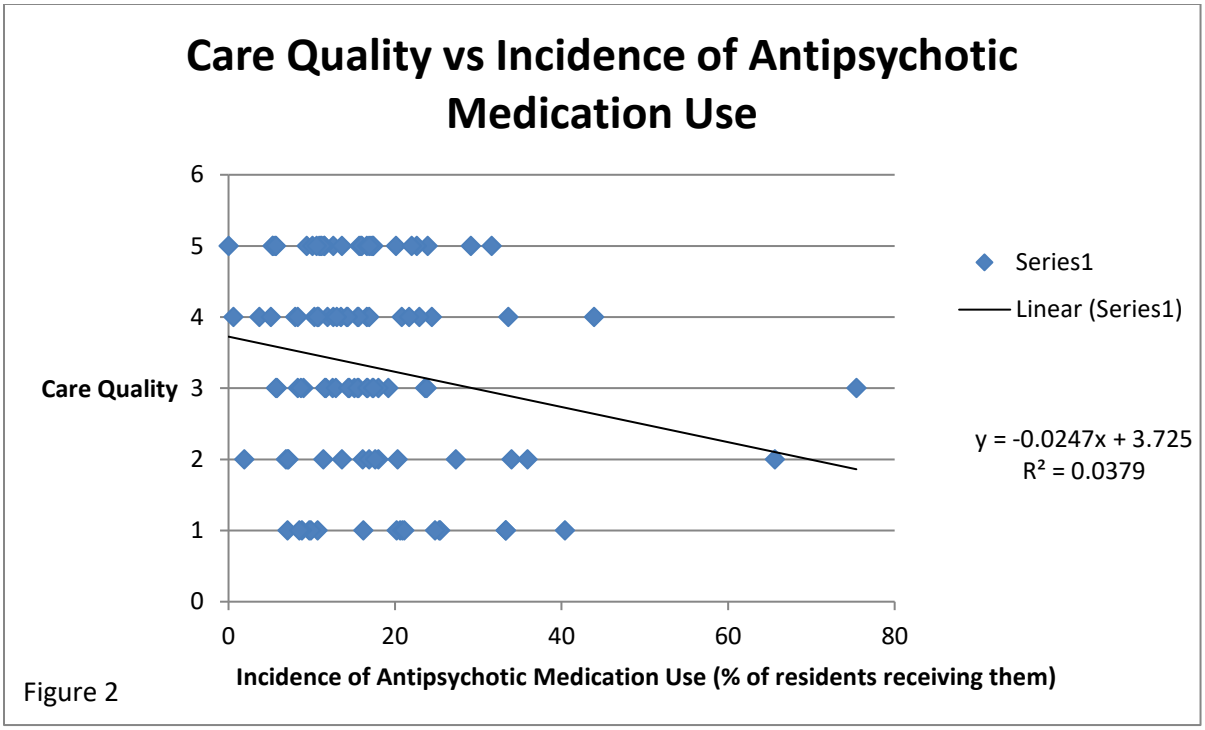

Figure 2

With a P-value of 0.04 and a steep slope, it's safe to say there is a significant inverse relationship between care quality and the incidence of antipsychotic medication use. In other words, higher rates of antipsychotic medications are associated with lower care quality.

RN + LPN Staffing vs Care Quality

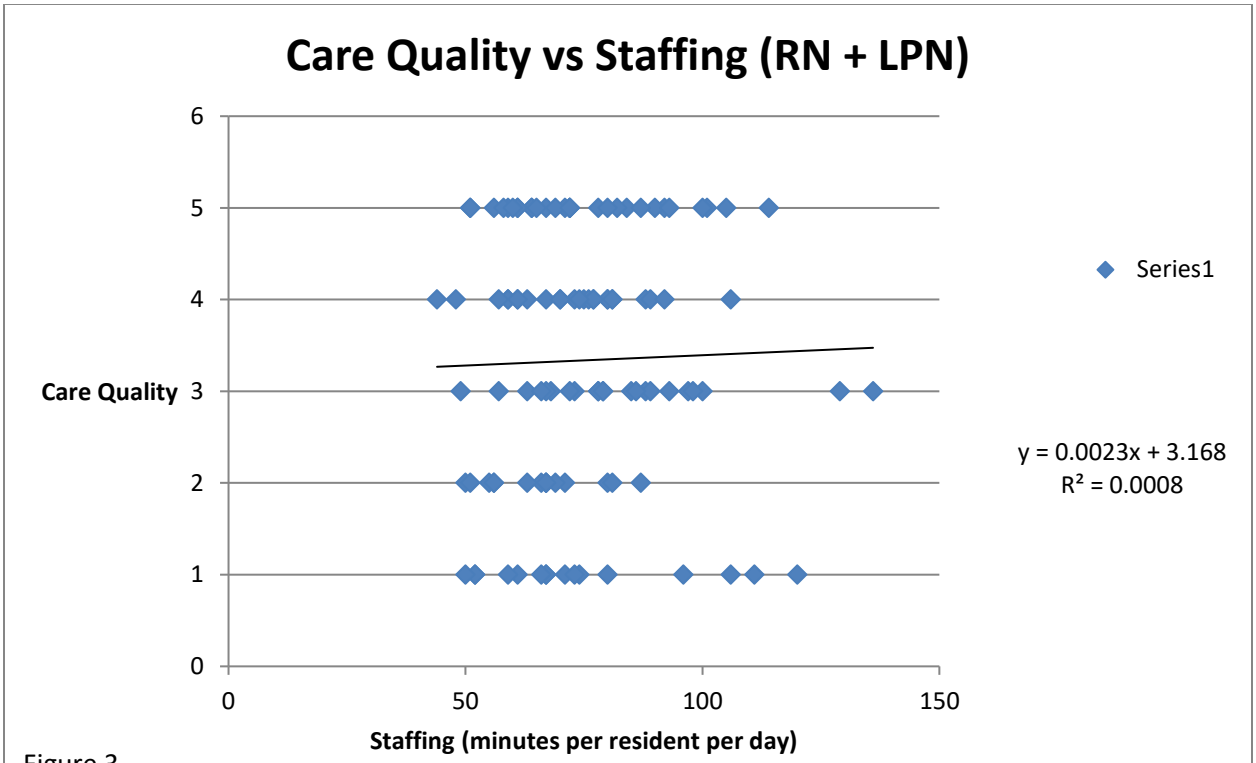

Figure 3

A P-value of 0.43 and a gentle slope confirm the lack of relationship between care quality and total nursing staff hours. This measure combines the man-hours worked by both RNs and LPNs before dividing by the number of residents.

RN Staffing vs Care Quality

Figure 4

When RN man hours alone are measured and compared to care quality, the relationship becomes much stronger. Overall care quality improves by one point for each 45 minutes logged by RNs. The P-value is 0.009, indicating a significant relationship.

LPN Staffing vs Care Quality

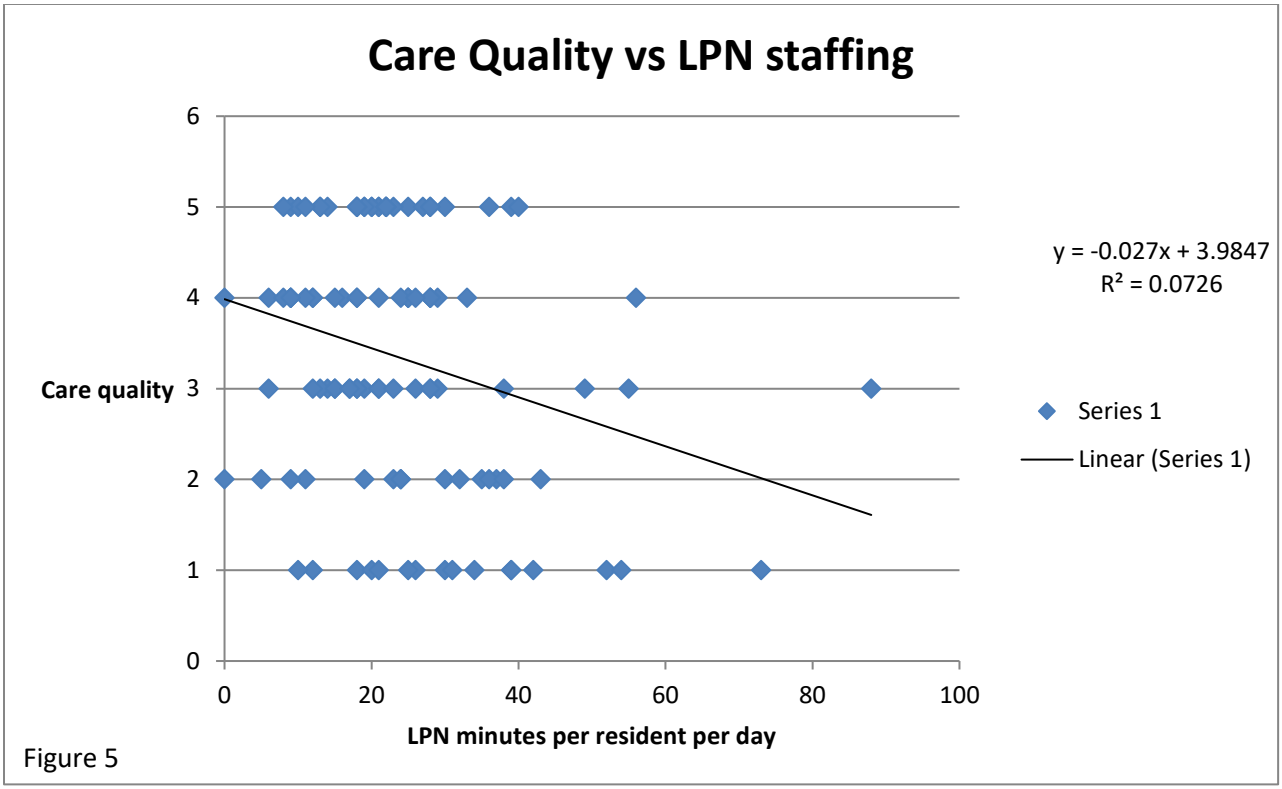

Figure 5

LPN staffing, meanwhile, exhibits a significant (P = 0.005) inverse relationship with care quality. This is confusing in light of Figure 3 which displays a gentle but positive regression slope between care quality and total nursing staff. Determining the relationship between RN staffing and LPN staffing will help clarify these findings.

RN Staffing vs LPN Staffing

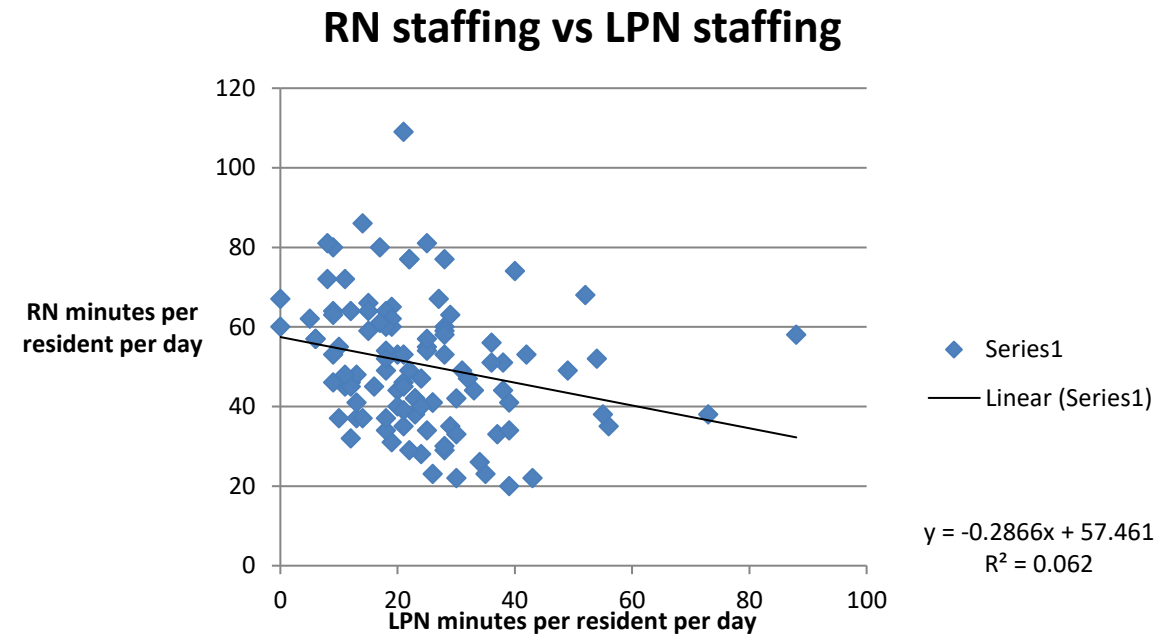

Figure 6

Figure 6 helps to explain the contradicting results from previous staffing measures analyses. There is a significant (P = 0.01) inverse relationship between RN staffing and LPN staffing. So while two given nursing homes may have equal total nursing staff hours, the relative proportions of RNs and LPNs determine the quality of care. A higher proportion of RNs correlate with higher care quality, while a higher portion of LPNs correlate with lower care quality.

