

# Supplemental Appendix - Modeling Idaho COVID-19 Health Disparities

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## **Supplemental Appendix Overview**

This supplemental appendix provides data outputs as part of the University of Idaho's Modeling Idaho COVID-19 Health Disparities grant (2022). This publication was made possible by the National Initiative to Address COVID-19 Health Disparities through Centers for Disease Control and Prevention (CDC), #OT21-2103. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Idaho Dept of Health and Welfare, or CDC.

The data and used construct all models and figure outputs are for the Idaho seven-region study area (Figure 1).

## **Data Input**

Our data input involves four (4) sources:

1. The Behavioral Risk Factors Surveillance System (BRFSS) survey, from 2020, for the state of Idaho. Survey responses on obesity, overweight, and diabetes ( $n = 5474$ ) were collected across the state of Idaho, at a regional, health district scale;
2. American Community Survey (ACS) data for 2020. The U.S. Census, in coordination with the American Community Survey, provide annual updates to population demographics. In this instance, we utilized county-level demographics as constraining data for our microsimulation modeling;
3. Center for Health Statistics, 2020. The CSA provided cross-tabulated census data, which allowed us to assess empty cell concerns; and
4. Geographic data for state and county boundaries.

## **Model Developmennt**

Using the aforementioned datasets, we constructed four main iterative proportional fitting (IPF) models:

- Model 1: Static base model. Maintains all census groupings, and does no filtering based on significance testing.
- Model 2: Static grouped model. Performs no significance testing, but does an initial group combination.
- Model 3: Dynamic base model. Performs a significance testing to remove variables - but does no grouping.
- Model 4: Dynamic grouped model. Performs both significance testing and grouping.

Each model was constructed and run for each variable (obesity, overweight, diabetes, kidney disease, depressive disorder, pulmonary disease, asthma, stroke, angina/heart disease, heart attack, and smoking) and each health district (n=7).

**Figure S1. State of Idaho Study Area**

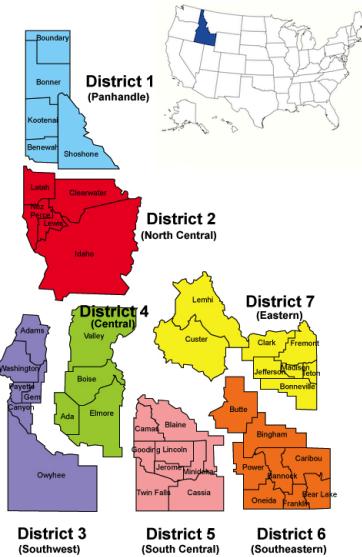


Figure 1: State of Idaho study area. Modified from the State of Idaho's Department of Health and Welfare ([healthandwelfare.idaho.gov](http://healthandwelfare.idaho.gov))

**Figure S2. Small Area Estimation Methodology**

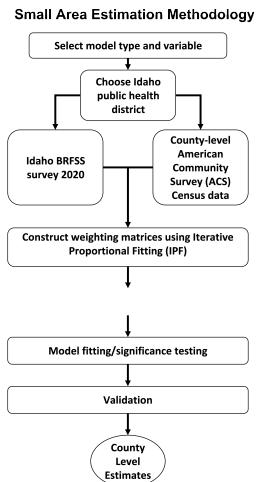


Figure 2: Modeling methodology

**Figure S3. Model Groupings**

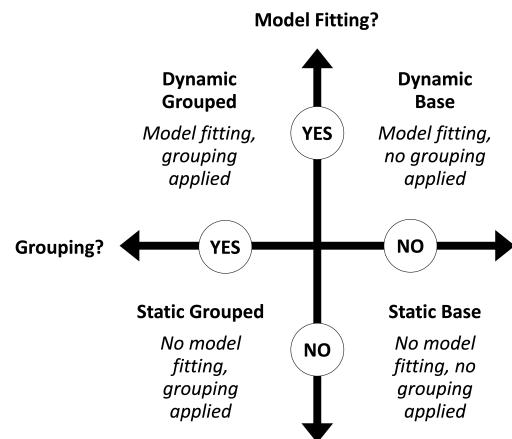
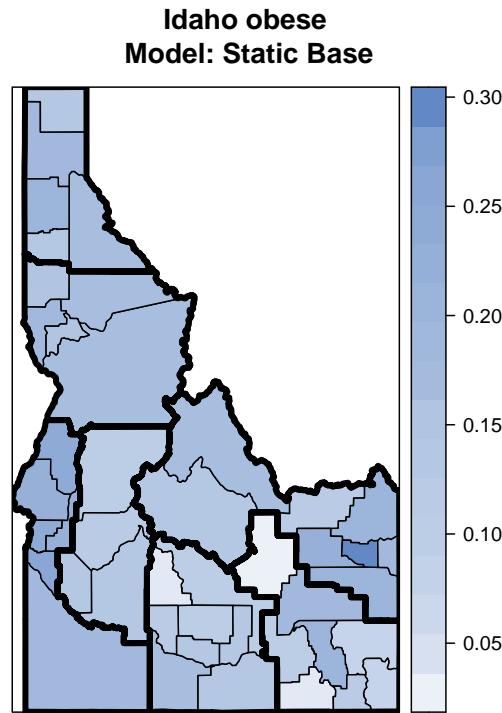


Figure 3: Model groupings

**Figure S4. Obesity 2020 Static Base Model**

A



B

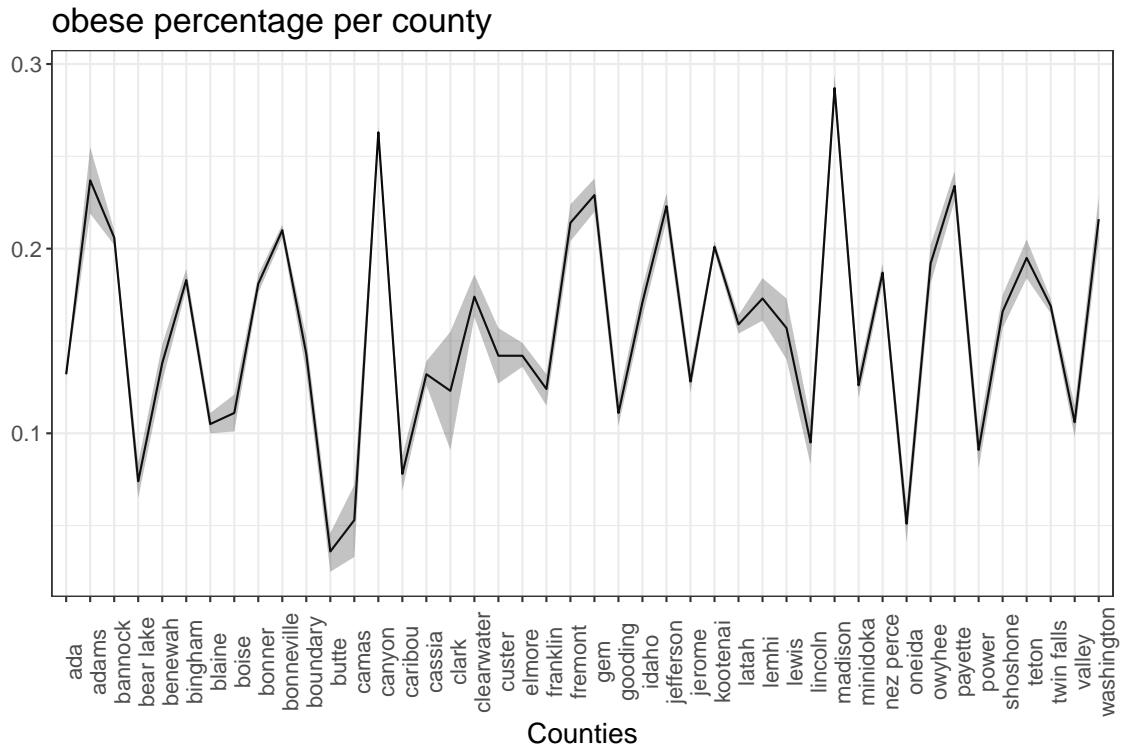


Figure 4: Idaho Obesity 2020 - Static Base Model.

**Figure S5. Obesity 2020 Static Grouped Model**

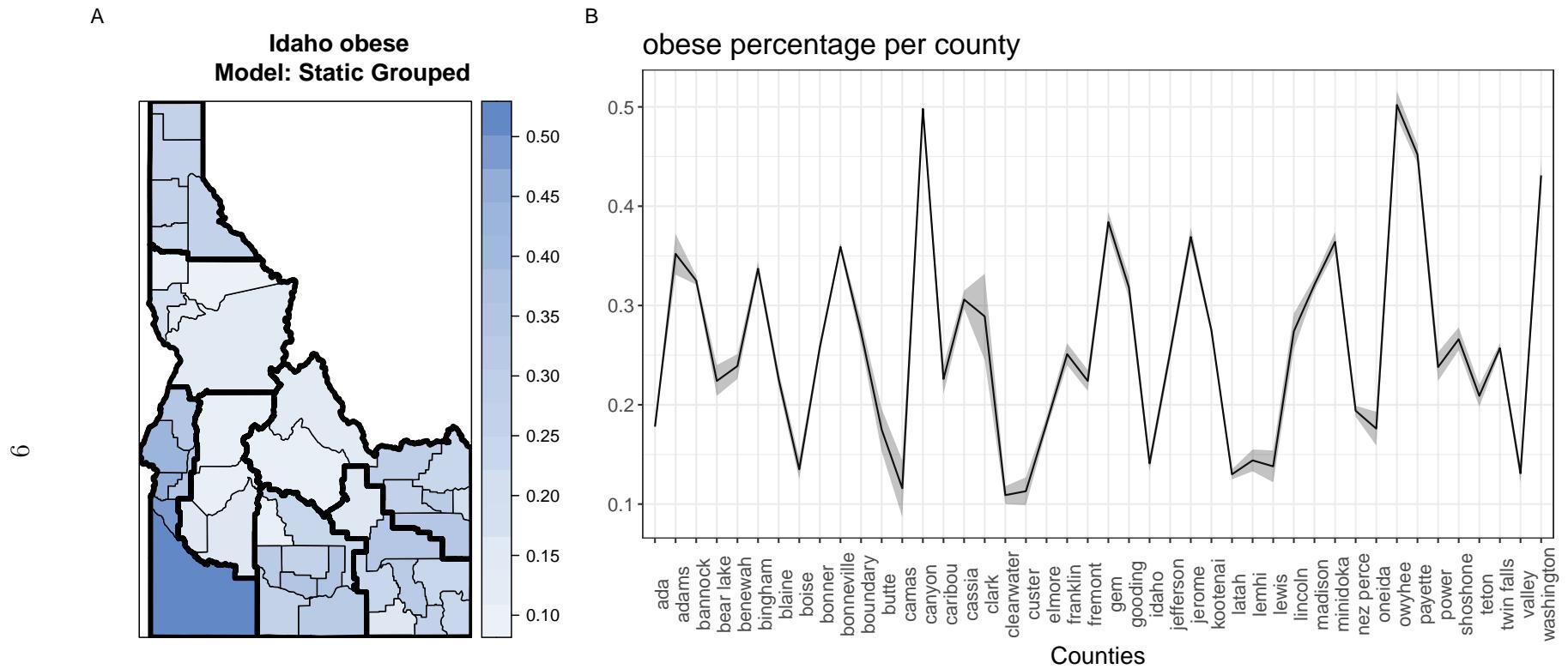


Figure 5: Idaho Obesity 2020 - Static Grouped Model.

**Figure S6. Obesity 2020 Dynamic Base Model**

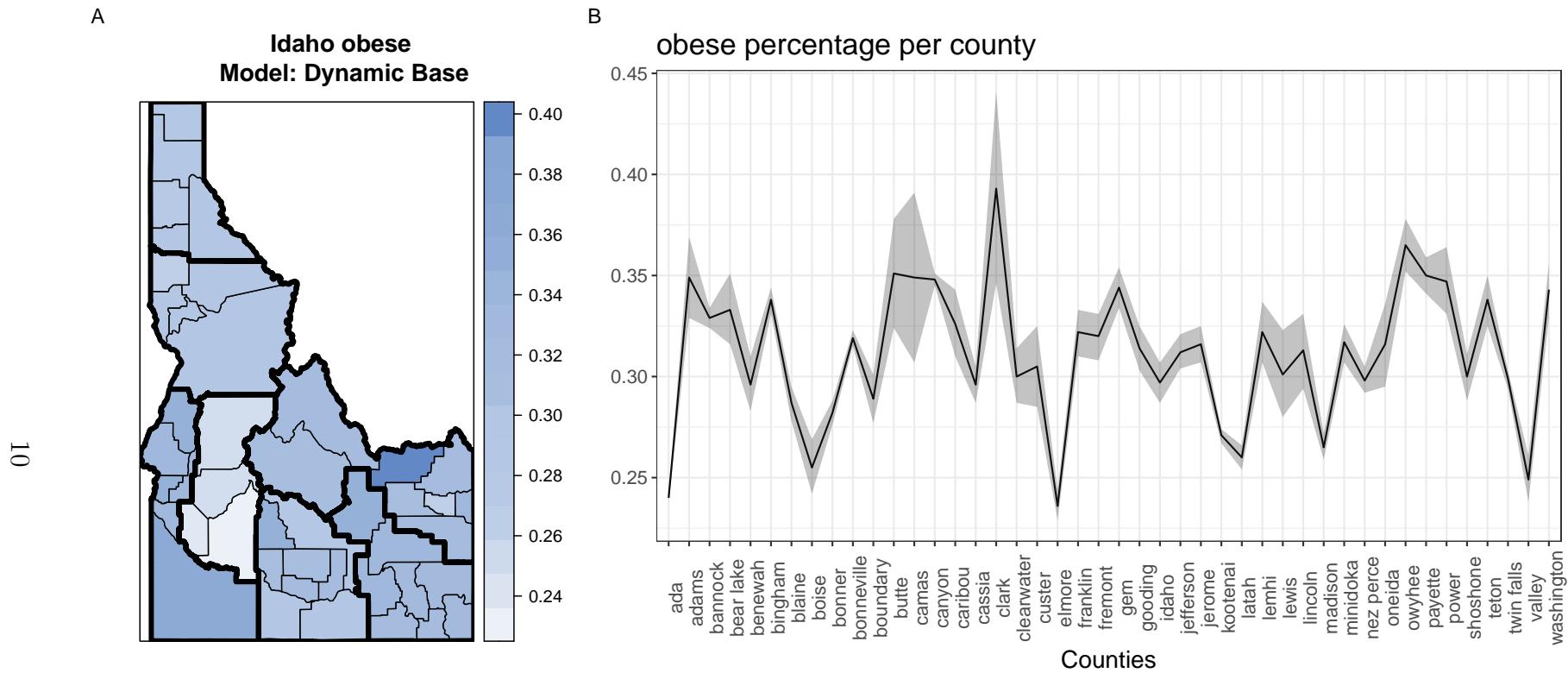


Figure 6: Idaho Obesity 2020 - Dynamic Base Model.

**Figure S7. Obesity 2020 Dynamic Grouped Model**

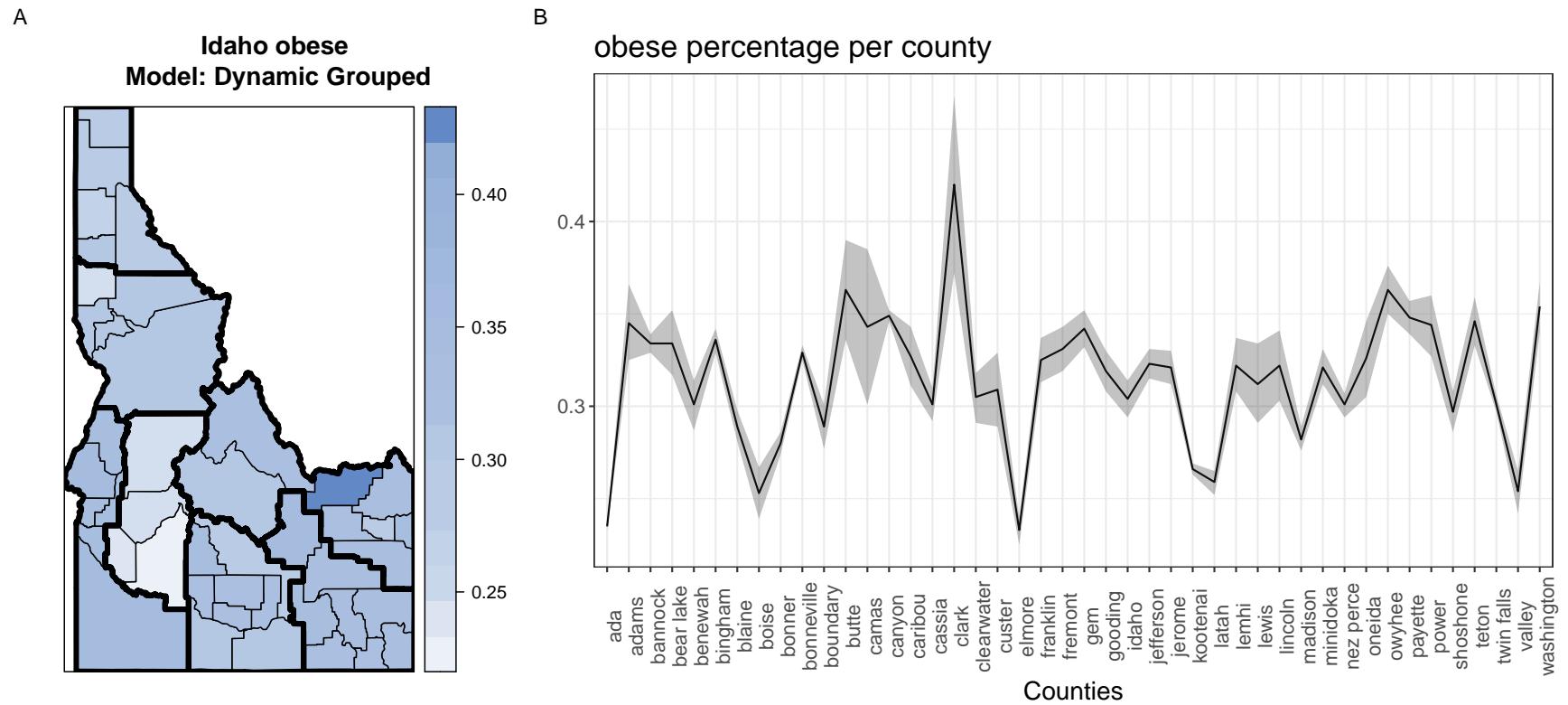
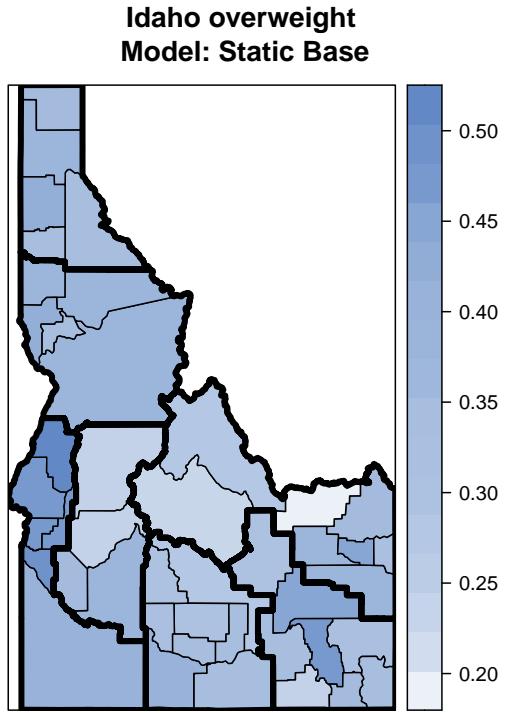


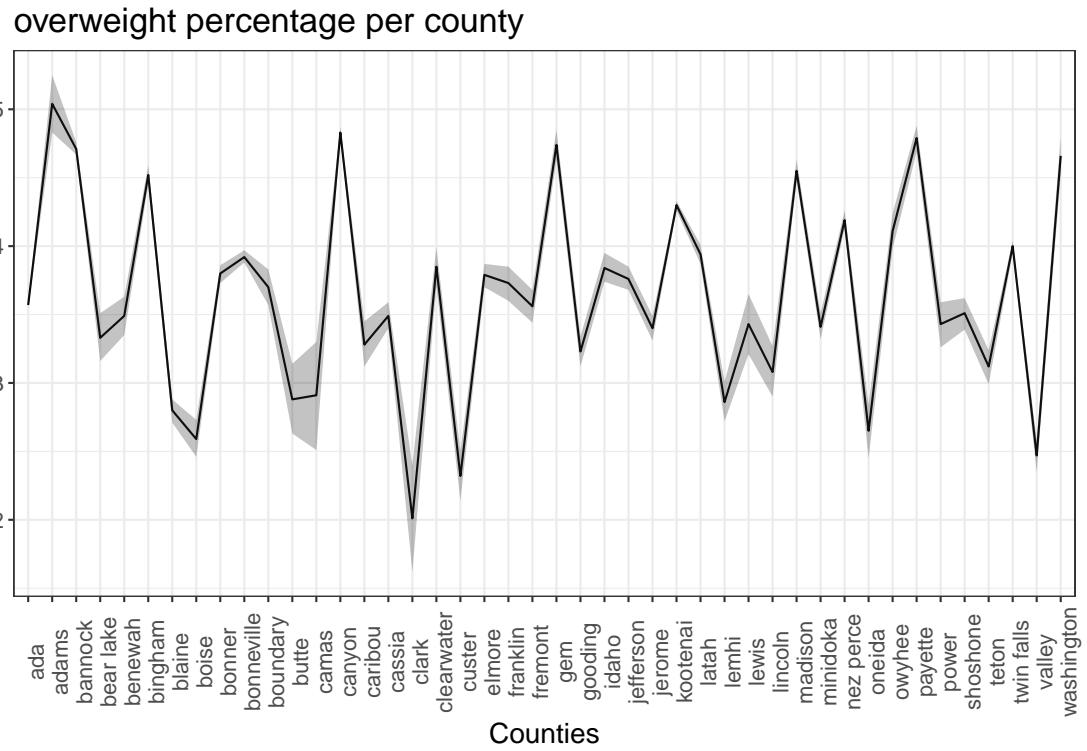
Figure 7: Idaho Obesity 2020 - Dynamic Grouped Model.

**Figure S8. Overweight 2020 Static Base Model**

A



B



**Figure 8: Idaho Overweight 2020 - Static Base Model.**

**Figure S9. Overweight 2020 Static Grouped Model**

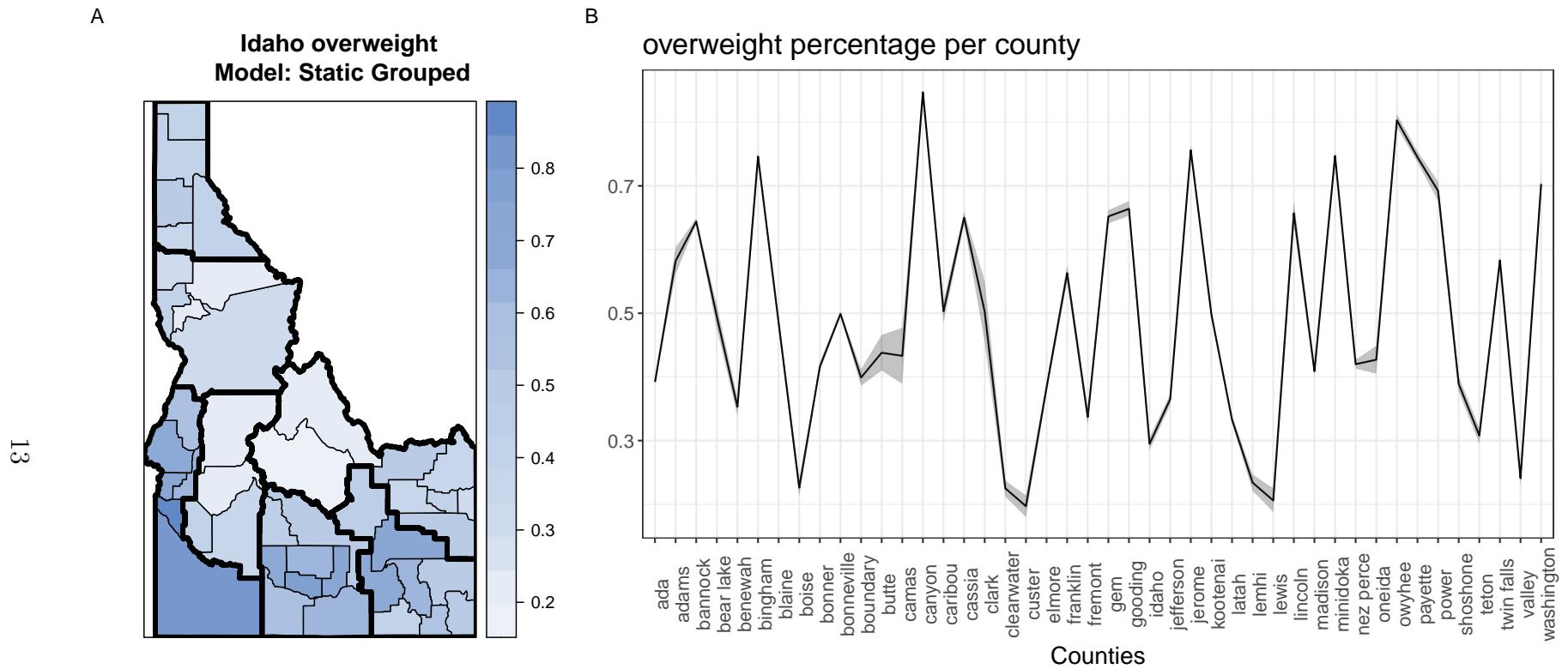
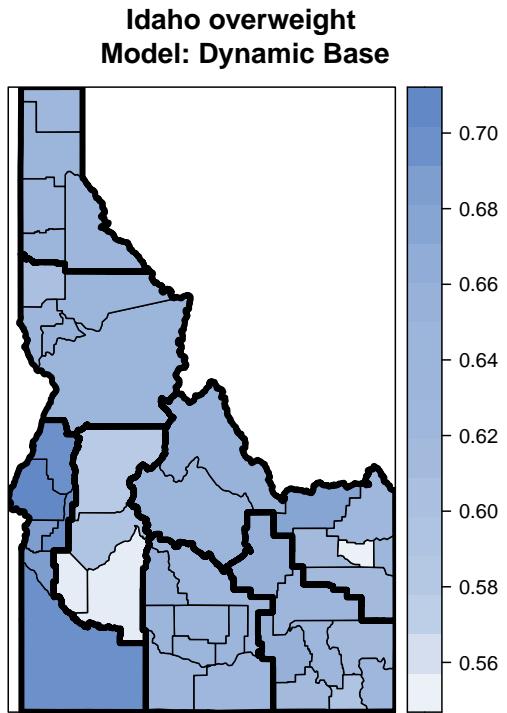


Figure 9: Idaho Overweight 2020 - Static Grouped Model.

