

## WASHINGTON STATE HEALTH SERVICES RESEARCH PROJECT

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## Geographic Variations in Hospitalizations for Bacterial Pneumonia

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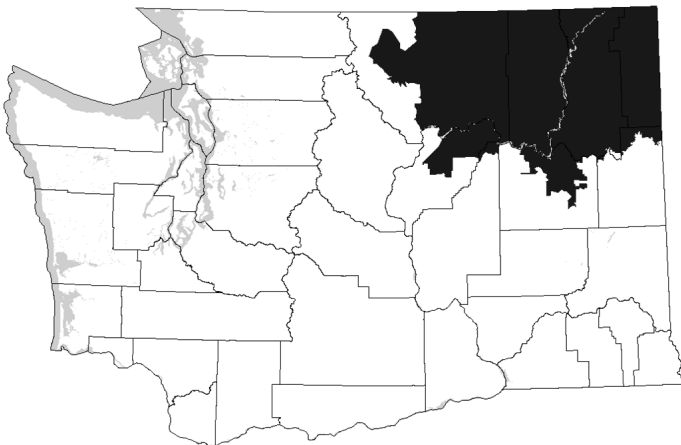
**L**ocation matters – especially in health care. Where people live often reflects not only their geographic access to care, but also their income status, educational attainment, social norms and cultural ties. These characteristics, generally described as *social determinates of health*, play an important role in the health and well-being of communities – and in the health and well-being of the individuals living within them.

In this first of a series of reports, one of the most common units of geography, a person's ZIP code of residence, serves as the building block in assessing geographic variations in hospitalization rates. For this initial analysis, bacterial pneumonia was chosen as the focus because it is widely acknowledged as being preventable – *provided those at-risk receive the pneumococcal vaccinations at least once in their lifetime*. As a preventable condition, the potential is high for constraining costs associated with hospitalizations and for lessening needless suffering and risk. Arguably, too, as an Agency for Healthcare Research and Quality (AHRQ) Prevention Quality Indicator (PQI), hospitalizations for bacterial pneumonia may also serve as one proxy indicator of the preventative and primary care systems within a community or region, and, perhaps, as a reflection of the knowledge, attitudes and beliefs of the individuals living there – as well as the resources available to them.

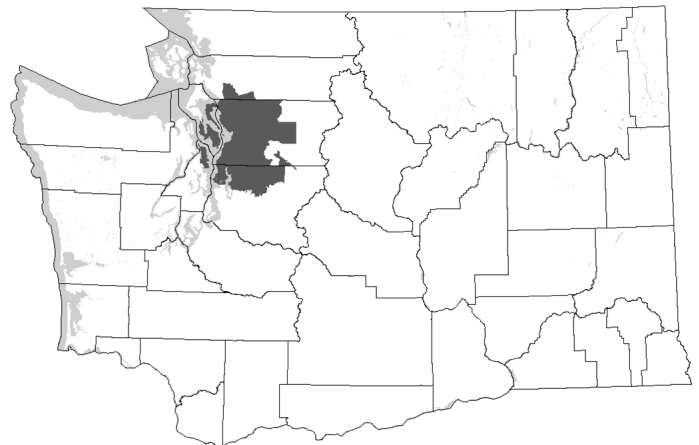
### - MAJOR FINDINGS SUMMARY -

Residents of the northeast corner of the state had significantly more bacterial pneumonia hospitalizations than expected. Pneumonia and influenza immunization rates in this region appeared low. Residents engaged in behaviors and had pre-existing conditions that made them more susceptible to the disease and more apt to face higher levels of acuity and complications. They were also less apt to have a personal physician or insurance coverage, and more apt to forego care because of costs. They were poorer, less educated, and more likely to be of American Indian or Alaska Native descent.

### Region with HIGHER than expected hospitalizations for Bacterial Pneumonia



### Region with LOWER than expected hospitalizations for Bacterial Pneumonia



Based on ZIP code of residence for Washington residents discharged from any community hospital in Washington or Oregon, all military hospitals in Washington State, and any VA hospital in the USA, for 2003 through 2005 combined.

### METHODS

Regions with higher or lower than expected hospitalizations for bacterial pneumonia were identified using the spatial scan statistic, a cluster analysis methodology developed for the National Cancer Institute. This methodology assesses all possible combinations of contiguous geographic areas to identify outlier regions, and then tests those regions for statistical significance. The “expected” in this methodology is strictly a relative measure.

In this analysis, regions were based upon the *ZIP code of residence* for Washington residents discharged from any community hospital within Washington or Oregon States, as well as Washington residents discharged from any military

hospital in our state or any Veterans’ Administration hospital within the USA. Discharges occurring between 2003 and 2005 were included in the analysis.

