Final Report

on

Targeted Testing Plan for Childhood Lead Poisoning

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By

The Ohio State University Statistical Consulting Service

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Executive Summary

The Ohio Healthy Homes and Lead Poisoning Prevention Program (OHHLPPP) at the Ohio Department of Health (ODH) provides ongoing guidance to healthcare providers for targeting blood-lead testing of children at high risk for lead poisoning. Currently, they utilize a high-risk zip code lead testing model implemented in 2004. The current methodology identifies zip codes in Ohio where children under the age of 6 are thought to be at a high risk for blood-lead poisoning. This methodology was established through identifying high-risk census tracts by a statistical model, which was based on lead testing data and census tract covariates. This model relies on census data from the 2000 decennial census, which are over ten years old, and blood-lead data with a limited number of samples from rural areas. OHHLPPP is revising their predictive statistical model to make use of the most recently available data and known risk factors for elevated childhood blood-lead levels in Ohio and to use of a new target level of 5 μg/dL to define lead poisoning.

The development of the new predictive model used data from three sources: the ODH database of blood-lead concentrations in children, the 2010 U.S. Census database, and the 2011 American Community Survey database. The latter two sources were used to provide values of 25 population and housing characteristic variables for each of the 2,952 census tracts in Ohio. Blood-lead data were geocoded to obtain the associated census tract, reduced to a single observation per child, and summarized to provide proportions of children whose blood-lead concentrations were greater than or equal to each of two target levels (10 and 5 μg/dL) within each census tract. Principal components analysis was used to determine whether the number of predictors could be reduced, and stepwise logistic regression models were fitted. The results of the model were used to identify significant predictors of the proportions of children with elevated blood-lead levels and census tracts with high predicted proportions of children with elevated blood-lead levels.

The statistical modeling showed that the five most significant predictors of high proportions of elevated blood-lead levels were the percentage of homes built prior to 1950, the percentage of the population who are African American, the percentage of the population with either a high-school or college education, the percentage of families whose income-to-poverty ratio was greater than 2, and the percentage of the population under the age of 6. The model found that the census tracts with the highest predicted proportions of children with elevated blood-lead levels were found in highly urban areas (in particular, in Cuyahoga County), and the census tracts with the lowest predicted probability of children with elevated blood-lead levels were in suburban/exurban areas surrounding metropolitan areas. Census tract results were converted to zip codes, and the model showed that 1348 of 1388 zip codes had at least a 5% probability of children's blood-lead concentrations at 5 μg/dL or higher.

1. Project Background

The Ohio Healthy Homes and Lead Poisoning Prevention Program (OHHLPPP) at the Ohio Department of Health (ODH) provides ongoing guidance to healthcare providers for targeting blood-lead testing of children at high risk for lead poisoning. Currently, they utilize a high-risk zip code lead testing model implemented in 2004. The current methodology identifies zip codes in Ohio where children under the age of 6 are thought to be at a high risk for blood-lead poisoning. This methodology was established through identifying high-risk census tracts by a statistical model. The model was based on lead testing data and census tract covariates. This model relies on census data from the 2000 decennial census, which are over ten years old. The model is also based on a target blood-lead concentration of 10 μg/dL to define lead poisoning.

OHHLPPP is seeking to develop a new predictive statistical model to identify geographic areas in Ohio where children under six years of age have a high risk for elevated blood-lead levels. The resulting model will improve upon and update the existing methodology historically used for this purpose, making use of the most recently available data and known risk factors for elevated childhood blood-lead levels in Ohio, as well as potentially identifying and incorporating new information to enhance the ability to appropriately target childhood blood lead testing in the state. ODH would like to update this model for three important reasons: most obviously, the data utilized in the current model is old and, likely, no longer valid; ODH believes that the model has inherent biases from using historical lead testing data; and the Centers for Disease Control and Prevention (CDC) has modified its definition of lead poisoning to be based on a concentration of 5 μg/dL rather than 10 μg/dL. With respect to the historical bias, lead poisoning was commonly thought of as an urban problem until recently, and only now has lead testing in the rural areas captured a significant percentage of the rural population.

This report documents the collection, processing, and statistical analysis of blood-lead and predictor data to form the new predictive model for identifying high-risk areas in Ohio. Section 2 provides an overview of the study design. Section 3 identifies the data sources and discusses the methods that were used to adapt the raw data for use in the statistical modeling and analysis. Section 4 presents the statistical models and methods that were used for the data analysis. Finally, Section 5 presents conclusions and discussion of the model for targeted testing.

2. Study Design

The design of the statistical model development study is retrospective; that is, the data used in this study have been obtained from historical records rather than being obtained from newly enrolled study participants. The study population is all Ohio children – present and future – younger than 6 years old. Recent historical recorded blood lead concentrations are used to represent values that are and will be observed in the population. Blood-lead data have been collected and submitted to the Ohio Department of Health, which maintains a database of measured blood-lead concentrations.

The purpose of the study is to develop a model that will predict the likelihood of lead poisoning in children based on various characteristics of the population and their housing. This model is being developed using statistical analysis of the blood-lead data and population and housing characteristic data obtained for various geographical areas of Ohio. Because of variability in blood-lead levels within and between the geographic areas, the model will not predict the observed probability of lead poisoning exactly, but the best predictive model, based on the characteristic data available, will be selected.

Specific personal and housing information about each child in the blood-lead database were not collected, so it is not possible to use the child as the basic unit of analysis. The U.S Census maintains databases that provide summaries of population and housing characteristics across various geographic units, including the entire state, each county, each census tract (within a county), and each census block with a census tract. While some census data are available for zip codes or for census blocks, to obtain data for all of the predictors of interest requires using the census tract as the basic unit of analysis. There are 2,952 census tracts in Ohio. In terms of a comparison of geographic units, the data contain records for 1,388 5-digit zip codes in Ohio.

3. Data Sources and Database Development

The data that were used to develop and fit the statistical model to predict geographic areas where there is an elevated risk of lead poisoning came from three sources: ODH's in-house database of lead testing results for children in the State of Ohio, the 2010 U.S. Census data, and the 2011 American Community Survey data. The blood-lead database was provided directly by ODH. The other two data sources were available via the American FactFinder website, which provides a portal to identify and download specific portions of the two databases.

The sections that follow provide an overview of the data sources, summarize the data in those sources, and present the methods used to process the data into the form required for the statistical modeling and analysis.

3.1. ODH Blood Lead Data

The blood-lead database provided by ODH consisted of five Excel files. Each file contained all blood-lead measurements in the ODH database for all children under the age of 6 years collected within a specific year. The five files represented the five years from 2007 through 2011. Each file contained the following variables:

- a unique child identification number,
- the age (in months) of the child at the time of the test,
- the gender of the child,
- a unique address identification number,
- the street address of the child's residence,
- any apartment number/information for the child's residence,
- the city of the child's residence,
- the county of the child's residence,
- the state of the child's residence,
- the zip code of the child's residence,
- the date of the blood sample collection,
- the type of sample (venous or capillary),
- the measured blood-lead concentration (in μg/dL, rounded to the nearest integer), and
- a flag indicating whether the test results were confirmed.

3.1.1. Blood Lead Data Summary

Frequency tables were produced to examine the values for the following variables by year and across all years: gender, sample type, and confirmation indicator. Based on these tables, it was discovered that several entries were misaligned in the database, so that the value of gender was "R," the value of sample type was "OH," and the value of confirm was "Z." In addition, the value for state was "1" or "2" for these records. In particular, four records of this type were found in 2008, two of these records were found in 2009, and one of these records was found in 2010. All seven of these records were removed from the data. Table 1 summarizes the number of records per year (after removal of the seven invalid records) with each value of gender, sample type, and confirmatory.

Table 1. Blood-Lead Observation Counts by Year

Year	Category	2007	2008	2009	2010	2011	Total
Total Observations		172,382	174,756	162,243	168,084	165,404	842,869
Gender	F	82,843	83,974	78,297	81,305	79,547	405,966
	M	88,531	90,017	83,370	86,239	85,163	433,320
	Z	1,008	765	576	540	694	3,583
Sample	C	93,644	93,732	87,649	93,421	91,951	460,397
	V	62,136	64,906	61,417	63,478	64,907	316,844
	Z	16,602	16,118	13,177	11,185	8,546	49,043
Confirmatory	N	102,656	103,691	95,981	100,470	98,345	501,143
	Y	69,726	71,065	66,262	67,614	67,059	341,726

A frequency table of observations per year per county was also created. This table showed that there were approximately 20 records where the county name was either entered with an error or where an abbreviation was used. In all cases, the actual county name was clear, so the county names were corrected. In addition, there were 168 records where there was no county name. These 168 records were examined, and it was found that the address, apartment, city, state, and zip code was also missing in each case. Further examination found that 29 of these records had an identical address_id equal to 40000000; 24 others had address_ids equal to 5000000, and the remaining records had differing values for address_id. These records were all removed from the data. Table 2 shows the counts of observations per county for each calendar year after corrections were made to the county name and invalid records were removed.

The age of the child at the time the blood sample was collected was also examined. Figure 1 shows a histogram and boxplot for the children's ages at sample collection. This figure shows a significant spike in blood collection at age 12 months and a smaller spike at age 24 months.

Table 2. Observations by County and Year

County	Year					Total
	2007	2008	2009	2010	2011	
Adams	457	253	503	452	275	1,940
Allen	1,525	2,008	1,779	1,535	1,527	8,374
Ashland	532	587	566	569	601	2,855
Ashtabula	2,123	1,644	921	895	1,198	6,781
Athens	985	981	943	902	985	4,796
Auglaize	398	497	477	506	446	2,324
Belmont	606	993	531	610	665	3,405
Brown	459	254	530	558	414	2,215
Butler	4,860	5,710	3,498	4,778	5,992	24,838
Carroll	295	225	285	277	288	1,370
Champaign	811	894	614	591	536	3,446
Clark	5,579	4,597	4,068	4,171	4,043	22,458
Clermont	1,394	1,127	1,966	2,052	1,928	8,467
Clinton	456	464	485	477	383	2,265
Columbiana	758	931	571	1,201	1,199	4,660
Coshocton	582	583	627	542	516	2,850
Crawford	867	487	356	497	441	2,648
Cuyahoga	28,795	27,971	24,052	25,839	26,146	132,803
Darke	616	722	641	774	727	3,480
Defiance	514	728	666	416	419	2,743
Delaware	846	881	891	834	945	4,397
Erie	622	775	490	726	594	3,207
Fairfield	1,474	1,454	1,720	1,739	1,646	8,033
Fayette	438	438	564	591	569	2,600
Franklin	18,230	19,957	20,136	20,737	20,078	99,138
Fulton	471	578	501	438	480	2,468
Gallia	466	517	535	509	460	2,487
Geauga	420	451	340	321	373	1,905
Greene	1,531	1,591	1,118	1,327	1,447	7,014
Guernsey	663	694	816	805	881	3,859
Hamilton	15,932	15,883	15,441	17,120	17,647	82,023
Hancock	564	843	804	643	665	3,519
Hardin	322	519	567	402	431	2,241
Harrison	168	207	190	209	185	959
Henry	354	395	395	327	287	1,758
Highland	746	629	674	740	695	3,484
Hocking	422	607	421	462	455	2,367
Holmes	401	392	184	212	258	1,447
Huron	1,512	1,366	1,086	1,228	1,174	6,366
Jackson	598	684	523	513	359	2,677
Jefferson	820	511	405	437	361	2,534
Knox	673	772	1,004	967	984	4,400
Lake	1,676	1,719	1,657	1,689	2,080	8,821
Lawrence	1,188	814	634	682	792	4,110
Licking	2,114	2,376	2,289	2,328	2,459	11,566
Logan	529	734	661	651	554	3,129
Lorain	3,509	3,581	3,370	3,209	3,106	16,775

County	Year					Total
	2007	2008	2009	2010	2011	
Lucas	7,629	9,024	9,427	8,103	6,689	40,872
Madison	658	609	614	641	659	3,181
Mahoning	3,306	3,145	2,856	3,051	2,109	14,467
Marion	1,701	1,037	669	957	850	5,214
Medina	1,270	1,162	1,156	1,254	1,280	6,122
Meigs	399	401	383	381	371	1,935
Mercer	365	398	445	461	485	2,154
Miami	1,068	1,122	1,011	1,145	1,165	5,511
Monroe	108	127	161	204	168	768
Montgomery	6,478	6,884	6,270	7,715	7,311	34,658
Morgan	241	244	219	224	240	1,168
Morrow	241	199	252	340	281	1,313
Muskingum	2,234	2,113	2,087	1,782	1,750	9,966
Noble	202	226	245	245	249	1,167
Ottawa	362	428	462	375	384	2,011
Paulding	150	161	159	141	164	775
Perry	559	535	484	528	570	2,676
Pickaway	909	992	997	924	957	4,779
Pike	346	306	291	231	182	1,356
Portage	1,169	1,550	1,667	1,574	1,552	7,512
Preble	367	349	353	399	439	1,907
Putnam	233	351	324	367	241	1,516
Richland	2,032	2,376	2,366	2,317	2,187	11,278
Ross	1,614	1,459	1,168	1,047	793	6,081
Sandusky	681	774	761	859	893	3,968
Scioto	497	927	720	642	458	3,244
Seneca	2,159	1,362	1,295	720	661	6,197
Shelby	1,143	891	565	649	656	3,904
Stark	5,965	6,059	5,884	5,969	5,657	29,534
Summit	8,251	8,080	7,676	7,646	6,991	38,644
Trumbull	2,755	2,018	1,633	1,734	1,530	9,670
Tuscarawas	987	1,104	1,062	1,134	1,426	5,713
Union	223	356	414	428	411	1,832
Van Wert	382	538	549	355	328	2,152
Vinton	284	233	164	193	158	1,032
Warren	1,266	1,310	1,245	1,550	2,185	7,556
Washington	621	653	747	725	727	3,473
Wayne	1,643	1,319	1,145	1,179	1,202	6,488
Williams	694	849	902	411	524	3,380
Wood	1,556	1,732	1,631	1,653	1,475	8,047
Wyandot	245	288	266	330	349	1,478
Total	172,294	174,715	162,220	168,071	165,401	842,701
Missing	88	45	25	14	3	168

In addition to examining the variables in the dataset that described the child and the sample collection procedure, the measured blood lead levels were examined. A histogram of the blood lead levels revealed that there were several very high blood lead values. In particular, there were 85 records where the blood lead level was 75 μg/dL or

higher and 25 records where it was 100 μg/L or higher. The maximum value reported was 904 μg/L.

```
                                Histogram                          #             Boxplot
    age   72.5+*                                                3729                |
              .***                                             13552                |
              .******                                          29615                |
              .*******                                         34467                |
              .********                                        40399                |
              .**********                                      46538                |
              .********                                        37736                |
         37.5+***********                                     54850             +-----+
              .********                                        35858             |     |
              .**************                                  68850             |  +  |
              .**********************                         111054             *-----*
              .***************                                 75554             |     |
              .**************************************************245249             +-----+
              .*********                                       43476                |
           2.5+*                                                1942                |
                ----+----+----+----+----+----+----+----+----+---
                * may represent up to 5110 counts
```

Figure 1. Histogram and Boxplot of Child's Age

These blood-lead concentrations were reported to ODH, who did a more thorough review of the data records. Based on their review, it was determined that 23 of these records were either likely data errors (with no corrections) or came from contaminated samples. These records were dropped from the data. In addition, a corrected blood-lead concentration was determined for one record, which was corrected in the database used for analysis (but not the original copy of the database provided by ODH).

3.1.2. Blood Lead Analysis Database Development

In order to match the children whose blood-lead levels are in the database to the population and housing characteristics obtained from the Census Bureau, it was necessary to determine the census tract where each observation was collected. As noted earlier, the unit that was selected for analysis was the census tract.

The blood-lead data provided by ODH contained the street address, city, county, and zip code, but it did not provide the associated census tract. Thus, the census tract for every address in the blood-lead database was determined using a process known as geocoding. This process requires a known database of location information for every address within the state of Ohio. The SAS® Business Analytics and Business Intelligence Software package, which has a national reference database and an analysis procedure for geocoding addresses to determine the associated census tract, was selected to perform the geocoding.

The following protocol was used to perform the geocoding:

1. Clean the data of any clearly erroneous, uncorrectable addresses;
2. Obtain a list of unique addresses from the blood-lead database provided by ODH;
3. Obtain and prepare the SAS® database of addresses to use in geocoding;
4. Review the SAS® geocoding procedure to determine the variables of need, and identify the variables in the blood-lead data that correspond to the variables of need;
5. Perform an initial evaluation of the required variables for potential problems and correct any data values;
6. Perform the geocoding;
7. Evaluate the geocoding results;
8. Revise the data for unmatched addresses to the extent possible, and re-geocode; and
9. Combine geocoding results.

The procedures and results for each step of the geocoding procedure are provided below.

1. Clean the data

The original database of blood-lead measurements provided by ODH was processed to remove records with erroneous information regarding gender, state, and other variables. The resulting data had 842,869 individual records. Additional records were eliminated due to invalid blood-lead levels, resulting in a database with 842,853 records.

2. Obtain a list of unique addresses

These 842,853 records were sorted by state, county, zip, and address, and each unique combination of these four variables was placed into an address data file. There were a total of 483,310 unique addresses in the blood-lead database.

3. Obtain and process the SAS® reference database of addresses

The SAS® online support site provided information about obtaining and processing the national database of addresses for use in geocoding. The site provides a link enabling the user to download a zip file containing the geocoding reference data in CSV format and a SAS® program to import the CSV files and create SAS® datasets containing the reference data that could be used in the SAS® geocoding procedure. The file was downloaded and unzipped, and the SAS® import program was modified to process the data to fit the file structure where the data were stored. The resulting program was run, producing three SAS® datasets whose total size was 10GB.

4. Review the SAS® geocoding procedure

SAS® provides electronic documentation regarding data processing and analysis procedures included in its software. The documentation regarding PROC GEOCODE was reviewed to determine the appropriate programming code for this project. SAS® PROC GEOCODE offers several options to match addresses from one file to the reference file. For this project, street-level matching was required. Under this method, the user must specify variable names in the address database for the street address, city, zip, and state, which were "address," "city," "zip," and "state," respectively, in the blood-lead database. The user must also provide the name of the reference database (which was obtained in the previous step), the name for the output dataset to contain the geocoding results, and a list of attributes to be included in the output dataset. For this application, we selected one attribute variable, census tract, which was the variable of interest from the geocoding procedure.

5. Evaluate and correct the required variables for potential problems

Due to the nature of the blood-lead database, it was expected that there would be errors in some of the children's addresses. In order to avoid potential problems, we reviewed the four variables from the address database that are required for the geocoding procedure. In all cases, the state was listed as Ohio, so no corrective action was required for that variable. For the street address and city, correction of errors would have been too time consuming and beyond the scope of this project, so no corrections were made. The zip codes in the blood-lead database were briefly reviewed to evaluate potential problems, of which three were discovered. First, in most cases, the 5-digit zip code was provided in the blood-lead database, but in a few cases, the zip+4 code was provided. For consistency, and to maximize the number of usable observations, the 5-digit code was chosen as the basis for geocoding. SAS® code was written to eliminate the extra four digits. Second, there were some cases where the zip code had either fewer than five digits, or between six and eight digits. Correcting these errors was outside the scope of the problem, so the records with incorrect number of digits were removed from the database. Finally, there were some 5-digit zip codes that were clearly outside the bounds of values that are found in Ohio. Research into postal codes showed that zip codes in Ohio range from 43001 to 45999, so any addresses with zip codes outside of that range were removed. Based upon the data reductions noted in this section, the address database was reduced to 483,185 unique addresses.

6. Perform geocoding

Once the address database was finalized, a SAS® program was written and run that performed the geocoding. For the first attempt, which involved trying to geocode all 483,185 addresses in a single run, the geocoding program got stuck in an infinite holding pattern due to an internal SAS® error. After stopping the program, the program was successfully tested on a subset of the data (all addresses within a single zip code.

However, a second attempt at geocoding the entire address database resulted in another infinite holding pattern. In an attempt to avoid the holding issue, the code was revised to geocode smaller subsets of the addresses sequentially. After trial and error, the program was set to geocode 100 addresses in a group, with a programming loop to perform the groups of 100 for 50 iterations. With each iteration, the results were outputted to a permanent SAS® dataset. Even with this process, there were occasional holding errors, so the routine was modified to process 10 addresses per group. This size also had occasional problems, so the routine was modified to process individual addresses. This latter routine always worked, but because of input/output functions and printing functions, it was not efficient. The final geocoding was performed using 100-, 10-, and 1-address groupings as needed. Whenever a holding error occurred in the 100-group program, the program was stopped and restarted at the point where it stopped, using a smaller group size. After a few successful runs using the smaller group size, a larger group size was used again. This process was used until all addresses had been submitted to the geocoding program. The final geocoding process, once all the errors were eliminated, required approximately 15 hours to complete, with all 483,185 records processed.

7. Evaluate the geocoding results and implement address correction activities

In performing the geocoding, the SAS® procedure creates an output database that contains the original data from the address file as well the address, city, zip, and state values from the reference database, latitude and longitude values (in degrees) for the address, and the census tract. In addition, the SAS® procedure creates four variables that provide information about the matching. These variables provide information about whether the exact street address was matched, whether only zip codes could be matched, or whether only the city and state could be matched. Frequency tables of these variables showed that of the 483,185 addresses, 418,808 (86.7%) were matched exactly (to the street address and zip code), 63,880 (13.2%) were matched only by zip code, 481 (0.1%) were matched by city, and 16 could not be matched in any manner. For these matches, the geocoding program provided census tract information only for the 418,808 addresses that were matched exactly.

As part of the geocoding evaluation, a frequency table of matching results by county was produced in order to determine the variability of matching percentages around the state. Eight counties had matches for fewer than 60% of the addresses: Coshocton (57.66%), Fulton (57.26%), Holmes (37.28%), Lawrence (36.40%), Morrow (35.42%), Paulding (49.19%), Putnam (52.93%), and Williams (59.11%). Counties with 90% or higher matching included Clark, Cuyahoga, Lucas, Mahoning, Stark, and Summit.

In examining the results for Morrow County (which had the lowest match percentage), it appeared as though there had been difficulty with addresses that were on numbered township and county roads (addresses on state routes were usually matched), addresses that were on “Private” roads, and addresses that were PO boxes. Yahoo was used to map the locations of several selected addresses from Edison, OH, that that had county roads in their listed addresses. In all three cases, the maps showed an actual street name in

addition to the road number (e.g., Co Rd 9 is Cardington-Edison Iberia Rd, Co Rd 67 is Canaan-Central Rd, and Co Rd 59 is Marion-Johnson Rd). In all three cases, the national database was able to match the alternative road name but not the county road name. A similar result occurred for a township road (Township Rd 60 is W Canaan Rd).

Several attempts were made to find either (1) a database the provided both the numbered county and township roads and their alternate names or (2) a geocoding reference database that included the numbered county and township roads. These attempts included:

- Contacting the Ohio Department of Transportation,
- Contacting a professor in the Ohio State University Geography Department whose research interest included GIS and mapping,
- Discussing possible options with a former ODH GIS consultant, and
- Contacting OGRIP.

The fourth option was the one that ultimately produced usable results. ODH was provided with a list of unmatched addresses that included county, township, and private road numbers, as well as several state highway addresses that were not matched in the initial geocoding attempt. OGRIP was able to provide latitude and longitude coordinates for each of these addresses, although some of these coordinates were for the postal city or zip code rather than the specific address. A SAS® program was written to find the census tract using the latitude and longitude values provided using a census tract mapping database. The program used the following process:

- The distance between the address coordinates and the coordinates of every point in the boundary mapping database were calculated, and the minimum distance was identified.

- The one or two mapping boundary points that had the minimum distance were identified (one point if the address was near the state border, and two points if the address was near the dividing line between two tracts).

- If there was only one point, the census tract associated with the mapping boundary point was selected as the correct census tract.

- If there were two points – which had identical coordinates for each of the census tracts it divided – then:

    - the centroids of the two census tracts were determined;
    - the direction between the census tract centroids was determined;
    - the direction between the address and the boundary point was determined; and
    - the census tract was determined based on whether the two directions were similar or opposite.

After identifying the issue with the numbered county and township roads, the address database was split into three pieces: addresses with census tracts that were found (i.e. matched addresses), addresses with numbered roads that were matched with the assistance of OGRIP, and all unmatched addresses. For those in the third group, the addresses were reviewed to search for issues that could be resolved fairly easily using data cleaning operations. The issues that were examined and the associated resolutions that were applied are discussed below.

- Any address for which the street number included "1/2" or "1/3," either in numeric or text format, were modified to remove the fractional number. This solution assumes that eliminating the fraction part of the street number does not change the census tract.

- Any street address that included apartment or PO Box information in addition to an actual street address was modified to remove the apartment/PO box information from the street address. This operation looked for key words including "PO," "APT," "UNIT," "FLOOR," "UP," "DOWN," "FRONT," and "REAR." In addition, there were some cases where there was a number after the street name (i.e., after "RD," "ST," or other street type without any of the key words above; when it was clear that the number was not clearly a part of the street name (e.g., "COUNTY RD 20"), then the number was assumed to be an apartment number, and it was deleted.

- Numbered United States highways were entered in the ODH database in several ways, using some combination of "HWY" and "RTE." The reference database preference for US highways was "US RTE." So, any US highway address that was not in that format was modified to put it into the "US RTE" form.

- Some addresses for state highways in the ODH database were written as "ST RTE." Because the reference database preference was "STATE RTE," the ODH addresses were modified to conform to the preferred form.

- The unmatched ODH database addresses occasionally contained abbreviations that, when tested in unabbreviated form, were found to result in matches. These abbreviations included RDG for RIDGE, CK or CRK for CREEK, LK for LAKE, and VLY for VALLEY. We replaced these abbreviations that occurred in street names with the corresponding full word.

- The database of unmatched addresses included a large number of street names that included the word "SAINT," with no apparent errors in any part of the street name. Several of these addresses were checked with the SAS geocoding program,

and it was found that replacing "SAINT" with "ST" led to matching of the addresses to the reference database. As a result, we made this change in all unmatched addresses. Alternatively, there were some addresses in the unmatched data that included "ST," while the SAS reference database preferred "SAINT." These addresses were also corrected to match the reference database.

- Examination of the unmatched addresses identified what appeared to be general typographical errors in the street addresses. Examples of the types of typographical errors that were found and corrected included:
    - mistyped street names (e.g. EMLWOOD instead of ELMWOOD, CEMETARY instead of CEMETERY, PLEASENT or PLESANT instead of PLEASANT, VEIW instead of VIEW, CHRUCH instead of CHURCH). We corrected the spelling in these street names.;
    - street numbers that included "th," "st," "nd," or "rd" in the number (no corrections were made when the name of the street was numbered, like "1st St);
    - the absence of a space between the street number and the street name;
    - duplicate street numbers (e.g. 3212 3212 MAIN ST); and
    - the presence of a 5- or 6-digit number in the address after the street name (the number was removed).

- There were several instances where there were a large number of addresses on a specific street that was not found in the reference database. Most of those streets were successfully mapped using Yahoo. Also, in Lucas County, there were a large number of unmatched addresses where the street name was the name of a housing complex rather than the name of the street on which the housing complex was located. In total, there were approximately 100 frequently appearing street names that were found on a map but not found in the SAS® reference database. US Census Bureau census tract maps were used to identify the census tract where these streets were located, and SAS® code was written to match these streets to the correct census tract.

- There was one particular case in Mansfield, where the census tract maps indicated that the street was a boundary line between several census tracts. SAS® code was written to assign the address to the correct census tract based on the street number.

- There were a large number of addresses that were listed as only PO boxes. For cities and towns that were large enough to have more than one census tract, it was concluded that it would not be possible to identify the appropriate census tract. On the other hand, for towns that were clearly located within a single census tract,

it was assumed that there was a strong likelihood that the home was also located within the same census tract. Census tract maps were used to identify cities located within a single census tract, and SAS® code was written to provide the census tract. This adjustment was also used on other (non – PO) unmatched addresses to assign a census tract.

8. Re-geocode unmatched addresses.

After making all the data corrections, the previously unmatched were submitted to the SAS® geocoding program. Census tracts were found for approximately 25,000 additional addresses after the editing process.

9. Combine geocoding results.

Once the three geocoding procedures were completed, the three sets of matched addresses were combined into a single file. This file had 459,130 unique addresses for which the census tract was determined, which represents 95% of the original 483,185 addresses obtained in Step 5. All remaining unmatched addresses were placed in a separate data file.

3.1.3. Reducing Blood-Lead Data to One Observation per Child

The blood-lead database contains all measured blood-lead concentrations reported to ODH over the study period. In many cases, there was a single observation per child, but there were some children for whom there were multiple records. For these children, follow-up measurements were often collected to either (1) confirm a high blood-lead reading, or (2) follow a child over the course of a treatment to evaluate whether the blood-lead levels were declining. In a few of these cases, the address associated with the child differed across the multiple records.