Proportion of Staffing by RNs vs Care Quality

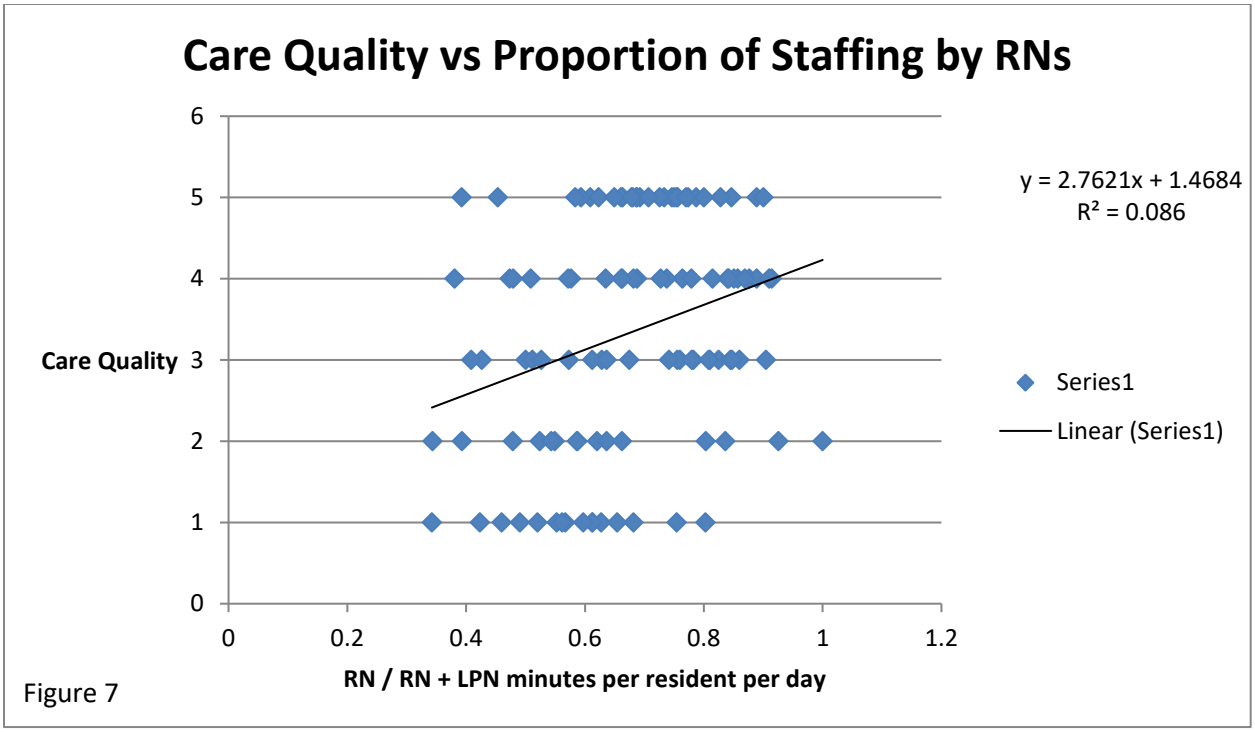

Figure 7

Care quality increases directly with the proportion of nursing hours performed by RNs. A glance at Figure 7 reveals a strong, significant relationship between the two factors (P = 0.002). The average proportion of nursing performed by RNs is visibly higher for all the nursing homes which scored a 4 or 5 for care quality than for those that scored a 1 or 2.

CNA Staffing vs Care Quality

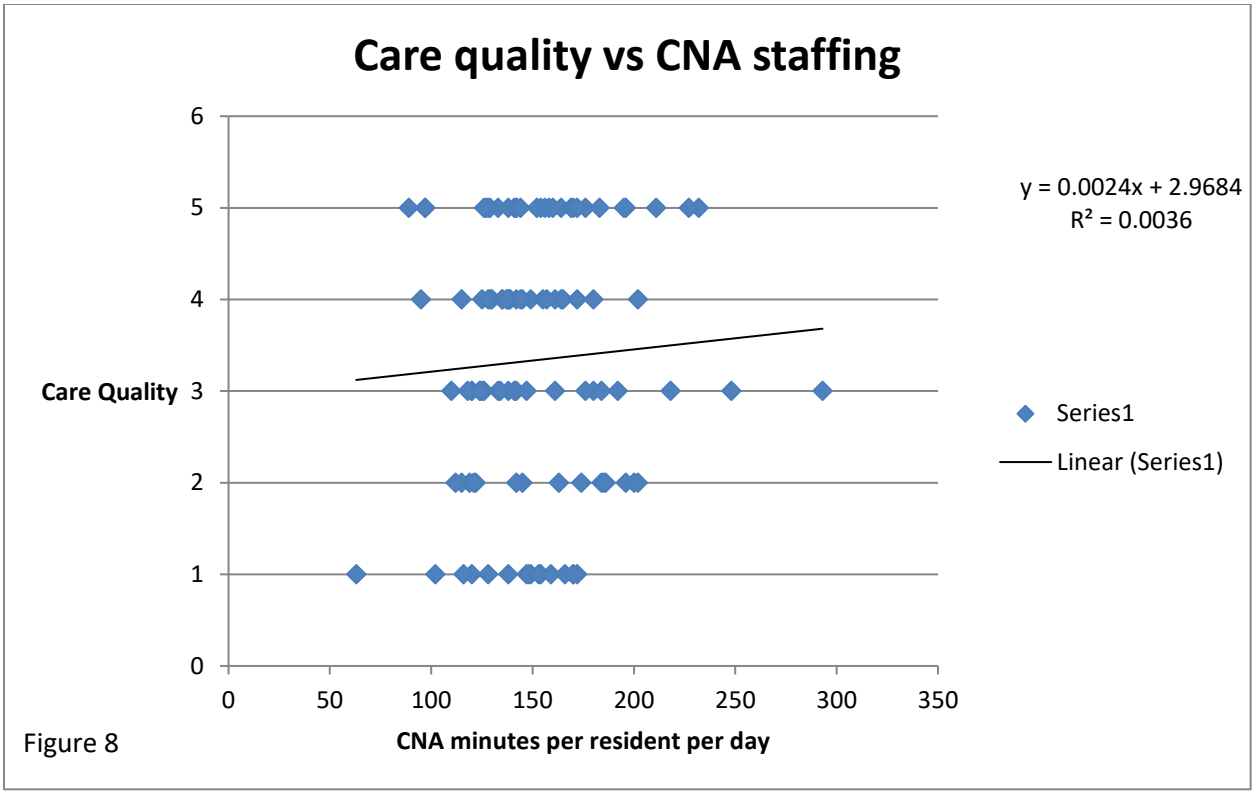

Figure 8

With a P-value of 0.54 and a slope nearing zero (Figure 8), it's safe to say there is no significant relationship between care quality and CNA staffing.

Population vs Care Quality

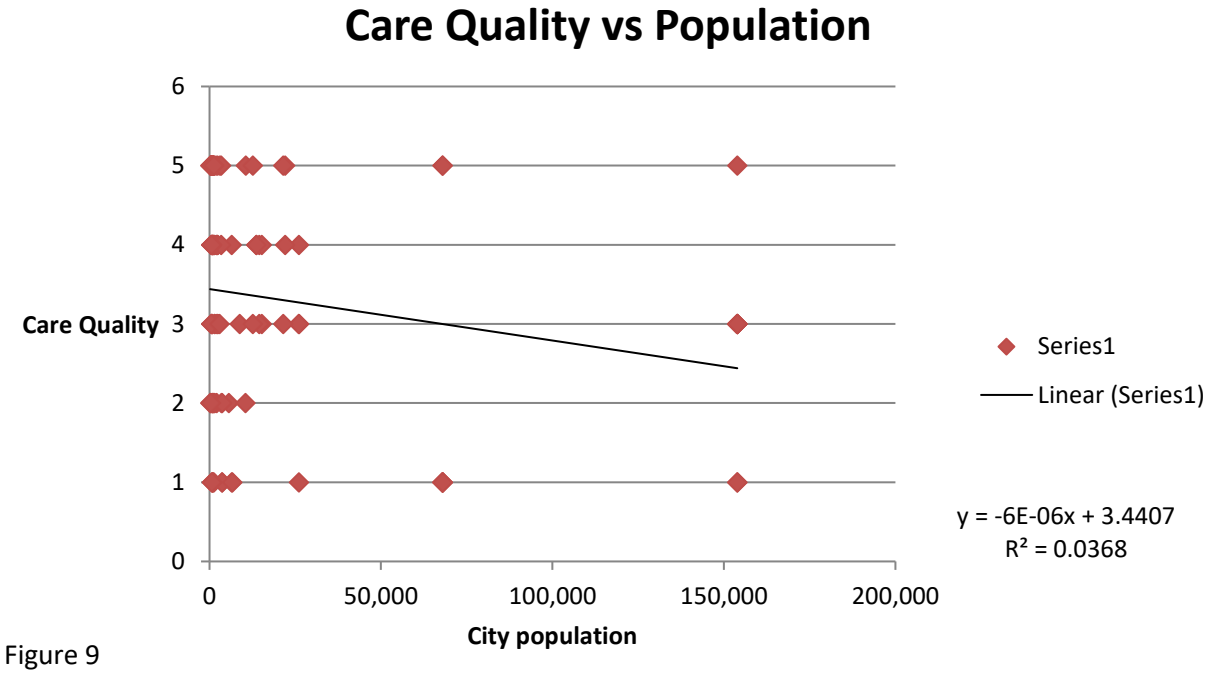

Figure 9

Surprisingly, population was found to have an inverse relationship with care quality, which was the opposite of what was hypothesized based on a review of literature. While the slope of the regression line (Figure 9) isn't terribly steep, the P-value is 0.05, making the results significant. Further analysis of population's relationship with other factors was performed in search of an explanation.

Population (quartiles) vs Quality

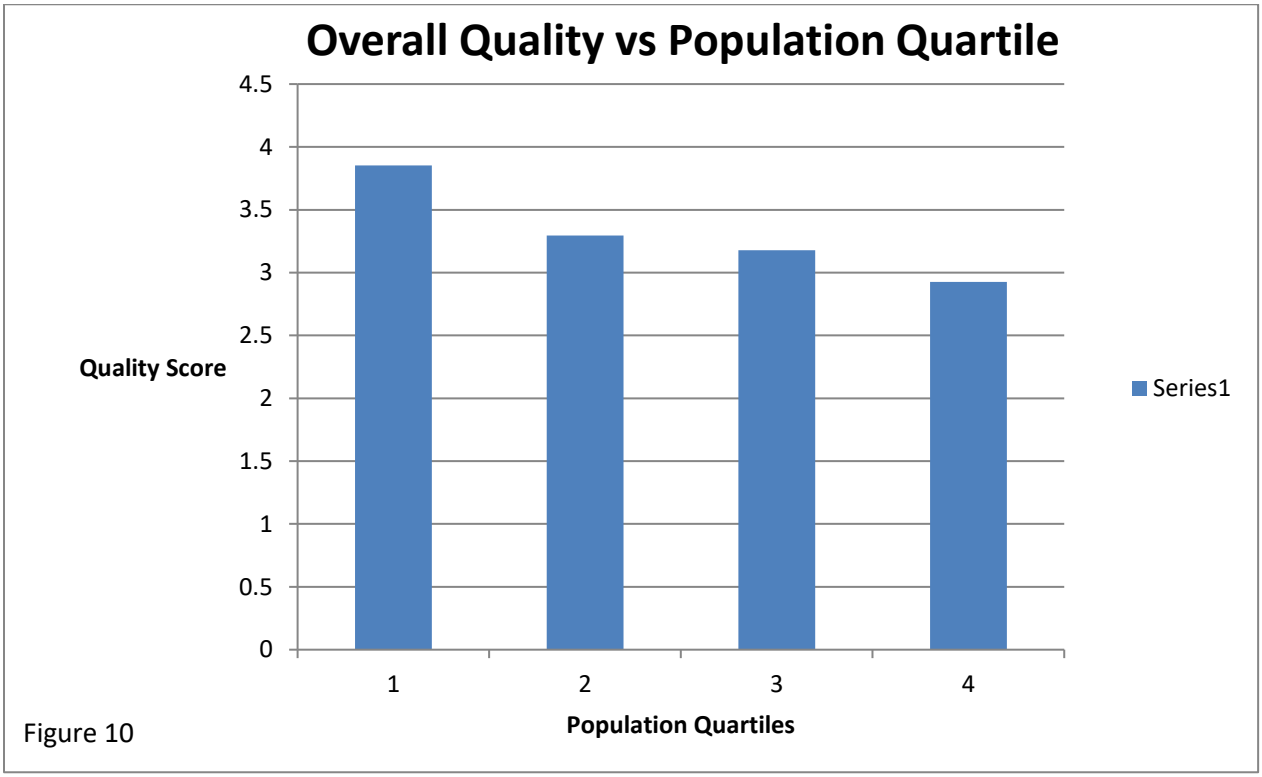

Figure 10

When towns containing nursing homes in South Dakota are broken down into quartiles based on population, the differences between the averages within each quartile are not significant, but intriguing. Again, smaller town nursing homes perform better than those in larger towns in terms of care quality. The population stratification can be seen in Table 10 located in Appendix B.