Once identified, these regions were then profiled in accordance to the relevant characteristics and behaviors of the people living there. These profiles were based upon data collected through the Behavioral Risk Factors Surveillance System (BRFSS). Between 2003 and 2007, approximately 20,000 BRFSS interviews were completed each year, equaling over 100,000 completed interviews for that five-year period. In addition to questions pertaining to behaviors affecting health, respondents were asked questions about their use of health care services and their ability to access those services. They were also asked questions relating to their demographic characteristics. And they were asked their ZIP code of residence.

Using those ZIP codes, the BRFSS data were grouped to match the regions with higher and lower than expected hospitalization rates. From these data, we were able to profile those communities.

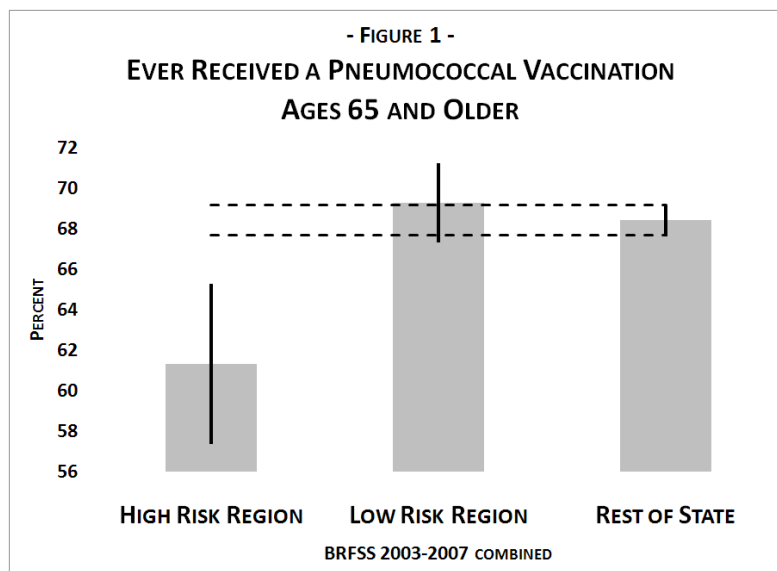
**KEY FINDINGS**

In the spatial analysis of hospitalizations for bacterial pneumonia, the northeast corner of the state persistently had significantly higher than expected rates. For 2003-2005 combined, the relative risk in that region was 2.0 – twice what would be expected given the age and sex distribution of the population living there. During those three years, there were over 1,600 bacterial pneumonia hospitalizations in that region, averaging about 560 hospitalizations per year – *twice the expected* – or about 280 *excess* hospitalizations per year.

Conversely, in the central Puget Sound region, including northern King County, western Snohomish County, and portions of Kitsap and Island Counties, the rate of hospitalizations was significantly lower than expected. For 2003-2005 combined, the relative risk in that area was 0.6, or 60 percent of the expected. In this region, for those three years, there were more than 260 *fewer* than expected hospitalizations, averaging 87 fewer hospitalizations per year.

In 2005, the average charge per stay for simple pneumonia was \$13,000. And while hospitals are often reimbursed less than what they charge (due to negotiated contractual agreements), it is also true that nearly *all* bacterial pneumonia hospitalizations are potentially preventable. Therefore, considering the 560 bacterial pneumonia hospitalizations per year in the northeast corner of the state, if hospitals were only paid *half their charges*, health care purchasers would still be paying over \$3.5 million per year – for bacterial pneumonia only, and for this region alone.

So why are there higher rates of hospitalizations for bacterial pneumonia in the northeast corner of the state? And why are there lower rates in the central Puget Sound region?



Each year, the 65 year-old or older respondents to the BRFSS survey are asked if they have ever had a pneumococcal vaccination. As seen in Figure 1, among those respondents in the northeast corner of the state – labeled the “high-risk region” – only 61 percent indicated that they had. In contrast, over 69 percent of those living in the central Puget Sound region, labeled the “low-risk region” reported that they had had the vaccination, and so, too, had 68 percent of those living outside both the high and low-risk regions.

The difference between the high-risk region and the other two regions is statistically significant, evidenced by the fact that the 95% confidence interval (CI) for the high-risk region does not overlap the 95% CI's of the other two regions. Figure 1 also shows the 95% CI's for the state as a whole; this is the dashed line across the graph. Here, too, the difference between the high-risk region and the state as a whole is statistically significant.

In short, the BRFSS data indicate that the pneumococcal vaccination rates in the northeast corner of the state are low.

