

Section III. Associations between Socioeconomic Conditions and Disparities in Premature Mortality

This section examines associations between premature mortality and selected indicators of socioeconomic condition. Individual analyses were performed for each socioeconomic indicator with premature all-cause mortality as well as disease-specific premature mortality for major causes of death. Two regional-level analyses were performed for each case, one for the U.S. and one for the Appalachian region (see Section I). Because the LISAs are partly dependent on the global mean for each distribution, this was done in order to determine associations relative to both the national and regional averages. In each case key associations were identified for two levels of statistical significance; .05 and .01, although for brevity's sake only the .05 levels are shown.

Some care must be taken in the interpretation of these results. As outlined in Section I, the unit of analysis is a neighborhood defined by a county and its contiguous neighbors. Therefore associations assigned to each county reflect its position relative to surrounding counties, e.g. a high-high value indicates that a county is high in one variable and surrounded by counties with high values on the other variable. In addition, a consistent method was used to depict these associations, i.e. reds indicate high-high associations regardless of the expected direction of the association. For example, the theoretical expectation is that high levels of poverty will be associated with high levels of premature mortality. However for income, the theoretical expectation is that high levels of income will be associated with low levels of premature mortality. (see Appendix III for tables indicating associations derived from national and regional analyses.)

III. A. National Associations

III. A.1 Premature All-cause Mortality

The national distribution of premature all-cause mortality is dominated by high death rates in the Southeastern U.S. and Central Appalachia, and low death rates in the Upper Mid-West, Pacific Northwest, and Northeastern U.S (see Section II, Figure 2). Statistically significant associations between socioeconomic indicators and premature all-cause mortality are consistently found among counties in the Southeastern, Upper-Midwest, and Pacific Northwest regions of the country (see Figures 10-14.). However the nature of these associations appears to be in sharp contrast. The strong and persistent gradient in rates of all-cause mortality at the national level may limit the ability of the method used here to identify significant associations in areas that fall between the extremes in the distribution (highest and lowest rates of mortality).

Among the general regions of the U.S. three stand out as significant associations with the Southeast (including the Mississippi Delta Region) and Upper Midwest as the most prominent. In many cases, however, the direction of association varies between these dominant regions. For example, in the Southeastern U.S. low levels of income, high poverty rates, high unemployment, and high percentages without health insurance are generally associated with high rates of premature all-cause mortality, whereas in the

Upper Midwest comparable socioeconomic conditions are primarily associated with low rates of premature all-cause mortality.

Few statistically significant associations are apparent for all-cause mortality in the Appalachian Region when compared with the rest of the U.S. Exceptions include counties in the extreme Southern portion of the region in Alabama, Mississippi, and Georgia and in Central Appalachian counties in West Virginia and Kentucky. Among Appalachian counties with significant associations, low levels of income, high poverty rates, high unemployment, and high percentages without health insurance are generally associated with high rates of premature all-cause mortality.

Figure 10. National Associations between Premature All-cause Mortality and Percent Urban Population.

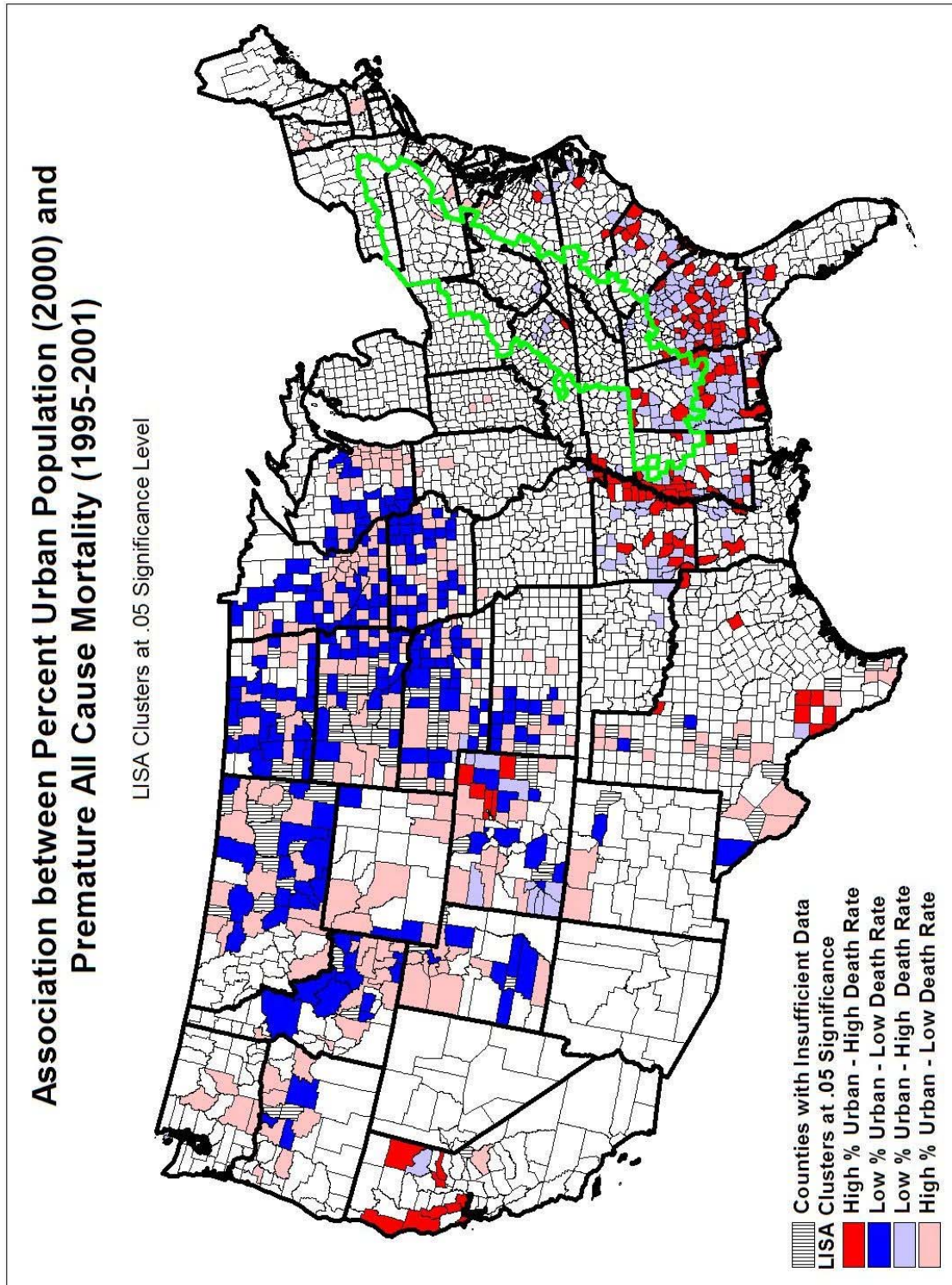


Figure 11. National Associations between Premature All-cause Mortality and Median Family Income.

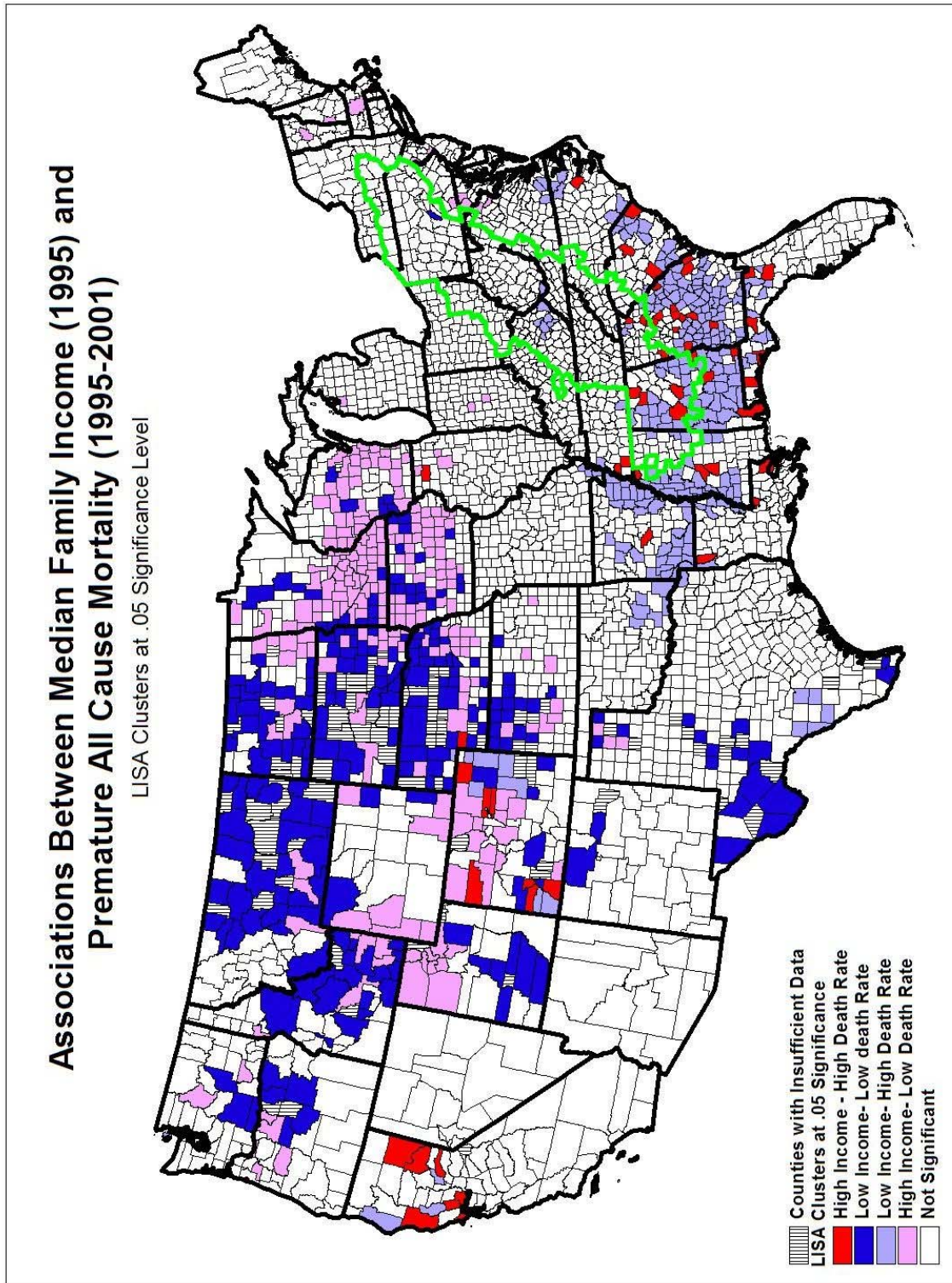


Figure 12. National Associations between Premature All-cause Mortality and Poverty Rate.

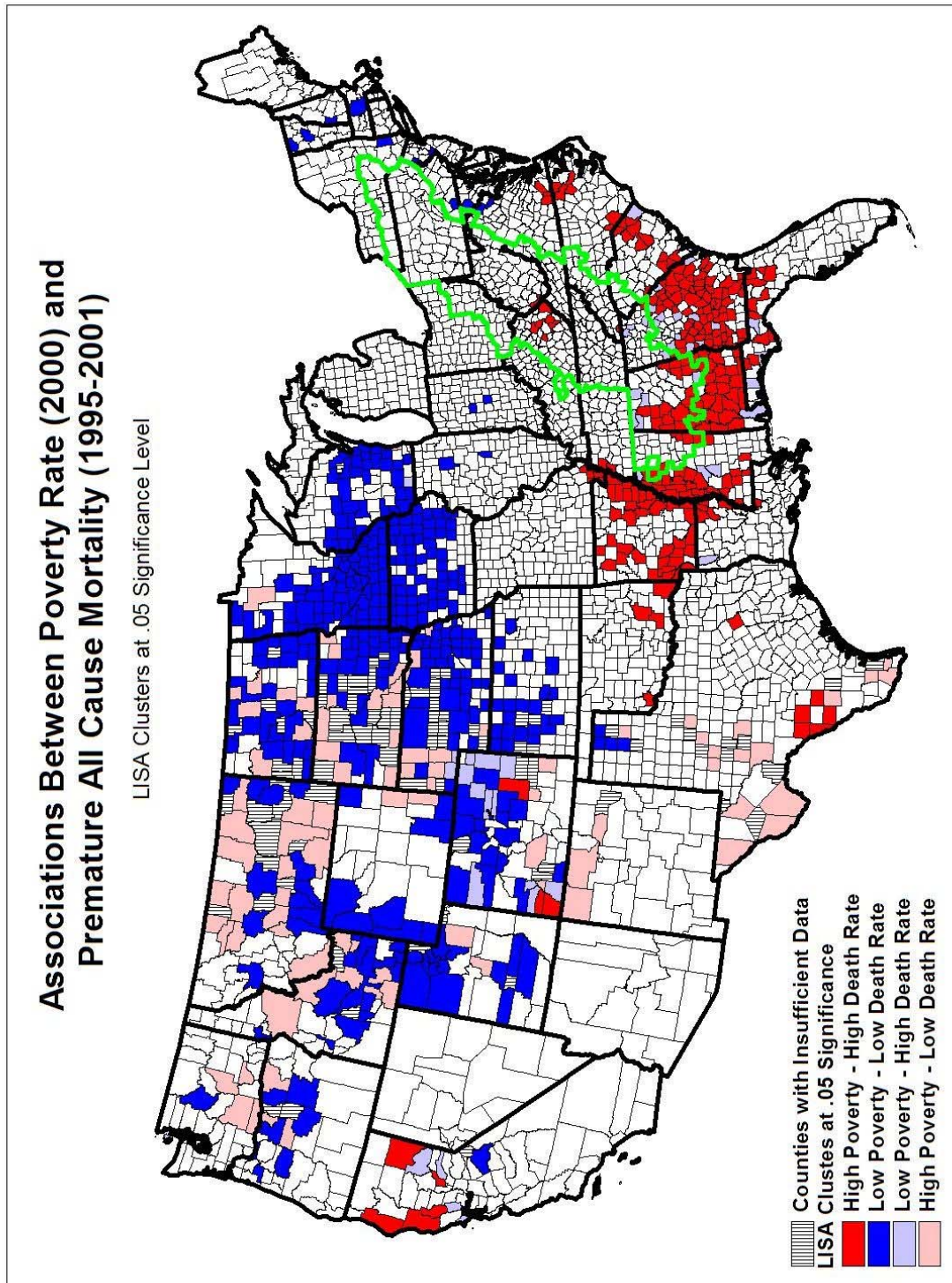


Figure 13. National Associations between Premature All-cause Mortality and the Unemployment Rate.

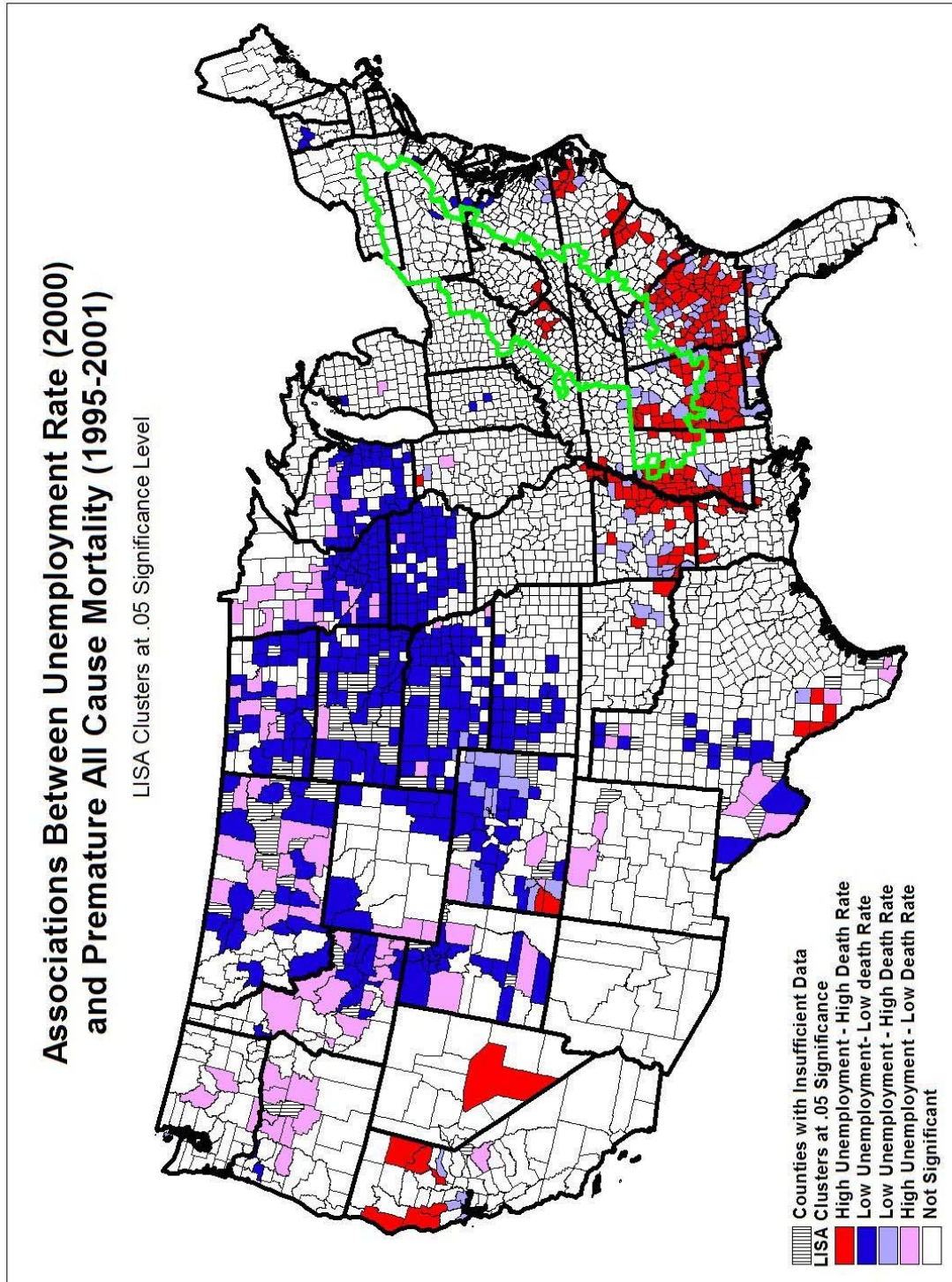
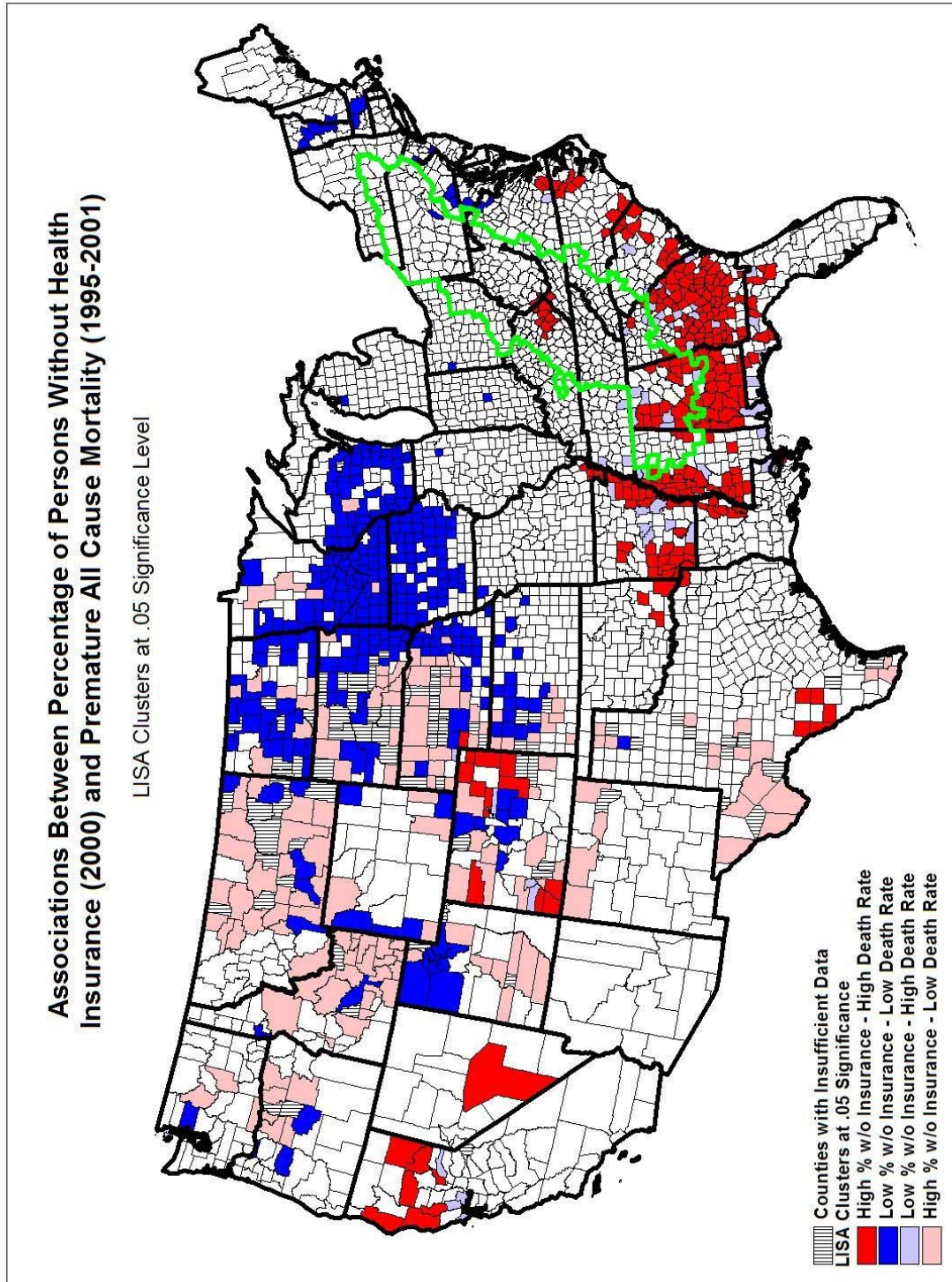


Figure 14. National Associations between Premature All-cause Mortality and the Percentage of Persons without Health Insurance.



