

Association Between Dental Prophylaxis and Pneumonia in Kentucky Medicaid Beneficiaries

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BACKGROUND

Pneumonia is a lung infection that may result in life-threatening complications. There is evidence that people with uncontrolled type 2 diabetes mellitus (T2DM) may be at higher risk of death due to pneumonia and that, generally, those with diabetes have worse infection outcomes than those without diabetes.¹ Kentucky is ranked 7th nationally for influenza and pneumonia-related mortality.² In 2021, Kentucky had the 5th highest prevalence of T2DM in the U.S. at 13.8%.³

Dental prophylaxis refers to a thorough teeth cleaning completed by a dental professional. A recent study found that frequent tooth brushing and regular professional dental cleaning were associated with decreased risk of pneumonia.⁴ The relationship of dental prophylaxis to the incidence of pneumonia among those with T2DM has not been evaluated in the U.S.

The objective of this study was to investigate the association between dental prophylaxis and pneumonia risk among adult Kentucky Medicaid beneficiaries with and without T2DM.

METHODS

Data source

The main data source for this study was Medicaid administrative/claims data through the Kentucky Cabinet for Health and Family Services (CHFS). The CHFS utilized a Medicaid Management Information System (MMIS) to collect provider claims and conducted a custom de-identified data pull upon approval to provide data for this retrospective study.

Study population

The study cohort was selected from the CHFS Medicaid dataset for the years 2014-2019 and included 1,992,963 total beneficiaries. Subjects were included if the age at entry into the study was 21 to 75 years (n=954,595). Individuals with less than one year of claims history prior to pneumonia were excluded from the study. After applying the selection criteria, the total number of individuals included in this study was 780,113.

Definitions and outcomes

The outcome variable was whether or not a pneumonia diagnosis occurred to a Medicaid beneficiary. The individual subjects were followed from the entry date into the study (the subjects' first date of service) until the first date of pneumonia or until the study ended. The subjects were censored from the analysis on December 31, 2019.

Independent variables

The study incorporated T2DM and other typical comorbidities associated with pneumonia, including hypertension, atrial fibrillation, chronic kidney disease, dyslipidemia, peripheral vascular disease (PVD), and periodontal disease based on ICD-9 and ICD-10 codes. Dental prophylaxis and tooth extraction were identified using dental procedure codes (CDT).

Statistical analysis

A longitudinal sample was constructed for a survival analysis. Based on the availability of information on the dependent and independent variables, the longitudinal sample included 780,113 Medicaid beneficiaries between 2014 and 2019. The sample was used to analyze incidence rates (IRs) of pneumonia during five-year follow-up periods for dental prophylaxis. Also, a Cox regression was estimated to analyze the effect of dental prophylaxis on the incidence of pneumonia among beneficiaries with and without T2DM, adjusted for covariates.

RESULTS

Bivariate analysis showed that the incidence rate of pneumonia was 3.76% per year (95% confidence interval (CI): 3.74% – 3.79%) among Kentucky Medicaid beneficiaries. Beneficiaries without dental prophylaxis were 3.13 times more likely to get pneumonia compared to those with dental prophylaxis.

Figures 1 and 2 illustrate the differences in pneumonia prevalence among Medicaid beneficiaries who have had (Figure 1) and have not had (Figure 2) dental prophylaxis. The highest rates of pneumonia, regardless of dental prophylaxis, are found in the eastern part of the state.