But there's more.

First, one of the more common complications of influenza is bacterial pneumonia. As Figure 2 shows, the influenza vaccination rates in the northeast corner of the state are significantly lower than the other two regions and the state as a whole. In other words, not only do the people living in northeast Washington have relatively low protection against bacterial pneumonia, they also have relatively low protection against influenza, which can lead to bacterial pneumonia.

Next, according to the Centers for Disease Control and Prevention (CDC), adults with diabetes should be, in general, a priority population in receiving the pneumococcal vaccination. This is because pneumonia patients with diabetes are at increased risk of complications due to diabetes' association with heart and kidney disease. As Figure 3 shows, the apparent prevalence of diabetes is significantly higher in the high-risk region.

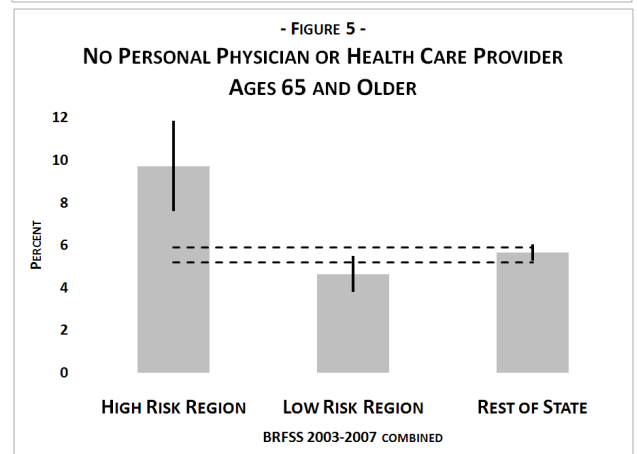
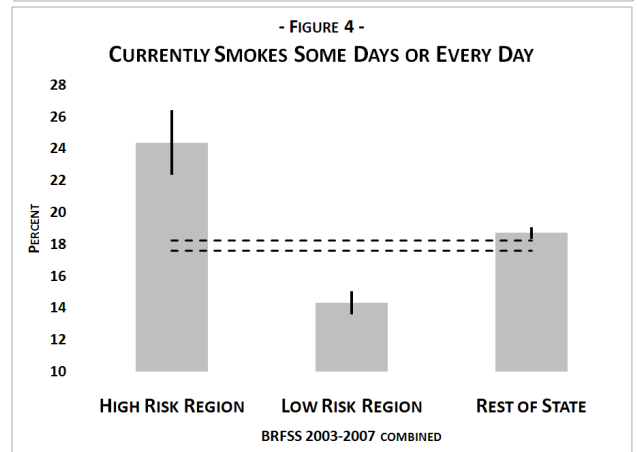
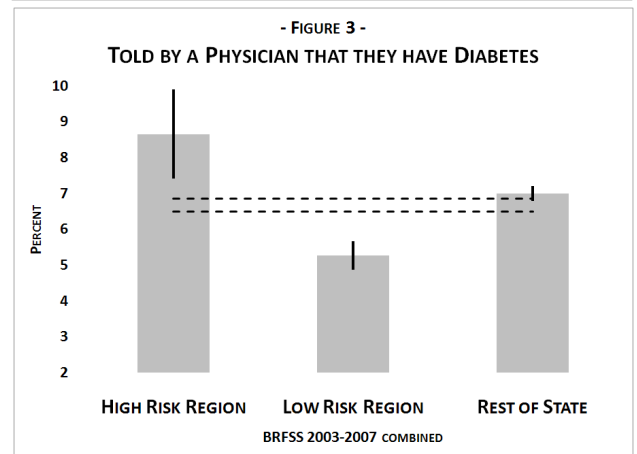
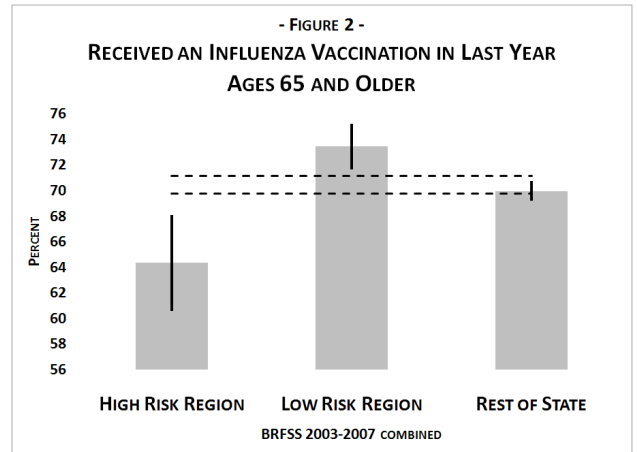
Finally, smokers tend to be at higher risk for getting pneumonia, and once they have the disease, generally experience higher levels of acuity and complications. In Figure 4, we see that those living in the high-risk region have the highest smoking rates.