III. A.2 Premature Heart Disease Mortality

Patterns of premature heart disease mortality suggest a steeper east-west gradient than exists for all-cause mortality (see Section II, Figure 4). High rates of premature heart disease mortality are clustered primarily in the Southeastern U.S. although high rates also occur prominently in the Appalachian region. The majority of Appalachian counties occur within the third and fourth quartiles of the national distribution of premature heart disease mortality rates.

Statistically significant associations between socioeconomic indicators and premature heart disease mortality are consistently found among counties in the Southeastern (including Southern Appalachia), Central Appalachian, and Western regions of the country (see Figures 15-19). The appearance of statistical associations between socioeconomic conditions and premature heart disease mortality in Central Appalachian, and the lack of comparable associations for all-cause mortality, highlight the need to examine disease specific associations.

Similar to the patterns of association shown for all-cause mortality, the patterns of association for premature heart disease mortality reflect the steep east-west gradient. Counties in the Southeast and Central Appalachian region demonstrate the expected direction of association, with socioeconomically disadvantaged counties experiencing high rates of premature mortality. However, counties in the Western U.S. that share socioeconomic characteristics found in the Southeast and Central Appalachian, do not experience comparable rates of mortality, with a notable exception in Southern Nevada.

High poverty, unemployment, and percentages of persons without health insurance, and low incomes are particularly prevalent among counties in the Southeast and Central Appalachia showing positive association with premature heart disease mortality.

Figure 15. National Associations between Premature Heart Disease Mortality and Percent Urban Population.

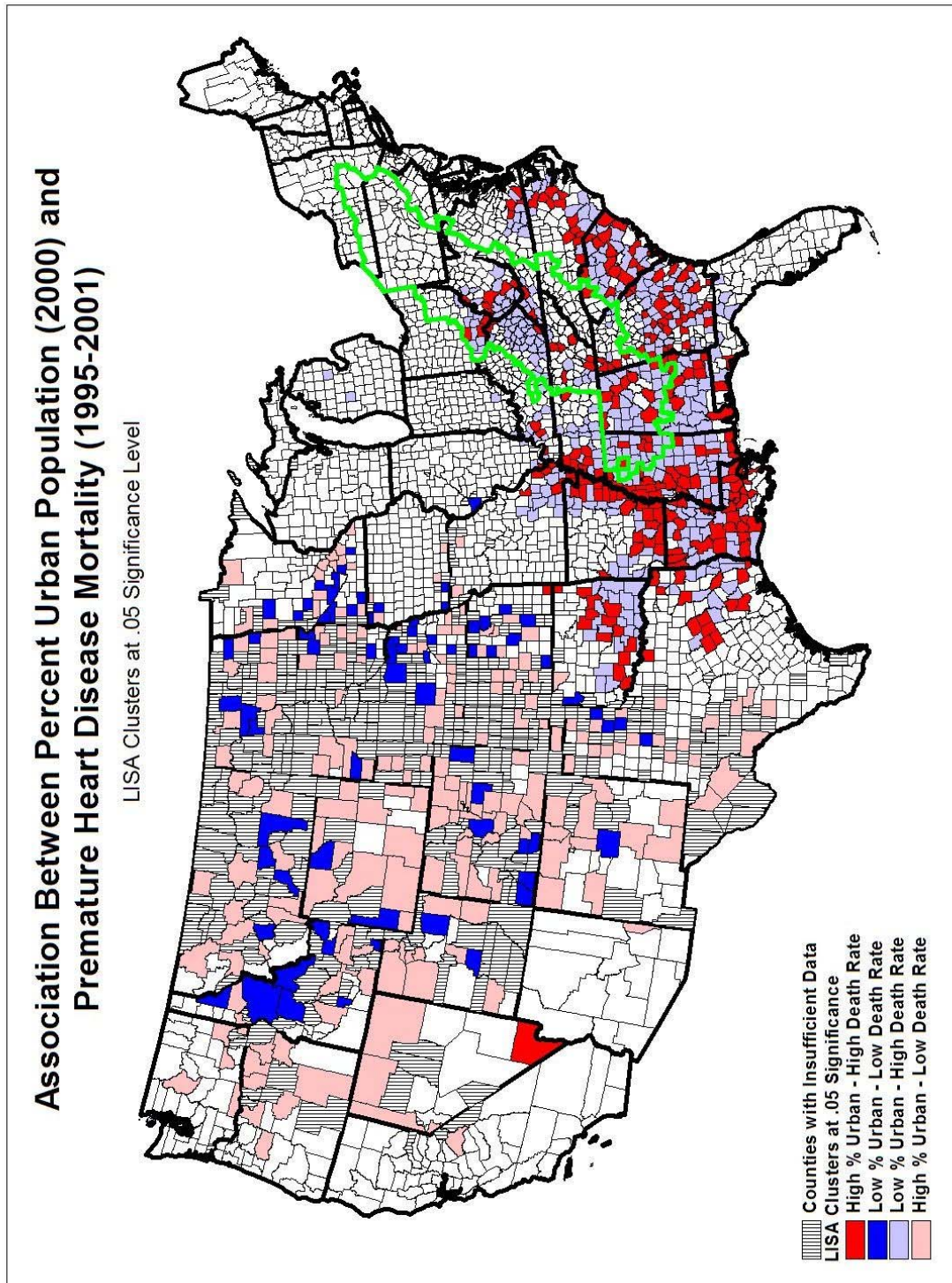


Figure 16. National Associations between Premature Heart Disease Mortality and Median Family Income.

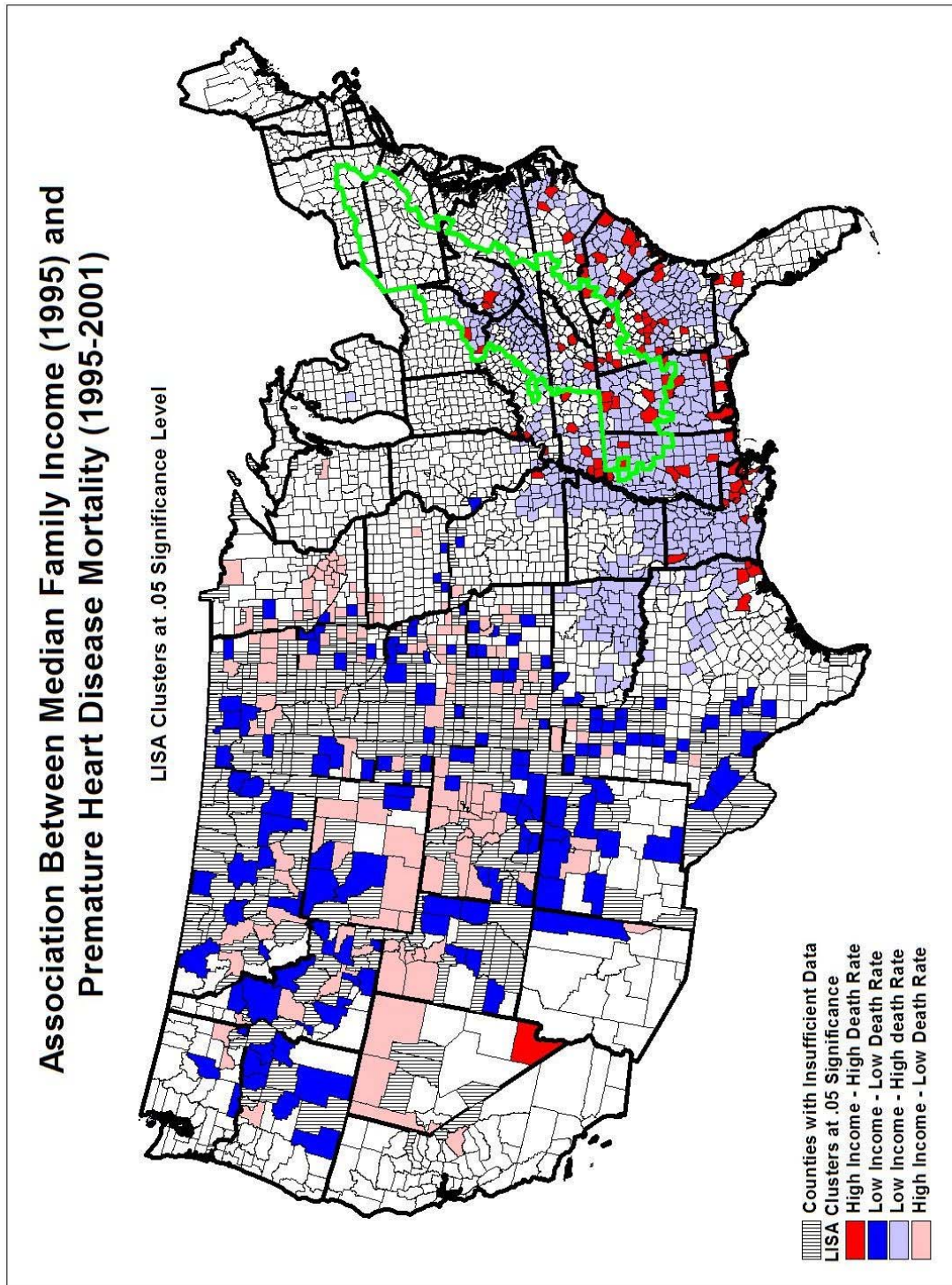


Figure 17. National Associations between Premature Heart Disease Mortality and Poverty Rate.

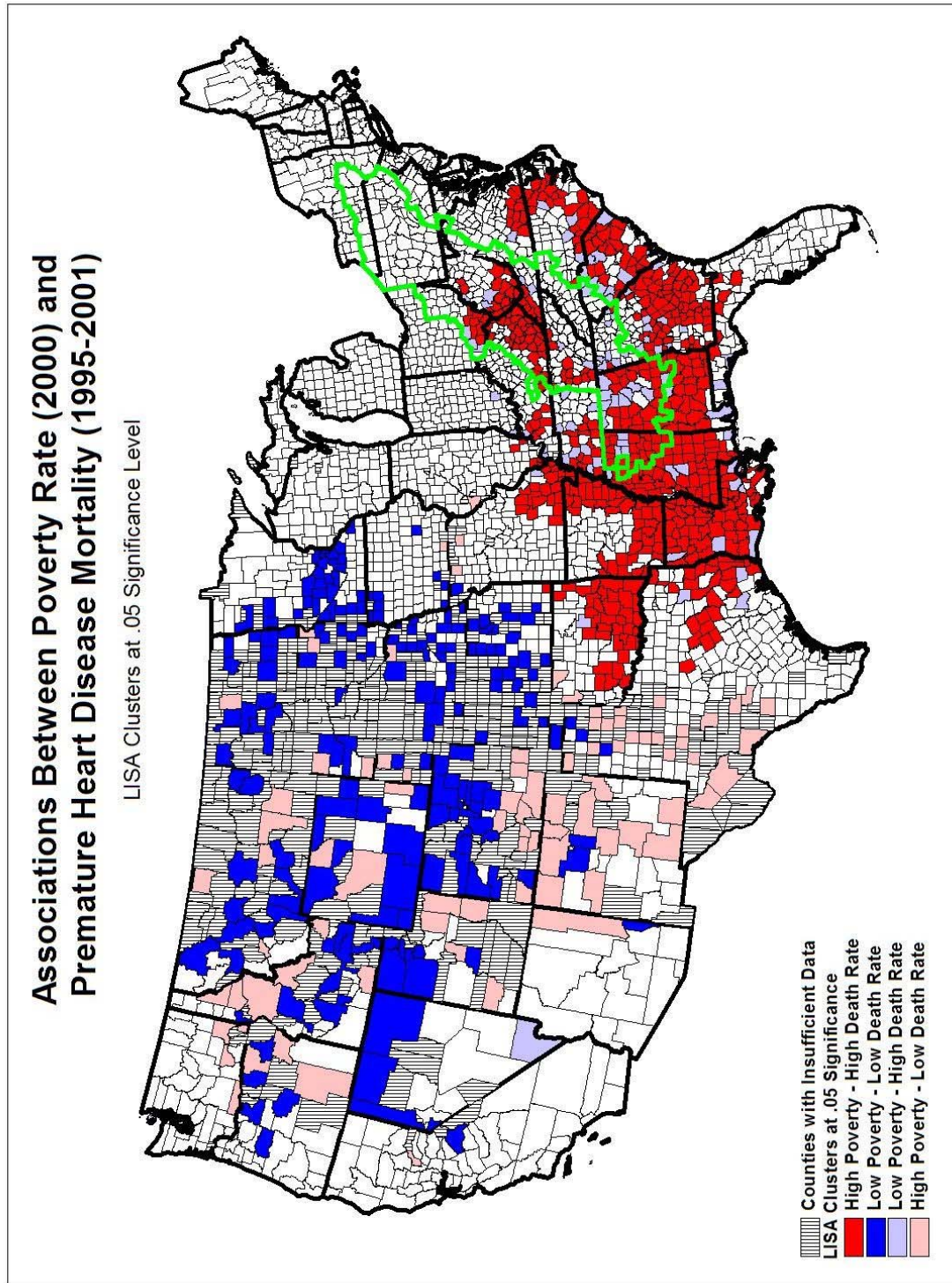


Figure 18. National Associations between Premature Heart Disease Mortality and the Unemployment Rate.

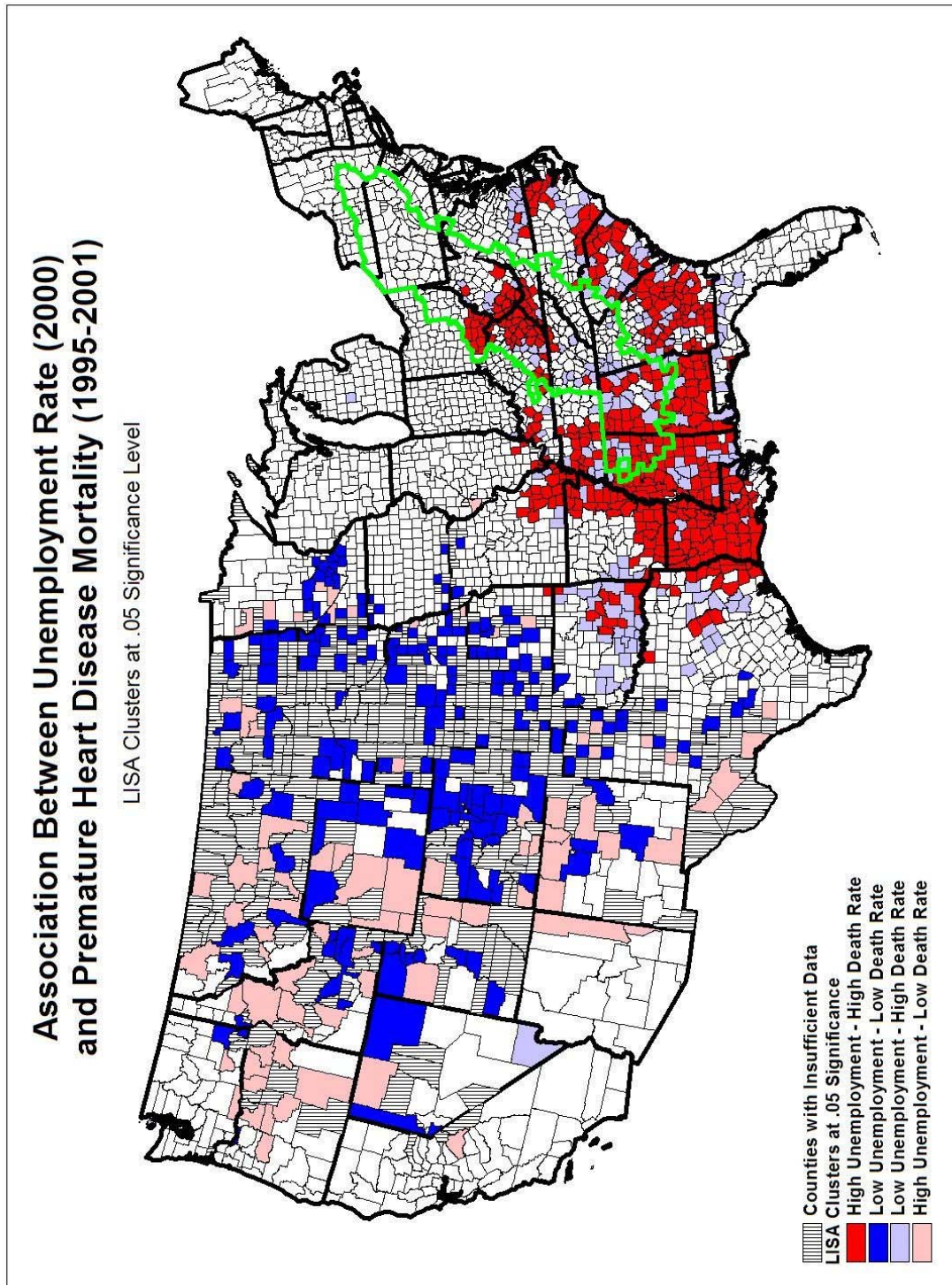
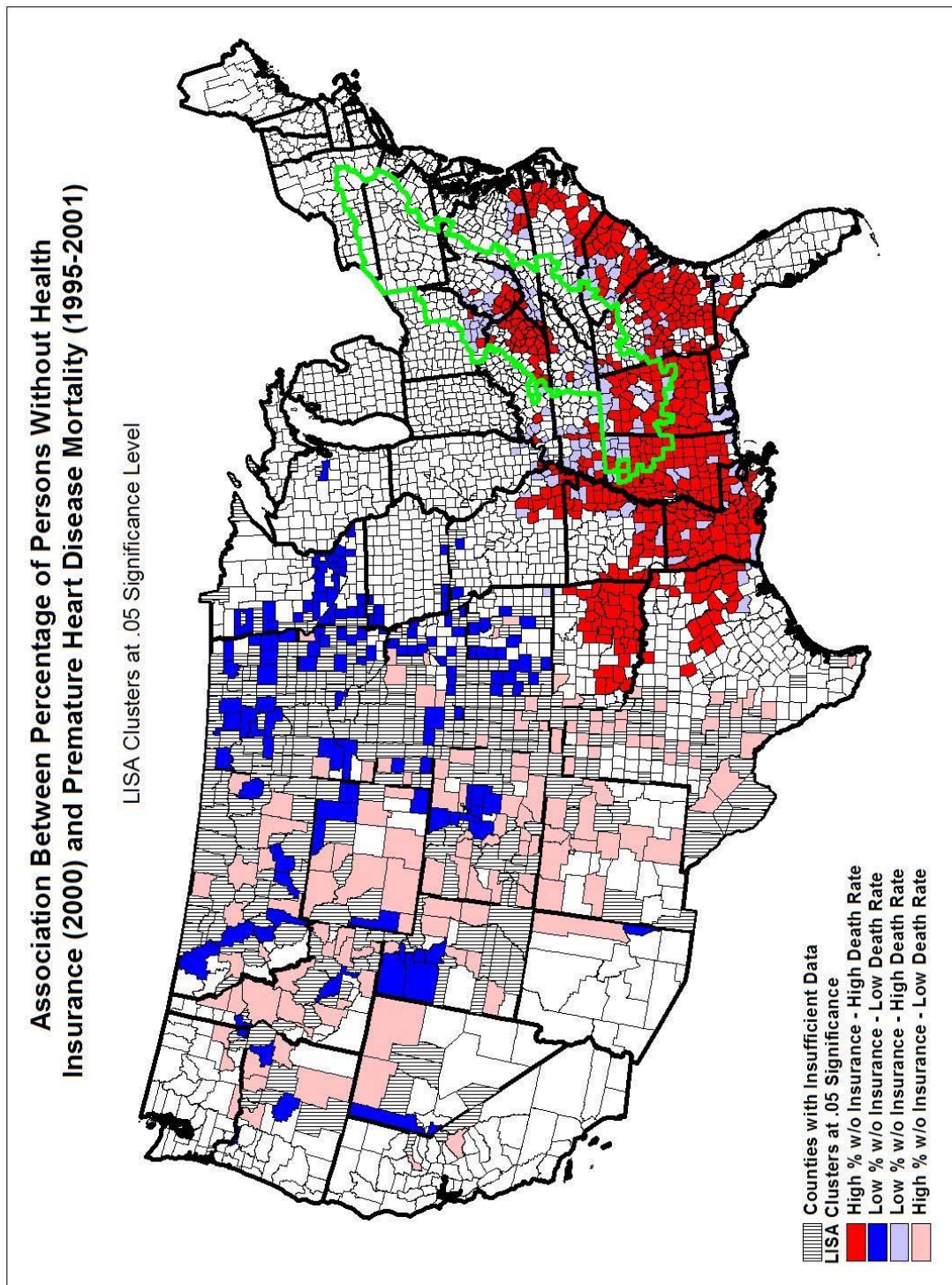


Figure 19. National Associations between Premature Heart Disease Mortality and the Percentage of Persons without Health Insurance.