In order to allow each child to provide an equal weight during the development of the statistical model, there must be an equal number of observations per child. Thus, it was necessary to reduce the data for those children with multiple records to a single record. The procedure that was used for each child was as follows:

1. Select observations whose census tract number was found (i.e., remove observations with unknown census tract);
2. Sort the remaining data sample date,
3. Determine the number of remaining samples per child;
4. If there is only one sample, include it in the analysis database;

5. If there were multiple records per child, determine if any of them were confirmatory samples;
6. If there was a confirmatory sample, find the confirmatory with the largest measured blood-lead concentration and select it for the analysis database;
7. If there were no confirmatory samples, select the sample with the largest blood-lead concentration; and
8. Use the address associated with the selected sample.

3.2. Census Data Summary and Database Development

The US Census Bureau collects and disseminates data regarding characteristics of the people within various geographic areas via the American FactFinder website. In addition to data collected during the decennial census, this site provides access to data from the American Community Survey (ACS), which collects data regarding housing characteristics for various geographic areas. Currently, the site provides data from the 2010 decennial census and the 2011 ACS. To obtain data, one identifies the type of information required, the geographic units of interest, and any subgroups of interest, and the website provides access to several data tables that contain the information of interest. Each table can be downloaded via zip file that contains a comma-separated data file and three additional files that provide information about the data.

3.2.1. Summary of Source Data

Predictors for lead poisoning were selected to include those from the previous modeling effort and also included a few additional variables. All of the predictor variables of interest were available from one of seven distinct datasets from American FactFinder. The sources (and published file names) are:

- The 2010 decennial census data (DEC SF1DP1),
- The 2011 ACS file on household characteristics (DP02),
- The 2011 ACS file on income/poverty (DP03),
- The 2011 ACS file on housing characteristics (DP04),
- A detailed table from the 2011 ACS regarding poverty and income (B17026),
- The Guide to State and Local Census Geography (Geo), and
- SF1 Urban/Rural Update from 9/27/12 (U/R).

The American FactFinder website allows users to download most of these data sets directly. The data are downloaded into comma-separated files that can read into Excel. The files vary in format. The DP1, DP02, DP03, and DP04 files have one record per census tract and four columns for each characteristic that is contained in the file. These columns contain (1) counts of individuals, families, or houses that possess the characteristic, (2) an estimated error in the count, (3) the percentage of the population (individuals, families, houses) that the count represents, and (4) an estimated error

associated with the percentage. The B17026 file contains one record per census tract and two columns per characteristic: percentage and its estimated error. The Guide to State and Local Census Geography was copied from a web page that contained 10 columns of characteristics for each census tract and pasted into an Excel file. The SF1 Urban/Rural Update was a large fixed-format text file that contained a large number of records, some for census blocks, others for census tracts within communities, others for communities, others for counties, and the rest for the entire state. Census-tract level data were obtained by writing computer code that selected the rows with the required data, capturing the required information from the associated columns, and combining the data within each census tract.

As noted above, the census data files contained data for a large number of characteristics, of which only 25 were selected as predictors of lead poisoning. The specific predictor variables that were selected for the model (and their data sources) were:

- pct_age_5 – percent of population under age 5 (DP1),
- pct_age_65 – percent of population over age 65 (DP1),
- pct_asian – percent of population that is Asian (DP1),
- pct_black – percent of population that is African American (non-Hispanic) (DP1),
- pct_cl_ed – percent of population with a college degree (DP02),
- pct_f_head – percent of household with a female head (DP02),
- pct_fh_ch – percent of households with a female head and children (DP1),
- pct_hisp – percent of population that is Hispanic (DP1),
- pct_hs_ed – percent of population with a high-school degree (DP02),
- pct_married – percent of population that is married (DP02),
- pct_mixed – percent of population with mixed race (DP1),
- pct_poverty – percent of households with income below poverty level (DP03),
- pct_pre_50 – percent of homes built prior to 1950 (DP04),
- pct_pubasst – percent of families with public assistance (DP03),
- pct_renter – percent of houses occupied by renters (DP04),
- pct_rur – percent of houses in rural areas (U/R),
- pct_un_20 – percent of homes in developments with more than 20 units (DP04),
- pct_unemploy – percent unemployment (DP03),
- pct_vacant – percent of vacant homes (DP04),
- popden_a – population density per acre (DP1 / Geo),
- houseden_a – housing density per acre (DP1 / Geo),
- pct_pov_5 – percent of families below poverty line with children under 5 (DP03),
- pct_fr_00 – percent population who have moved to US since 2000 (DP02),
- pct_inpov1 – percent of households with income-poverty ratio less than 1 (B17026), and
- pct_inpov2 – percent of household with income-poverty ratio greater than 2 (B17026)

3.2.2. Predictor Database Development

The seven data files of interest were downloaded and, in the case of the large census files, extracted. The data were then individually inputted into a SAS program. For each file, the variables of interest were identified, extracted or calculated, and saved into a temporary file, with one record per census tract. The seven temporary files were combined into a single file with all predictors of interest by matching census tracts. This file was saved as a permanent data file.

3.3. Matching Blood Lead and Predictor Data

In order to perform the statistical modeling and analysis, the blood-lead data and predictor data must be matched by the 2,952 census tracts in Ohio. An examination of census tract maps for the state of Ohio show that census tracts are contained with counties (i.e., no census tracts contain area from more than one county). Also, it was noted that the census tract numbers, which contain between three and six digits, are not always unique within the state of Ohio. For example, census tract 200 can be found in 12 separate counties. Thus, matching of blood-lead and predictor data must be done by county and census tract.

The predictor database was created to have one observation for each of the 2,952 census tracts. An examination of the blood-lead data showed that there were more than 2,952 combinations of county and census tract. In order to determine why there were extra combinations, several small, rural counties (i.e., counties with small numbers of census tracts) were selected, and a list of all census tracts in these counties was produced. The list showed that in several cases, there were invalid census tracts within the counties. For example, Adams county has six census tracts (770100, 770200, 770300, 770400, 770500, 770600), but the blood-lead data also had 144 records in Adams County with invalid census tract numbers 2300, 4000, 11300, 32300, 600603, 951500, 951600, 952600, 952700, 955100, and 955200.

During earlier examination of the census tracts (Step 7 of geocoding), it was noticed that several communities were located close to county lines. Thus, it may be possible that a house in one county might have a mailing address in an adjacent county. The reference database would be expected to match the address to the correct census tract (and, thus, the actual county of residence rather than the county provided with the mailing address). An investigation of the counties adjacent to Adams County showed that Scioto County contained census tracts 2300 and 4000 that are adjacent to Adams County, Brown County contained census tracts 951500 and 951600 that are adjacent to Adams County, Pike County contained census tract 952700 that is adjacent to Adams County, and Highland County contained census tract 955100 that is adjacent to Adams County.

Assuming that the reference database provides the correct census tract for the address, it was decided that if the census tract for an address in a particular county was invalid, but the census tract number matched a census tract in an adjacent county that abutted the

county on record, then the county in the blood-lead database would be changed to match the adjacent county (where the census tract was located). For example, addresses in Adams County where the census tract was 2300 or 4000 were reassigned to Scioto County. This resulted in reassigning 113 of the 144 addresses with invalid census tracts in Adams County.

To implement this adjustment, all census tracts in adjacent counties that abutted a particular county were identified and placed in a database. This database was matched to all records in the blood-lead database with invalid census tract numbers. If the invalid census tract was in the database of adjacent tracts, the county name was changed in the blood-lead database. All records whose counties were modified were combined with the records with valid county/census tract combinations for the final analysis database. Any records with invalid census tract numbers and no matching census tract in an adjacent county were eliminated from the analysis.

4. Statistical Model and Methods

The specific blood-lead variable of interest in the predictive model is the proportion of the population whose blood-lead concentrations is equal to or exceeds some threshold value. In the past, the threshold value was 10 μg/dL, but recently CDC has been using 5 μg/dL as the threshold for elevated blood-lead. The proportions of interest (for each census tract) are calculated in two steps. First, two indicator variables are defined for each subject that are equal to 1 if (1) the child's blood-lead level is greater than or equal to 10 μg/dL and (2) the child's blood-lead concentration is greater than or equal to 5 μg/dL. Second, the proportion of children with elevated blood-lead levels (using the two definitions) is determined by taking the average of the indicator variables across all children within a census tract.

The statistical model/method that is used to predict probabilities of events (e.g., elevated blood-lead levels) using various predictors is logistic regression. The mathematical model for logistic regression when all predictors are continuous variables can be written as

$$\text{logit}(p_j) = \alpha + \sum_{i=1}^{k} \beta_i X_{ij} ,$$

where p_j is the probability of elevated blood-lead levels in census tract j, k is the number of predictors, X_{ij} is the value of the ith predictor variable in census tract j, and α and β_1 to β_k are unknown parameters that will be estimated from the data. When fitting the model, each predictor is evaluated regarding the strength of its association with the probability of elevated blood-lead levels, with a calculated "p-value" indicating the strength of association. This model can be transformed to provide a method for estimating the probability of elevated blood-lead levels. Specifically, for any set of predictors X_1 to X_k,

$$p = \frac{\exp\left(\alpha + \sum_{i=1}^{k} \beta_i X_i\right)}{1 + \exp\left(\alpha + \sum_{i=1}^{k} \beta_i X_i\right)} .$$

Logistic regression is most often performed by fitting a model with all predictor variables included; any predictors that are not statistically significant contributors (i.e., p-value > 0.05) are eliminated and the model is re-run with a final set of predictors. As an alternative, models can be built iteratively, either by adding the most significant predictor not currently in the model (forward selection), eliminating the most insignificant predictor currently in the model (backward selection) or a combined approach that allows one to enter or remove predictors at each step (stepwise selection). For this analysis, stepwise selection was chosen, with a p-value to enter of 0.15 and a p-value to remove of 0.15.

An examination of the list of predictors indicates that there may be several predictors that are highly correlated, leading to issues of collinearity issues. These issues are somewhat resolved by using stepwise selection – if one predictor of a highly-correlated pair is entered into the model, the second predictor of the pair is less likely to be added because its relationship to the proportion of children with elevated BLLs is already incorporated using the first predictor.

Another method that can be used to address the potential collinearity issues with the predictor variables is the use of principal components analysis (PCA) to combine the predictors and reduce their number. PCA seeks to partition the total variability in the values of all predictors into a set of orthogonal factors that are linear combinations of the predictors. The first PC explains the largest proportion of the variability, with subsequent PCs explaining smaller proportions of the variability. It is hoped that the PCs are found to provide clearly explainable factors. For example, if a PC has high, relatively-equal weights on all socioeconomic predictors and low weights on all other predictors, that PC represents an overall socioeconomic status of the census tract. If PCA partitions the predictors into a smaller group of clearly identifiable factors, those factors can be used as the predictors in the logistic regression analysis rather than using the original predictors.

5. Statistical Analysis Results

Figure 2 shows the distribution of the observed proportion of children per census tract with blood-lead concentrations of 10 μg/dL or more, and Figure 3 shows the distribution of the observed proportion of children per census tract with blood-lead levels (BLLs) equal to 5 μg/dL or more. Figure 2 shows that 1,097 census tracts had no children with BLLs equal to or above 10 μg/dL, and Figure 3 shows that of those 1,097 census tracts, 86 had no children whose BLLs were greater than or equal to 5 μg/dL.

```
                          Histogram                          #             Boxplot
0.49+*                                                       3                0
    .*                                                       1                0
    .*                                                       5                0
    .*                                                       6                0
    .*                                                       9                0
    .*                                                       6                0
    .*                                                      15                0
    .*                                                      20                0
    .*                                                      18                |
    .**                                                     30                |
    .**                                                     36                |
    .**                                                     28                |
0.25+***                                                    52                |
    .**                                                     46                |
    .****                                                   80                |
    .*****                                                  97                |
    .******                                                119                |
    .*******                                               160                |
    .**********                                            212             +-----+
    .************                                          270             |     |
    .***************                                       341             *--+--*
    .**********                                            220             |     |
    .***                                                    68             |     |
    .*                                                       3             |     |
0.01+**************************************************  1097             +-----+
     ----+----+----+----+----+----+----+----+----+---
     * may represent up to 23 counts
```

Figure 2. Distribution of Observed Proportions of Children with BLL ≥ 10 (by Census Tract)

Table 3 shows the results of a correlation analysis of the predictor variables. Specifically, Table 3 contains the Pearson correlation between every pair of the 25 predictors. As expected, there are several strong correlations between predictors such as female head and African American, female head and poverty, and unemployment and poverty, among others. As a result, either principal components analysis or stepwise selection of predictors will be required to avoid collinearity issues.

Table 3. Correlations between Predictors (Percentages)

	Age<6	Age>64	Asian	Black	Hispan	Mixed Race	HS	College	Immig	Married	F head	F head & child
Age > 64	-0.418											
Asian	-0.114	-0.153										
Black	0.282	-0.149	-0.075									
Hispanic	0.268	-0.225	0.048	0.066								
Mixed Race	0.450	-0.341	0.045	0.313	0.543							
HS	-0.400	0.185	0.258	-0.414	-0.317	-0.341						
College	-0.305	0.008	0.524	-0.240	-0.146	-0.194	0.667					
Immigrant	0.072	-0.218	0.196	0.007	0.096	0.128	-0.031	0.088				
Married	-0.177	0.296	0.000	-0.632	-0.247	-0.469	0.525	0.312	-0.141			
F head	0.529	-0.242	-0.189	0.723	0.237	0.479	-0.543	-0.453	0.009	-0.609		
F head & child	0.699	-0.325	-0.183	0.704	0.287	0.554	-0.549	-0.441	0.038	-0.582	0.856	
Poverty	0.477	-0.322	-0.125	0.588	0.296	0.510	-0.663	-0.445	0.090	-0.719	0.710	0.742
Poverty & Child	-0.160	0.060	-0.026	0.307	0.071	0.156	-0.271	-0.150	0.018	-0.433	0.201	0.159
Pub assist	0.419	-0.201	-0.151	0.496	0.271	0.439	-0.570	-0.418	0.031	-0.524	0.604	0.652
Unemployed	0.351	-0.124	-0.176	0.572	0.226	0.388	-0.624	-0.477	0.011	-0.608	0.627	0.642
Income-pov < 1	0.343	-0.266	-0.130	0.465	0.267	0.445	-0.575	-0.402	0.067	-0.611	0.564	0.572
Income-pov > 2	-0.490	0.307	0.192	-0.585	-0.297	-0.525	0.745	0.592	-0.089	0.738	-0.728	-0.747
House pre 1950	0.217	-0.256	-0.211	0.359	0.220	0.349	-0.447	-0.287	0.003	-0.507	0.415	0.410
Renter	0.305	-0.298	0.141	0.518	0.279	0.510	-0.443	-0.190	0.241	-0.799	0.507	0.558
20+ units	-0.123	0.093	0.240	0.233	0.058	0.112	-0.061	0.122	0.132	-0.397	-0.003	0.030
Rural	-0.135	0.042	-0.233	-0.329	-0.215	-0.417	0.023	-0.211	-0.089	0.388	-0.326	-0.342
Vacant	0.243	-0.193	-0.110	0.553	0.163	0.336	-0.479	-0.306	0.046	-0.566	0.507	0.519
Pop density	0.160	-0.297	0.170	0.431	0.278	0.402	-0.181	0.058	0.126	-0.578	0.383	0.378
House density	0.180	-0.237	0.128	0.499	0.244	0.376	-0.221	0.016	0.094	-0.589	0.403	0.399

Table 3 (continued). Correlations between Predictors (Percentages)

	Poverty	Poverty & Child	Pub assist	Unemployed	Income-pov < 1	Income-pov > 2	House pre 1950	Renter	20+ units	Rural	Vacant	Pop density
Poverty & Child	0.286											
Pub assist	0.688	0.199										
Unemployed	0.741	0.252	0.629									
Income-pov < 1	0.847	0.293	0.535	0.584								
Income-pov > 2	-0.902	-0.317	-0.670	-0.741	-0.782							
House pre 1950	0.476	0.297	0.421	0.439	0.432	-0.528						
Renter	0.699	0.350	0.489	0.509	0.592	-0.705	0.383					
20+ units	0.218	0.258	0.117	0.162	0.176	-0.184	0.014	0.558				
Rural	-0.235	-0.172	-0.207	-0.172	-0.184	0.190	-0.101	-0.418	-0.244			
Vacant	0.594	0.349	0.427	0.522	0.498	-0.617	0.504	0.524	0.156	-0.139		
Pop density	0.402	0.245	0.286	0.274	0.354	-0.384	0.423	0.547	0.275	-0.507	0.347	
House density	0.423	0.275	0.314	0.309	0.355	-0.418	0.464	0.574	0.322	-0.467	0.434	0.943

```
                              Histogram                          #             Boxplot
      0.975+*                                                     1                *
           .
           .*                                                     3                *
           .*                                                     4                0
           .**                                                   15                0
           .***                                                  36                0
           .****                                                 48                0
           .******                                               62                0
           .******                                               67                |
           .*********                                            98                |
           .***********                                         130                |
           .*************                                       155                |
           .******************                                  215             +-----+
           .*******************************                     368             |  +  |
           .*******************************************         502             *-----*
           .************************************************   559             +-----+
           .*********************************                  390                |
           .***************                                      177                |
           .***                                                   26                |
      0.025+********                                              86                |
            ----+----+----+----+----+----+----+----+----+--
            * may represent up to 12 counts
```

Figure 3. Distribution of Observed Proportions of Children with BLL ≥ 5 (by Census Tract)

Principal components analysis (PCA) was performed to examine the variability within and between the 25 predictor variables. Table 4 shows the proportion of variability explained by each of the first 10 PCs, and Table 5 shows the factor loadings for each of the first 10 PCs (factor loadings are the multipliers for each predictor associated with the PC). To identify the predictors that most significantly contribute to a PC, one looks for the predictors with the largest loadings. As a general rule of thumb, it is recommended that one should select all PCs whose eigenvalue is greater than 1, although some will choose to identify significant PCs based on the relationship between the proportion explained by each PC and the cumulative proportion explained to that point. From Table 3, one could either choose the first six PCs, which explain 74% of the total variability between census tracts with respect to the 25 predictors, or one might choose to select 8 PCs, where the cumulative proportion of variance explained exceeds 80% and the proportion explained by each individual PC drops below 2.5%.

An examination of the factor loadings in Table 4 shows that the first principal component is mainly a function of pct_black, pct_f_head, pct_fh_ch, pct_hs_ed, pct_married, pct_mixed, pct_poverty, pct_pubasst, pct_renter, pct_unemploy, pct_inpov1, pct_inpov2. In general, this is a combination of household characteristics and socioeconomic status. The second PC is mainly a combination of pct_asian, pct_cl_ed, pct_rur, pct_un_20, popden, and houseden, which is a different combination of some of the other household and socioeconomic characteristics. The third PC is mainly a combination of pct_age_5, pct_age_65, and pct_poverty, which is a combination of population and socioeconomic

characteristics. The fourth PC is mainly the predictor pct_fr_00. The fifth PC is mainly a combination of pct_hisp and pct_pre_50. The sixth PC is mainly a combination of pct_age_65 and pct_hisp.

Table 4. PCA Results – Proportion of Variability Explained for Each PC

PC Number	Eigenvalue	Proportion of Variability Explained	Cumulative Proportion Explained
1	10.3775	0.4151	0.4151
2	2.8773	0.1151	0.5302
3	1.8295	0.0732	0.6034
4	1.2586	0.0503	0.6537
5	1.1400	0.0456	0.6993
6	1.0420	0.0417	0.7410
7	0.7801	0.0312	0.7722
8	0.7227	0.0289	0.8011
9	0.5762	0.0230	0.8242
10	0.5398	0.0216	0.8457

Table 5. Factor Loadings for Each Principal Component

Predictor	Principal Component Number									
	1	2	3	4	5	6	7	8	9	10
pct_age_5	0.170	-0.133	0.451	-0.065	0.164	-0.071	-0.060	-0.120	-0.248	0.082
pct_age_65	-0.117	-0.071	-0.423	-0.113	0.174	0.443	0.250	-0.165	0.340	0.055
pct_asian	-0.040	0.390	0.155	0.215	0.180	-0.041	-0.284	0.396	0.384	0.043
pct_black	0.226	0.044	-0.147	-0.251	0.300	-0.133	0.094	0.111	0.026	0.326
pct_cl_ed	-0.150	0.398	0.098	-0.091	0.103	-0.093	-0.112	0.253	0.123	-0.070
pct_f_head	0.255	-0.093	0.060	-0.230	0.211	0.007	0.148	0.086	-0.015	0.076
pct_fh_ch	0.265	-0.088	0.162	-0.181	0.227	0.006	0.086	0.046	-0.117	0.113
pct_hisp	0.121	0.061	0.285	0.165	-0.399	0.520	-0.004	0.006	0.168	0.377
pct_hs_ed	-0.223	0.225	0.056	-0.196	0.110	-0.063	0.013	0.063	-0.142	-0.048
pct_married	-0.262	-0.125	0.155	-0.063	0.006	0.051	0.002	0.019	0.099	0.037
pct_mixed	0.198	0.095	0.280	0.040	-0.143	0.343	0.048	0.143	-0.210	0.017
pct_poverty	0.281	-0.073	-0.006	0.114	0.102	-0.011	-0.133	0.0250	0.090	-0.211
pct_pre_50	0.189	-0.026	-0.098	-0.120	-0.483	-0.222	-0.004	0.056	0.119	-0.146
pct_pubasst	0.229	-0.108	0.028	0.011	0.093	0.099	-0.019	0.016	0.349	-0.273
pct_renter	0.245	0.202	-0.054	0.228	0.111	-0.008	-0.091	-0.141	-0.184	0.010
pct_rur	-0.116	-0.335	-0.071	0.265	-0.192	-0.361	-0.256	-0.086	0.069	0.265
pct_un_20	0.079	0.308	-0.265	0.344	0.230	0.118	-0.255	-0.414	-0.183	0.188
pct_unemploy	0.244	-0.138	-0.067	0.006	0.100	0.015	-0.021	0.082	0.307	0.019
pct_vacant	0.214	-0.016	-0.174	-0.010	-0.083	-0.215	-0.040	0.230	0.116	0.534
popden_a	0.182	0.349	0.006	-0.278	-0.247	-0.093	0.031	-0.269	0.081	-0.076
houseden_a	0.191	0.333	-0.063	-0.270	-0.229	-0.136	0.005	-0.289	0.097	0.019
pct_pov_5	0.114	0.095	-0.429	0.126	-0.186	0.104	0.184	0.513	-0.423	-0.081
pct_fr_00	0.034	0.160	0.179	0.481	0.045	-0.296	0.756	-0.088	0.150	-0.013
pct_inpov1	0.243	-0.073	-0.045	0.160	0.016	0.022	-0.177	0.033	0.045	-0.394
pct_inpov2	-0.284	0.116	0.034	-0.128	-0.026	0.018	0.061	0.029	0.001	0.105

A review of the loadings does not show clearly identifiable underlying factors associated with each. As a result, the predictors have not been replaced by PCs, and the logistic regression will use the original 25 predictors.

Two logistic regression models were fitted to the data. The first used the proportion of children (per census tract) for whom BLL ≥ 10 μg/dL, and the second used the proportion of children (per tract) for whom BLL ≥ 5 μg/dL. Stepwise selection was used to choose the best set of predictors in each model.

Table 6 shows the results of the logistic regression using BLL ≥ 10 μg/dL. In particular, Table 6 shows the order in which the variables were entered, the estimated value of β (or α for the intercept) for each predictor in the final model that used all selected predictors, the significance of the predictor at the time of its entry into the model, and the odds ratio (with a 95% confidence interval) associated with an increase of 1 in the predictor variable.

Table 6. Logistic Regression Results for BLL ≥ 10 μg/dL

Step	Variable	df	Estimate	p-value	Odds Ratio	Lower CL	Upper CL
1	pct_pre_50	1	0.0268	<.0001	1.027	1.026	1.028
2	pct_black	1	0.00673	<.0001	1.007	1.006	1.008
3	pct_hs_ed	1	-0.00723	<.0001	0.993	0.989	0.996
4	pct_age_5	1	-0.0761	<.0001	0.927	0.911	0.943
5	pct_inpov2	1	-0.4957	<.0001	0.609	0.469	0.791
6	houseden	1	0.0351	<.0001	1.036	1.027	1.045
7	pct_hisp	1	0.0108	<.0001	1.011	1.008	1.014
8	pct_cl_ed	1	-0.00835	<.0001	0.992	0.989	0.994
9	pct_un_20	1	0.00514	<.0001	1.005	1.003	1.008
10	pct_age_65	1	0.0206	<.0001	1.021	1.015	1.027
11	pct_asian	1	0.0151	0.0001	1.015	1.007	1.023
12	pct_vacant	1	0.00395	0.0035	1.004	1.001	1.007
13	pct_fh_ch	1	0.0158	<.0001	1.016	1.008	1.024
14	pct_rural	1	0.00258	<.0001	1.003	1.001	1.004
15	pct_renter	1	0.00375	0.0005	1.004	1.002	1.006
16	pct_unemploy	1	0.0660	<.0001	1.007	1.003	1.010
17	pct_poverty	1	-0.0667	<.0001	0.993	0.990	0.997
18	pct_inpov1	1	0.4083	0.0191	1.504	1.069	2.116
19	pct_pov_5	1	0.00197	0.0478	1.002	1.000	1.004
	intercept	1	-5.2308				

The order that the predictors are entered into the model appears to make sense. The percentage of houses built prior to 1950 is the most important predictor of the proportion of elevated BLLs. For an increase of 1% in the proportion of houses built prior to 1950, there is a 2.7% increase in the proportion of children with elevated BLLs (if all other variables are held constant). Similarly, there is a 0.7% increase in the proportion of elevated BLLs when the percentage of African American people increases by 1. The percentage of children with elevated BLLs decreases by 0.7% when the percentage of people with a high-school degree increases by 1. The fourth significant predictor, the

proportion of children with elevated BLLs, decreases by 7.3% when the proportion of children younger than 6 in the census tract increases by 1%; similarly, the proportion of children with elevated BLLs increases by 2.1% when the percentage of people aged 65 and older increases by 1%. While these results may at first seem unusual, it should be noted that the model predicts the proportion of children with elevated BLLs and not the number of children with elevated BLLs, so the relationship between an increase in the proportion of children and the proportion of children with elevated BLLs is not necessarily positive. In addition, this factor is included after three other factors are already in the model, so its effects, after other affects are incorporated, may not appear as it would be expected.

Figure 4 is a scatterplot of the predicted and observed proportions of children with BLL ≥ 10 μg/dL. A perfect model would have a line of plots rising diagonally from the lower left to the upper right corners of the plot along the red line. Figure 4 clearly shows that the model is not perfect in identifying census tracts with higher proportions of children with elevated BLLs. For example, there is one census tract (Tract 210602 in Greene County) where the observed proportion of children with elevated BLLs was 0.111 but the predicted proportion was 0.002. However, in general, the data points are mostly concentrated around the line of equality.

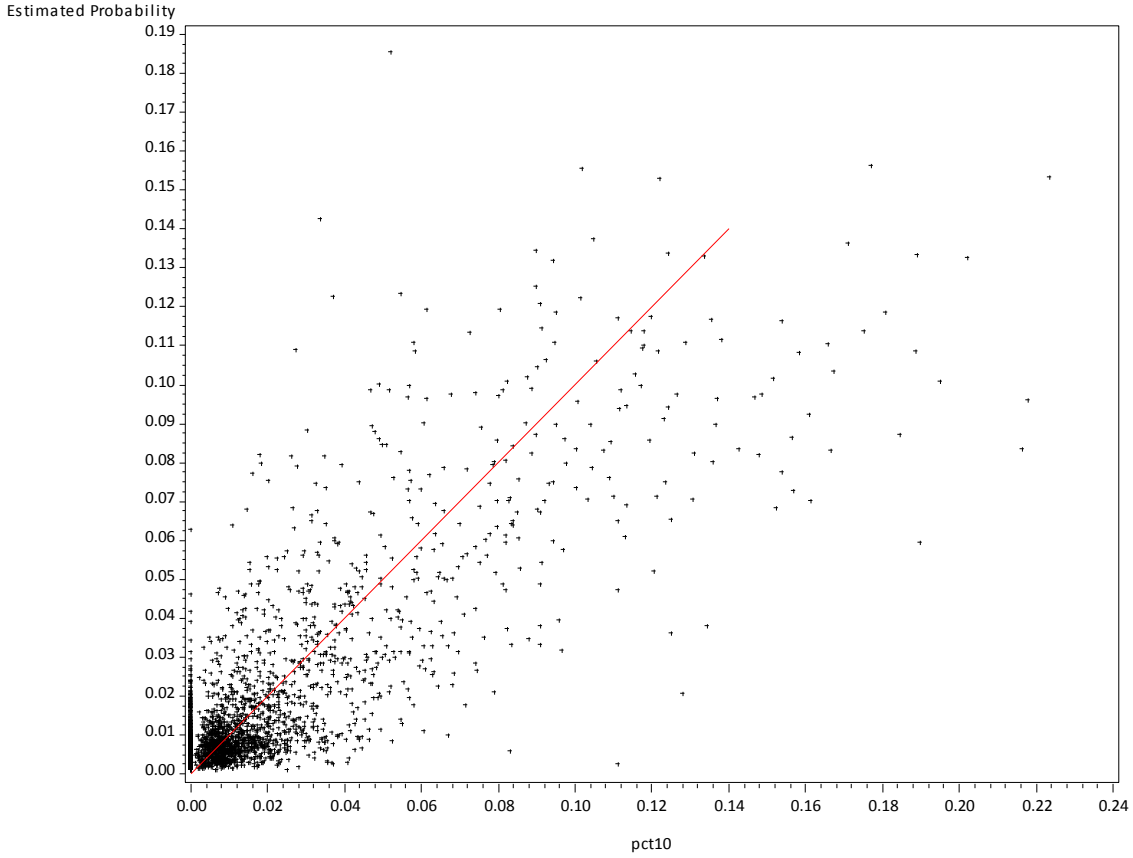


Figure 4. Predicted Versus Observed Proportion of Children with BLL ≥ 10 μg/dL

Figure 5 maps the predicted probability of BLLs ≥ 10 μg/dL by census tract for the entire state of Ohio. Individual county maps showing the predicted probability of BLLS≥ 10 μg/dL by census tract are shown in Appendix B. Table A.1 (Appendix A) provides a list of 240 Ohio census tracts where the predicted proportion of children with BLLs ≥ 10 μg/dL is greater than 5%. These census tracts are ordered from highest to lowest predicted proportion of elevated BLLs. Table A.1 shows that a large majority of census tracts with high estimated probability of elevated BLLs is in Cuyahoga County.