Population vs Nursing Home Size

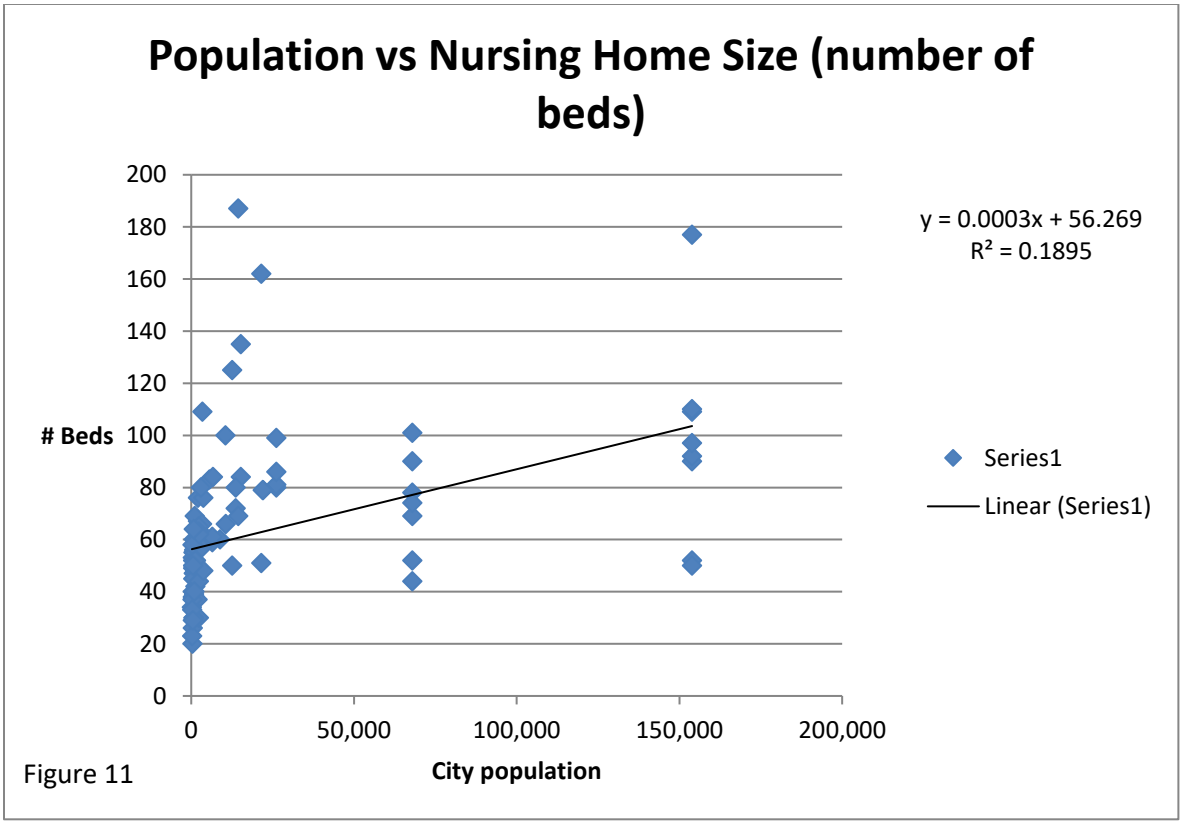

Figure 11

It makes sense that larger towns would have larger nursing homes, so it should come as no surprise that there is a significant (P = 0.000002) positive relationship between population of a town and the number of beds in a nursing home in that town.

Population vs Incidence of Antianxiety and Hypnotic Medication Use

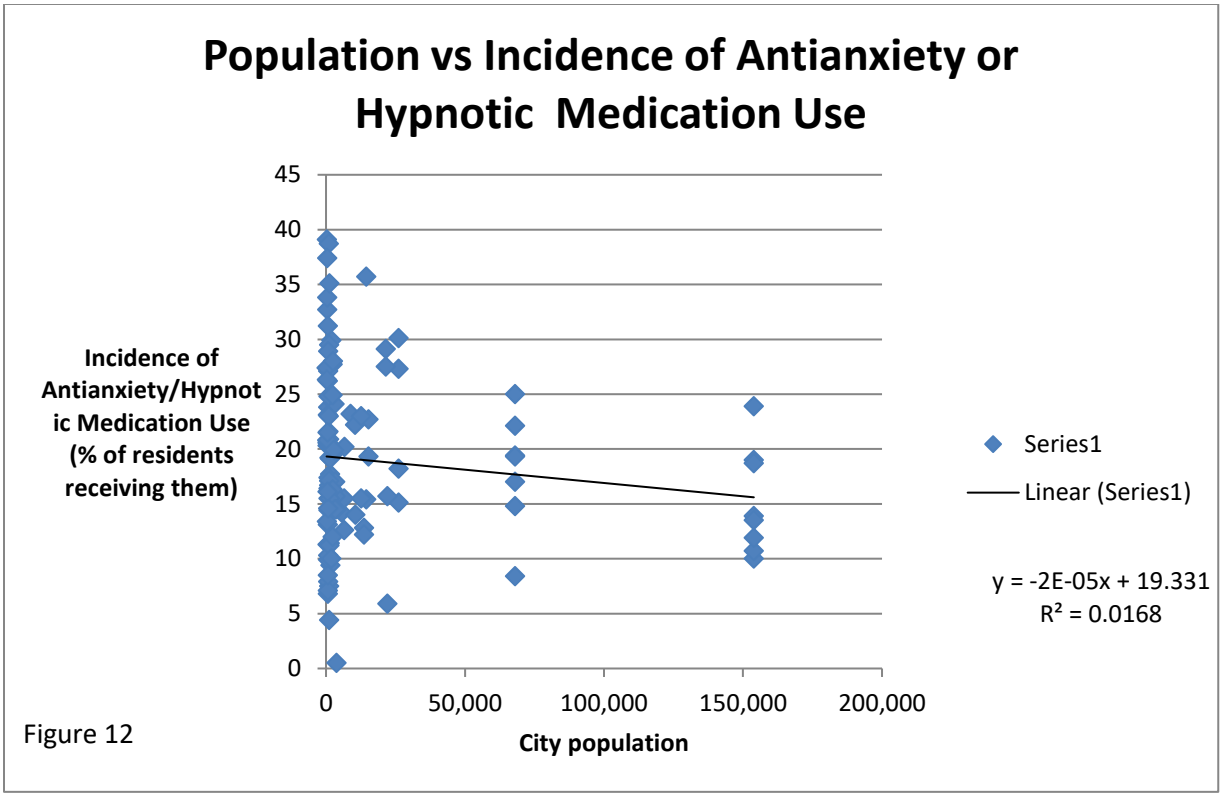

Figure 12

There is no significant relationship between population and the incidence of antianxiety or hypnotic medication use. (P = 0.18)

Population vs Incidence of Antipsychotic Medication Use

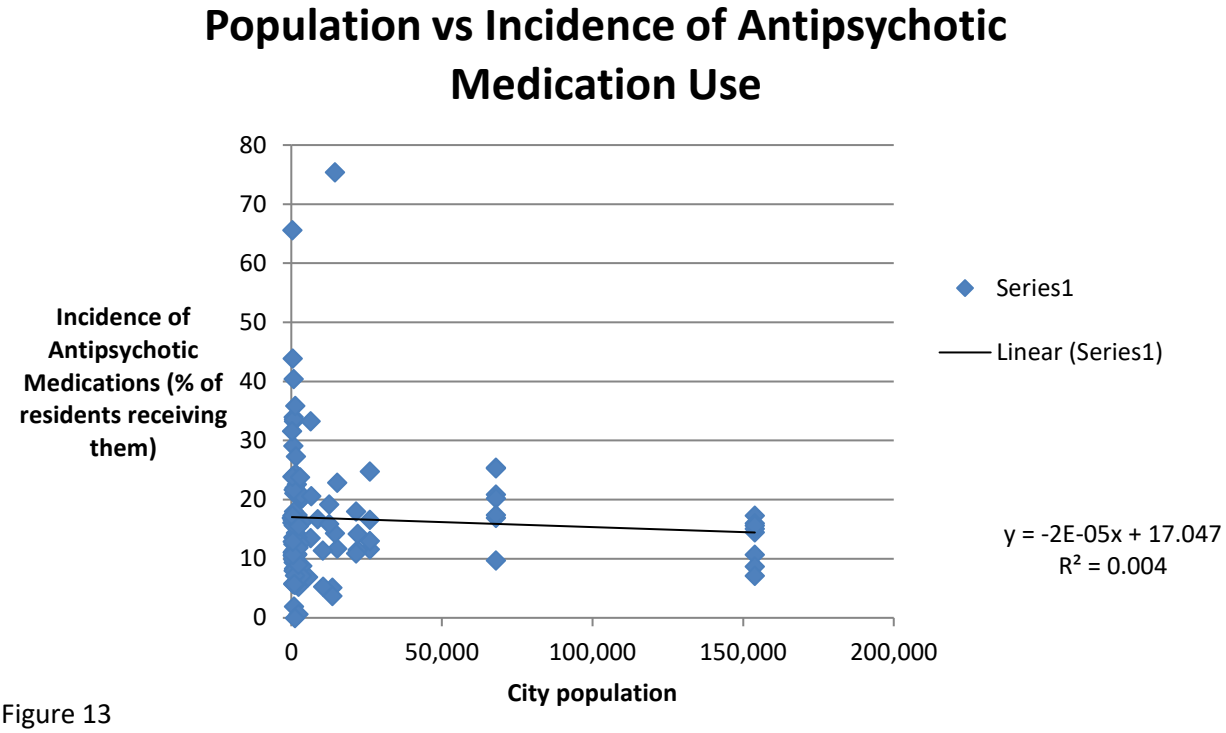

Figure 13

There is no significant relationship between population and the incidence of antipsychotic medication use. (P = 0.51)

Population vs Staffing (RNs + LPNs)