III. A.3 Premature Cancer Mortality

National patterns of premature cancer mortality are similar to those of premature heart disease mortality; with the addition of a northeastern shift in high mortality rates (see Section II, Figure 6). High rates of premature cancer mortality are again clustered primarily in the Southeastern U.S. in the Mississippi Delta, counties among states along the Atlantic coast, and in the Central Appalachian region. In the Appalachian region, high premature cancer death rates are more strongly concentrated in the Central portion of the region when compared with premature heart disease mortality.

Statistically significant associations between socioeconomic indicators and premature cancer mortality are consistently found among counties in the Southeastern states, Mississippi Delta region, Central Appalachian, and Western regions of the country (see Figures 20-24). Within Appalachia, significant associations are primarily limited to counties in the Central portion of the region. Many of the Appalachian counties in the Southern Appalachian states do not show significant associations between socioeconomic conditions and premature cancer mortality that were apparent for both all-cause and heart disease mortality. This may be indicative of variable disease etiologies as well as the variable nature of local associations with underlying socioeconomic conditions.

High poverty, unemployment, and percentages of persons without health insurance, and low incomes are very prominent among counties in the Southeast, Mississippi Delta, and Central Appalachia showing positive association with premature cancer mortality.

Figure 20. National Associations between Premature Cancer Mortality and Percent Urban Population.

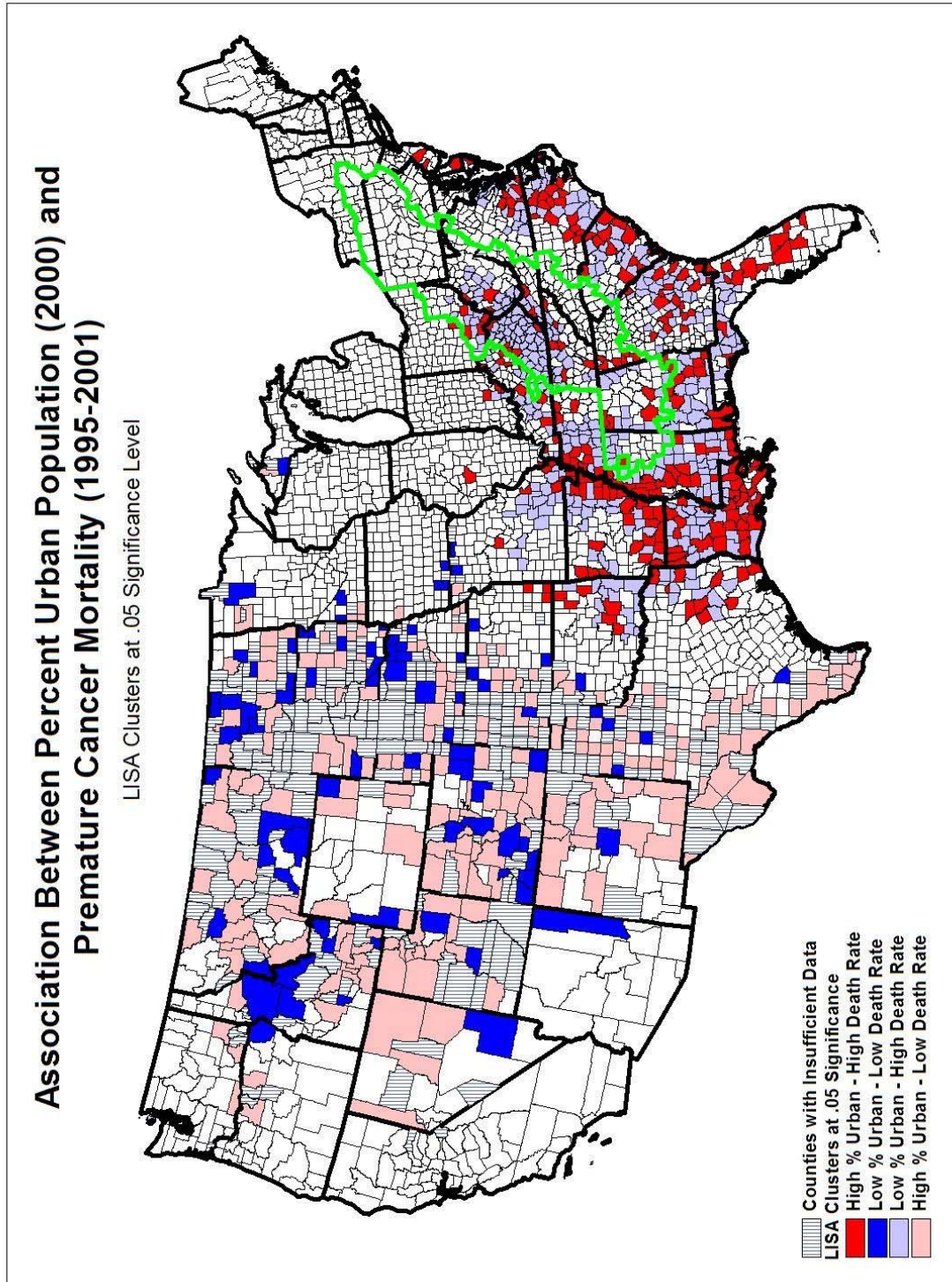


Figure 21. National Associations between Premature Cancer Mortality and Median Family Income.

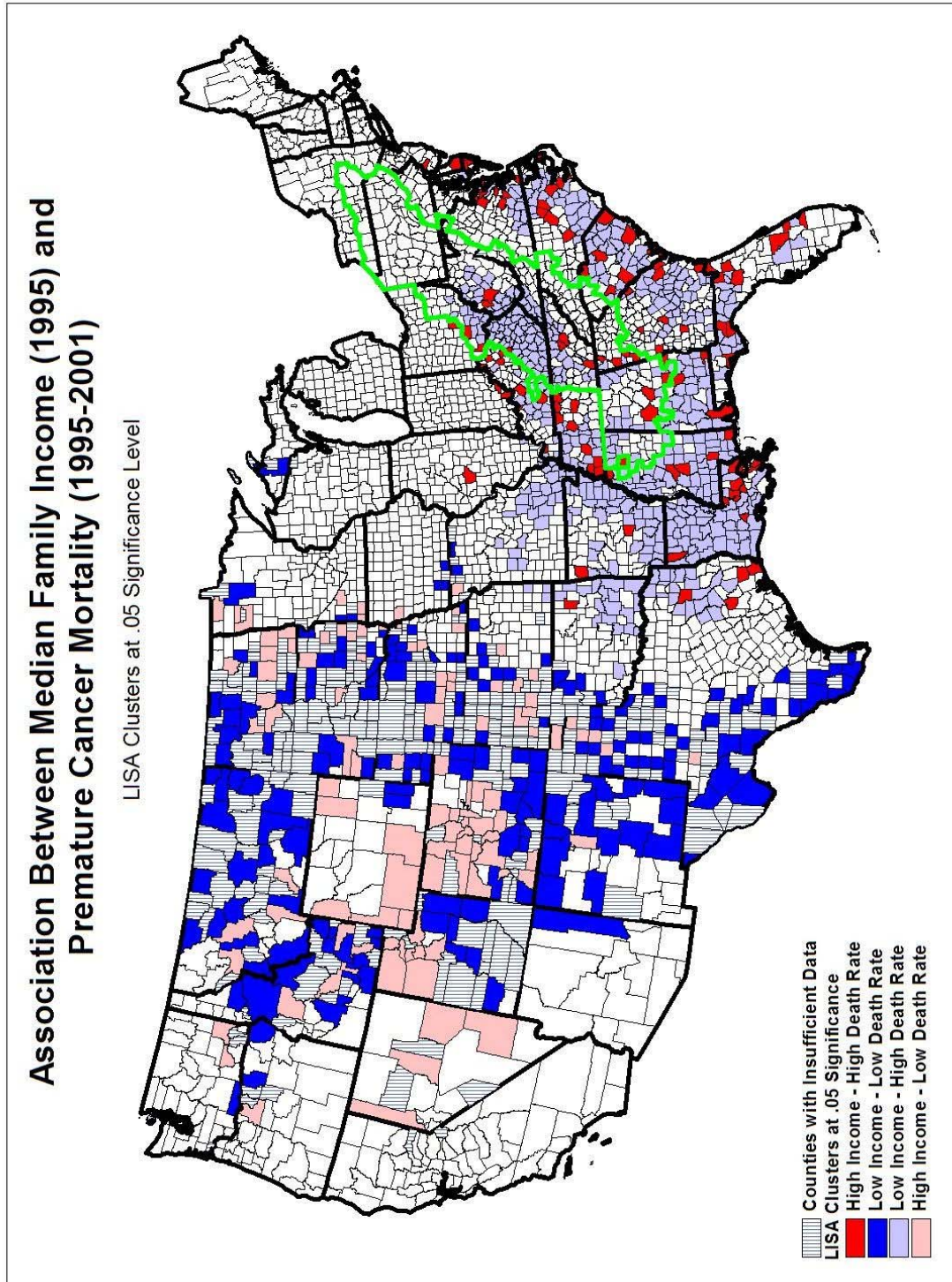


Figure 22. National Associations between Premature Cancer Mortality and the Poverty Rate.

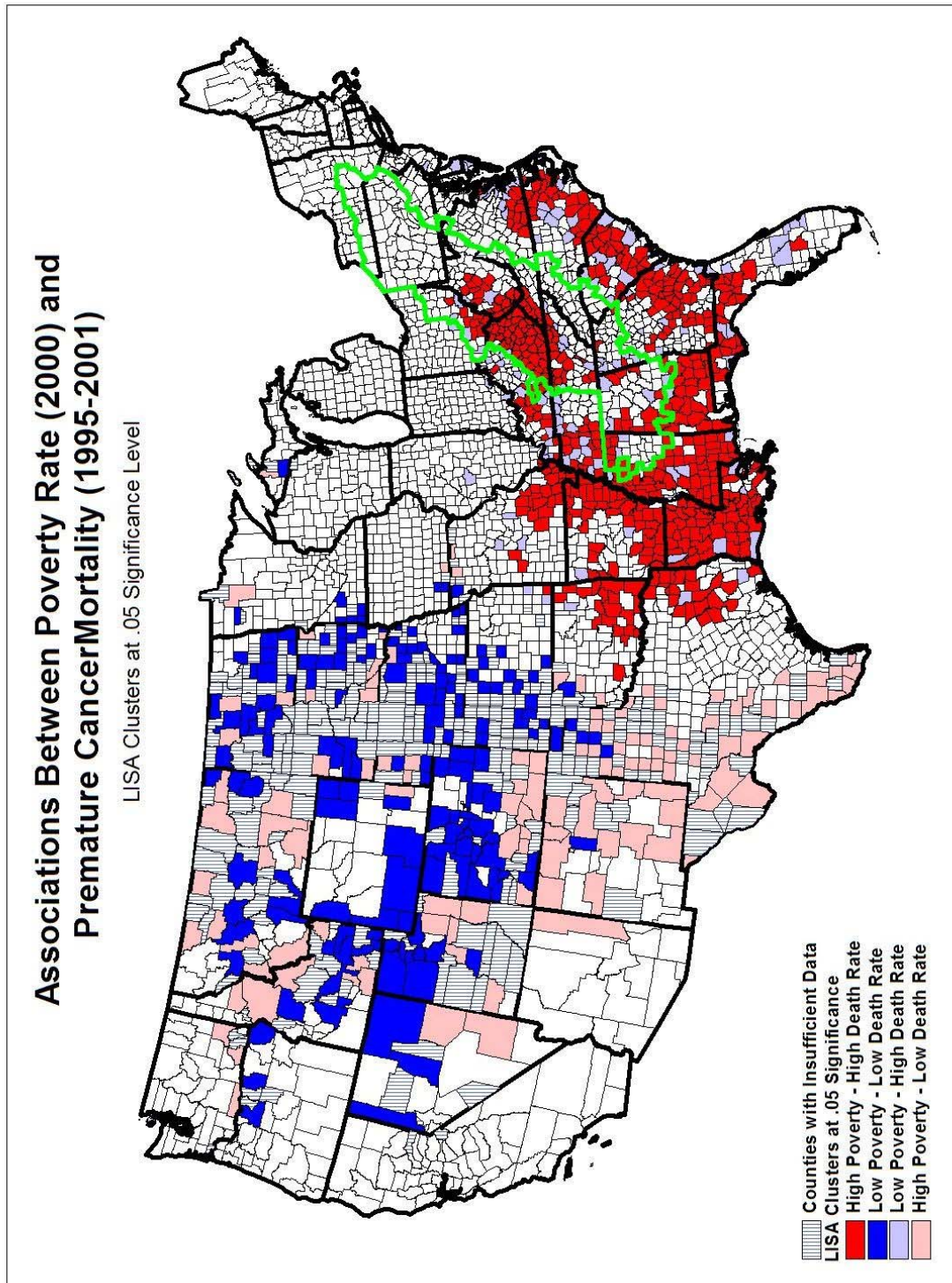


Figure 23. National Associations between Premature Cancer Mortality and the Unemployment Rate.

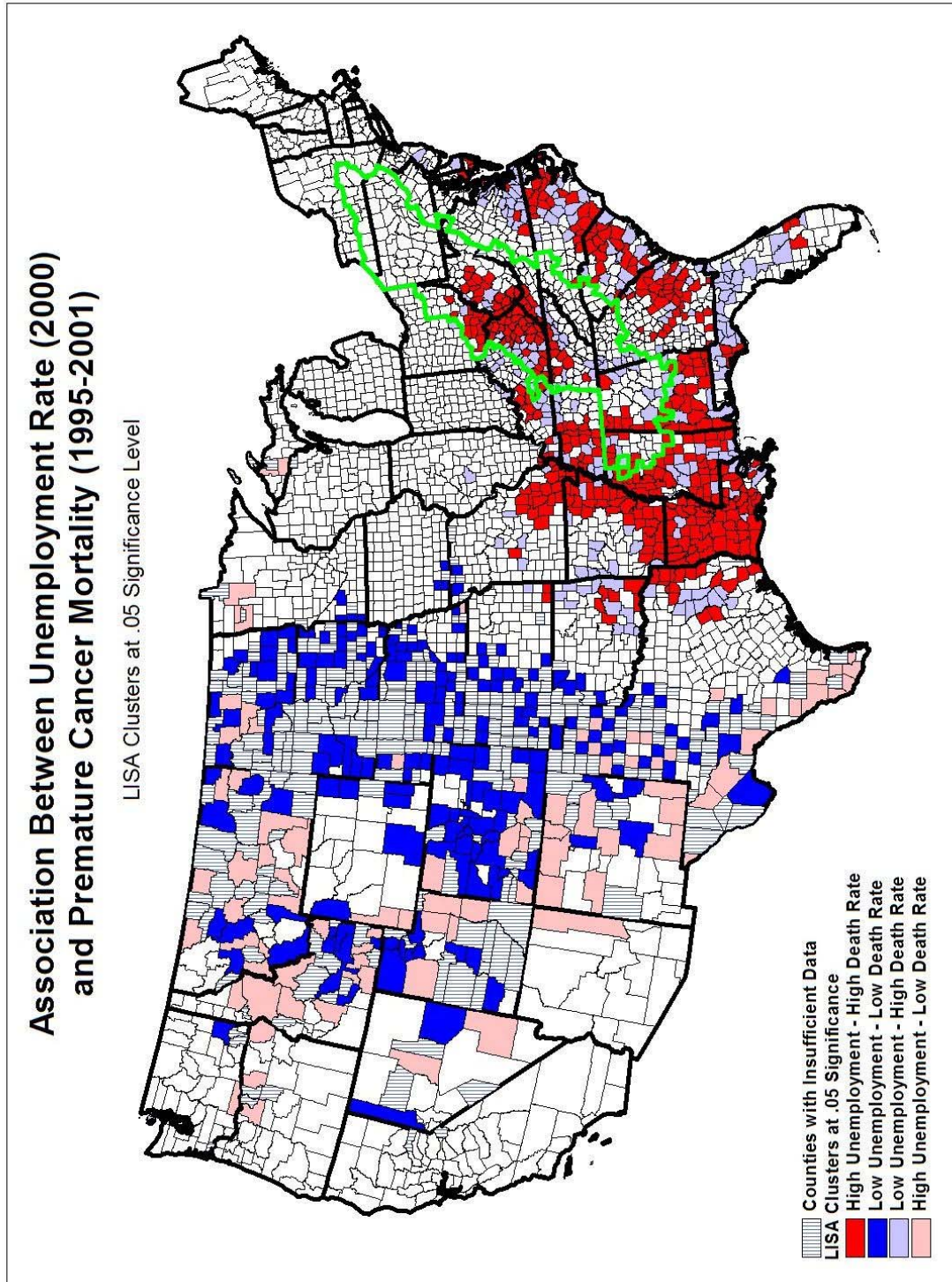
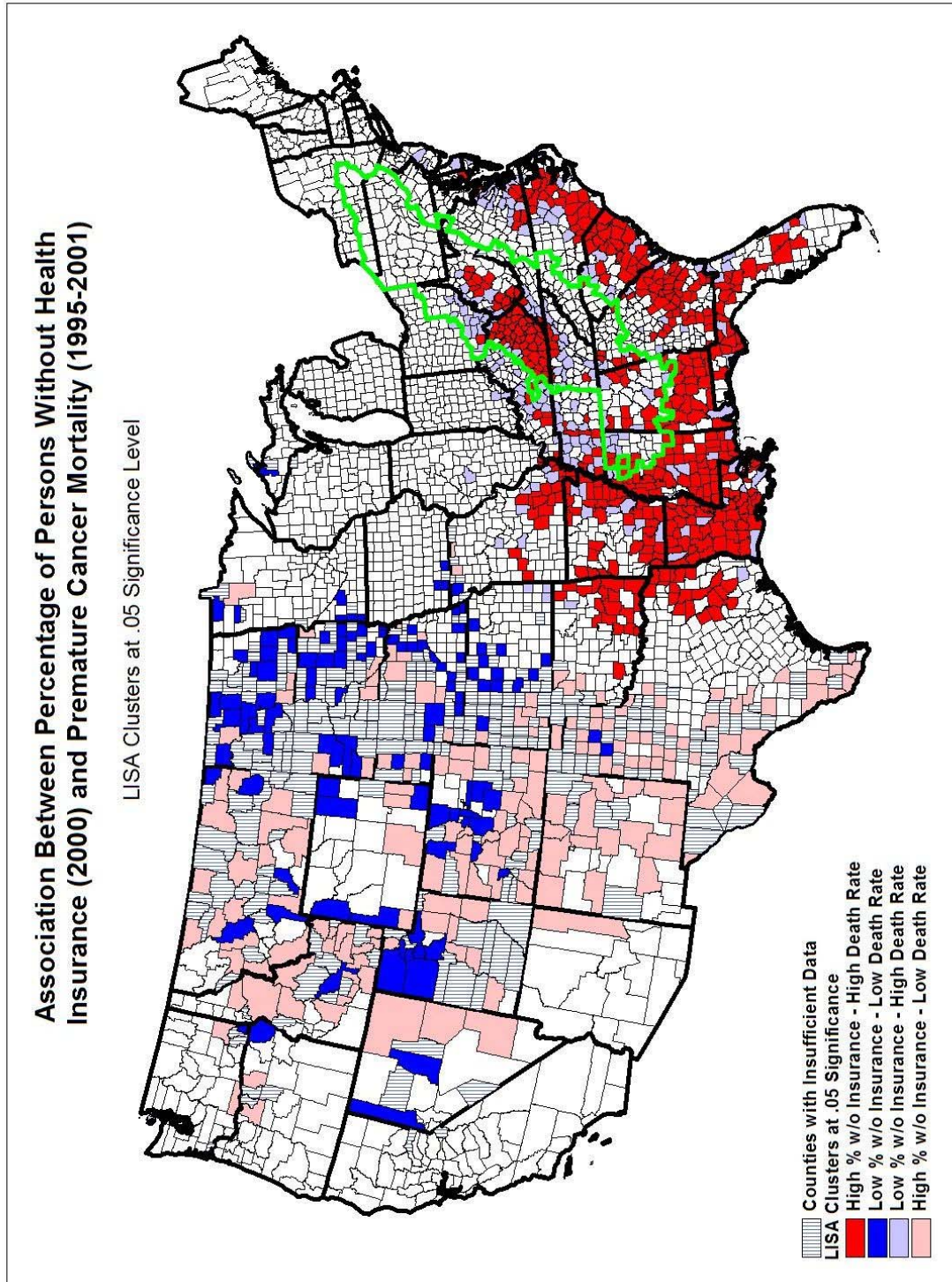


Figure 24. National Associations between Premature Cancer Mortality and the Percentage of Persons without Health Insurance.