Table 7 shows the results of the logistic regression using the proportion of children with BLL ≥ 5 μg/dL as the response variable. A comparison of Tables 6 and 7 shows that three of the first four predictors entered into the models were the same and that both models contain mostly the same variables, although the order of entry differs between the two models. Also, the odds ratios for the predictors in the two models are similar, although not exactly equal.

Table 7. Logistic Regression Results for BLL ≥ 5 μg/dL

Step	Variable	df	Estimate	p-value	Odds Ratio	Lower CL	Upper CL
1	pct_pre_50	1	0.0168	<.0001	1.017	1.016	1.017
2	pct_inpov2	1	-0.6969	<.0001	0.498	0.440	0.564
3	pct_age_5	1	-0.0843	<.0001	0.919	0.912	0.926
4	pct_black	1	0.00221	<.0001	1.002	1.002	1.003
5	pct_cl_ed	1	-0.00574	<.0001	0.994	0.993	0.995
6	pct_unemploy	1	0.00865	<.0001	1.009	1.007	1.010
7	houseden	1	0.0923	<.0001	1.097	1.082	1.111
8	pct_pubasst	1	0.0117	<.0001	1.012	1.009	1.014
9	pct_mixed	1	0.0530	<.0001	1.054	1.047	1.062
10	popden	1	-0.0348	<.0001	0.966	0.959	0.973
11	pct_age_65	1	0.0112	<.0001	1.011	1.009	1.014
12	pct_fh_ch	1	0.0189	<.0001	1.019	1.015	1.023
13	pct_hisp	1	-0.00608	<.0001	0.994	0.992	0.995
14	pct_hs_ed	1	-0.00595	<.0001	0.994	0.992	0.996
15	pct_rur	1	0.000942	<.0001	1.001	1.001	1.001
16	pct_pov_5	1	-0.00245	<.0001	0.998	0.997	0.998
17	pct_f_head	1	-0.00413	<.0001	0.996	0.994	0.998
18	pct_poverty	1	-0.00463	<.0001	0.995	0.994	0.997
19	pct_inpov1	1	0.3954	<.0001	1.485	1.244	1.773
20	pct_un_20	1	-0.00181	0.0008	0.998	0.997	0.999
21	pct_asian	1	0.00522	0.0179	1.005	1.001	1.010
	intercept		-2.0761	<.0001			

Figure 6 is a scatterplot of the predicted and observed proportions of children with BLLs equal to or exceeding 5 μg/dL. The points in Figure 6 appear to have a generally tighter fit to the line of equality than in Figure 4, indicating that the model predicting the probability of exceeding 5 μg/d provides a better fit than the model predicting the

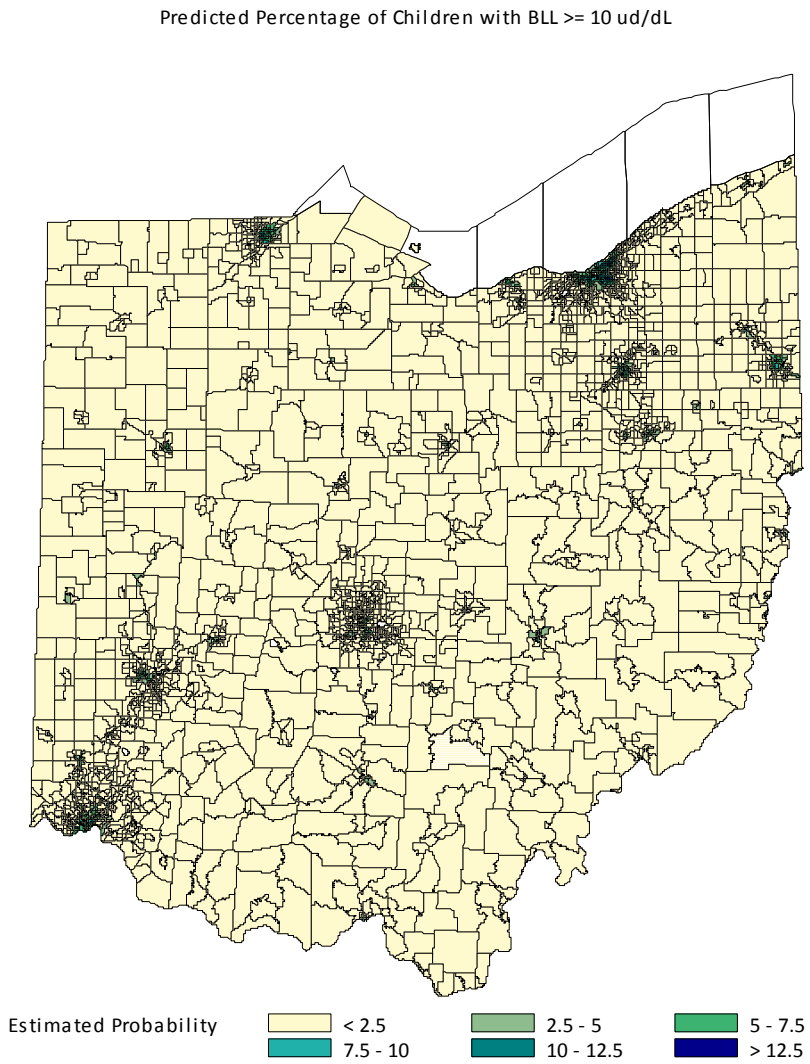


Figure 5. Predicted Percentage of Children with BLL ≥ 10 μg/dL by Census Tract

probability that BLLs that are equal to or exceed 10 μg/dL. However, there are a group of census tracts where the predicted probability of children's BLL ≥ 5 is much smaller than the observed proportions. The reason that this group of census tracts is poorly predicted is unclear, but may be due to the absence of an important predictor from the analysis. Table 8 provides a listing of these census tracts, along with their observed and predicted probabilities of BLL ≥ 5 μg/dL.

Table 8. Census Tracts with High Observed and Low Predicted Probabilities of BLL ≥ 5 μg/dL

County	Census Tract	Predicted Prob	Obs Prob	County	Census Tract	Predicted Prob	Obs Prob
CARROLL	720100	0.07088	0.34426	STARK	712102	0.05136	0.34123
CARROLL	720300	0.07185	0.31959	STARK	712111	0.04194	0.39516
CARROLL	720400	0.08198	0.30597	STARK	712112	0.04360	0.39130
CARROLL	720500	0.09011	0.23442	STARK	712201	0.05166	0.36842
CARROLL	720600	0.10885	0.22857	STARK	712202	0.05038	0.42754
COLUMBIANA	951000	0.09381	0.26087	STARK	712300	0.08106	0.36967
FRANKLIN	4300	0.07970	0.20430	STARK	712400	0.08461	0.32933
HAMILTON	3200	0.10403	0.23256	STARK	712500	0.07579	0.28571
LUCAS	10400	0.08444	0.21429	STARK	712601	0.05757	0.26712
MONTGOMERY	90700	0.06250	0.21818	STARK	712602	0.06564	0.32287
MORROW	965400	0.06922	0.25000	STARK	712700	0.08221	0.32749
SENECA	963600	0.09736	0.21605	STARK	712900	0.10409	0.29060
STARK	700700	0.09991	0.42244	STARK	713000	0.08970	0.39063
STARK	710600	0.08845	0.22026	STARK	713201	0.10003	0.46939
STARK	710900	0.06900	0.39683	STARK	713202	0.06953	0.49451
STARK	711000	0.05834	0.21116	STARK	713300	0.05677	0.30693
STARK	711121	0.03745	0.23913	STARK	713401	0.08736	0.33921
STARK	711122	0.03944	0.34028	STARK	713402	0.07203	0.30899
STARK	711202	0.07153	0.21978	STARK	713501	0.05157	0.27957
STARK	711211	0.05603	0.23153	STARK	713502	0.06906	0.32645
STARK	711311	0.04308	0.30675	STARK	714000	0.08859	0.26496
STARK	711312	0.03605	0.37313	STARK	714302	0.09064	0.25591
STARK	711321	0.05219	0.37097	STARK	714400	0.07907	0.35000
STARK	711322	0.06665	0.38095	STARK	714600	0.10220	0.31148
STARK	711402	0.04258	0.36813	STARK	714701	0.07679	0.25210
STARK	711411	0.04251	0.25758	STARK	714702	0.08869	0.32258
STARK	711412	0.06695	0.22472	STARK	714801	0.10462	0.26577
STARK	711501	0.06630	0.32432	STARK	714802	0.07637	0.45902
STARK	711502	0.05402	0.45745	STARK	714901	0.08680	0.39716
STARK	711600	0.09663	0.34914	TUSCARAWAS	20300	0.04460	0.25385
STARK	711700	0.08386	0.36039	WAYNE	3100	0.05731	0.24706
STARK	711800	0.05453	0.32414	WAYNE	3200	0.06084	0.23077
STARK	711900	0.08251	0.44156	WAYNE	3300	0.06009	0.22222
STARK	712000	0.06388	0.42143				

Table A.2 (Appendix A) lists 1052 census tracts where the predicted probability is greater than 10% that a child's BLL ≥ 5 μg/dL. The list is sorted from highest to lowest predicted probability of a child's BLL exceeding 5μg/dL. Figure 7 maps the predicted probability of BLLs ≥ 5 μg/dL by census tract for the entire state of Ohio. Appendix C contains similar plots for each of the 88 individual counties to more clearly show the predicted proportions of children in each census tract with BLL ≥ 5 μg/dL.

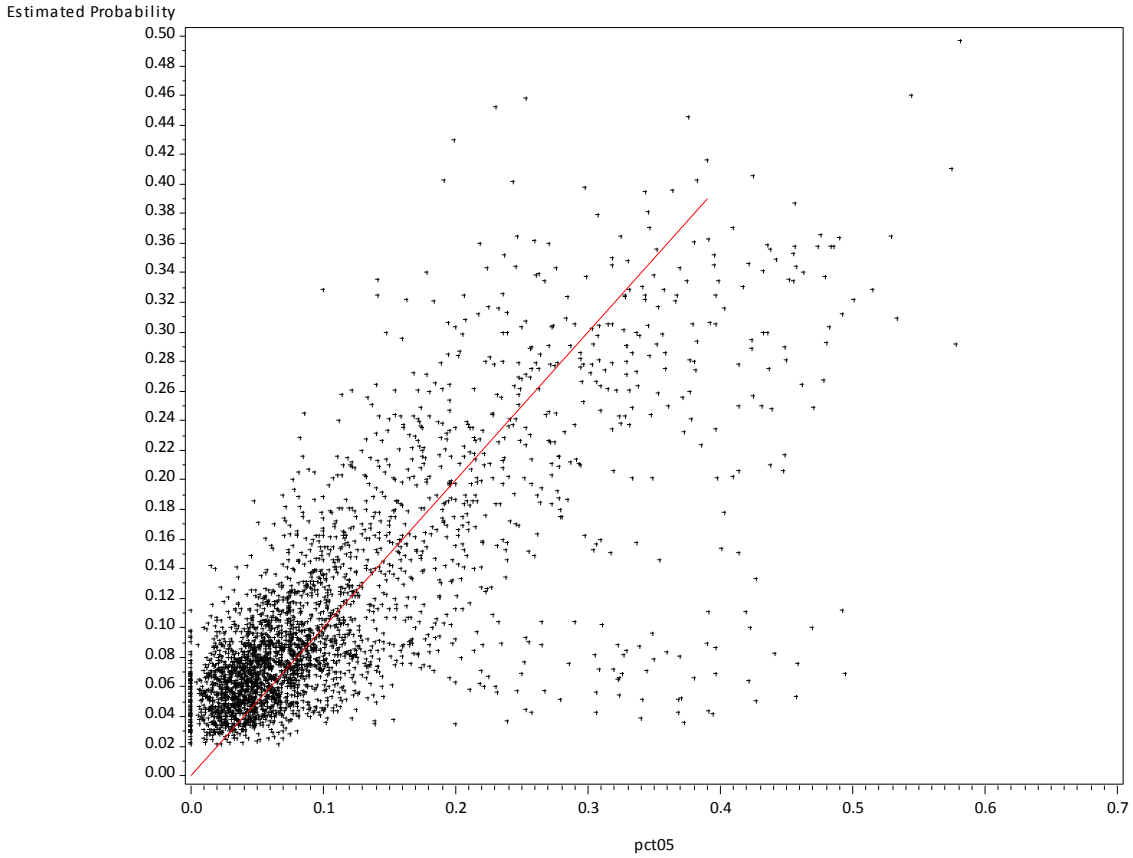


Figure 6. Predicted Versus Observed Proportion of Children with BLL ≥ 5 μg/dL

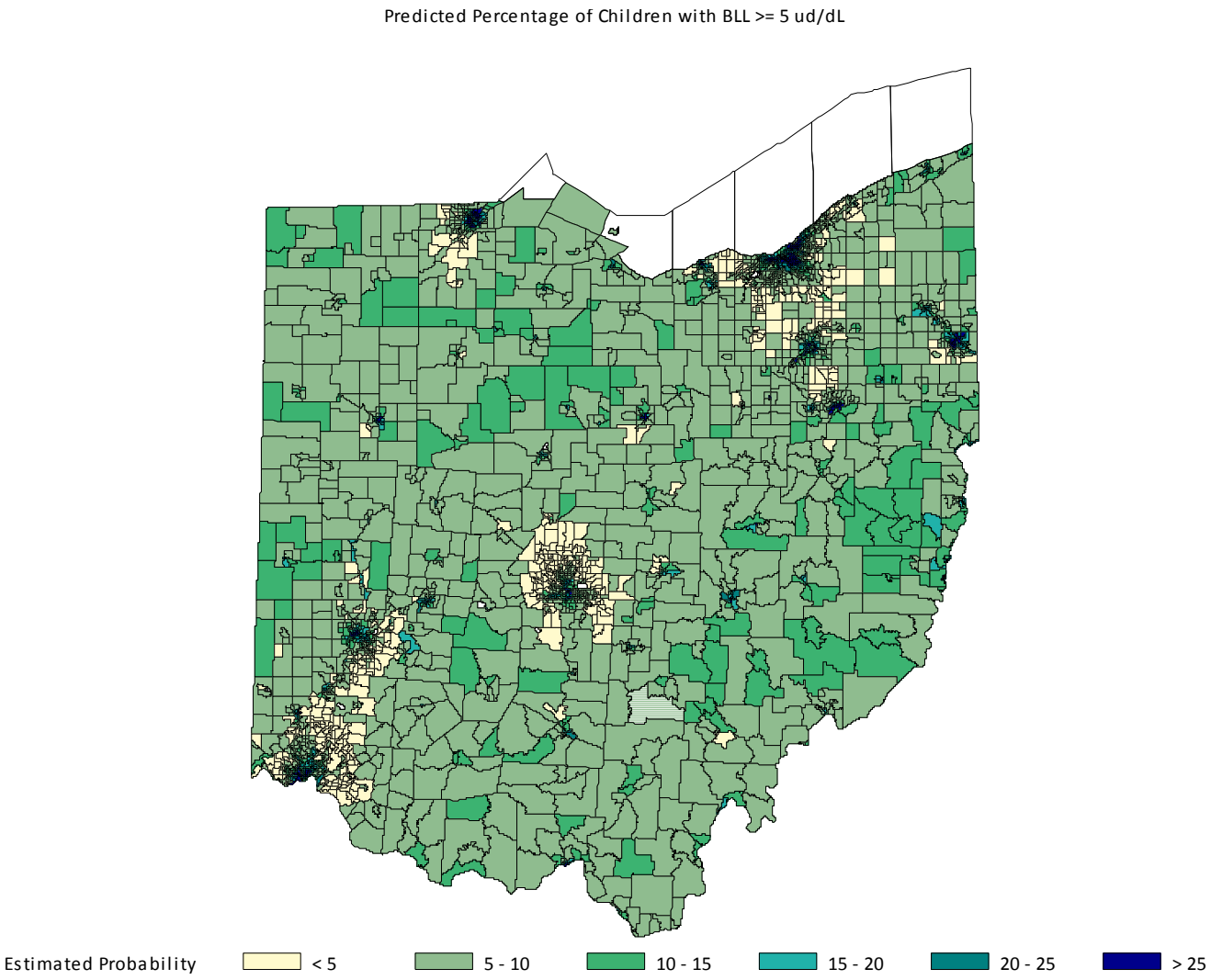


Figure 7. Predicted Percentage of Children with BLL ≥ 5 μg/dL by Census Tract

6. Conclusions and Discussion

Several conclusions are clear regarding the results of the statistical modeling and analysis.

- The four variables that most significantly affect the predicted probability of elevated BLLs are the percentage of houses built before 1950, the proportion of the population that is African American, the percentage of the population with a high-school or college degree, and the percentage of families whose income-to-poverty ratio exceeds 2. These four variables are significant drivers of the conclusions that follow.

- Table A.2 and the figures in Appendix B show that the highest predicted probabilities of BLLs ≥ 5 μg/dL occur in the heart of the primary urban areas of Ohio. These areas generally have a large proportion of older homes, a high percentage of African American people, a low proportion of educated people, and low income-to-poverty ratios. The metropolitan (urban) areas include:
    - Cleveland (Cuyahoga County),
    - Cincinnati (Hamilton County),
    - Columbus (Franklin County),
    - Akron (Summit County),
    - Toledo (Lucas County),
    - Youngstown (Mahoning County),
    - Dayton (Montgomery County), and
    - Canton (Stark County).

- The largest number of census tracts with high probabilities of BLL ≥ 5 μg/dL is found in Cuyahoga County. Of the top 100 census tracts with the highest probabilities of elevated BLLs, over 50 are from Cuyahoga County.

- Figure 6 shows that the census tracts with the lowest risk of elevated BLLs (i.e., less than 5% probability) are found in areas at the edges of the major urban centers. For example, many of the census tracts in the suburban areas surrounding Columbus appear in yellow in Figure 6. These census tracts correspond to areas where new homes are being built (so the percentage of pre-1950 homes is small), where higher-educated people and higher-income families are living, and where the percentages of African Americans are small.

- Figure 6 shows that most census tracts located in rural areas or areas where small towns are located have between 5 and 15% probability of BLL ≥ 5 μg/dL.

- The figures in Appendix B show that for some smaller cities in generally rural or suburban counties, the probabilities of BLLs ≥ 5 μg/dL can reach 15% or higher. These cities (counties) include:

- Lima (Allen),
- Bellaire, Bridgeport, and Martins Ferry (Belmont),
- Middletown and Hamilton (Butler),
- Springfield (Clark),
- Wilmington (Clinton),
- East Liverpool and Wellsville (Columbiana),
- Coshocton (Coshocton),
- Bucyrus and Galion (Crawford),
- Greenville (Darke),
- Sandusky (Erie),
- Xenia (Greene),
- Cambridge (Guernsey)
- Steubenville (Jefferson),
- Newark (Licking),
- Bellefontaine (Logan),
- Lorain and Elyria (Lorain),
- London (Madison),
- Marion (Marion),
- Middleport (Meigs),
- Piqua and Troy (Miami),
- Zanesville (Muskingum),
- Circleville (Pickaway),
- Ashland (Richland),
- Chillicothe (Ross),
- Fremont (Sandusky),
- Portsmouth (Scioto),
- Tiffin and Fostoria (Seneca),
- Warren and Girard (Trumbull),
- Marietta (Washington), and
- Orrville (Wayne).

In the past, ODH has focused on zip codes rather than census tracts in order to allow for easy identification of children who should be screened for lead exposure. As noted earlier, predictor variables obtained from the U.S. Census are available for census tracts but not always for zip codes. Maps of census tracts by county, which can be found at http://www.census.gov/geo/www/maps/pl10_map_suite/st39_tract.html, and for zip codes show that there are not many places where census tracts and zip codes align in a reasonable manner. Thus, a direct conversion from census tracts to zip codes cannot easily be made. A risk-based conversion was created by

- overlaying census tract and zip code maps and identifying all regions defined by the intersections of zip code and census tract,
- for each region, assigning the predicted probability of elevated BLL to be equal to the predicted probability of elevated BLL for the associated census tract; and
- calculating the predicted probability of an elevated BLL in a zip code as the maximum predicted probability over all regions that contain the zip code.

This procedure was applied separately for the 10 and 5 μg/dL definitions of elevated BLLs. Defining the zip-code probability of elevated BLL as the maximum over all census tracts in the zip code ensures that all parts of census tracts with high risk of elevated BLLS will be included in high-risk zip codes (whereas, if a weighted average of intersecting census tracts had been used, it would be possible that a portion of a high-risk census tract might have been missed if it was part of a zip code that also contained other lower-risk census tracts).

Table 8 lists all 40 zip codes where there is less than a 5% chance of a BLL ≥ 5 μg/dL, using this conversion. Table 9 lists the 753 Ohio zip codes that contain at least part of a census tract where there is at least a 10% probability that a child's BLL ≥ 5 μg/dL. Figure 8 plots the predicted probability that a child's BLL ≥ 5 μg/dL by zip code, and Figure 9 plots the predicted probability that a child's BLL ≥ 10 μg/dL by zip code

Table 8. Ohio Zip Codes Where there is Less than 5% Predicted Probability of BLL ≥ 5 μg/dL.

43002	43018	43109	43240	43328	44011	44080	44368	45039	45147
43004	43026	43116	43260	43414	44016	44149	44424	45050	45301
43016	43035	43136	43265	43525	44023	44243	44630	45069	45437
43017	43065	43165	43299	43815	44056	44262	44697	45073	45489

Table 9. Ohio Zip Codes with at Least 10% Probability of BLL ≥ 5 μg/dL

43003	43229	43545	43772	43988	44134	44436	44691	44905	45233	45402	45679
43005	43230	43548	43777	44001	44135	44438	44695	44906	45234	45403	45682
43008	43231	43550	43778	44003	44137	44440	44699	44907	45235	45404	45688
43015	43232	43553	43779	44004	44138	44441	44701	44966	45236	45405	45692
43025	43233	43557	43780	44005	44139	44444	44702	44967	45237	45406	45693
43044	43234	43567	43782	44012	44143	44445	44703	45002	45238	45407	45694
43046	43235	43601	43786	44017	44144	44446	44704	45003	45239	45408	45697
43050	43287	43602	43787	44021	44145	44449	44705	45004	45240	45409	45701
43051	43301	43603	43788	44030	44146	44455	44706	45011	45241	45410	45705
43054	43302	43604	43789	44035	44147	44460	44707	45012	45242	45412	45711
43055	43306	43605	43791	44036	44177	44471	44708	45013	45243	45413	45714
43056	43307	43606	43793	44039	44195	44480	44709	45014	45244	45414	45715
43058	43310	43607	43798	44041	44197	44481	44710	45015	45245	45415	45716
43062	43311	43608	43811	44044	44201	44482	44711	45020	45246	45416	45719
43072	43314	43609	43812	44047	44203	44483	44712	45033	45247	45417	45727
43076	43316	43610	43821	44052	44221	44484	44714	45042	45248	45418	45732
43078	43324	43611	43832	44053	44222	44485	44718	45043	45249	45419	45734
43079	43326	43612	43836	44055	44223	44486	44719	45044	45250	45420	45740
43093	43330	43613	43840	44057	44230	44488	44720	45052	45251	45422	45744
43105	43331	43614	43844	44070	44236	44501	44721	45062	45252	45423	45745
43107	43332	43615	43901	44074	44242	44502	44730	45066	45255	45424	45746
43113	43346	43617	43903	44075	44250	44503	44766	45092	45282	45425	45750
43115	43351	43620	43906	44076	44266	44504	44772	45112	45299	45426	45760
43128	43359	43623	43907	44077	44270	44505	44798	45123	45303	45427	45761
43130	43402	43624	43908	44082	44288	44506	44802	45130	45304	45428	45764
43138	43405	43643	43909	44087	44300	44507	44804	45133	45305	45429	45766
43140	43406	43652	43910	44088	44301	44509	44805	45144	45306	45430	45767
43142	43407	43660	43912	44090	44302	44510	44806	45167	45308	45431	45769
43143	43408	43661	43913	44092	44303	44511	44807	45169	45311	45432	45771
43145	43413	43701	43917	44093	44304	44512	44809	45177	45312	45433	45779
43151	43416	43702	43920	44094	44305	44514	44811	45200	45317	45434	45780
43153	43420	43711	43928	44101	44306	44515	44815	45201	45318	45439	45782
43155	43431	43713	43933	44102	44307	44601	44817	45202	45320	45440	45786
43160	43432	43716	43934	44103	44308	44608	44818	45203	45321	45444	45788
43164	43437	43717	43935	44104	44309	44609	44820	45204	45324	45449	45789
43201	43445	43718	43938	44105	44310	44611	44825	45205	45325	45458	45801
43202	43449	43719	43939	44106	44311	44612	44827	45206	45326	45459	45802
43203	43450	43720	43940	44107	44312	44613	44828	45207	45328	45470	45803
43204	43452	43722	43943	44108	44313	44615	44830	45208	45331	45501	45804
43205	43457	43723	43944	44109	44314	44621	44833	45209	45332	45502	45805
43206	43458	43724	43945	44110	44315	44622	44841	45210	45335	45503	45806
43207	43460	43725	43946	44111	44316	44626	44842	45211	45338	45504	45808
43208	43465	43726	43947	44112	44319	44627	44844	45212	45342	45505	45810
43209	43466	43728	43948	44113	44320	44638	44845	45213	45344	45506	45812
43210	43469	43730	43950	44114	44321	44640	44849	45214	45346	45542	45832
43211	43502	43731	43951	44115	44322	44641	44851	45215	45347	45543	45833
43212	43505	43732	43952	44116	44325	44643	44854	45216	45352	45570	45839
43213	43506	43733	43953	44117	44333	44644	44860	45217	45356	45601	45840
43214	43507	43735	43962	44118	44397	44646	44865	45218	45362	45608	45841
43215	43510	43738	43963	44119	44403	44647	44867	45219	45365	45612	45843
43216	43511	43747	43964	44120	44405	44651	44870	45220	45368	45614	45850
43217	43512	43748	43968	44121	44406	44657	44871	45221	45371	45621	45854
43218	43516	43749	43971	44122	44411	44662	44875	45222	45373	45631	45856
43219	43517	43750	43972	44123	44413	44663	44878	45223	45380	45638	45859
43220	43518	43754	43973	44124	44415	44667	44882	45224	45381	45640	45872
43221	43521	43755	43974	44125	44420	44669	44883	45225	45382	45648	45874
43222	43523	43756	43976	44126	44423	44672	44887	45226	45384	45656	45882
43223	43524	43758	43977	44127	44425	44675	44888	45227	45385	45657	45887
43224	43527	43759	43981	44128	44427	44676	44889	45228	45387	45659	45891
43225	43529	43761	43983	44129	44428	44683	44901	45229	45390	45660	45894
43226	43534	43764	43984	44130	44430	44688	44902	45230	45400	45662	45895
43227	43535	43766	43985	44131	44431	44689	44903	45231	45401	45663	45898
43228	43543	43771	43986	44132	44432	44690	44904	45232			