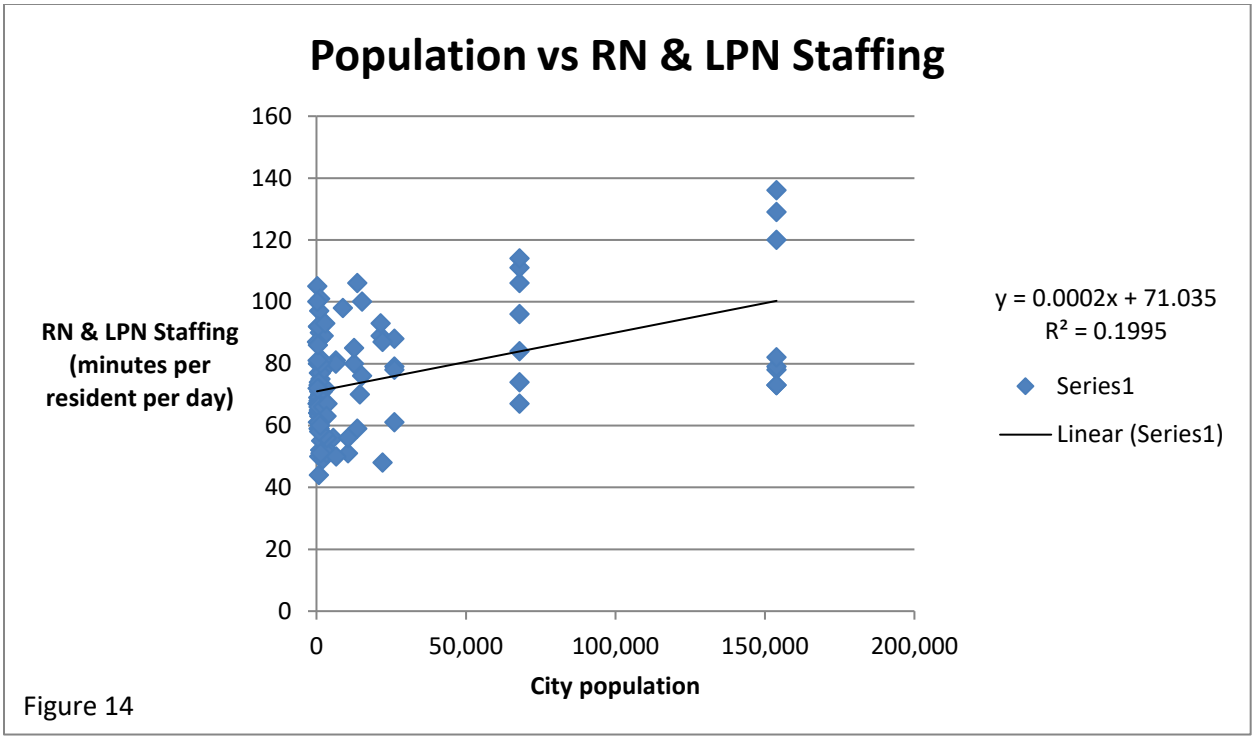

Figure 14

While there is a direct, significant relationship between total nursing staffing and population (P = 0.000002), there is no such relationship between total nursing staffing and care quality (Figure 3). Therefore, total nursing staffing is not a factor contributing to the care quality disparity between rural and urban nursing homes.

Population vs RN Staffing

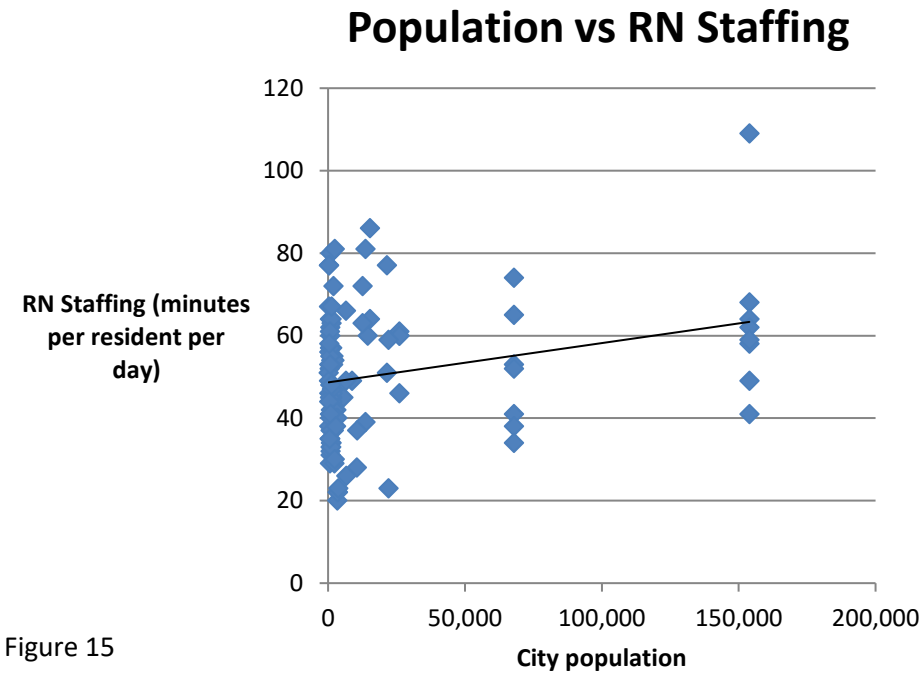

Figure 15

There seems to be a direct, significant relationship between population and RN staffing (P = 0.01). This stands to oppose what we have already seen from the relationship between RN staffing and care quality (Figure 4), which have a direct relationship, and from that between population and care quality (Figure 9), which have an indirect relationship. Something other than staffing must be disproportionately affecting the care quality between urban and rural SD nursing homes.

Population vs LPN Staffing

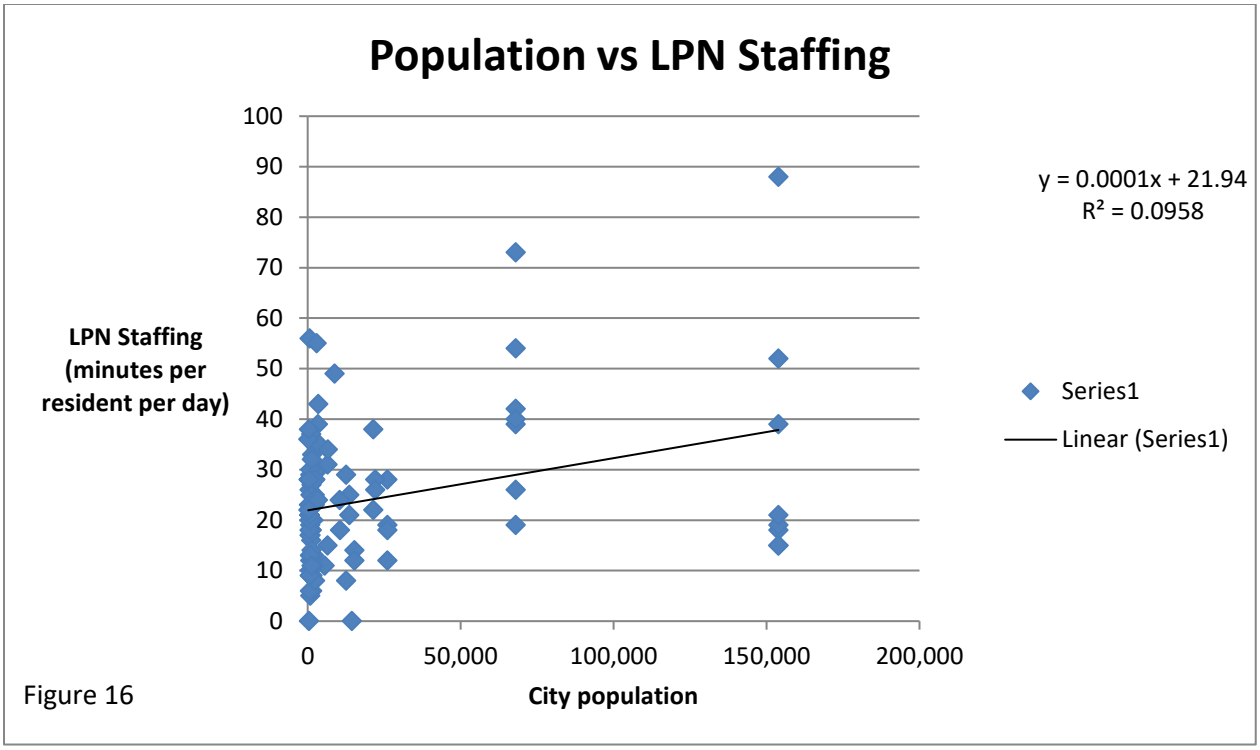

Figure 16

LPN staffing increases along with population, exhibiting a significant relationship (P = 0.001). This aligns with what we already know about the relationships between LPN staffing and care quality (Figure 5), and population and care quality (Figure 9), respectively, but in light of the contradictory relationships between RN staffing, population, and care quality, the results are called into question. The proportion of staffing performed by RNs can make interpretation of the results easier.

Population vs Proportion of Staffing by RNs

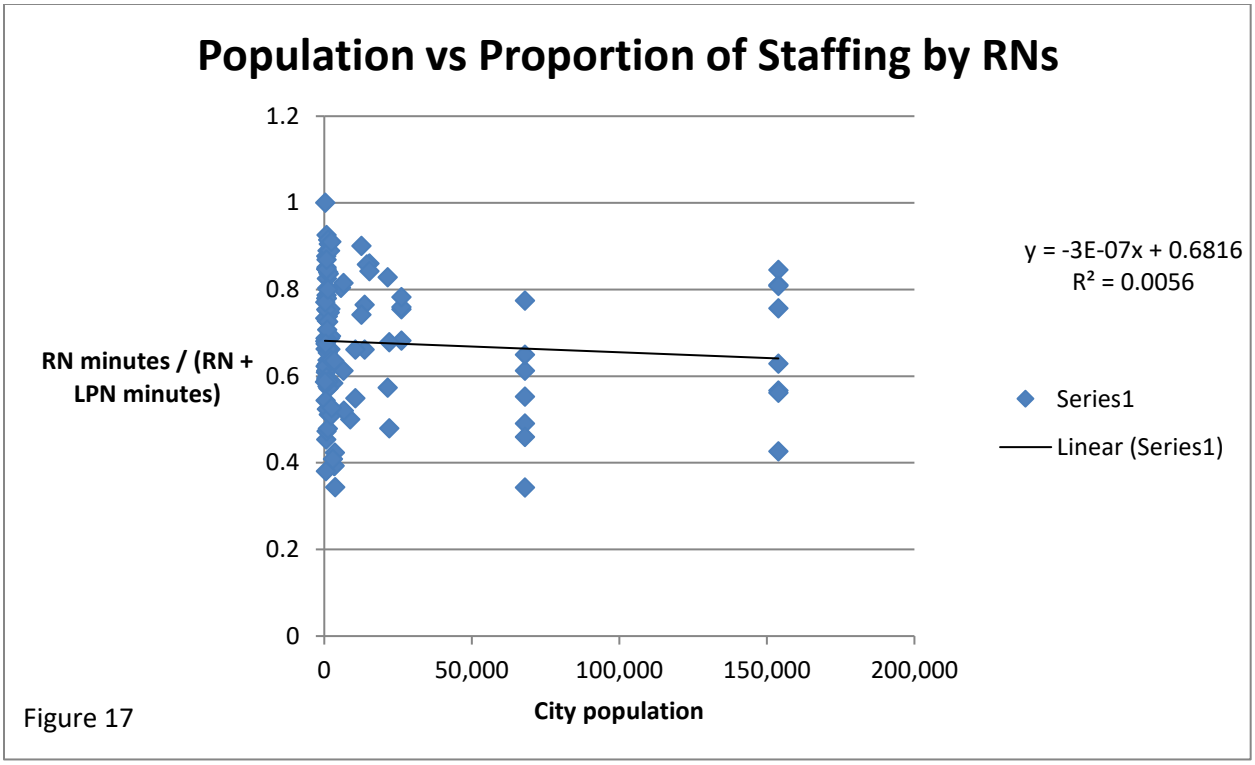

Figure 17

With a P-value of 0.44, there is no significant relationship between the proportion of staffing performed by RNs and population, so no explanation for the relationship between population and care quality can be drawn from staffing measures.