**Figure S10. Overweight 2020 Dynamic Base Model**

A



B

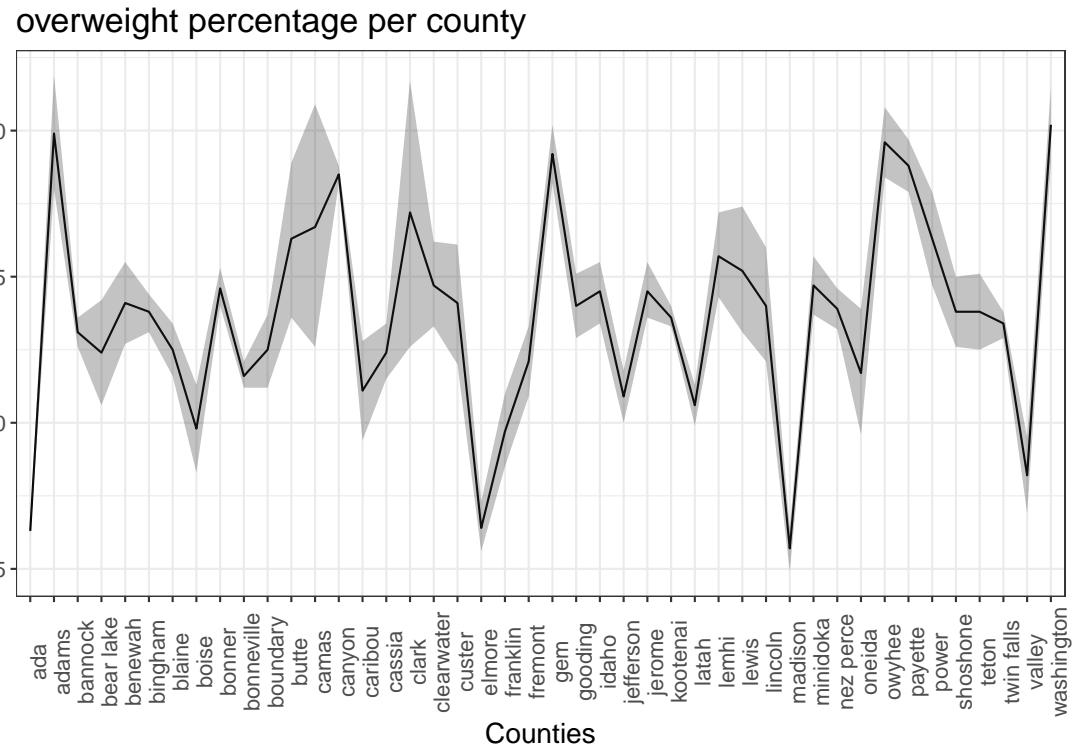


Figure 10: Idaho Overweight 2020 - Dynamic Base Model.

**Figure S11. Overweight 2020 Dynamic Grouped Model**

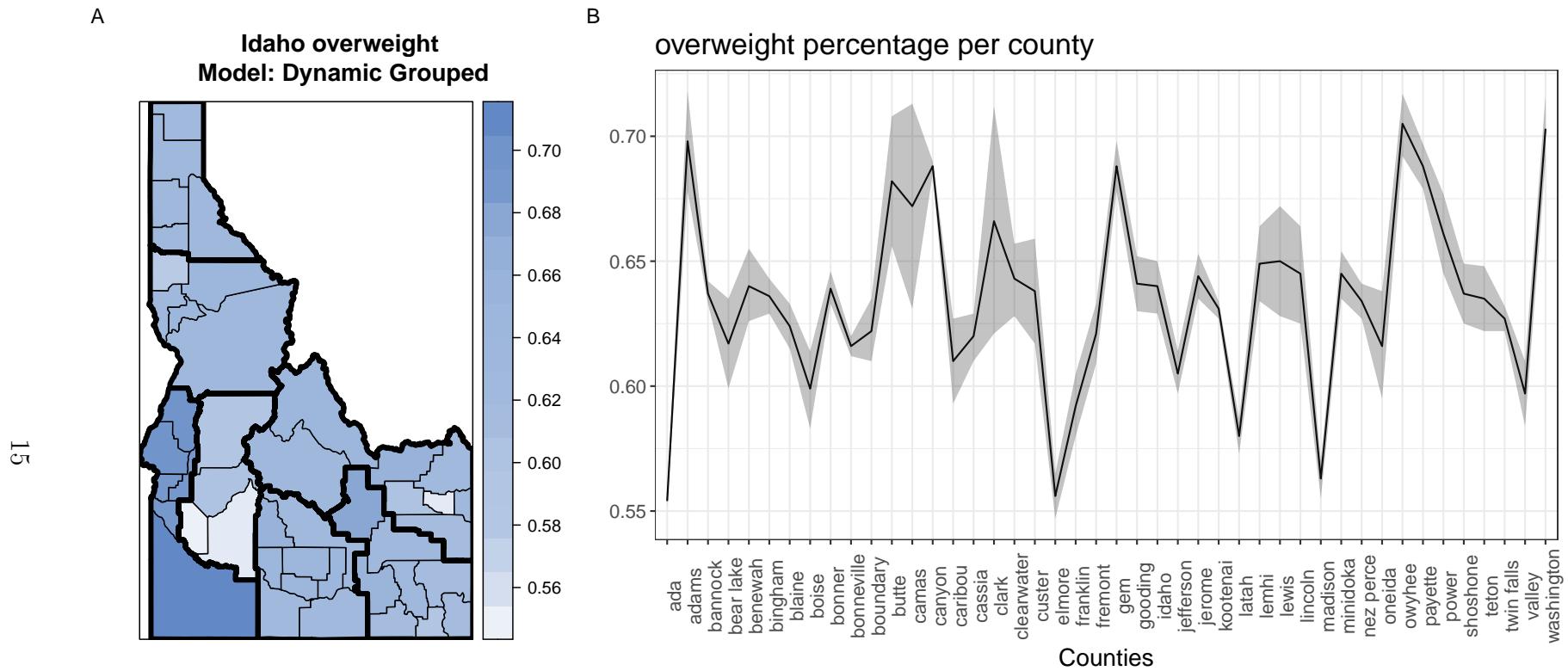
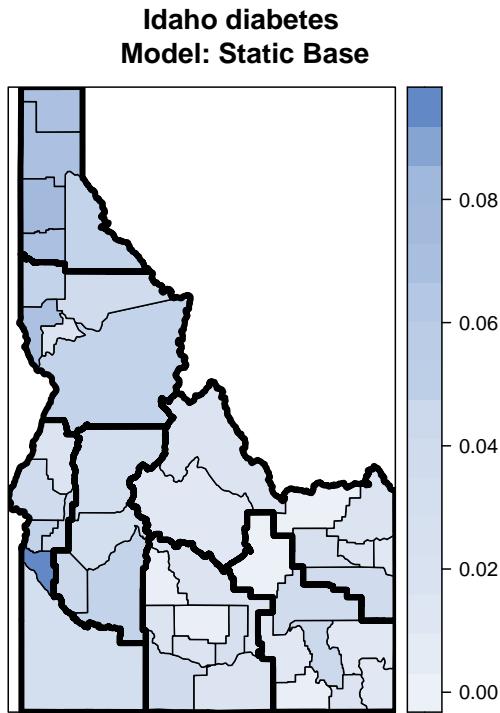


Figure 11: Idaho Overweight 2020 - Dynamic Grouped Model.

**Figure S12. Diabetes 2020 Static Base Model**

A



B

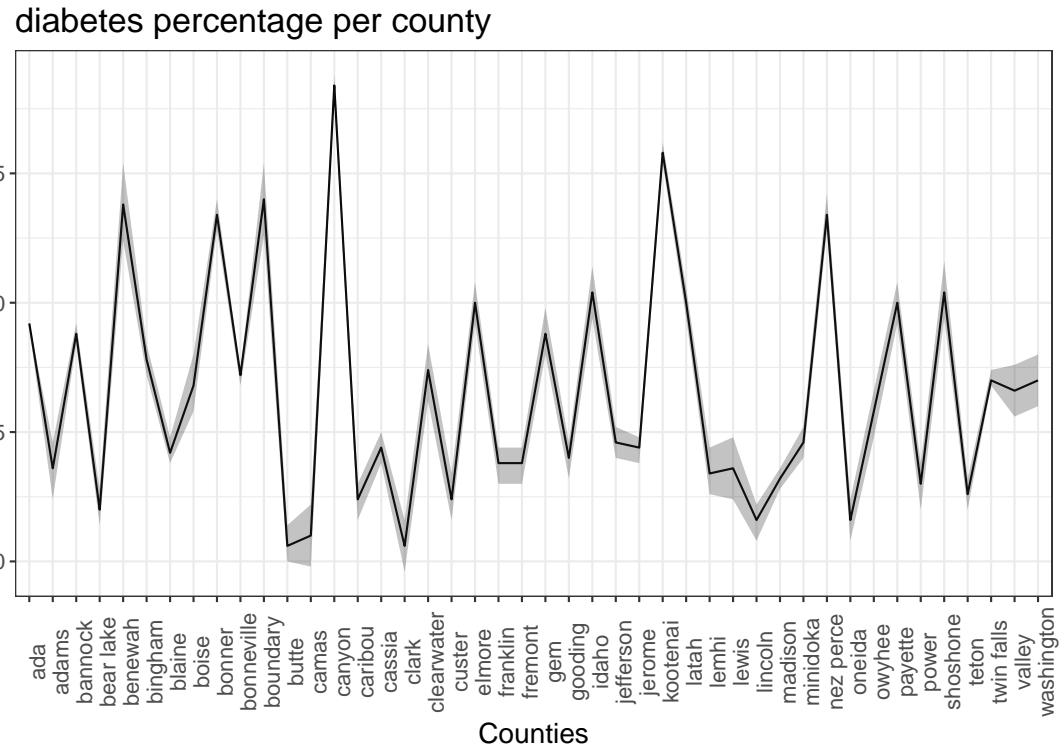


Figure 12: Idaho Diabetes 2020 - Static Base Model.

**Figure S13. Diabetes 2020 Static Grouped Model**

17

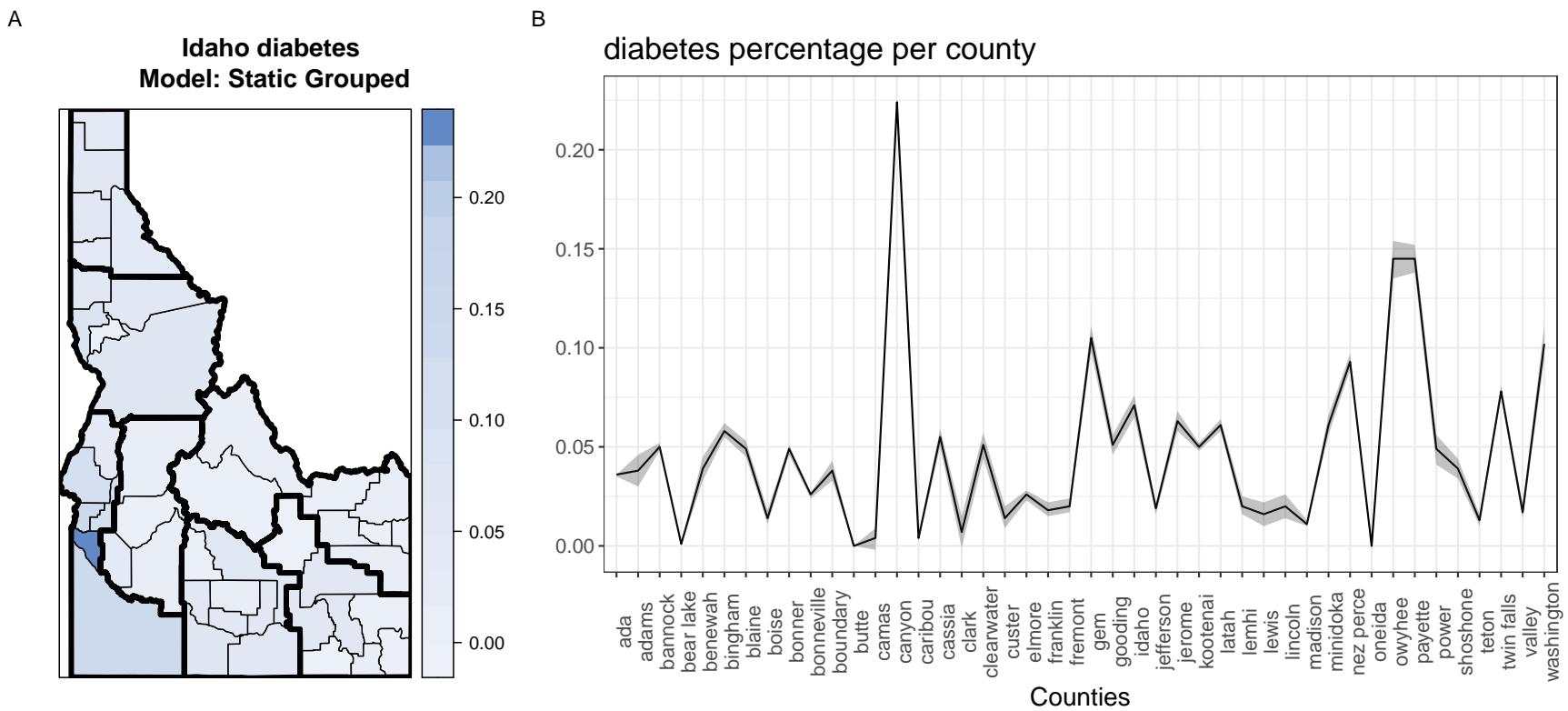


Figure 13: Idaho Diabetes 2020 - Static Grouped Model.

**Figure S14. Diabetes 2020 Dynamic Base Model**

18

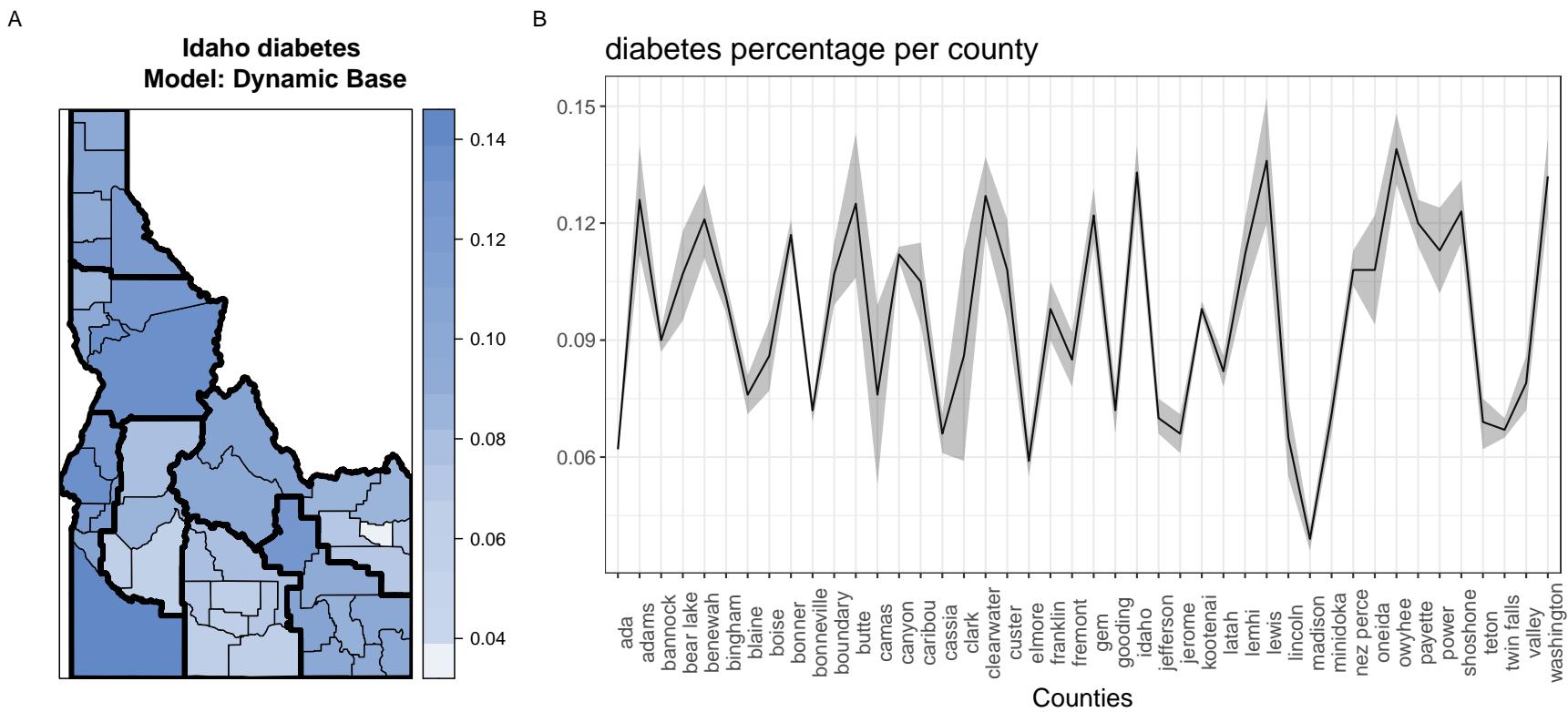
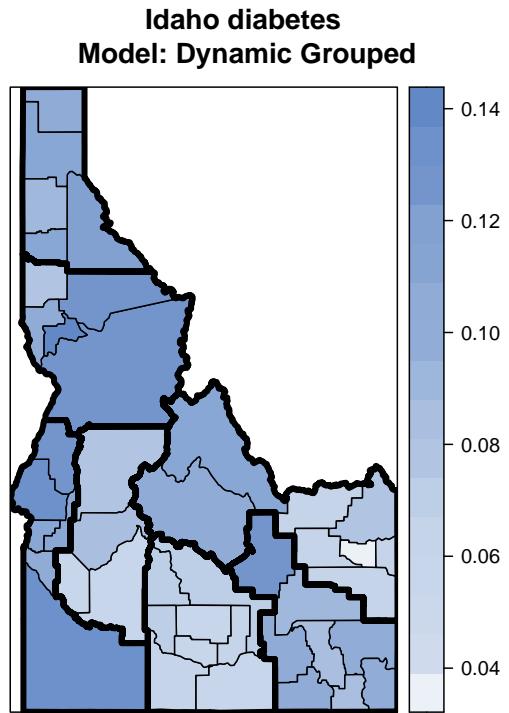


Figure 14: Idaho Diabetes 2020 - Dynamic Base Model.

Figure S15. Diabetes 2020 Dynamic Grouped Model

A



B

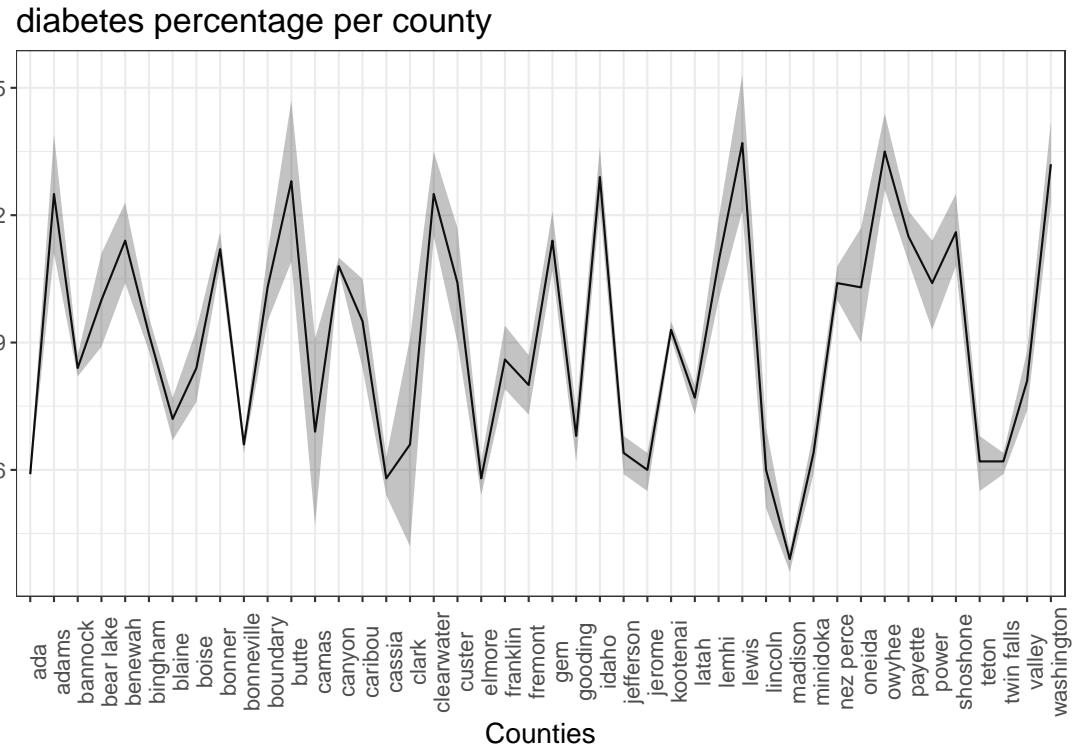
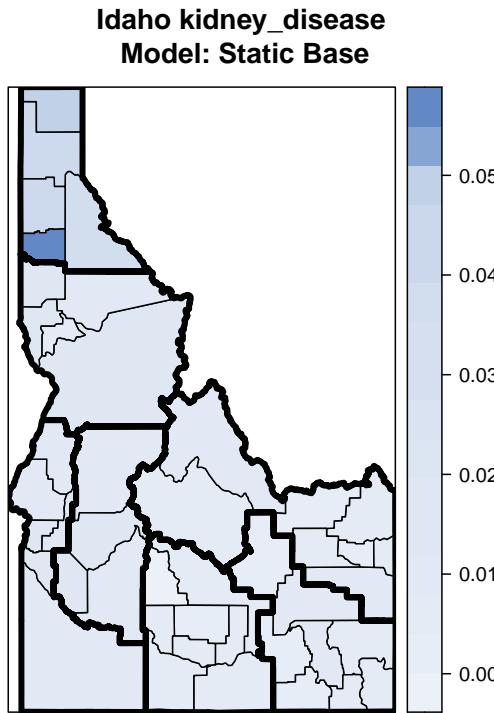


Figure 15: Idaho Diabetes 2020 - Dynamic Grouped Model.

Figure S16. Kidney Disease 2020 Static Base Model

A



B

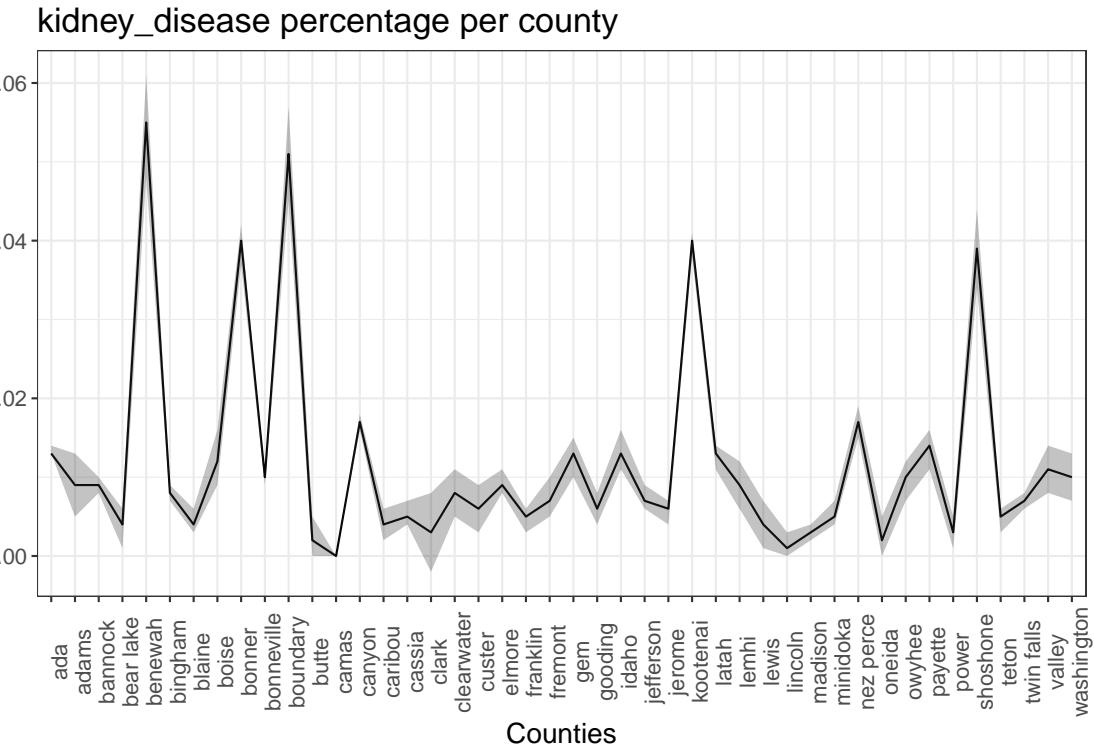
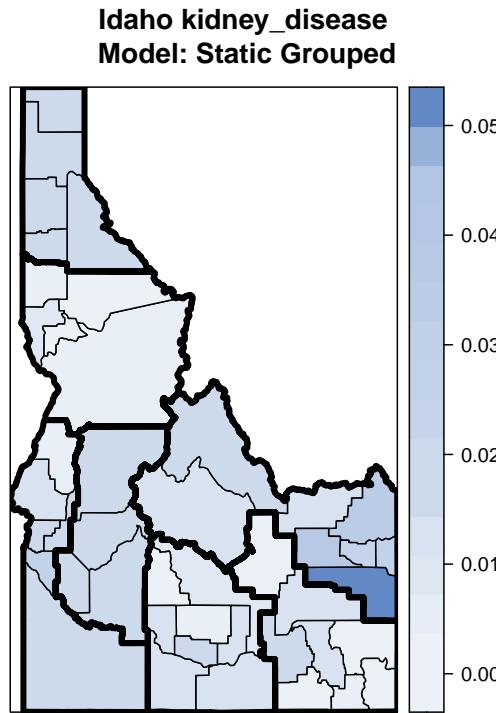


Figure 16: Idaho Kidney Disease 2020 - Static Base Model.

Figure S17. Kidney Disease 2020 Static Grouped Model

A



B

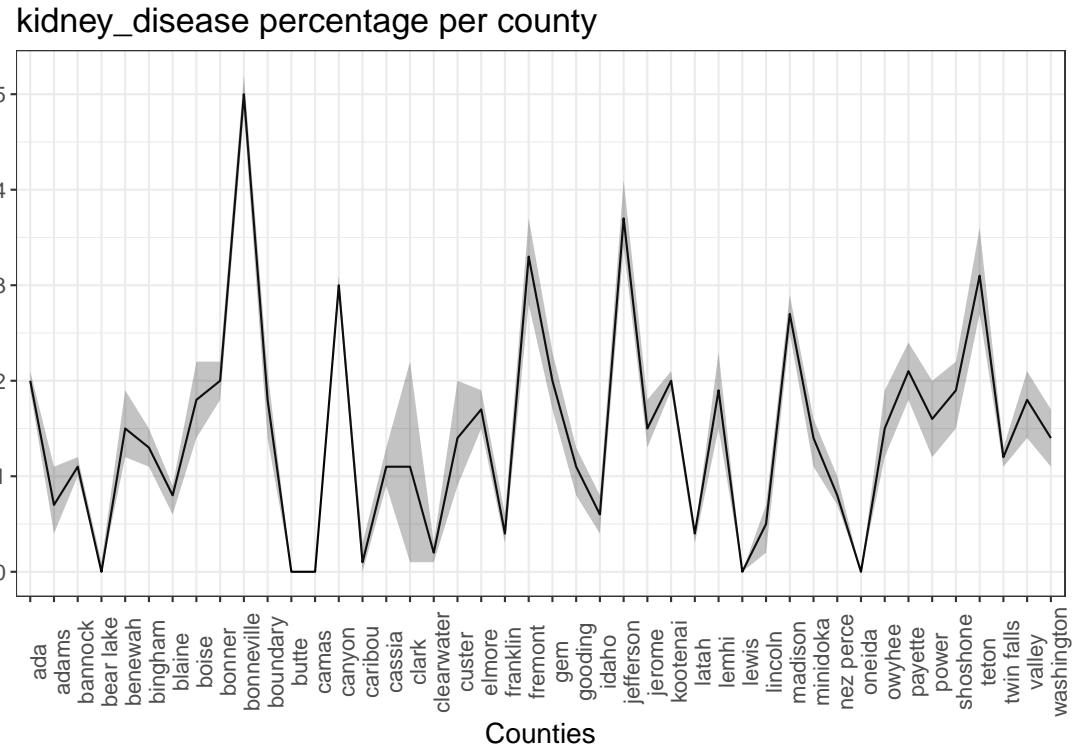


Figure 17: Idaho Kidney Disease 2020 - Static Grouped Model.