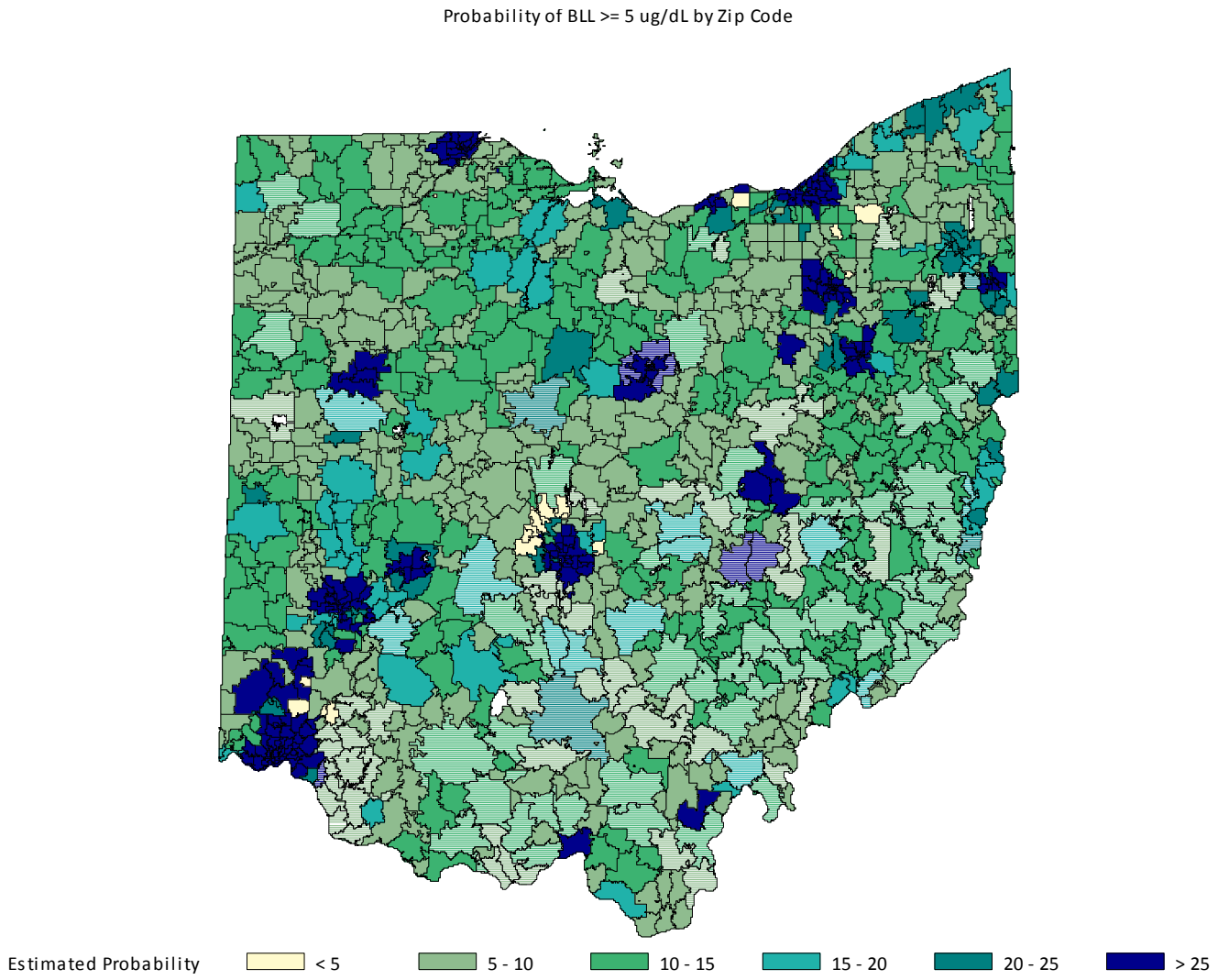


Figure 8. Estimated Probabilities of BLLs ≥ 5 µg/dL by Zip Code

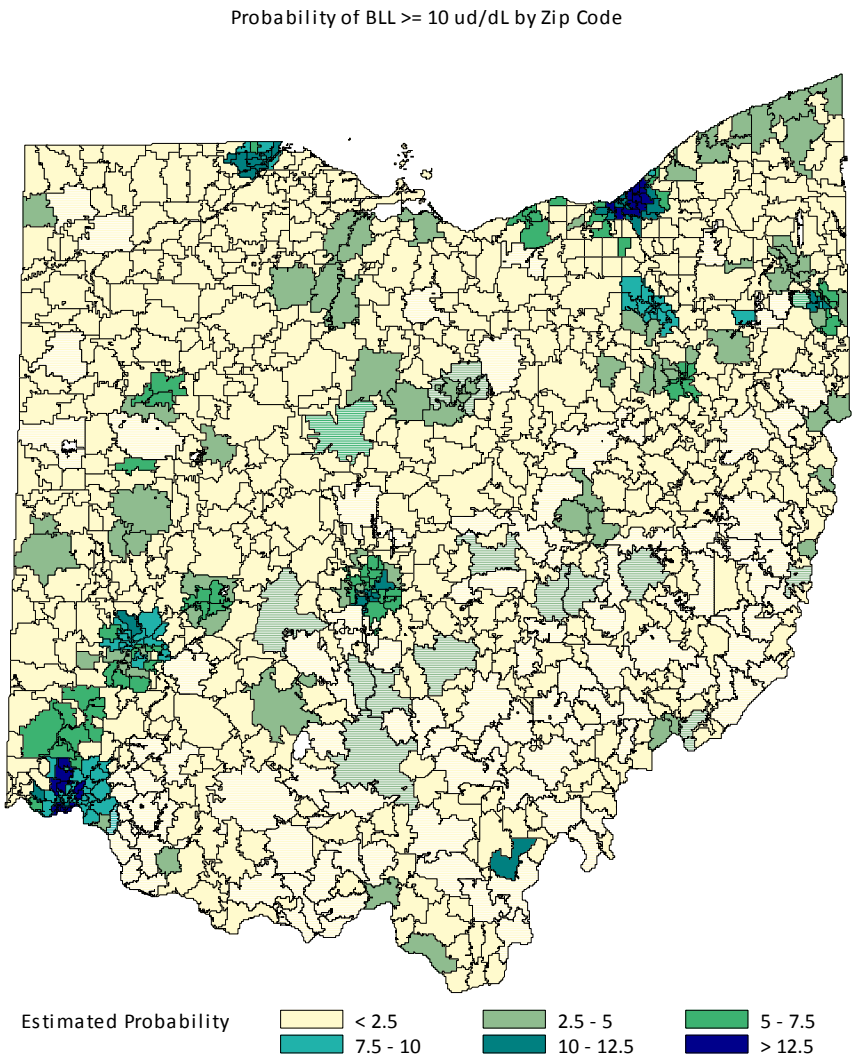


Figure 9. Estimated Probabilities of BLLs ≥ 10 μg/dL by Zip Code

Appendix A

Lists of Census Tracts Where the Predicted Proportion of Children with Elevated Blood Lead Levels Exceeds a Specified Threshold

Table A.1. All Ohio Census Tract Where the Predicted Proportion of Children with BLL ≥ 10 μg/dL Exceeds 5%.

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
HAMILTON	900	0.18549	0.05224
CUYAHOGA	102800	0.15623	0.17697
CUYAHOGA	113600	0.15569	0.10169
CUYAHOGA	111700	0.15333	0.22363
CUYAHOGA	116900	0.15287	0.12195
HAMILTON	1700	0.14285	0.03371
CUYAHOGA	118500	0.13753	0.10484
CUYAHOGA	116300	0.13635	0.17130
CUYAHOGA	119800	0.13465	0.08989
CUYAHOGA	150300	0.13378	0.12446
CUYAHOGA	111500	0.13346	0.18919
CUYAHOGA	116600	0.13321	0.13386
CUYAHOGA	151800	0.13285	0.20213
CUYAHOGA	120600	0.13208	0.09424
CUYAHOGA	115100	0.12549	0.08995
CUYAHOGA	114700	0.12351	0.05479
HAMILTON	1600	0.12258	0.03721
CUYAHOGA	102900	0.12254	0.10150
CUYAHOGA	121200	0.12083	0.09091
MAHONING	802300	0.11939	0.06154
CUYAHOGA	121100	0.11936	0.08065
CUYAHOGA	120702	0.11875	0.09524
CUYAHOGA	151500	0.11863	0.18072
CUYAHOGA	116700	0.11738	0.12000
CUYAHOGA	111800	0.11736	0.11111
CUYAHOGA	116800	0.11680	0.13550
CUYAHOGA	150100	0.11653	0.15385
CUYAHOGA	120500	0.11463	0.09124
LUCAS	3200	0.11387	0.11811
CUYAHOGA	150400	0.11384	0.17521
CUYAHOGA	110801	0.11369	0.11458
CUYAHOGA	120802	0.11364	0.07280
CUYAHOGA	112100	0.11176	0.13830
CUYAHOGA	120400	0.11099	0.09464
CUYAHOGA	108301	0.11089	0.05797
CUYAHOGA	120200	0.11075	0.12883
CUYAHOGA	118400	0.11070	0.16601
CUYAHOGA	115200	0.11029	0.11811
CUYAHOGA	113500	0.10938	0.11765
FRANKLIN	5410	0.10896	0.02740
CUYAHOGA	110501	0.10878	0.18889
CUYAHOGA	103900	0.10878	0.12158
CUYAHOGA	105500	0.10864	0.05858
CUYAHOGA	151700	0.10833	0.15842
CUYAHOGA	104900	0.10663	0.09264
CUYAHOGA	105300	0.10614	0.10548
CUYAHOGA	105400	0.10447	0.09035
CUYAHOGA	114900	0.10356	0.16725

LUCAS	3500	0.10261	0.11565
CUYAHOGA	119502	0.10191	0.08772
CUYAHOGA	113101	0.10171	0.15152
CUYAHOGA	101501	0.10095	0.08251
CUYAHOGA	111902	0.10085	0.19497
LUCAS	3300	0.10022	0.04918
CUYAHOGA	127501	0.09990	0.11733
SUMMIT	506500	0.09981	0.05678
CUYAHOGA	101700	0.09893	0.08889
CUYAHOGA	118700	0.09874	0.08140
HAMILTON	1000	0.09872	0.04688
CUYAHOGA	121401	0.09869	0.11184
HAMILTON	3700	0.09864	0.05172
MAHONING	801700	0.09784	0.07432
CUYAHOGA	117300	0.09772	0.12647
HAMILTON	3800	0.09762	0.06780
CUYAHOGA	112200	0.09759	0.14872
CUYAHOGA	119900	0.09715	0.08000
LUCAS	1800	0.09688	0.05676
CUYAHOGA	118301	0.09681	0.14692
CUYAHOGA	120801	0.09649	0.06154
CUYAHOGA	101800	0.09636	0.13714
CUYAHOGA	111600	0.09614	0.21788
CUYAHOGA	121403	0.09584	0.10092
CUYAHOGA	118101	0.09462	0.11364
CUYAHOGA	121300	0.09420	0.12416
CUYAHOGA	115400	0.09404	0.11146
CUYAHOGA	118200	0.09247	0.16084
CUYAHOGA	104800	0.09137	0.12324
CUYAHOGA	102401	0.09033	0.06061
LUCAS	2500	0.09026	0.08730
CUYAHOGA	119600	0.08988	0.10398
CUYAHOGA	116400	0.08970	0.13660
CUYAHOGA	102700	0.08967	0.09510
SUMMIT	504200	0.08942	0.04706
CUYAHOGA	117500	0.08908	0.07568
HAMILTON	2300	0.08845	0.03057
CUYAHOGA	115700	0.08789	0.04787
CUYAHOGA	111202	0.08721	0.18452
HAMILTON	3900	0.08718	0.09000
CUYAHOGA	119702	0.08642	0.15646
MONTGOMERY	900	0.08630	0.04906
CUYAHOGA	115800	0.08624	0.09732
LUCAS	800	0.08583	0.11940
HAMILTON	9400	0.08580	0.07965
CUYAHOGA	117102	0.08525	0.10929
CUYAHOGA	115300	0.08471	0.05000
CUYAHOGA	183603	0.08451	0.05085
CUYAHOGA	151600	0.08441	0.08407
CUYAHOGA	101101	0.08373	0.10056
CUYAHOGA	119402	0.08371	0.14286
CUYAHOGA	151400	0.08344	0.21637
CUYAHOGA	104100	0.08326	0.16667

CUYAHOGA	101603	0.08319	0.10736
MAHONING	802100	0.08264	0.05479
CUYAHOGA	102300	0.08250	0.13125
LUCAS	3600	0.08232	0.08876
HAMILTON	2800	0.08201	0.01818
CUYAHOGA	116500	0.08195	0.14791
HAMILTON	1100	0.08185	0.02632
HAMILTON	27000	0.08183	0.03493
CUYAHOGA	105100	0.08050	0.08197
CUYAHOGA	103800	0.08036	0.07904
CUYAHOGA	112500	0.08006	0.13580
CUYAHOGA	102402	0.07994	0.09778
SUMMIT	505200	0.07969	0.01852
SUMMIT	509000	0.07951	0.03947
CUYAHOGA	102101	0.07936	0.07855
MONTGOMERY	1000	0.07912	0.02778
LUCAS	5400	0.07861	0.06612
CUYAHOGA	111401	0.07860	0.10438
LUCAS	1900	0.07836	0.07177
SUMMIT	508301	0.07792	0.05714
CUYAHOGA	101901	0.07767	0.15385
SUMMIT	503200	0.07733	0.01617
HAMILTON	26900	0.07677	0.06231
CUYAHOGA	114600	0.07630	0.10881
HAMILTON	9500	0.07599	0.05280
LUCAS	2600	0.07571	0.08537
SUMMIT	503400	0.07534	0.02027
HAMILTON	26700	0.07527	0.05725
CUYAHOGA	196500	0.07497	0.12376
MONTGOMERY	3900	0.07494	0.04375
CUYAHOGA	103400	0.07489	0.09440
CUYAHOGA	119300	0.07475	0.07774
CUYAHOGA	117101	0.07455	0.09325
HAMILTON	25700	0.07455	0.03247
CUYAHOGA	104600	0.07372	0.10056
CUYAHOGA	106800	0.07357	0.03537
CUYAHOGA	118602	0.07337	0.05660
MAHONING	813700	0.07336	0.06009
LUCAS	1600	0.07291	0.15700
MAHONING	801600	0.07147	0.11009
CUYAHOGA	108400	0.07124	0.12121
CUYAHOGA	117900	0.07085	0.08311
CUYAHOGA	116200	0.07078	0.13065
CUYAHOGA	114501	0.07045	0.10329
CUYAHOGA	105602	0.07044	0.05686
HAMILTON	27200	0.07034	0.07987
CUYAHOGA	112400	0.07021	0.16154
HAMILTON	7400	0.07009	0.08290
MONTGOMERY	1200	0.07009	0.09231
LUCAS	2402	0.06963	0.06383
LUCAS	4200	0.06915	0.11336
CUYAHOGA	120701	0.06875	0.07538
MAHONING	804100	0.06838	0.15254

HAMILTON	700	0.06823	0.02649
HAMILTON	2200	0.06820	0.09032
CUYAHOGA	140702	0.06799	0.01471
HAMILTON	26300	0.06761	0.06583
MONTGOMERY	700	0.06753	0.03286
CUYAHOGA	161800	0.06747	0.04673
LUCAS	2100	0.06728	0.09091
LUCAS	4000	0.06725	0.08487
FRANKLIN	3600	0.06689	0.04762
STARK	700100	0.06670	0.03158
MAHONING	804000	0.06593	0.05785
CUYAHOGA	151100	0.06533	0.12500
LUCAS	2200	0.06515	0.08403
CUYAHOGA	119202	0.06497	0.11111
FRANKLIN	730	0.06491	0.03133
MAHONING	813900	0.06446	0.03521
CLARK	1101	0.06431	0.07000
CUYAHOGA	121500	0.06430	0.05929
LUCAS	1700	0.06420	0.08365
LORAIN	23600	0.06415	0.01093
HAMILTON	10300	0.06391	0.08407
CUYAHOGA	103500	0.06376	0.07983
BUTLER	14600	0.06318	0.02703
CUYAHOGA	152603	0.06292	0.00000
STARK	701700	0.06180	0.07780
MAHONING	802400	0.06173	0.06383
LUCAS	2000	0.06156	0.08190
HAMILTON	6400	0.06137	0.04962
CUYAHOGA	112800	0.06094	0.11304
MAHONING	802500	0.06072	0.03759
CUYAHOGA	116100	0.06069	0.08523
CUYAHOGA	106300	0.06016	0.07667
CUYAHOGA	110901	0.05992	0.09456
LUCAS	1100	0.05974	0.03734
LUCAS	10300	0.05949	0.08197
CUYAHOGA	108201	0.05941	0.18966
CUYAHOGA	124100	0.05939	0.03855
LUCAS	2800	0.05935	0.03361
LUCAS	3100	0.05918	0.06542
CUYAHOGA	109801	0.05915	0.03831
CUYAHOGA	101300	0.05852	0.07407
CUYAHOGA	140301	0.05846	0.05051
HAMILTON	7800	0.05815	0.05983
CUYAHOGA	117400	0.05773	0.09709
SUMMIT	501800	0.05771	0.06338
CUYAHOGA	119501	0.05747	0.02970
MAHONING	800600	0.05719	0.02500
STARK	701500	0.05681	0.03284
LUCAS	1500	0.05659	0.07194
LUCAS	4900	0.05637	0.04575
LUCAS	1400	0.05629	0.07732
CUYAHOGA	106400	0.05619	0.02941
MONTGOMERY	802	0.05607	0.03349

SUMMIT	506700	0.05602	0.01987
HAMILTON	4100	0.05602	0.05882
FRANKLIN	920	0.05584	0.02427
LUCAS	4800	0.05582	0.07092
MONTGOMERY	2300	0.05561	0.05263
SUMMIT	503100	0.05550	0.02235
HAMILTON	3600	0.05460	0.03608
ALLEN	14100	0.05437	0.01527
LUCAS	2900	0.05432	0.09143
CUYAHOGA	101200	0.05425	0.04580
CUYAHOGA	140701	0.05422	0.07547
MONTGOMERY	3404	0.05383	0.04202
HAMILTON	6800	0.05331	0.06959
LUCAS	2700	0.05318	0.02027
CLARK	200	0.05303	0.08582
BUTLER	13100	0.05284	0.04301
HAMILTON	6900	0.05255	0.04570
SUMMIT	504600	0.05244	0.01550
MARION	100	0.05237	0.02247
CUYAHOGA	151300	0.05235	0.05814
CUYAHOGA	112301	0.05226	0.12057
HAMILTON	1800	0.05220	0.02804
FRANKLIN	3700	0.05218	0.04403
LORAIN	97300	0.05218	0.03356
CUYAHOGA	101400	0.05176	0.05882
FRANKLIN	6100	0.05171	0.06494
LUCAS	900	0.05170	0.07937
CUYAHOGA	119401	0.05078	0.06438
BUTLER	400	0.05076	0.04444
LUCAS	3000	0.05035	0.06612
LORAIN	71000	0.05032	0.04930
CUYAHOGA	102200	0.05025	0.05926
MAHONING	814000	0.05018	0.06818

Table A.2. All Ohio Census Tract Where the Predicted Proportion of Children with BLL ≥ 5 μg/dL Exceeds 10%.

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
CUYAHOGA	111500	0.49723	0.58108
CUYAHOGA	111700	0.45962	0.54430
HAMILTON	900	0.45812	0.25373
HAMILTON	1700	0.45219	0.23034
CUYAHOGA	115100	0.44555	0.37566
FRANKLIN	5410	0.43034	0.19863
CUYAHOGA	116900	0.41663	0.39024
CUYAHOGA	111600	0.41088	0.57542
CUYAHOGA	150300	0.40576	0.42489
CUYAHOGA	120600	0.40305	0.38220
SUMMIT	505200	0.40235	0.19136
CUYAHOGA	115200	0.40163	0.24409
HAMILTON	1600	0.39774	0.29767
CUYAHOGA	119800	0.39615	0.36404
CUYAHOGA	113600	0.39497	0.34322
LUCAS	3200	0.38753	0.45669
LUCAS	1800	0.38145	0.34595
MAHONING	802300	0.37951	0.30769
CUYAHOGA	112100	0.37110	0.40957
CUYAHOGA	101101	0.37070	0.34637
CUYAHOGA	111800	0.36558	0.47619
CUYAHOGA	118400	0.36486	0.52964
SUMMIT	504200	0.36461	0.24706
CUYAHOGA	120500	0.36441	0.32482
CUYAHOGA	116300	0.36376	0.49074
CUYAHOGA	116600	0.36325	0.39108
MAHONING	802100	0.36203	0.26027
CUYAHOGA	110801	0.36086	0.38021
SUMMIT	506500	0.35984	0.27129
HAMILTON	1000	0.35958	0.21875
CUYAHOGA	118500	0.35870	0.43548
CUYAHOGA	112200	0.35830	0.45641
CUYAHOGA	150400	0.35799	0.47436
CUYAHOGA	151800	0.35777	0.48404
CUYAHOGA	150100	0.35758	0.48626
CUYAHOGA	102800	0.35596	0.43820
LUCAS	5400	0.35557	0.35262
CUYAHOGA	116800	0.35357	0.45528
CUYAHOGA	120200	0.35218	0.39571
CUYAHOGA	120802	0.35197	0.23755
CUYAHOGA	121200	0.35047	0.31818
CUYAHOGA	115400	0.34907	0.44272
LUCAS	1900	0.34790	0.33014
LUCAS	3500	0.34677	0.42177
CUYAHOGA	121100	0.34569	0.31855
CUYAHOGA	111902	0.34514	0.39623
MONTGOMERY	900	0.34433	0.24528
CUYAHOGA	151500	0.34389	0.45783

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
MAHONING	801600	0.34386	0.37003
SUMMIT	509000	0.34349	0.22368
CUYAHOGA	120702	0.34318	0.27619
LUCAS	800	0.34099	0.43284
CUYAHOGA	114700	0.34084	0.17808
CUYAHOGA	114900	0.34036	0.46341
CUYAHOGA	119502	0.33954	0.26316
CUYAHOGA	101501	0.33847	0.26073
CUYAHOGA	120400	0.33807	0.35016
CUYAHOGA	118200	0.33797	0.47902
CUYAHOGA	115800	0.33768	0.29927
CUYAHOGA	119702	0.33595	0.45238
SUMMIT	504100	0.33533	0.14103
CUYAHOGA	105500	0.33511	0.26778
CUYAHOGA	121401	0.33505	0.37500
CUYAHOGA	113500	0.33447	0.39869
CUYAHOGA	110501	0.33418	0.45556
CUYAHOGA	116700	0.33108	0.41778
LUCAS	2500	0.33108	0.34127
CUYAHOGA	151700	0.32911	0.51485
CUYAHOGA	118602	0.32902	0.33208
MAHONING	801700	0.32890	0.35811
SUMMIT	503200	0.32835	0.09973
HAMILTON	3700	0.32578	0.23563
LUCAS	4000	0.32529	0.34317
MONTGOMERY	3900	0.32503	0.20625
CUYAHOGA	101800	0.32492	0.39714
CUYAHOGA	127501	0.32482	0.36800
SUMMIT	503400	0.32479	0.14189
CUYAHOGA	121300	0.32455	0.32886
MONTGOMERY	1200	0.32374	0.28462
LUCAS	3300	0.32363	0.32787
STARK	701500	0.32217	0.50149
SUMMIT	504600	0.32179	0.16279
CUYAHOGA	102700	0.32177	0.34406
HAMILTON	1100	0.32073	0.18421
LUCAS	3600	0.32060	0.36686
MONTGOMERY	700	0.31747	0.22535
LUCAS	2000	0.31715	0.35345
HAMILTON	3800	0.31660	0.23305
CUYAHOGA	118301	0.31651	0.40284
HAMILTON	9500	0.31371	0.23913
SUMMIT	503100	0.31248	0.21788
CUYAHOGA	116400	0.31219	0.49227
CUYAHOGA	116100	0.30948	0.28409
STARK	701700	0.30917	0.53318
FRANKLIN	6100	0.30809	0.20779
MAHONING	813900	0.30711	0.25352
HAMILTON	25700	0.30683	0.19481
CUYAHOGA	119402	0.30607	0.39194
CUYAHOGA	117300	0.30589	0.39706
CUYAHOGA	119600	0.30587	0.37920

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
STARK	700100	0.30576	0.31579
CUYAHOGA	121403	0.30570	0.31804
CLARK	1101	0.30553	0.29000
CUYAHOGA	119900	0.30496	0.30909
CUYAHOGA	112500	0.30446	0.34568
HAMILTON	9400	0.30418	0.27434
CUYAHOGA	111202	0.30379	0.48214
MAHONING	800400	0.30356	0.20000
CUYAHOGA	120801	0.30331	0.27308
CUYAHOGA	115700	0.30304	0.25000
CUYAHOGA	101700	0.30256	0.30370
LUCAS	1700	0.30132	0.32700
HAMILTON	2800	0.29990	0.23636
LUCAS	4200	0.29986	0.43320
SUMMIT	501800	0.29985	0.23944
HAMILTON	2300	0.29969	0.14847
CUYAHOGA	105400	0.29949	0.33676
CUYAHOGA	101603	0.29931	0.43558
LUCAS	2402	0.29907	0.35638
CUYAHOGA	161800	0.29822	0.20561
CUYAHOGA	102101	0.29778	0.30816
MAHONING	804000	0.29740	0.33884
FRANKLIN	920	0.29566	0.16019
CUYAHOGA	118101	0.29468	0.42424
LUCAS	3100	0.29337	0.38318
STARK	701800	0.29250	0.48034
HAMILTON	7400	0.29174	0.35233
CUYAHOGA	102900	0.29165	0.30451
STARK	702100	0.29151	0.57849
CUYAHOGA	105100	0.29116	0.32992
LUCAS	2600	0.29058	0.32927
CUYAHOGA	110901	0.29054	0.28653
BUTLER	14600	0.29051	0.27027
CUYAHOGA	113101	0.29017	0.25758
STARK	700500	0.28959	0.44940
CUYAHOGA	116500	0.28868	0.42444
MAHONING	800600	0.28850	0.25625
HAMILTON	27000	0.28747	0.20306
LUCAS	2900	0.28634	0.29429
CUYAHOGA	104800	0.28616	0.35915
MAHONING	802400	0.28591	0.33333
MONTGOMERY	1000	0.28473	0.19444
LUCAS	4900	0.28460	0.26471
CUYAHOGA	103900	0.28455	0.34650
HAMILTON	26700	0.28416	0.20229
BUTLER	13100	0.28349	0.22581
CUYAHOGA	117900	0.28204	0.29491
CUYAHOGA	151400	0.28120	0.45029
LUCAS	1400	0.28108	0.30928
CUYAHOGA	111401	0.28092	0.37710
LUCAS	1100	0.28064	0.23651
SCIOTO	3500	0.28013	0.22330

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
HAMILTON	3900	0.28000	0.38000
CLARK	300	0.27974	0.32975
CUYAHOGA	102401	0.27967	0.31818
MONTGOMERY	2300	0.27944	0.18947
MONTGOMERY	2200	0.27898	0.26106
FRANKLIN	3600	0.27888	0.27778
MUSKINGUM	912100	0.27877	0.24835
CUYAHOGA	101901	0.27850	0.41453
MONTGOMERY	802	0.27846	0.22967
CUYAHOGA	119300	0.27842	0.27208
CUYAHOGA	117500	0.27819	0.29730
CUYAHOGA	103400	0.27793	0.30383
HAMILTON	27200	0.27771	0.27476
HAMILTON	26300	0.27594	0.29467
HAMILTON	26900	0.27558	0.25816
LUCAS	900	0.27550	0.35873
CUYAHOGA	183603	0.27521	0.26271
STARK	700300	0.27498	0.43750
CUYAHOGA	196500	0.27462	0.38119
MAHONING	813700	0.27404	0.31330
CUYAHOGA	103800	0.27326	0.33677
LUCAS	4800	0.27278	0.30260
CUYAHOGA	140702	0.27200	0.16912
MAHONING	804300	0.27150	0.32955
SUMMIT	506700	0.27145	0.17881
CLARK	200	0.27099	0.25373
CUYAHOGA	115300	0.26939	0.25714
FRANKLIN	5500	0.26911	0.24742
WAYNE	1200	0.26857	0.25000
LUCAS	1600	0.26748	0.47782
FRANKLIN	5620	0.26699	0.29524
LUCAS	2200	0.26638	0.30672
SUMMIT	510100	0.26569	0.18543
CUYAHOGA	116200	0.26486	0.46231
FRANKLIN	2300	0.26476	0.14085
MAHONING	802500	0.26425	0.19549
CUYAHOGA	114501	0.26383	0.33803
CUYAHOGA	101300	0.26340	0.24444
HAMILTON	10300	0.26331	0.30973
COSHOCTON	961500	0.26210	0.19048
RICHLAND	600	0.26196	0.26331
CUYAHOGA	117400	0.26160	0.31553
SUMMIT	508301	0.26133	0.21429
LUCAS	5100	0.26128	0.24855
ALLEN	14100	0.26091	0.12214
FRANKLIN	730	0.26091	0.17232
RICHLAND	3100	0.26076	0.32178
ALLEN	12700	0.26058	0.15493
CUYAHOGA	117101	0.26047	0.33119
CUYAHOGA	117102	0.25982	0.37705
CLARK	500	0.25942	0.18027
CUYAHOGA	102402	0.25889	0.35333