Figure 1. Pneumonia Prevalence among Beneficiaries with Dental Prophylaxis

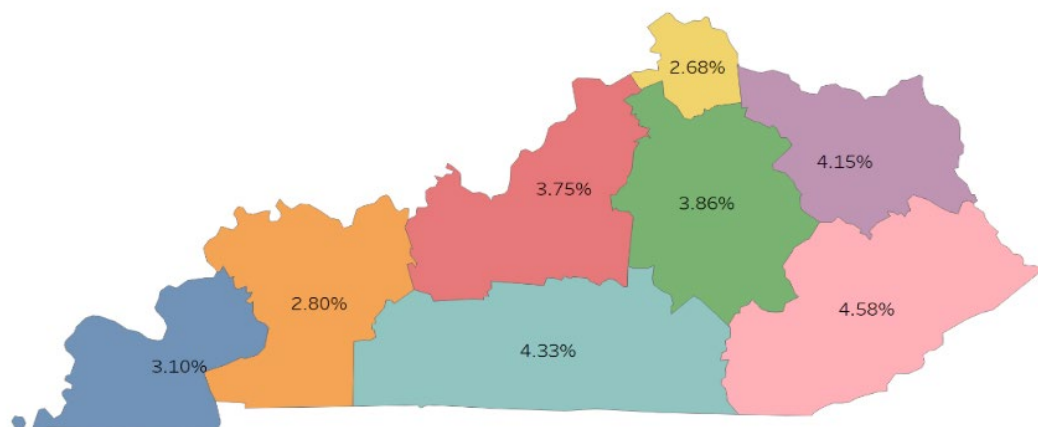
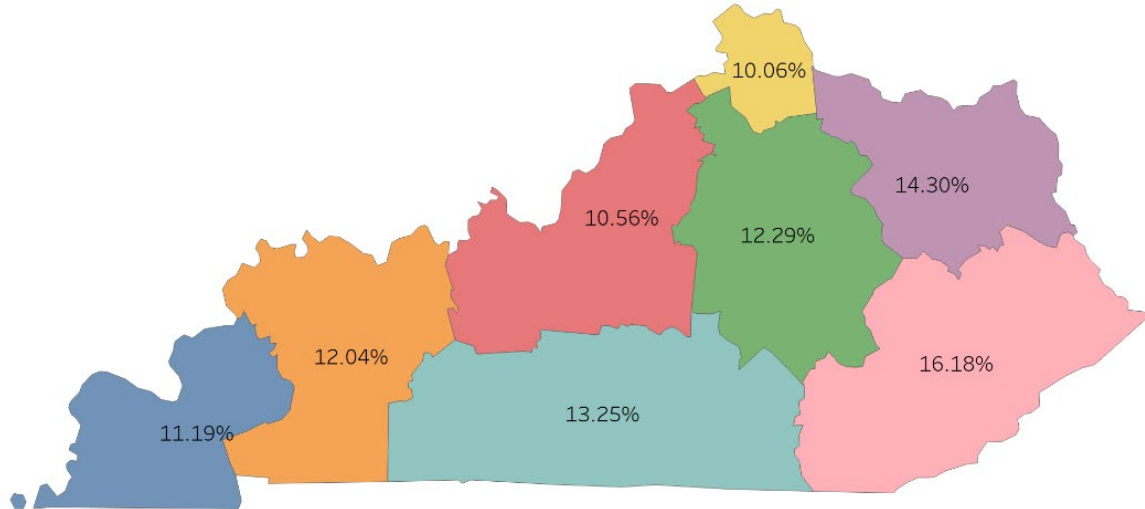


Figure 2. Pneumonia Prevalence among Beneficiaries without Dental Prophylaxis

A Cox regression analysis found that the hazard ratio (HR) of pneumonia increased by 23% ($p < 0.001$) for those with T2DM. Dental prophylaxis was protective against pneumonia (HR=0.70, $p < 0.001$). Tooth extraction increased the likelihood of pneumonia by 21% ($p < 0.001$). Other medical conditions such as hypertension, chronic kidney disease, atrial fibrillation, dyslipidemia, and PVD were associated with increased risk of pneumonia but statin use was a protective factor (Table 1).

Table 1. Sample Characteristics

Variables	HR (95% CI)	p value
Age 45+ years	1.09 (1.08 – 1.11)	<0.001
Female	1.14 (1.13 – 1.16)	<0.001
Non-white	0.87 (0.85 – 0.88)	<0.001
Rural	0.99 (0.98 – 1.01)	0.284
T2DM	1.23 (1.21 – 1.25)	<0.001
Hypertension	1.38 (1.36 – 1.40)	<0.001
Chronic Kidney Disease	1.47 (1.44 – 1.49)	<0.001
Atrial fibrillation	1.68 (1.64 – 1.71)	<0.001
Dyslipidemia	1.21 (1.19 – 1.23)	<0.001
Peripheral Vascular Disease	1.30 (1.28 – 1.32)	<0.001
Prophylaxis	0.70 (0.69 – 0.71)	<0.001
Tooth extraction	1.21 (1.20 – 1.23)	<0.001
Statin	0.55 (0.54 – 0.55)	<0.001

Figure 3 shows the cumulative incidence of pneumonia by T2DM status. The unadjusted cumulative incidence of pneumonia was higher among beneficiaries with diabetes than those without diabetes. The discrepancy in cumulative incidence of pneumonia between these two groups increased gradually over the study period.

Figure 4 includes the cumulative incidence by both T2DM status and dental prophylaxis. The unadjusted cumulative incidence of pneumonia was highest among beneficiaries with diabetes and without dental prophylaxis. Beneficiaries with dental prophylaxis and without diabetes had the lowest cumulative incidence of pneumonia. The discrepancy in cumulative incidence of pneumonia between

these four groups increased gradually over the study period.

