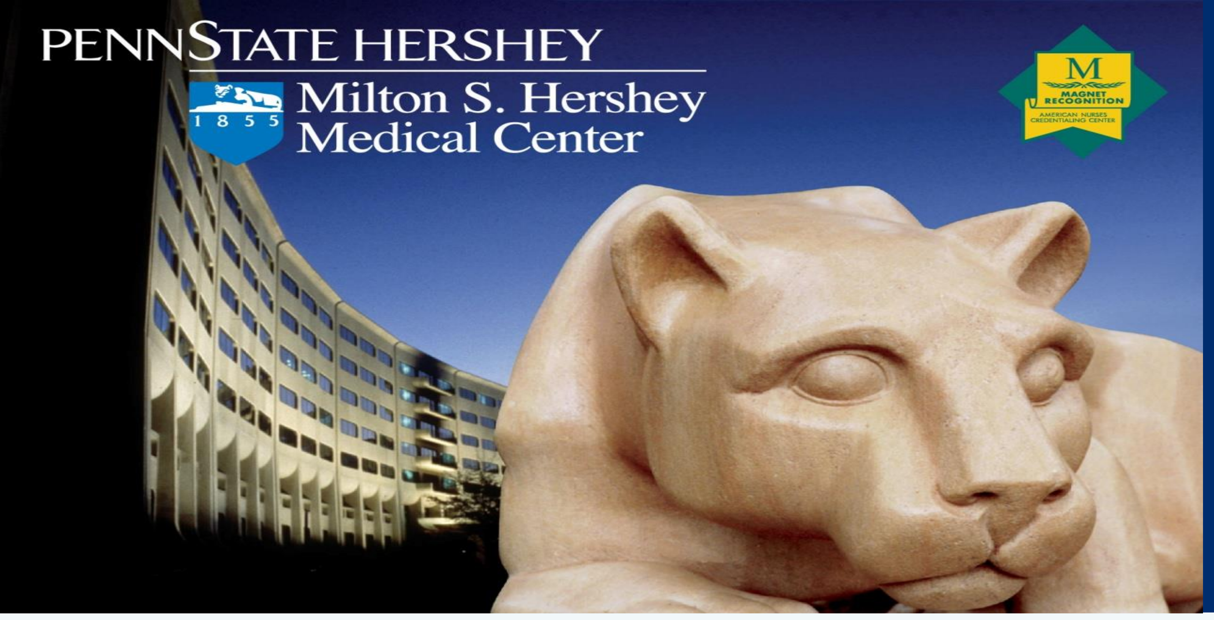

Healthcare Access and Utilization are Associated with Geographic Variation in Thyroid Cancer

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Introduction

Over the last forty years the incidence of thyroid cancer in the U.S. has risen over four fold[1]. This increase has likely resulted from a true increase in disease combined with increased detection and "overdiagnosis"[2]. Prior studies have demonstrated correlations between thyroid cancer incidence and higher socioeconomic status (SES), better access to health insurance, and larger numbers of physicians[3]. However, these observations do not fully explain the observed geographic variations in disease incidence.

We hypothesized that state-level variations in thyroid cancer incidence may correlate with higher levels of healthcare utilization as evidenced by increased screening for other cancers. Our objective was to determine whether regional differences in healthcare access and utilization are associated with thyroid cancer incidence.

Methods

Data regarding healthcare access and utilization in all 50 states and the District of Columbia were obtained from the US Census Bureau, the Centers for Disease Control, and the US Department of Health.

Multivariate logistic regression models were used to assess the association between thyroid cancer incidence and select healthcare access and utilization variables. Generalized estimating equations with an autoregressive (AR1) correlation structure were used to obtain parameter estimates, confidence intervals, and assess statistical significance. All models included a single healthcare access or utilization variable and were corrected for state/year-specific median age; models with multiple observations were also corrected for year.

Results

We first tested whether state thyroid cancer incidence (Figure 1A) correlated with markers of socioeconomic status. We observed significant associations between state thyroid cancer incidence and median income (p<0.0001) and percentage of the population with health insurance (p=0.0012) (Figure 1B; Table 1). State thyroid cancer incidence was not significantly associated with education (p=0.264) or race (p=0.469).

We next asked whether access to physicians also influenced thyroid cancer incidence. The number of primary care physicians (PCPs) per capita was positively associated with thyroid cancer incidence (p<0.0001) (Table 1). Similarly, the proportion of residents living within 10 miles of an endocrinologist, and therefore having greater access to specialist care, was also positively associated with thyroid cancer incidence (p<0.0001) (Table 1).