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
FRANKLIN	3700	0.25828	0.24843
LUCAS	1000	0.25816	0.23121
SUMMIT	505700	0.25749	0.11429
STARK	702500	0.25689	0.42545
HAMILTON	7800	0.25588	0.23504
LORAIN	97300	0.25581	0.13423
LUCAS	3000	0.25549	0.37190
CUYAHOGA	106800	0.25391	0.19614
CUYAHOGA	104900	0.25310	0.29691
MONTGOMERY	3800	0.25123	0.13699
SUMMIT	505600	0.25105	0.24832
CUYAHOGA	114600	0.24986	0.41451
LUCAS	10300	0.24972	0.36066
CUYAHOGA	104100	0.24956	0.43137
CUYAHOGA	108301	0.24950	0.17391
LUCAS	2100	0.24919	0.33333
STARK	701300	0.24896	0.47059
LUCAS	1500	0.24777	0.43885
HAMILTON	2200	0.24700	0.30968
ALLEN	13600	0.24690	0.19565
CUYAHOGA	105602	0.24633	0.27090
CUYAHOGA	160601	0.24566	0.08571
CUYAHOGA	109801	0.24549	0.22797
CLARK	901	0.24485	0.27596
FRANKLIN	2800	0.24444	0.15409
STARK	710400	0.24419	0.34783
MONTGOMERY	1900	0.24415	0.26807
FRANKLIN	4700	0.24378	0.22804
ALLEN	13300	0.24351	0.18045
SUMMIT	504500	0.24313	0.15924
SUMMIT	502500	0.24298	0.16814
FRANKLIN	5610	0.24288	0.32420
CUYAHOGA	105300	0.24284	0.32860
FRANKLIN	3800	0.24274	0.14286
CUYAHOGA	124100	0.24171	0.14966
MONTGOMERY	3404	0.24158	0.17227
CUYAHOGA	108400	0.24142	0.37879
MAHONING	814000	0.24103	0.24545
JEFFERSON	800	0.24093	0.24194
MARION	100	0.23985	0.11236
SUMMIT	508600	0.23971	0.20833
CUYAHOGA	119501	0.23934	0.17327
FRANKLIN	1400	0.23915	0.18750
CUYAHOGA	102300	0.23879	0.32500
ROSS	956400	0.23813	0.19048
JEFFERSON	1700	0.23777	0.24390
RICHLAND	700	0.23769	0.16077
CUYAHOGA	103500	0.23764	0.28992
CUYAHOGA	120701	0.23708	0.33166
CUYAHOGA	121500	0.23693	0.20949
ALLEN	12900	0.23646	0.17453
SUMMIT	507400	0.23602	0.24000

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
HAMILTON	4100	0.23582	0.20000
HAMILTON	6400	0.23572	0.17557
LUCAS	1202	0.23546	0.21321
ERIE	41100	0.23532	0.16116
SUMMIT	506600	0.23531	0.21081
CUYAHOGA	140701	0.23516	0.25283
STARK	710500	0.23462	0.31860
STARK	701000	0.23433	0.39633
CUYAHOGA	117201	0.23379	0.19608
CUYAHOGA	118700	0.23369	0.22093
CUYAHOGA	152603	0.23362	0.14876
TRUMBULL	933800	0.23288	0.28249
MAHONING	804100	0.23231	0.37288
HAMILTON	1800	0.23173	0.14019
FRANKLIN	4500	0.23110	0.19368
CUYAHOGA	151600	0.23093	0.25664
FRANKLIN	5820	0.23066	0.16561
HAMILTON	3600	0.22968	0.17010
FRANKLIN	910	0.22887	0.18873
ASHTABULA	601	0.22870	0.08293
HAMILTON	8601	0.22819	0.21410
CUYAHOGA	106300	0.22817	0.23667
MONTGOMERY	165100	0.22775	0.13223
FRANKLIN	4620	0.22734	0.19366
CUYAHOGA	102200	0.22723	0.21852
CUYAHOGA	101400	0.22703	0.21569
CUYAHOGA	152400	0.22695	0.17143
LORAIN	22400	0.22690	0.14516
FRANKLIN	5420	0.22644	0.27103
FRANKLIN	5000	0.22643	0.24956
LORAIN	71000	0.22573	0.23239
FRANKLIN	5900	0.22566	0.27165
CUYAHOGA	101200	0.22550	0.27481
CUYAHOGA	104600	0.22409	0.38547
SUMMIT	506400	0.22345	0.25359
CUYAHOGA	140301	0.22321	0.20707
MAHONING	800300	0.22290	0.17333
MONTGOMERY	1100	0.22195	0.17595
CUYAHOGA	154700	0.22191	0.16729
MAHONING	802900	0.22078	0.15761
CUYAHOGA	115900	0.22066	0.19280
MAHONING	800500	0.22027	0.12996
SUMMIT	504400	0.21947	0.17557
MAHONING	810300	0.21889	0.21081
ERIE	40800	0.21831	0.22222
HAMILTON	7300	0.21830	0.21429
STARK	700600	0.21707	0.44898
HAMILTON	6900	0.21680	0.18817
CUYAHOGA	161700	0.21638	0.20628
SCIOTO	3600	0.21634	0.19718
MARION	200	0.21627	0.08455
ERIE	41200	0.21604	0.17557

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
HAMILTON	8202	0.21569	0.11062
BUTLER	14400	0.21565	0.27835
CUYAHOGA	112800	0.21554	0.27826
FRANKLIN	5300	0.21551	0.17760
BELMONT	12100	0.21534	0.11905
LUCAS	4400	0.21512	0.23653
MONTGOMERY	500	0.21469	0.13575
HAMILTON	6800	0.21439	0.16753
HAMILTON	2600	0.21419	0.25758
LUCAS	3700	0.21390	0.14773
BELMONT	11600	0.21373	0.21538
HAMILTON	3300	0.21365	0.29167
ASHTABULA	701	0.21335	0.23592
CUYAHOGA	161500	0.21278	0.14176
SUMMIT	501700	0.21220	0.12195
CUYAHOGA	106400	0.21197	0.28676
CUYAHOGA	151200	0.21104	0.29375
BUTLER	400	0.21100	0.20370
LORAIN	70500	0.21097	0.17647
CUYAHOGA	196100	0.21092	0.27320
CUYAHOGA	117800	0.21089	0.22672
HAMILTON	7900	0.21039	0.11486
CUYAHOGA	112400	0.21033	0.43846
LORAIN	23200	0.21031	0.12092
MUSKINGUM	911400	0.21020	0.29439
HAMILTON	4702	0.21016	0.22222
SCIOTO	3400	0.20986	0.14978
STARK	714200	0.20963	0.27798
BUTLER	300	0.20953	0.18894
CLARK	2100	0.20901	0.14286
HAMILTON	25500	0.20896	0.12195
FRANKLIN	820	0.20859	0.12406
BUTLER	1100	0.20805	0.17438
COLUMBIANA	952200	0.20787	0.23577
MAHONING	801300	0.20714	0.16418
LORAIN	23100	0.20702	0.08982
MUSKINGUM	911900	0.20681	0.21171
CUYAHOGA	112301	0.20674	0.31915
CUYAHOGA	151100	0.20644	0.41406
STARK	700800	0.20611	0.44837
HAMILTON	25600	0.20558	0.09317
LORAIN	23600	0.20552	0.08197
CUYAHOGA	121700	0.20525	0.14706
COLUMBIANA	951800	0.20359	0.27273
ALLEN	13400	0.20345	0.13187
ROSS	956500	0.20334	0.11111
FRANKLIN	4820	0.20300	0.11397
MONTGOMERY	3300	0.20274	0.18101
STARK	701100	0.20254	0.40930
HAMILTON	9600	0.20246	0.24085
LUCAS	5000	0.20239	0.16867
CUYAHOGA	161400	0.20200	0.13303

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
CUYAHOGA	123900	0.20176	0.21667
LORAIN	70800	0.20169	0.33333
MONTGOMERY	165200	0.20165	0.10769
COLUMBIANA	952300	0.20157	0.22814
STARK	715000	0.20147	0.39827
TRUMBULL	920800	0.20146	0.25275
CUYAHOGA	119202	0.20145	0.34921
CUYAHOGA	113801	0.20141	0.16561
HAMILTON	6600	0.20094	0.15385
BUTLER	13200	0.20068	0.15441
MONTGOMERY	801	0.20033	0.17787
FRANKLIN	720	0.20001	0.07729
LUCAS	4701	0.19963	0.21918
BUTLER	600	0.19919	0.19636
CRAWFORD	975100	0.19889	0.16031
MUSKINGUM	912200	0.19877	0.21629
RICHLAND	500	0.19831	0.19608
FRANKLIN	6000	0.19828	0.17834
HAMILTON	2700	0.19775	0.20000
MAHONING	801000	0.19768	0.19549
HAMILTON	9300	0.19751	0.23557
SUMMIT	502600	0.19744	0.13546
CUYAHOGA	119401	0.19744	0.25751
TRUMBULL	920400	0.19733	0.21192
SUMMIT	502200	0.19701	0.19569
CLARK	1200	0.19669	0.17121
ROSS	956100	0.19661	0.10476
JEFFERSON	200	0.19475	0.14085
JEFFERSON	400	0.19463	0.26515
HAMILTON	6300	0.19346	0.07895
CUYAHOGA	117600	0.19225	0.27734
ASHTABULA	103	0.19198	0.14453
HAMILTON	4000	0.19043	0.24490
MIAMI	315300	0.19002	0.20783
SUMMIT	505300	0.18993	0.21569
ALLEN	12400	0.18984	0.07018
STARK	710300	0.18941	0.26159
CUYAHOGA	161600	0.18938	0.18621
LORAIN	71400	0.18900	0.13851
LAWRENCE	50300	0.18889	0.08219
LORAIN	70901	0.18869	0.09969
HAMILTON	25402	0.18832	0.14660
CUYAHOGA	141602	0.18820	0.19708
CUYAHOGA	140600	0.18811	0.27869
CUYAHOGA	117700	0.18756	0.18021
MONTGOMERY	1700	0.18730	0.11765
CUYAHOGA	117202	0.18711	0.28479
SUMMIT	503500	0.18683	0.09392
RICHLAND	400	0.18655	0.20000
CUYAHOGA	160602	0.18604	0.21649
FRANKLIN	4900	0.18597	0.13296
LUCAS	700	0.18588	0.20885

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
LUCAS	2700	0.18585	0.15541
MAHONING	801100	0.18583	0.19429
MUSKINGUM	911800	0.18573	0.21348
SUMMIT	501100	0.18573	0.04839
MAHONING	814100	0.18566	0.15700
CUYAHOGA	183402	0.18557	0.15584
CUYAHOGA	103100	0.18493	0.26400
LUCAS	2300	0.18478	0.19205
SHELBY	972000	0.18438	0.23352
STARK	710200	0.18393	0.23062
LUCAS	2401	0.18392	0.27273
MAHONING	801200	0.18360	0.19149
LUCAS	5300	0.18348	0.20705
SENECA	962900	0.18345	0.15899
PICKAWAY	20200	0.18336	0.16000
LUCAS	3900	0.18295	0.21127
TRUMBULL	920500	0.18204	0.07143
SUMMIT	506200	0.18182	0.08251
CUYAHOGA	140900	0.18120	0.12195
CLARK	400	0.18118	0.17629
MONTGOMERY	600	0.18106	0.17391
MONTGOMERY	400	0.18089	0.11429
SANDUSKY	961400	0.18064	0.12019
LORAIN	23300	0.18054	0.11224
CUYAHOGA	161000	0.18029	0.15455
CUYAHOGA	101102	0.18019	0.19070
HAMILTON	5600	0.18009	0.13285
STARK	714100	0.17986	0.27979
CUYAHOGA	183604	0.17952	0.12414
CUYAHOGA	121900	0.17879	0.10577
MONTGOMERY	3500	0.17862	0.15315
CRAWFORD	974500	0.17861	0.16410
FRANKLIN	710	0.17854	0.09924
CUYAHOGA	141000	0.17841	0.40351
MARION	501	0.17834	0.14286
MONTGOMERY	4400	0.17819	0.10625
CUYAHOGA	118800	0.17804	0.13913
HAMILTON	27100	0.17794	0.08481
CUYAHOGA	151300	0.17706	0.20930
CUYAHOGA	119701	0.17643	0.22286
BUTLER	14700	0.17545	0.15457
CUYAHOGA	124600	0.17539	0.13836
STARK	713700	0.17533	0.28033
CLARK	3400	0.17529	0.20594
CUYAHOGA	103602	0.17518	0.19880
FRANKLIN	5810	0.17513	0.15108
SUMMIT	507600	0.17512	0.08487
MONTGOMERY	1800	0.17504	0.12544
LICKING	751000	0.17502	0.27907
HAMILTON	23201	0.17440	0.10000
LUCAS	4600	0.17426	0.19027
MADISON	40700	0.17395	0.07054

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
LUCAS	4702	0.17249	0.14409
FRANKLIN	1600	0.17223	0.15044
HAMILTON	25300	0.17219	0.08943
HAMILTON	22700	0.17206	0.11022
CUYAHOGA	104300	0.17199	0.24194
ERIE	41000	0.17196	0.07143
CUYAHOGA	106600	0.17187	0.19188
MIAMI	315100	0.17172	0.21027
PICKAWAY	20100	0.17140	0.19186
MARION	800	0.17108	0.05085
TRUMBULL	921100	0.17061	0.12977
CUYAHOGA	154300	0.17043	0.24561
CUYAHOGA	161200	0.17026	0.16162
MONTGOMERY	80600	0.17019	0.06329
GUERNSEY	977600	0.17011	0.13636
LORAIN	22200	0.17004	0.10884
HAMILTON	7000	0.16953	0.19355
LUCAS	600	0.16947	0.20530
BELMONT	11700	0.16923	0.24762
FRANKLIN	7520	0.16900	0.07485
WASHINGTON	20800	0.16884	0.15060
MAHONING	802600	0.16872	0.21569
TRUMBULL	932802	0.16869	0.12319
HAMILTON	7700	0.16862	0.10833
CUYAHOGA	160400	0.16832	0.18254
FAIRFIELD	32100	0.16781	0.10056
SUMMIT	505500	0.16727	0.13580
LAKE	204500	0.16712	0.12097
CUYAHOGA	123501	0.16654	0.20199
SENECA	963500	0.16649	0.20988
GUERNSEY	977500	0.16649	0.13167
HAMILTON	9700	0.16622	0.18589
CUYAHOGA	122100	0.16590	0.10000
LORAIN	23900	0.16541	0.08108
MAHONING	813800	0.16506	0.11500
SANDUSKY	961500	0.16464	0.14222
CUYAHOGA	141100	0.16427	0.15038
SUMMIT	502101	0.16419	0.17729
BUTLER	12200	0.16413	0.11640
CUYAHOGA	161100	0.16395	0.18143
DARKE	555101	0.16380	0.08051
CUYAHOGA	154100	0.16371	0.12950
CUYAHOGA	106200	0.16356	0.16541
SUMMIT	503300	0.16334	0.07563
LICKING	759000	0.16313	0.26184
SUMMIT	507300	0.16298	0.14765
ALLEN	12600	0.16287	0.07101
TRUMBULL	920600	0.16273	0.09524
CUYAHOGA	122300	0.16265	0.11765
CUYAHOGA	107701	0.16261	0.08036
CLARK	1500	0.16253	0.11494
FRANKLIN	2900	0.16237	0.09972

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
MAHONING	804200	0.16233	0.20253
SUMMIT	506800	0.16223	0.13889
CUYAHOGA	114100	0.16217	0.29818
BELMONT	11500	0.16209	0.09722
TRUMBULL	932702	0.16205	0.16000
SUMMIT	508800	0.16200	0.10538
CLINTON	964600	0.16189	0.11017
RICHLAND	800	0.16185	0.16942
LUCAS	2800	0.16169	0.19328
CUYAHOGA	152502	0.16104	0.14286
HAMILTON	25401	0.16104	0.13274
MAHONING	801500	0.16102	0.13492
MONTGOMERY	80400	0.16059	0.08721
CUYAHOGA	123800	0.16054	0.11697
HAMILTON	25200	0.16012	0.05629
CUYAHOGA	118900	0.15974	0.31019
MAHONING	810600	0.15969	0.15909
MUSKINGUM	912000	0.15953	0.23551
CUYAHOGA	161300	0.15944	0.15736
JEFFERSON	1300	0.15926	0.09259
HAMILTON	25800	0.15901	0.09643
FRANKLIN	1500	0.15865	0.12426
MIAMI	365200	0.15860	0.17672
HAMILTON	6100	0.15851	0.22069
FAIRFIELD	32000	0.15827	0.15000
COLUMBIANA	952100	0.15800	0.33721
LUCAS	400	0.15776	0.23954
LICKING	752500	0.15775	0.22102
CUYAHOGA	105700	0.15774	0.15238
MAHONING	803000	0.15719	0.11828
MONTGOMERY	50402	0.15712	0.09184
SUMMIT	504700	0.15678	0.11644
BELMONT	11900	0.15673	0.16279
HAMILTON	27400	0.15667	0.15698
HAMILTON	9800	0.15642	0.20588
LUCAS	6600	0.15640	0.16312
HAMILTON	2000	0.15629	0.30612
MAHONING	811100	0.15619	0.07692
SCIOTO	3200	0.15607	0.20000
MONTGOMERY	70202	0.15574	0.12000
CUYAHOGA	108701	0.15539	0.23166
LORAIN	70700	0.15525	0.06140
MONTGOMERY	3000	0.15521	0.10791
ALLEN	13800	0.15521	0.09748
MARION	900	0.15502	0.10142
BELMONT	10200	0.15495	0.10317
LOGAN	4500	0.15468	0.17857
FRANKLIN	4810	0.15457	0.11468
MONTGOMERY	2600	0.15427	0.15877
GREENE	200400	0.15423	0.11290
STARK	701200	0.15403	0.40136
GREENE	240600	0.15371	0.06186

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
CUYAHOGA	141500	0.15330	0.14414
CLARK	700	0.15321	0.23762
LUCAS	6700	0.15316	0.30435
MIAMI	355002	0.15315	0.14085
JEFFERSON	12000	0.15311	0.09091
HAMILTON	1900	0.15310	0.12605
SUMMIT	505400	0.15289	0.10506
CUYAHOGA	123601	0.15278	0.07432
MEIGS	964400	0.15270	0.20690
MONTGOMERY	2700	0.15236	0.13043
CLARK	600	0.15235	0.17073
STARK	713600	0.15213	0.25547
CLARK	902	0.15211	0.15642
HAMILTON	4200	0.15157	0.17500
SUMMIT	502300	0.15148	0.09865
HAMILTON	5500	0.15140	0.17042
STARK	713900	0.15117	0.31765
TRUMBULL	920700	0.15111	0.14173
CUYAHOGA	104200	0.15075	0.12069
CUYAHOGA	126100	0.15066	0.15773
CUYAHOGA	108201	0.15062	0.41379
ALLEN	13700	0.15059	0.07353
FRANKLIN	7511	0.15046	0.08333
COSHOCTON	961400	0.14994	0.11765
MONTGOMERY	90600	0.14970	0.10400
BUTLER	13000	0.14930	0.16176
VAN WERT	20600	0.14907	0.08696
CUYAHOGA	112600	0.14897	0.26000
WASHINGTON	20500	0.14897	0.20896
BELMONT	10802	0.14879	0.09859
FRANKLIN	9331	0.14866	0.17424
HANCOCK	800	0.14863	0.04615
CUYAHOGA	196400	0.14800	0.12548
SCIOTO	3000	0.14784	0.12097
MONTGOMERY	200	0.14749	0.11058
CUYAHOGA	160200	0.14721	0.18519
RICHLAND	1300	0.14710	0.09717
CUYAHOGA	140302	0.14663	0.17368
LAKE	204000	0.14663	0.09420
FRANKLIN	2730	0.14628	0.07422
WAYNE	100	0.14602	0.19748
CUYAHOGA	154200	0.14594	0.15888
MONTGOMERY	4100	0.14594	0.11062
STARK	700200	0.14592	0.35433
CUYAHOGA	160300	0.14589	0.23967
CUYAHOGA	152102	0.14584	0.10778
DARKE	555102	0.14583	0.10029
HAMILTON	2500	0.14579	0.16667
FAIRFIELD	32200	0.14577	0.11240
ASHTABULA	102	0.14559	0.08205
FRANKLIN	4200	0.14549	0.13366
MONTGOMERY	4200	0.14547	0.08143

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
CUYAHOGA	105900	0.14520	0.14623
GALLIA	954000	0.14463	0.09091
TUSCARAWAS	22001	0.14459	0.08122
MONTGOMERY	70300	0.14437	0.10884
FAIRFIELD	31700	0.14332	0.08562
CUYAHOGA	160500	0.14328	0.15029
LAWRENCE	50200	0.14302	0.07018
FRANKLIN	2520	0.14300	0.11538
MUSKINGUM	911700	0.14276	0.20248
LORAIN	22500	0.14218	0.01563
LUCAS	5200	0.14215	0.19205
PREBLE	410100	0.14208	0.04225
SCIOTO	3700	0.14205	0.13274
HAMILTON	700	0.14187	0.15232
LUCAS	3400	0.14159	0.21918
FRANKLIN	2000	0.14138	0.03448
BUTLER	12700	0.14122	0.11268
CUYAHOGA	102102	0.14120	0.14229
MORGAN	969100	0.14110	0.10983
MONTGOMERY	60300	0.14109	0.07299
CUYAHOGA	121800	0.14105	0.10924
TRUMBULL	920300	0.14100	0.20670
CUYAHOGA	140500	0.14049	0.18491
BUTLER	200	0.14045	0.13265
LUCAS	4501	0.14032	0.21429
JEFFERSON	11300	0.13984	0.01852
LUCAS	200	0.13981	0.13889
ROSS	955602	0.13981	0.07692
ASHLAND	970500	0.13980	0.12060
TRUMBULL	932600	0.13972	0.15929
LAWRENCE	50100	0.13964	0.05738
TUSCARAWAS	20800	0.13950	0.10976
CUYAHOGA	154501	0.13946	0.07831
SUMMIT	508900	0.13937	0.17582
JEFFERSON	12100	0.13923	0.09434
CUYAHOGA	187103	0.13904	0.09955
CUYAHOGA	132200	0.13903	0.09333
ERIE	40900	0.13897	0.10400
ASHTABULA	703	0.13893	0.13622
ASHTABULA	400	0.13875	0.09346
FRANKLIN	600	0.13855	0.15000
SUMMIT	507500	0.13850	0.16192
HAMILTON	6500	0.13793	0.09774
SCIOTO	3100	0.13792	0.17500
FRANKLIN	8811	0.13783	0.09302
FRANKLIN	2750	0.13778	0.14352
CUYAHOGA	106500	0.13773	0.12500
CUYAHOGA	140400	0.13767	0.12551
MONTGOMERY	3100	0.13763	0.09167
ASHTABULA	801	0.13760	0.05714
MONTGOMERY	4600	0.13734	0.11111
CUYAHOGA	185201	0.13731	0.13699

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
HAMILTON	11000	0.13725	0.09091
CUYAHOGA	141200	0.13666	0.15287
PORTAGE	601000	0.13645	0.10000
HANCOCK	900	0.13632	0.06478
FRANKLIN	4610	0.13620	0.10241
CUYAHOGA	171102	0.13607	0.10054
FRANKLIN	5200	0.13584	0.11765
MAHONING	810200	0.13580	0.14634
MONTGOMERY	2900	0.13518	0.05314
SUMMIT	510500	0.13517	0.10065
JEFFERSON	11200	0.13472	0.03571
CUYAHOGA	124300	0.13462	0.09174
LUCAS	300	0.13455	0.16619
FRANKLIN	2510	0.13446	0.11628
LICKING	751900	0.13434	0.23851
DELAWARE	10100	0.13413	0.09697
ATHENS	972700	0.13412	0.10748
CUYAHOGA	160100	0.13386	0.07292
ALLEN	13200	0.13379	0.09804
MAHONING	813200	0.13370	0.16746
MONROE	966800	0.13367	0.10180
MAHONING	810800	0.13335	0.07500
STARK	702300	0.13329	0.42675
CUYAHOGA	160900	0.13329	0.20465
CUYAHOGA	160700	0.13327	0.15714
CUYAHOGA	109301	0.13284	0.19767
ASHTABULA	704	0.13269	0.18868
FRANKLIN	2600	0.13268	0.11940
ATHENS	972600	0.13267	0.10204
CRAWFORD	974400	0.13249	0.14793
CRAWFORD	974100	0.13201	0.11927
CUYAHOGA	141400	0.13198	0.12000
CUYAHOGA	106900	0.13172	0.09607
CUYAHOGA	152702	0.13158	0.08673
LUCAS	1303	0.13139	0.19672
CUYAHOGA	123603	0.13131	0.09220
FRANKLIN	2770	0.13130	0.09043
PREBLE	460100	0.13095	0.08451
FRANKLIN	8730	0.13087	0.09794
CUYAHOGA	171103	0.13080	0.12913
CUYAHOGA	122200	0.13056	0.18947
MONTGOMERY	4300	0.13019	0.06912
CUYAHOGA	141700	0.13007	0.08163
JEFFERSON	12300	0.12999	0.09890
CHAMPAIGN	10500	0.12993	0.08779
LICKING	750700	0.12969	0.16096
BELMONT	11300	0.12958	0.06604
SUMMIT	505900	0.12940	0.11852
MAHONING	811800	0.12914	0.09211
TRUMBULL	931400	0.12889	0.06936
CUYAHOGA	193900	0.12885	0.12000
ASHLAND	971100	0.12885	0.14205

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
CUYAHOGA	185103	0.12884	0.08696
CUYAHOGA	152501	0.12879	0.09375
CUYAHOGA	124201	0.12879	0.10417
CUYAHOGA	141300	0.12875	0.12727
CLARK	1300	0.12832	0.12190
HAMILTON	8000	0.12815	0.07659
HAMILTON	5800	0.12815	0.08832
BUTLER	500	0.12801	0.12158
MONTGOMERY	1501	0.12796	0.21970
SUMMIT	510200	0.12794	0.09025
MONTGOMERY	2400	0.12792	0.11299
MONTGOMERY	2000	0.12783	0.12017
HAMILTON	10900	0.12781	0.02312
MONTGOMERY	21100	0.12777	0.08721
TRUMBULL	933100	0.12773	0.06897
LICKING	751300	0.12767	0.22756
SUMMIT	508399	0.12750	0.10159
CUYAHOGA	123502	0.12714	0.11388
LUCAS	5703	0.12706	0.12950
COLUMBIANA	952000	0.12692	0.22430
HAMILTON	20902	0.12626	0.11653
CLARK	1000	0.12621	0.09146
HAMILTON	22602	0.12607	0.05714
HAMILTON	10700	0.12590	0.07609
JEFFERSON	11100	0.12586	0.08571
HAMILTON	23400	0.12578	0.03289
ATHENS	972800	0.12569	0.10556
FRANKLIN	2100	0.12561	0.04545
CUYAHOGA	154400	0.12537	0.09326
HAMILTON	21802	0.12537	0.04955
CUYAHOGA	154601	0.12535	0.10294
MARION	300	0.12534	0.07895
BELMONT	10100	0.12522	0.09600
HAMILTON	5702	0.12520	0.05938
MARION	502	0.12509	0.12500
ASHTABULA	101	0.12507	0.06211
HAMILTON	26400	0.12485	0.08470
ASHLAND	970400	0.12483	0.06280
CUYAHOGA	160800	0.12482	0.12195
ASHTABULA	500	0.12468	0.07619
MAHONING	802800	0.12466	0.12230
CUYAHOGA	188104	0.12463	0.08065
HAMILTON	24700	0.12452	0.12329
CLARK	1102	0.12450	0.11364
PORTAGE	600901	0.12443	0.08118
MAHONING	813000	0.12429	0.22283
LORAIN	60200	0.12414	0.07527
CRAWFORD	974900	0.12405	0.09143
HAMILTON	8201	0.12397	0.11910
HAMILTON	5301	0.12391	0.12587
ROSS	956300	0.12366	0.08000
CUYAHOGA	124202	0.12353	0.14583