Population vs CNA Staffing

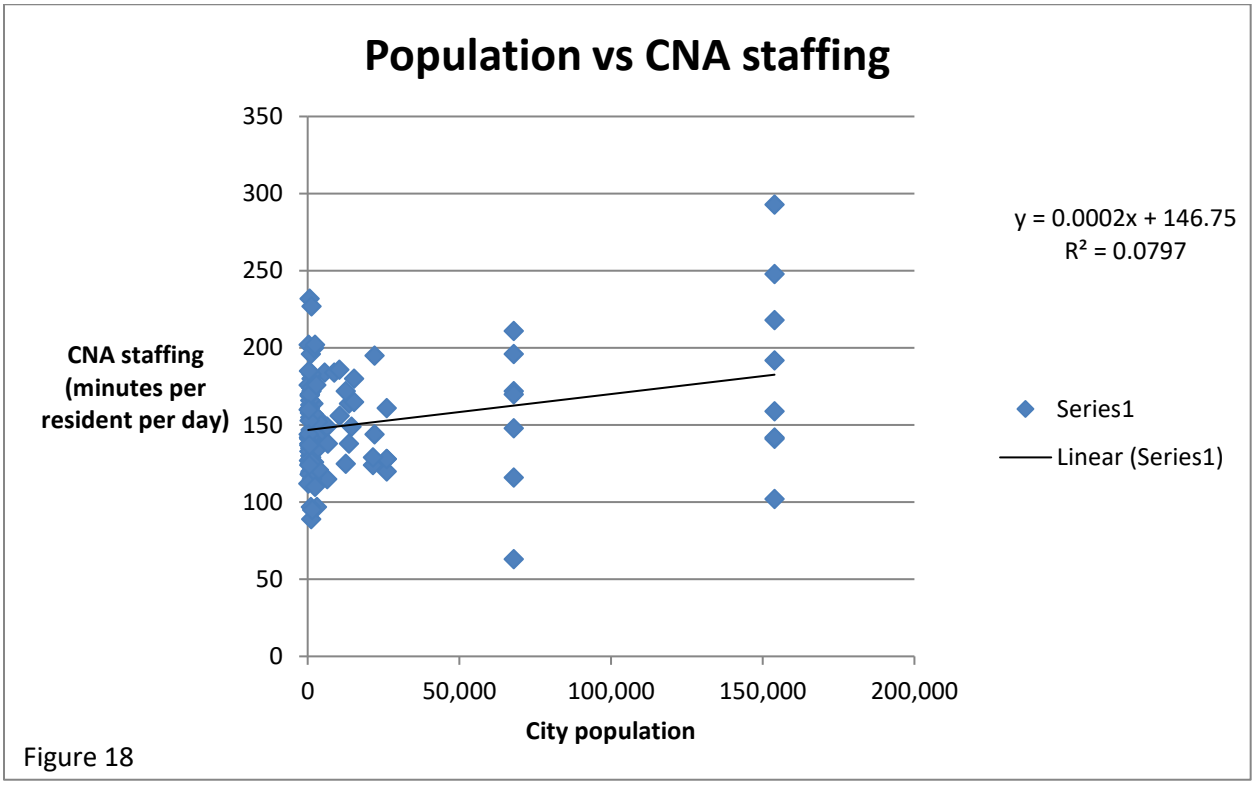

Figure 18

The relationship between population and CNA staffing is direct and significant (P = 0.003), but there is no relationship between CNA staffing and care quality, so these results are unremarkable.

Nursing Home Size vs Care Quality

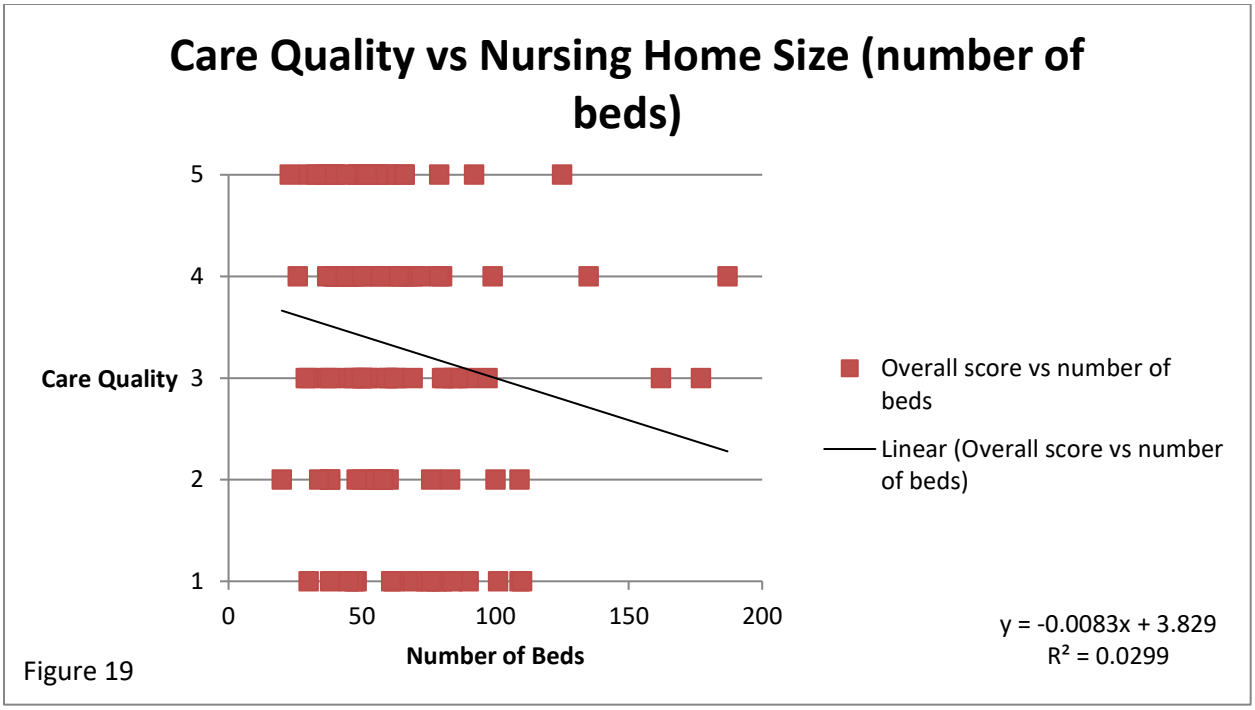

Figure 19

A glance at figure 19 reveals a visible difference between in quality between small and large nursing homes. While we must reject the significance of this relationship ($P = 0.07$) owing to the arbitrary $P < 0.05$ cutoff, the number of beds remains the most likely candidate for explanation of the discrepancy in care quality between urban and rural nursing homes.

Nursing Home Size vs Staffing (RNs + LPNs)

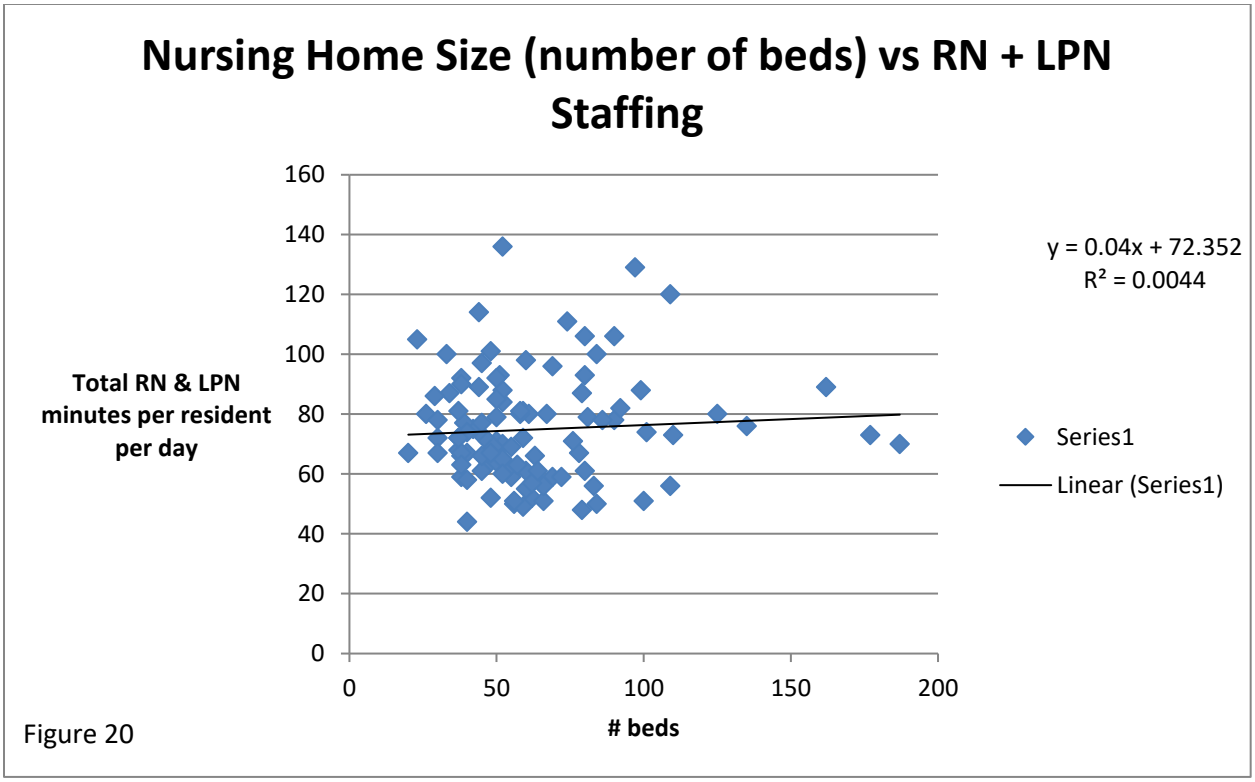

Figure 20

With a P-value of 0.89 and a near-zero slope of the regression line, it's clear that there is no relationship between the size of a nursing home and the staffing levels. Larger nursing homes have more staff than smaller ones so that when staffing is calculated by dividing out the total man hours by the number of residents, staffing measures are roughly equal in all sized nursing homes.

Nursing Home Size vs RN Staffing

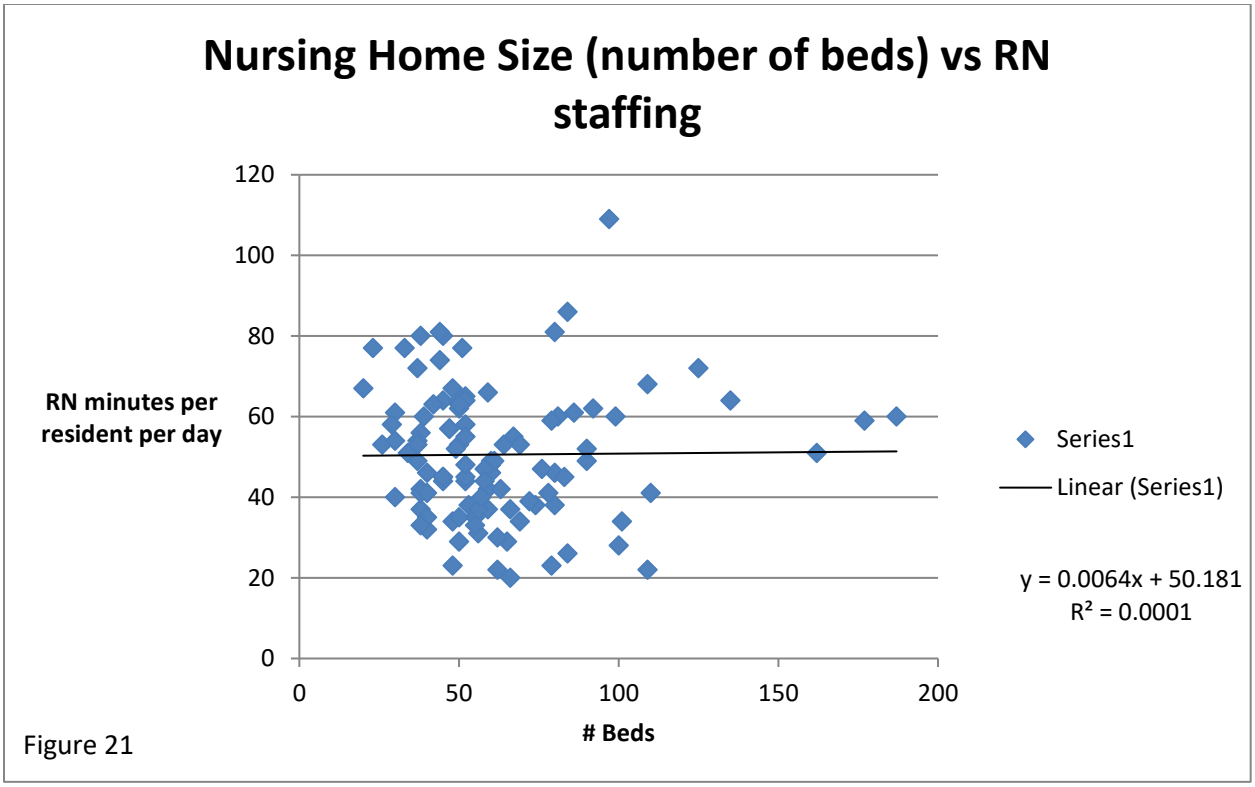

Figure 21

When viewed alone, RN staffing levels exhibit a similar relationship with nursing home size to that of overall nurse staffing levels, which is to say none at all. With a P-value of 0.94 and an extremely flat regression slope, the results of this analysis are completely unremarkable.