To evaluate for associations between thyroid cancer incidence and healthcare utilization, we next tested for associations between thyroid cancer incidence and screening for breast, colorectal, or prostate cancer. At the state level, we observed small but significant positive associations between thyroid cancer incidence and percentage of the population over 40 years who underwent mammography in the past two years (p=0.005), the percentage of the population age 50 or older who had ever had a colonoscopy or sigmoidoscopy (p=0.019), and the percentage of men over the age of 40 who had PSA testing in the last two years (p=0.001) (Figure 1C; Table 1). Significant positive correlations were also observed between thyroid cancer incidence and the incidence of breast cancer (p=0.001), colon cancer (p<0.001), and prostate cancer (p=0.001) (Figure 1C; Table 1). Smoking and obesity rates, were not significantly associated with thyroid cancer incidence (p=0.2 and p=0.318, respectively) (Figure 1D; Table 1).

Figure 1

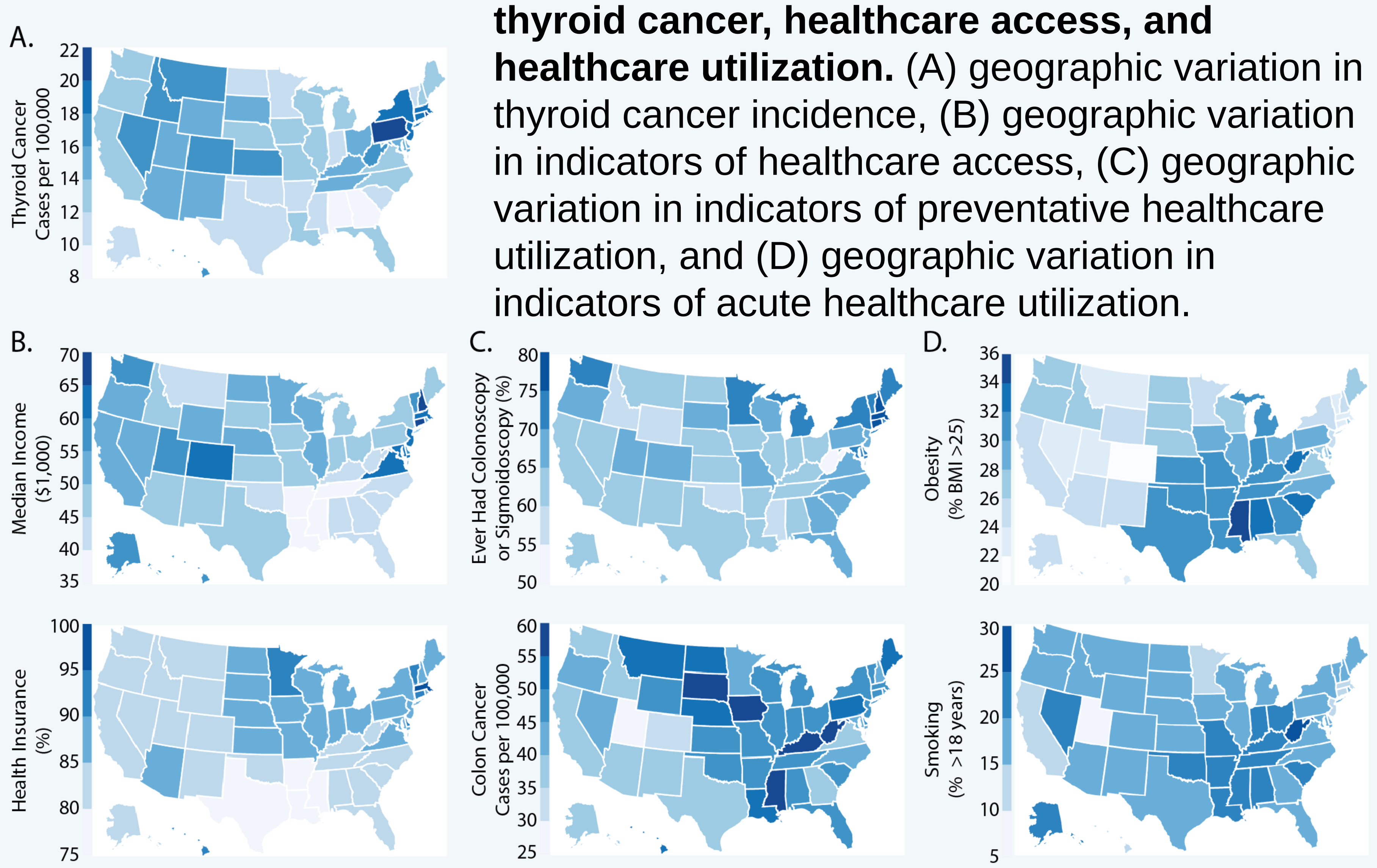

Figure 1: 2010 Geographic variations in thyroid cancer, healthcare access, and healthcare utilization. (A) geographic variation in thyroid cancer incidence, (B) geographic variation in indicators of healthcare access, (C) geographic variation in indicators of preventative healthcare utilization, and (D) geographic variation in indicators of acute healthcare utilization.

Table 1. Predictors of geographic variation in thyroid cancer incidence

Variable	Parameter Estimate	95% Confidence Interval		*p*-value
Healthcare Access				
Median Income	0.0726	0.0425	0.1026	**<0.0001***
Education	0.0039	-0.0029	0.0107	0.264*
Insurance	0.0139	0.0055	0.0223	**0.0012***
Race	-0.0013	-0.0047	0.0022	0.469*
PCPs	0.0056	0.005	0.0061	**<0.0001†**
Endocrinologists	0.0059	0.0052	0.0065	**<0.0001†**
Healthcare Utilization				
Mammogram	0.0083	0.0025	0.0142	**0.005***
Colonoscopy	0.006	0.0010	0.011	**0.019***
PSA	0.0068	0.0027	0.0108	**0.001***
Breast CA	3.1855	1.3825	4.9885	**0.0005***
Colon CA	8.5155	3.7782	13.2527	**0.0004***
Prostate CA	1.5774	0.5436	2.6112	**0.0028***
Obesity	-0.0059	-0.0165	0.0048	0.283*
Smoking	-0.007	-0.0159	0.0018	0.12*

Median Income: Median household income; Education: % of population with ≥ high school education; Insurance: % of population <65 years with health insurance; Race: % of population identifying as white race; PCPs: Primary Care Physicians per capita; Endocrinologists: % of population living within 10 miles of an endocrinologist; Mammogram: % of women >40 years who had a mammogram in the last 2 years; Colonoscopy: % of population >50 years who has ever had a colonoscopy or sigmoidoscopy; PSA: percentage of men >40 years who had PSA testing in the last two years; Breast CA: breast cancer incidence per 100,000; Colon CA: Colon cancer incidence per 100,000; Prostate CA: Prostate cancer incidence per 100,000; Obesity: % of population with BMI >30; Smoking: percentage of population > 18 who are current smokers. *GEE Model of data from 2002, 2004, 2006, 2008, and 2010; †Linear model of data from a single year

Discussion

Our data confirm previous studies that thyroid cancer incidence is associated with increased healthcare access. Specifically, we identified positive associations between thyroid cancer incidence and higher income, availability of health insurance, PCPs per capita, and proximity to an endocrinologist. Our modeling approach does not allow us to estimate the proportion of variance accounted for by these variables, however previous studies have indicated that healthcare access accounts for a minority of the variance in thyroid cancer incidence.

Strikingly, we found significant associations between thyroid cancer incidence and preventative healthcare utilization. Screening for non-thyroid malignancies by mammography, colonoscopy, and PSA testing were all associated with increased thyroid cancer incidence. Furthermore, thyroid cancer incidence was also positively associated with breast, colorectal, and prostate cancer incidences, suggesting that survivors of one cancer type may undergo increased screening for other cancers.

Notably, markers of acute healthcare utilization, namely smoking and obesity, were not associated with thyroid cancer incidence. These data suggest that thyroid cancer diagnosis is associated with specific types of healthcare utilization, namely preventative care, and may help to explain some of the discrepancies between healthcare access and thyroid cancer diagnosis.[5]

Conclusions

Our data indicate that regional variations in access to and utilization of preventative healthcare measures may explain some of the regional variations in thyroid cancer incidence. These data are consistent with the assertion that the rising incidence of thyroid cancer in the US is due to increased diagnostic scrutiny. Therefore, thyroid cancer incidence may continue to increase as more people gain access to preventative healthcare under the Affordable Care Act. However, we cannot exclude the possibility that a true increase in disease prevalence also plays an important role in the rising incidence of thyroid cancer.

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