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
HAMILTON	5200	0.12353	0.06091
CUYAHOGA	188103	0.12350	0.11523
ALLEN	13000	0.12342	0.07394
LUCAS	10200	0.12333	0.10294
HURON	916600	0.12327	0.07843
BUTLER	14000	0.12280	0.08865
NOBLE	968400	0.12279	0.14835
MONTGOMERY	20100	0.12265	0.11278
HAMILTON	21900	0.12260	0.05195
CUYAHOGA	141601	0.12248	0.10714
HAMILTON	200	0.12235	0.09615
SUMMIT	502800	0.12232	0.04255
ASHTABULA	900	0.12193	0.05641
KNOX	7100	0.12184	0.08418
PERRY	966000	0.12183	0.18792
CUYAHOGA	171104	0.12182	0.12624
FRANKLIN	1700	0.12178	0.12435
CLARK	1400	0.12177	0.06625
MARION	400	0.12171	0.07500
VAN WERT	20400	0.12160	0.04878
FRANKLIN	2200	0.12159	0.10366
HARRISON	976000	0.12152	0.12707
LICKING	758300	0.12151	0.12174
COLUMBIANA	951100	0.12149	0.20115
TUSCARAWAS	21600	0.12143	0.09195
MORGAN	968900	0.12093	0.18824
SUMMIT	510301	0.12087	0.07385
FRANKLIN	8813	0.12069	0.06936
LUCAS	5501	0.12067	0.10156
BROWN	951700	0.12065	0.02830
RICHLAND	1600	0.12064	0.16379
HAMILTON	10500	0.12052	0.07273
SUMMIT	520202	0.12050	0.05628
HENRY	500	0.12041	0.05607
MONTGOMERY	60200	0.12038	0.05128
HAMILTON	9200	0.12031	0.16997
COLUMBIANA	951900	0.12011	0.15426
HARRISON	975900	0.12010	0.05455
PERRY	966300	0.11982	0.13939
HAMILTON	7100	0.11928	0.07299
COLUMBIANA	951400	0.11922	0.11724
TRUMBULL	931700	0.11918	0.05882
HAMILTON	8800	0.11914	0.10491
GREENE	255000	0.11909	0.06977
SENECA	962700	0.11901	0.06667
DEFIANCE	958800	0.11855	0.07278
FRANKLIN	8330	0.11827	0.10204
HAMILTON	10202	0.11821	0.12299
HAMILTON	6000	0.11817	0.10502
HIGHLAND	954900	0.11790	0.09845
HAMILTON	23800	0.11789	0.06552
HARDIN	600	0.11782	0.06296

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
WYANDOT	938200	0.11771	0.07692
SANDUSKY	961700	0.11766	0.07732
COLUMBIANA	951500	0.11764	0.05844
HOCKING	965300	0.11761	0.11538
SUMMIT	504800	0.11750	0.02469
CUYAHOGA	177202	0.11746	0.06417
MARION	700	0.11736	0.05797
LORAIN	70400	0.11726	0.10248
HAMILTON	23702	0.11721	0.05469
MONTGOMERY	70201	0.11713	0.07937
ERIE	40700	0.11694	0.03571
LORAIN	71100	0.11686	0.09479
MONTGOMERY	70400	0.11680	0.07500
MIAMI	325000	0.11667	0.11765
CUYAHOGA	123400	0.11647	0.08228
LUCAS	6200	0.11643	0.21111
HAMILTON	26800	0.11643	0.07407
CRAWFORD	974200	0.11638	0.05738
ALLEN	12300	0.11637	0.08800
TUSCARAWAS	21700	0.11631	0.06360
HAMILTON	5701	0.11630	0.05069
TRUMBULL	933900	0.11625	0.05769
HAMILTON	7500	0.11616	0.15534
TRUMBULL	921600	0.11615	0.12048
WILLIAMS	950300	0.11607	0.09714
GUERNSEY	977300	0.11590	0.14521
BELMONT	10700	0.11584	0.01613
WOOD	22100	0.11580	0.13514
HAMILTON	21702	0.11569	0.09701
FRANKLIN	1000	0.11568	0.17600
HARDIN	100	0.11541	0.03604
MONTGOMERY	300	0.11540	0.13636
ADAMS	770600	0.11540	0.06015
MONROE	966900	0.11511	0.10345
DARKE	540100	0.11506	0.13821
COSHOCTON	961300	0.11479	0.08475
FRANKLIN	420	0.11475	0.06349
DARKE	510100	0.11474	0.07368
CUYAHOGA	152101	0.11473	0.05263
CUYAHOGA	183606	0.11468	0.11304
FRANKLIN	1820	0.11446	0.16327
FRANKLIN	1902	0.11430	0.07500
VAN WERT	20800	0.11385	0.07407
HARRISON	975600	0.11359	0.10370
ATHENS	973400	0.11327	0.09459
NOBLE	968500	0.11313	0.11111
MUSKINGUM	912500	0.11305	0.20530
SENECA	963800	0.11299	0.15044
HARRISON	975700	0.11297	0.15541
CUYAHOGA	106100	0.11291	0.08299
TRUMBULL	933600	0.11283	0.03352
MADISON	41300	0.11274	0.05607

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
ALLEN	11200	0.11263	0.03846
HAMILTON	8100	0.11260	0.06509
CUYAHOGA	152202	0.11254	0.10313
CUYAHOGA	152301	0.11253	0.04444
FRANKLIN	810	0.11252	0.06548
CARROLL	720200	0.11247	0.20000
WASHINGTON	21300	0.11244	0.14094
WOOD	21701	0.11243	0.07353
HAMILTON	9902	0.11224	0.13492
CRAWFORD	975300	0.11223	0.04494
PORTAGE	600800	0.11216	0.06952
HAMILTON	5000	0.11206	0.07727
FULTON	40800	0.11192	0.06667
FRANKLIN	5700	0.11177	0.10811
LAKE	205900	0.11167	0.00000
STARK	714902	0.11161	0.49231
SANDUSKY	961100	0.11158	0.07407
MONTGOMERY	80700	0.11155	0.03333
WASHINGTON	20102	0.11151	0.05000
FAYETTE	925900	0.11134	0.07538
STARK	713100	0.11125	0.39085
FRANKLIN	8812	0.11120	0.02857
TRUMBULL	921000	0.11115	0.07442
BELMONT	10600	0.11114	0.11207
LORAIN	57100	0.11108	0.06250
TUSCARAWAS	22002	0.11107	0.08421
STARK	700400	0.11101	0.42000
MEIGS	964500	0.11098	0.13768
LUCAS	5502	0.11096	0.06897
CUYAHOGA	107802	0.11091	0.17450
HARRISON	975800	0.11083	0.10000
FRANKLIN	8720	0.11037	0.10506
CUYAHOGA	132302	0.11035	0.05405
BELMONT	10900	0.11025	0.10676
HIGHLAND	954500	0.11017	0.09783
PORTAGE	601901	0.11006	0.07339
FAYETTE	926100	0.10980	0.08269
CUYAHOGA	107101	0.10963	0.03704
FRANKLIN	8900	0.10957	0.07229
FRANKLIN	410	0.10947	0.05263
LORAIN	60100	0.10945	0.10949
RICHLAND	2800	0.10935	0.06757
TRUMBULL	932200	0.10902	0.05376
SUMMIT	501900	0.10895	0.10891
WILLIAMS	950600	0.10886	0.09140
CARROLL	720600	0.10871	0.22857
COLUMBIANA	951200	0.10863	0.19380
DELAWARE	11101	0.10835	0.09195
SUMMIT	505800	0.10834	0.10508
CUYAHOGA	137102	0.10822	0.05738
CUYAHOGA	123200	0.10809	0.01515
KNOX	7600	0.10803	0.11152

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
WOOD	22300	0.10792	0.10559
LORAIN	23500	0.10782	0.06250
FRANKLIN	9333	0.10776	0.07746
CLARK	3302	0.10765	0.04639
WOOD	20200	0.10746	0.12037
CUYAHOGA	152201	0.10739	0.11489
CUYAHOGA	134300	0.10729	0.16667
CUYAHOGA	132100	0.10727	0.07801
SUMMIT	531101	0.10724	0.01974
LICKING	752200	0.10712	0.16418
WYANDOT	938400	0.10710	0.15470
HARDIN	500	0.10698	0.06422
HAMILTON	26200	0.10695	0.02941
HENRY	600	0.10680	0.06107
DARKE	560100	0.10675	0.04720
CUYAHOGA	109701	0.10671	0.14824
WYANDOT	938000	0.10661	0.13253
SENECA	962800	0.10647	0.11240
CUYAHOGA	188105	0.10638	0.09864
BUTLER	13900	0.10635	0.10417
CUYAHOGA	123100	0.10627	0.04301
FRANKLIN	500	0.10625	0.12360
WILLIAMS	950500	0.10614	0.07438
SCIOTO	3900	0.10609	0.09677
ASHTABULA	1301	0.10604	0.06522
VAN WERT	20300	0.10592	0.04615
CUYAHOGA	103300	0.10586	0.18563
JACKSON	957600	0.10573	0.07547
RICHLAND	1700	0.10566	0.09091
LUCAS	6100	0.10566	0.10241
MONTGOMERY	2500	0.10557	0.12205
MIAMI	390100	0.10556	0.16197
PICKAWAY	21600	0.10554	0.11696
MAHONING	811400	0.10551	0.02326
VAN WERT	20500	0.10541	0.10084
CUYAHOGA	183401	0.10540	0.05714
HIGHLAND	954800	0.10539	0.06597
HAMILTON	10800	0.10531	0.06122
HENRY	700	0.10528	0.05714
DARKE	520100	0.10526	0.05405
TUSCARAWAS	21100	0.10526	0.04698
FRANKLIN	7512	0.10522	0.05574
LORAIN	24000	0.10514	0.01942
SANDUSKY	961600	0.10513	0.06471
SENECA	963300	0.10512	0.13816
MONTGOMERY	1600	0.10507	0.07692
TRUMBULL	930101	0.10501	0.07317
LAWRENCE	50600	0.10497	0.11538
CHAMPAIGN	11505	0.10470	0.06790
WOOD	22400	0.10467	0.11224
RICHLAND	2500	0.10467	0.05882
STARK	714801	0.10454	0.26577

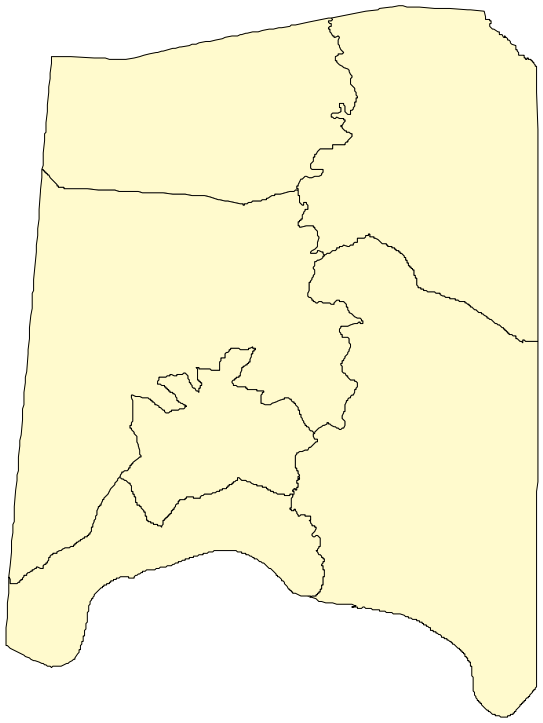
County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
CUYAHOGA	171203	0.10444	0.08840
FRANKLIN	8210	0.10438	0.08077
MONTGOMERY	70700	0.10427	0.07540
MAHONING	812400	0.10421	0.05882
WILLIAMS	950200	0.10418	0.05814
HAMILTON	26600	0.10417	0.17241
SUMMIT	531801	0.10416	0.03226
HAMILTON	3200	0.10414	0.23256
STARK	712900	0.10402	0.29060
BELMONT	12200	0.10393	0.05263
RICHLAND	1400	0.10391	0.08333
GUERNSEY	977900	0.10357	0.11551
TUSCARAWAS	20700	0.10357	0.07295
CUYAHOGA	171204	0.10349	0.08633
BUTLER	10500	0.10345	0.08333
ADAMS	770200	0.10341	0.01299
WAYNE	3400	0.10340	0.05941
HURON	916000	0.10332	0.07554
SENECA	962500	0.10323	0.19130
CUYAHOGA	196200	0.10315	0.11270
STARK	710800	0.10308	0.18462
WAYNE	1900	0.10300	0.05369
LAWRENCE	50900	0.10296	0.04464
MIAMI	320100	0.10271	0.11538
FRANKLIN	220	0.10252	0.05797
OTTAWA	50600	0.10246	0.03401
ERIE	41300	0.10230	0.03306
BELMONT	12000	0.10226	0.10370
CHAMPAIGN	10400	0.10225	0.04683
CLARK	1700	0.10224	0.09920
ROSS	956900	0.10223	0.10985
STARK	714600	0.10217	0.31148
COLUMBIANA	950500	0.10215	0.19697
OTTAWA	50900	0.10203	0.07732
FRANKLIN	8821	0.10200	0.08511
JEFFERSON	11900	0.10200	0.04255
OTTAWA	50700	0.10199	0.05882
BELMONT	11400	0.10196	0.08333
MAHONING	810100	0.10195	0.11852
LUCAS	1302	0.10195	0.11290
SANDUSKY	962200	0.10183	0.05348
SENECA	963000	0.10175	0.08143
HAMILTON	21602	0.10172	0.04651
JEFFERSON	11800	0.10169	0.05714
HAMILTON	20901	0.10167	0.06604
FRANKLIN	330	0.10152	0.12727
HANCOCK	100	0.10147	0.10185
KNOX	7200	0.10144	0.10864
ALLEN	11600	0.10137	0.03571
CUYAHOGA	124500	0.10134	0.07653
HAMILTON	26500	0.10122	0.06870
GUERNSEY	977800	0.10121	0.10549

County	Census Tract	Predicted Proportion of Elevated BLL	Observed Proportion of Elevated BLL
FRANKLIN	1300	0.10088	0.01852
FAIRFIELD	30300	0.10088	0.06061
DARKE	570101	0.10087	0.05882
HAMILTON	10002	0.10079	0.09626
PERRY	966100	0.10073	0.18301
MUSKINGUM	912300	0.10044	0.16975
FAIRFIELD	30100	0.10042	0.07965
JACKSON	957300	0.10038	0.09694
HAMILTON	7200	0.10025	0.06087
LORAIN	50400	0.10023	0.02410
SUMMIT	530105	0.10013	0.04795
WILLIAMS	950900	0.10009	0.04444
SCIOTO	2200	0.10007	0.03030
GALLIA	954100	0.10004	0.08148
GREENE	240302	0.10000	0.10127
STARK	713201	0.10000	0.46939

Appendix B

Plots of Predicted Proportion of Children with Blood Lead Levels Greater than 10 μg/dL by Census Tract within County

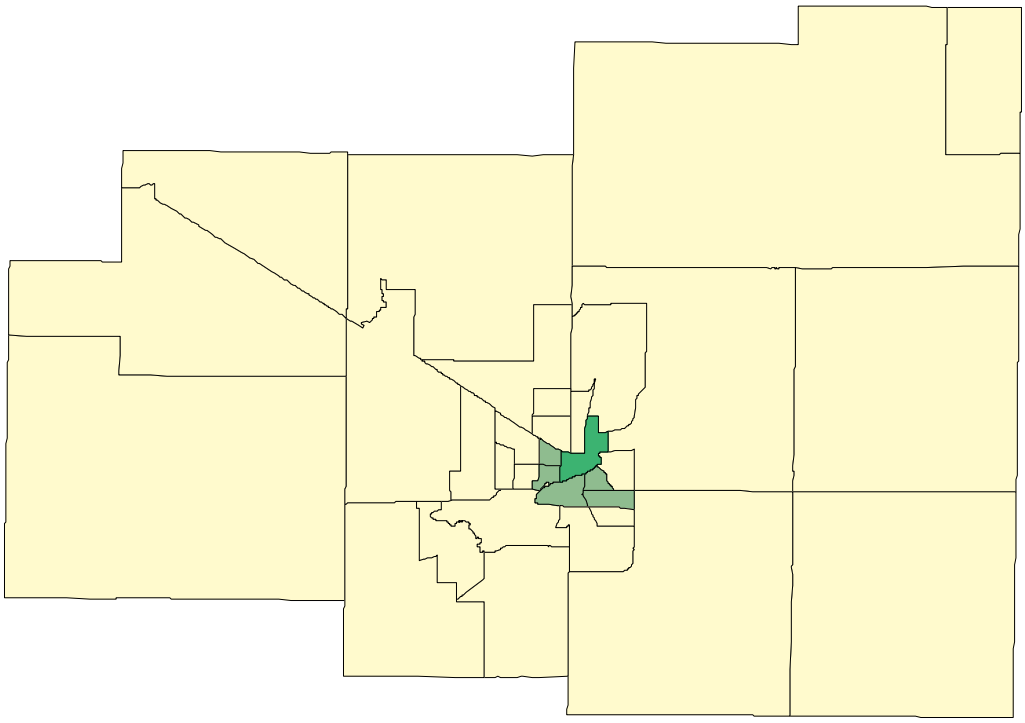
Predicted Percentage of Children with BLL >= 10 ug/dL for ADAMS County



Estimated Probability

< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

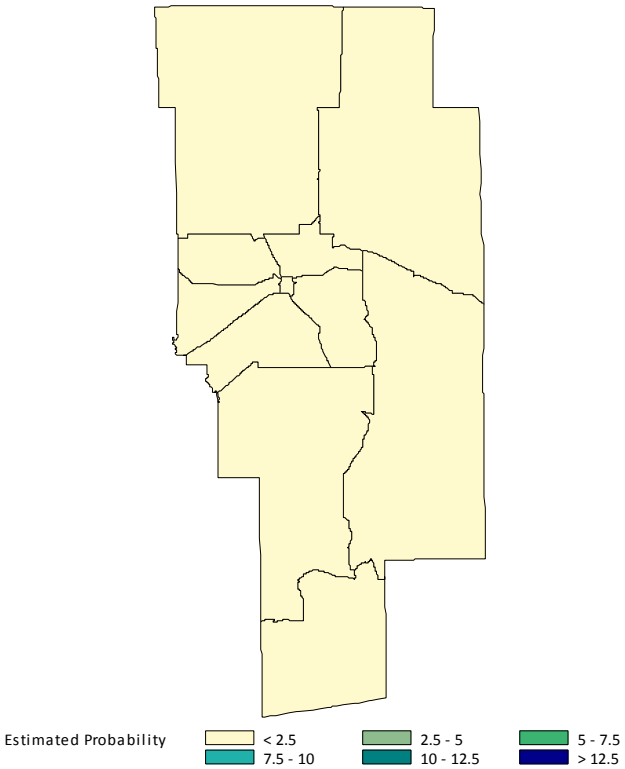
Predicted Percentage of Children with BLL >= 10 ug/dL for ALLEN County



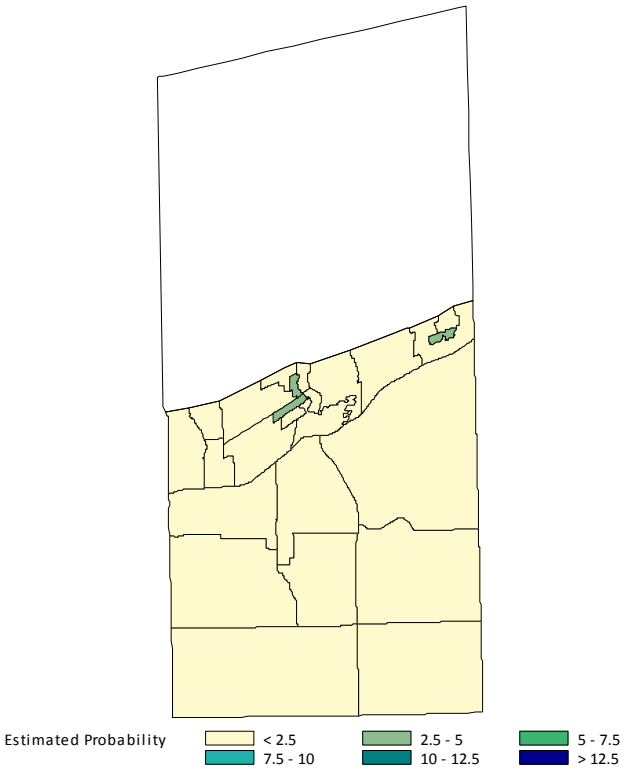
Estimated Probability

< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

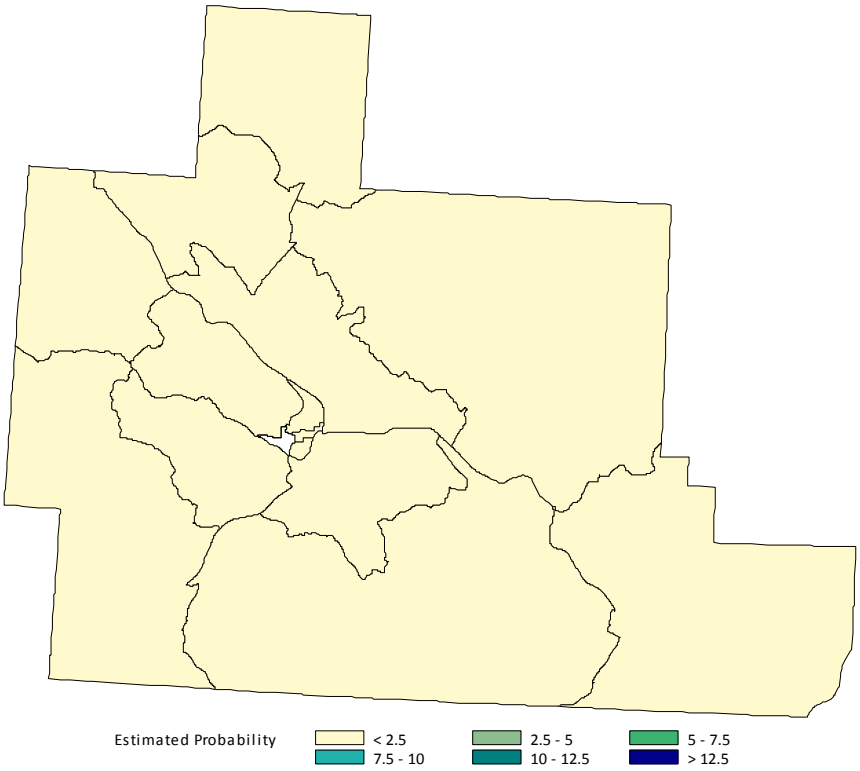
Predicted Percentage of Children with BLL >= 10 ug/dL for ASHLAND County



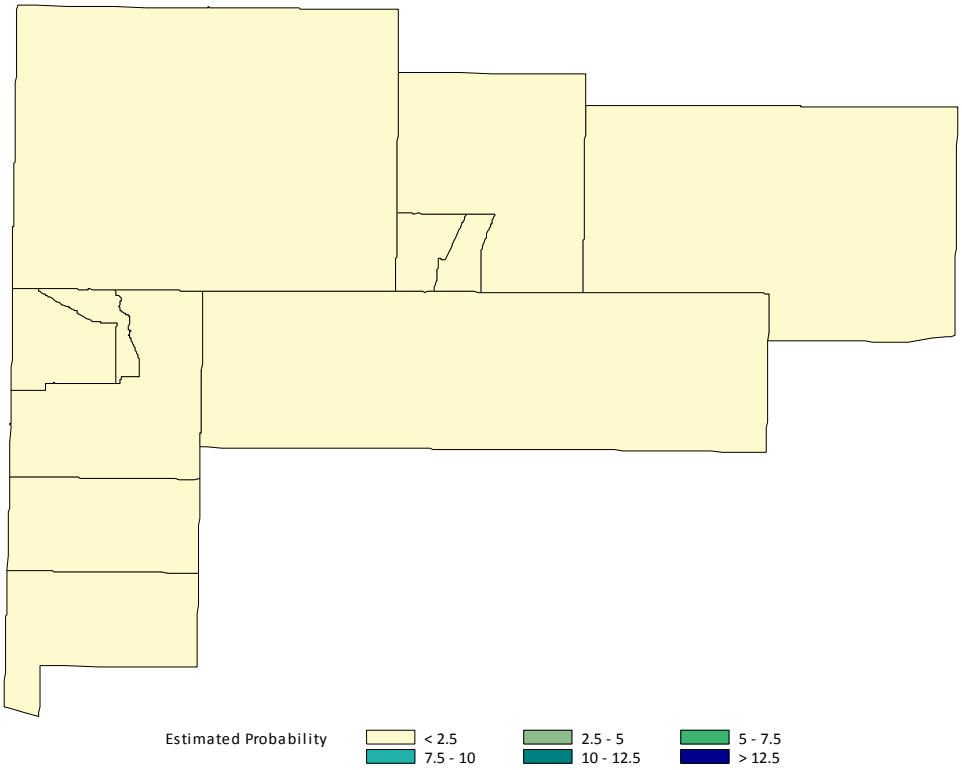
Predicted Percentage of Children with BLL >= 10 ug/dL for ASHTABULA County



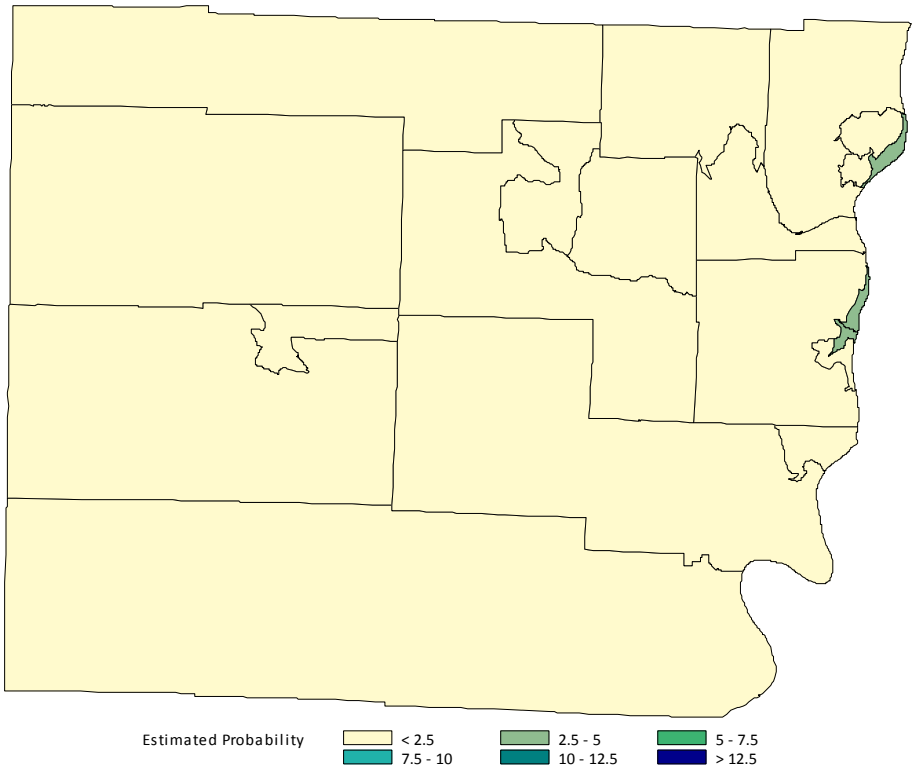
Predicted Percentage of Children with BLL >= 10 ug/dL for ATHENS County



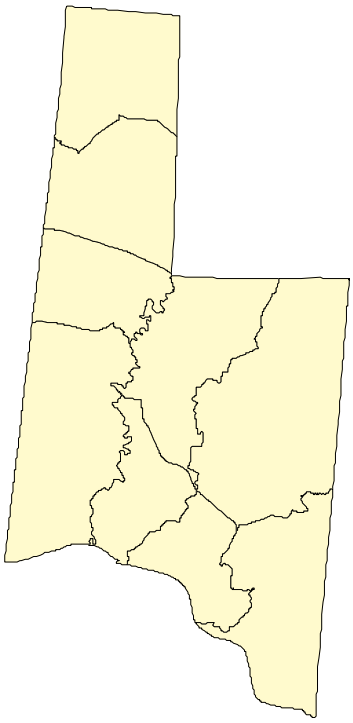
Predicted Percentage of Children with BLL >= 10 ug/dL for AUGLAIZE County



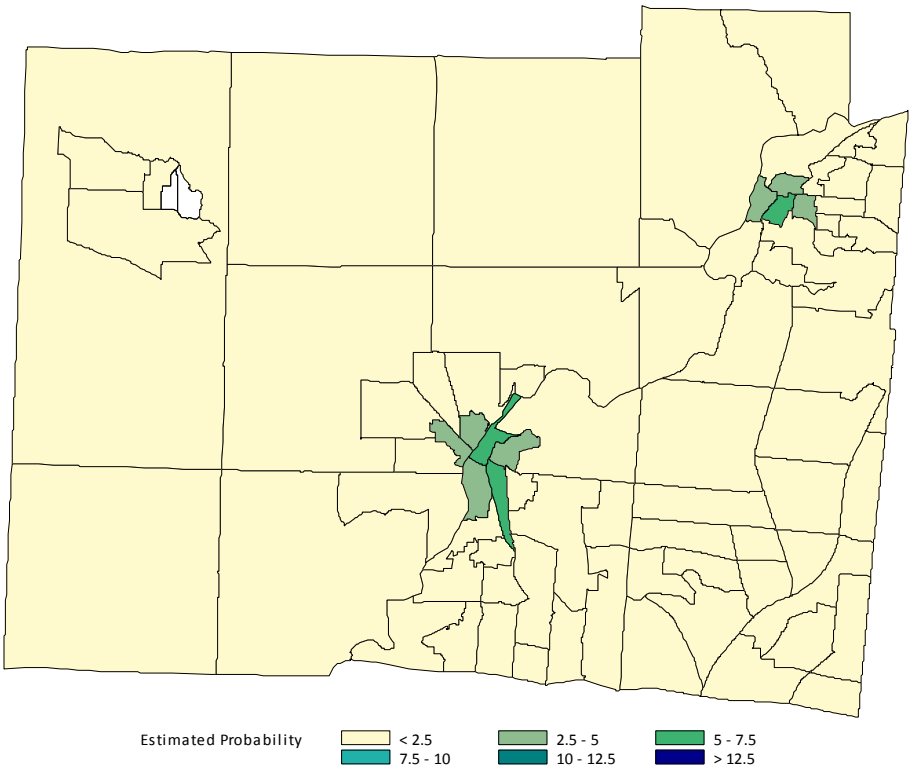
Predicted Percentage of Children with BLL >= 10 ug/dL for BELMONT County



