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Exploring Preventable Hospital Stays in Maryland

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☒ By checking this box, I indicate that my mentor has read and reviewed my draft proposal prior to submission.

Abstract

Objective: The objective of this study is to analyze data to determine the factors that influence preventable hospital stays in all Maryland counties. Explicitly, I am examining how preventable hospital stays changes over the past eight years, comparing preventable hospital stays in Maryland and Virginia, correlating preventable hospital stays with Flu vaccinations, and lastly, examining how the rate of uninsured and income inequality can predict the variance in preventable hospital stays by county.

Methods: The data I will be using is sourced from the 2020 County Health Rankings and Roadmaps report. The most recent data available in this published 2020 report is from the year 2017. I will be utilizing paired t-tests, unpaired t-tests, Pearson/Spearman correlations, and stepwise linear regressions to analyze the data.

Results: A paired t-test analysis was used to compare the rate of preventable hospital stays (which the data source defines as the number of hospital stays for ambulatory-care sensitive conditions per 100,000 Medicare enrollees [11]) in Maryland counties in 2012 versus 2020. We

found that the rate of preventable hospital stays significantly decreased from 7284.36 per 100,000 Medicare enrollees in 2012, to 4419.04 per 100,000 Medicare enrollees in 2020 (t = 11.663, $p < .001$). An unpaired t-test analysis was used to compare the rates of preventable hospital stays between Maryland (4419.04) and Virginia (4808.02) counties in 2020 (t = -1.503, p = .135). We found that a statistically significant difference does not exist between the states' preventable hospital stays rates. A Spearman correlation analysis indicated a small but significant negative correlation (r = -0.615, p = .001) between the percentage of flu vaccinations and the rate of preventable hospital stays. The outcome of the linear regression analyses of rate of uninsured and income inequality was determined to be insignificant ($F_{2,21} = 0.784$, $p < 0.469$), with a weak accounting for 7% of the variance in preventable hospital stays. Neither the rate of uninsured nor income inequality contributed significantly to the strength of the model. Therefore, we determined that these two variables are not good indicators of preventable hospital stays.

Key Words: Maryland, Virginia, Preventable hospital stays, Flu vaccinations, income inequality, uninsured.

Introduction/Literature Review

Optimization of resources and improving healthcare outcomes are some of the key tenets of improving the quality of life of our senior citizens. The fact that these measures continue to lag in a country that spends a significant amount of money per capita towards a sophisticated healthcare system goes to show the complexity of this costly multivariable challenge. Preventable hospitalization in the US is a good performance indicator of our country's population health initiatives and clinical outcomes. The national annual cost of preventable hospitalizations was estimated to be 30 billion dollars in 2006.[1] Preventable hospital admissions are a costly resource drain during the admission, and subsequently during frequent readmission episodes associated with people who fall under this healthcare services utilization behavior.[2] It has been determined that one of the exacerbating components to the rate of preventable hospital stays is the population uninsured rate. [3] By extension, it is clear that socioeconomics play a key role in this utilization trend despite of Medicare and Medicaid services being available to those who qualify. This is indicative of other confounding variables that prevent proper utilization of preventive and ambulatory care.

Some of these confounding variables have been examined in different studies. For instance, one study analyzed data on patients' financial stability, housing, access to home health care, transportation reliability, and prescription coverage.[2] These variables paint the picture of the complex systemic issue that forces health outcomes and utilization trends to be inextricably tied to socioeconomics. Furthermore, other studies have found that the rate of uninsured and also enrollment in Medicaid coverage are directly related to rehospitalizations. [4] These issues of access and or utilization hesitancy of primary and preventive health care services affects can be seen clearly in the weak participation in the annual influenza vaccination campaigns, and the

resulting consequences. [5, 6] It is reported that the 2018 - 2019 flu season resulted in over two hundred and seventy-nine thousand influenza associated hospitalizations among the 65 and older population.[7] It is believed that access to the flu vaccine, and willing participation in these immunization campaigns could reduce hospitalizations by up to fifty percent in this population strata. [5,8,9] Reducing the access barriers associated with socioeconomics will empower the healthcare system to address the poor health outcomes and resources drain from preventable hospitalizations.[10]

The availability of a real-time population health metrics dashboard, or at the minimum, up-to-date research would be very beneficial to policy makers in driving effective change on this issue. The County Health Ranking project has contributed to this body of research by compiling and modelling data every few years to help understand the clinical care, socioeconomic and health behaviors dimensions of this issue.[11] It is through such contribution that we are able to investigate this interest in preventable hospital stays and examine the factors in play for the counties in the state of Maryland, and in the neighboring state of Virginia with a lot of shared features. Previous studies on the improvement of access to care and reduction of preventable hospitalizations in vulnerable populations in Maryland and Virginia are well over nineteen years old [4], and due for updates. Moreover, the body of research is lacking up to date multivariate investigations in preventable hospital stays in both Maryland and Virginia. This study seeks to contribute to the existing evidence on the factors that influence preventable hospital stays. Specifically, this study focuses on the effect of uninsured rates, flu vaccinations, and income inequality effect on preventable hospital stays in the states of Maryland and Virginia.

