In the U.S., diabetes has become one of the major health concerns. In like manner, health insurance coverage is vital to the health needs of individuals. Adult having diabetics’ levels are recommended to receive glycated hemoglobin (HbA1c) testing to determine the average blood sugar concentrations. Differences in insurance coverage has significant impact on recommended screenings.

The study analyzed secondary data from 2011 to 2013 in three different health plans being Medicaid, Blue Care Network (BCN) and Blue Cross Blue Shield (BCBS) of Michigan. Statistical methods were used to ascertain the best regressive model for count data and the association between county specific health and socioeconomic factors and insurance plans associated with the HbA1c testing.

The study finds that the negative binomial model is best in predicting county event data. Also, urban-rural differences and type of insurance plans are key in understanding patterns and frequency of diabetes service utilization. The BCBS plan has more people taking the required HbA1c test compared to the BCN and Medicaid. Across all plans, analysis indicate that interventions should be focused on the southern part of Michigan. Further, health and socioeconomic factors determine the rate and frequency of the HbA1c screening.

Introduction

- 11.7 million people are newly diagnosed with diabetes each year in U.S.
- Based on current projections, one in three U.S. adults will be diagnosed with diabetes by 2050.
- Diabetes was the seventh leading cause of death in the U.S. in 2010.
- Mismanged diabetes could lead to several related issues including blindness, heart disease, stroke, and premature death.
- People with diabetes near higher medical costs estimated to be 2.3 times higher than those without diabetes.
- More than 1 in 10 healthcare dollars is spent on care for people diagnosed with diabetes.
- In the U.S the total medical cost associated with diabetes management for 2012 is estimated to be 234.4 billion dollars with an indirect cost of 44.8 billion dollars.
- Health insurance has been associated with the quality of care and management of diabetes, including encouraging recommended A1C testing and the type of health insurance (public vs. private) plays a key role in determining the level of care and management due to the cost burden of diabetes.

Diabetes in Michigan

- 7.5 percent of the population in Michigan are diagnosed with diabetes each year.
- Cost: 5.76 billion dollars in direct cost and 2.43 billion dollars indirect cost to manage diabetes.
- Diabetes is a primary cause of new cases of adult blindness, kidney failure and non-traumatic lower-limb amputations.
- Death due to diabetes is higher in MI than in the U.S. consistently from 1999 to 2012.

Objectives

- Identify the best model for predicting count secondary health data
- The association between screening rates and socioeconomic factors.
- HbA1c testing rates in Michigan on county level to identify areas with lower testing rates and geographic patterns
- Does HbA1c testing rates vary by insurance type (public vs. private)

Methods

Study Design


Population

- Cases were analyzed Medicaid, BCN and BCBS was n=42,337
- Eligibility: 18 years old and older
- Had previous been screened with diabetes
- In the insurance plan for at least 12 consecutive months during the 3-year study period

Measures

- A1C testing at least once per year (yes/no)
- County of residence

Analysis

- Statistical analysis was conducted in R
- Poisson regression
- Negative Binominal regression
- Model selection using AIC, Young test and Residual Deviance
- Residual analysis

- AccGIS 10.4 used for mapping
- Individual cases were aggregated into county of residence
- County HbA1c screening rates computed by insurance type

Results

- The Poisson model yielded higher AIC values and over-stated the significance of all the covariates.
- Ignoring over-dispersion leads to wrong statistical inference which further leads to an inaccurate conclusion.
- Thus, prior to selecting statistical model to be used for count health data analysis, it is essential to consider the distribution of the data to ascertain the dispersion of the data.

Model Selection

- Countries where there is lower exercising and engagement in physical activity have a significant increase in HbA1c testing.
- As poverty increases across the various counties, the more people get their HbA1c testing.
- Counties with more minorities record the higher number of people taking the HbA1c test (significant only in 2011)

- Countries where there is lower exercising and engagement in physical activity have a significant increase in HbA1c testing.
- As poverty increases across the various counties, the more people get their HbA1c testing.
- Poverty is insignificant (not a key factor)

- Countries where there is lower exercising and engagement in physical activity have a significant increase in HbA1c testing.
- Poverty is insignificant.
- Across the various counties, the more counties have more people receiving HbA1c testing.

Discussion and Conclusions

- Noticeable variations across the counties of Michigan (southern MI)
- Exercising and engaging in any physical activity does not influence a person’s decision to take the required HbA1c testing.
- Socioeconomic and health factors are associated with screening rates and patterns.
- The patterns for all the plans differ.

Strengths

- Data for selection criteria was available for entire years
- Multiple years were examined
- No missing data was identified

Limitations

- Could not examine causality
- Secondary data
- Differences in population across plans was not examined

References


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Table 4. Parameter Estimates and Goodness of Fit Statistics for Poisson and Negative Binomial Models (Medicaid)