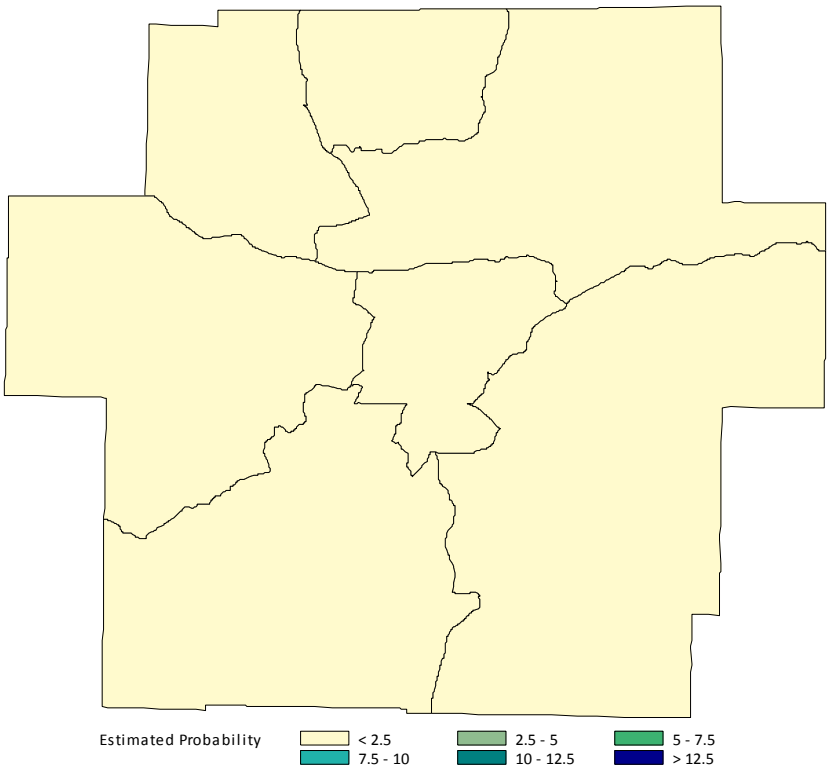
Predicted Percentage of Children with BLL >= 10 ug/dL for BROWN County



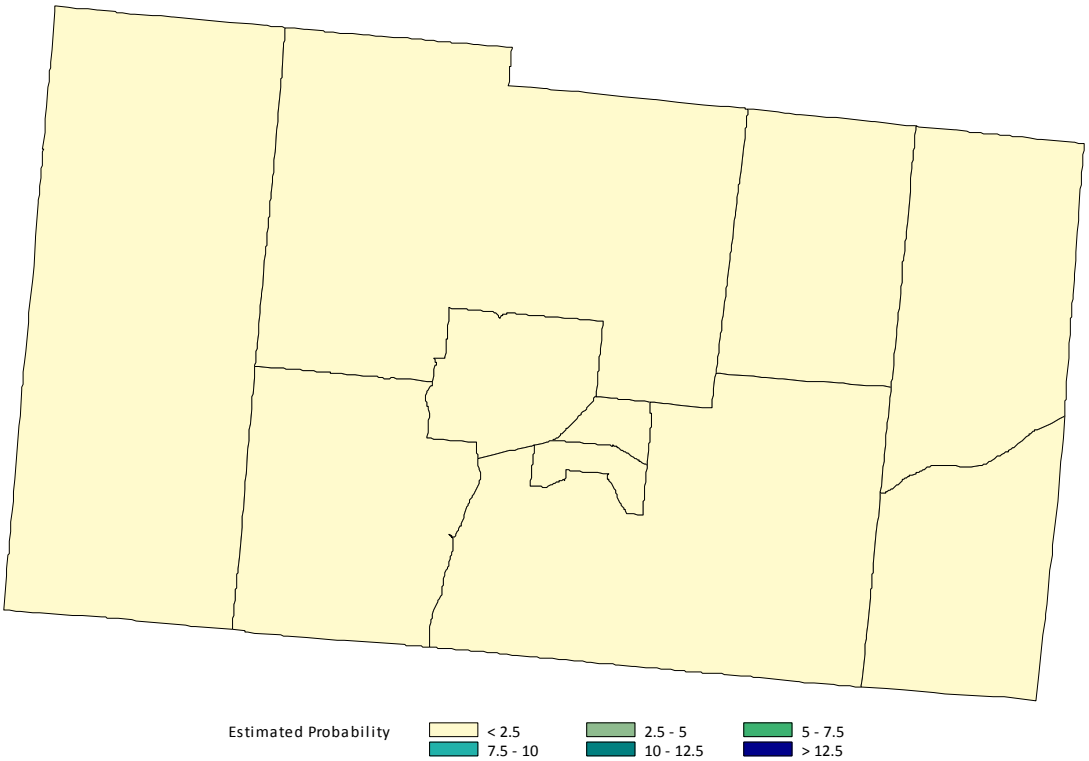
Predicted Percentage of Children with BLL >= 10 ug/dL for BUTLER County



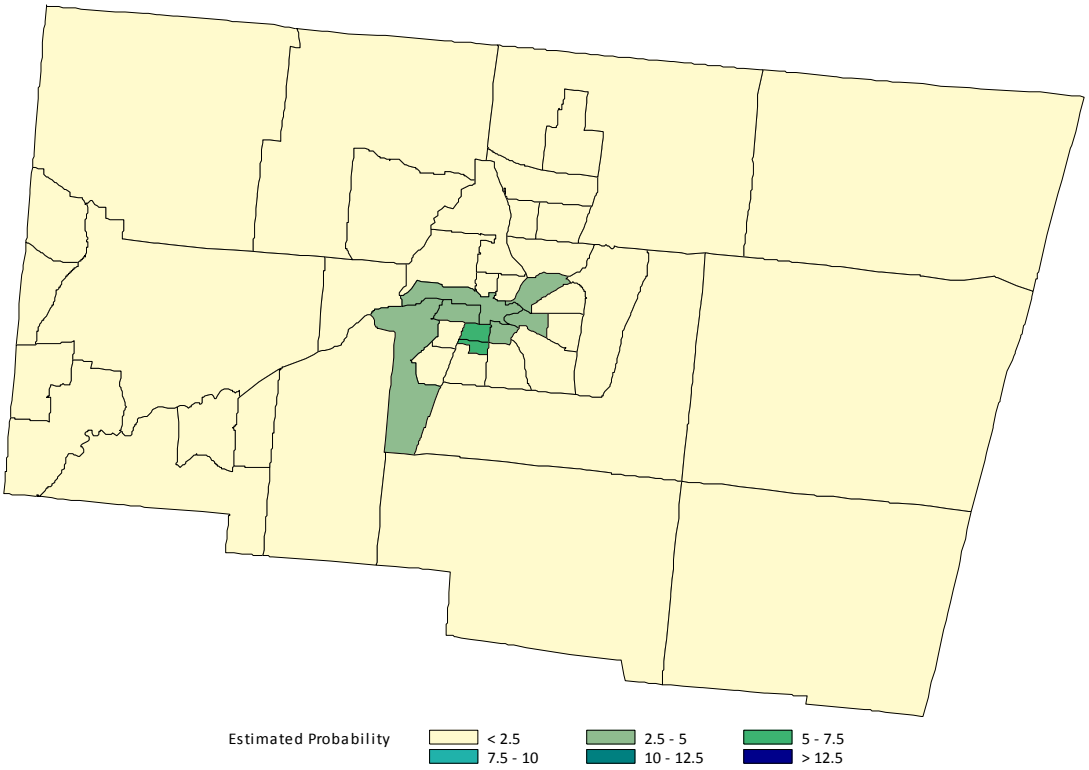
Predicted Percentage of Children with BLL >= 10 ug/dL for CARROLL County



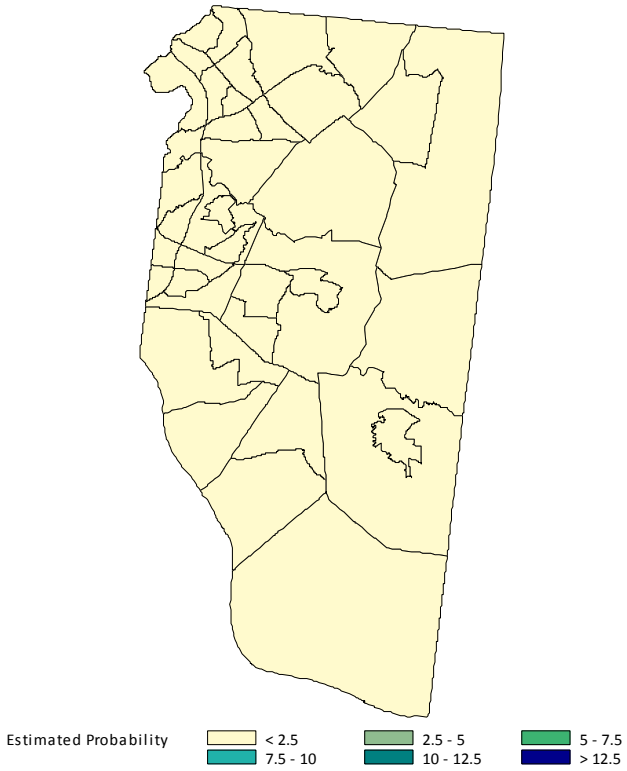
Predicted Percentage of Children with BLL >= 10 ug/dL for CHAMPAIGN County



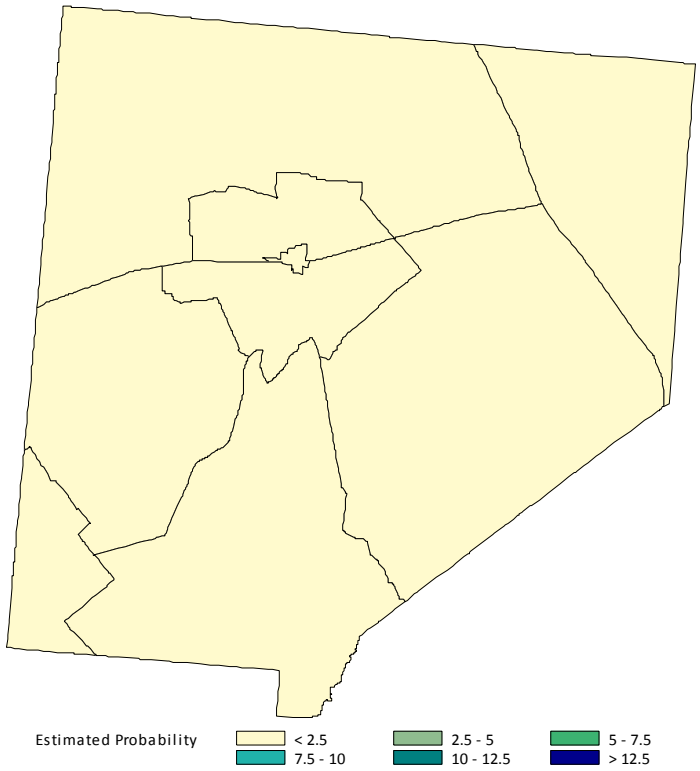
Predicted Percentage of Children with BLL >= 10 ug/dL for CLARK County



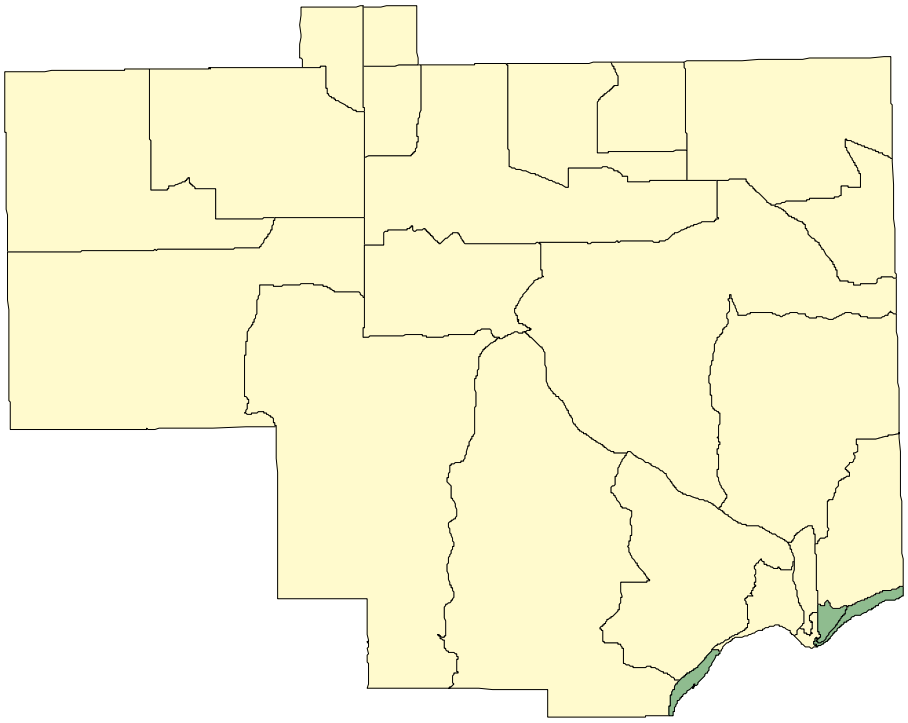
Predicted Percentage of Children with BLL >= 10 ug/dL for CLERMONT County



Predicted Percentage of Children with BLL >= 10 ug/dL for CLINTON County

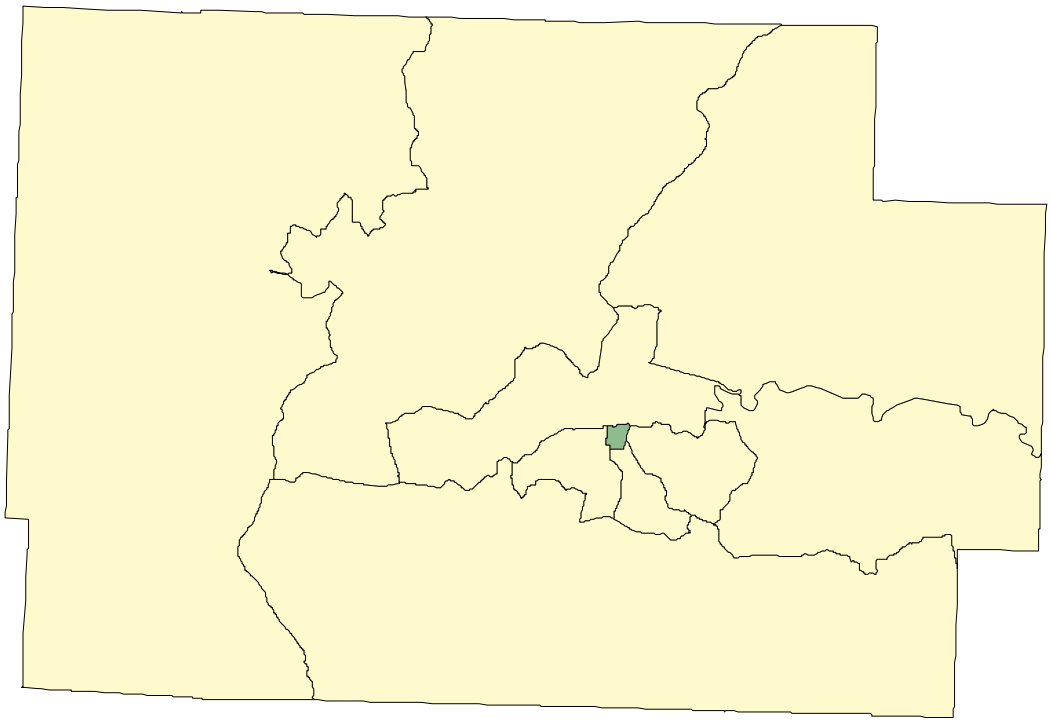


Predicted Percentage of Children with BLL >= 10 ug/dL for COLUMBIANA County



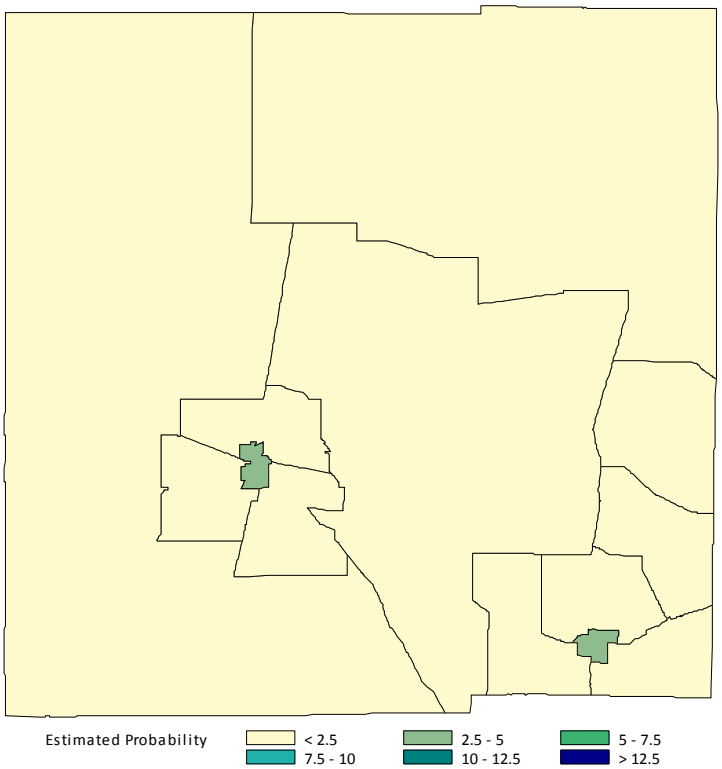
Estimated Probability
< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

Predicted Percentage of Children with BLL >= 10 ug/dL for COSHOCTON County

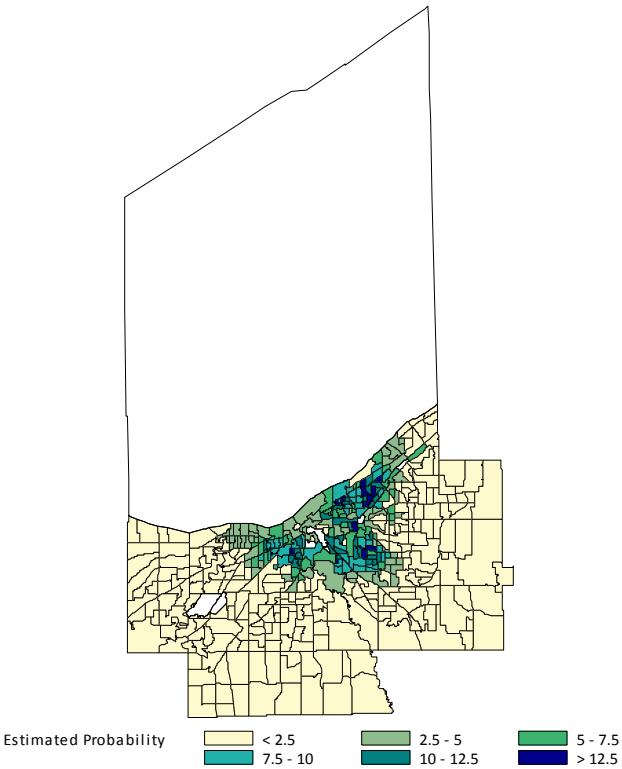


Estimated Probability
< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

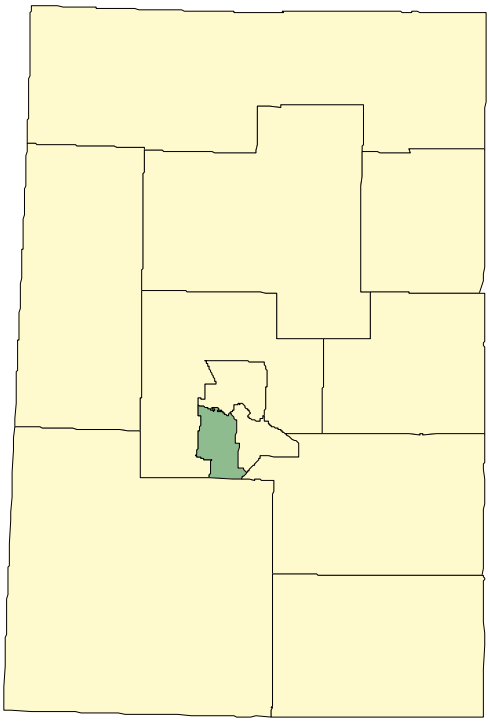
Predicted Percentage of Children with BLL >= 10 ug/dL for CRAWFORD County



Predicted Percentage of Children with BLL >= 10 ug/dL for CUYAHOGA County

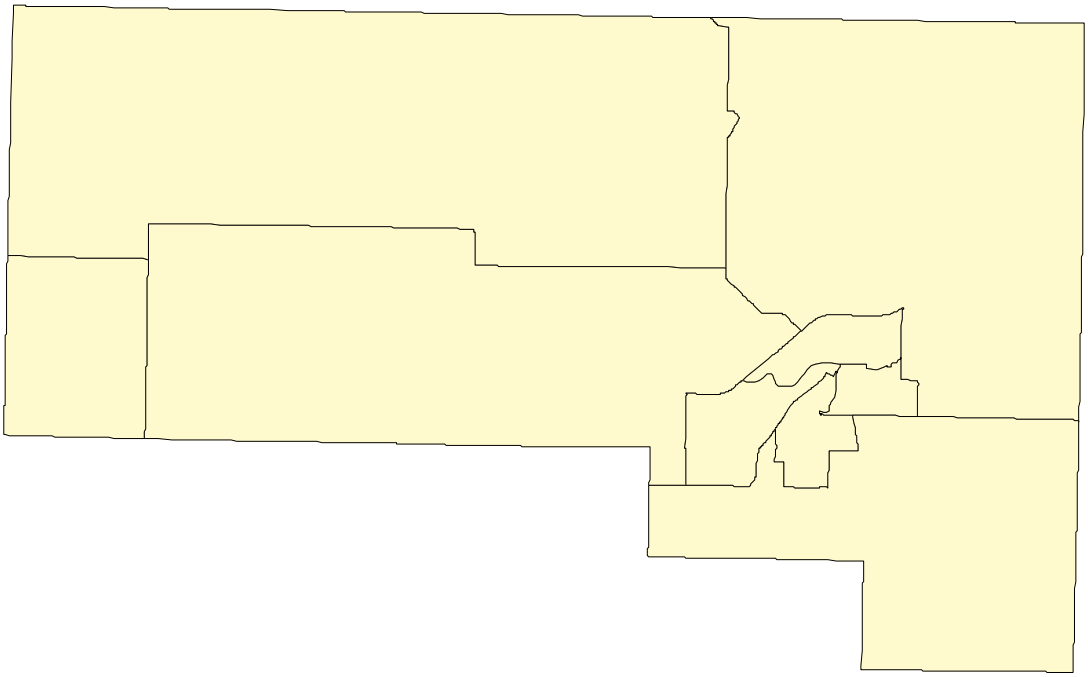


Predicted Percentage of Children with BLL >= 10 ug/dL for DARKE County



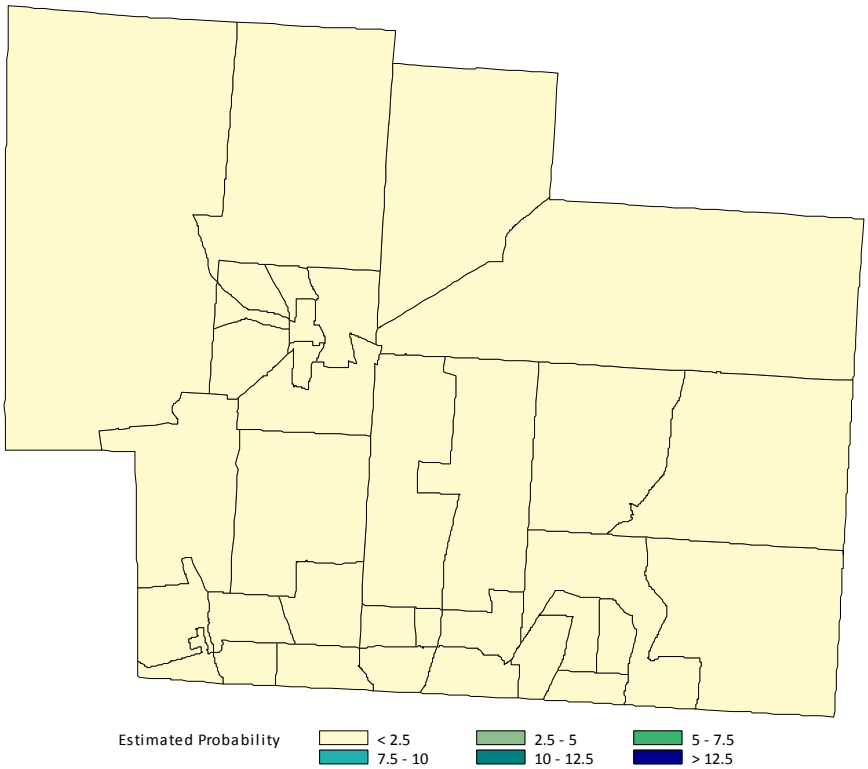
Estimated Probability
< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

Predicted Percentage of Children with BLL >= 10 ug/dL for DEFIANCE County

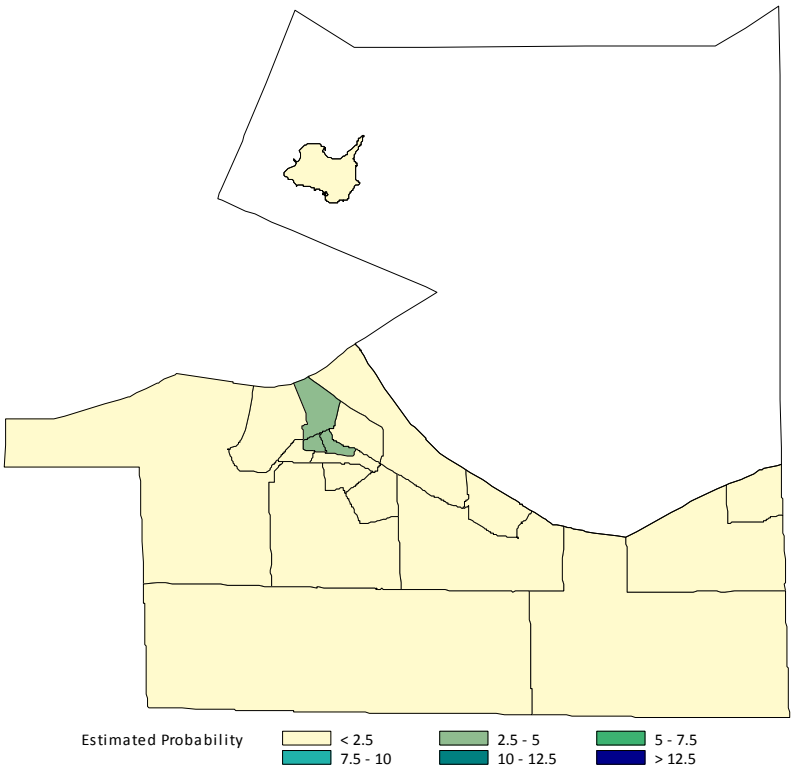


Estimated Probability
< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

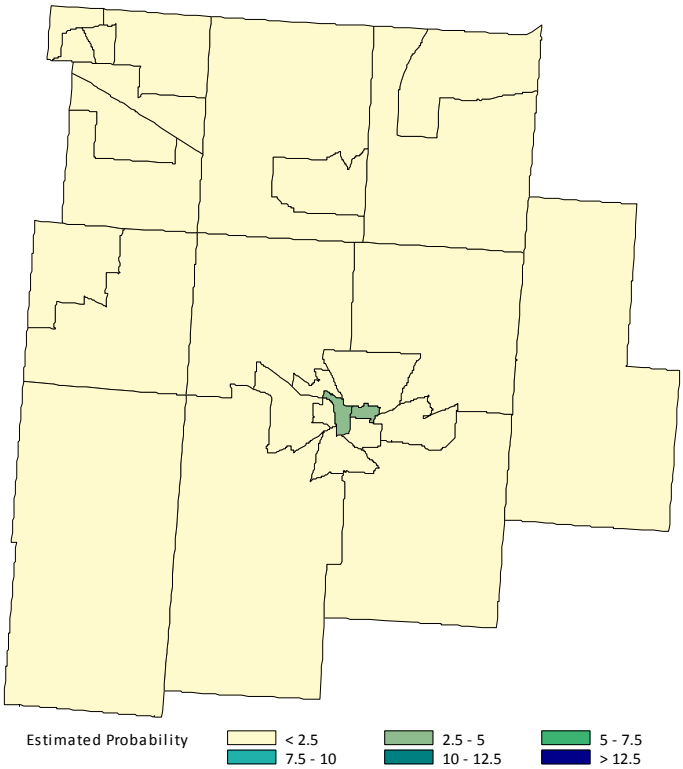
Predicted Percentage of Children with BLL >= 10 ug/dL for DELAWARE County