III. A.4 Premature Stroke Mortality

National patterns of premature stroke mortality are consistent with the pattern of stroke mortality for all age-groups with a concentration of high rate counties in the Southeastern U.S. (see Section II, Figure 8). The persistent pattern of high stroke death rates in the Southeast has led to this region being dubbed the 'Stroke Belt'. Within Appalachia, high rates of premature mortality cluster primarily among counties in the Southern part of the region with a relatively small cluster of high rate counties in the Central Appalachian region. Areas with extremely high rates of premature stroke mortality, identified by 'high-outliers', are prominent in the Mississippi Delta region and among counties in states along the Atlantic coast.

The method used to derive associations between socioeconomic conditions and premature mortality is based on 'unsmoothed' rates (Section I) as opposed to the smoothed rates used in Section II. Nationally premature stroke mortality is rare and, although smoothing increases in the ability to generate rate estimates for a greater number of counties, estimates for unsmoothed rates are sparse. Therefore the ability to derive local associations between premature stroke mortality and socioeconomic conditions is primarily limited to regions of the country that experience a higher number of premature stroke deaths.

Statistically significant associations between socioeconomic indicators and premature stroke mortality are limited primarily to Southeastern states, including areas of the Mississippi Delta, the Carolinas, and in Southern Appalachia among counties in North central Alabama and Northwestern Georgia (see Figures 25-29).

The significant associations with high poverty, unemployment, and low incomes appear less consistently than were apparent of premature heart disease and cancer mortality in these regions. However there does appear to be a fairly consistent association between premature stroke mortality and the percentage of persons without health insurance and may reflect the importance of primary care and prevention to reduce the risk of stroke mortality in these areas.

Figure 25. National Associations between Premature Stroke Mortality and Percent Urban Population.

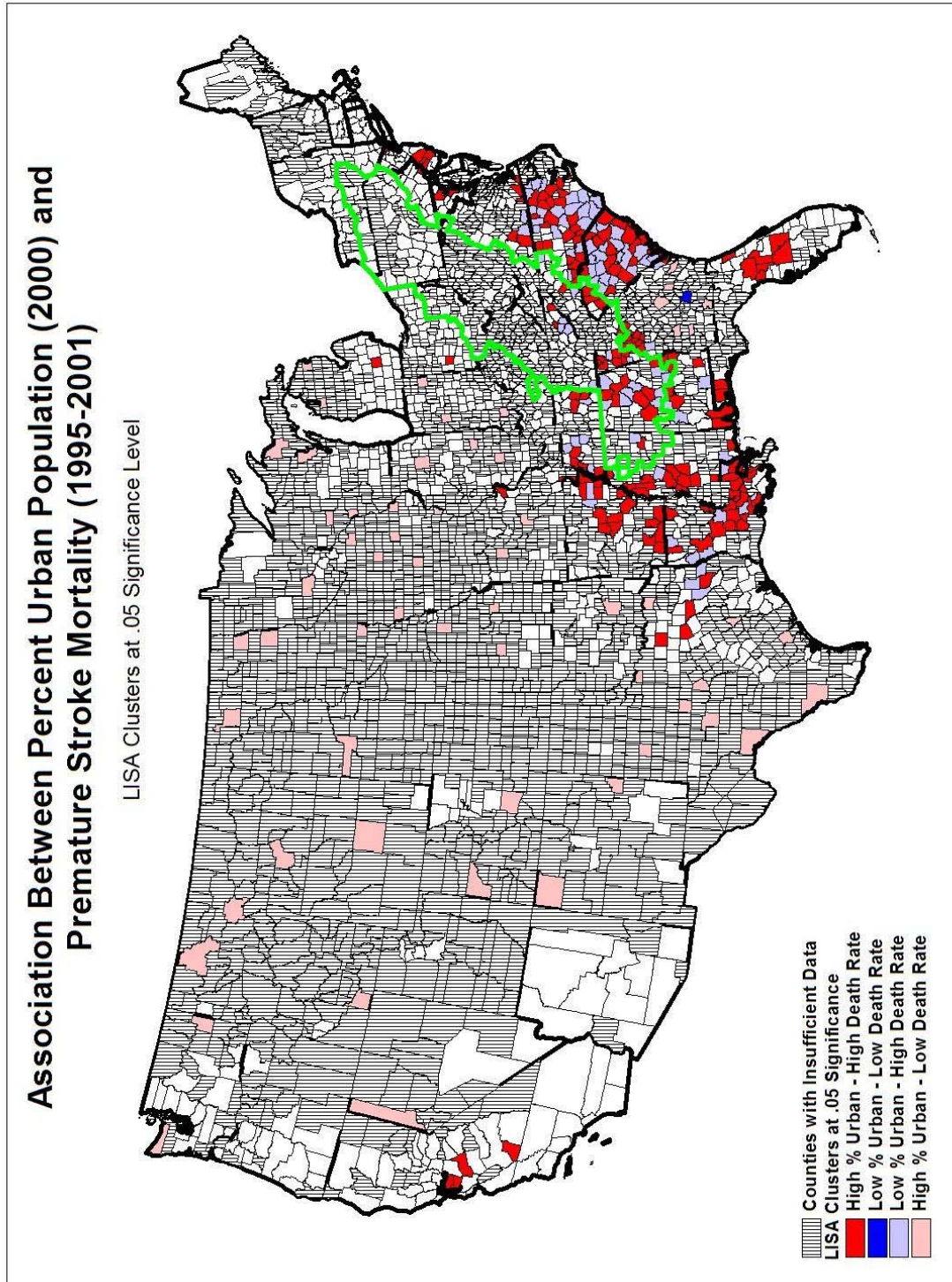


Figure 26. National Associations between Premature Stroke Mortality and Median Family Income.

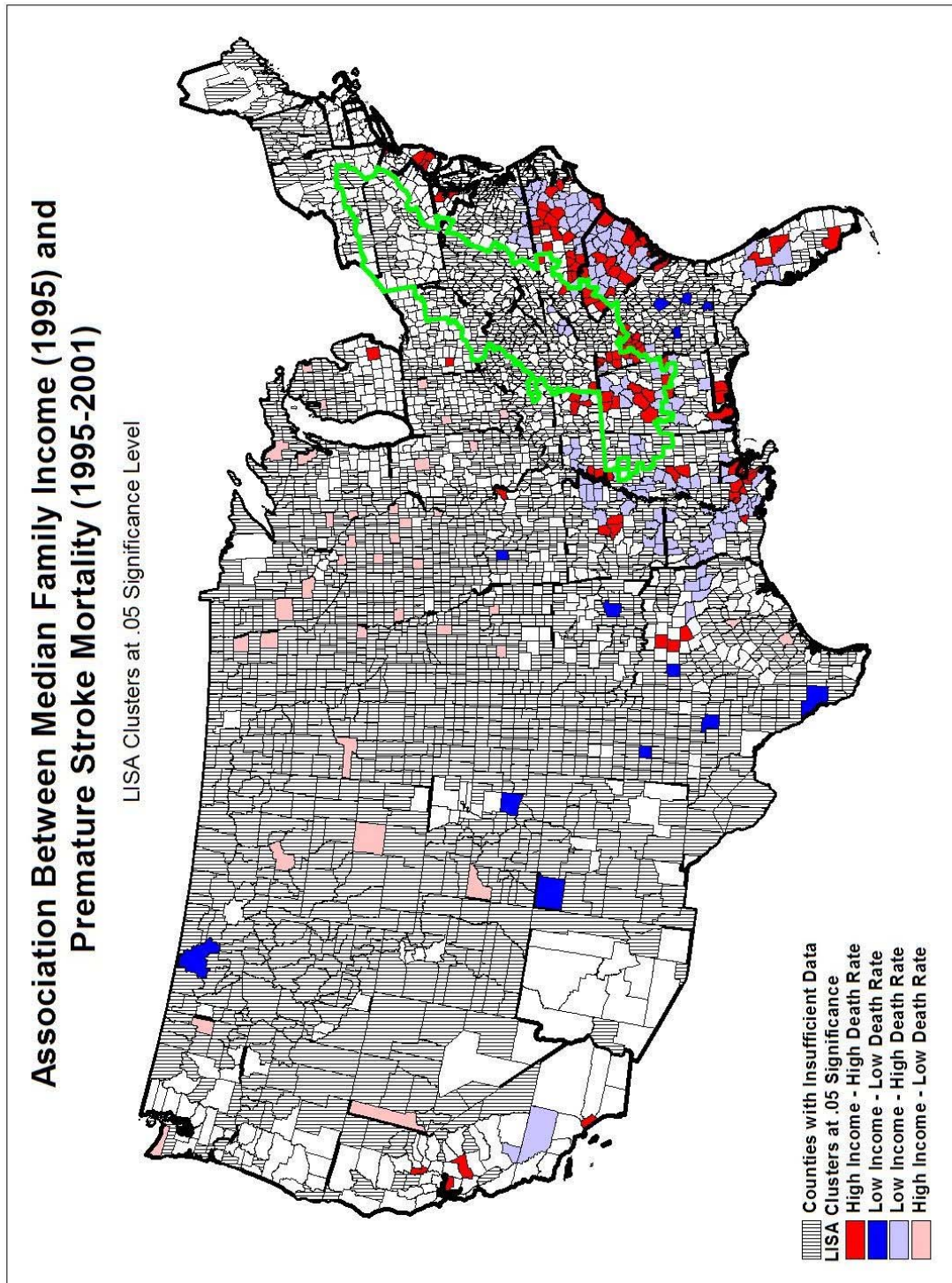


Figure 27. National Associations between Premature Stroke Mortality and the Poverty Rate.

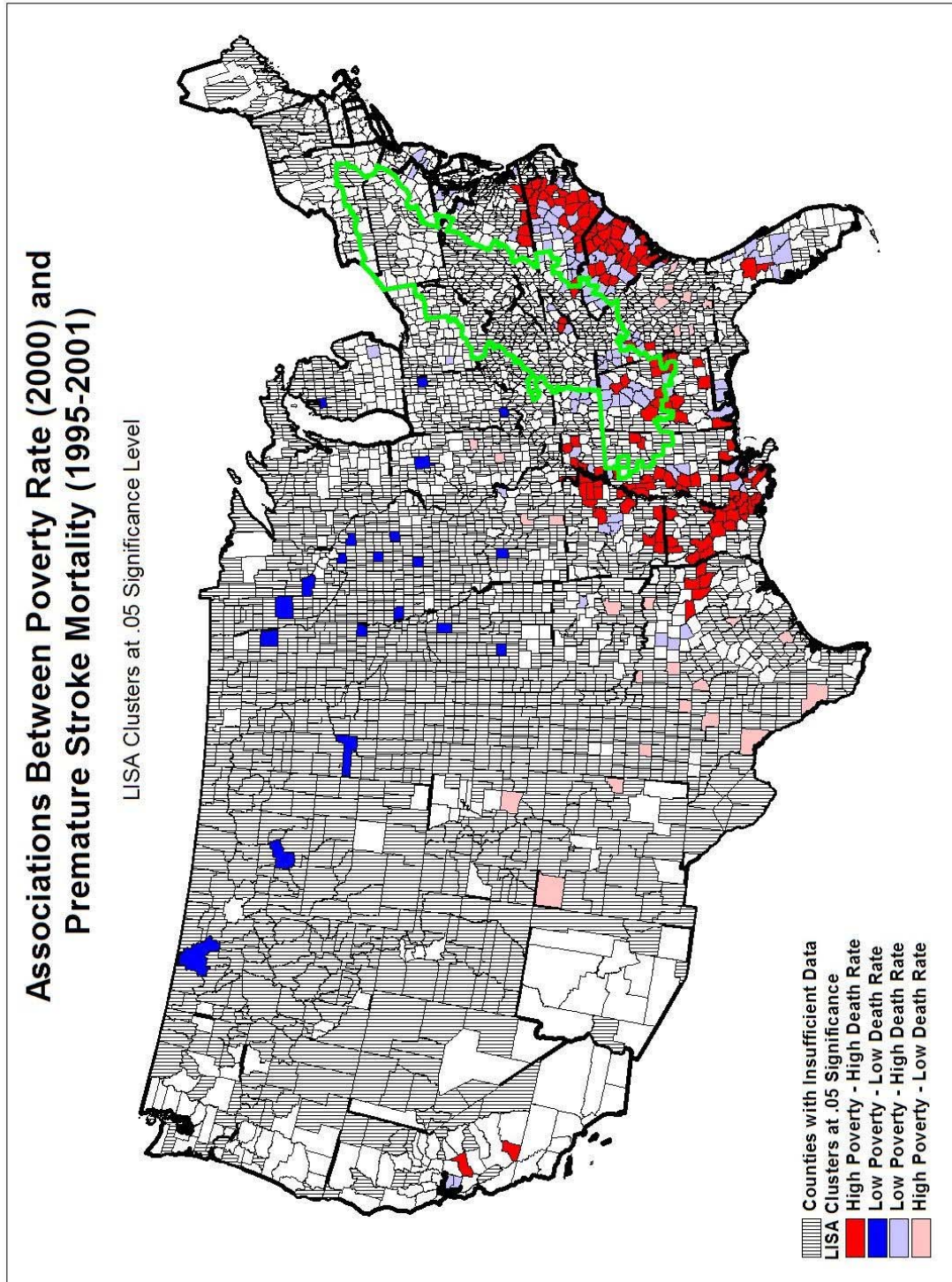


Figure 28. National Associations between Premature Stroke Mortality and the Unemployment Rate.

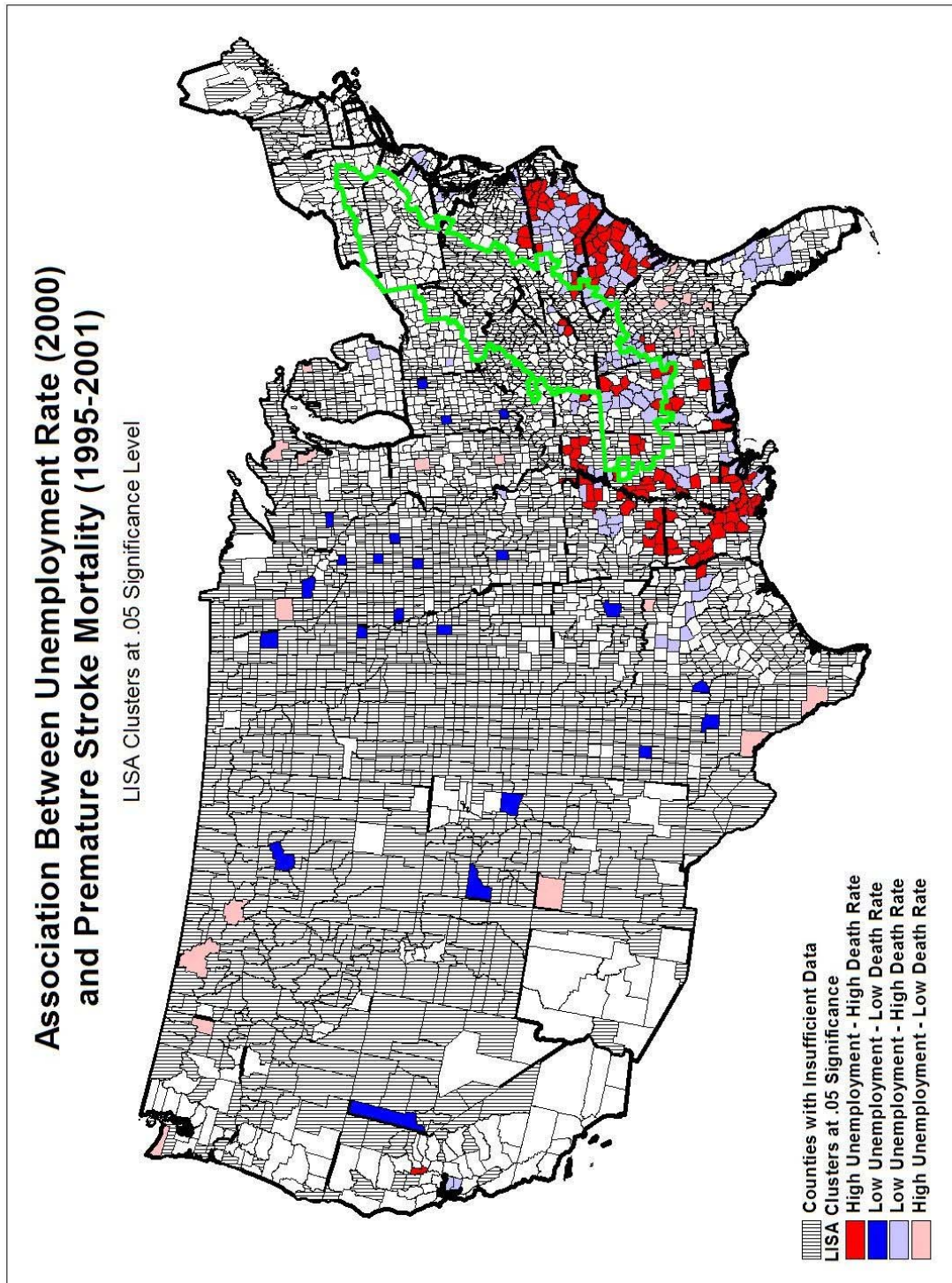
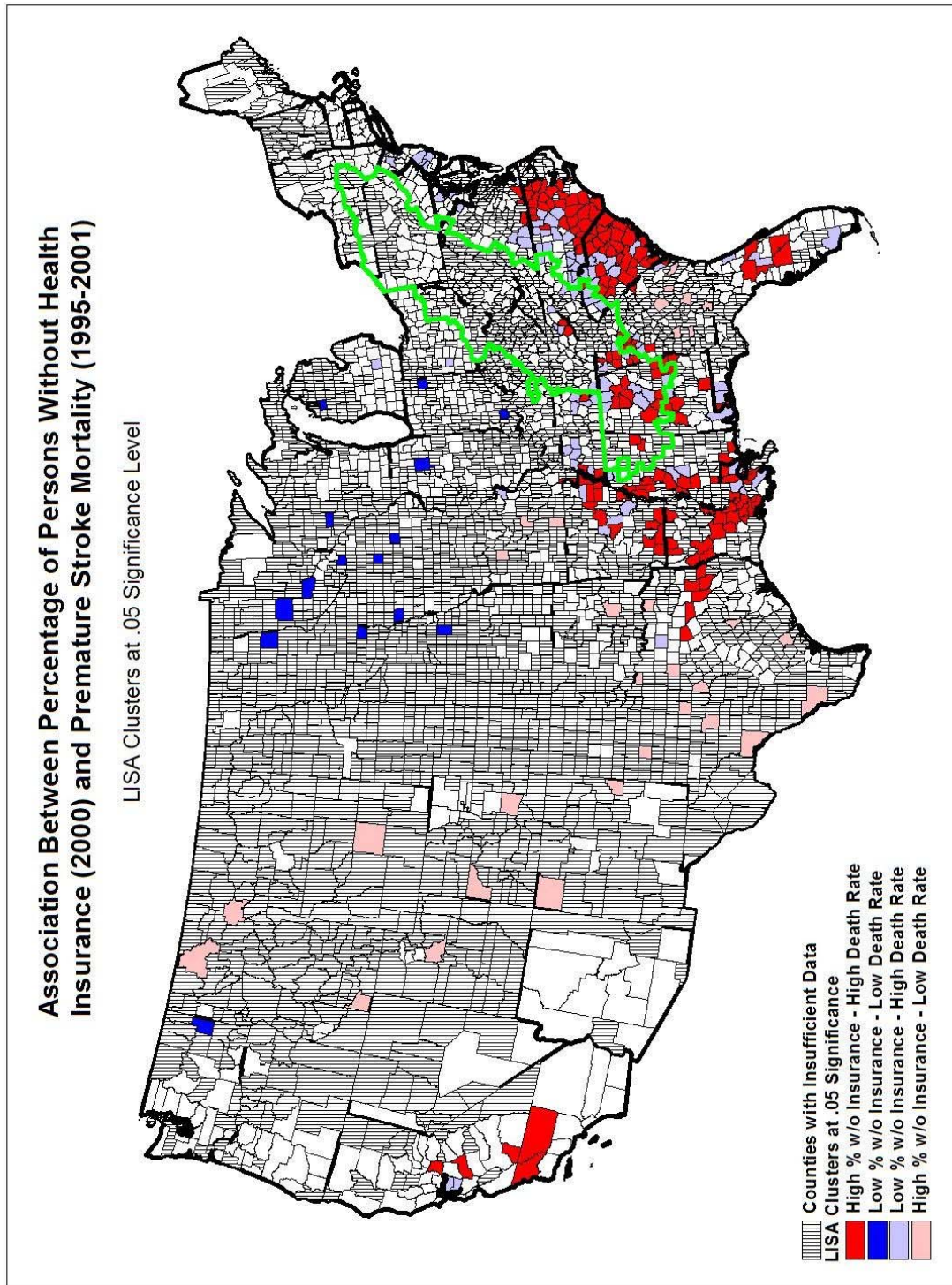


Figure 29. National Associations between Premature Stroke Mortality and the Percentage of Persons without Health Insurance.