Nursing Home Size vs LPN Staffing

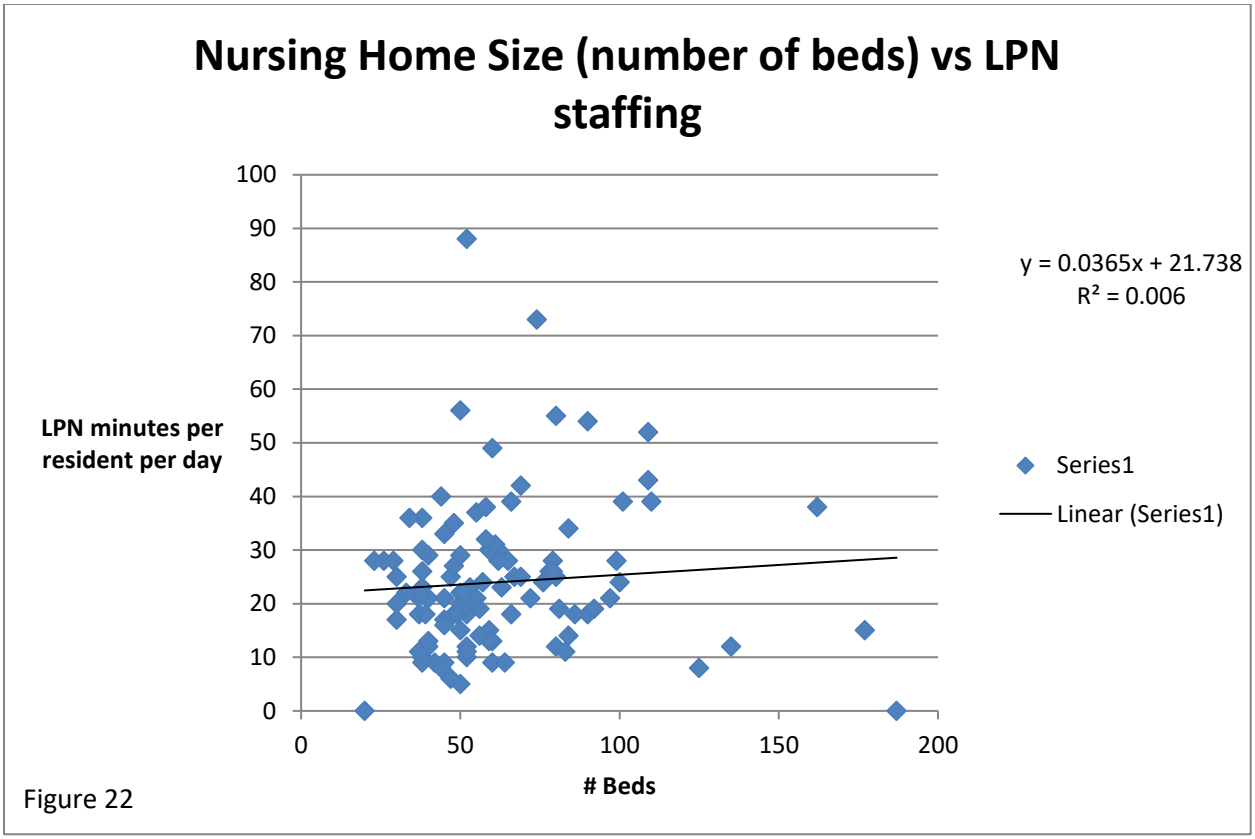

Figure 22

Similar to both total nursing staff hours and RN specific hours, LPN specific hours show no semblance of a relationship with the size of the nursing home as determined by the number of beds. P = 0.43 and the slope of the regression line indicates that LPNs log only about 4 more minutes per resident per day for every 100 beds; a marginal difference.

Nursing Home Size vs Proportion of Staffing by RNs

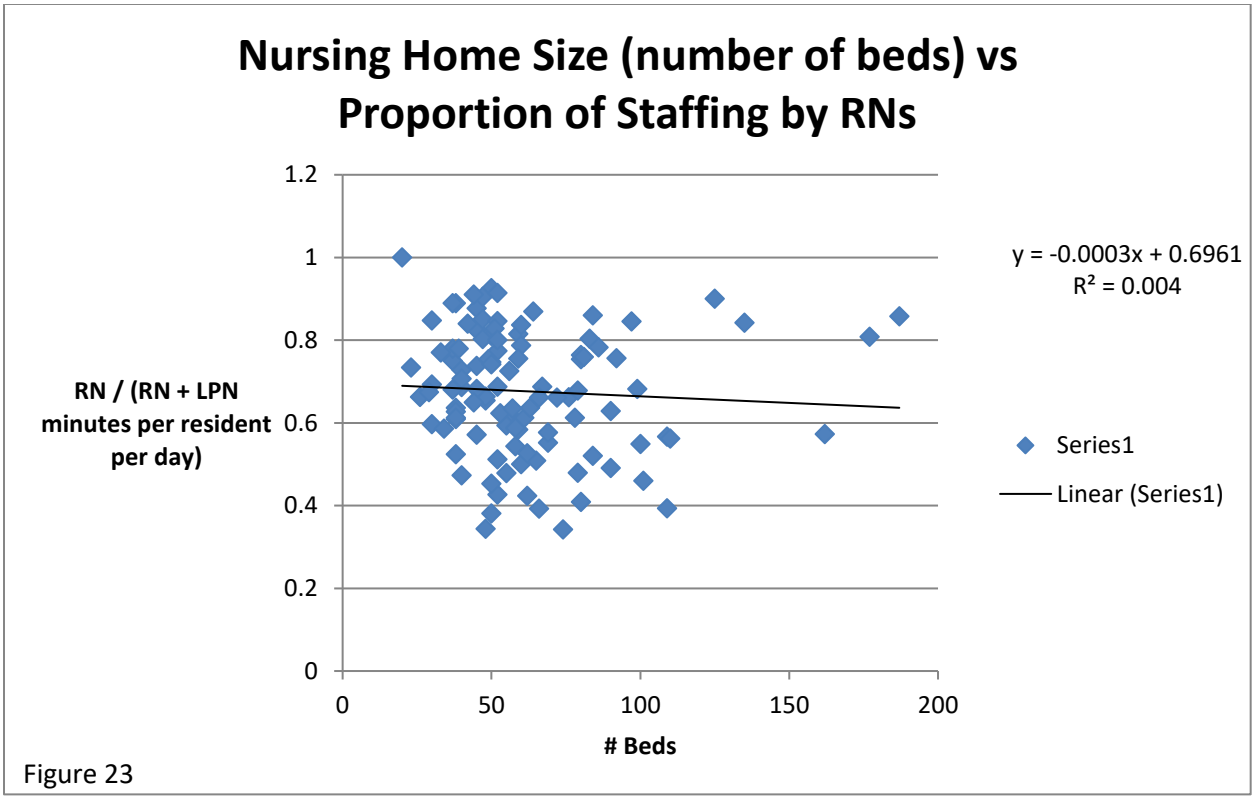

Figure 23

In light of the weak relationships between nursing home size and every staffing measure analyzed thus far, it should come as no surprise that the size of the nursing home carries no weight with regard to the proportion of staffing performed by RNs either. A P-value of 0.52 and a nearly horizontal regression slope demonstrate this.

Nursing Home Size vs CNA Staffing

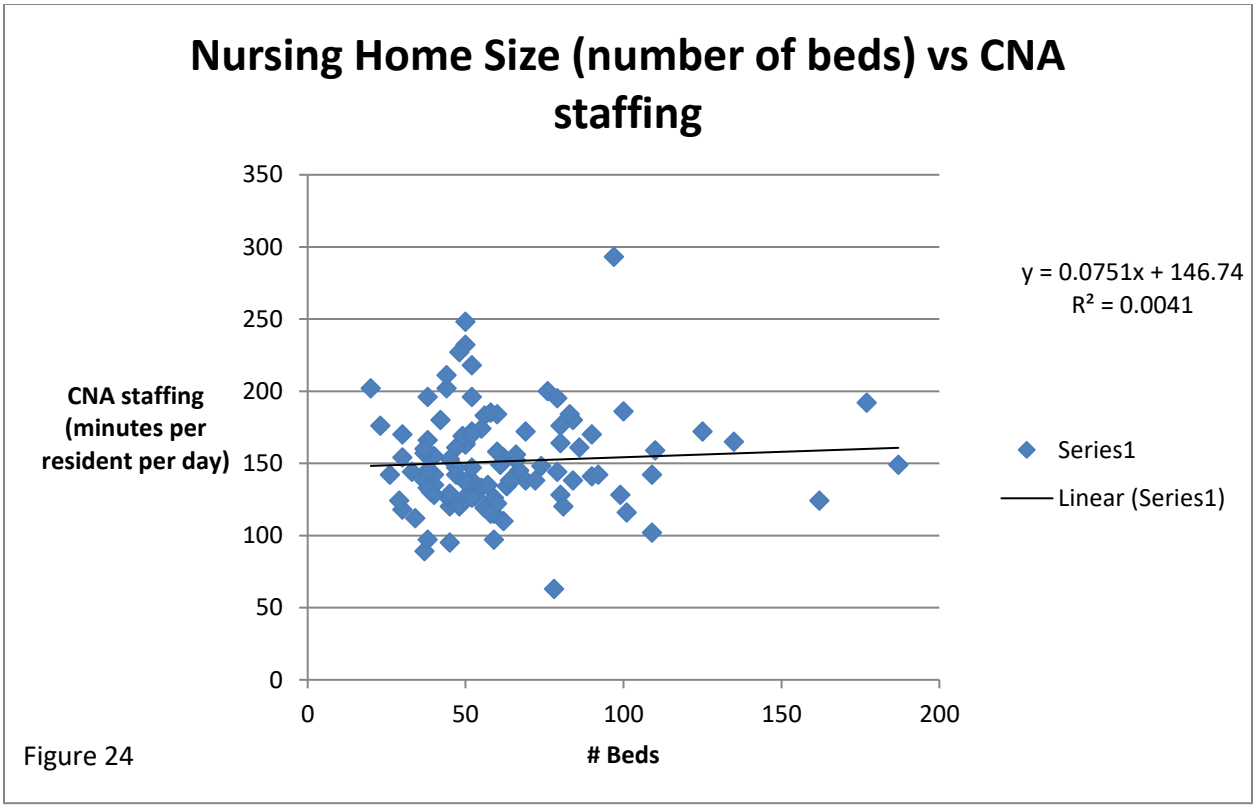

Figure 24

CNAs work 7-8 minutes more per resident per day for every 100 beds in a nursing home.

When viewed graphically, it's easy to see why this result is insignificant. (P = 0.51)

Discussion

Conclusions

When reviewing the results of the regression analysis, most of the relationships between different factors affecting care quality in nursing homes are pretty straightforward and make sense. For example, fewer antipsychotic medications, more educated staff, and smaller, more individualized nursing homes all result in better care quality. But one surprising factor is population, which exhibited an inverse correlation with care quality; nursing homes in more populous areas have lower quality of care when compared to their more rural counterparts. Following the order in which the data were analyzed, the results will now be examined for the purpose of drawing conclusions.

The first factor to be tested for a relationship with care quality was the incidence of antianxiety and hypnotic medication use. The incidence of use of this class of drugs was found to have no significant relationship with the quality of care received in nursing homes, or with the population of the town in which the nursing home was found. A different class of drug, antipsychotics, is an entirely separate measure, one that is found to have a significant inverse relationship with care quality. This means that lower rates of antipsychotic medication use in nursing homes correlate with better care quality. Unfortunately, there is no relationship between antipsychotic use and population, so the population anomaly cannot be explained by differential drug therapies.

At first glance, the amount of nursing staff appears to have no connection to the quality of care received by the residents of a nursing home. However, when dissected further, it becomes apparent that the level of education of the nursing staff does play a significant role in care quality. Staffing hours for RNs specifically have a significant

direct relationship with care quality; more time logged by RNs correlates with better quality of care. The opposite is true for LPNs; more time logged by this class of nurses correlates significantly with lower quality of care. This phenomenon is summarized nicely by a regression analysis of the relationship between care quality and the proportion of total nurse staffing performed by RNs. As the proportion of work done by RNs increases, so too does the quality of care. Meanwhile, CNA staffing levels appear to have no effect on care quality.

