Are Hand Hygiene Rates a Predictor of *Clostridium difficile* Infection Rates in a Large Urban Southern Ontario Hospital?

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**Problem Definition and Scope**

Every year, 8000 to 12000 Canadians die from health care-associated infections acquired as hospital in-patients (Provincial Hand Hygiene Working Group of British Columbia, 2014; DiDiodato, 2013). In 2007, the Ontario government developed and implemented the “Just Clean Your Hands” best practice patient safety initiative (Queen’s Printer for Ontario, 2008). There are ongoing efforts to determine if any association exists between changes in rates of health care worker hand hygiene compliance and rates of hospital-acquired infections. For example, The Ministry of Health and Long-Term Care requires that Ontario hospitals publically report their hand hygiene compliance rates, along with hospital-acquired infection rates annually (World Health Organization, n. d.).

Our group posed the following clinical question to be answered by data: Are hand hygiene (HH) rates a predictor of Clostridium Difficile Infection (CDI) rates in a large urban southern Ontario hospital? Two of three group members recently completed a Master’s course in Health Care Finance and were interested in utilizing newly acquired competencies in Excel functionality. Group members had access to private data from a large urban hospital and worked with epidemiologists regarding proper statistical analysis techniques to answer the question posed.

**Data Set and Source**

In order to answer any clinical question utilizing data, it is important to ensure that the dataset comes from a reputable source. It is equally important to understand the dataset to ensure that it is appropriate to answer the question posed. In our clinical scenario, it is customary for the

specimen collection date to be used as the onset date for a case of CDI. A specimen is collected when a patient becomes symptomatic. The exposure to Clostridium Difficile and acquisition may

have been weeks or months prior, but the patient is only experiencing symptoms now as a result of antibiotic use killing off good bacteria in the intestinal tract resulting in CDI symptoms. The incubation period for CDI is undefined but hospitals must consider them hospital acquired if they present with symptoms 72 hours following admission (Public Health Ontario [PHO], 2013).

We utilized two data sets to conduct our analysis (Appendix A). The publicly reported data that we accessed was from Health Quality Ontario (HQO). In 2010, the *Excellent Care for All Act* mandated HQO, an arms length agency of the Ontario government, report to the public on many indicators including the quality of the health care system (HQO, 2016). Hospitals are required to report their CDI case counts and rates per 1,000 patient days on a monthly basis.

Secondly, we were able to access the average HH practice by month for nurses working in a large urban hospital in southern Ontario. HH is recommended at four points during care: before initial patient care; before aseptic procedure; after contact with body fluid; and after patient contact (Queen’s Printer for Ontario, 2008). The data we obtained was a combination of HH practices at all of these points in time. The data is collected monthly at the hospital by using audit tools, but only publically reported annually to HQO as an aggregate of all health care workers.

**Structure and Statistical Analysis of the Data**

 In order to compare the data between the two different data sources it was plotted and graphed into four calendar years from 2012 to 2015. The data used is continuous numerical data. All CDI rates per 1,000 patient days are greater than or equal to zero. HH rates are reported as a percentage and can be anywhere between zero and one hundred percent.

To assess the strength of the association between HH and CDI, we used the Spearman rank correlation coefficient. Spearman is an appropriate nonparametric measure as it is less

sensitive to outliers and can be used for data with small sample sizes. To assess if there was a linear relationship between HH and CDI, linear regression was used.

**Results**

 The Spearman correlation coefficient for all years (2012 to 2015) indicated a very weak association between HH and CDI rates. P-values ranged from 0.41 to 0.96 for the years examined, indicating that there was not a statistically significant association between HH and CDI rates. The slopes of the trend lines were not steep and the values were not plotted on the trend line, which would indicate statistical significance. The trend lines varied in direction between years showing there is not a strong relationship between the two factors.

**Evaluation of the Data Set’s Usefulness**

The observational method captures less than one to three percent of all HH practices occurring in health care settings, which raises the question of the statistical validity of compliance rates generated (Pyrek, 2012). There is also potential selection, observer and observation bias (PHO, 2014). Health care worker HH can be limited by the Hawthorne effect, or the phenomenon of people changing their behaviour when they know they are being observed (Punke, 2015; PHO, 2014).

Additional data is required to determine the fluctuation in CDI rates at the hospital. This data may include antibiotic use, environmental cleaning practices, appropriate use of antimicrobial agents, and the HH practices of all staff, volunteers and other caregivers (Chen et al., 2011).

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***Appendix A***

***Project 2 Data Analysis***