III. B. Appalachian Associations

As outlined in Section I, the method used to derive associations between socioeconomic conditions and premature mortality is dependent on the global mean of the overall distribution. Therefore the analyses described in Section III.A represent associations relative to the national average of each socioeconomic indicator and the national average of the rate of premature mortality for each cause of death. This is useful in order to situate the socioeconomic and health outcome conditions of the Appalachian region within the broader national context.

For this section, a more constrained geographic area was used based on the official A.R.C. designated Appalachian region. This region includes, in addition to the 410 county Appalachian region, counties whose boundaries are roughly within 50 miles of the A.R.C. designated counties. This was done to ensure that Appalachian counties had a sufficient number of neighbors to include in the analysis. The constrained region permits an evaluation of the associations between socioeconomic condition and premature mortality compared to regional, as opposed to national, averages.

III.B.1 Premature All-cause Mortality

The regional pattern of premature all-cause mortality is represented by a strong north-south gradient with high rates in the Central and Southern counties of the region and low rates in the Northern counties (see Section II, Figure 3). Appalachian counties are primarily represented by the mid-range values of the national distribution of rates of premature all-cause mortality, ranging from the 2nd through 4th quartiles.

Statistically significant associations between socioeconomic conditions and premature all-cause mortality are found consistently in the northern and extreme southern counties in the region (see Figures 26-30). However, there is a clear demarcation between these northern and southern counties with respect to two key indicators of socioeconomic condition; the poverty rate and the percentage of persons without health insurance. The majority of the northern counties have low rates of poverty and low percentages of persons without health insurance when compared to the regional average. Conversely, the counties in the south have generally high rates of poverty and high percentages of persons without health insurance. The majority of counties in both areas have relatively low income levels and appear to be comparable with regards to the percent urban population and the proportion of counties in each area with both high and low rates of unemployment.

Figure 26. Associations between Premature All-cause Mortality and Percent Urban Population in the Appalachian Region.

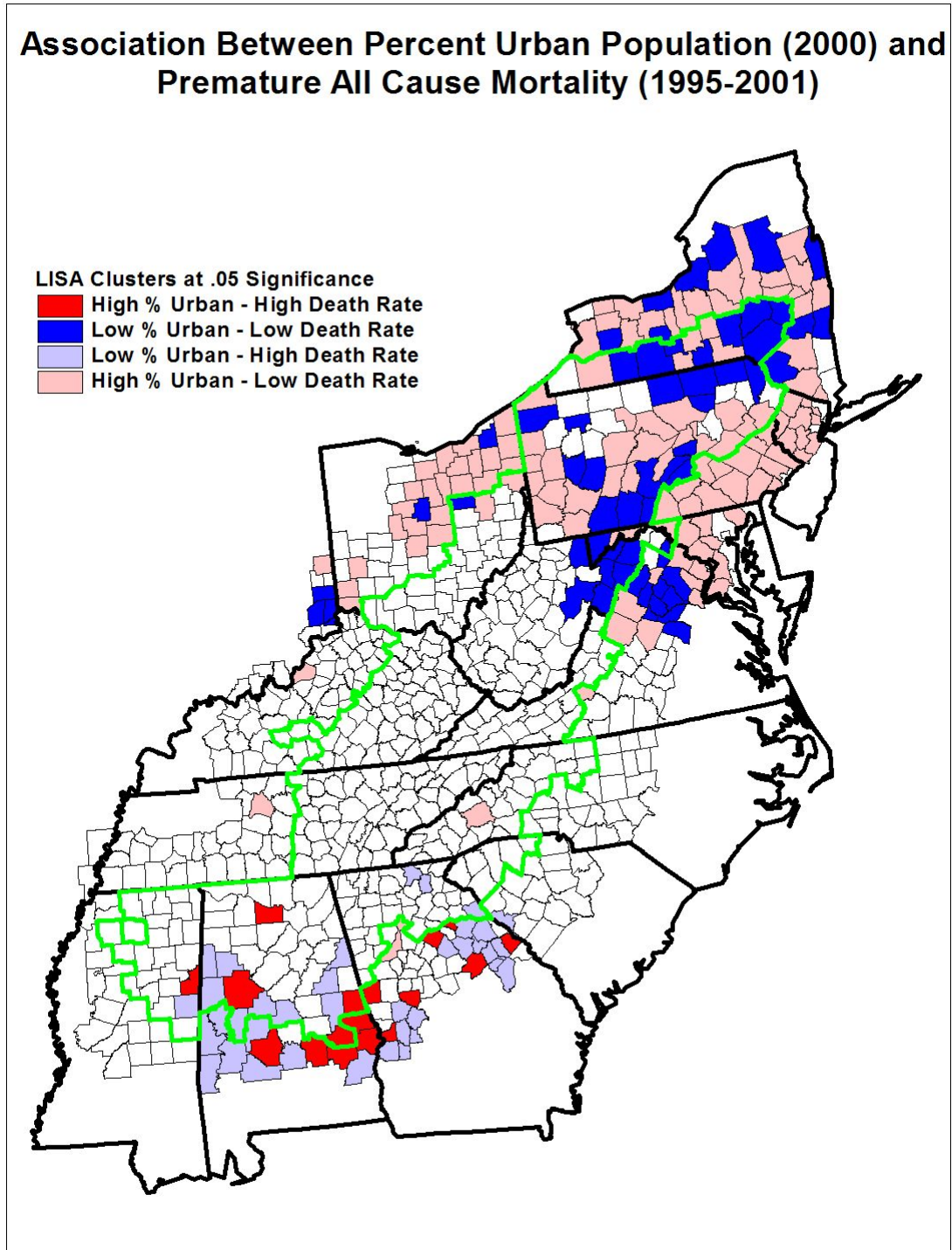


Figure 27. Associations between Premature All-cause Mortality and Median Family Income in the Appalachian Region.

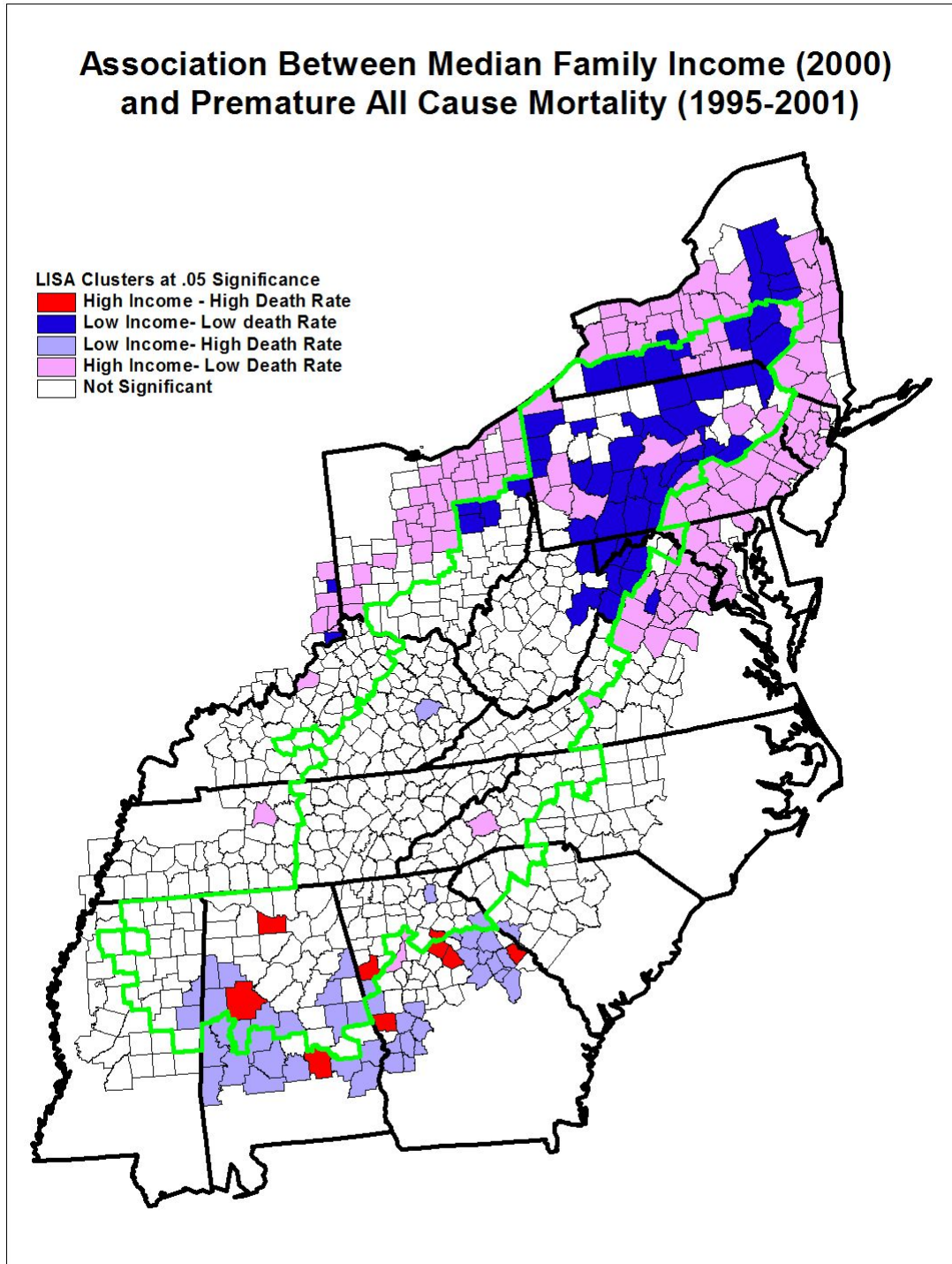


Figure 28. Associations between Premature All-cause Mortality and the Poverty Rate in the Appalachian Region.

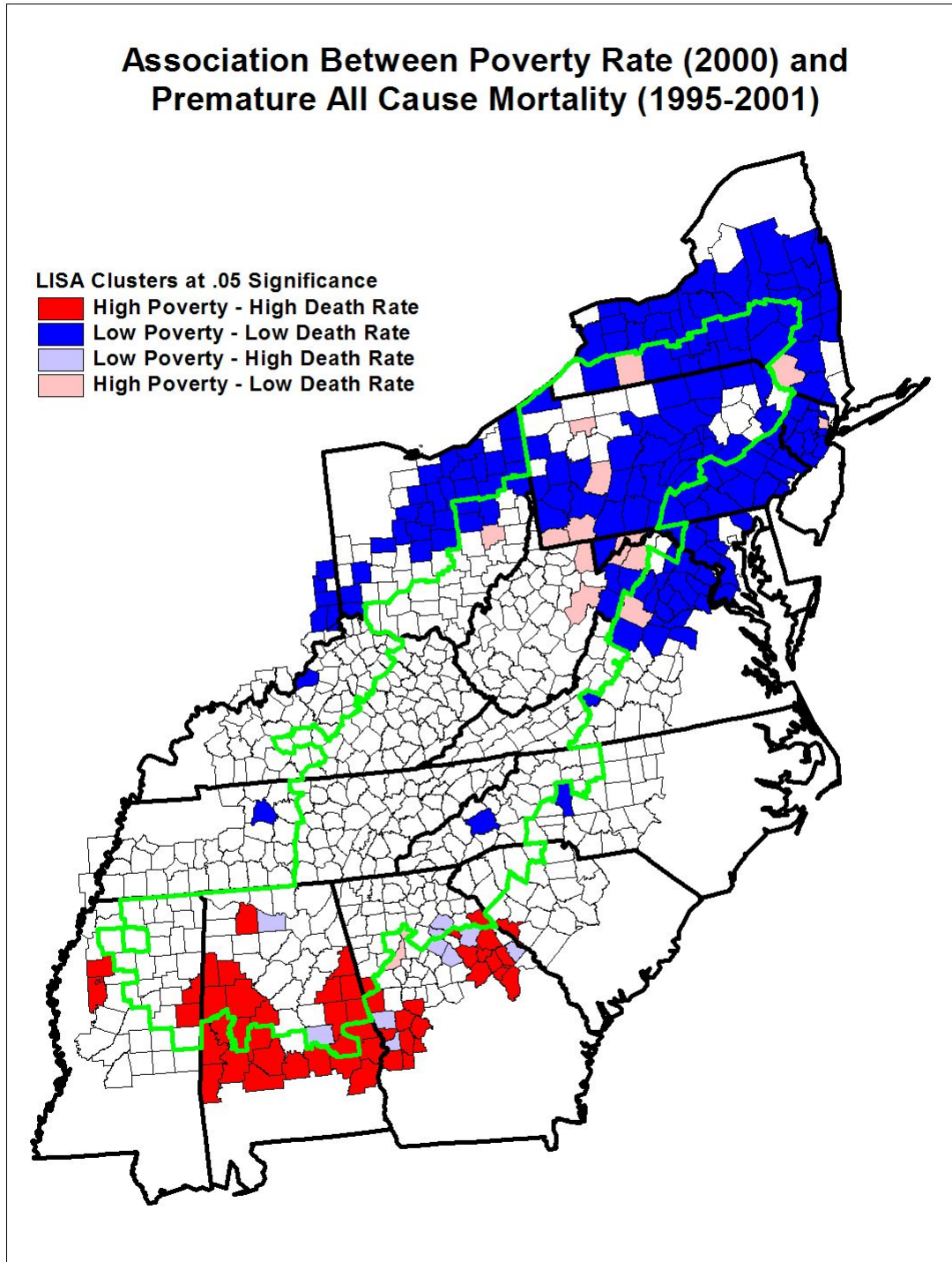


Figure 29. Associations between Premature All-cause Mortality and the Unemployment Rate in the Appalachian Region.

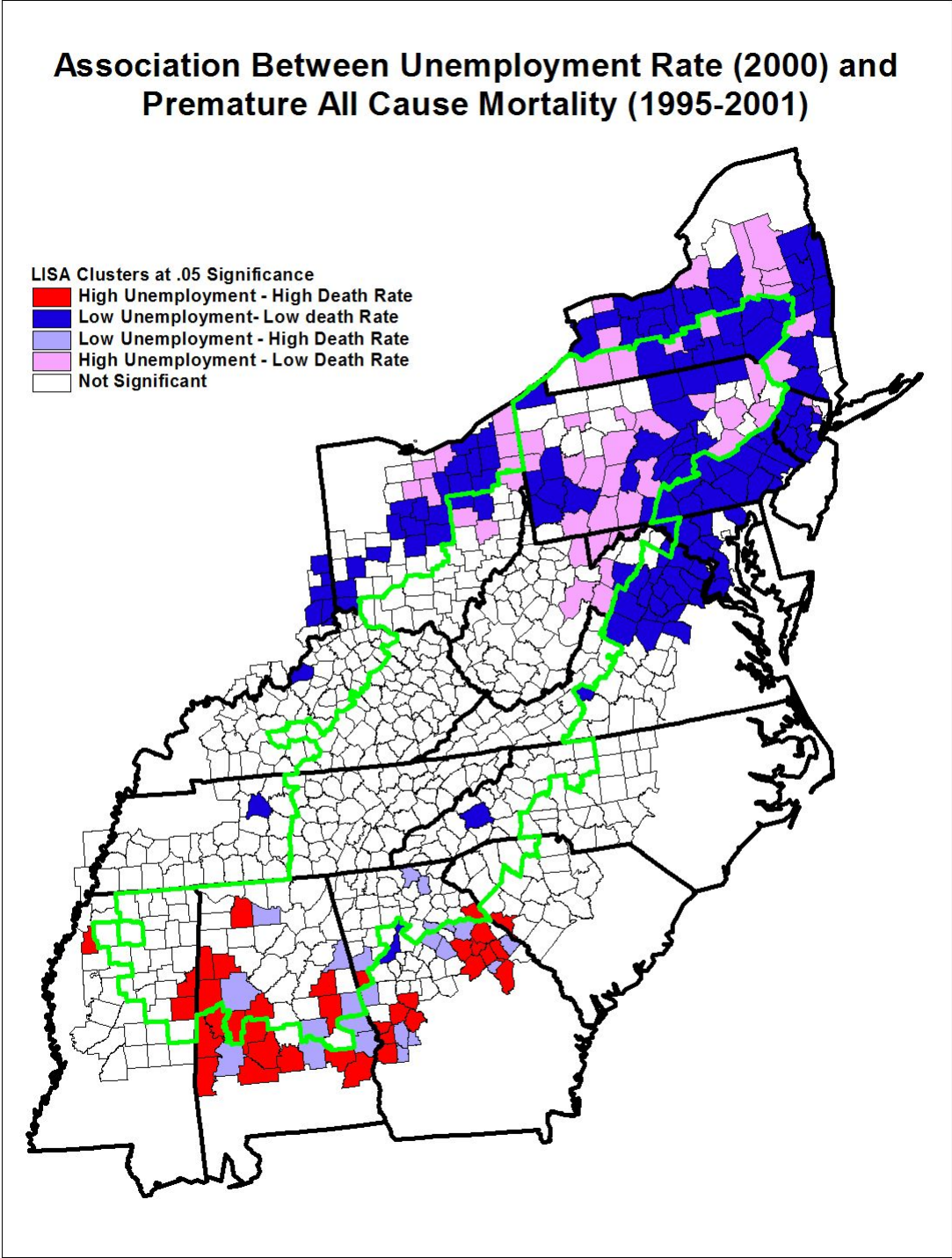
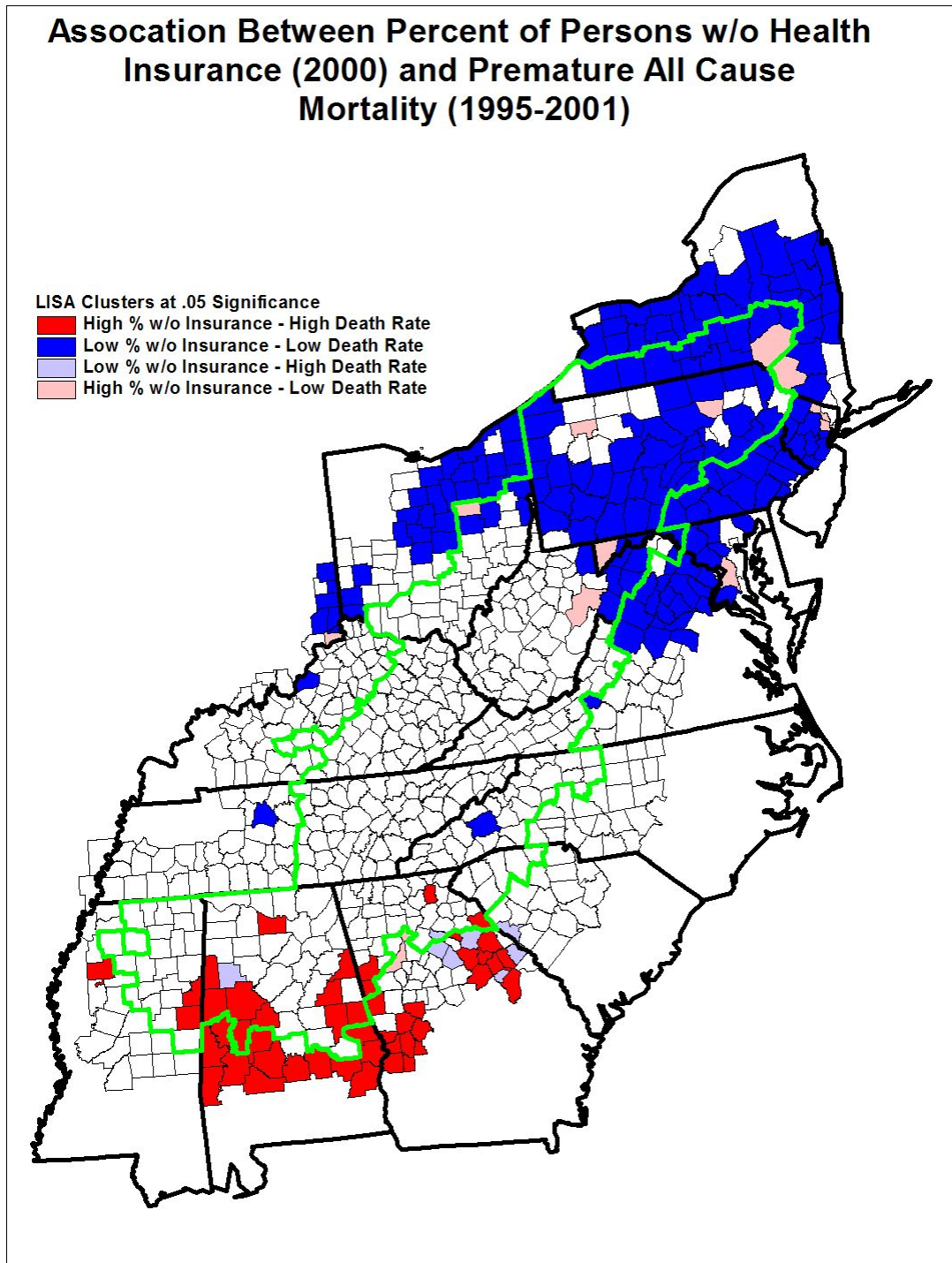


Figure 30. Associations between Premature All-cause Mortality and the Percentage of Persons without Health Insurance in the Appalachian Region.