**Figure S18. Kidney Disease 2020 Dynamic Base Model**

22

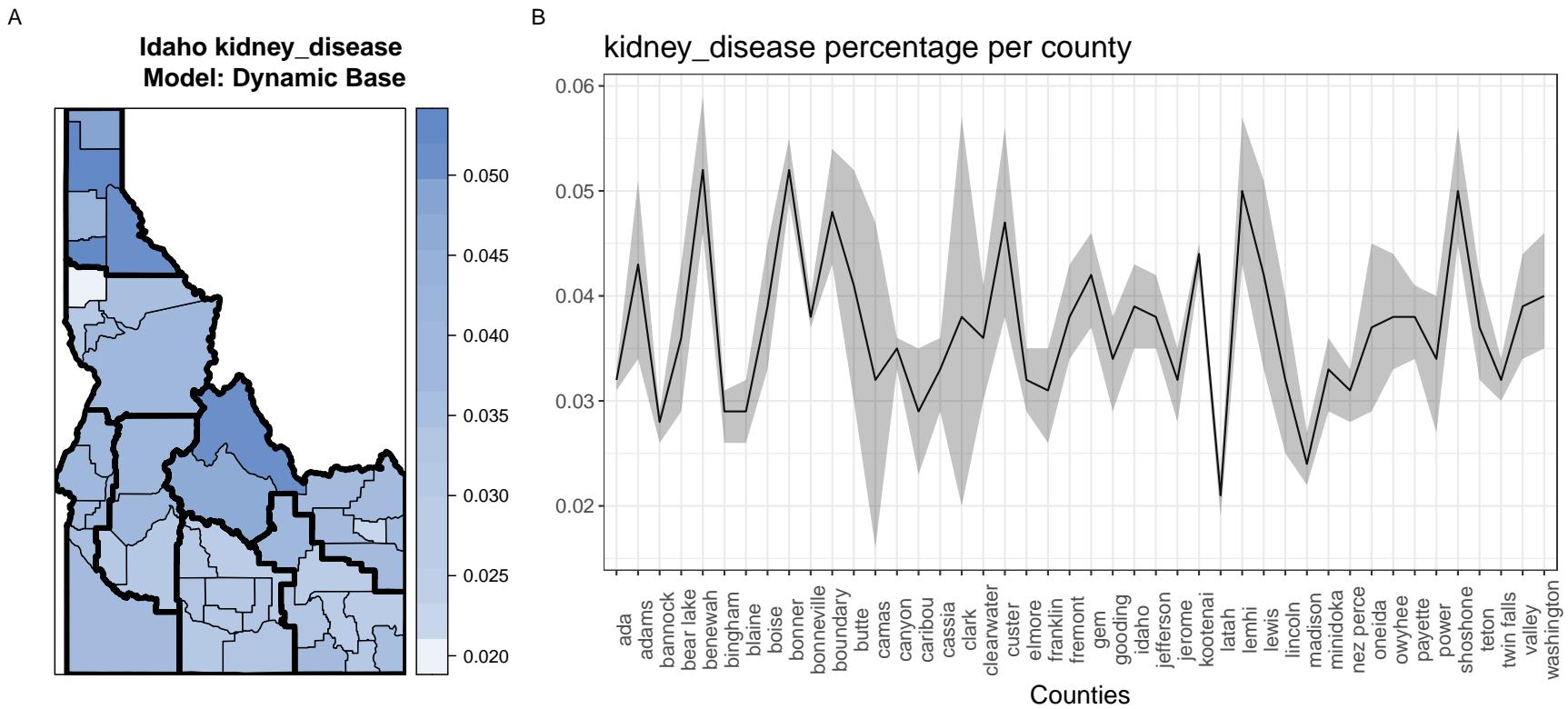


Figure 18: Idaho Kidney Disease 2020 - Dynamic Base Model.

Figure S19. Kidney Disease 2020 Dynamic Grouped Model

23

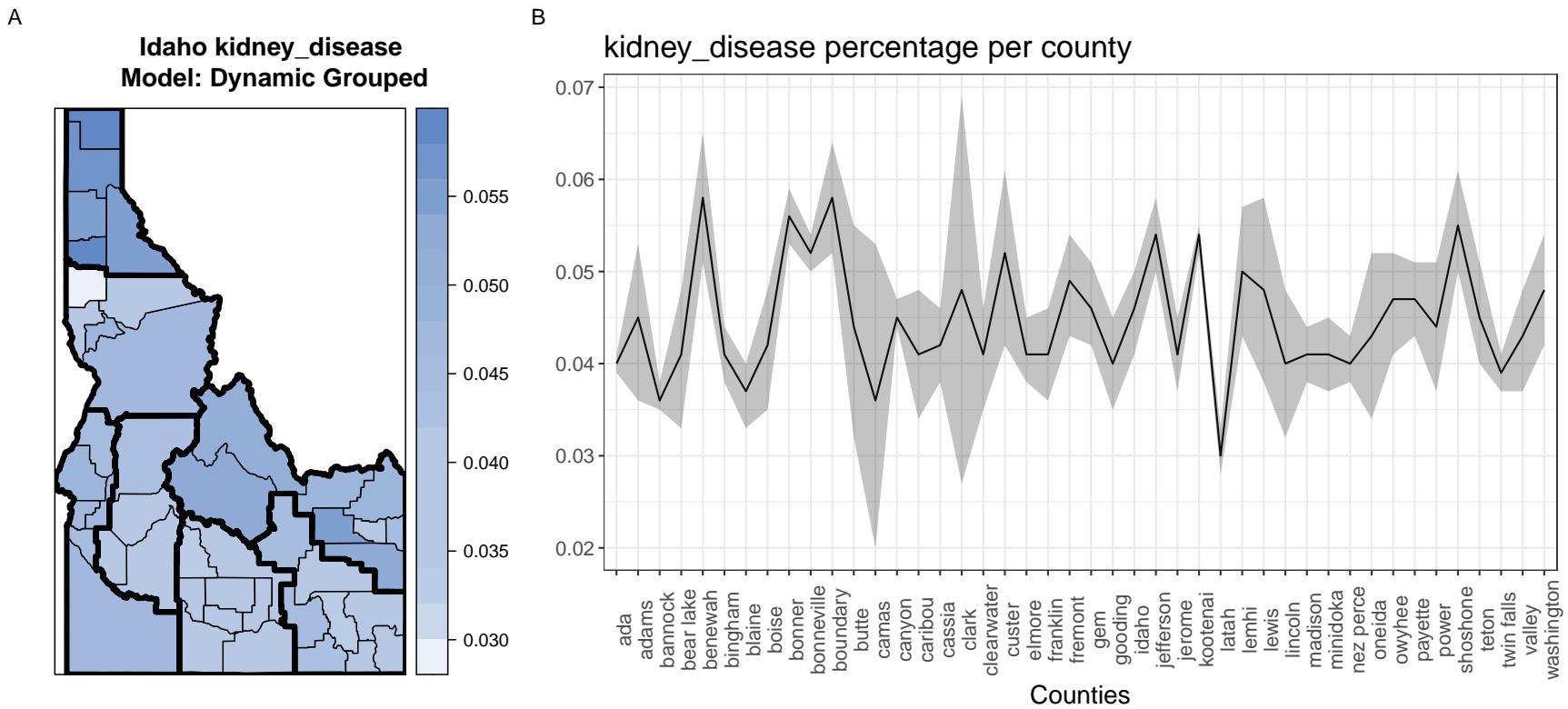
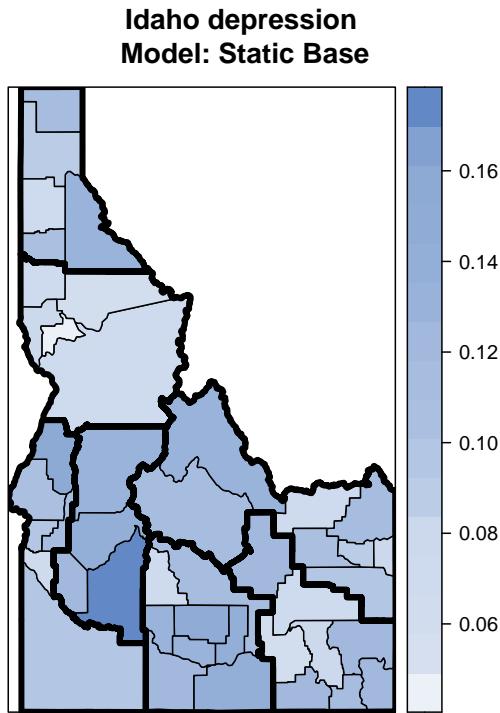


Figure 19: Idaho Kidney Disease 2020 - Dynamic Grouped Model.

Figure S20. Depressive Disorder 2020 Static Base Model

A



B

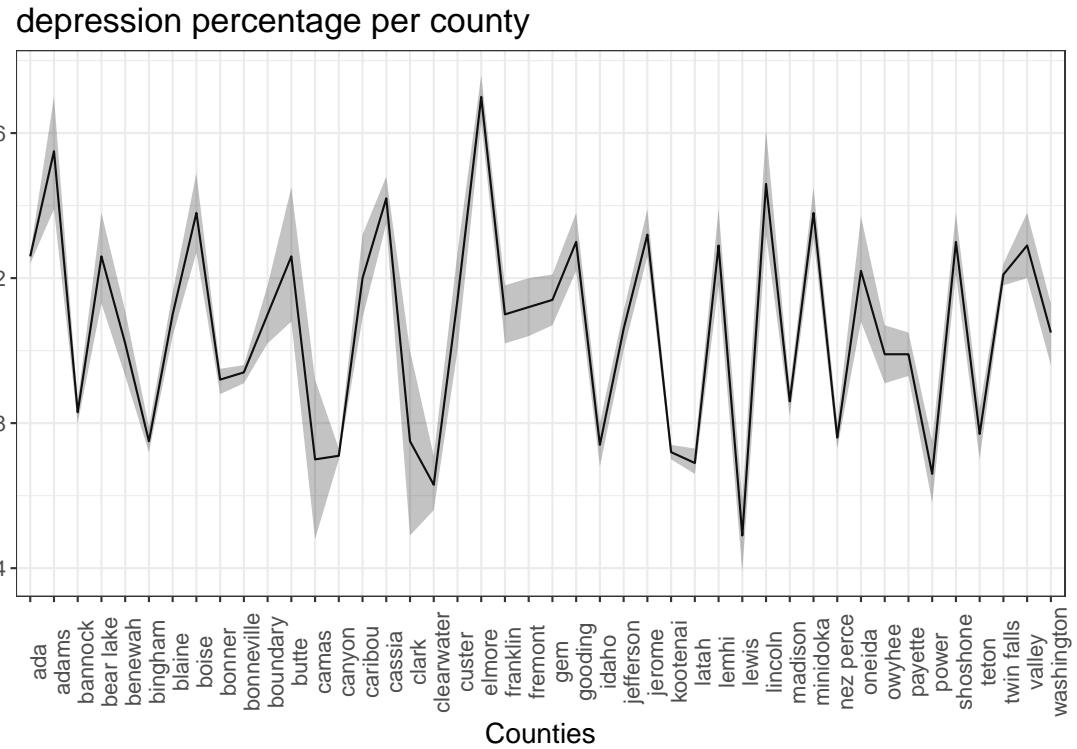


Figure 20: Idaho Depressive Disorder 2020 - Static Base Model.

**Figure S21. Depressive Disorder 2020 Static Grouped Model**

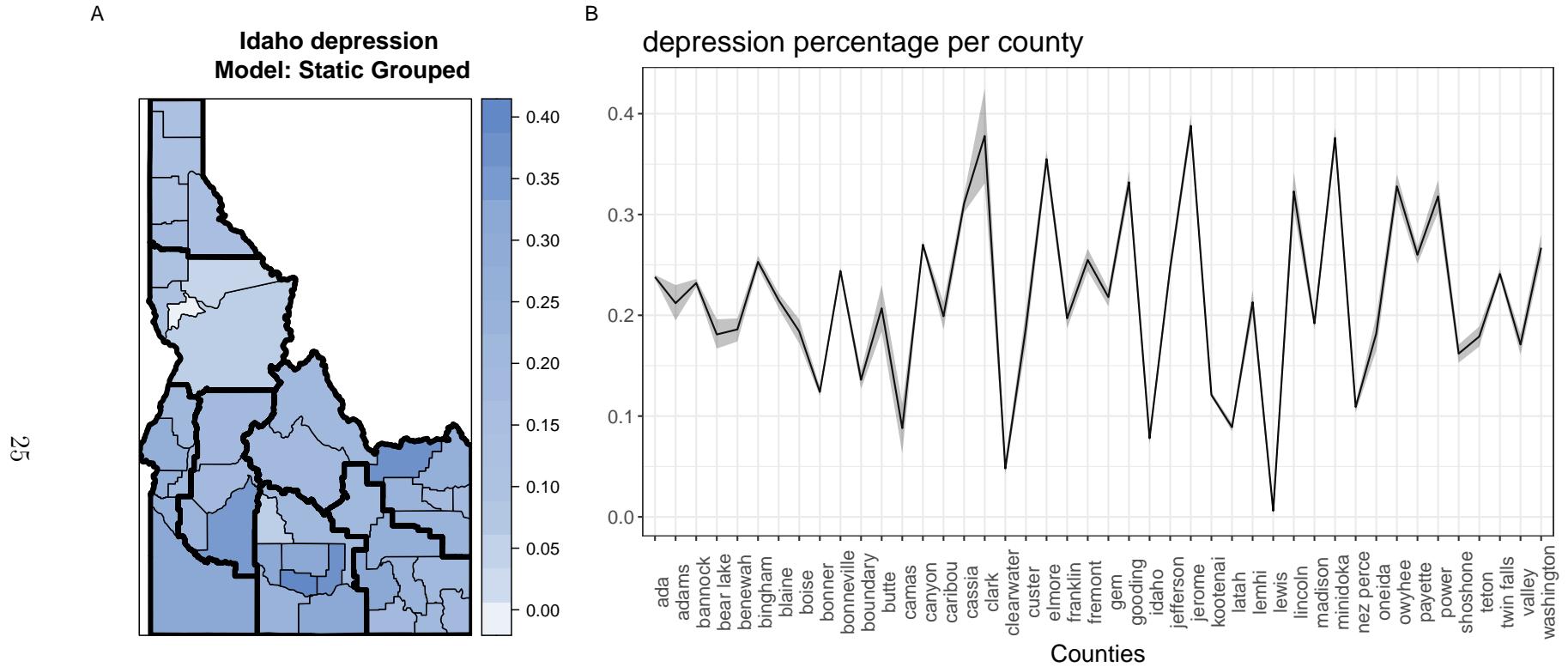
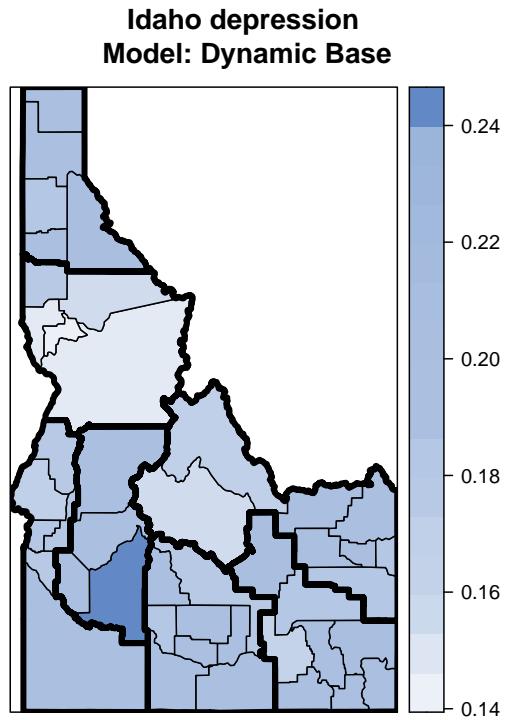


Figure 21: Idaho Depressive Disorder 2020 - Static Grouped Model.

**Figure S22. Depressive Disorder 2020 Dynamic Base Model**

A



B

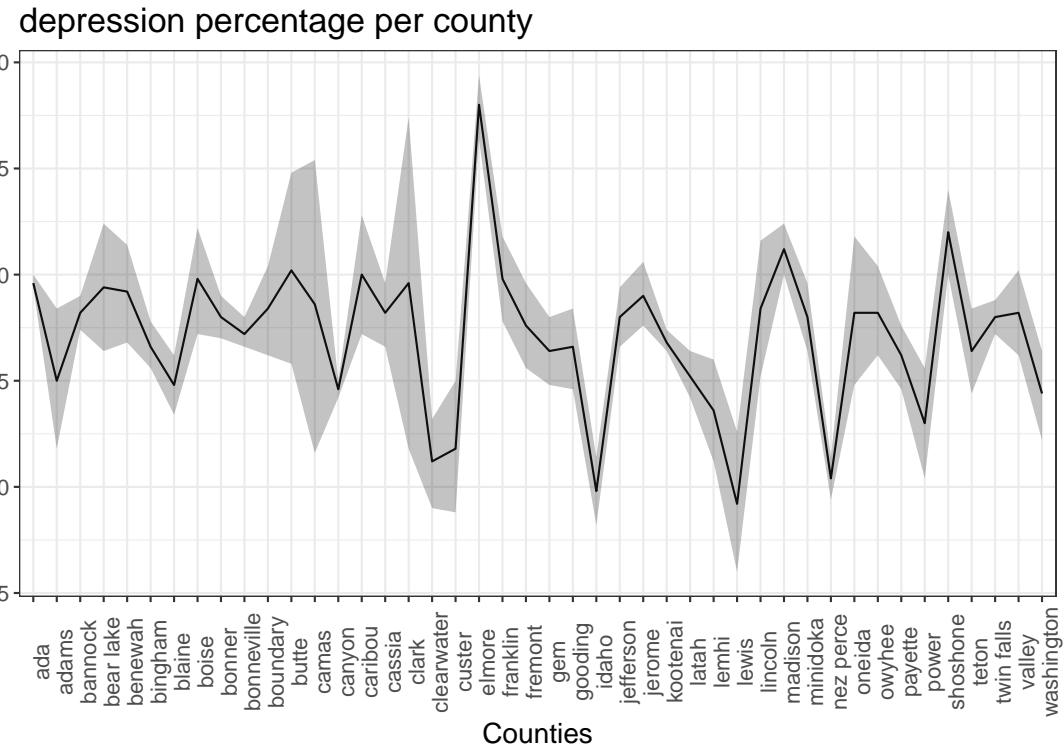
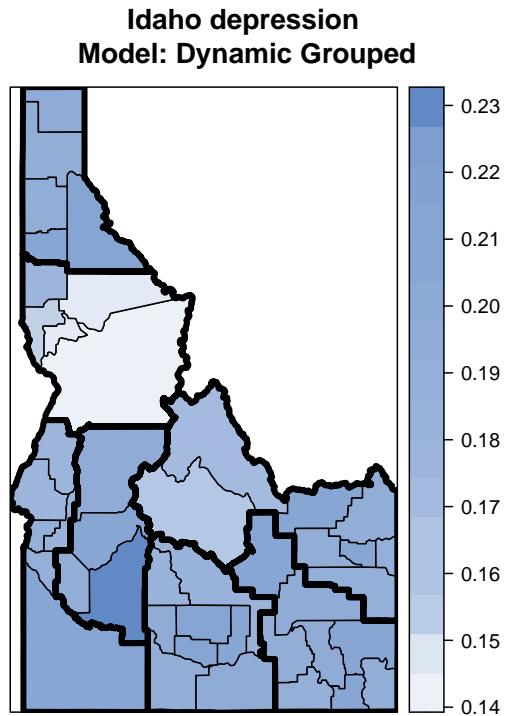


Figure 22: Idaho Depressive Disorder 2020 - Dynamic Base Model.

**Figure S23. Depressive Disorder 2020 Dynamic Grouped Model**

A



B

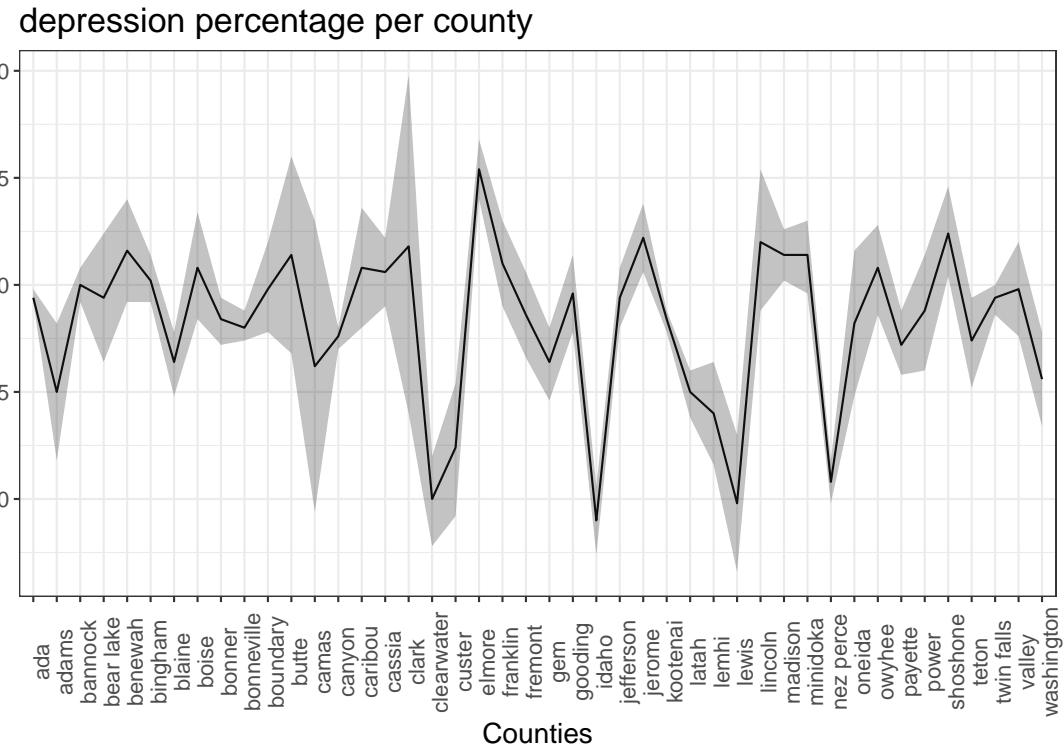


Figure 23: Idaho Depressive Disorder 2020 - Dynamic Grouped Model.

**Figure S24. Pulmonary Disease 2020 Static Base Model**

28

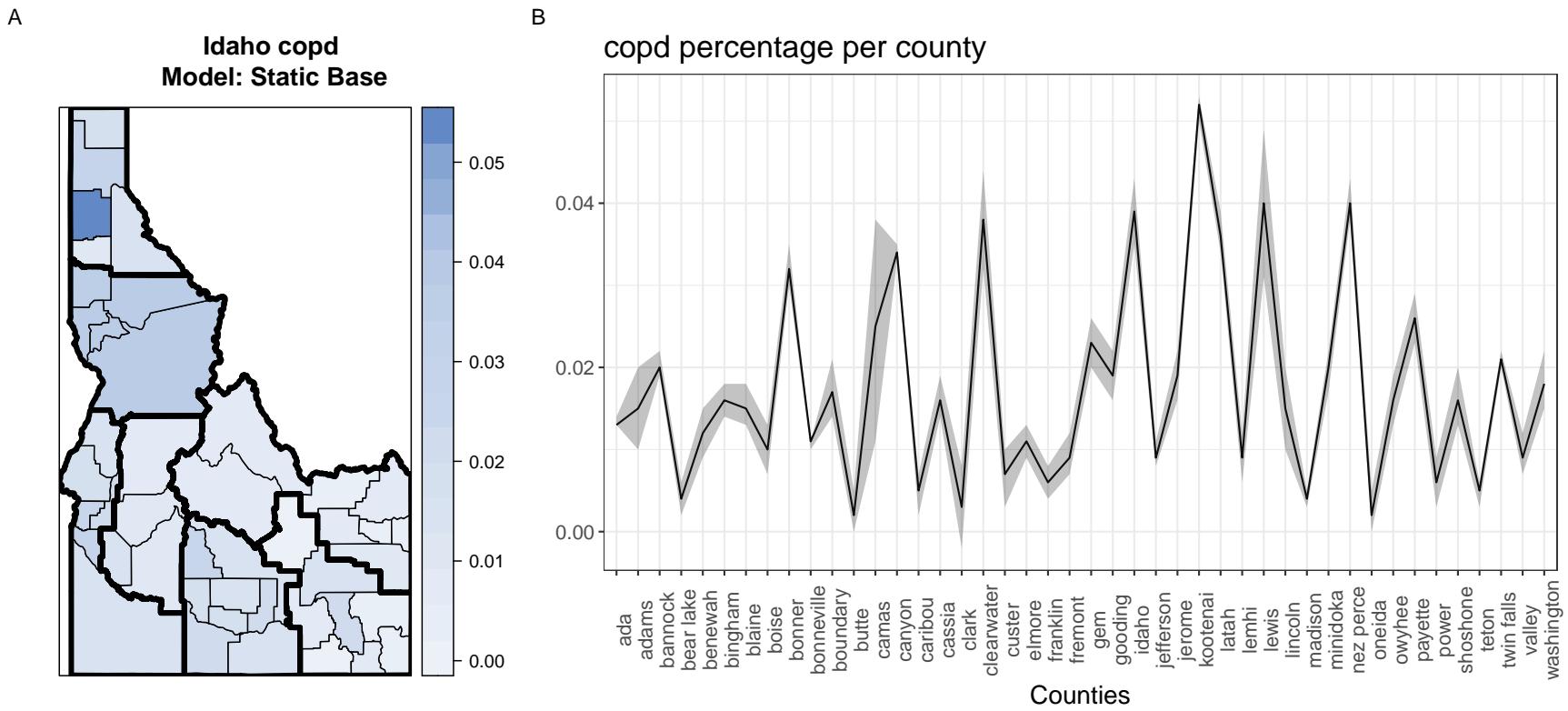
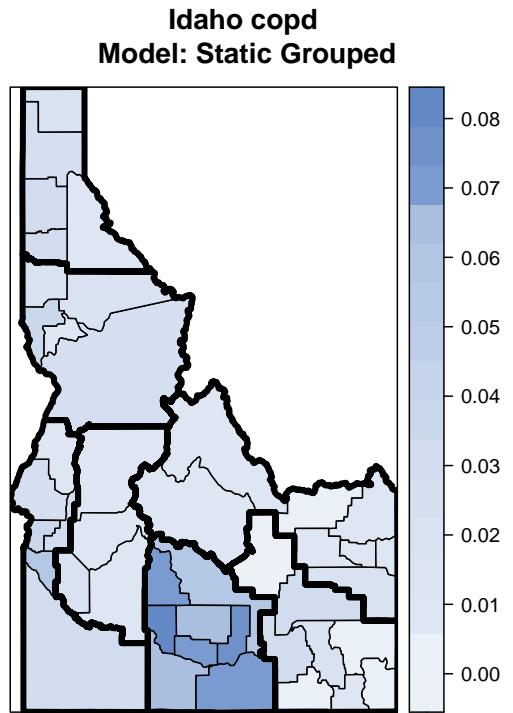


Figure 24: Idaho Pulmonary 2020 - Static Base Model.

**Figure S25. Pulmonary Disease 2020 Static Grouped Model**

A



B

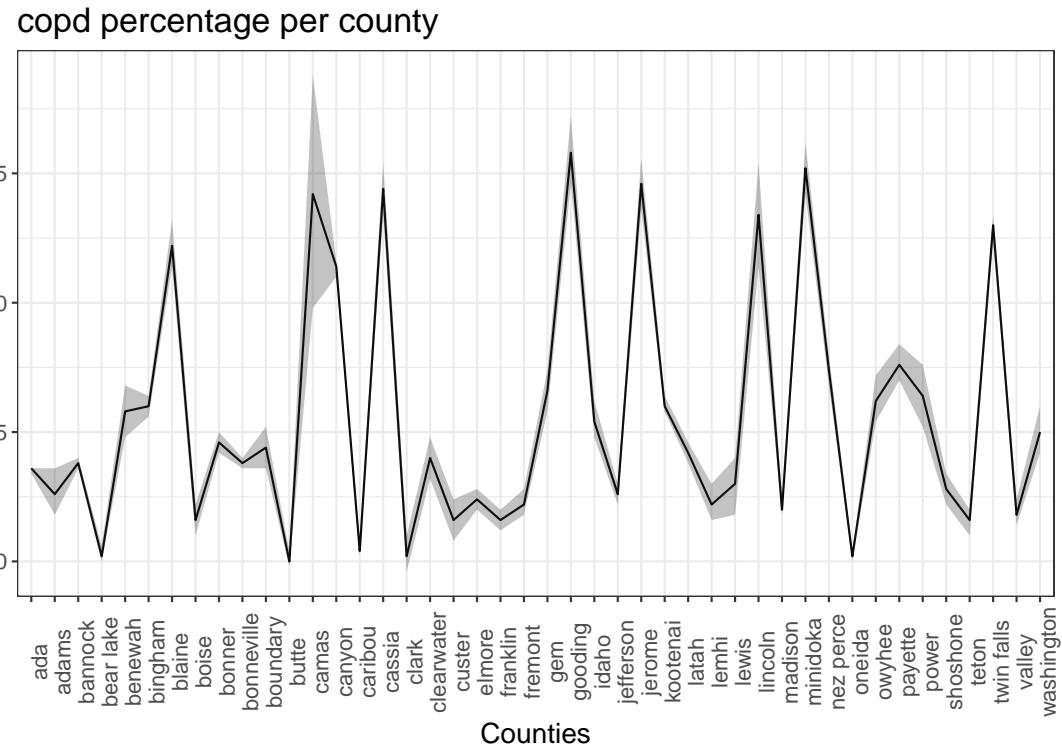


Figure 25: Idaho Pulmonary Disease 2020 - Static Grouped Model.