Research Questions

RQ1: How does the rate of preventable hospital stays change by county in Maryland in 2012 to 2020?

RQ2: How does preventable hospital stays rate in Maryland compare to Virginia in 2020?

RQ3: How does rate of preventable hospital stays correlate to percent Flu vaccinations by county in Maryland in 2020?

RQ4: How does the percent uninsured and income inequality impact preventable hospital stays in Maryland counties in 2020?

Methods

Context/Protocol & Data Collection

The data utilized in this research project is sourced from the County Health Rankings & Roadmaps 2020 publishing. County data is collected for each of the variables in the 2020 County Health Rankings report for a multivariable analysis. Medicare parts A and B claims data is originally sourced from the year 2017, and stratified by age, gender, and race.

The 2020 County Health Rankings sources data from 2017 Medicare Part A claims activity to calculate the number of events of preventable hospital stays. This measure is the ratio of the number of hospitalization events that could be addressed on an outpatient / ambulatory basis per 100,000 Medicare enrollees. The inclusion criteria for this measure is Medicare beneficiaries ages ≥18 years old who were continuously enrolled in Medicare fee-for-service Part A and hospitalized.

Flu vaccination data is stratified by age, gender, and race per 2017 Medicare fee-for-service claims analysis. This measure reports Flu vaccinations percentage of Medicare part B fee-for-service enrollees who have received a covered influenza vaccine in 2016. This measure is the

ratio of Medicare beneficiaries enrolled in fee-for-service Medicare Part B for at least one month in 2016 and received a covered influenza vaccine. Uninsured data is modeled for the year 2017 and the data reports the percentage of the population under age 65 without health insurance coverage. Uninsured data is stratified by age, gender, race, income, and sub county area. Lastly, household income inequality data is presented on a county-by-county basis as the ratio of the 80th percentile to the 20th percentile. The data collection utilized all the County Health Rankings data for each of the investigated variables for the years 2020 and 2012 on preventable hospital stays in Maryland (absent inclusion or exclusion criteria).

Data Analysis

To determine how the rate of preventable hospital stays change by county in Maryland in 2012 to 2020 (RQ1), a paired samples t-test analysis was conducted. To determine how preventable hospital stays rate in Maryland compare to Virginia in 2020 (RQ2), an unpaired t-test analysis was conducted. To determine how the rate of preventable hospital stays correlate with the percent of flu vaccinations by county in Maryland in 2020 (RQ3), a Spearman correlation analysis was conducted. To determine how income inequality and percent uninsured account for the variance in preventable hospital stays in Maryland counties in 2020 (RQ4), a step wise linear regression analysis was conducted.

Results

RQ1- Comparing the preventable hospital stays prevalence in Maryland counties in 2012 versus 2020, a Paired t-test was performed, and we found that the rate significantly decreased from 7284.36 in 2012 to 4419.04 in 2020 ($t = 11.663$, $p < .001$). (Table 1)

Table 1: Preventable Hospital Stays Prevalence in Maryland

Year	n	Mean	SD
2012	24	7284.36	1557.121
2020	24	4419.04[a]	818.049

Abbreviation: SD, Standard Deviation

[a]statistically significantly different from 2012 ($p < .001$)

RQ2- Rates of preventable hospital stays were not significantly different between Maryland (4419.04) and Virginia (4808.02) counties in 2020 ($t = -1.503$, $p = .135$) when utilizing an Unpaired T-test. (Table 2)

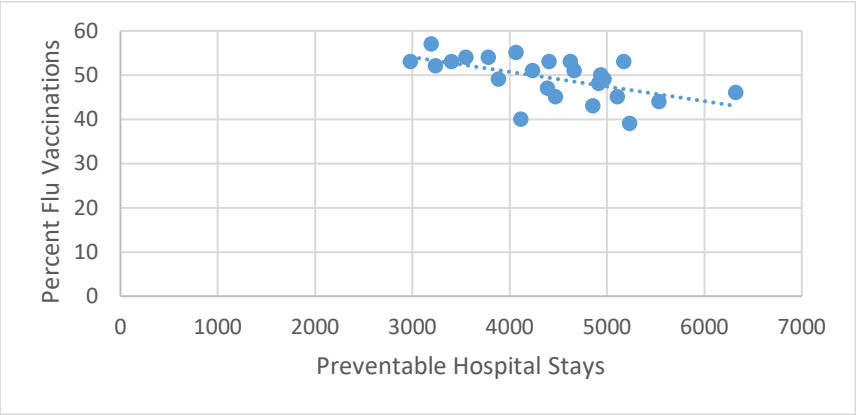
Table 2: Preventable Hospital Stays in 2020 Among Two States

State	n	Mean	SD
Maryland	24	4419.04	818.049
Virginia	131	4808.02	1216.667

Abbreviation: SD, Standard Deviation

RQ3 – A Spearman correlation indicates a small but significant negative correlation ($r = -.615$, $p = .001$) where, as the percentage of flu vaccinations increases, the rate of preventable hospital stays decreases. (Figure 1)

Figure 1: Correlation Between Preventable Hospital Stays and Percent Flu vaccinations in Maryland 2020



RQ4 – The results of the Linear Regression showed that it was not significant $F_{2,21} = .784$, $p < .469$), accounting for 7% of the variance in preventable hospital stays.