All these factors combined seem to provide a likely explanation for the higher than expected number of bacterial pneumonia hospitalizations seen in this region.

**ACCESS TO CARE**

Of course, access to preventative and primary care services is essential in preventing hospitalization for bacterial pneumonia. It is through these services that immunizations are delivered and first-line antibiotics are administered. BRFSS data provides some insights into the availability and barriers to these services.

Having an established relationship with a physician or other health care providers is one of the defining attributes of primary care, and has been associated with decreased hospitalizations and lower health care costs. As seen in Figure 5, residents of the northeast corner of the state, the high-risk region, are significantly more apt *not* to have a personal physician compared to the residents of the other two regions assessed and the state as a whole. In fact, compared to the low-risk region in the central Puget Sound area, the difference is two-fold.



This is particularly striking since the populations assessed have health care coverage through Medicare. Moreover, simply by being 65 or older, one would hope that they would have to have a health care provider whom they knew – and who knew them and their needs.

But access to health care seems to be a generic problem in this part of the state. As seen in Figure 6, when individuals of all ages are asked if they have health care coverage of any kind, those living in the high-risk region were significantly more apt to say no.

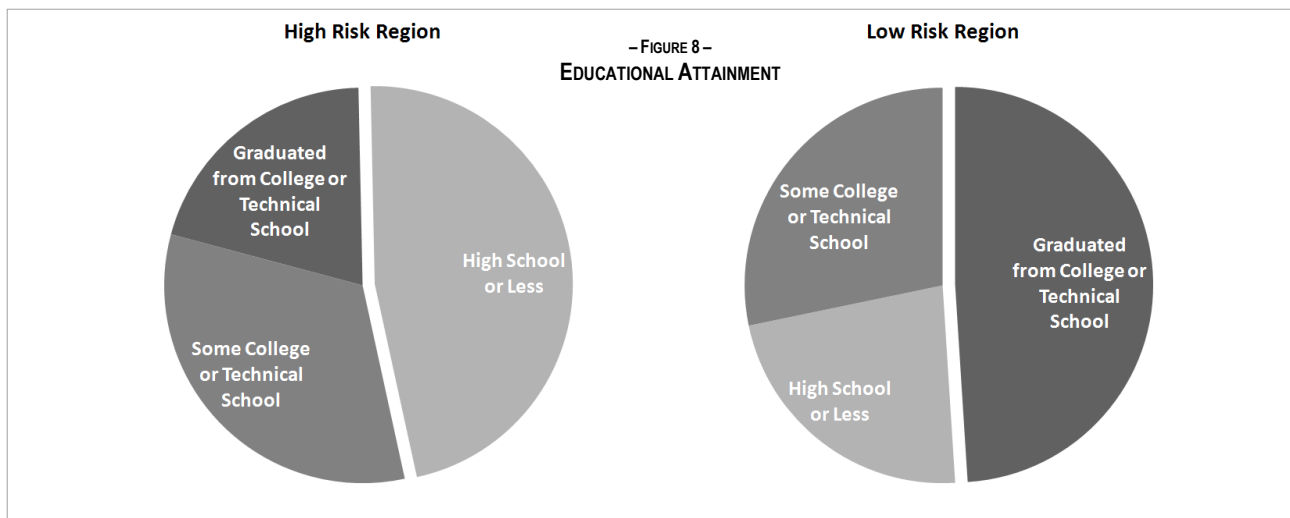
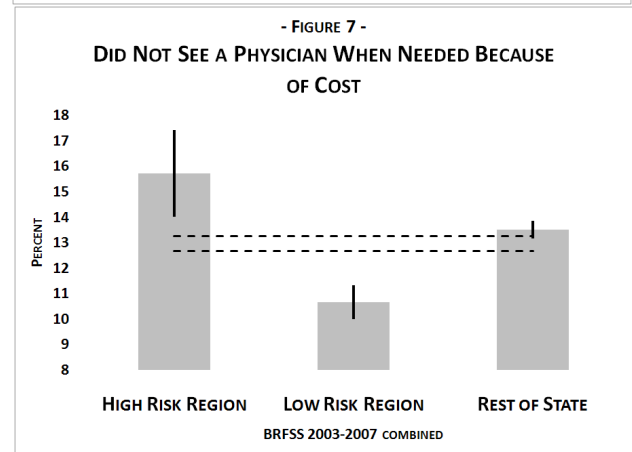
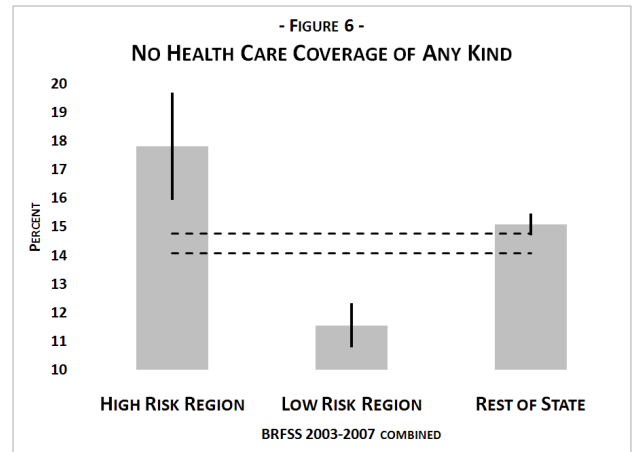
So, too, as seen in Figure 7, when asked if they ever had to forego needed care because they could not afford the costs, those living in the high-risk region were significantly more apt to say yes.