**Figure S26. Pulmonary Disease 2020 Dynamic Base Model**

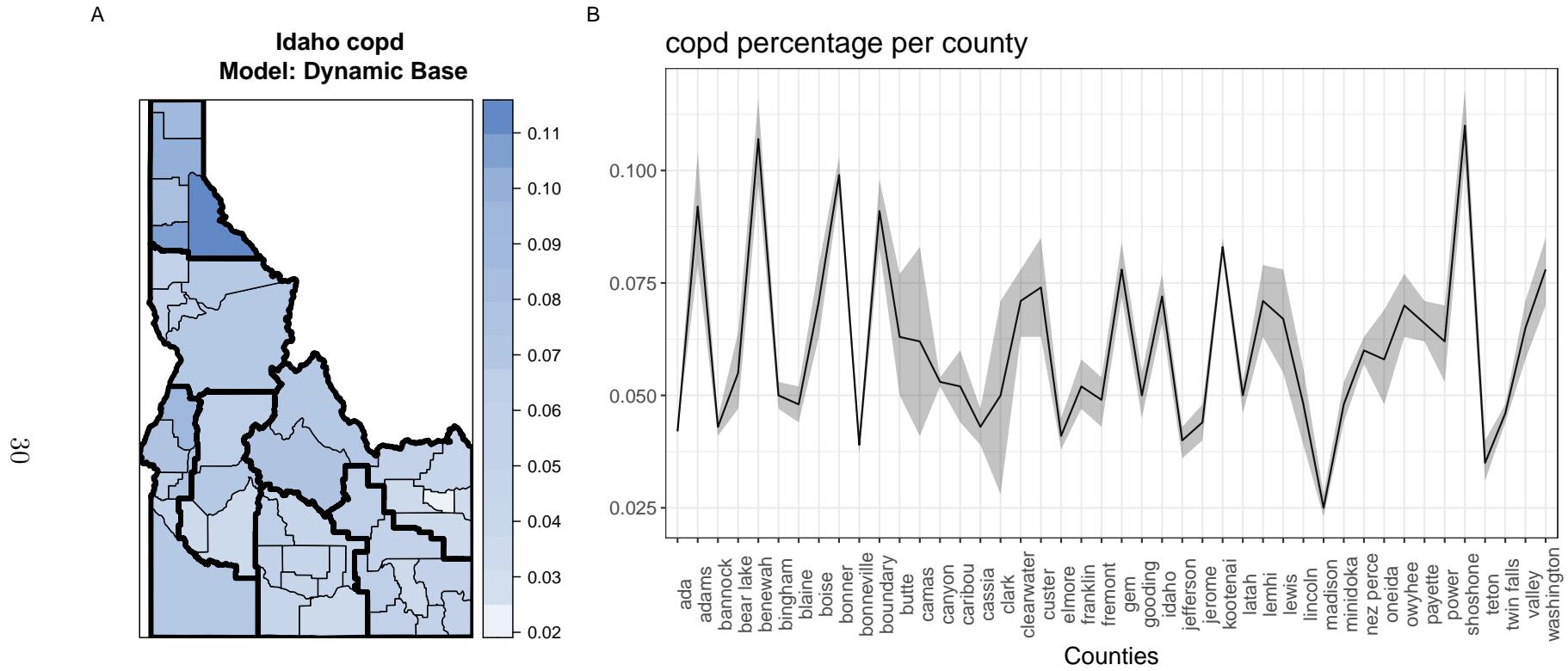


Figure 26: Idaho Pulmonary Disease 2020 - Dynamic Base Model.

**Figure S27. Pulmonary Disease 2020 Dynamic Grouped Model**

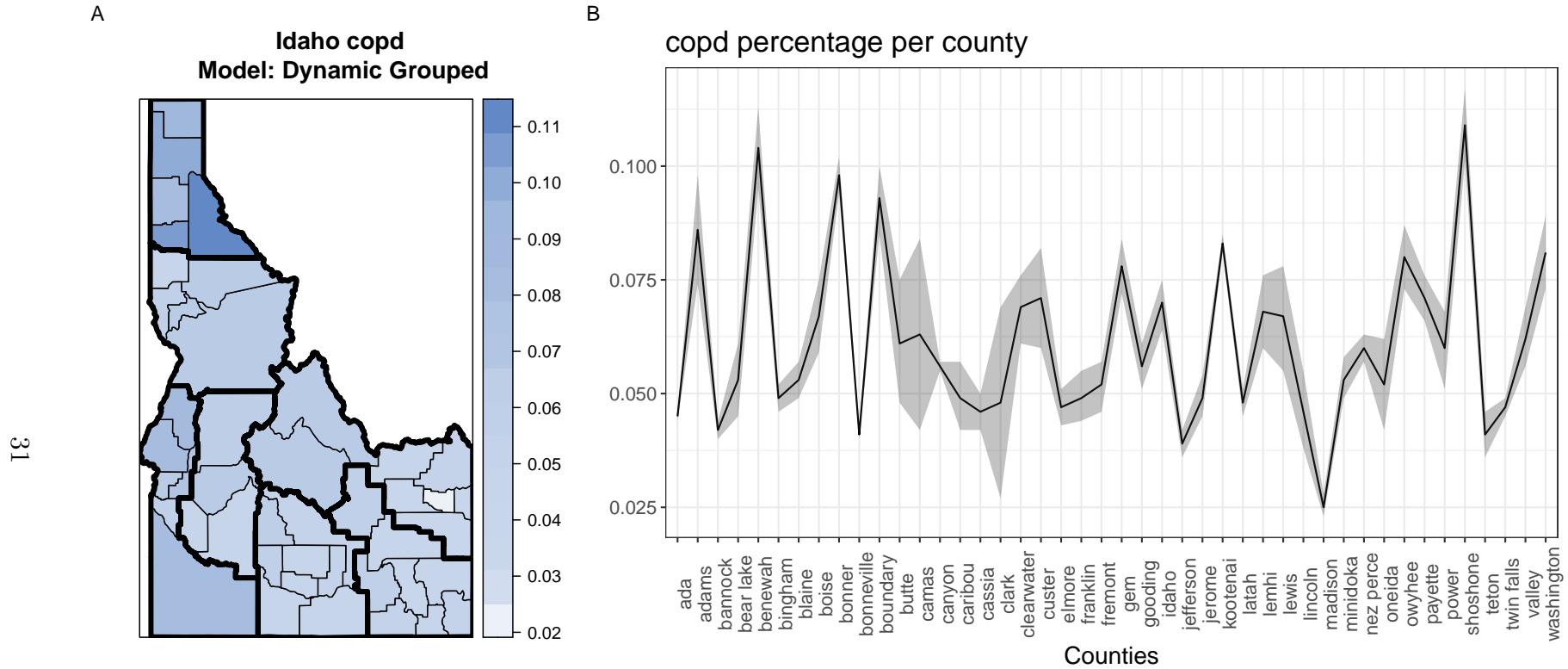


Figure 27: Idaho Pulmonary Disease 2020 - Dynamic Grouped Model.

**Figure S28. Asthma 2020 Static Base Model**

32

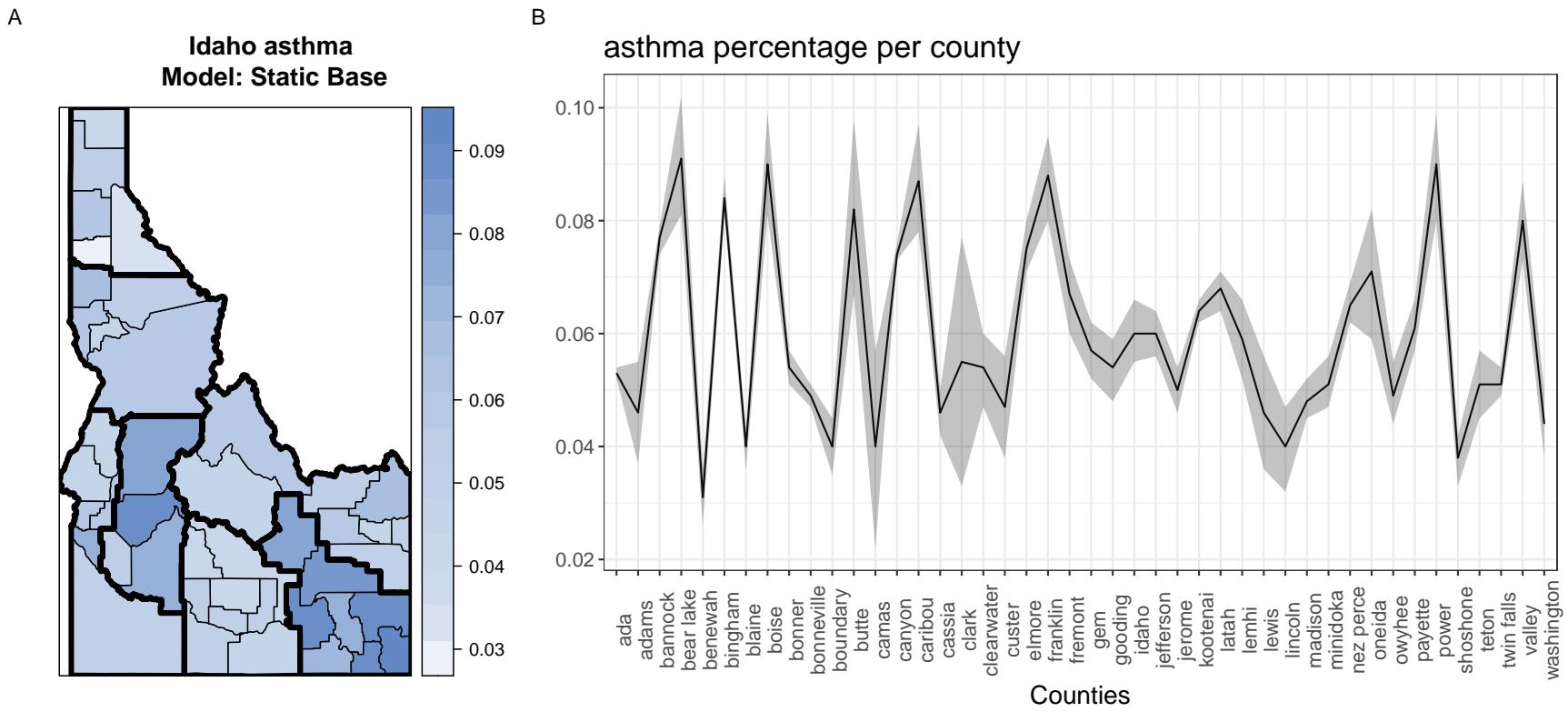


Figure 28: Idaho Asthma 2020 - Static Base Model.

**Figure S29. Asthma 2020 Static Grouped Model**

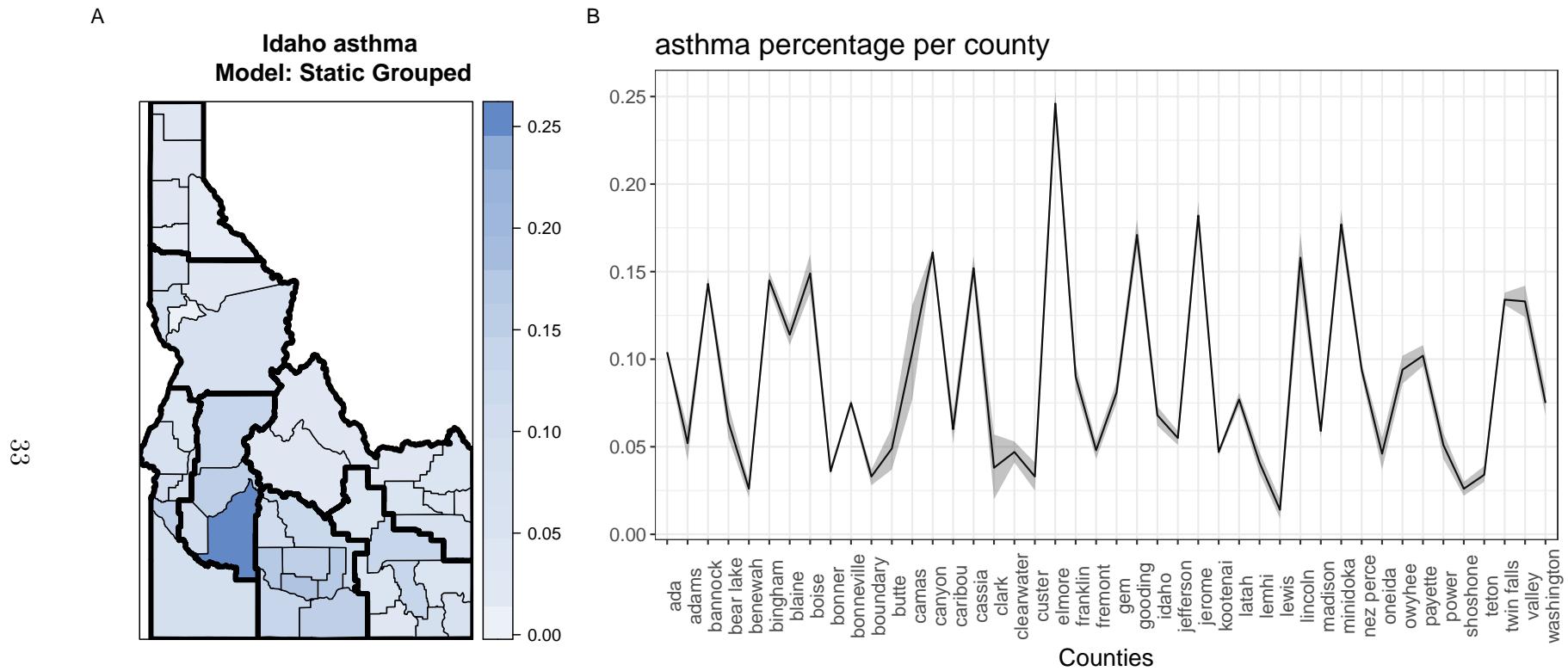
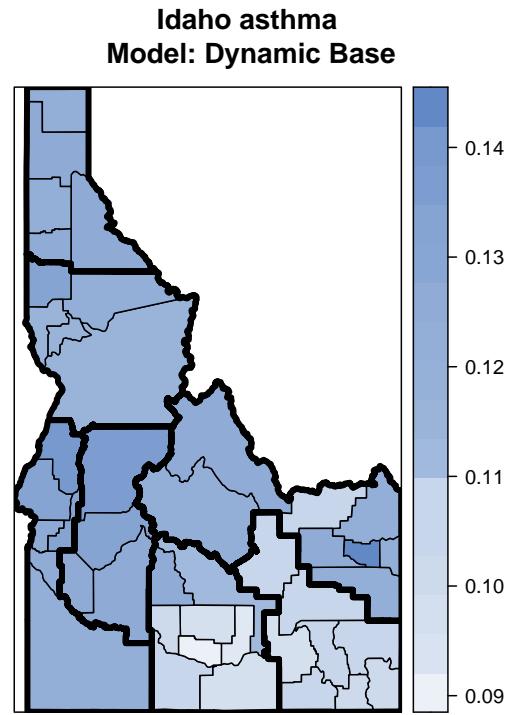


Figure 29: Idaho Asthma 2020 - Static Grouped Model.

**Figure S30. Asthma 2020 Dynamic Base Model**

A



B

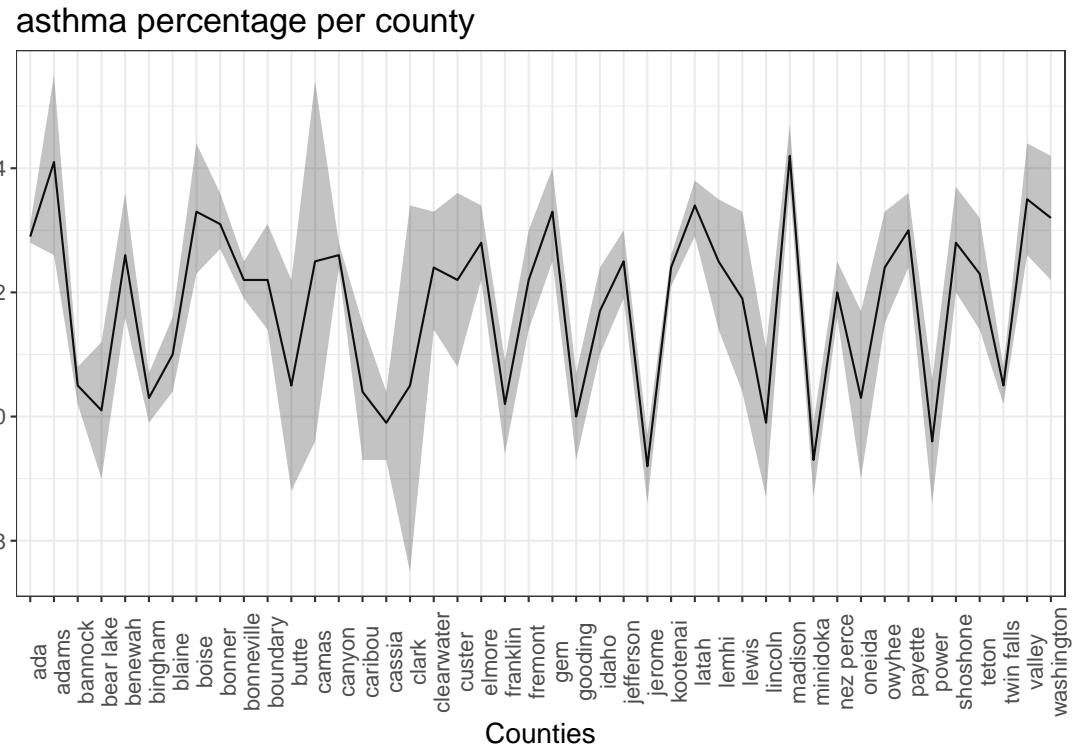


Figure 30: Idaho Asthma 2020 - Dynamic Base Model.

**Figure S31. Asthma 2020 Dynamic Grouped Model**

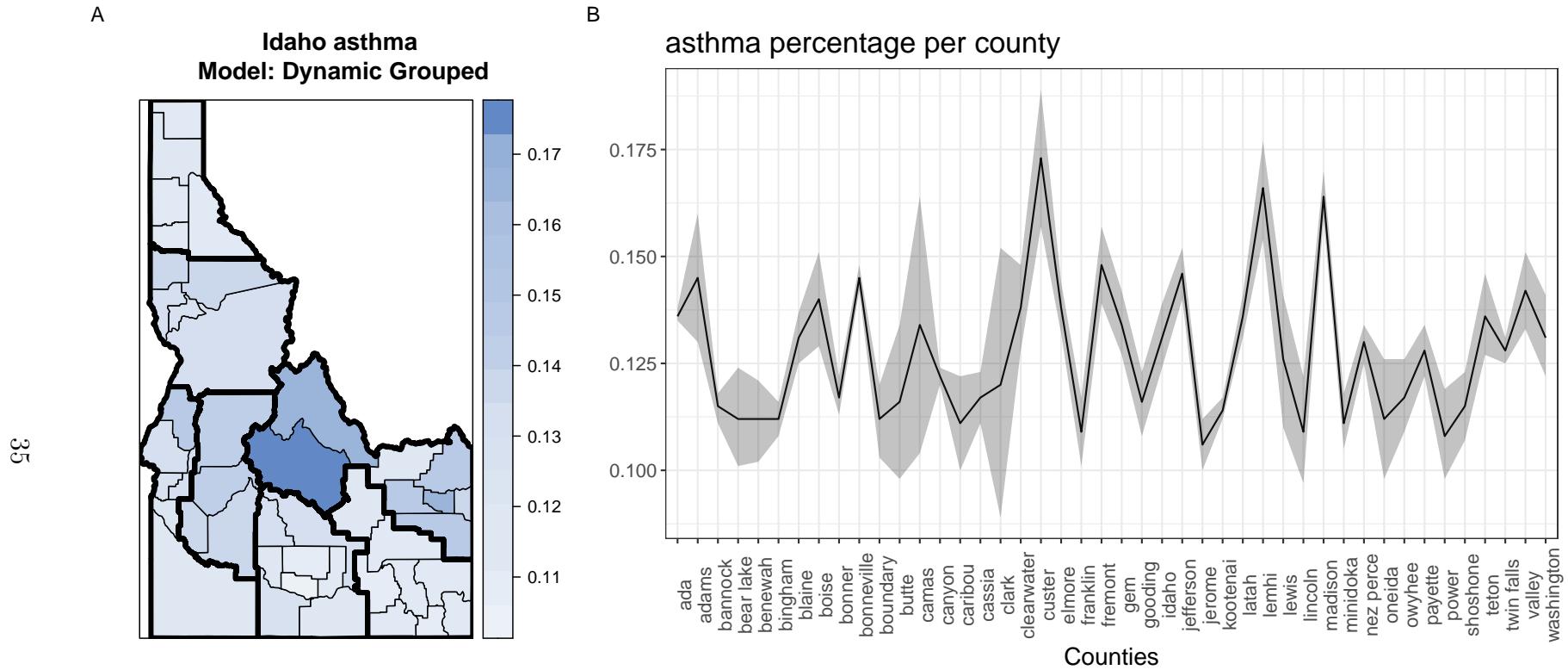


Figure 31: Idaho Asthma 2020 - Dynamic Grouped Model.

**Figure S32. Stroke 2020 Static Base Model**

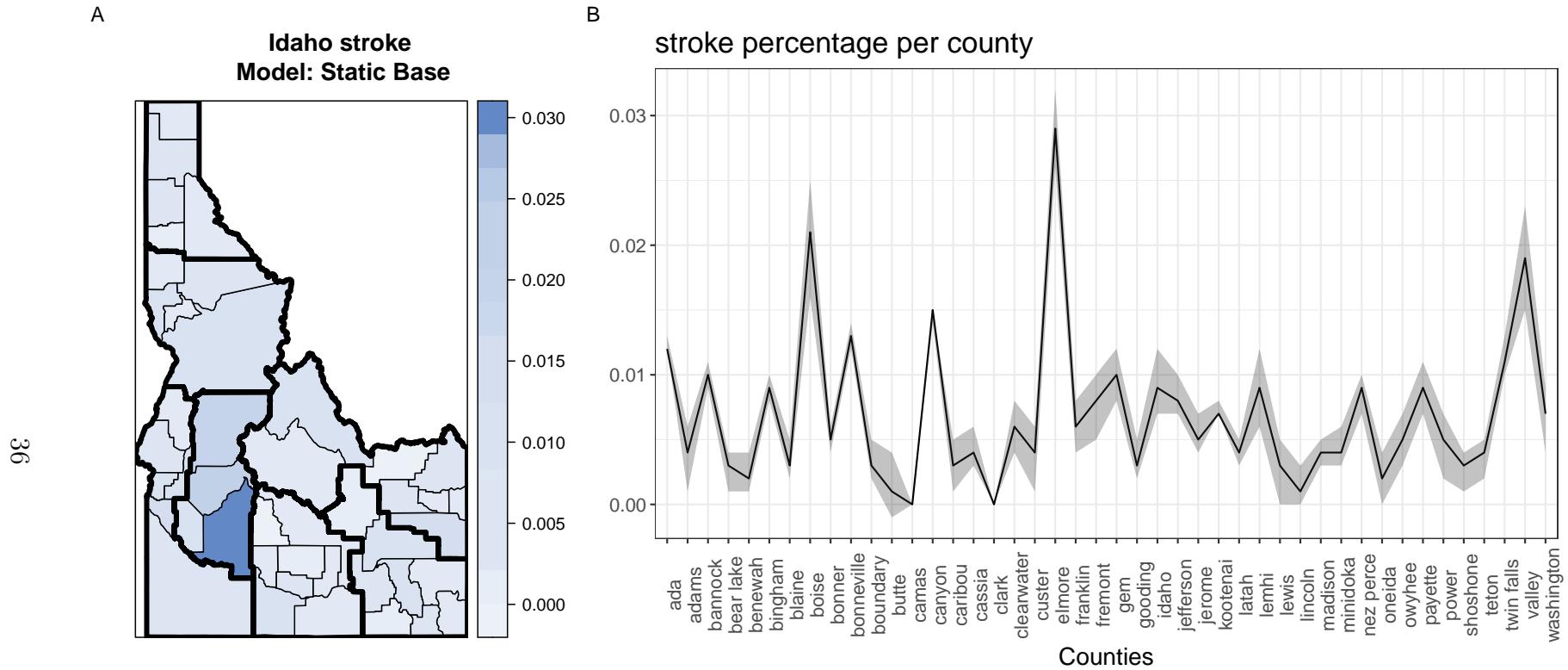
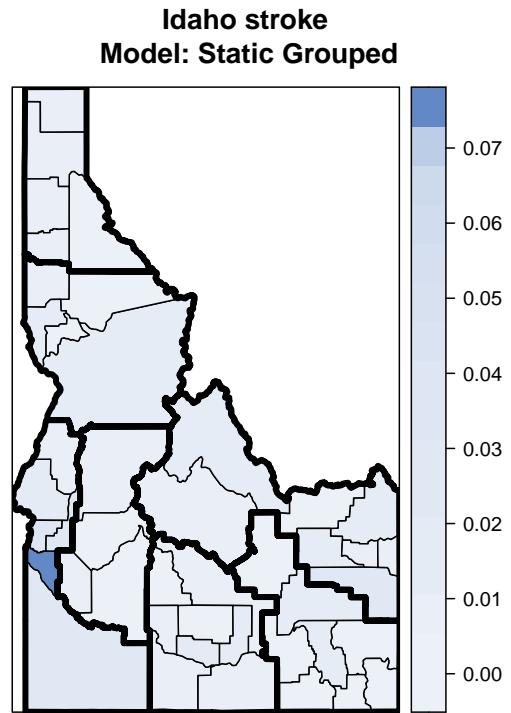


Figure 32: Idaho Stroke 2020 - Static Base Model.