Discussion

The first research question compared the preventable hospital stays in Maryland counties in 2012 versus 2020, a Paired t-test analysis was performed, and we found that the rate significantly decreased from 7284.36 in 2012 to 4419.04 in 2020 ($t = 11.663$, $p < .001$). This finding is statistically significant because the p-value is less than 0.001, and further provides evidence that preventable hospital stays in Maryland have decreased since 2012. The decrease in preventable hospital stays in Maryland over the last eight years can be attributed to the Affordable Care Act which mandated initiatives that increased access to primary care services.[3] Primary care accessibility has been shown to improve continuity of care after hospitalizations for the older adult population which comprises approximately 95% of the Medicare population.[3,4] The improved availability of continuous care is a good indicator of future success in reducing preventable hospitalization.

In the second research question, we found that the rates of preventable hospital stays were not significantly different between Maryland (4419.04) and Virginia (4808.02) counties in 2020 (t = -1.503, p = 0.135). These results are not statistically significant because the p-value was greater than 0.001, thus providing evidence that there is no significant difference between the rates of preventable hospital stays in Maryland and Virginia.

The third research question investigates the correlation between the rate of preventable hospital stays and the percent of flu vaccinations in Maryland in 2020. We find a small but significant negative correlation (r = -0.615, p = 0.001) between the percent of flu vaccinations, and the rate of preventable hospital stays. Our finding is statistically significant because the p value was 0.001, weakly but considerably providing evidence that flu vaccination rates will be inversely related to preventable hospital stays in Maryland counties in 2020. This finding goes to show the potential of an effective influenza vaccination campaign and vaccination compliance especially in this vulnerable population of senior citizens who have weakened immune systems.[5,7,8]

The fourth research question investigated how the percent of uninsured and the amount of income inequality by Maryland county in 2020 could account for the rate of preventable hospital stays. Linear regression analysis shows that ($F_{2,21}$ = 0.784, p < 0.469) -- accounting for about 7.84% of the variance in preventable hospital stays. These two variables are not good indicators of preventable hospital stays given the data that was used, and as a result we are not able to conclusively provide evidence that percent insured, and income inequality do impact preventable hospital stays in Maryland.

Some limitations in this study to consider in future research: age adjustment for the percent uninsured to only include individuals in the 65 years older group may be a better

comparison for regression analysis. Additionally, income inequality may also not play a role because Medicare recipients are over 65 and may possibly receive Social Security benefits and retirement or pension plans and other government assistance.[2] This is to note that it is possible that these inconsistencies and or lack of adjustment for the different factors that affect the investigated variables considerably weaken the reliability of this study. On the corollary, it also possible that the initiatives put in motion by policies like the Affordable Care Act have indeed compensated for these holes in our analysis i.e. by reducing uninsured rates.[3] To improve outcomes in the future; a concerted effort must be implemented to expand insurance coverage, bolster preventative services, and provide consistent primary care services.[3,11]

Conclusion

This project successfully accomplished the analysis of the items in its scope albeit with limitations. The data set provided modeled figures in instances where information was missing, and that introduces drawbacks in the accuracy of the analysis. This is particularly evident in the situations where the compilers of the data source footnote the compromised reliability of data from scarcely populated counties. Furthermore, it is important to note that the data on preventable hospitalization only includes Medicare enrollees, but we are not sure of the significance of excluding data through other payor methods.

It is also important to note some shortcoming in the methodology in this investigation. Our analytical approach assumed linearity in the relationship of the different variables. Since variables can relate in non-linear ways, the validity of some of our findings may be questionable. This should not discount the findings in our linear correlation analyses but should encourage an exploration of other inferential statistics approaches.

Future directions should consider a time-series analytical approach. This can provide a better gauge of the measured variables along different economic and policy landscapes. Aside from the direct benefit afforded by the depth of time, this method can better account for shifts in sociodemographic elements of the studied populations. Additionally, income inequality can be updated by assessing data from the department of treasury for the state of Maryland and Virginia for income level. All things considered, the health rankings data is indeed a great starting point and not an endpoint in analyses of this nature. Hopefully, this study contributes to the body of research on preventable hospital stays in Maryland, and hopefully future research can build from our findings.

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