III.B.2 Premature Heart Disease Mortality

The regional north-south gradient observed for premature all-cause mortality is less pronounced for premature heart disease mortality. Relatively low rates of mortality are still evident in the Northern counties however, the counties in the Central part of the region in Eastern Kentucky, Southern Ohio and West Virginia, are more predominantly represented among high rates. High rate counties are also evident in Eastern Mississippi and Alabama. Appalachian counties are primarily represented by the mid-to-upper range values of the national distribution of rates of premature heart disease mortality, ranging primarily from the 2nd through 4th quartiles.

Statistically significant associations between socioeconomic conditions and premature heart disease mortality are found consistently in three distinct parts of the region; the extreme Northern counties in Pennsylvania and New York, Central counties in Eastern Kentucky, Southern Ohio and West Virginia, and Southern counties in Mississippi and Alabama. (see Figures 31-35). In this case, there appear to be three key indicators of socioeconomic condition that differentiate the Central and Southern counties from those in the Northern part of the region; the poverty rate, the unemployment rate, and the percentage of persons without health insurance. The majority of the northern counties have low rates of poverty, unemployment, and low percentages of persons without health insurance when compared to the regional average. Conversely, the counties in the Central and Southern parts of the region have generally high rates of poverty and unemployment, and high percentages of persons without health insurance. The regions are generally comparable on both the percent urban population and income levels.

Figure 31. Associations between Premature Heart Disease Mortality and Percent Urban Population in the Appalachian Region.

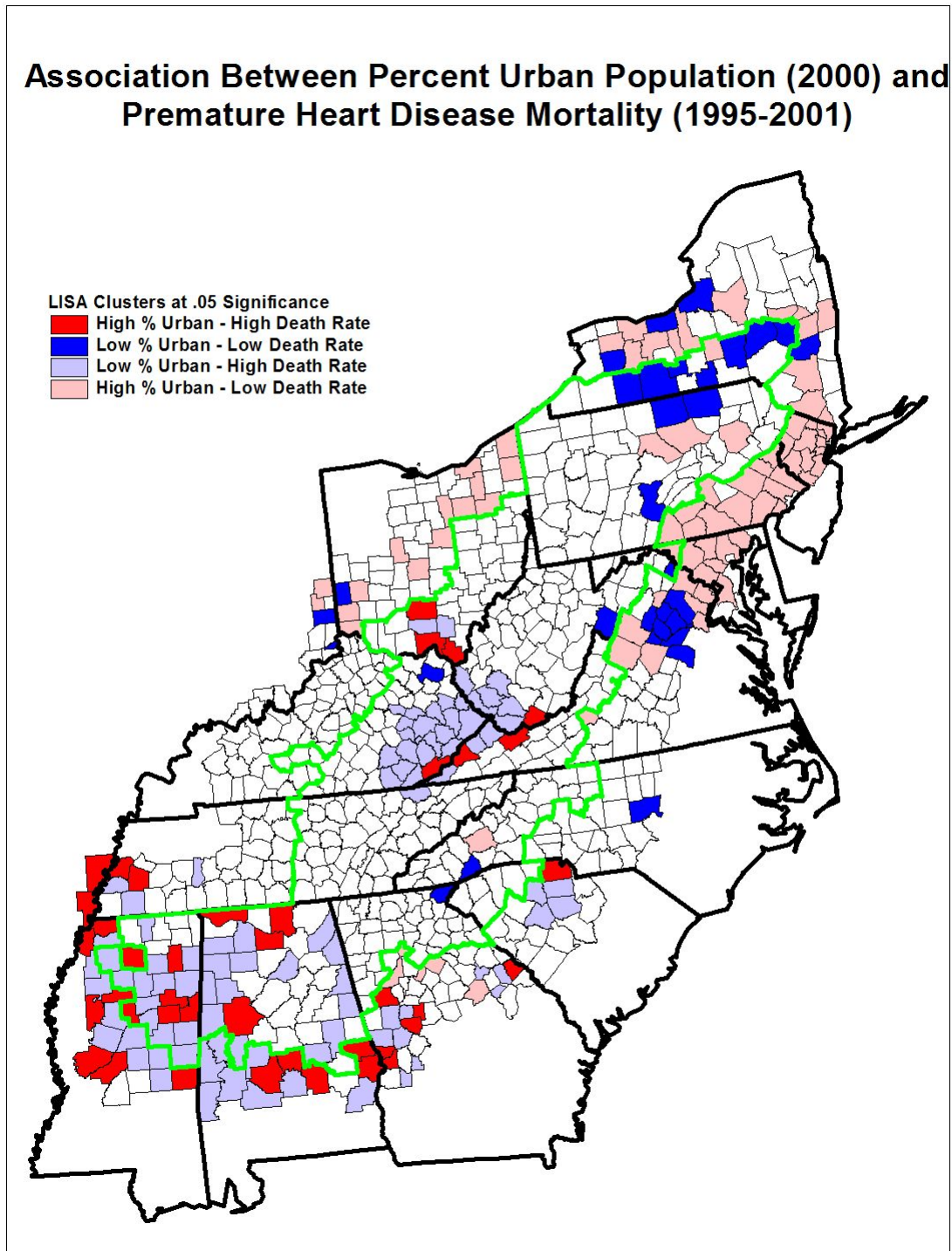


Figure 32. Associations between Premature Heart Disease Mortality and Median Family Income in the Appalachian Region.

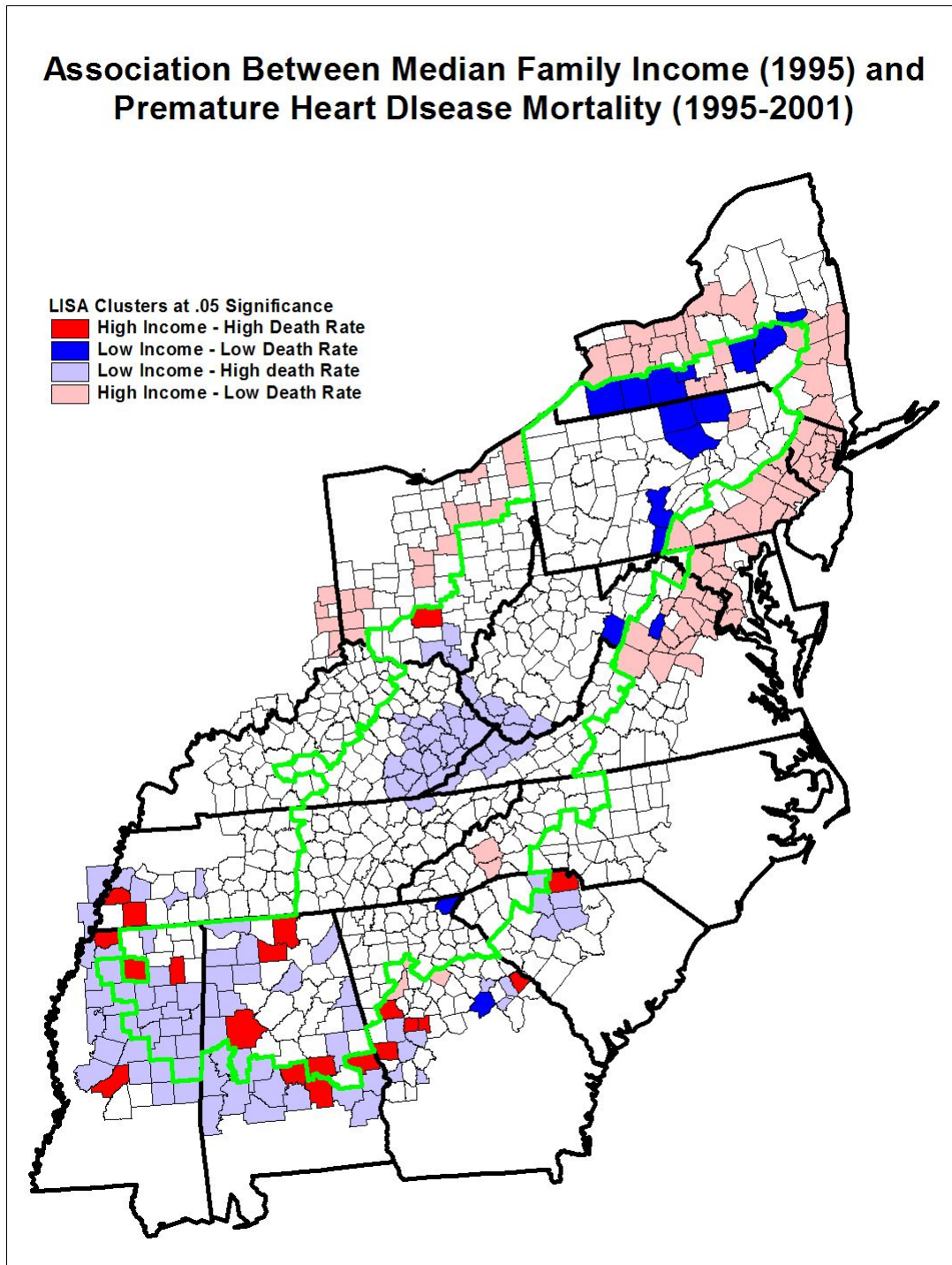


Figure 33. Associations between Premature Heart Disease Mortality and the Poverty Rate in the Appalachian Region.

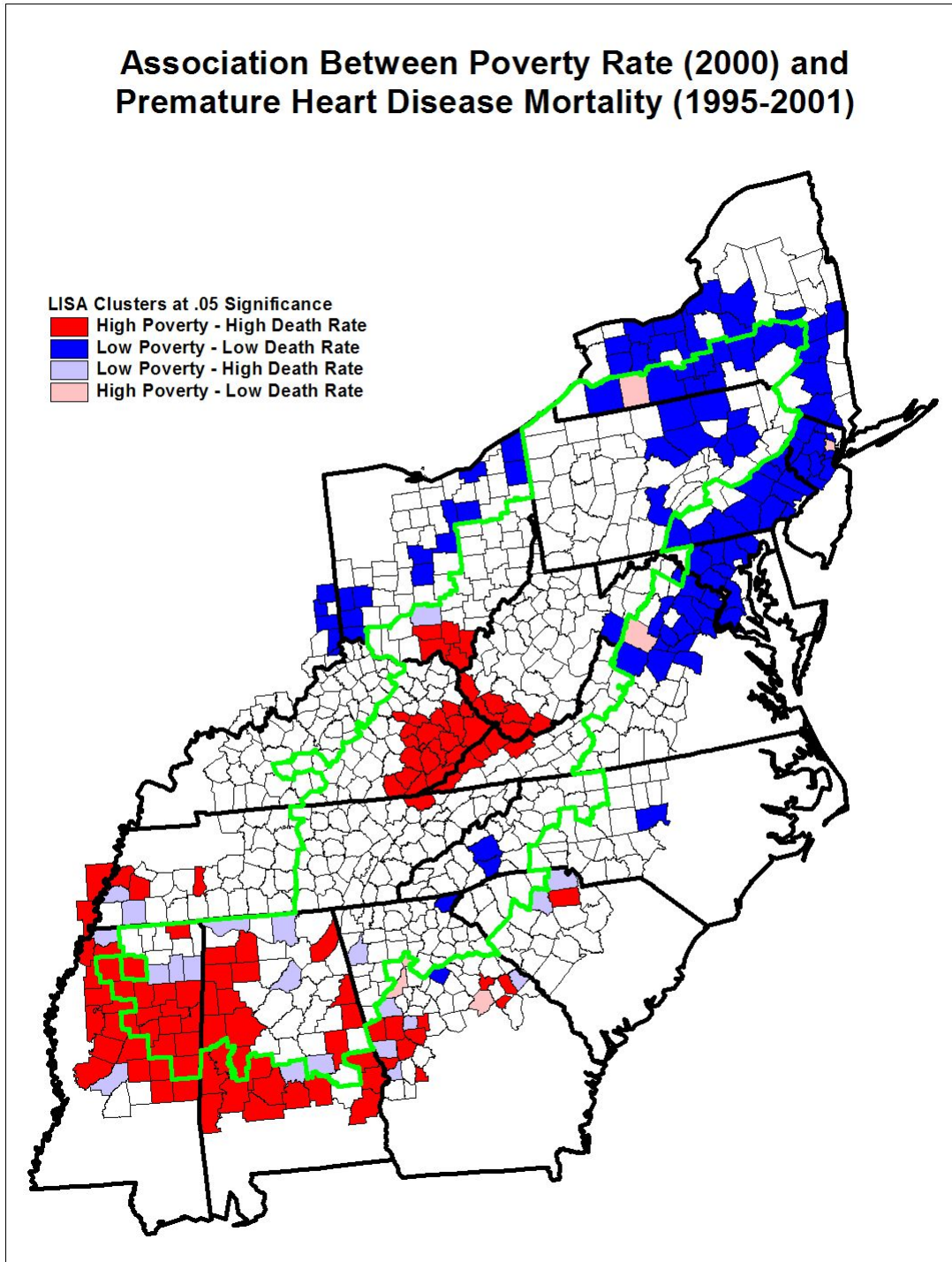


Figure 34. Associations between Premature Heart Disease Mortality and the Unemployment Rate in the Appalachian Region.

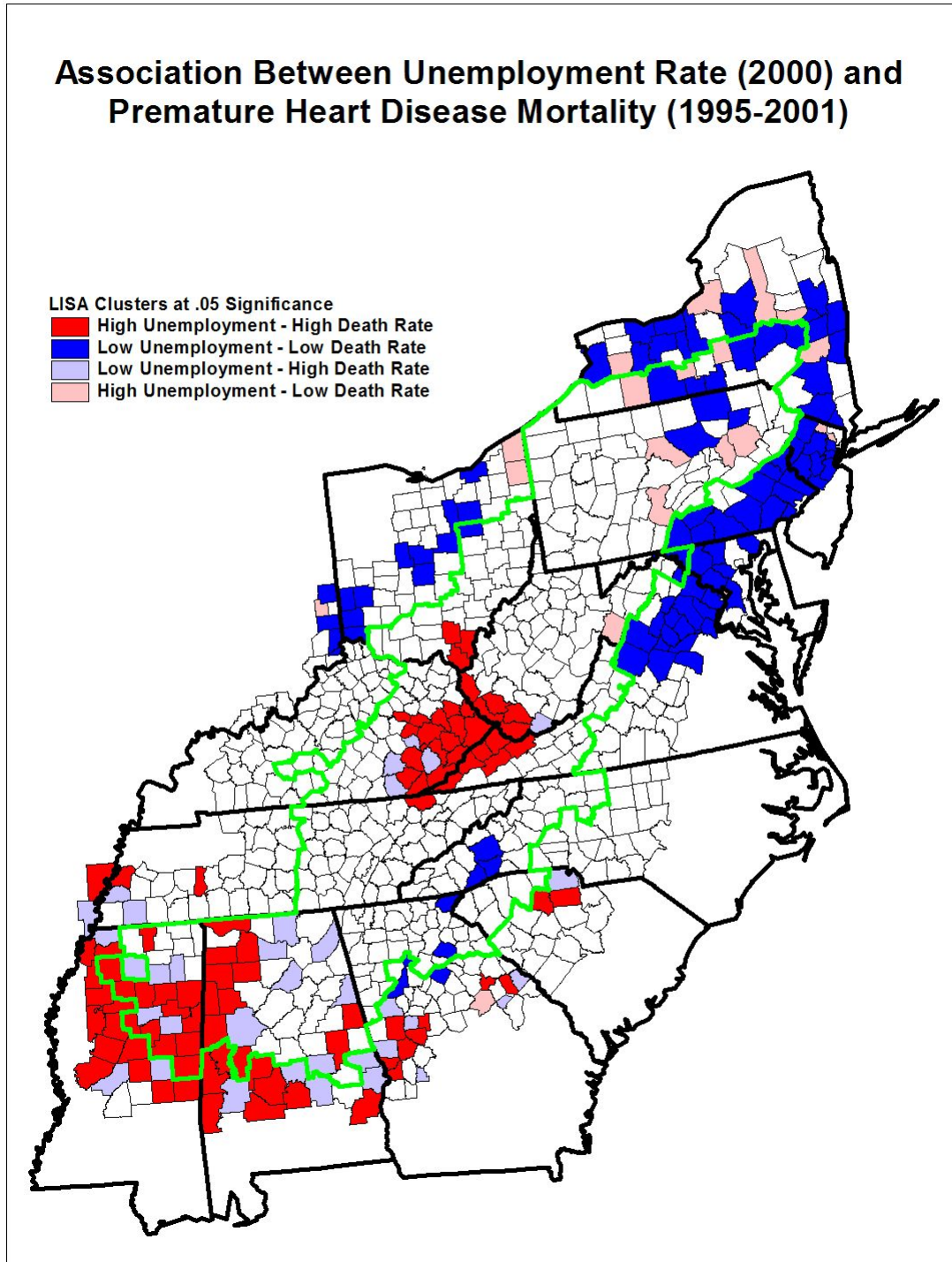
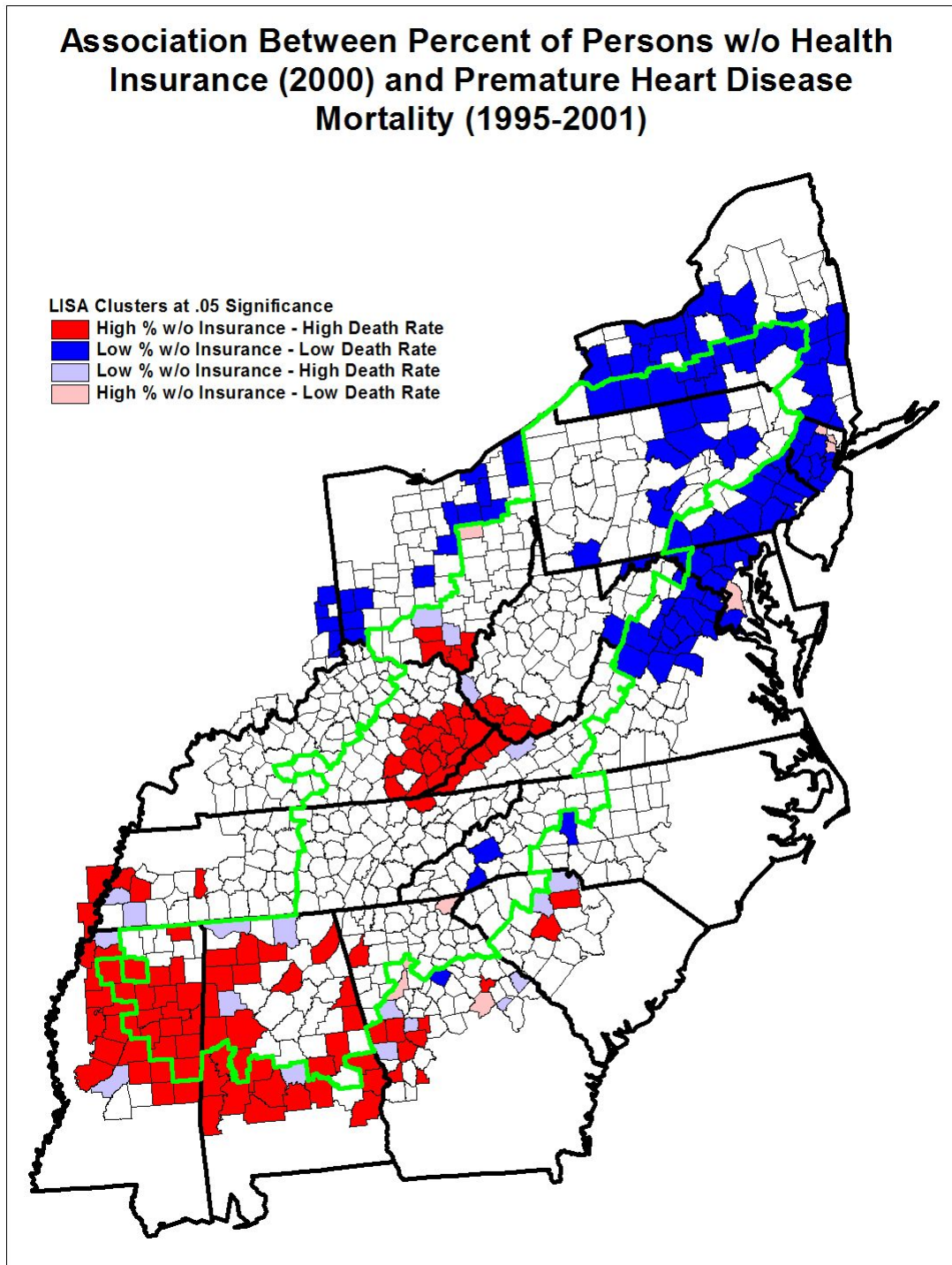


Figure 35. Associations between Premature Heart Disease Mortality and the Percentage of Persons without Health Insurance in the Appalachian Region.