**Figure S33. Stroke 2020 Static Grouped Model**

A



B

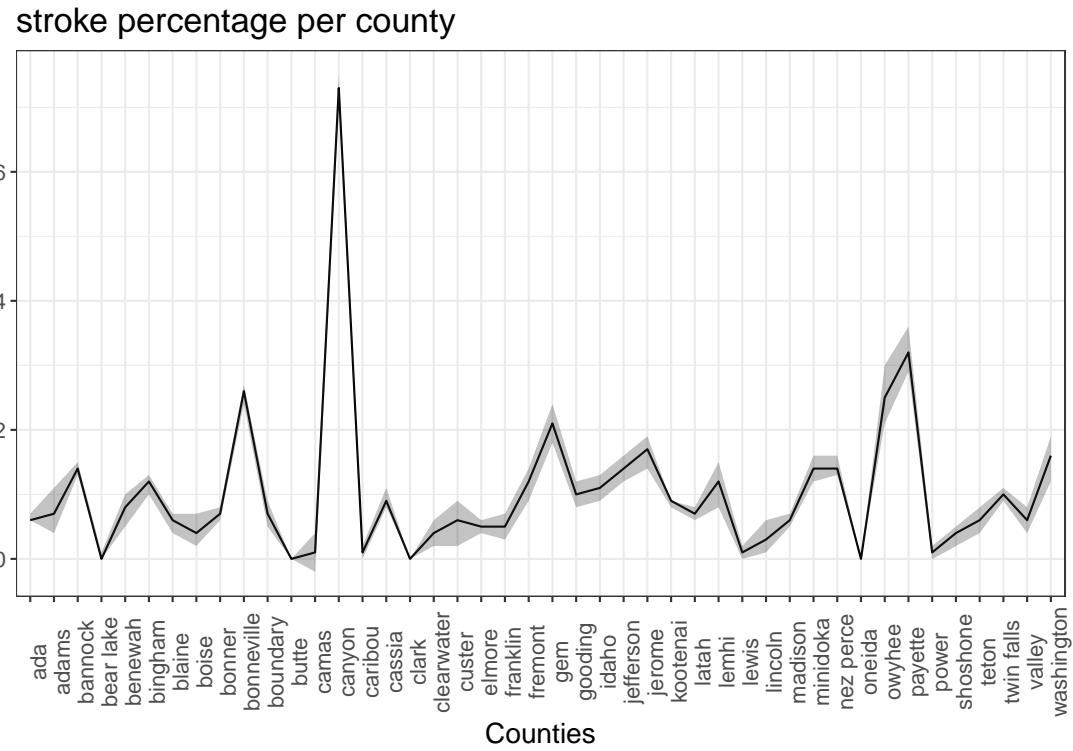


Figure 33: Idaho Stroke 2020 - Static Grouped Model.

**Figure S34. Stroke 2020 Dynamic Base Model**

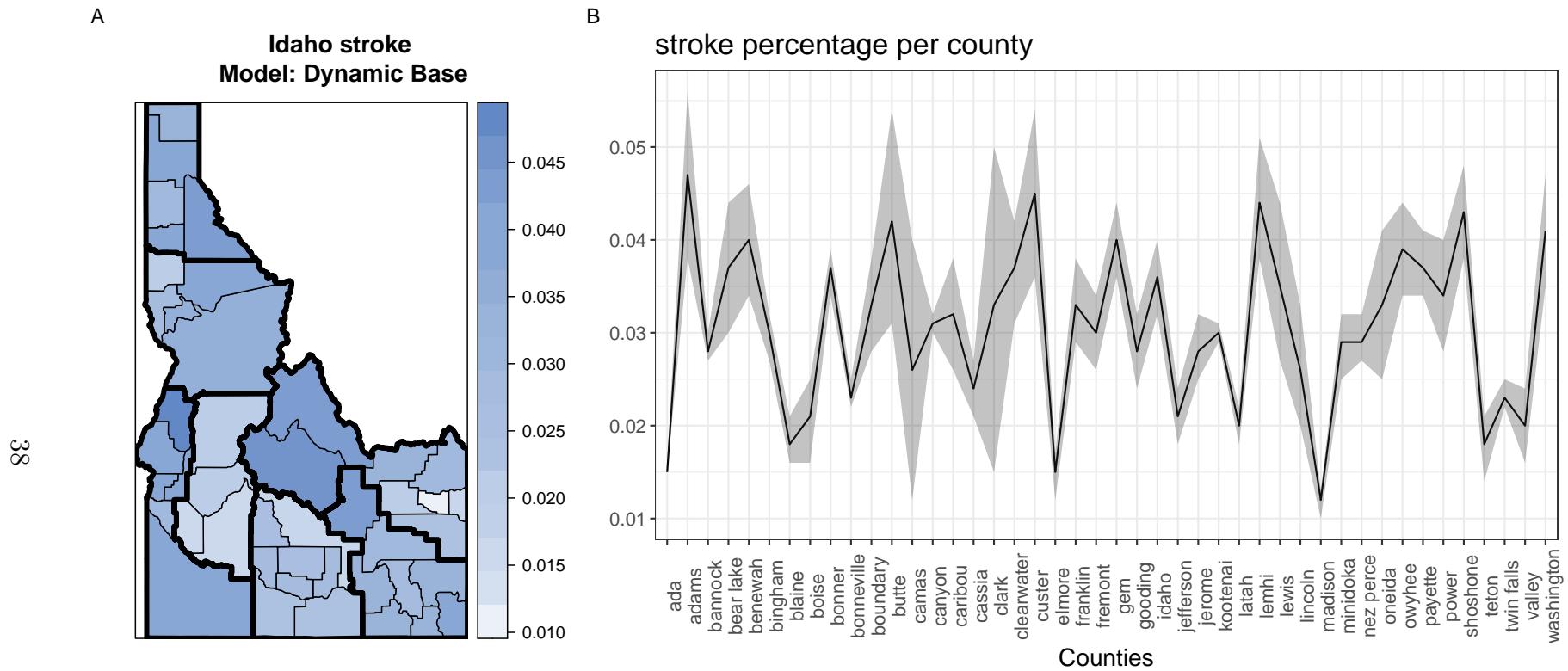
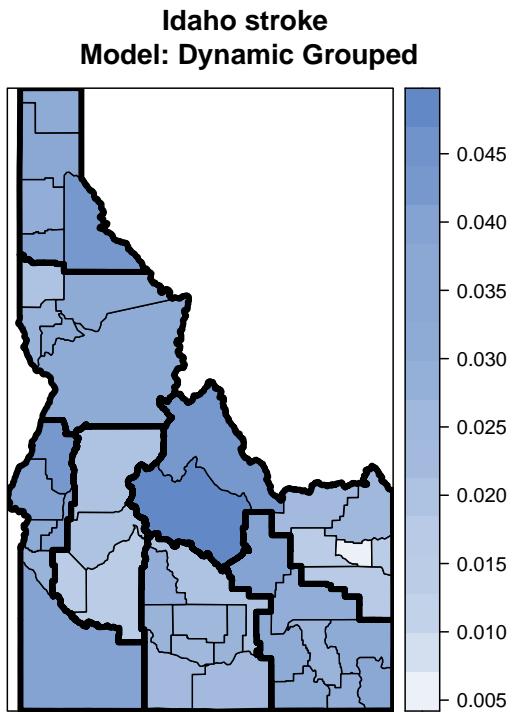


Figure 34: Idaho Stroke 2020 - Dynamic Base Model.

**Figure S35. Stroke 2020 Dynamic Grouped Model**

A



B

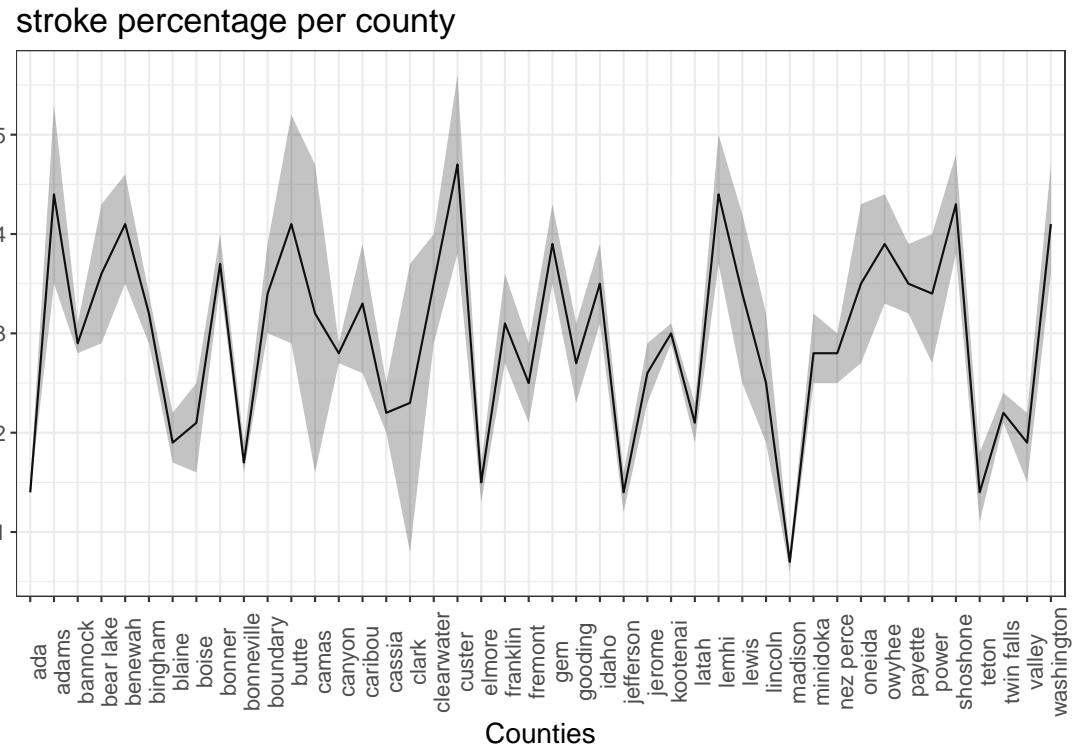


Figure 35: Idaho Stroke 2020 - Dynamic Grouped Model.

**Figure S36. Angina 2020 Static Base Model**

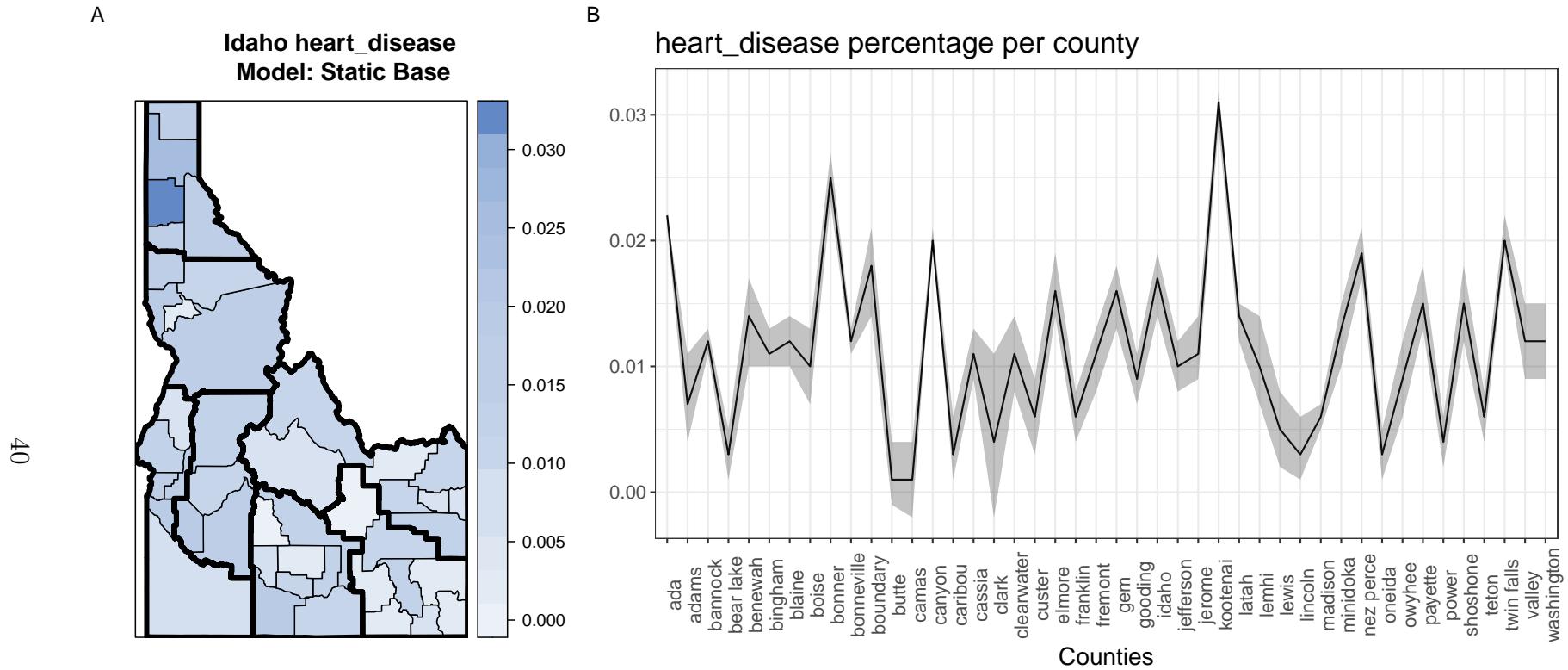
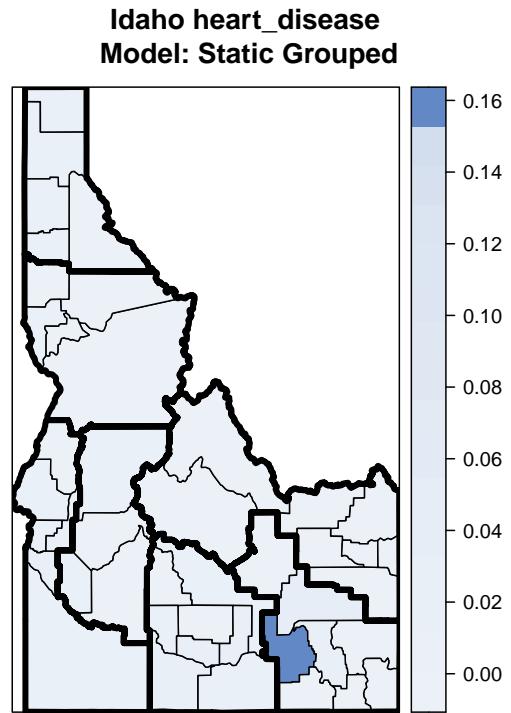


Figure 36: Idaho Angina 2020 - Static Base Model.

**Figure S37. Angina 2020 Static Grouped Model**

A



B

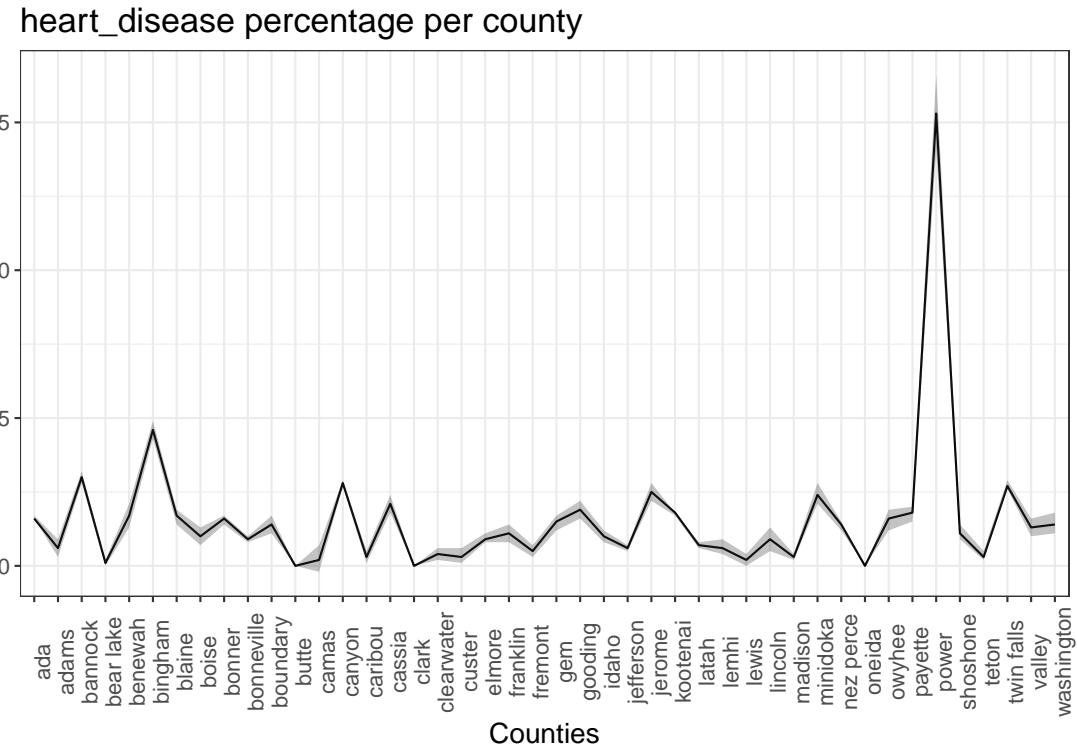
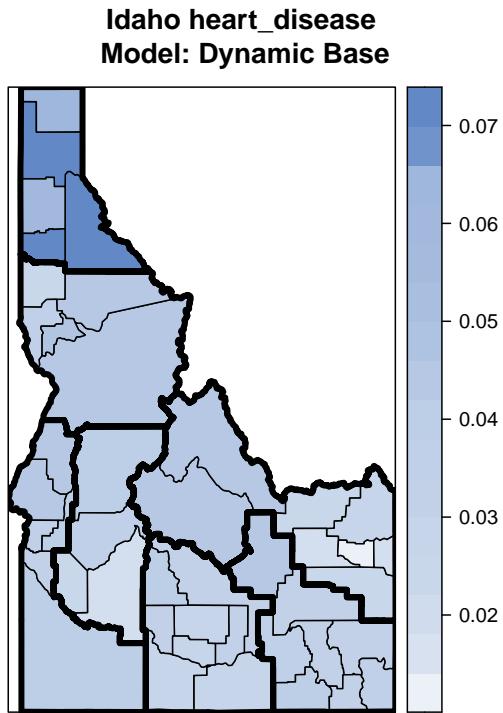


Figure 37: Idaho Angina 2020 - Static Grouped Model.

**Figure S38. Angina 2020 Dynamic Base Model**

A



B

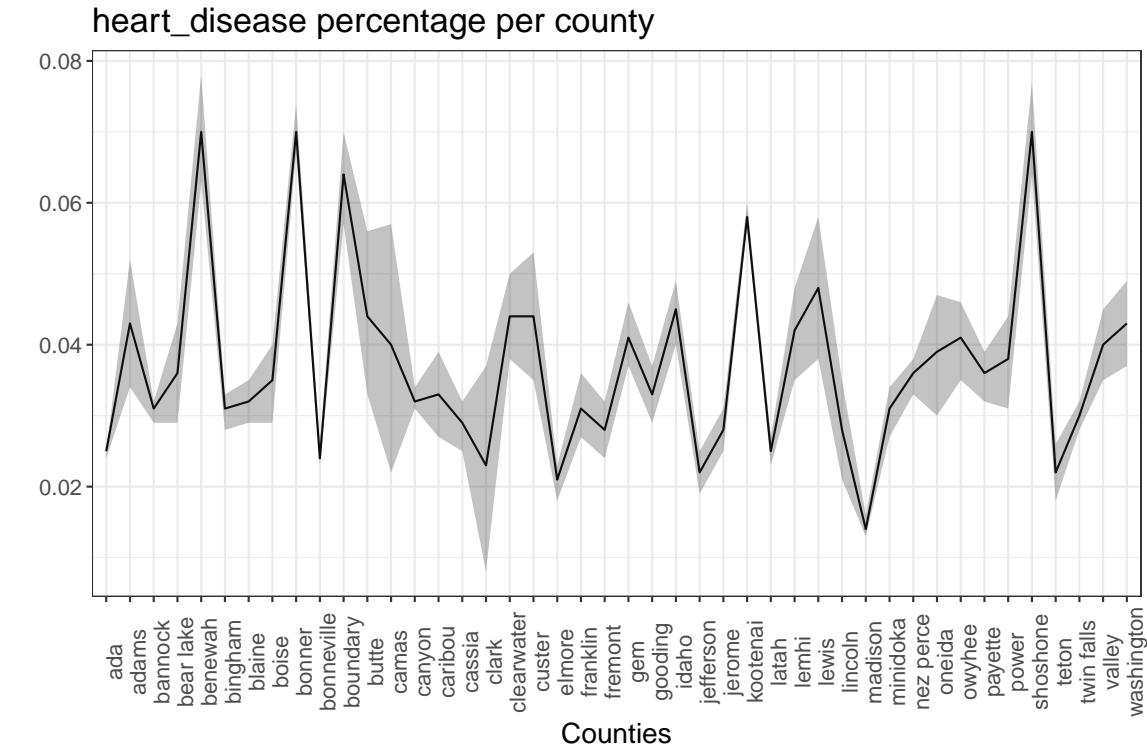


Figure 38: Idaho Angina 2020 - Dynamic Base Model.

**Figure S39. Angina 2020 Dynamic Grouped Model**

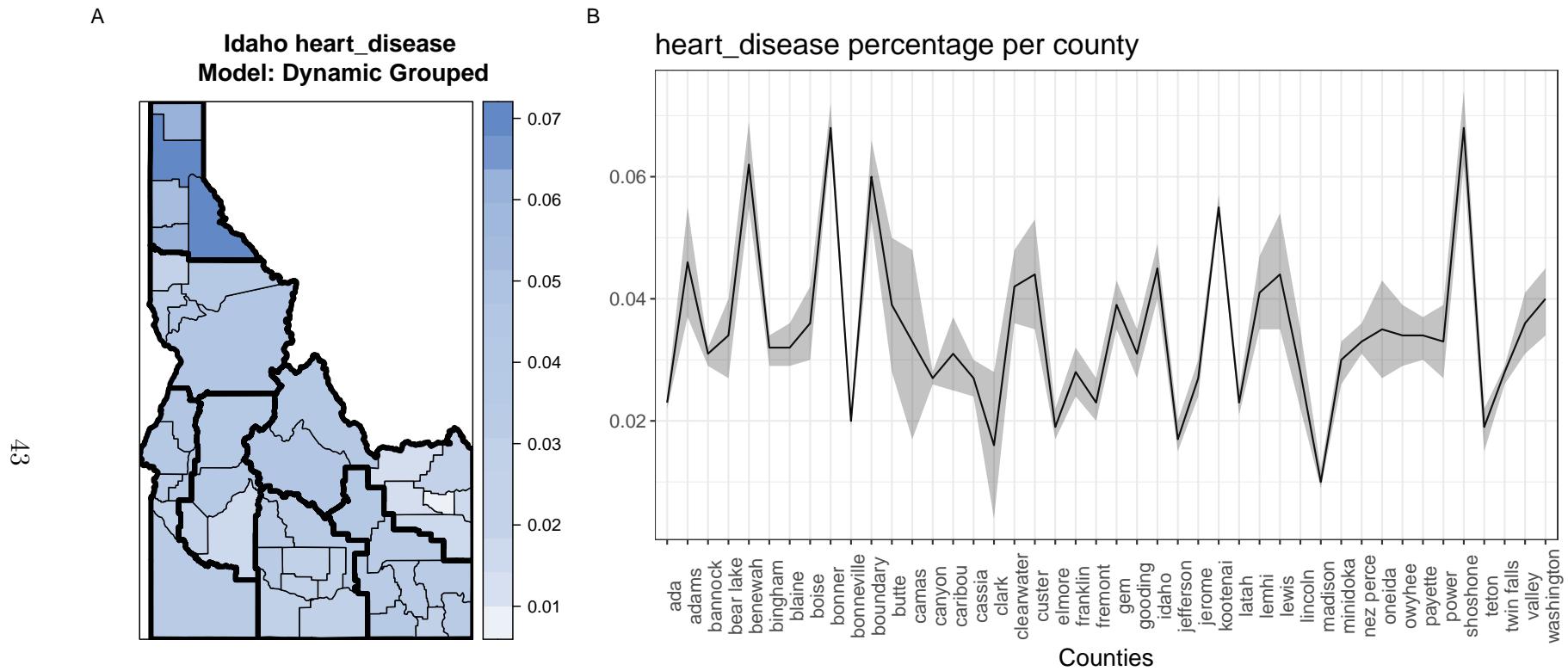
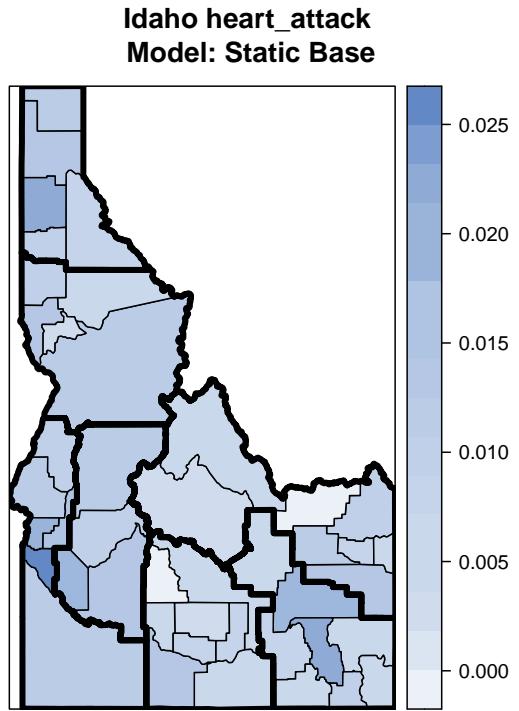


Figure 39: Idaho Angina 2020 - Dynamic Grouped Model.

Figure S40. Heart Attack 2020 Static Base Model

A



B

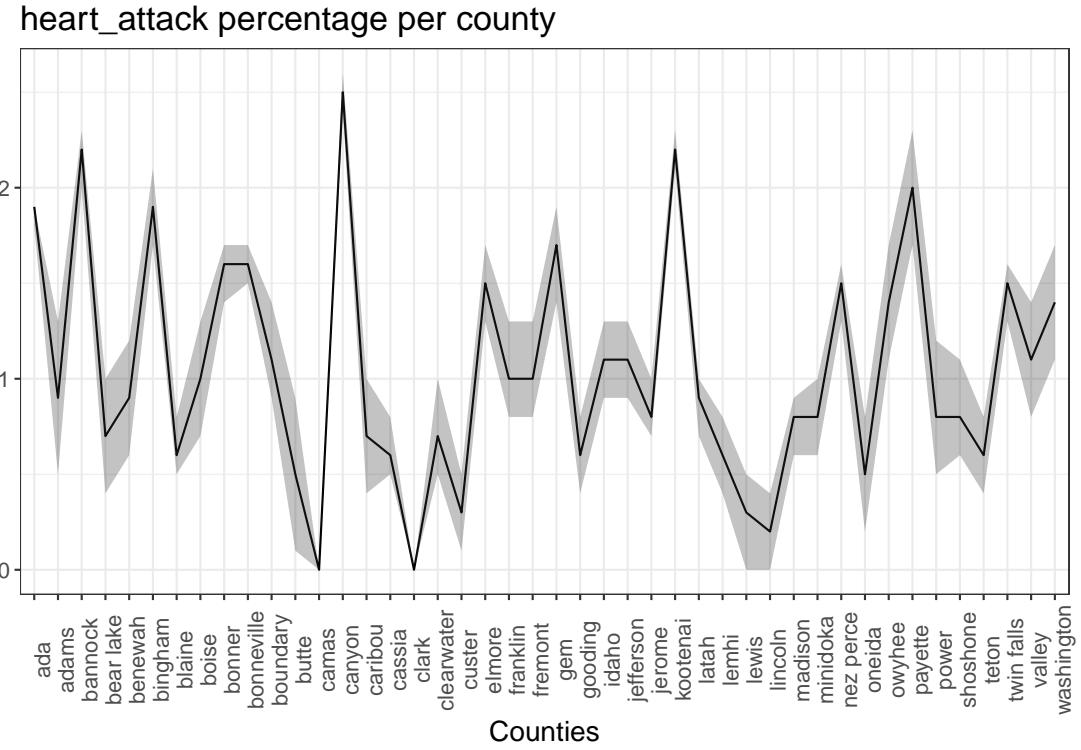


Figure 40: Idaho Heart Disease 2020 - Static Base Model.