Conversely, those living in the low-risk region were significantly more apt to have health care coverage, and they were significantly less apt to forego needed care because of costs.

**POPULATION CHARACTERISTICS**

Understanding a population’s general characteristics is important in developing a strategy and message for change. Here, too, BRFSS data provides important insights.

Limited or marginal literacy has long been associated with low immunization rates, and simple, one-page, fifth-grade level handouts that encourage patients to “ask your doctor about the pneumonia shot” have been shown to dramatically increase vaccination rates. Together, these findings seem particularly pertinent to the high-risk region.



Specifically, as Figure 8 shows, the educational attainments in the high- and low-risk regions are near mirror images: In the high-risk region, approximately half of the respondents have only a high school diploma or less; in the low-risk region, approximately half of the respondents have graduated from college or a technical school. The differences are statistically significant.

Similarly, income is widely acknowledged as a potential barrier to health care services. This, again, is particularly germane in assessing the high- and low-risk regions: More than forty percent of the BRFSS respondents in the high-risk region reported their annual household income as \$25,000 or less, while less than twenty percent of the respondents in the low-risk region fell into that same income bracket (see Figure 9).

While BRFSS has direct measures on education and income, it does not contain any similarly direct measures of “culture” or “cultural norms.” It does, however, include measures of race and Hispanic ethnicity, which can, to a degree, reflect the attitudes and experiences of a community, as well as assist in tailoring messages to target populations.

Along those lines, what is particularly striking about the northeast corner of the state is the high percent of American Indians and Alaska Natives (AI/AN) living there. As seen in Figure 10, the percent of AI/NA living in the high-risk region is more than four times that in the low-risk region. Ten years ago, a study from the University of Washington noted that “inadequate vaccination rates were observed in elderly Native Americans.” (Buchwald 2000) It may be that this problem persists.

**RECAP AND CONCLUSIONS**

First and foremost, it is important to recognize that although this analysis is focused on geographic variations, nearly *all* hospitalizations for bacterial pneumonia are potentially preventable.

Given that understanding, by using patient origin adjusted inpatient hospital discharge data, the region in the northeast corner of the state, in particular, was seen as having higher than expected hospitalizations for bacterial pneumonia when compared to the rest of the state. According to BRFSS data, the rates of pneumococcal vaccinations in that northeast region were significantly lower than any of the other regions assessed. Similarly, the rates of influenza vaccination there were also lower than they were elsewhere; bacterial pneumonia is a well-established potential complication of influenza.

Compounding this apparent lack of basic preventative care, residents in the northeast region also engaged in behaviors (smoking) and had pre-existing conditions (diabetes) that made them more susceptible to the disease and more apt to face higher levels of acuity and complications once they acquired it. In addition, residents of this region were less apt to have a personal health care provider, less apt to have insurance coverage, and more apt to forego care when needed because of costs. They were also poorer, less educated, and more likely to be of American Indian or Alaska Native descent. All of these factors are associated with lower vaccination rates.

In short, these findings provide a likely explanation for the higher than expected number of bacterial pneumonia hospitalizations seen in this region. More broadly, they suggest that regions with higher than expected hospitalization rates can be identified and that, in some circumstances, the underlying causes may also be identifiable – and preventable.

*For further information or to obtain this document in an alternative format, contact the Joe Campo, Washington State Office of Financial Management at (360) 725-3862 or [joe.campo@ofm.wa.gov](mailto:joe.campo@ofm.wa.gov)*