Population is the most interesting result from the data analysis, exhibiting a significant indirect relationship with care quality. Care quality was expected to increase with population for reasons such as availability of auxiliary services; instead care quality has been shown to decrease with increasing population. For this reason, every other factor tested against care quality was tested against population as well, and the results are telling. Neither incidence of antianxiety and hypnotic drug use nor incidence of antipsychotic drug use was shown to correlate with population. As far as staffing measures are concerned, population exhibited a direct and significant relationship with every category of staffing (RN + LPN, RN only, LPN only, CNA), meaning that as population increases, staffing levels increase across the board as well. The problem is that the increased levels of both RN specific and LPN specific staffing measures contradict each other. While increased levels of RN staffing should theoretically confer increased care quality, increased levels of LPN staffing should confer decreased care quality. Whether RNs or LPNs have a stronger effect on the relationship between care quality and population is impossible to determine from this data, especially considering that the

proportion of total nurse staffing performed by RNs does not exhibit a significant relationship with population.

The dark horse candidate for explanatory variable as it relates to population and care quality is the size of a nursing home which is measured by the number of beds. Nursing home size has been shown to have a direct, significant relationship with the population of the city or town in which the nursing home is found. In other words, larger nursing homes exist in more populated areas. Nursing home size has also been shown to have an indirect relationship with care quality, the significance of which is up for debate. The P-value of this relationship is 0.07, meaning there is a 7% chance of achieving the data set under the assumption of no relationship between care quality and nursing home size. For the purposes of this study, each potential relationship has been determined to be significant or not based on the traditional cutoff of $P < 0.05$. Of the relationships deemed insignificant, the next closest one to achieving significance was that between population and incidence of antianxiety/hypnotic drug use ($P = .18$) and beyond that the relationship between total nurse staffing and care quality ($P = .43$). It seems that the relationship between nursing home size and care quality is worth considering. The differential nursing home size is the most likely explanation for the disparity in quality of care between rural and urban nursing homes in South Dakota.

Critics of this theory will be quick to point out that staffing rates, even when adjusted for the number of residents in a nursing home, increase directly with population. However, that argument assumes that staffing measures are the only factor affected by nursing home size, and fails to account for other logistical factors which could make it harder for larger nursing homes to maintain a high standard of care. For example, along

with a larger nursing home comes a potentially larger physical separation between an individual resident and the nearest staff member. Additionally, with larger nursing homes come more complicated, hierarchal systems of command and communication between staff members. Factors like these can lead to confusion and allow important information pertaining to resident care to get lost in the shuffle. Additionally, there may be other intangible factors contributing to the results observed. The familiarity and relationship history between staff and residents is difficult to quantify, but it is reasonable to believe that staff and residents in smaller, more rural nursing homes are more intimately connected than their larger urban counterparts, which could understandably lead to higher care quality received.

Limitations

The design of this study is an observational one rather than an experimental one. With this in mind it is important to remember the conclusions that can be made from each. Whereas with experimental design studies the researcher has the power to control treatment groups, usually randomizing them and including a simultaneous control group, the observational design limits the power of researchers to control these variables. The inability to control them limits the scope of what may be concluded from an observational study. Observational studies like this one allow researchers to draw associations between different factors, but do not allow researchers to conclude reasons for those associations; correlation is not causation. As such, this serves as a reminder that this study assumes no specific reasons for associations between factors; it simply seeks to point out associations and potentially influential factors.

Another important limitation of this study that must be acknowledged is its scope. The data analyzed for this study came completely from nursing homes within the state of South Dakota; as such the results of the study are specific to South Dakota only and should not be extrapolated to represent nursing home care quality trends from other areas. South Dakota is unique in its population stratification, which has undoubtedly influenced the relationship between population and care quality; this fact should not be overlooked when considering the results and conclusions of this study.

Implications and Recommendations

As a result of this study, more information is now known about some important factors which affect the quality of care received by residents in South Dakota nursing homes. The research, however, was not exhaustive; there are more factors to analyze and relationships to be studied. Specific areas of research interest include a more in-depth analysis of population and nursing home size and how they relate to various other quality measures, as well as how a nursing home's for profit or nonprofit status relates to other factors. Other potentially influential factors which have yet to be analyzed for their effects on care quality include; health inspections, fire/safety inspections, various penalties and fines, fall rates, infection rates, rates of residents experiencing pain, incidence of pressure ulcers, incontinence rates, physical restraints, level of resident independence, weight loss rates, depression rates, vaccination rates, discharge rates, outpatient/ER visits, and re-hospitalization rates.

Clearly there is much more to care quality for South Dakotan nursing homes than meets the eye. The purpose of this study was to shine a light on some of the more prominent factors affecting care quality in South Dakota nursing homes, and has

demonstrated the relationships between care quality and several population factors, staffing measures, facility size, and the incidence of certain classes of drug use. If the results of this project could help to educate and inform families who find themselves confronted with the tough decision to place a loved one in a nursing home, then it will have served its purpose. This study has the potential to reverse the stigma that larger nursing homes in more urban areas give better care to their residents, allowing peace of mind for rural South Dakotan families who wish to keep their loved ones close to home.

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Appendix A

List of South Dakota Nursing Homes in Alphabetical Order

Name of Facility	City	Care Quality
Aberdeen Health & Rehab	Aberdeen	1
Alcester Care & Rehab Center	Alcester	2
Arlington Care & Rehab Center	Arlington	3
Armour Care & Rehab Center	Armour	4
Aurora Brule Nursing Home	White Lake	2
Avera Bormann Manor	Parkston	3
Avera Brady Health & Rehab	Mitchell	3
Avera Eureka Health Care Center	Eureka	2
Avera Maryhouse Long Term Care	Pierre	4
Avera Mother Joseph Manor Retirement Community	Aberdeen	3
Avera Oahe Manor	Gettysburg	4
Avera Prince of Peace	Sioux Falls	3
Avera Rosebud Country Care Center	Gregory	4
Avera Sister James Yankton Care Center	Yankton	4
Bella Vista Care & Rehab Center	Rapid City	1
Belle Fourche Healthcare Community	Belle Fourche	2
Bennett Country Hospital & Nursing Home	Martin	2
Bethany Home Brandon	Brandon	3
Bethany Home Sioux Falls	Sioux Falls	3
Bethel Lutheran Home	Madison	4
Bethesda Home	Webster	5
Bethesda Home of Aberdeen	Aberdeen	3
Bethesda of Beresford	Beresford	4
Black Hills Care & Rehab Center	Rapid City	1
Bowdle Nursing Home	Bowdle	5
Bryant Parkview Care Center	Bryant	4
Centerville Care & Rehab Center	Centerville	1
Clark Care & Rehab Center	Clark	5
Clarkson Health Care	Rapid City	5
Covington Care & Rehab Center	Sioux Falls	1
Custer Regional Senior Care	Custer	2
David M Dorset Healthcare Community	Spearfish	2
Dells Nursing & Rehab Center	Dell Rapids	1
Diamond Care Center	Bridgewater	5
Dow Rummel Village	Sioux Falls	3

Eastern Star Home of SD	Redfield	5
Estelline Nursing & Care Center	Estelline	5
Faulkton Senior Living	Faulkton	4
Firesteel Healthcare Community	Mitchell	4
Five Counties Nursing Home	Lemmon	1
Fountain Springs Healthcare	Rapid City	1
Good Samaritan Society Canistota	Canistota	5
Good Samaritan Society Canton	Canton	5
Good Samaritan Society Corsica	Corsica	5
Good Samaritan Society De Smet	De Smet	5
Good Samaritan Society Deuel County	Clear Lake	4
Good Samaritan Society Howard	Howard	4
Good Samaritan Society Lennox	Lennox	3
Good Samaritan Society Luther Manor	Sioux Falls	5
Good Samaritan Society Miller	Miller	3
Good Samaritan Society New Underwood	New Underwood	3
Good Samaritan Society Scotland	Scotland	4
Good Samaritan Society Selby	Selby	5
Good Samaritan Society Sioux Falls Center	Sioux Falls	3
Good Samaritan Society Sioux Falls Village	Sioux Falls	3
Good Samaritan Society Tripp	Tripp	3
Good Samaritan Society Tyndall	Tyndall	4
Good Samaritan Society Wagner	Wagner	2
Groton Care & Rehab Center	Groton	4
Highmore Health	Highmore	4
Hudson Care & Rehab Center	Hudson	5
Ipswich Care & Rehab Center	Ipswich	1
Jenkins Living Center	Watertown	3
Kodaka Nursing Home	Kodaka	3
Lake Andees Senior Living	Lake Andees	2
Lake Norden Care & Rehab Center	Lake Norden	5
Madison Care & Rehab Center	Madison	1
Manorcare Health Services	Aberdeen	4
Meadowbrook Care & Rehab Center	Rapid City	1
Menno-Olivet Care Center	Menno	5
Michael J Fitzmaurice SD Veterans Home	Hot Springs	1
Milbank Care and Rehab Center	Milbank	5
Mobridge Care & Rehab Center	Mobridge	2
Oakview Terrace	Freeman	5
Palisade Healthcare Community	Garretson	2
Phillip Nursing Home	Phillip	1
Pierre Care & Rehab Center	Pierre	4
Pioneer Memorial Nursing Home	Viborg	5

Platte Care Center	Platte	5
Prairie Estates Healthcare Community	Elk Point	4
Prairie Hills Care and Rehab Center	Rapid City	1
Prairie View Healthcare Community	Woonsocket	1
Redfield Care & Rehab Center	Redfield	4
Riverview Healthcare Community	Flandreau	3
Salem Care & Rehab Center	Salem	2
Sanford Care Center Vermillion	Vermillion	5
Sanford Chamberlain Care Center	Chamberlain	4
SD Human Services Center Geriatric Program	Yankton	3
Seven Sisters Living Center	Hot Springs	2
Southridge Healthcare Center	Sioux Falls	1
St Williams Care Center	Milbank	4
Strand-Kjorsvig Community Rest Home	Roslyn	2
Sturgis Regional Senior Care	Sturgis	1
Sun Dial Manor	Bristol	5
Sunquest Healthcare Center	Huron	5
Sunset Manor Avera Health	Irene	2
Tekakwitha Living Center	Sisseton	3
The Neighborhoods @ Brookview	Brookings	5
Tieszen Memorial Home	Marion	4
United Living Community	Brookings	4
Violet Tschetter Memorial Home	Huron	3
Wakonda Heritage Manor	Wakonda	5
Watertown Care & Rehab Center	Watertown	5
Weskota Manor	Wessington Springs	5
Westhills Village Healthcare Facility	Rapid City	5
Wheatcrest Hills Healthcare Community	Britton	5
White River Healthcare Center	White River	4
Wilmot Care Center	Wilmot	3
Winner Regional Healthcare Center	Winner	3
Average		3.31192660

Appendix B

List of Regression Analysis Summary Outputs

Table 1 - Care Quality vs Incidence of Antianxiety/Hypnotic Medications

Regression Statistics	
Multiple R	0.031686107
R Square	0.001004009
Adjusted R Square	-0.008332402
Standard Error	1.411502299
Observations	109

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.214250075	0.214250075	0.107536972	0.743606676
Residual	107	213.1802453	1.992338741		
Total	108	213.3944954			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.420363034	0.357241857	9.574362477	4.6967E-16	2.712172717	4.128553351	2.712172717	4.128553351
incidence of antianx	-0.005752176	0.017540955	-0.327928303	0.743606676	-0.040525074	0.029020722	-0.040525074	0.029020722

Table 2 - Care Quality vs Incidence of Antipsychotic Medications

Regression Statistics	
Multiple R	0.194799819
R Square	0.03794697
Adjusted R Square	0.02895582
Standard Error	1.385157709
Observations	109

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	8.09767441	8.097674	4.22048	0.042375689
Residual	107	205.296821	1.918662		
Total	108	213.3944954			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.725024661	0.240907018	15.4625	4.9E-29	3.247454595	4.20259473	3.247454595	4.202594727
incidence of antipsy	-0.02472011	0.012032879	-2.05438	0.042376	-0.048573893	-0.0008663	-0.04857389	-0.00086634

Table 3 - RN + LPN Staffing vs Care Quality

Regression Statistics	
Multiple R	0.077045287
R Square	0.005935976
Adjusted R Square	-0.0035313
Standard Error	1.402901188
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.234017357	1.234017	0.626999	0.430243334
Residual	105	206.6538331	1.968132		
Total	106	207.8878505			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.900884022	0.566544094	5.120315	1.39E-06	1.77753174	4.024236304	1.77753174	4.024236304
total number of lisce	0.00586896	0.007411866	0.791833	0.430243	-0.008827402	0.020565322	-0.008827402	0.020565322