**Figure S41. Heart Disease 2020 Static Grouped Model**

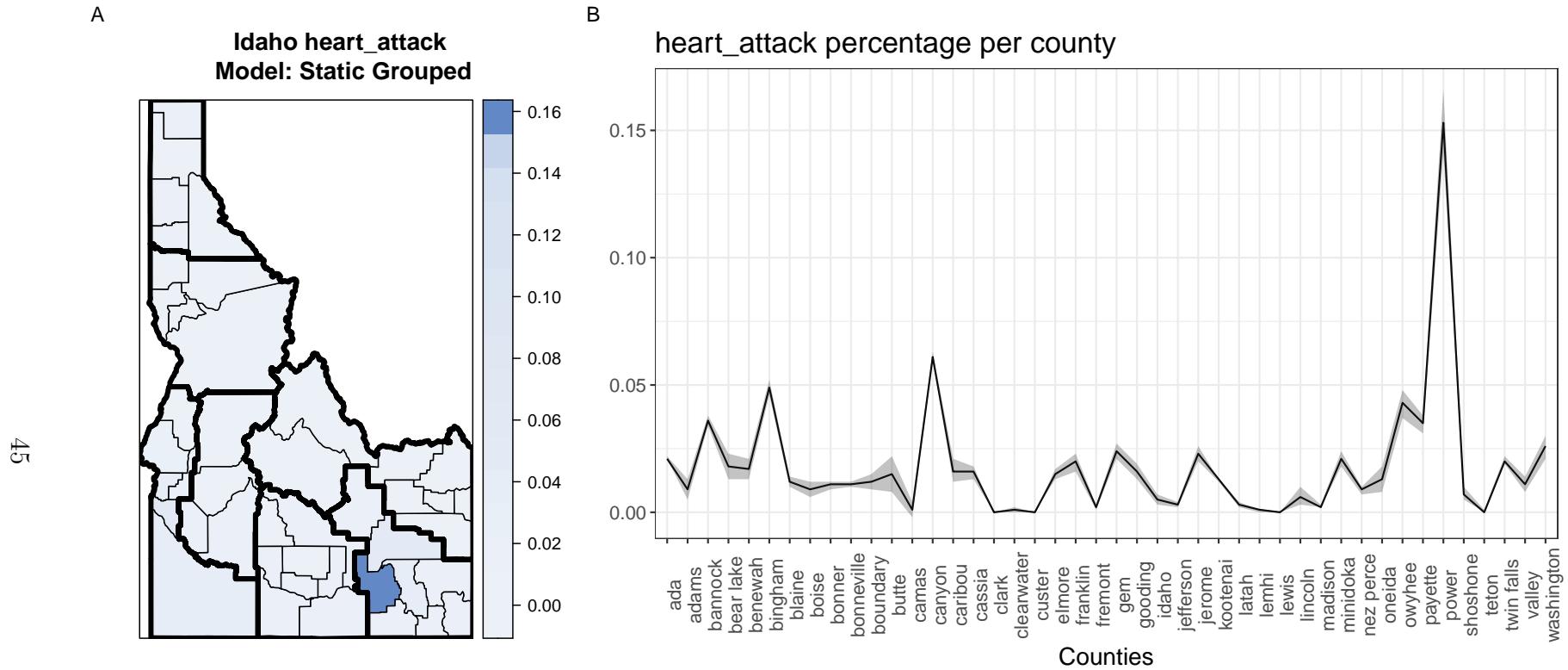
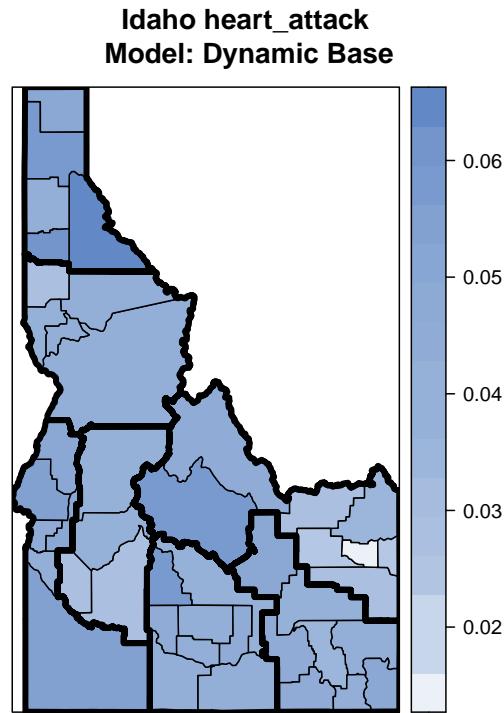


Figure 41: Idaho Heart Disease 2020 - Static Grouped Model.

**Figure S42. Heart Disease 2020 Dynamic Base Model**

A



B

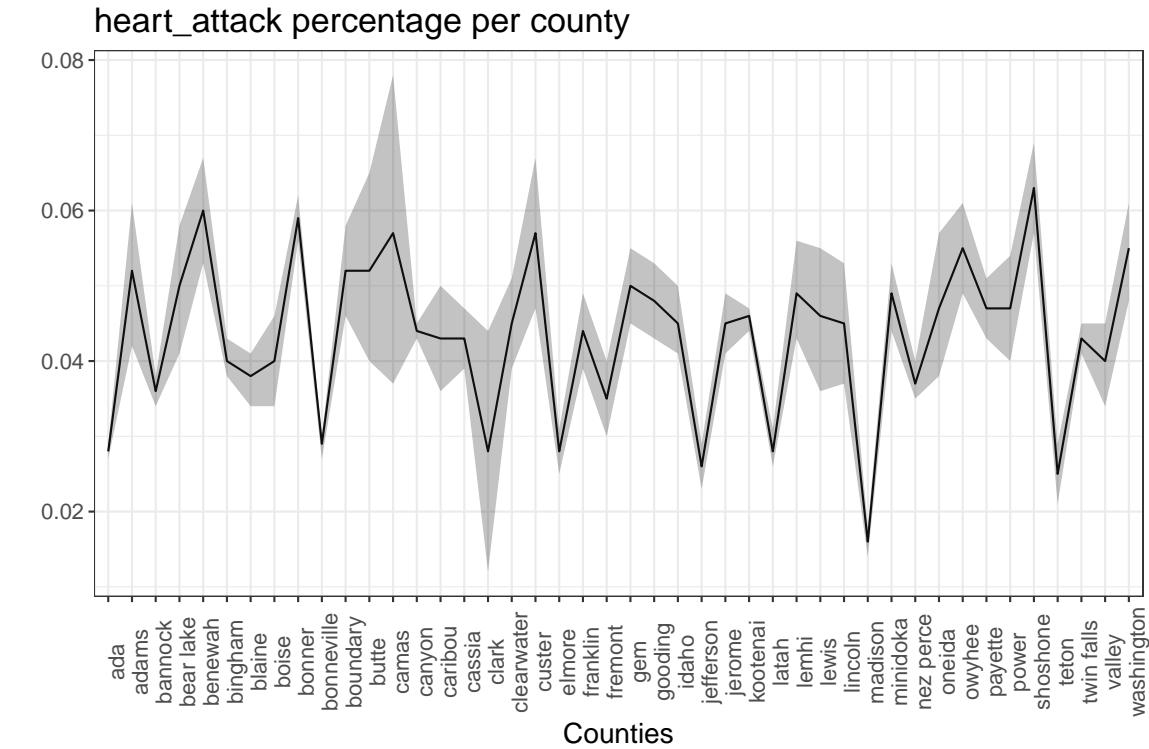
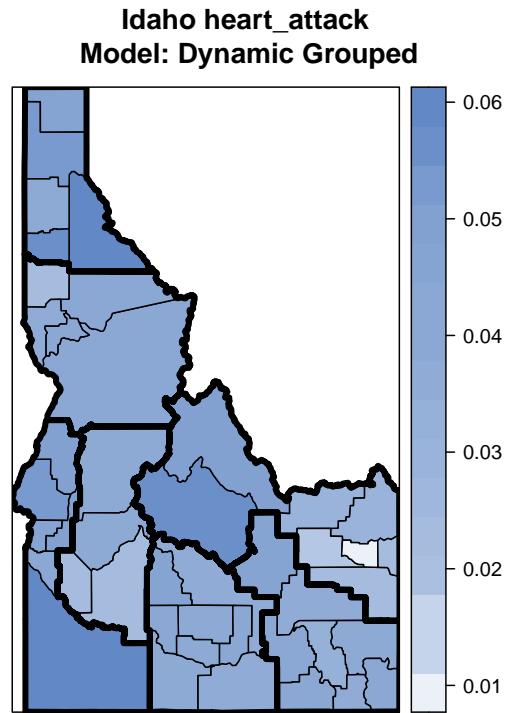


Figure 42: Idaho Heart Disease 2020 - Dynamic Base Model.

**Figure S43. Heart Disease 2020 Dynamic Grouped Model**

A



B

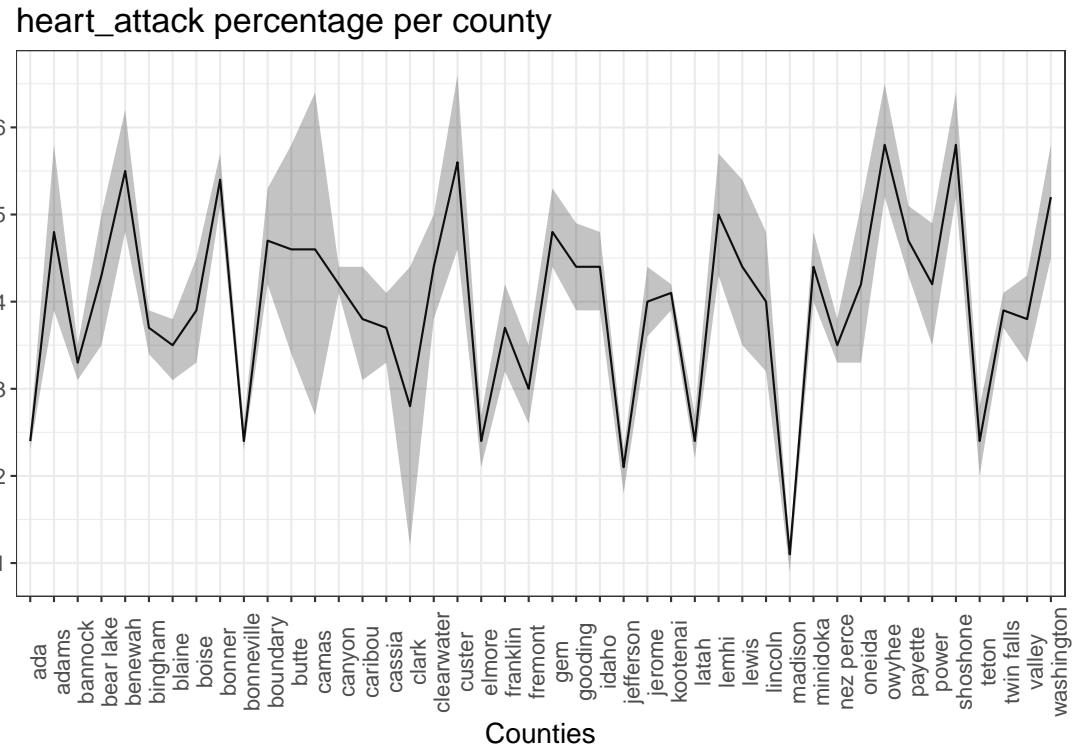
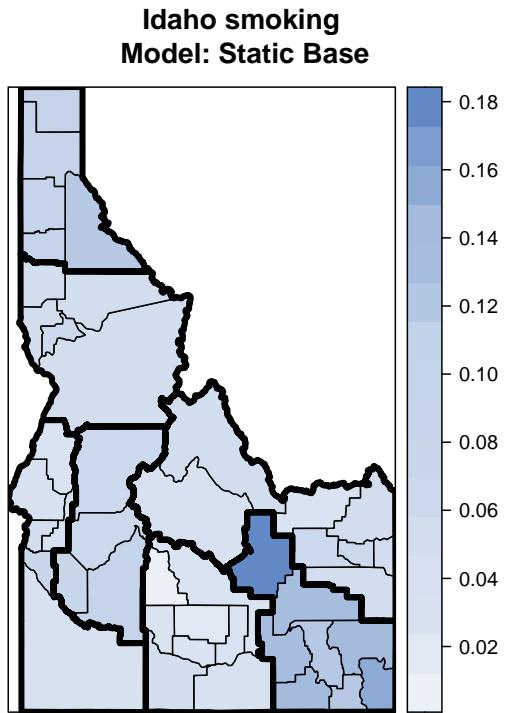


Figure 43: Idaho Heart Disease 2020 - Dynamic Grouped Model.

**Figure S44. Smoking 2020 Static Base Model**

A



B

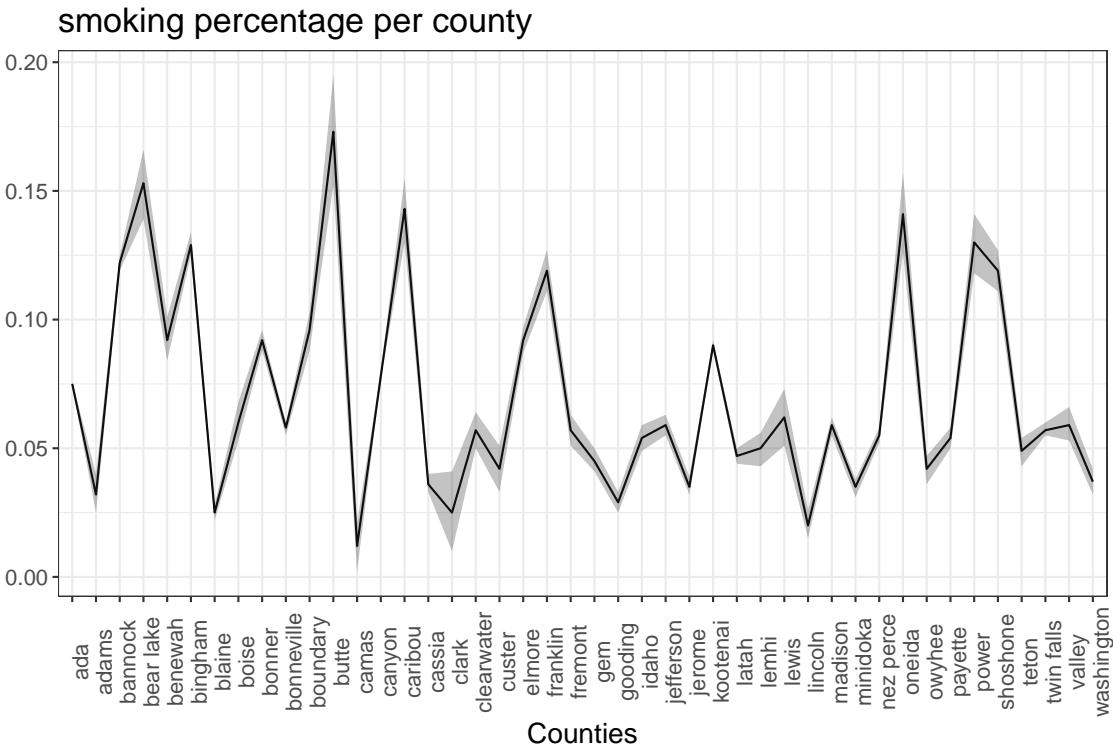
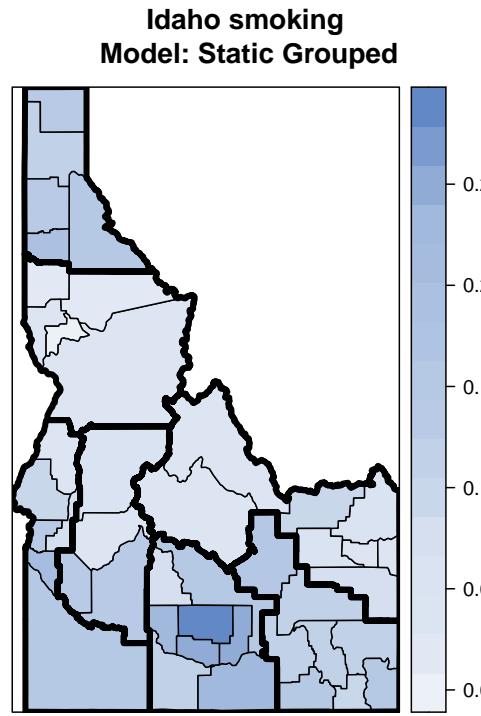


Figure 44: Idaho Smoking 2020 - Static Base Model.

**Figure S45. Smoking 2020 Static Grouped Model**

A



B

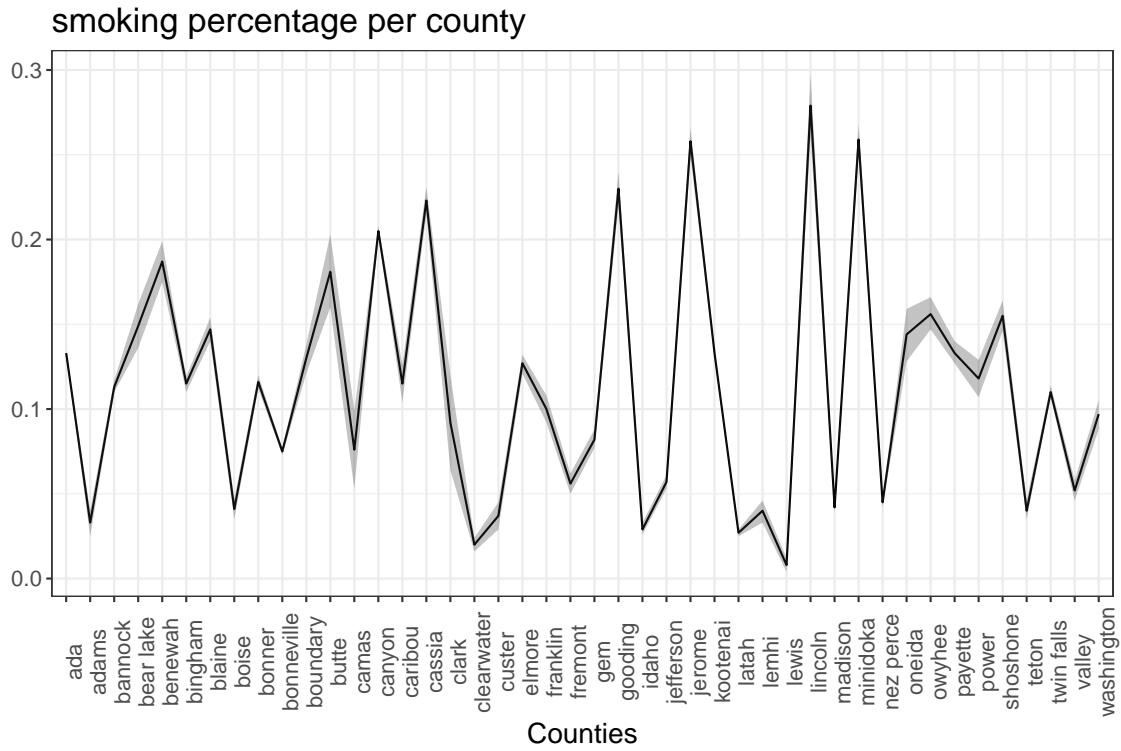


Figure 45: Idaho Smoking 2020 - Static Grouped Model.

**Figure S46. Smoking 2020 Dynamic Base Model**

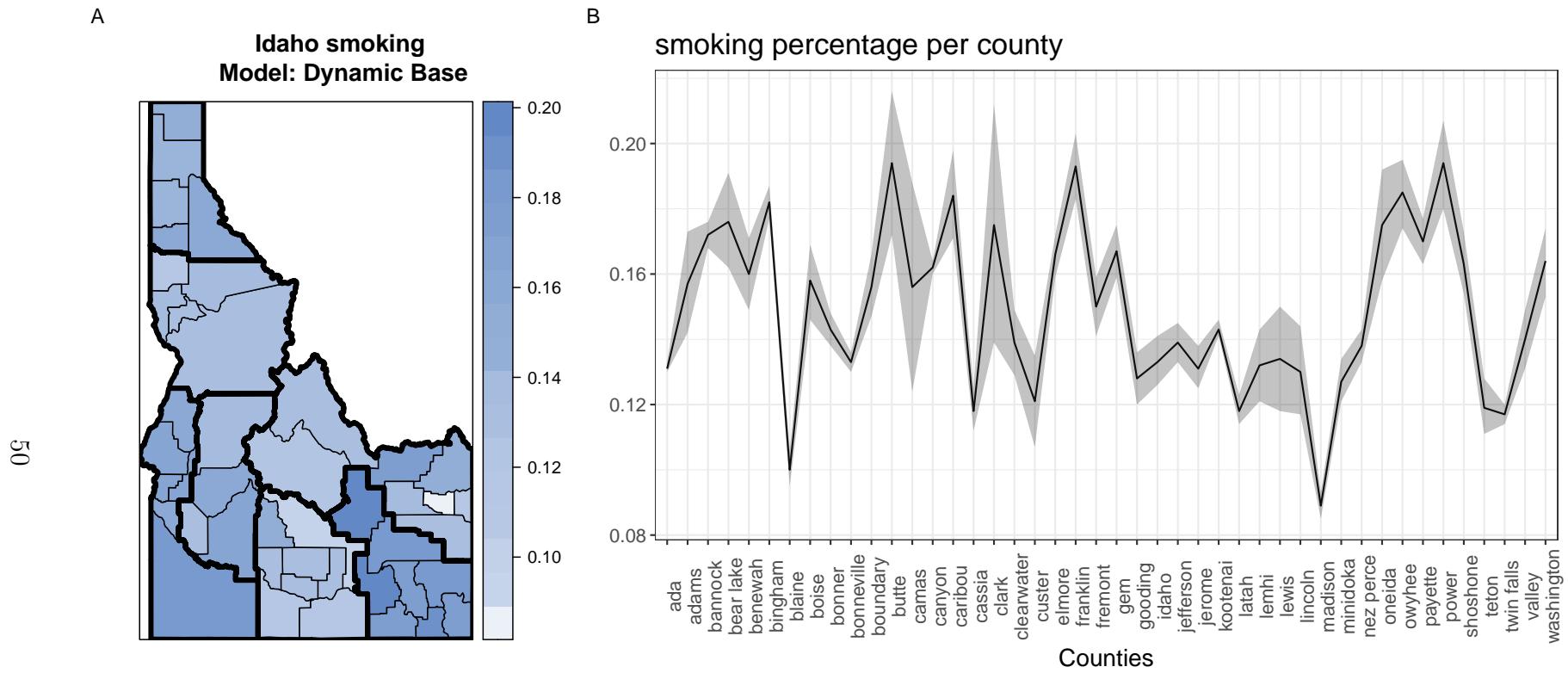
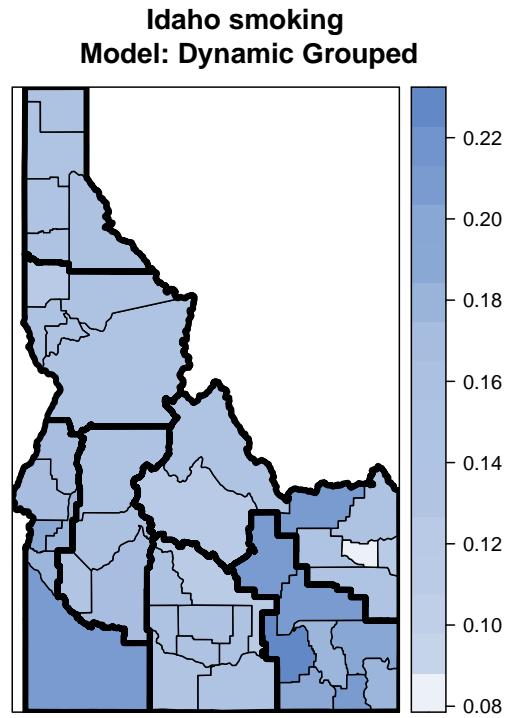


Figure 46: Idaho Smoking 2020 - Dynamic Base Model.

**Figure S47. Smoking 2020 Dynamic Grouped Model**

A



B

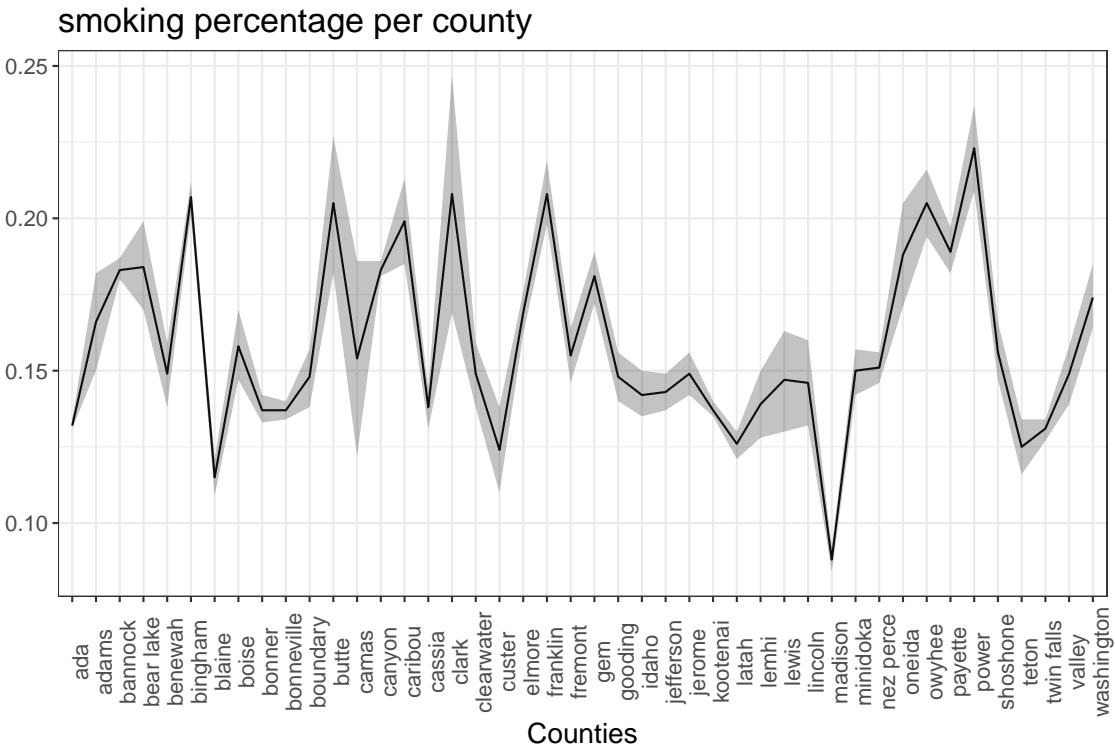


Figure 47: Idaho Smoking 2020 - Dynamic Grouped Model.

**Figure S48. Hypertension 2019 Static Base Model**

52

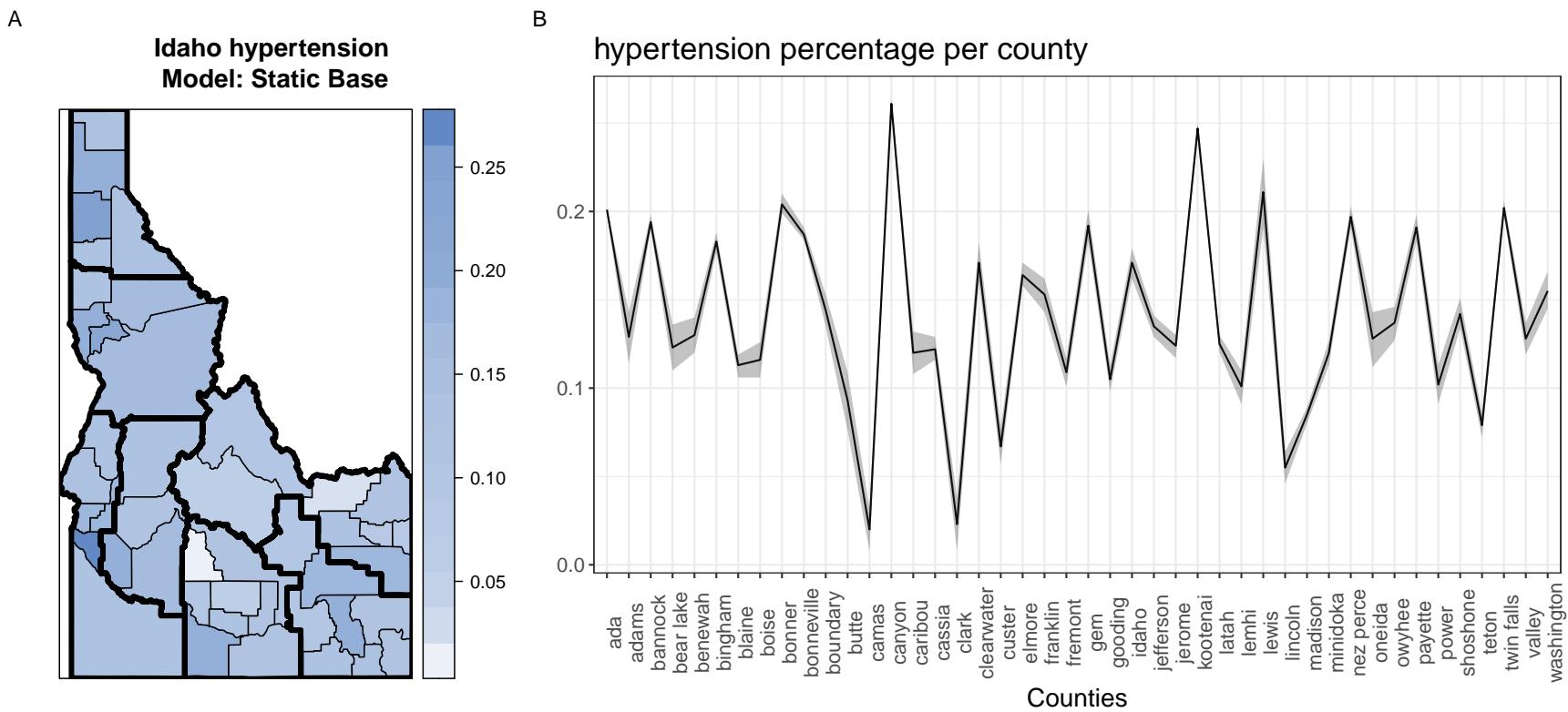


Figure 48: Idaho Hypertension 2019 - Static Base Model.