Figure 3. Cumulative Incidence of Pneumonia by Diabetes Status

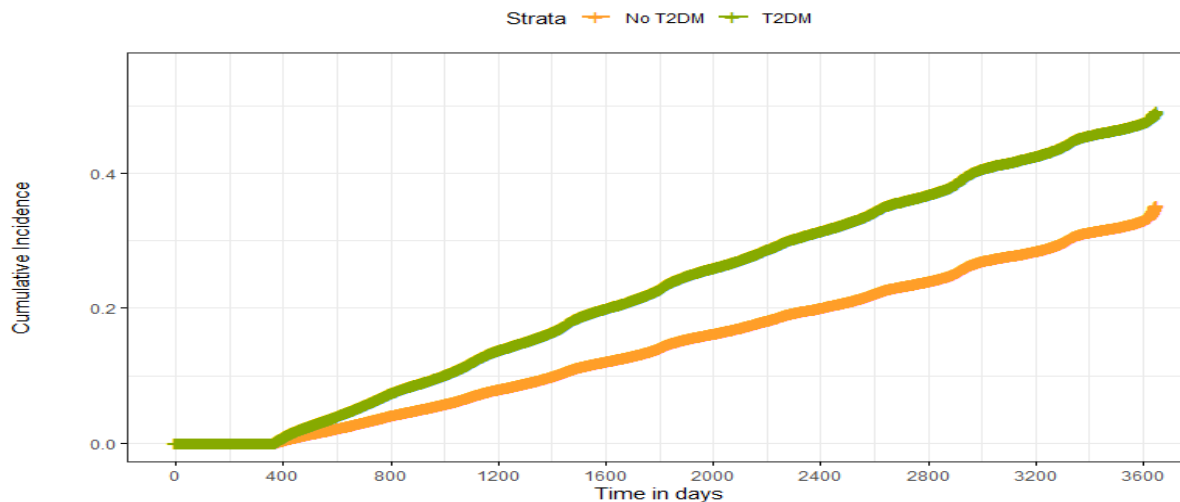
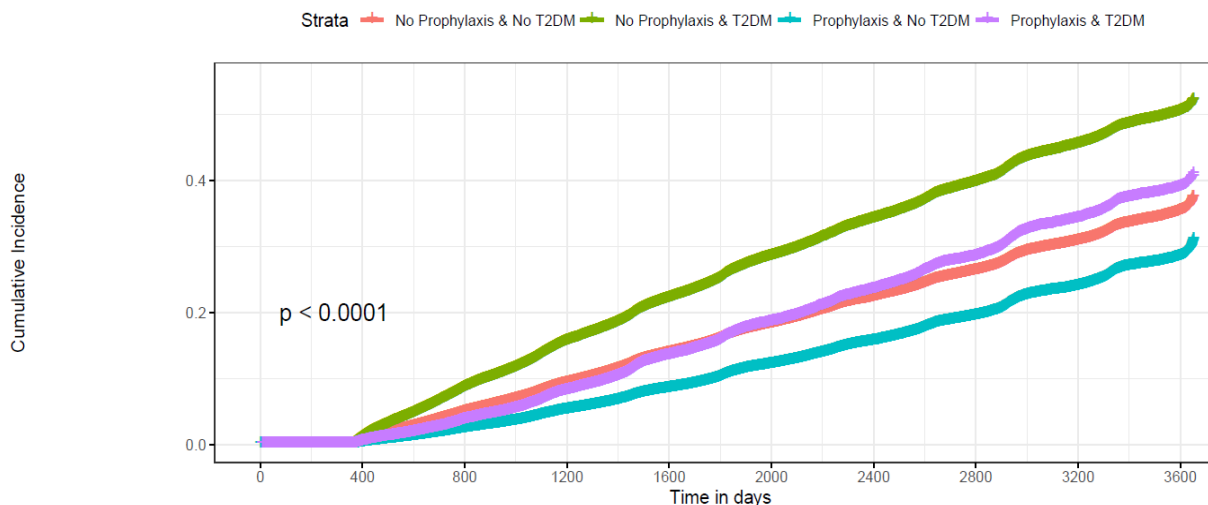


Figure 4. Cumulative Incidence of Pneumonia by the Use of Prophylaxis and Diabetes Status



DISCUSSION

This study found that dental prophylaxis was protective against incident and recurrent pneumonia in this study's sample of Medicaid beneficiaries. Lower respiratory infections, such as pneumonia, have been linked directly and indirectly with periodontitis (i.e., gum disease). Many oral pathogens are associated with lung infections. In one study, respiratory pathogens isolated from dental plaques were found to be genetically identical to isolates from bronchoalveolar fluid in the same patients.⁵ While the association of oral bacteria with pneumonia has been shown, the evidence is not consistent. Large-scale studies are needed to better understand the relationship between oral pathogens and pneumonia.⁶

Following Medicaid expansion, most states began providing emergency dental services for adults.⁷

However, fewer than half of U.S. states currently provide comprehensive dental care. Kentucky is one of fifteen states providing limited dental care, including preventive oral services such as dental prophylaxis, for adults.⁸ Coverage of comprehensive preventive dental care may reduce the incidence of pneumonia, particularly in high-risk populations, and improve overall health outcomes.

CONCLUSION

In this study, dental prophylaxis was associated with decreased risk of pneumonia among Kentucky Medicaid beneficiaries with and without T2DM. Those with no dental prophylaxis and T2DM had the highest incidence of pneumonia. Policy measures to provide coverage for comprehensive dental care can improve overall health outcomes, particularly for individuals with T2DM.

CONTACT INFORMATION

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