CMS collects staffing data on the following: (a) registered nurses (RNs), (b) licensed practical nurses (LPNs), (c) certified nursing assistants (CNA), and (d) physical therapists (CMS n.d.). The NHC database collects nurse staffing data, which include adjusted total nurse staffing hours per resident per day and the adjusted RN total nurse staffing hours per resident per day. The adjusted total nurse staffing hours per resident per day are calculated by adding CNA, LPN, and RN hours per resident per day, and dividing by the total number of residents. The adjusted total RN hours per resident per day are calculated by dividing the total number of RN hours per day by the total number of residents (CMS n.d.). This chapter investigates the influence of adjusted nurse staffing hours per resident per day and the adjusted RN nurse staffing hours per resident per day on one outcome measure.

The relationship between nurse staffing and quality measures in nursing homes has been studied; a number of those studies have identified a link between staffing and overall quality of care in nursing homes (Wellis 2004), but results appear mixed. A recent systematic review did not find consistent results between nursing staffing and nursing home quality measures (Backhaus et al. 2014). A study from the *Journal of the American Geriatrics Society* found nursing homes with higher CNA hours had lower fall rates (Leland et al. 2012). Results from a prospective cohort study suggested that older residents in nursing homes with no RNs but more nursing assistants were more likely to develop pressure ulcers than those residents in nursing homes where there were nurses, but fewer nursing assistants (Kwong et al. 2009). A systematic review of the literature focusing on total nurse staffing and quality indicators found that while the results for pressure ulcers were mixed (some studies indicating a positive association between total nurse staffing and pressure ulcers, others indicating no association between total nurse staffing and pressure ulcer), the total nurse staffing is more likely to result in better overall outcomes (Spilsbury et al. 2011). In a longitudinal study using MDS and Online Survey Certification and Reporting data, results suggest greater levels of RN intensity, care hours per resident per day, were associated with significantly lower rates of pressure ulcers (Konetzka et al. 2008).

Research Question and Hypothesis

Do nurse staffing rates impact the percentage of high-risk long-stay residents with pressure ulcers in nursing home facilities when compared by organization type and location?

To answer a research question dependent and independent variables need to be defined. Because of the nature of this study, the dependent variable will vary depending upon the specific analysis that is being conducted. For example, we will be conducting statistical analyses where pressure ulcer rates are the dependent variable, but we will also conduct a separate analysis where nurse staffing rates are the dependent variable. Give the complexity of this project, it is important to pay close attention to the hypotheses. In the case of the proposed research question

and similar to the dependent variables, the independent variables of this study will vary depending upon the specific analysis being conduct. The independent variables will include: adjusted nurse staffing hours per day, adjusted RN staffing hours per day, organization type, and the location of the nursing home.

The analysis for answering the proposed research question will have three parts:

1. Compare the percent of high-risk long-stay residents with pressure ulcers between for-profit, nonprofit, and government-owned nursing homes
2. Compare the rates of adjusted nurse staffing hours per resident per day between for-profit, nonprofit, and government-owned nursing homes
3. Determine if there is a correlation between the percent of high-risk long-stay residents with pressure ulcers and adjusted nurse staffing hours per resident per day across for-profit, nonprofit, and government-owned nursing homes

Given the research question, several hypotheses are proposed and will be tested. The hypotheses should be stated as a null (H_0) and alternative (H_A). Since our research question includes more than one independent variable the null and alternative hypotheses are developed using the dependent variable separately with each independent variable. Because the research question is measuring the percentage of high-risk nursing home residents with pressure ulcers and staffing rates for different groups of nursing homes (that is, ownership and location of nursing home), there are more than one set of hypotheses.

Hypotheses

The research question will require more than one hypothesis. The hypotheses will include the following:

$H1_0$: The percentage of high-risk long-stay nursing home residents with pressure ulcers is the same between for-profit, nonprofit, and government nursing homes.

$H1_A$: The percentage of high-risk long-stay nursing home residents with pressure ulcers is not the same between for-profit, nonprofit, and government nursing homes.

$H2_0$: The percentage of high-risk long-stay nursing home residents with pressure ulcers is the same between nursing homes located in hospitals and not in hospitals.

$H2_A$: The percentage of high-risk long-stay nursing home residents with pressure ulcers is not the same between nursing homes located in hospitals and not in hospitals.

$H3_0$: The average adjusted nurse staffing hours per resident per day in nursing homes is the same between for-profit, nonprofit, and government nursing homes.

$H3_A$: The average adjusted nurse staffing hours per resident per day in nursing homes is not the same between for-profit, nonprofit, and government nursing homes.

$H4_0$: The adjusted RN staffing hours per resident per day in nursing homes is the same between forprofit, nonprofit, and government nursing homes.

$H4_A$: The adjusted RN staffing hours per resident per day in nursing homes is not the same between forprofit, nonprofit, and government nursing homes.

$H5_0$: There is no relationship between the percentage of high-risk long-stay nursing home residents with pressure ulcers and adjusted nurse staffing hours per resident per day in for-profit, nonprofit, and government nursing homes.

$H5_A$: There is a relationship between the percentage of high-risk long-stay nursing home residents with pressure ulcers and adjusted nurse staffing hours per resident per day in for-profit, nonprofit, and government nursing homes.

Checklist

To answer the research question, a specific process of data acquisition, preparation, and discovery is required. The following steps will be explained in detail:

1. Extract data sets from MySQL
    a. Select required columns of data from database
    b. Join columns of data using MySQL queries
2. Data preparation with Microsoft Excel
    a. Review data for erroneous values
    b. Modify column headers
3. Import the data into R
4. Conduct descriptive statistics
5. Conduct statistical procedures: two-sample t-test, two-way ANOVA, and linear regression

The Analysis

Now that the research question and hypotheses are written, the data elements are identified, and the appropriate statistical procedures have been determined, the data analysis process can begin.

204

205