**Figure S49. Hypertension 2019 Static Grouped Model**

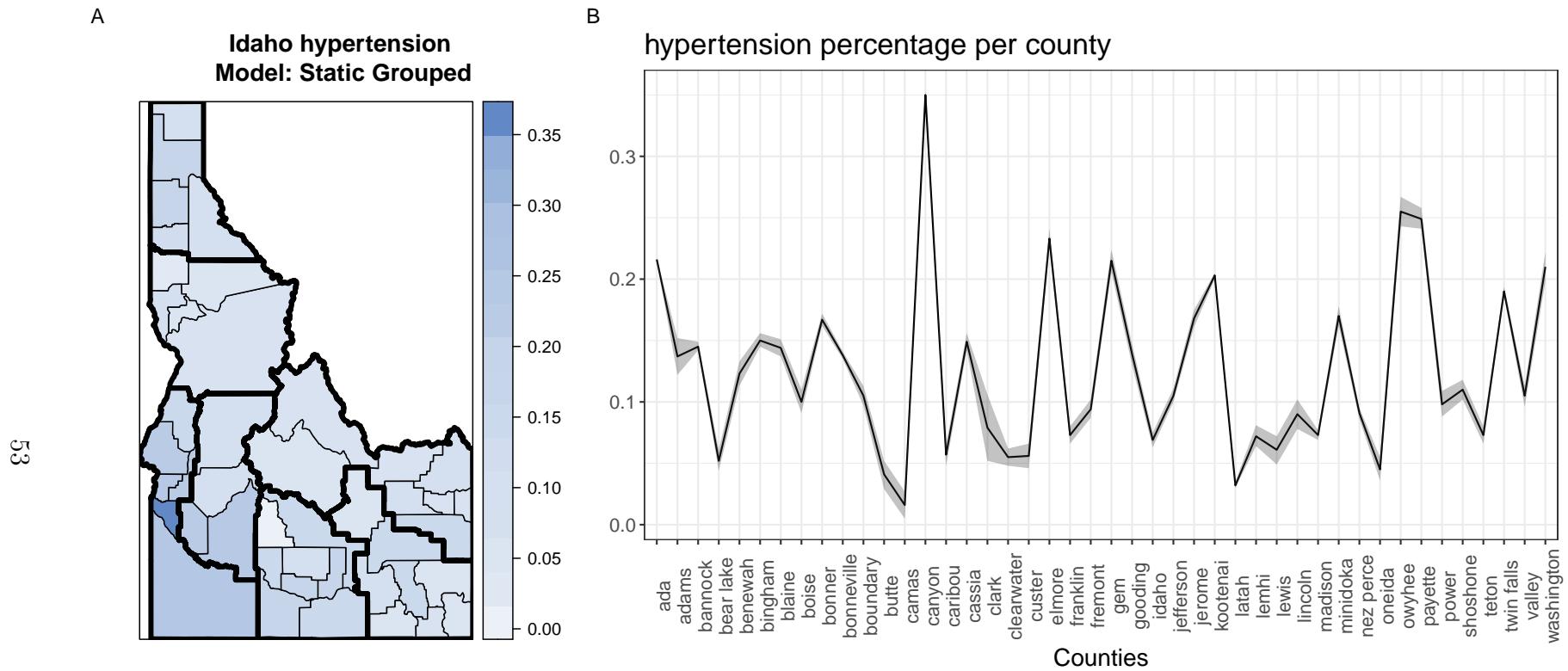


Figure 49: Idaho Hypertension 2019 - Static Grouped Model.

**Figure S50. Hypertension 2019 Dynamic Base Model**

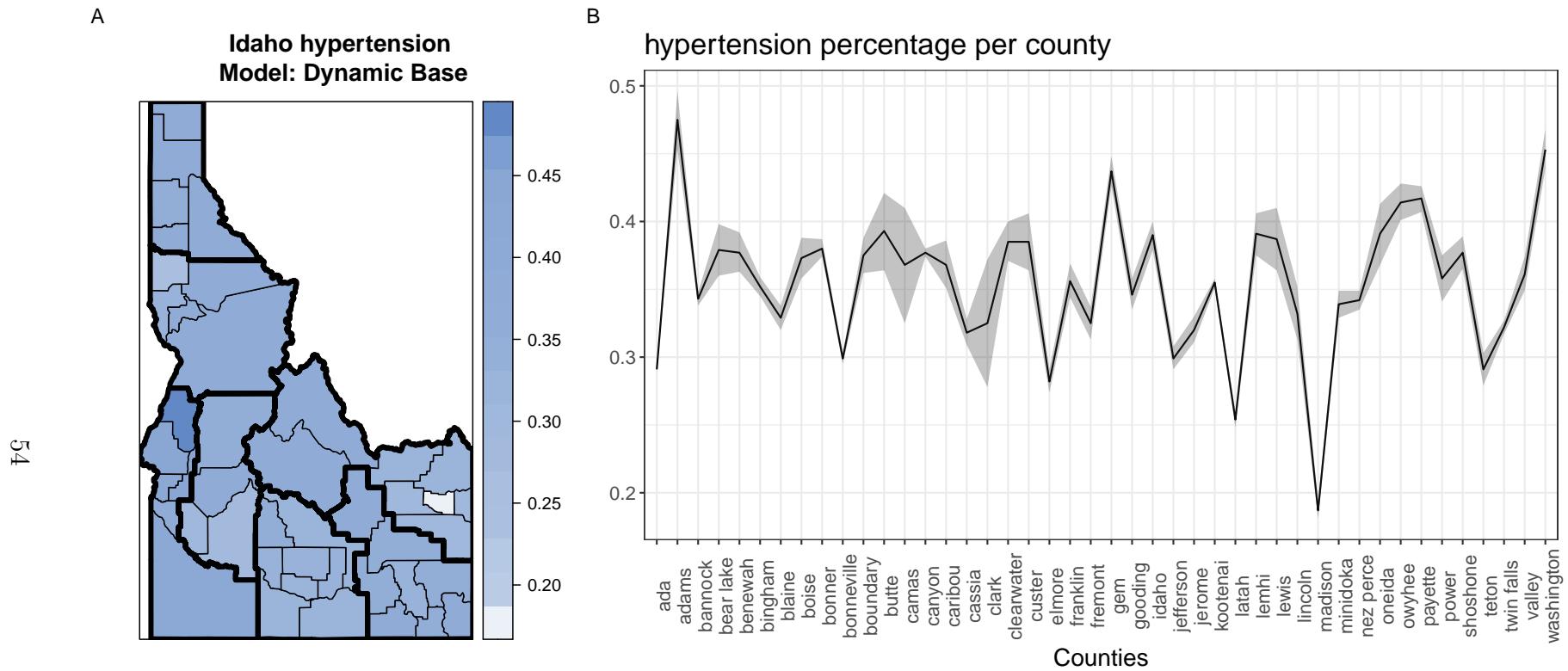


Figure 50: Idaho Hypertension 2019 - Dynamic Base Model.

**Figure S51. Hypertension 2019 Dynamic Grouped Model**

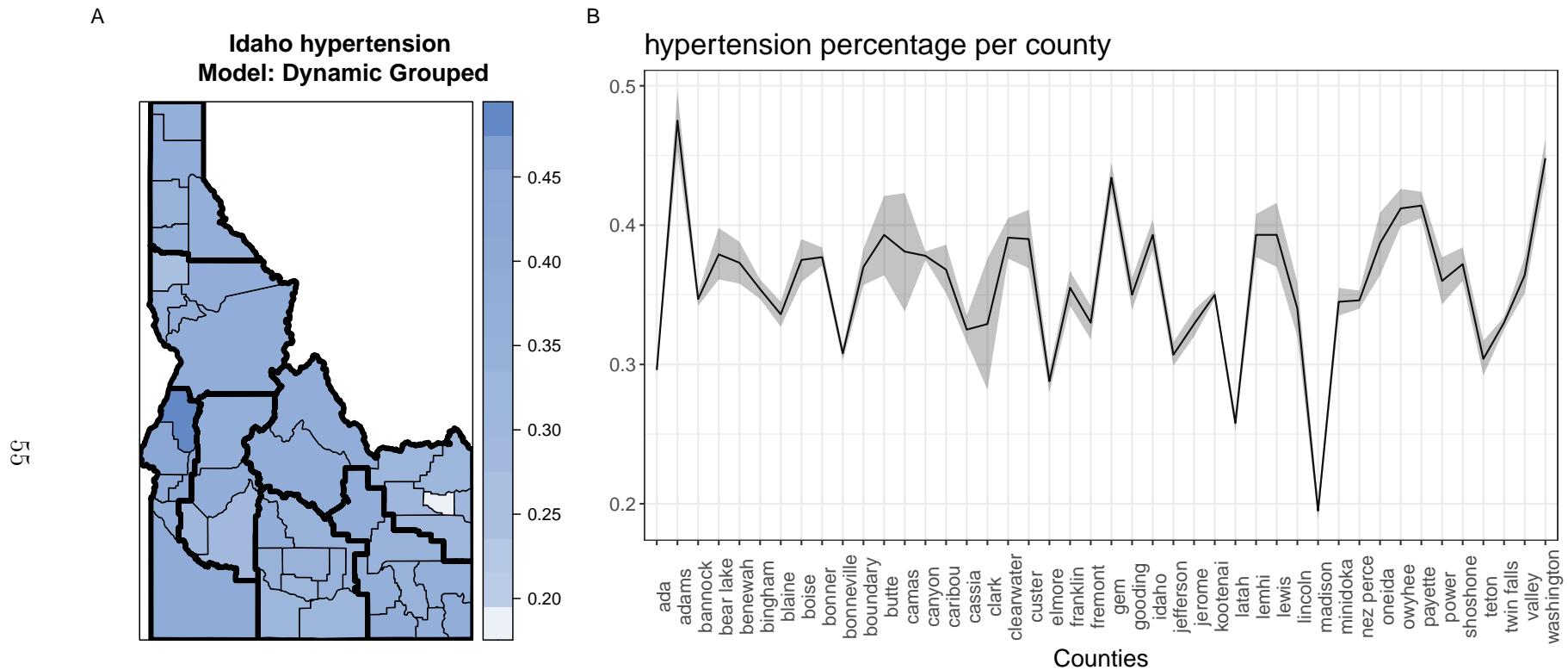
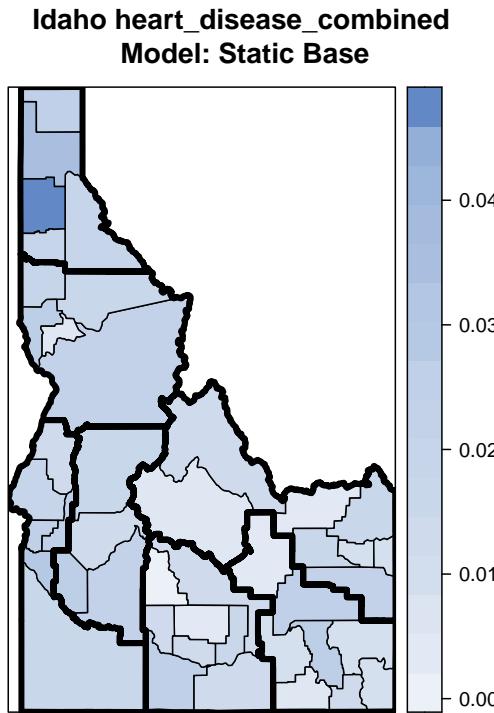


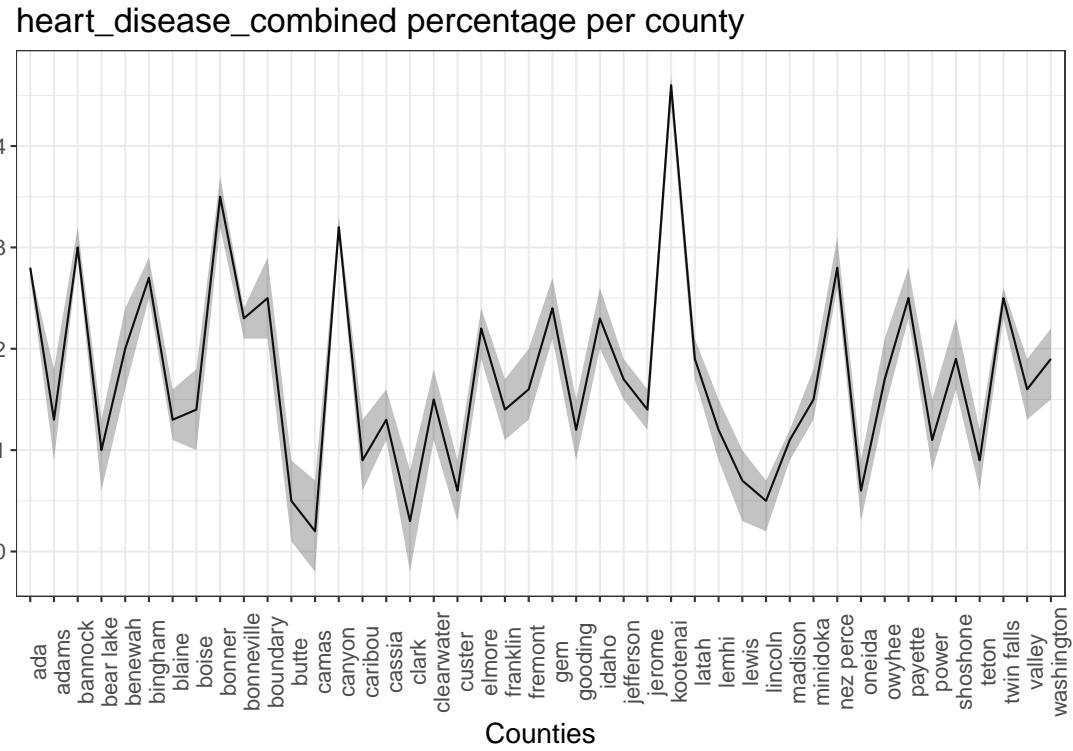
Figure 51: Idaho Hypertension 2019 - Dynamic Grouped Model.

**Figure S52. Heart Disease Combined 2020 Static Base Model**

A



B



**Figure 52: Idaho Hypertension 2019 - Static Base Model.**

**Figure S53. Heart Disease Combined 2020 Static Grouped Model**

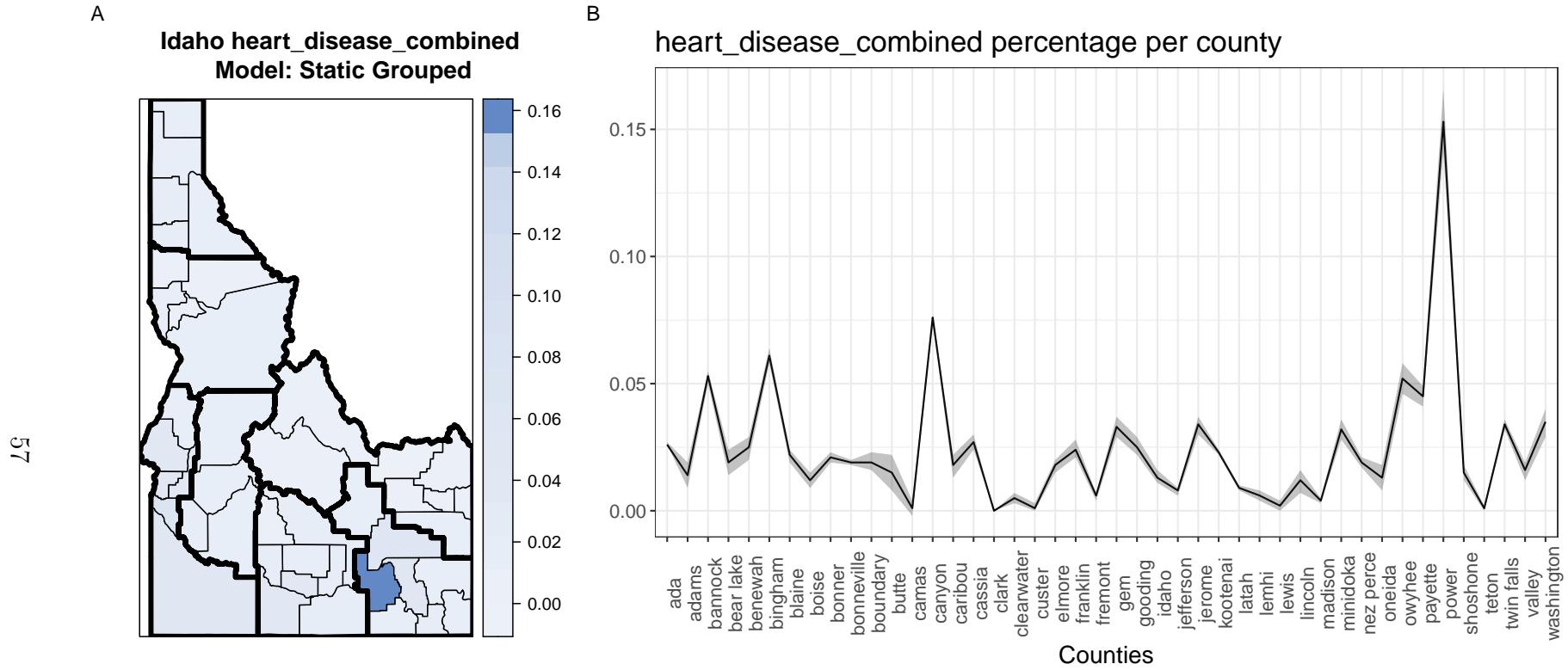
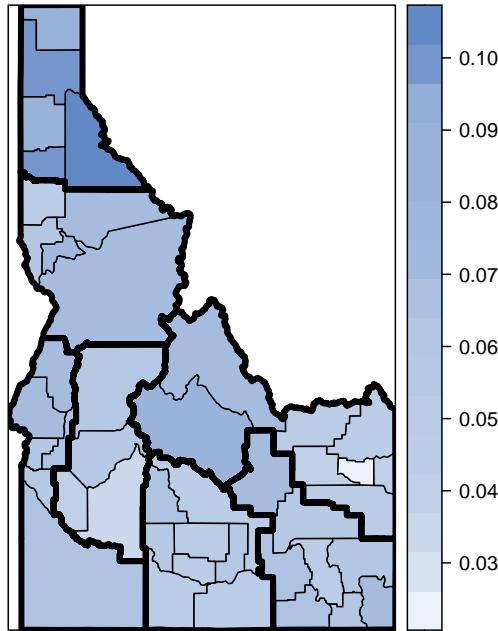


Figure 53: Idaho Hypertension 2019 - Static Grouped Model.

**Figure S54. Heart Disease Combined 2020 Dynamic Base Model**

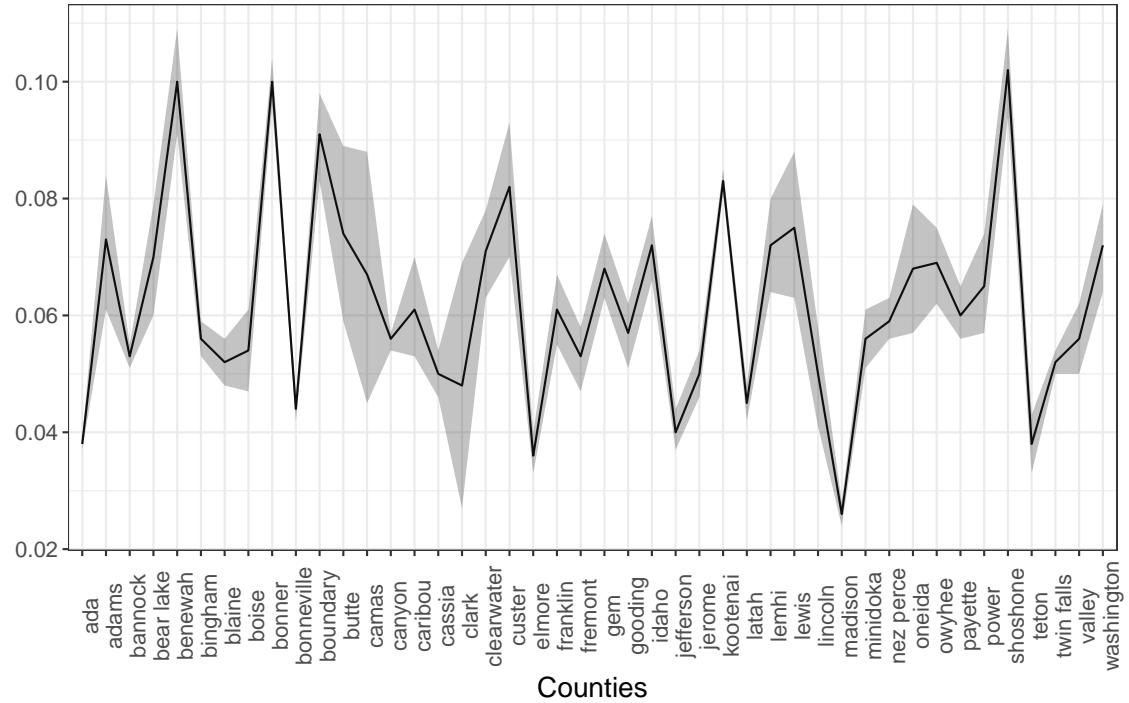
A

**Idaho heart\_disease\_combined  
Model: Dynamic Base**



B

**heart\_disease\_combined percentage per county**



**Figure 54: Idaho Hypertension 2019 - Dynamic Base Model.**

**Figure S55. Heart Disease Combined 2020 Dynamic Grouped Model**

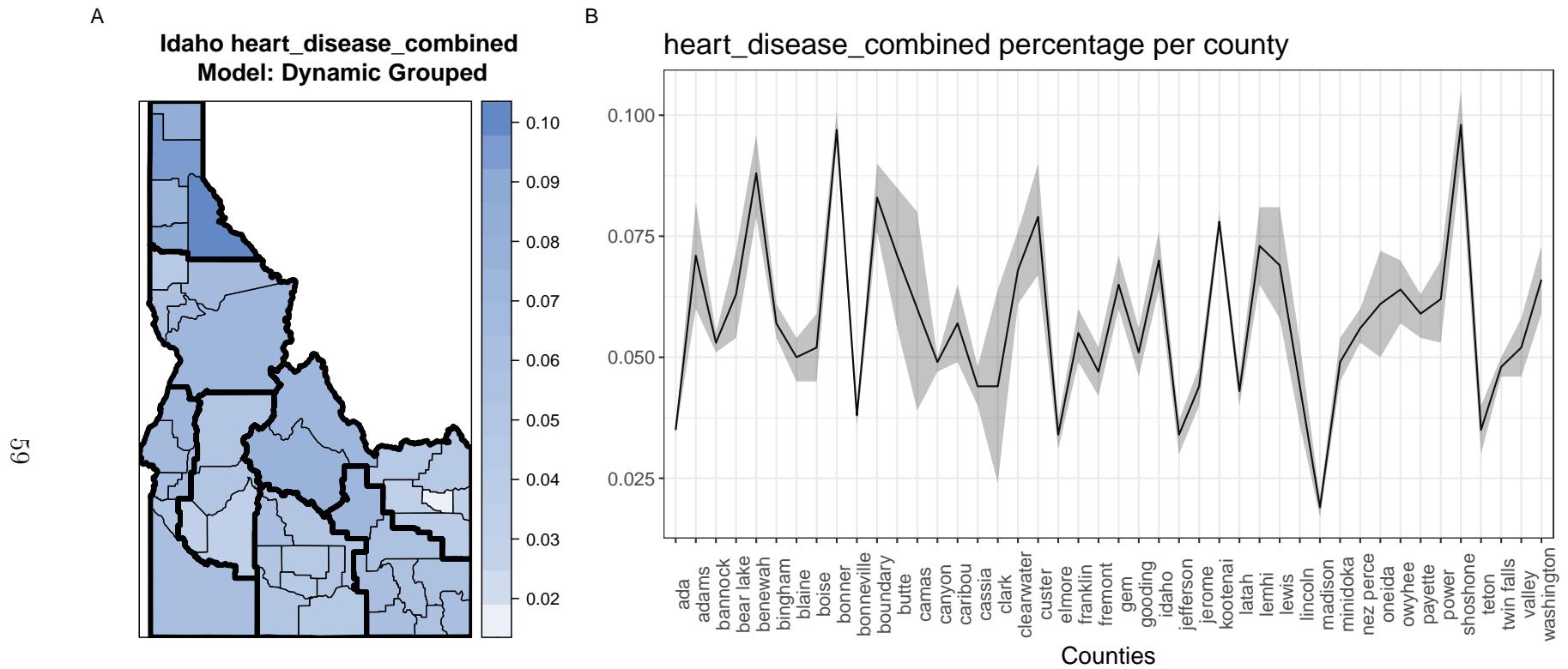
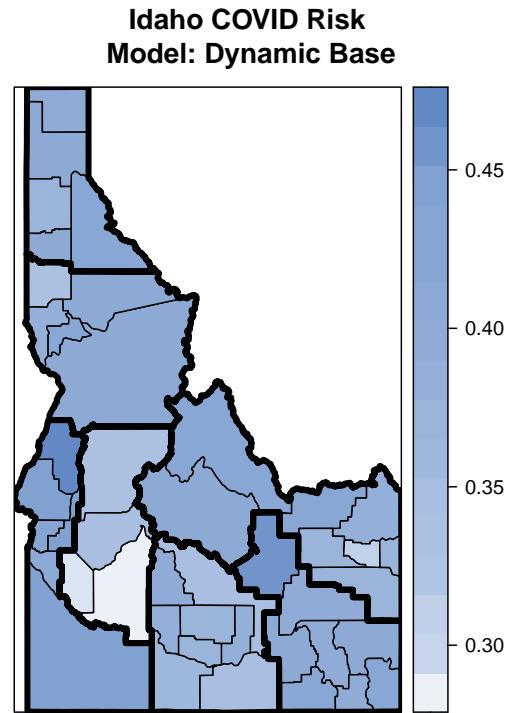


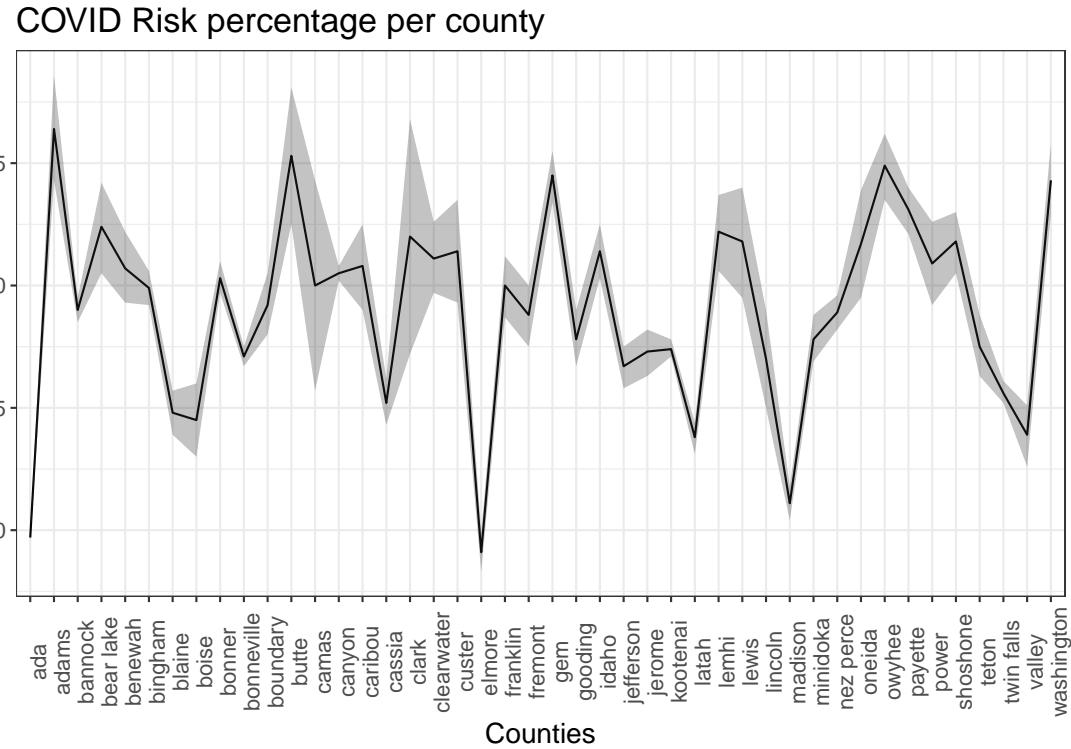
Figure 55: Idaho Hypertension 2019 - Dynamic Grouped Model.