III.B.3 Premature Cancer Mortality

The regional pattern of premature cancer mortality is dominated by high rates in the Central part of the region among counties in Eastern Kentucky, Southern Ohio and West Virginia. Although Appalachia is predominant in the national distribution of premature cancer death rates, and is represented primarily among the 2nd through 4th quartiles, relatively low rates of mortality are still evident among the Northern-most counties.

Statistically significant associations between socioeconomic conditions and premature cancer mortality are found consistently among Central counties in Eastern Kentucky, Southern Ohio and West Virginia, in a loose cluster along the North-central Appalachian border in West Virginia and Pennsylvania and sporadically and Southern counties (see Figures 36-40). Counties in the Central part of the region are represented fairly consistently among all five indicators of socioeconomic condition. These counties are represented by low percentages of urban population, low income levels, high poverty rates, high unemployment, and high percentages of persons without health insurance and are also consistently associated with high rates of premature cancer mortality. Among counties in the cluster along the North-Central Appalachian border, which are consistently associated with low rates of premature cancer mortality, they are generally comparable on four of the socioeconomic measures but appear to have a lower percentage of persons without health insurance.

Figure 36. Associations between Premature Cancer Mortality and Percent Urban Population in the Appalachian Region.

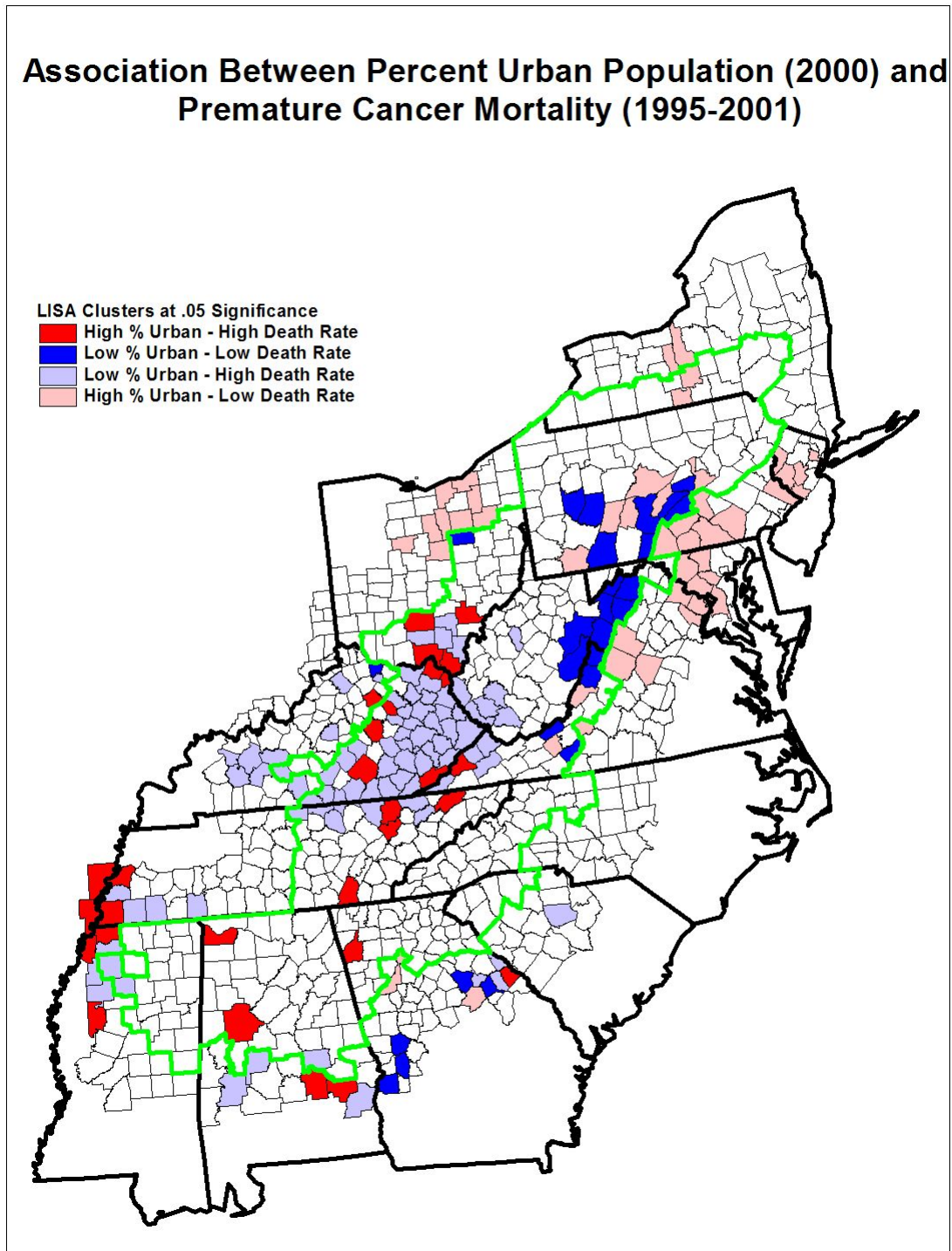


Figure 37. Associations between Premature Cancer Mortality and Median Family Income in the Appalachian Region.

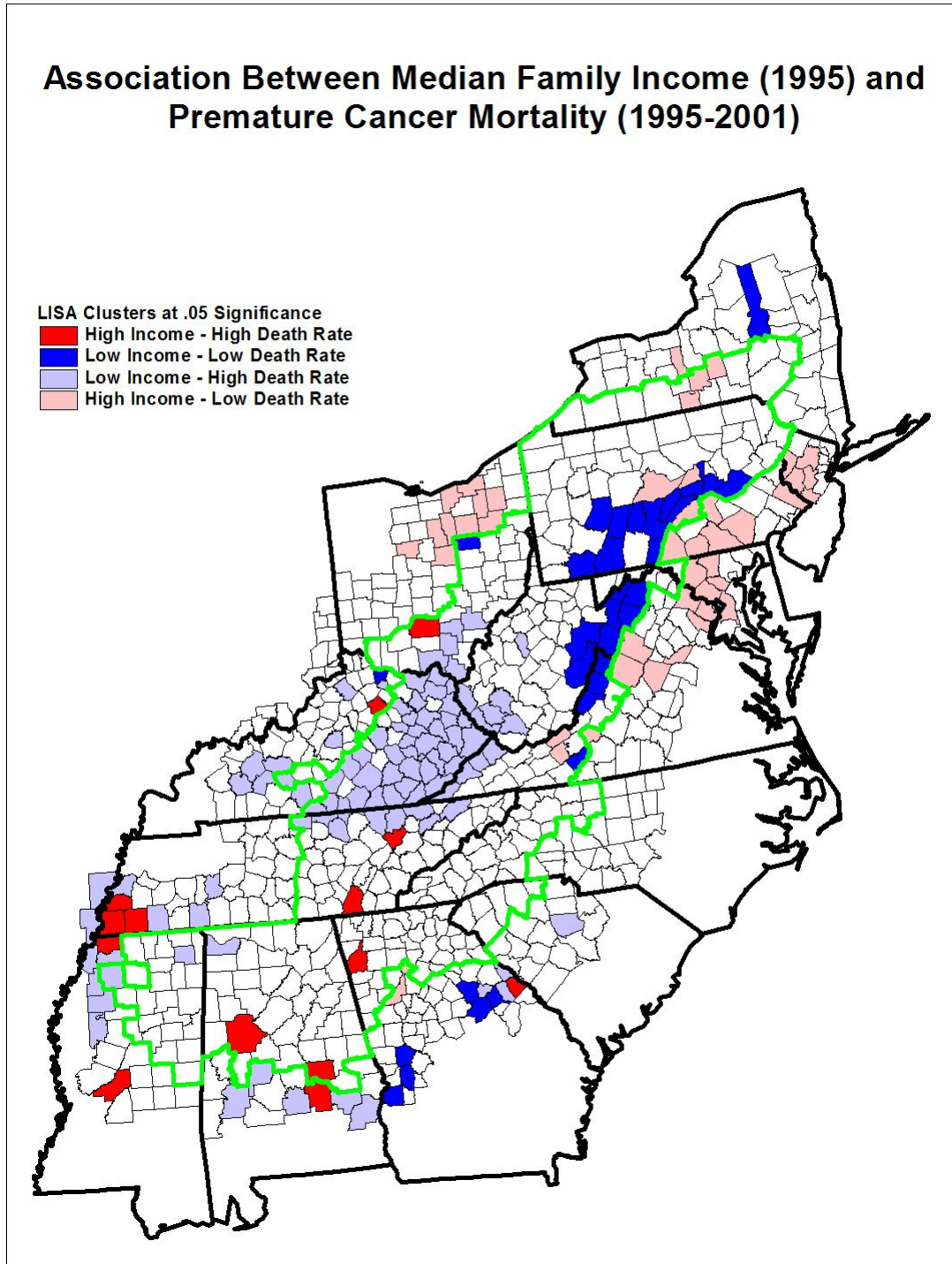


Figure 38. Associations between Premature Cancer Mortality and the Poverty Rate in the Appalachian Region.

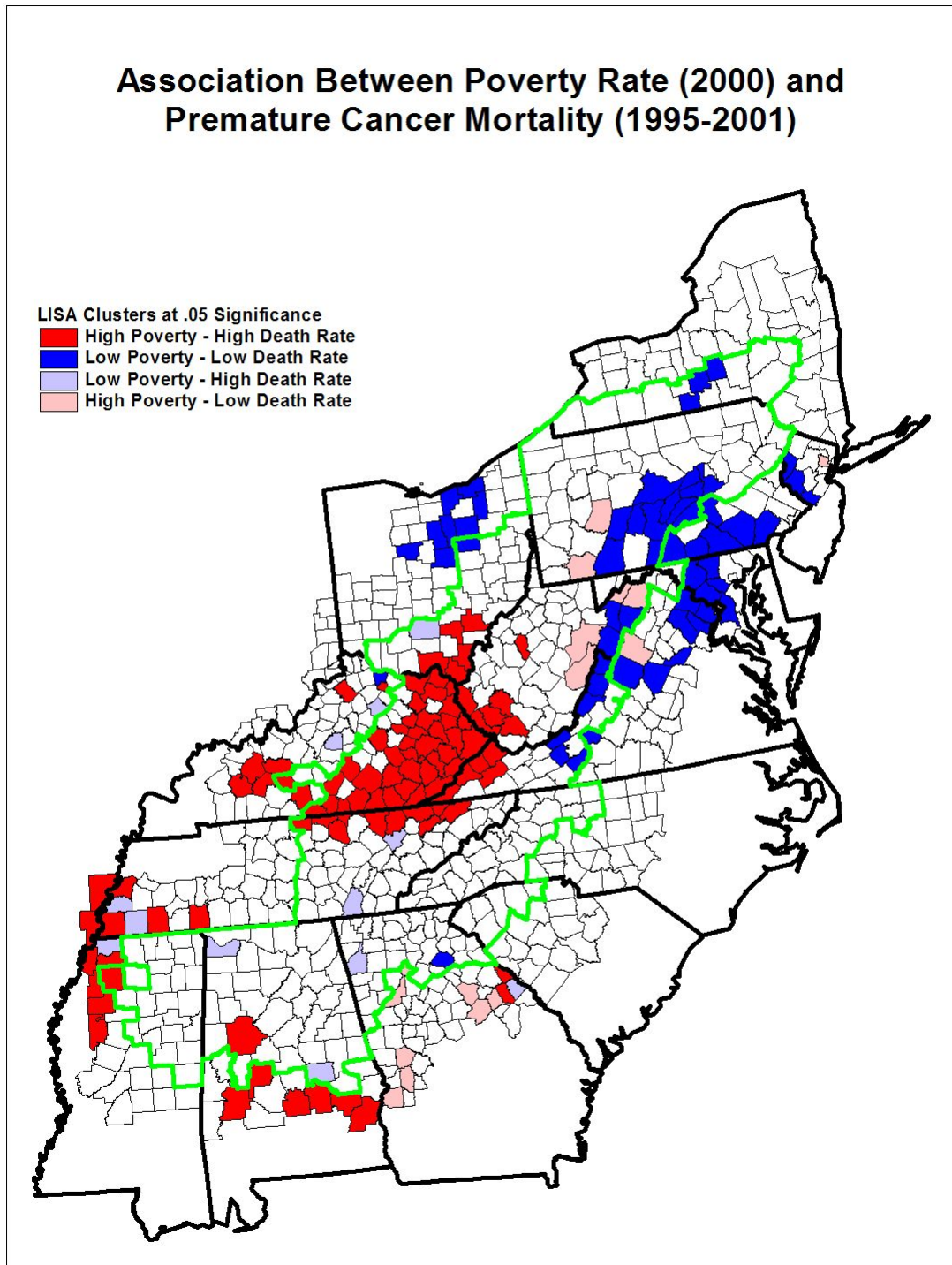


Figure 39. Associations between Premature Cancer Mortality and the Unemployment Rate in the Appalachian Region.

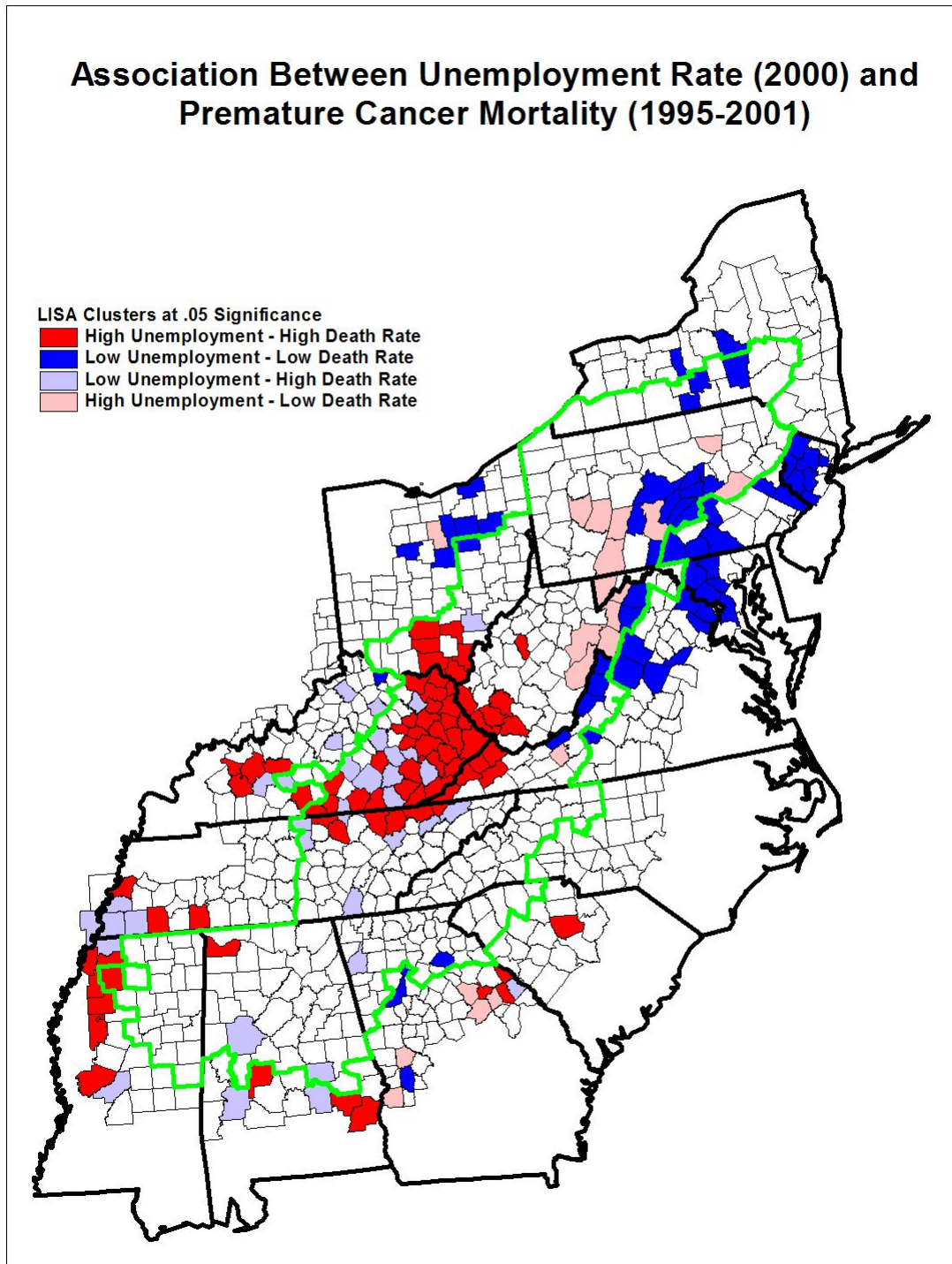
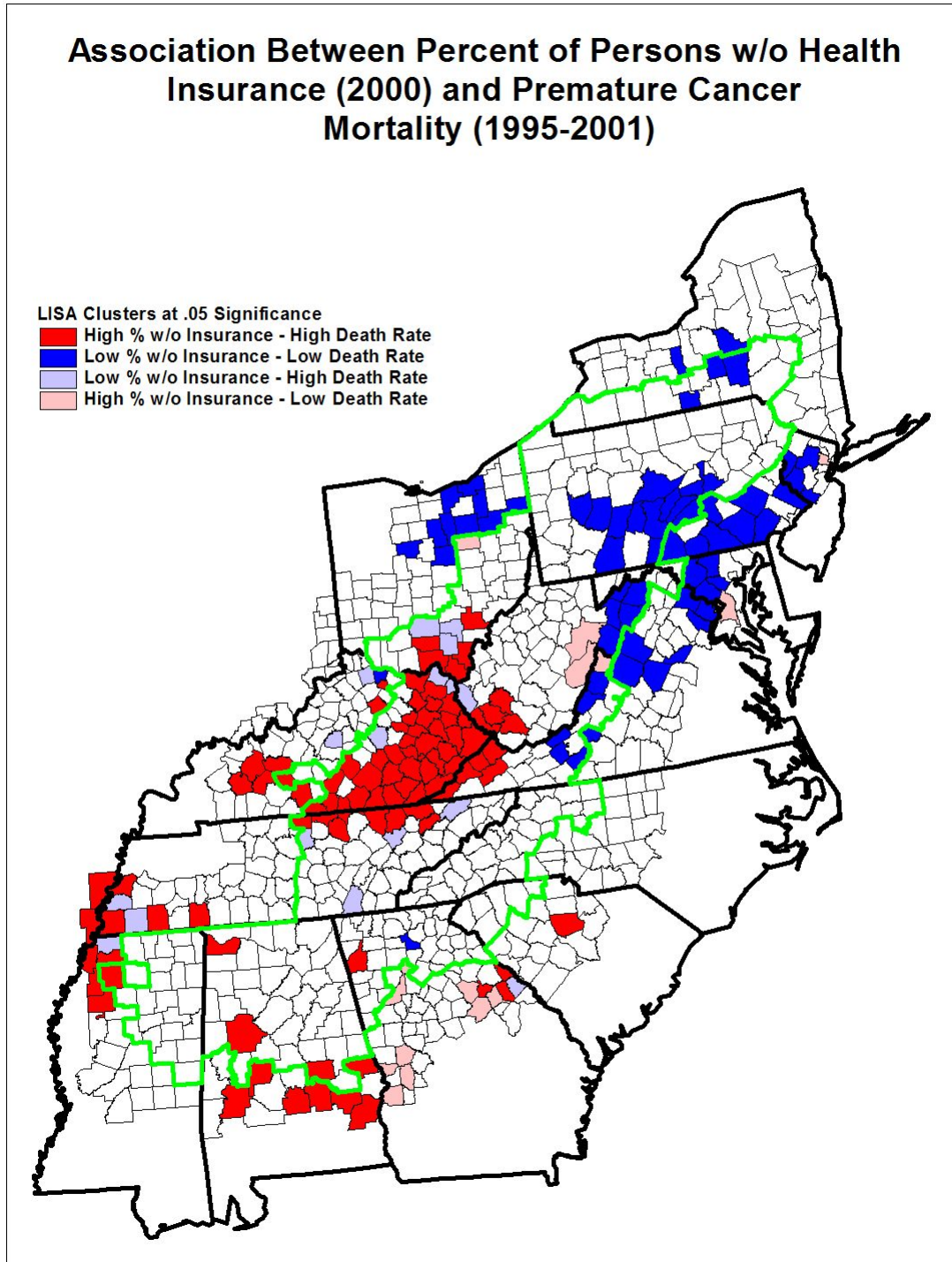


Figure 40. Associations between Premature Cancer Mortality and the Percentage of Persons without Health Insurance in the Appalachian Region.