Table 4 - RN Staffing vs Care Quality

Regression Statistics	
Multiple R	0.249998526
R Square	0.062499263
Adjusted R Square	0.053570685
Standard Error	1.362403384
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	12.99283747	12.99284	6.999912	0.009404008
Residual	105	194.895013	1.856143		
Total	106	207.8878505			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.235919028	0.43631746	5.124523	1.36E-06	1.370782104	3.101055952	1.370782104	3.101055952
X Variable 1	0.021758438	0.008223968	2.645735	0.009404	0.005451828	0.038065047	0.005451828	0.038065047

Table 5 - LPN Staffing vs Care Quality

Regression Statistics	
Multiple R	0.269522627
R Square	0.072642447
Adjusted R Square	0.06381047
Standard Error	1.355013155
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	15.10148206	15.10148	8.224936	0.004994836
Residual	105	192.7863684	1.836061		
Total	106	207.8878505			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.984675092	0.261242594	15.25278	2.18E-28	3.466679286	4.502670898	3.466679286	4.502670898
X Variable 1	-0.026998924	0.00941413	-2.86791	0.004995	-0.045665404	-0.008332444	-0.045665404	-0.008332444

Table 6 - RN Staffing vs LPN Staffing

Regression Statistics	
Multiple R	0.249012874
R Square	0.062007412
Adjusted R Square	0.053074149
Standard Error	15.65774986
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1701.736038	1701.736	6.941183	0.009697533
Residual	105	25742.33873	245.1651		
Total	106	27444.07477			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	57.46062196	3.018768619	19.03446	7.99E-36	51.47496144	63.44628249	51.47496144	63.44628249
X Variable 1	-0.28660434	0.108784248	-2.63461	0.009698	-0.50230341	-0.070905271	-0.50230341	-0.070905271

Table 7 - Proportion of Staffing Performed by RNs vs Care Quality

Regression Statistics	
Multiple R	0.293302661
R Square	0.086026451
Adjusted R Square	0.077321941
Standard Error	1.345199566
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	17.88385392	17.88385	9.882975	0.002169143
Residual	105	190.0039965	1.809562		
Total	106	207.8878505			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.468416741	0.608274694	2.414068	0.017506	0.262320386	2.674513095	0.26232039	2.674513095
X Variable 1	2.762101784	0.878609389	3.14372	0.002169	1.019981667	4.5042219	1.01998167	4.5042219

Table 8 - CNA Staffing vs Care Quality

Regression Statistics	
Multiple R	0.059929176
R Square	0.003591506
Adjusted R Square	-0.005898099
Standard Error	1.404554564
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.746630481	0.74663	0.378467	0.539755655
Residual	105	207.14122	1.972774		
Total	106	207.8878505			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.968448585	0.613399751	4.839338	4.49E-06	1.752190191	4.18470698	1.752190191	4.18470698
X Variable 1	0.002430467	0.003950714	0.615197	0.539756	-0.005403068	0.010264003	-0.005403068	0.010264003

Table 9 - Population vs Care Quality

Regression Statistics	
Multiple R	0.191810008
R Square	0.036791079
Adjusted R Square	0.027789127
Standard Error	1.385989581
Observations	109

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	7.851013754	7.851014	4.087011	0.045710015
Residual	107	205.5434817	1.920967		
Total	108	213.3944954			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.440679162	0.147240028	23.36782	7.88E-44	3.148792978	3.732565345	3.148792978	3.732565345
city population	-6.4997E-06	3.21505E-06	-2.02164	0.04571	-1.28731E-05	-1.26198E-07	-1.28731E-05	-1.262E-07

Table 10 - Population Quartiles vs Care Quality

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*	*Population*
Column 1	27	104	3.851852	1.74643875	183-795
Column 2	27	89	3.296296	1.98575499	807-1,886
Column 3	28	89	3.178571	1.78174603	1,963-13,646
Column 4	27	79	2.925926	2.14814815	14,454-153,888

ANOVA

ource of Variatio	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Group:	12.39846	3	4.132821	2.15897908	0.09726443	2.691133
Within Groups	200.996	105	1.914248			
Total	213.3945	108				

Table 11 - Population vs Number of Beds

Regression Statistics	
Multiple R	0.435353692
R Square	0.189532837
Adjusted R Square	0.181958377
Standard Error	26.48887314
Observations	109

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	17557.38305	17557.38	25.02262	2.23404E-06
Residual	107	75077.66283	701.6604		
Total	108	92635.04587			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	56.2691219	2.814034453	19.99589	6.29E-38	50.6906268	61.84761701	50.6906268	61.84761701
X Variable 1	0.000307367	6.14457E-05	5.002262	2.23E-06	0.000185559	0.000429176	0.000185559	0.000429176

Table 12 - Population vs Incidence of Antianxiety/Hypnotic Medications

Regression Statistics	
Multiple R	0.129773051
R Square	0.016841045
Adjusted R Square	0.007652643
Standard Error	7.71344395
Observations	109

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	109.0500143	109.05	1.832859	0.17864291
Residual	107	6366.202279	59.49722		
Total	108	6475.252294			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	19.33122654	0.819434519	23.59094	3.36E-44	17.70679318	20.9556599	17.70679318	20.9556599
X Variable 1	-2.42237E-05	1.78927E-05	-1.35383	0.178643	-5.9694E-05	1.12465E-05	-5.9694E-05	1.12465E-05

Table 13 - Population vs Incidence of Antipsychotic Medication

Regression Statistics	
Multiple R	0.063465672
R Square	0.004027892
Adjusted R Square	-0.005280259
Standard Error	11.10609493
Observations	109

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	53.37490727	53.37491	0.432727	0.51206643
Residual	107	13197.95188	123.3453		
Total	108	13251.32679			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	17.04671707	1.17985139	14.44819	6.78E-27	14.7077993	19.38563485	14.7077993	19.38563485
X Variable 1	-1.69471E-05	2.57626E-05	-0.65782	0.512066	-6.80185E-05	3.41242E-05	-6.8018E-05	3.41242E-05

Table 14 - Population vs Staffing (RN + LPN)

Regression Statistics	
Multiple R	0.445570299
R Square	0.198532891
Adjusted R Square	0.190899871
Standard Error	16.53665642
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	7112.650494	7112.65	26.00974	1.51462E-06
Residual	105	28713.40558	273.461		
Total	106	35826.05607			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	70.2973186	1.773637948	39.63454	5.54E-65	66.78052219	73.814115	66.7805222	73.81411502
X Variable 1	0.000195788	3.83899E-05	5.099975	1.51E-06	0.000119668	0.00027191	0.00011967	0.000271908

Table 15 - Population vs RN Staffing

Regression Statistics	
Multiple R	0.247803552
R Square	0.0614066
Adjusted R Square	0.052467616
Standard Error	15.66276368
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1685.24733	1685.247	6.869527	0.01006864
Residual	105	25758.82744	245.3222		
Total	106	27444.07477			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	48.6724861	1.679908642	28.97329	6.77E-52	45.34153759	52.0034346	45.3415376	52.00343461
X Variable 1	9.53019E-05	3.63612E-05	2.620978	0.010069	2.32044E-05	0.0001674	2.3204E-05	0.000167399

Table 16 - Population vs LPN Staffing

Regression Statistics	
Multiple R	0.309476216
R Square	0.095775528
Adjusted R Square	0.087163866
Standard Error	13.35693504
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1984.180719	1984.181	11.12161	0.001180029
Residual	105	18732.80994	178.4077		
Total	106	20716.99065			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	21.94016322	1.43259715	15.31496	1.62E-28	19.09958771	24.78073873	19.09958771	24.78073873
X Variable 1	0.000103409	3.10082E-05	3.334908	0.00118	4.19259E-05	0.000164893	4.19259E-05	0.000164893

Table 17 - Population vs Proportion of Staffing Performed by RNs

Regression Statistics	
Multiple R	0.074633584
R Square	0.005570172
Adjusted R Square	-0.003900588
Standard Error	0.148998982
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.013057209	0.013057	0.588144	0.444858611
Residual	105	2.331073137	0.022201		
Total	106	2.344130346			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.681616147	0.015980876	42.65199	3.91E-68	0.649929023	0.713303272	0.649929023	0.713303272
X Variable 1	-2.65274E-07	3.45902E-07	-0.76691	0.444859	-9.5113E-07	4.20585E-07	-9.51134E-07	4.20585E-07

Table 18 - Population vs CNA Staffing

Regression Statistics	
Multiple R	0.28229042
R Square	0.079687881
Adjusted R Square	0.070923004
Standard Error	33.28403649
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	10072.06262	10072.06	9.091728	0.00322018
Residual	105	116321.8439	1107.827		
Total	106	126393.9065			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	146.7492671	3.569877046	41.10765	1.51E-66	139.6708604	153.8276739	139.6708604	153.8276739
X Variable 1	0.000232985	7.72691E-05	3.015249	0.00322	7.97752E-05	0.000386196	7.97752E-05	0.000386196

Table 19 - Number of Beds vs Care Quality

Regression Statistics	
Multiple R	0.172772782
R Square	0.029850434
Adjusted R Square	0.020783616
Standard Error	1.390974166
Observations	109

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6.369918351	6.369918	3.292272	0.07240853
Residual	107	207.0245771	1.934809		
Total	108	213.3944954			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.829021255	0.314590301	12.17145	6.46E-22	3.205382673	4.452659837	3.205382673	4.452659837
number of beds	-0.008292381	0.00457016	-1.81446	0.072409	-0.017352191	0.000767428	-0.017352191	0.000767428

Table 20 - Number of Beds vs RN + LPN Staffing

Regression Statistics	
Multiple R	0.013798902
R Square	0.00019041
Adjusted R Square	-0.009331586
Standard Error	0.149401473
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.000446345	0.000446	0.019997	0.887816904
Residual	105	2.343684001	0.022321		
Total	106	2.344130346			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.684927857	0.062643361	10.93377	4.93E-19	0.560717643	0.809138071	0.560717643	0.809138071
X Variable 1	-0.000115174	0.000814467	-0.14141	0.887817	-0.001730111	0.001499763	-0.001730111	0.001499763

Table 21 - Number of Beds vs RN Staffing

Regression Statistics	
Multiple R	0.011747451
R Square	0.000138003
Adjusted R Square	-0.009384493
Standard Error	16.1658922
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.787353834	3.787354	0.014492	0.904409132
Residual	105	27440.28741	261.3361		
Total	106	27444.07477			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	50.18142545	3.656964503	13.72215	3.66E-25	42.93034038	57.43251052	42.9303404	57.43251052
X Variable 1	0.006402206	0.053181601	0.120384	0.904409	-0.099047085	0.111851497	-0.0990471	0.111851497

Table 22 - Number of Beds vs LPN Staffing

Regression Statistics	
Multiple R	0.077157686
R Square	0.005953308
Adjusted R Square	-0.003513803
Standard Error	14.00464413
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	123.3346353	123.3346	0.628841	0.429568955
Residual	105	20593.65602	196.1301		
Total	106	20716.99065			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	21.73805511	3.168058146	6.861634	4.89E-10	15.45638103	28.01972919	15.45638103	28.01972919
X Variable 1	0.036534592	0.046071654	0.792995	0.429569	-0.054816988	0.127886172	-0.054816988	0.127886172

Table 23 - Number of Beds vs Proportion of Staffing Performed by RNs

Regression Statistics	
Multiple R	0.063122312
R Square	0.003984426
Adjusted R Square	-0.005501436
Standard Error	0.149117733
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.009340015	0.00934	0.420038	0.518332644
Residual	105	2.334790332	0.022236		
Total	106	2.344130346			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.696073443	0.033732642	20.63501	9.79E-39	0.629187845	0.762959041	0.629187845	0.762959041
X Variable 1	-0.000317933	0.000490559	-0.6481	0.518333	-0.00129062	0.000654754	-0.00129062	0.000654754

Table 24 - Number of Beds vs CNA Staffing

Regression Statistics	
Multiple R	0.064186722
R Square	0.004119935
Adjusted R Square	-0.005364637
Standard Error	34.62357741
Observations	107

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	520.7347131	520.7347	0.434383	0.511288977
Residual	105	125873.1718	1198.792		
Total	106	126393.9065			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	146.7442079	7.832366565	18.73562	2.89E-35	131.2140718	162.2743439	131.2140718	162.2743439
X Variable 1	0.075070619	0.113902608	0.659077	0.511289	-0.150777212	0.30091845	-0.150777212	0.30091845