**Figure S56. COVID Risk Prevalence: Probability of 1 out of 5 Health Conditions**

A



B



**Figure 56: Idaho COVID Risk Prevalence: Probability of 1 our of 5 Health Conditions**

**Figure S57. COVID Composite Risk: Probability of being overweight AND having Diabetes**

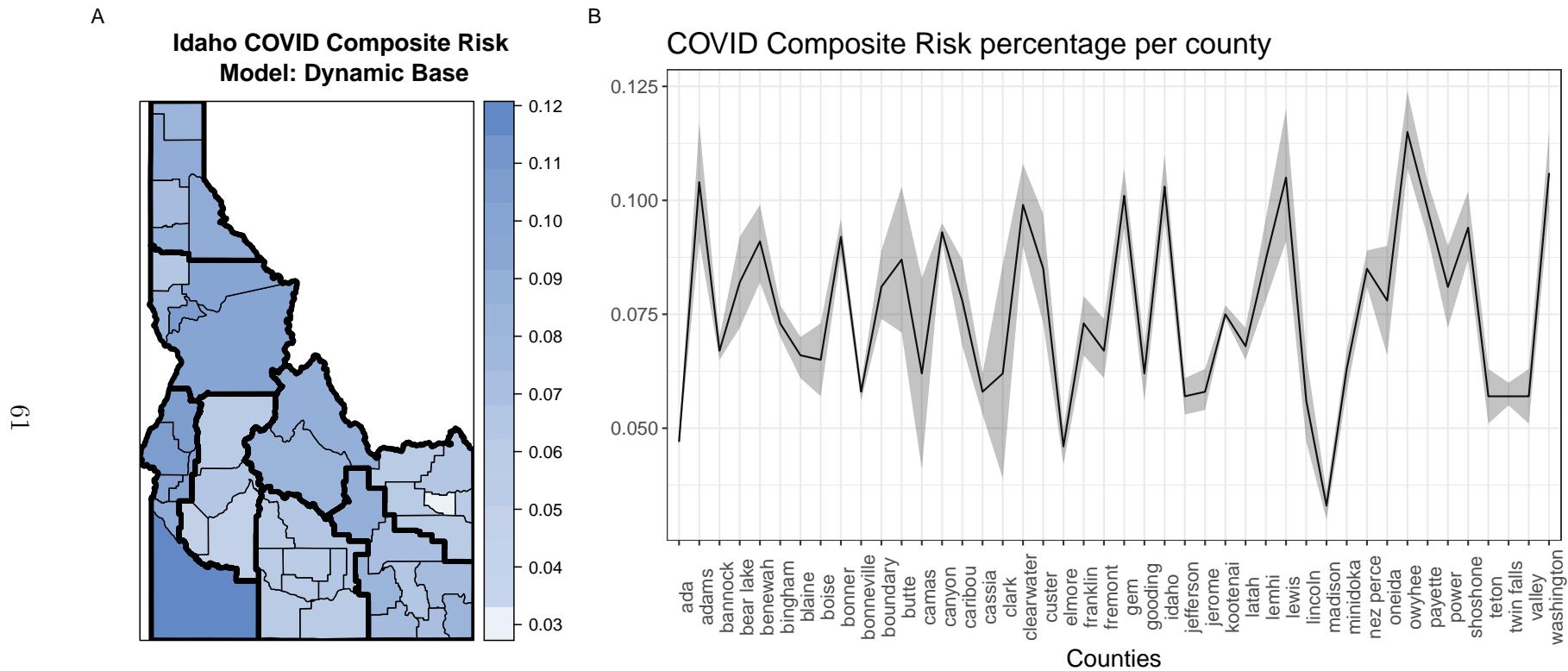


Figure 57: Idaho COVID Composite Risk: Probability of being overweight AND having Diabetes

**Figure S58. Model Outcome Comparison: Obesity, Overweight, Diabetes**

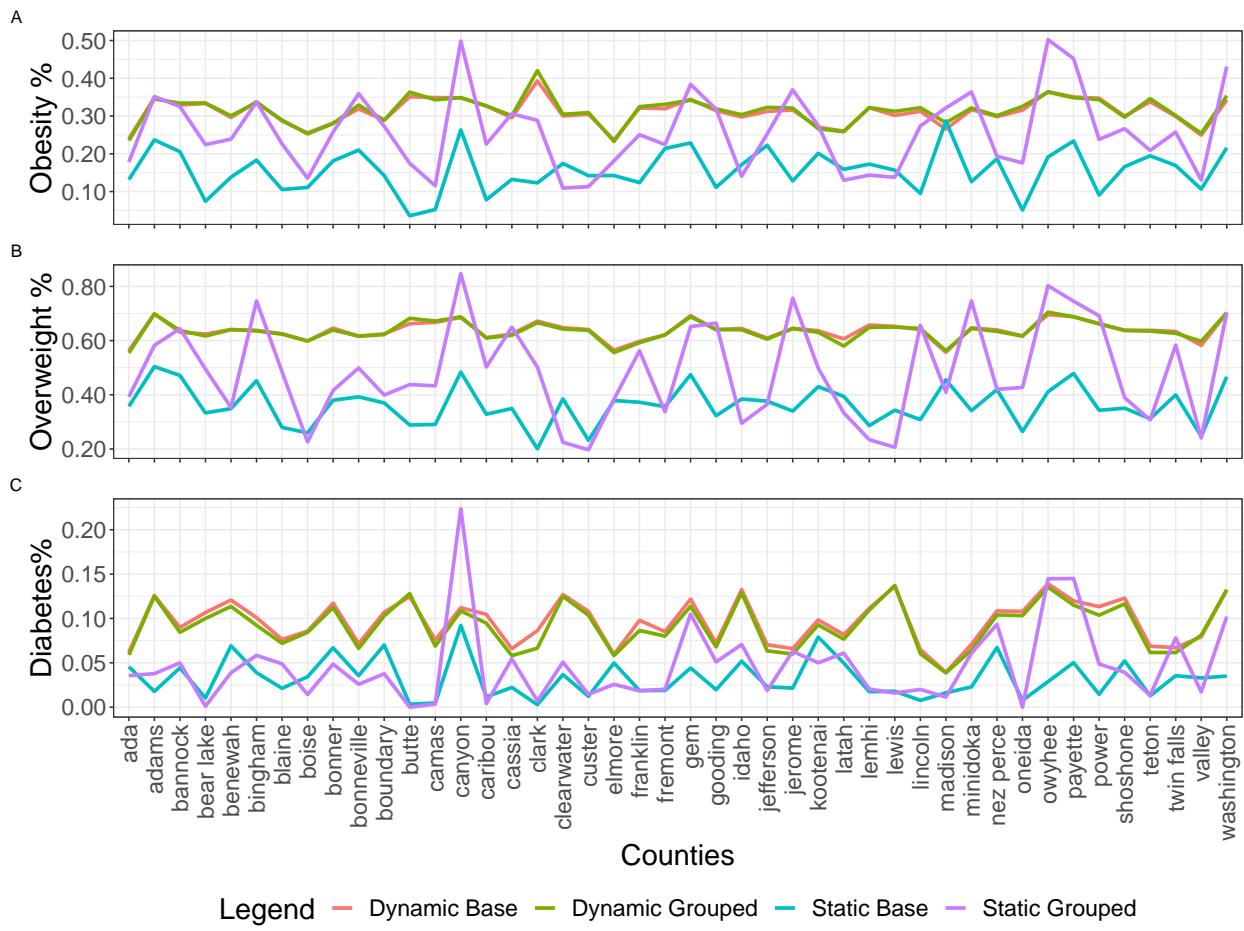


Figure 58: Model outcomes per variable.

**Figure S59. Model Outcome Comparison: Kidney Disease, Depression Pulmonary Disease**

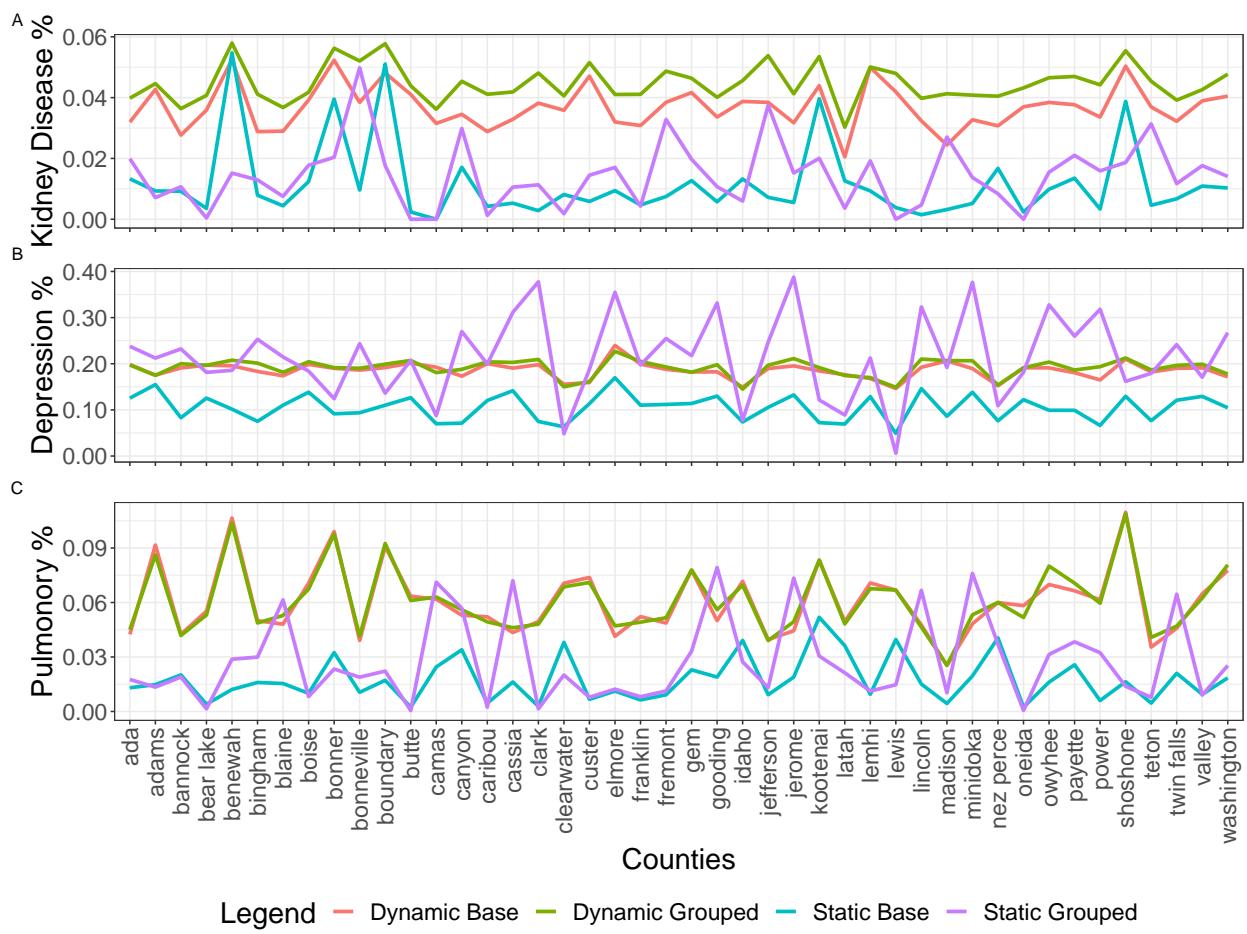


Figure 59: Model outcomes per variable.

**Figure S60. Model Outcome Comparison: Asthma, Stroke, Heart Attack**

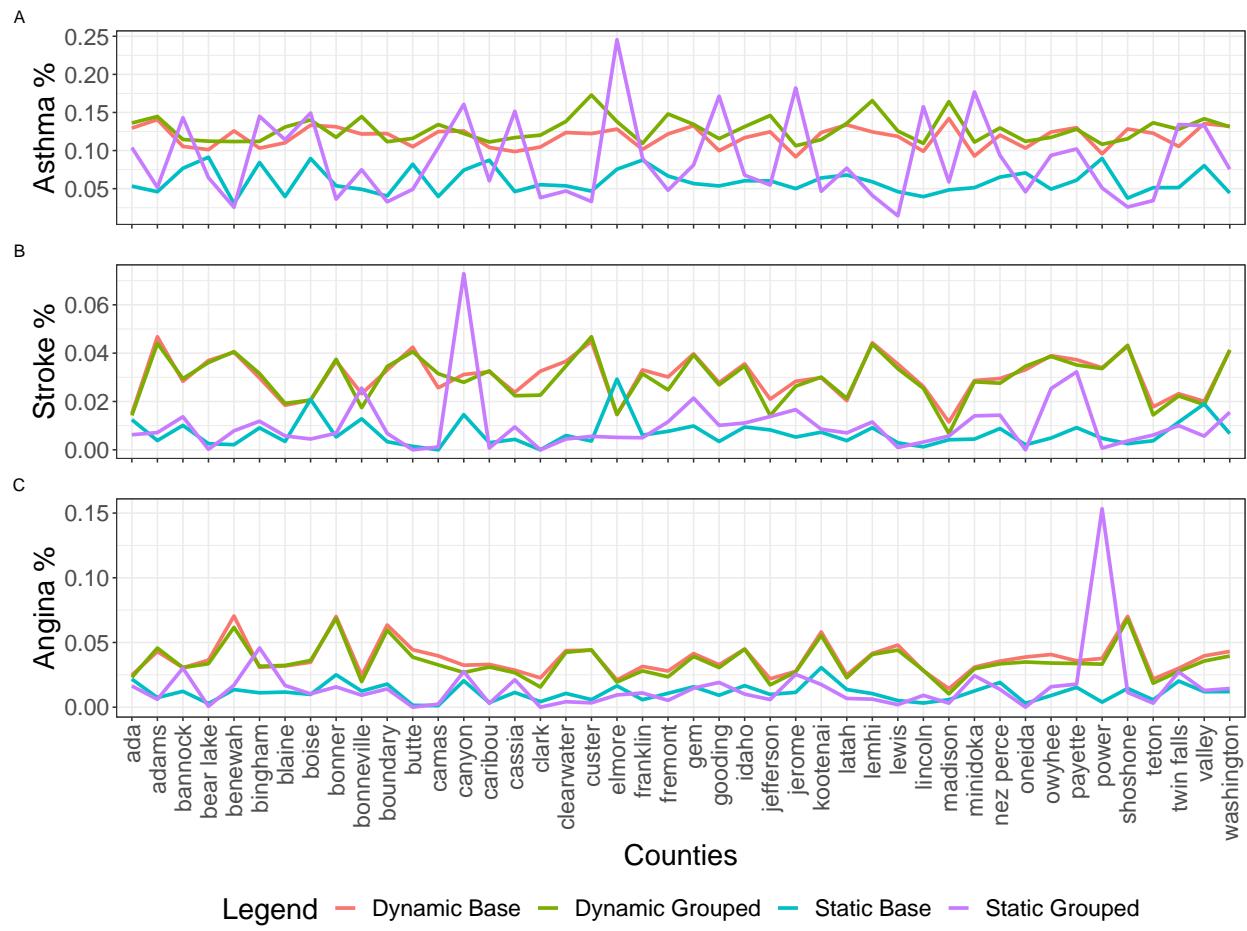


Figure 60: Model outcomes per variable.

**Figure S61. Model Outcome Comparison: Heart Disease, Hypertension, Smoking**

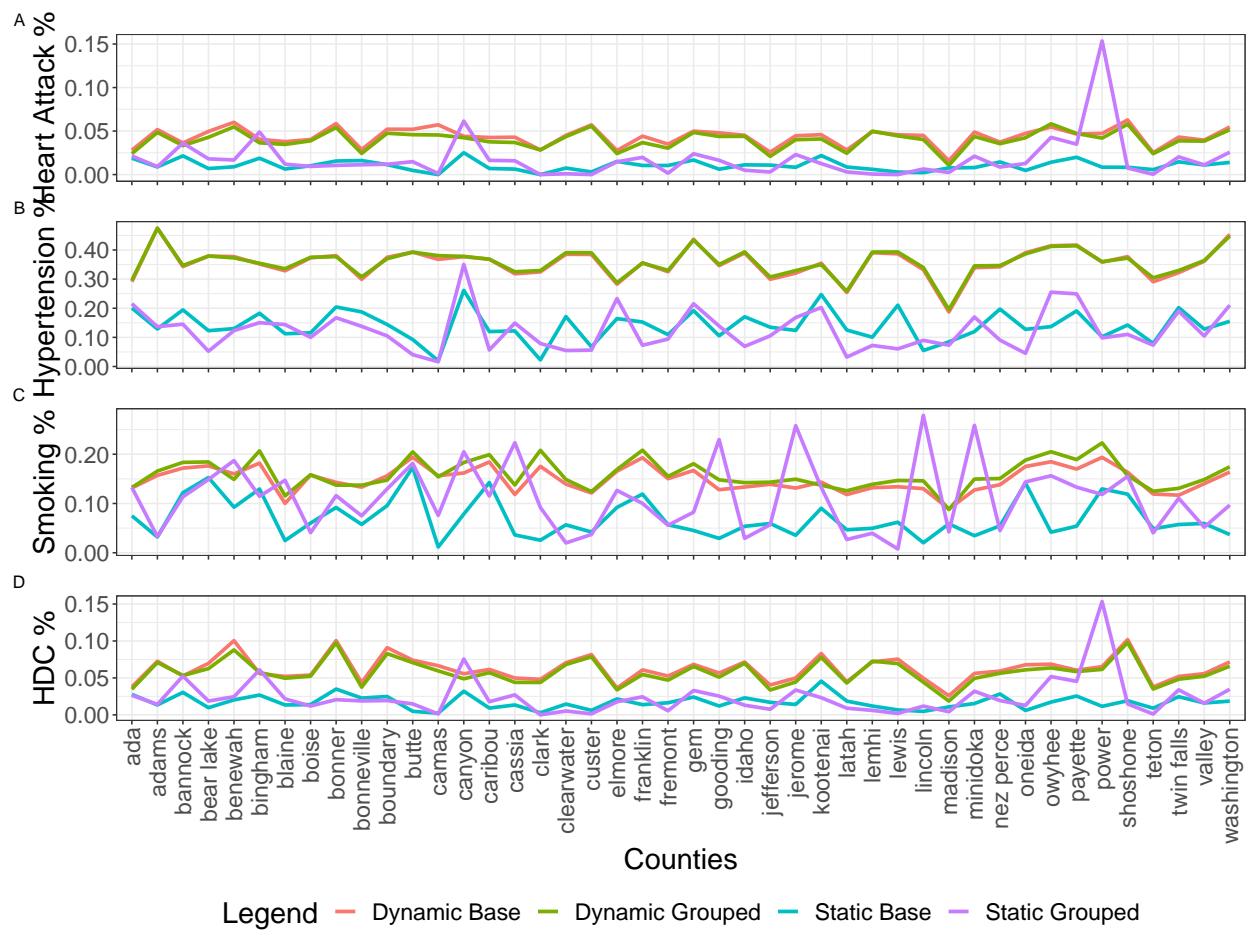


Figure 61: Model outcomes per variable.

**Figure S62. Model Outcome Comparison: Risk Prevalence and Composite Risk**

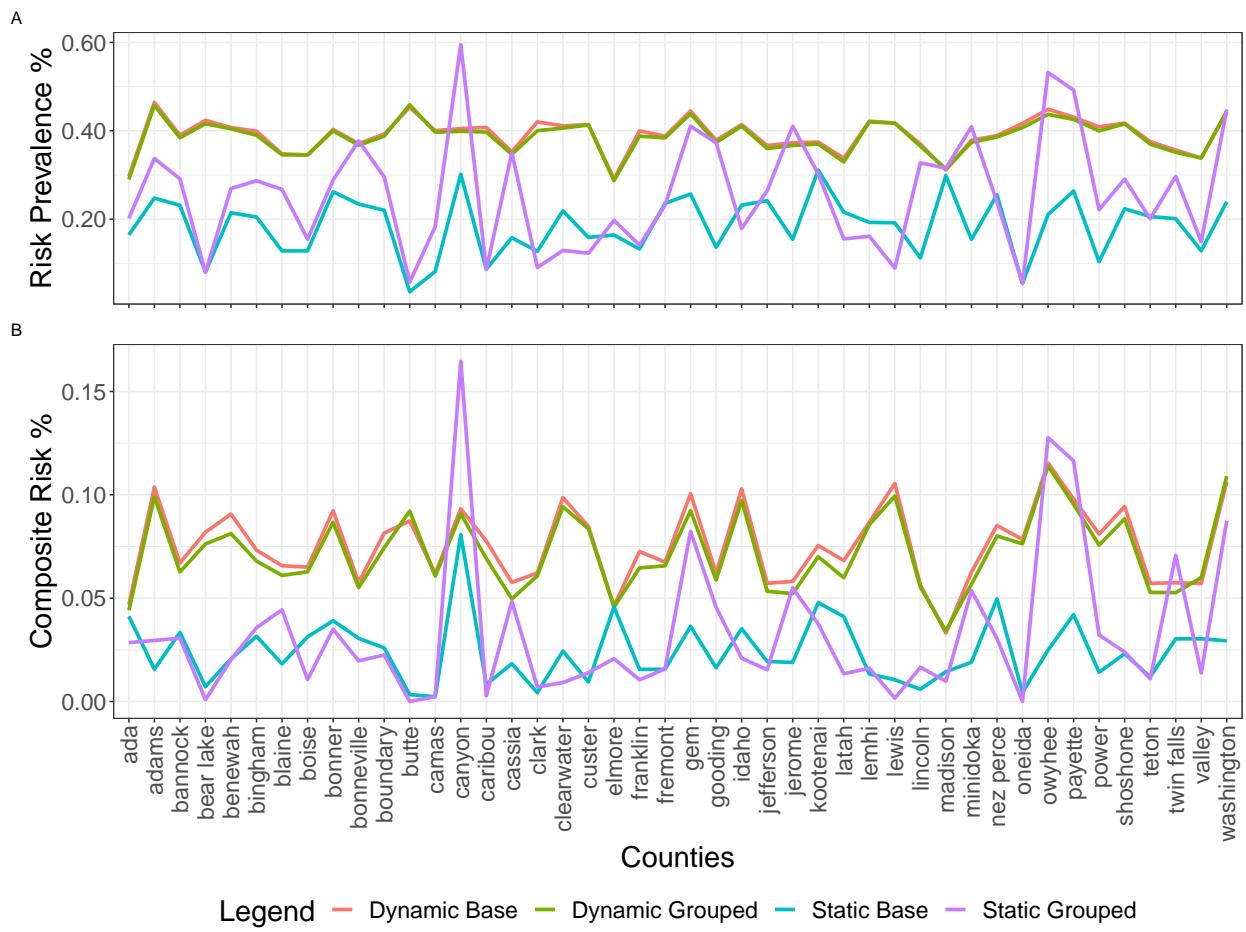


Figure 62: Model outcomes per variable.

**Figure S63. Model Error Comparisons**

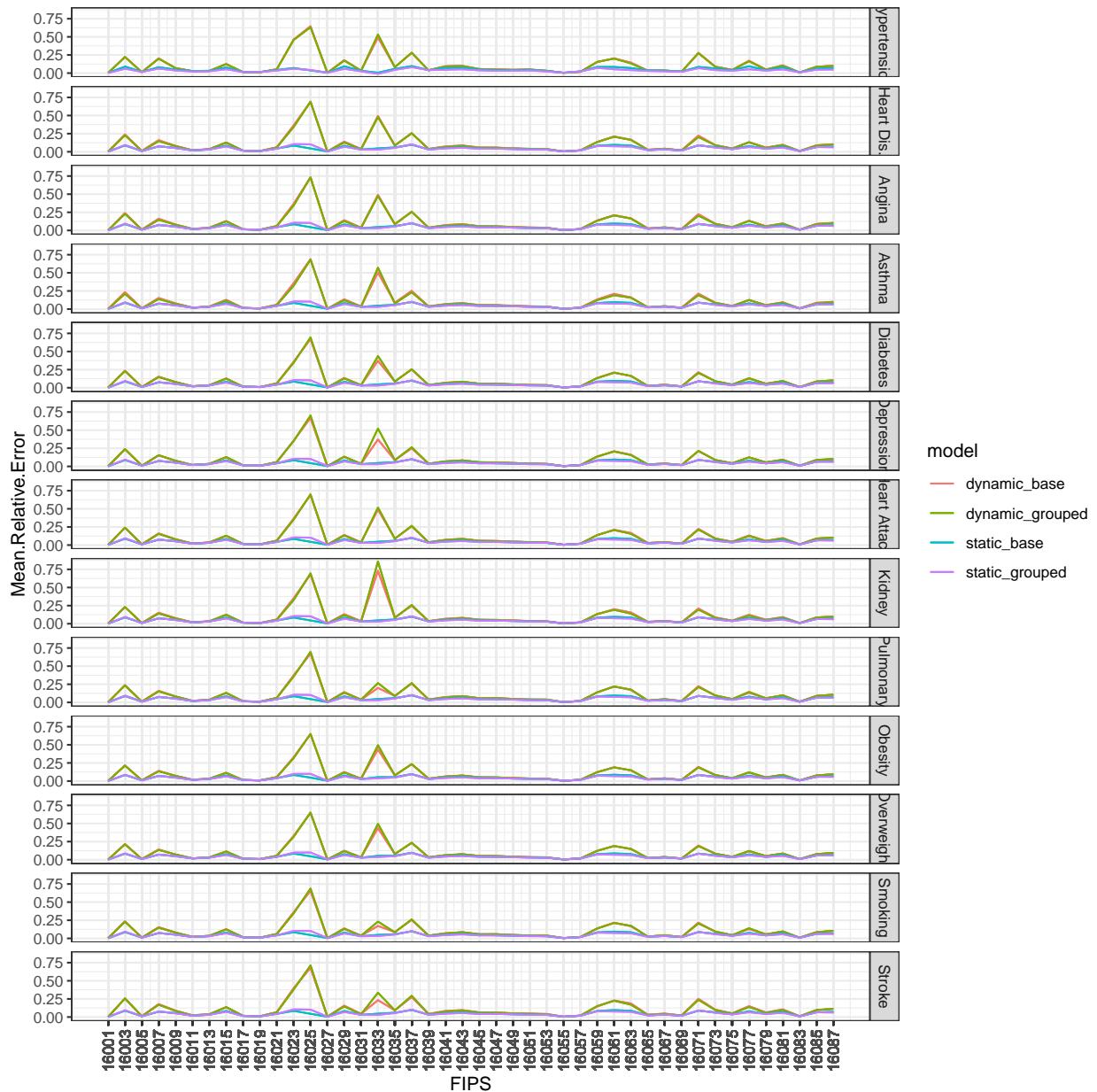


Figure 63: Model Error Comparisons.