III.B.4 Premature Stroke Mortality

The regional pattern of premature stroke mortality in the Appalachian region exhibits a very strong north-south gradient and is consistent with the national distribution of premature stroke mortality (see Section II, Figure 9). Counties in the extreme Southern part of the region, which occupy part of the historic ‘Stroke Belt’, have much higher rates of premature stroke mortality than the northern part of the region. A relatively small cluster of high-rate (fourth quartile) counties does appear in the Central part of the region in Eastern Kentucky. However, given the predominance of the ‘Stroke Belt’, premature death rates from stroke in Appalachia tend to occupy the lower end of the national distribution of rates and are represented primarily by 1st through 3rd quartiles.

Statistically significant associations between socioeconomic conditions and premature stroke mortality were difficult to derive due to the relative rarity of premature stroke deaths. As mentioned in III.A.4. unsmoothed rates were used to derive associations with socioeconomic measures and many fewer counties had sufficient numbers of deaths compared to other causes of death examined in this study. There are a few areas for which significant associations are apparent, however these lie primarily on the periphery of the Appalachian boundary among counties in the Southern-most states. One exception is a group of counties in Central Alabama. This group of counties appears to have reasonably favorable socioeconomic conditions with the exception of having high percentages of persons without health insurance.

Figure 41. Associations between Premature Stroke Mortality and Percent Urban Population in the Appalachian Region.

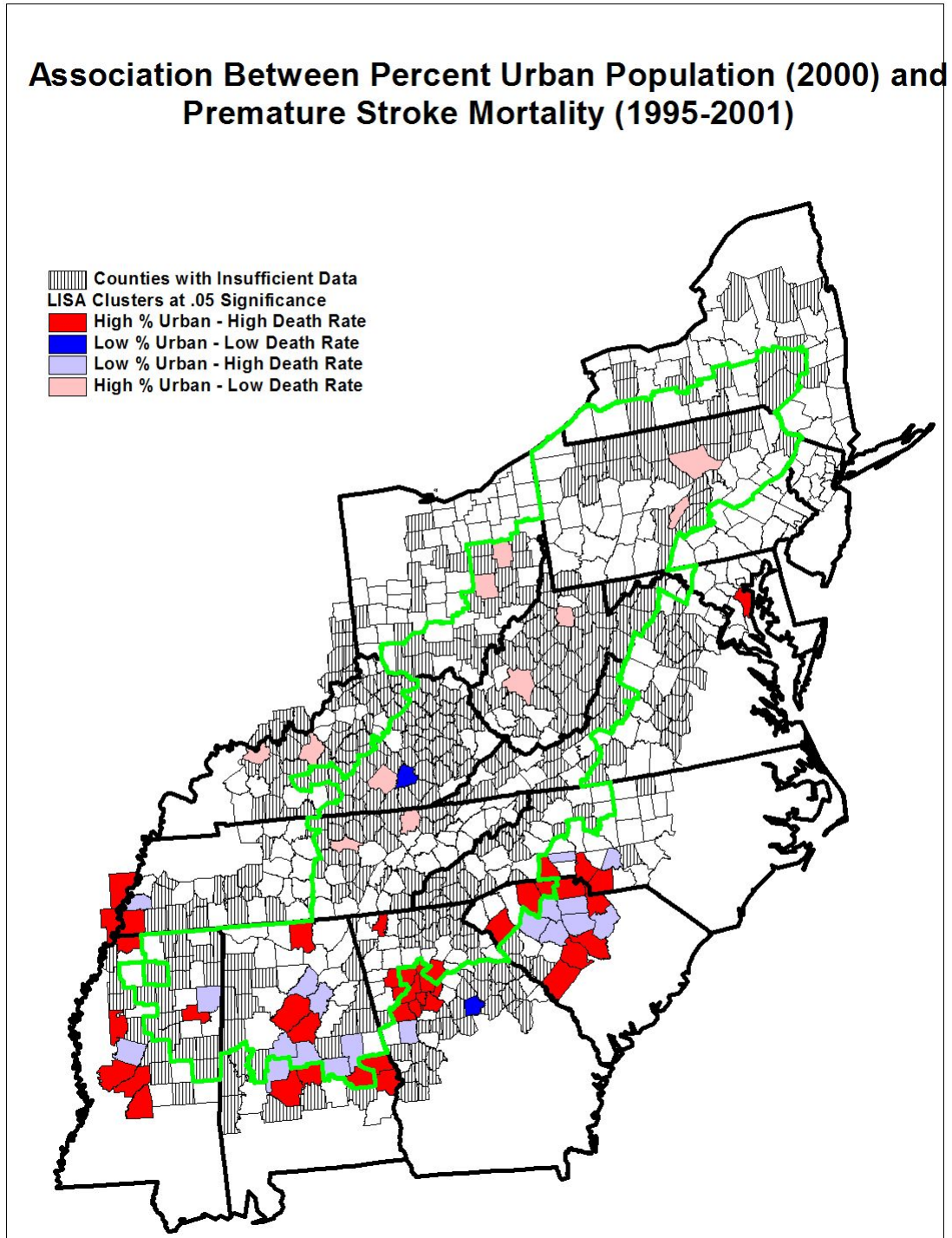


Figure 42. Associations between Premature Stroke Mortality and Median Family Income in the Appalachian Region.

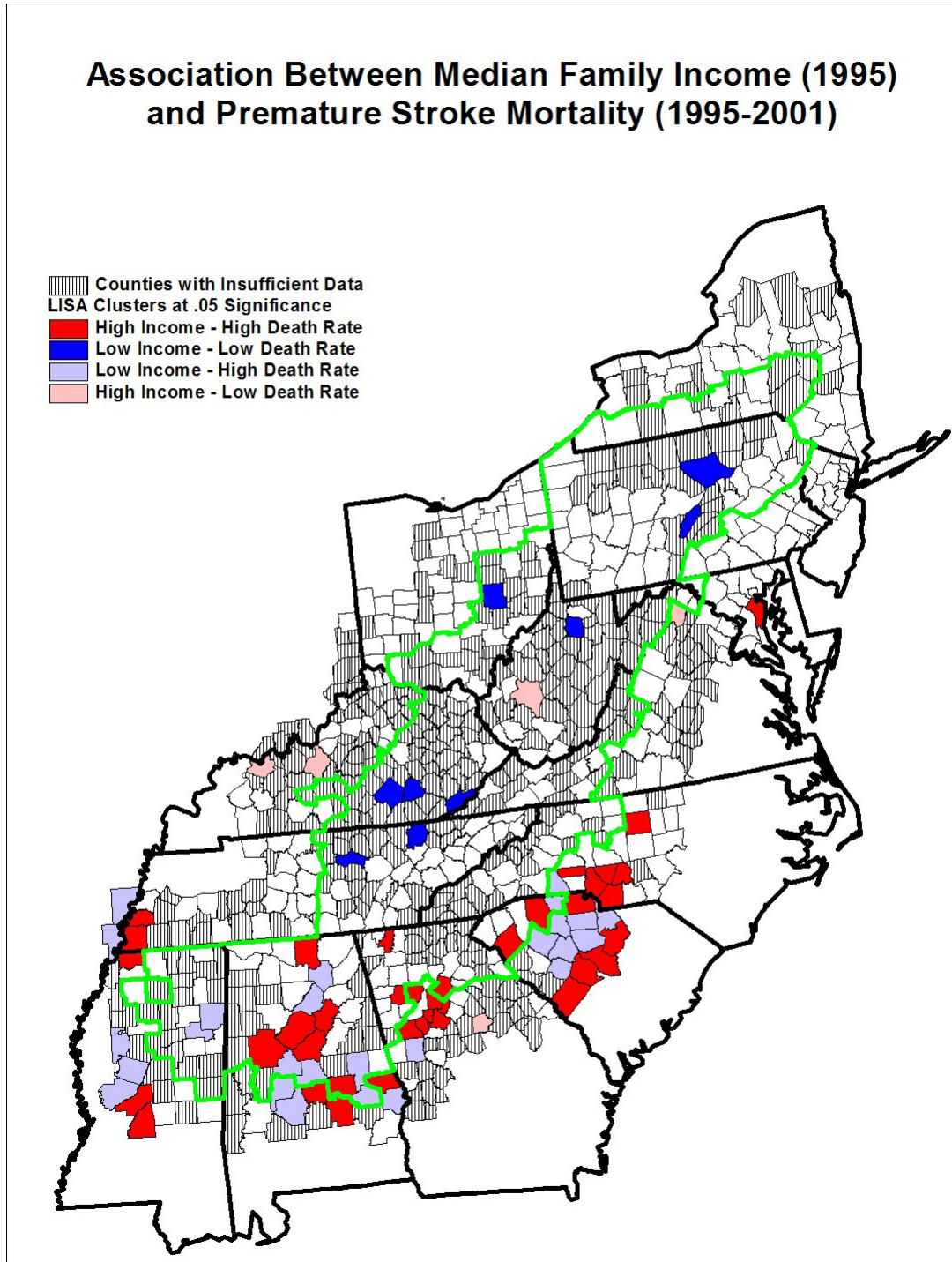


Figure 43. Associations between Premature Stroke Mortality and the Poverty Rate in the Appalachian Region.

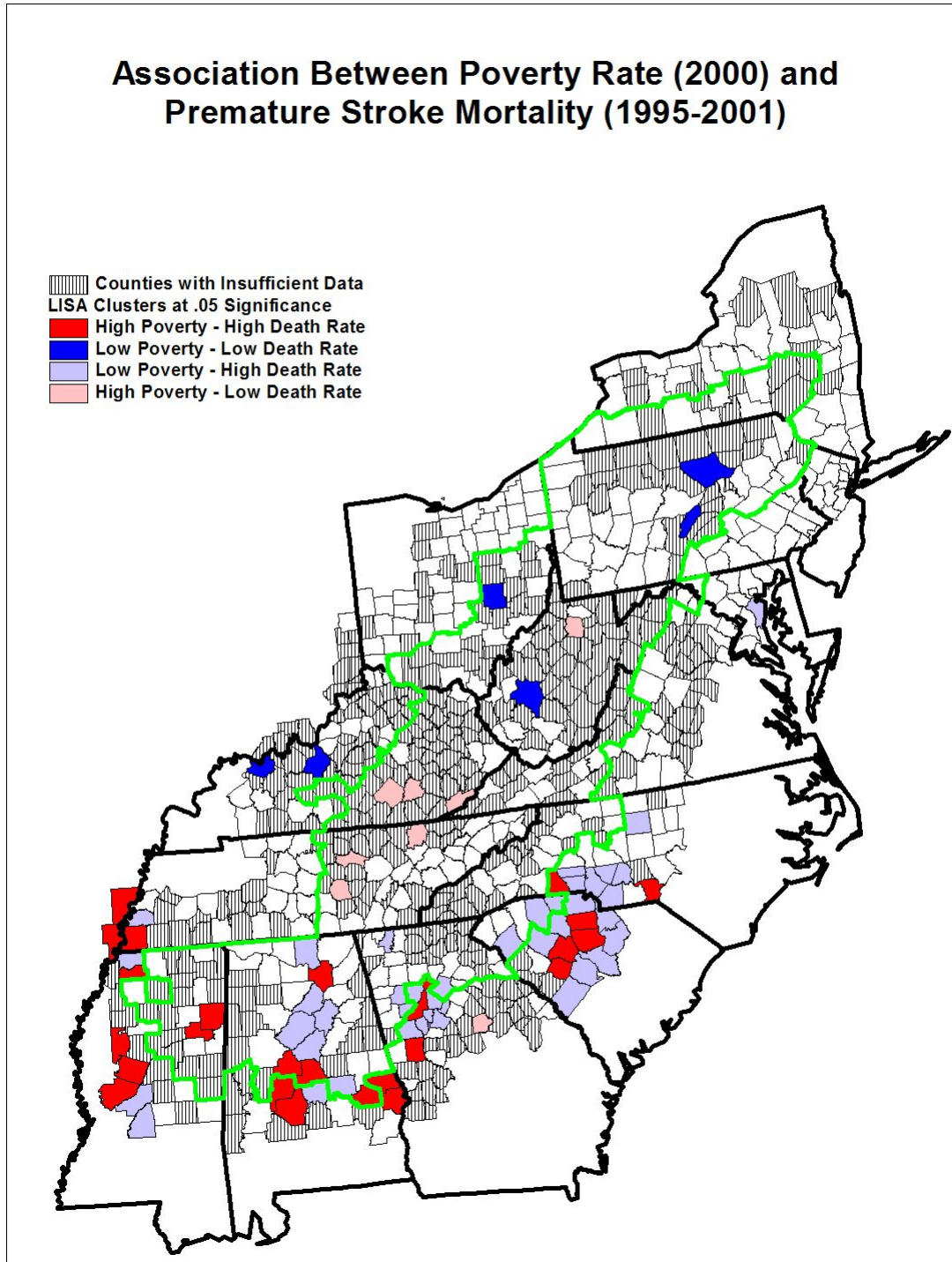


Figure 44. Associations between Premature Stroke Mortality and the Unemployment Rate in the Appalachian Region.

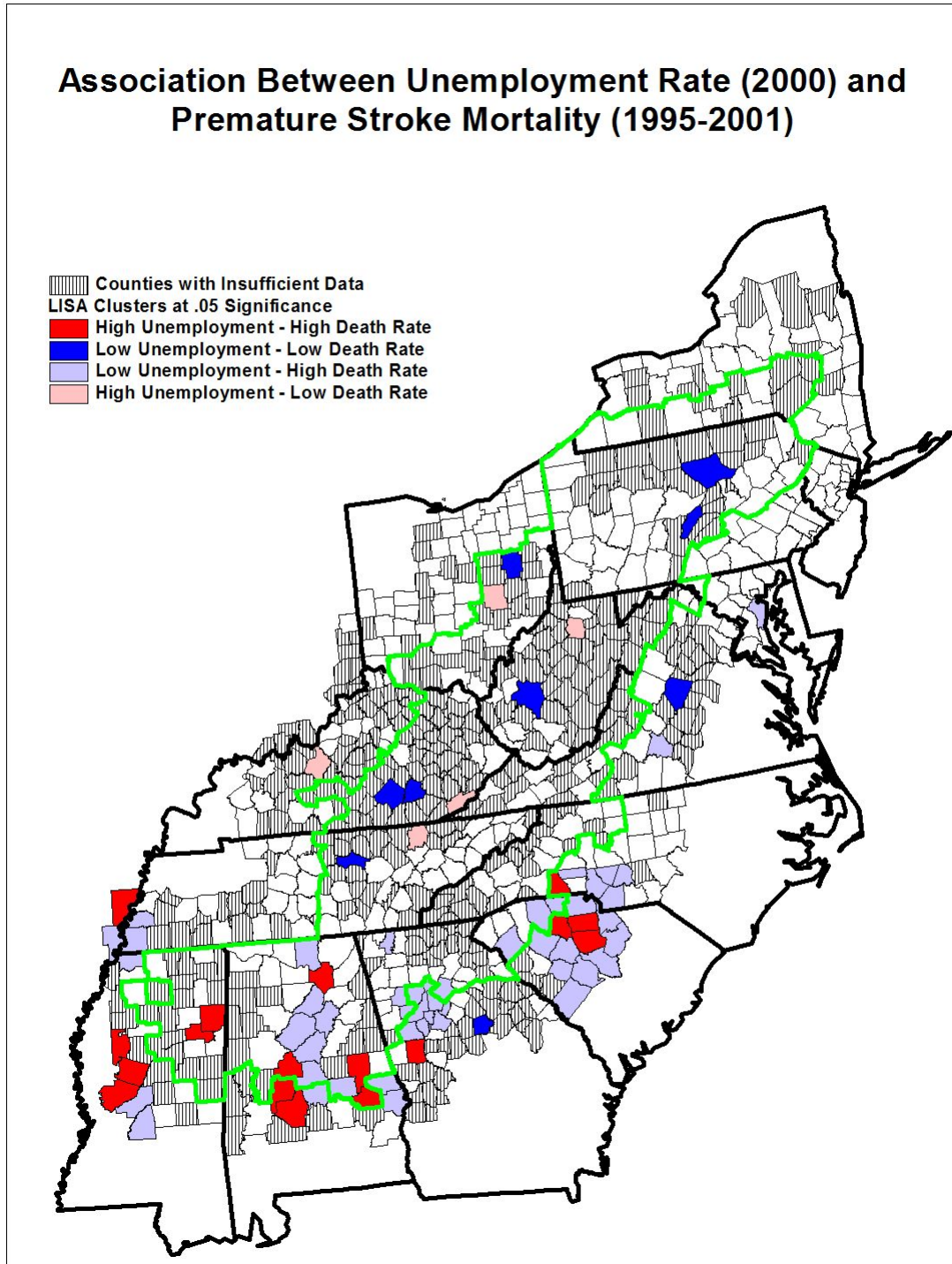
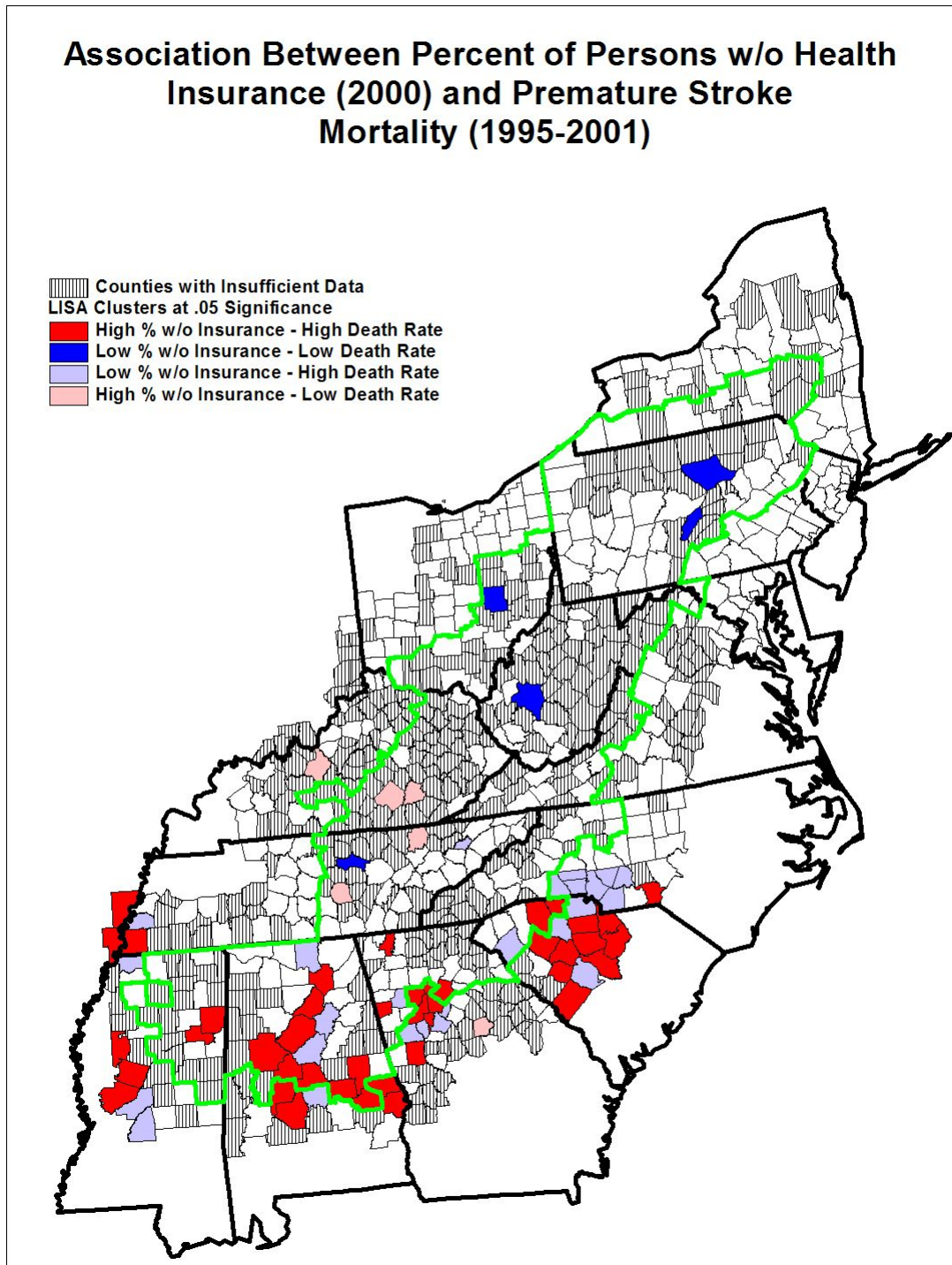


Figure 45. Associations between Premature Stroke Mortality and the Percentage of Persons without Health Insurance in the Appalachian Region.



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