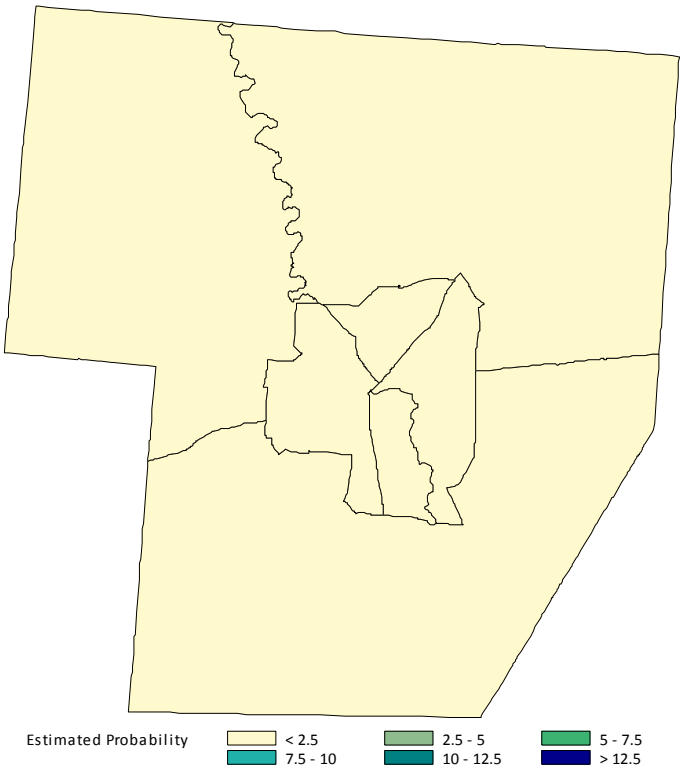
Predicted Percentage of Children with BLL >= 10 ug/dL for ERIE County



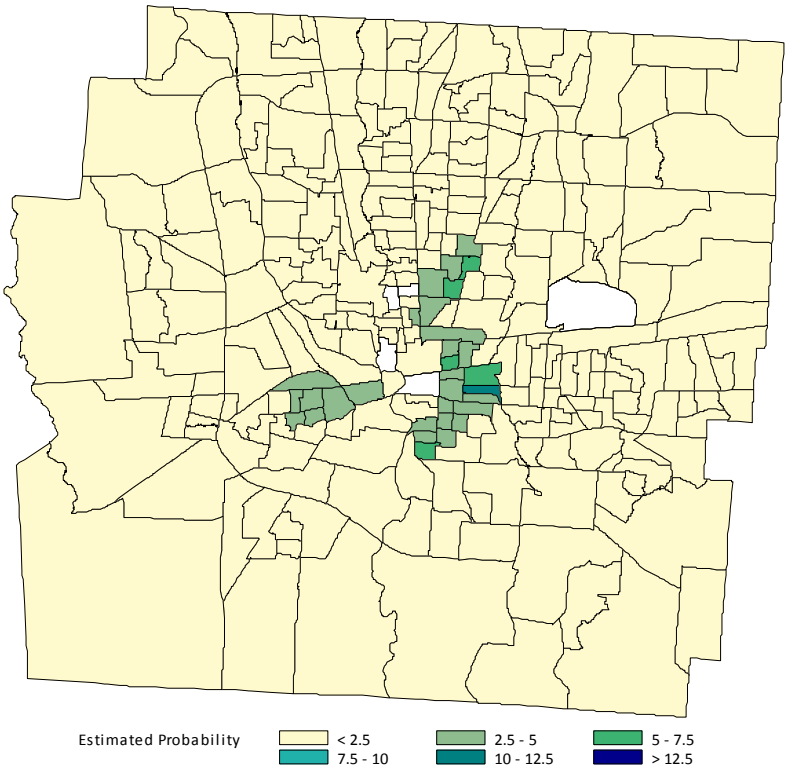
Predicted Percentage of Children with BLL >= 10 ug/dL for FAIRFIELD County



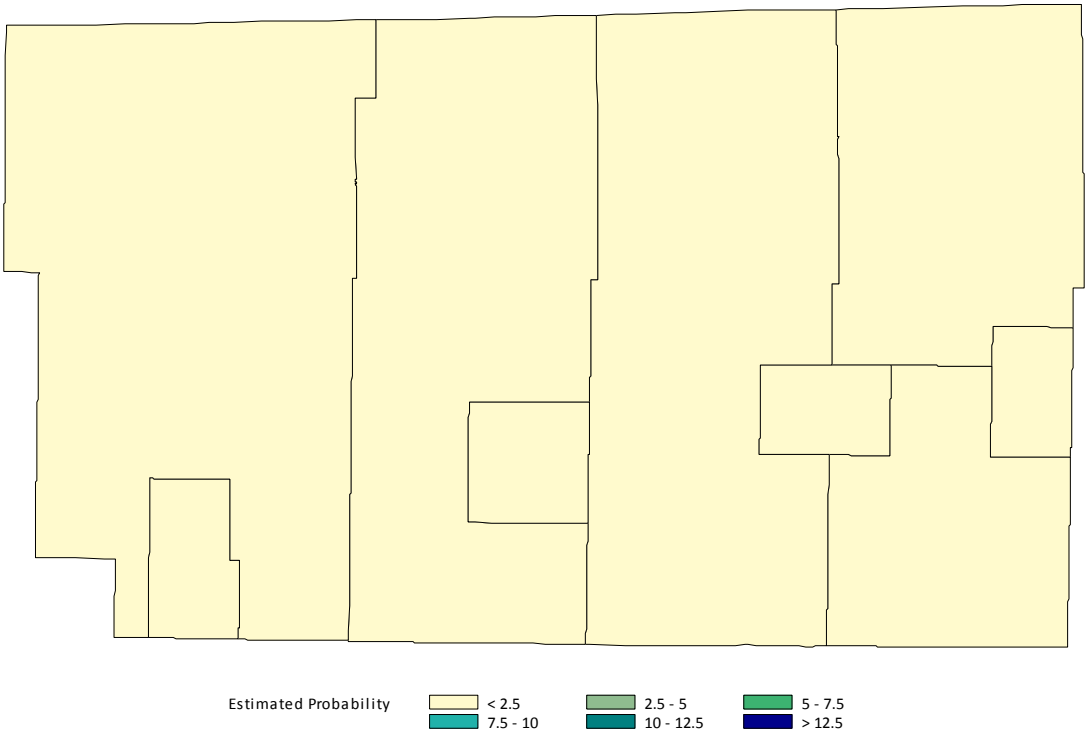
Predicted Percentage of Children with BLL >= 10 ug/dL for FAYETTE County



Predicted Percentage of Children with BLL >= 10 ug/dL for FRANKLIN County

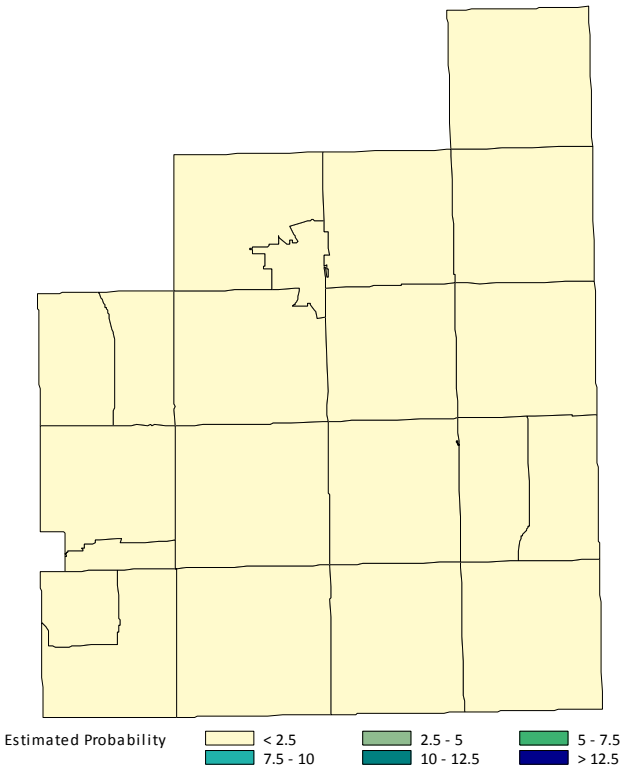


Predicted Percentage of Children with BLL >= 10 ug/dL for FULTON County

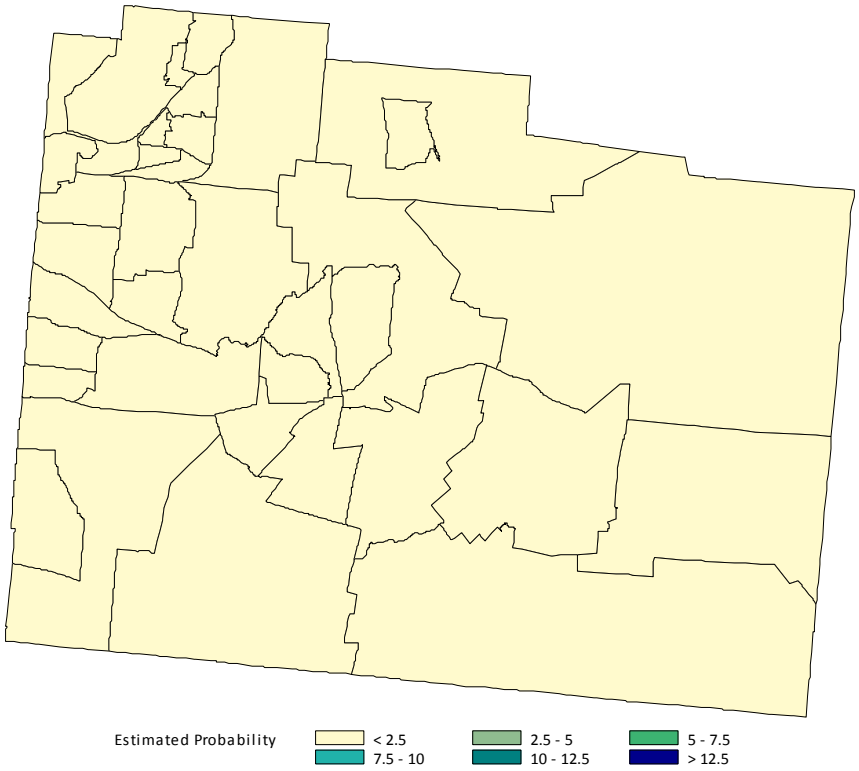


Predicted Percentage of Children with BLL >= 10 ug/dL for GALLIA County

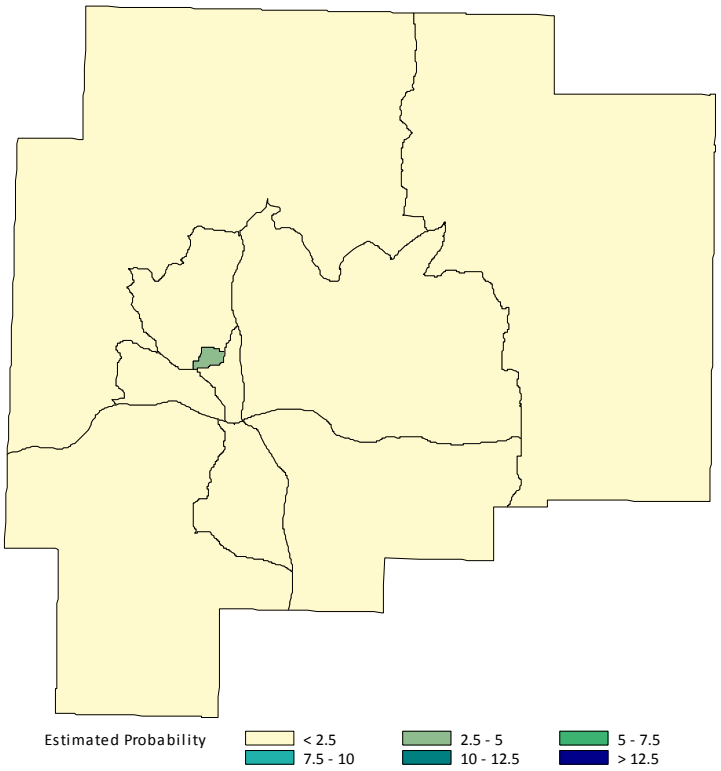
Predicted Percentage of Children with BLL >= 10 ug/dL for GEAUGA County



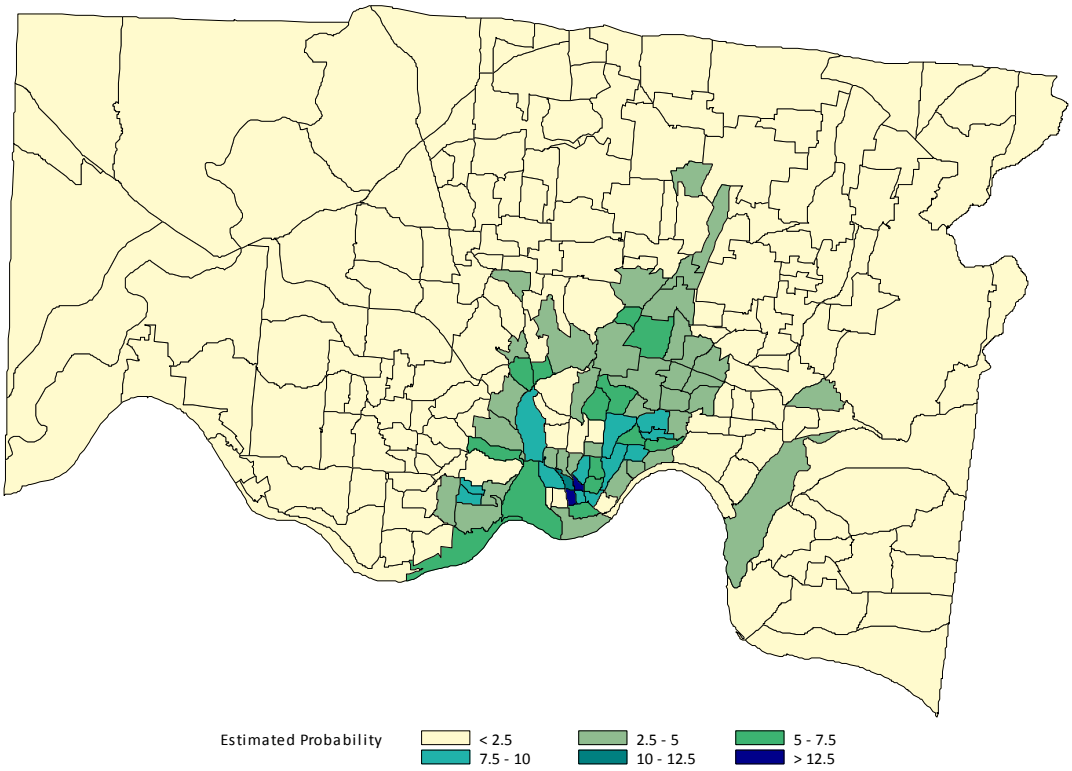
Predicted Percentage of Children with BLL >= 10 ug/dL for GREENE County



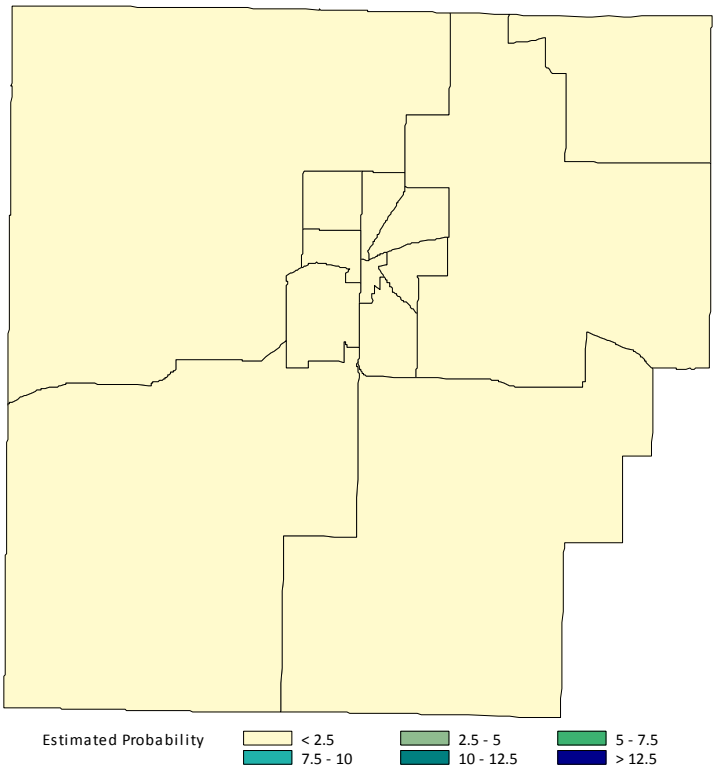
Predicted Percentage of Children with BLL >= 10 ug/dL for GUERNSEY County



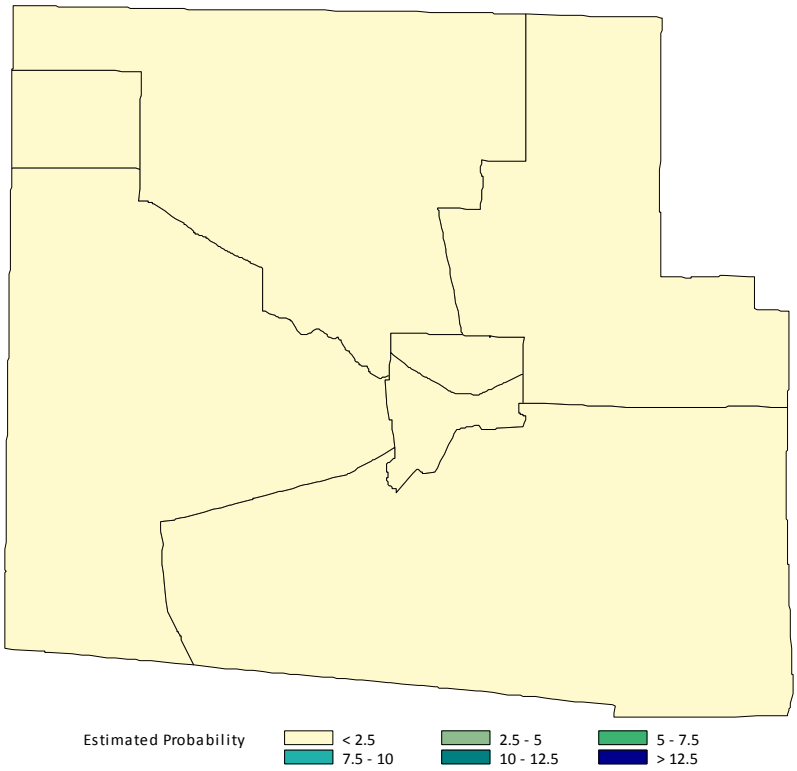
Predicted Percentage of Children with BLL >= 10 ug/dL for HAMILTON County



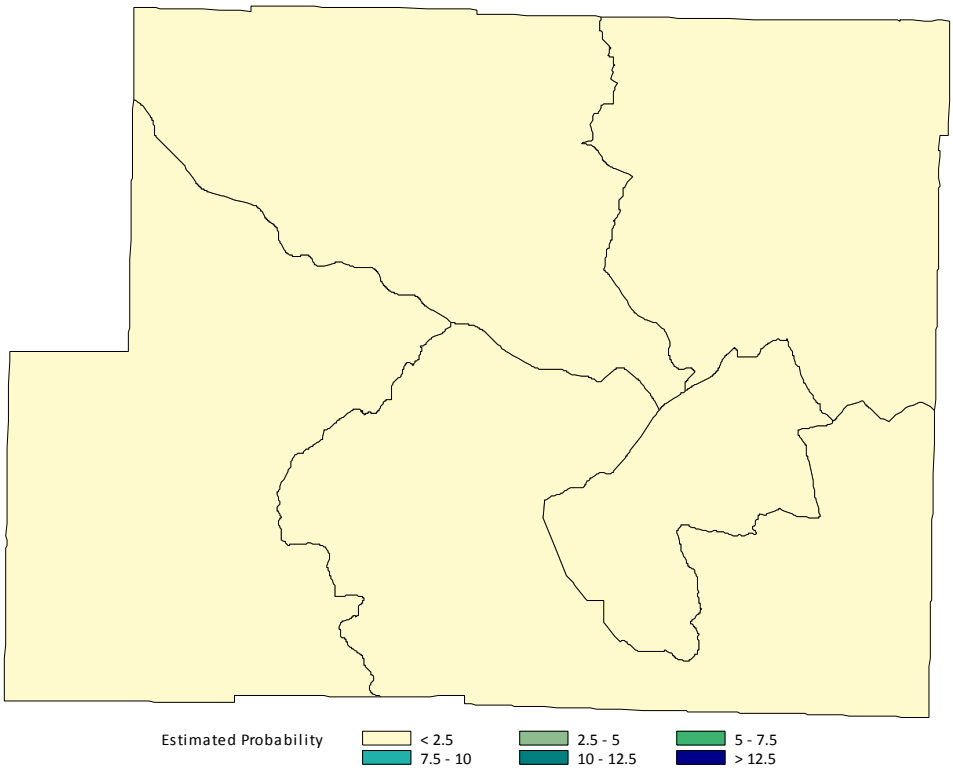
Predicted Percentage of Children with BLL >= 10 ug/dL for HANCOCK County



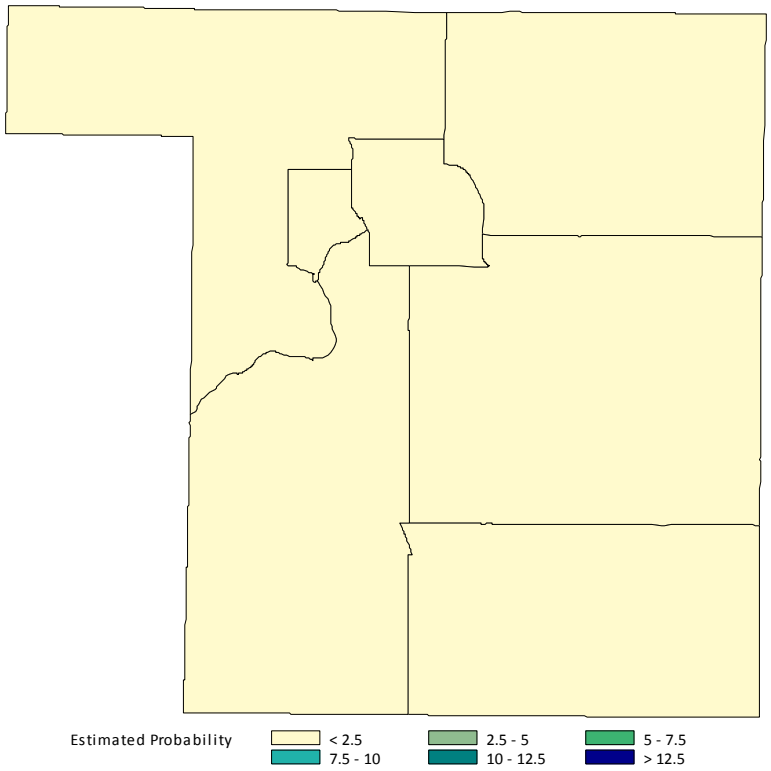
Predicted Percentage of Children with BLL >= 10 ug/dL for HARDIN County



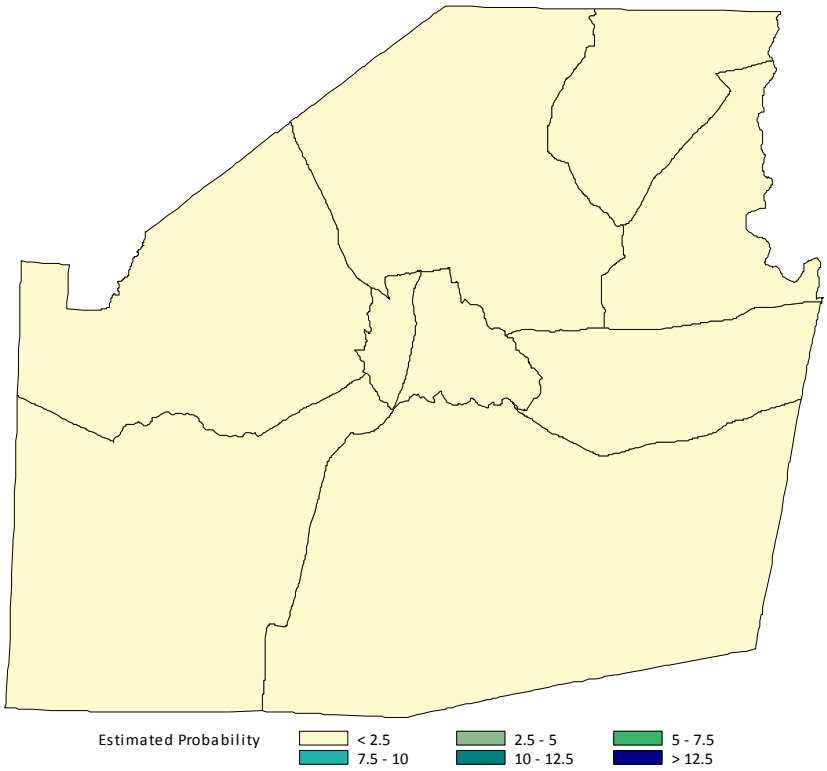
Predicted Percentage of Children with BLL >= 10 ug/dL for HARRISON County



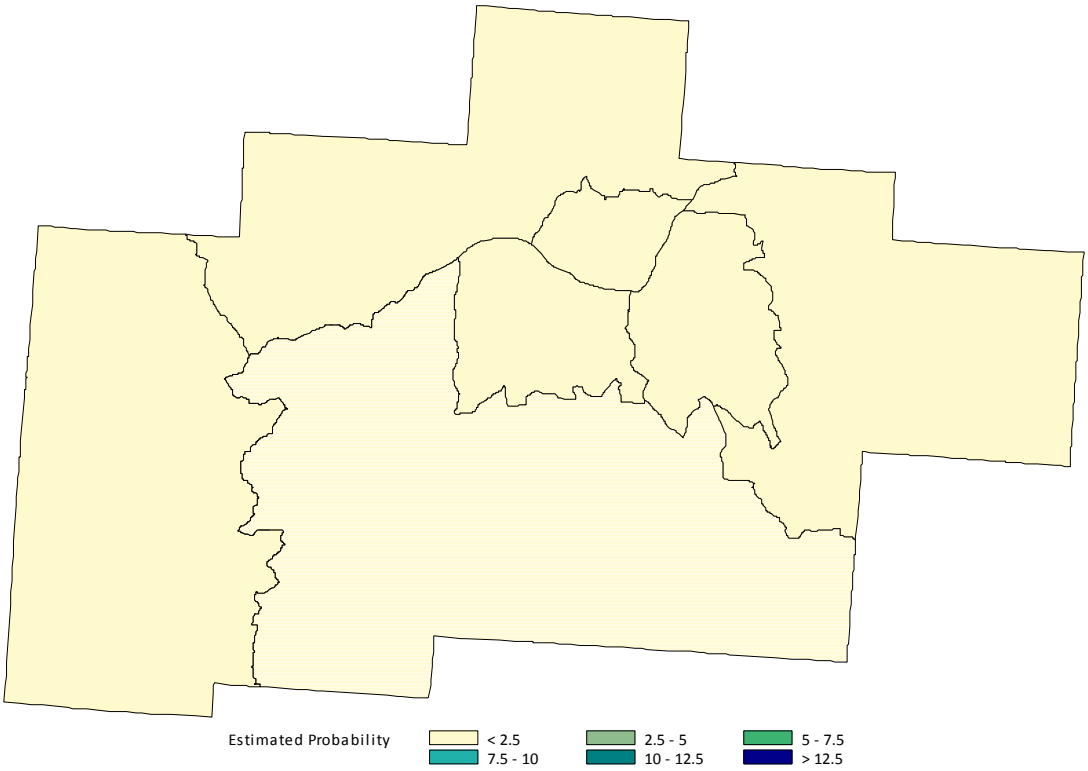
Predicted Percentage of Children with BLL >= 10 ug/dL for HENRY County



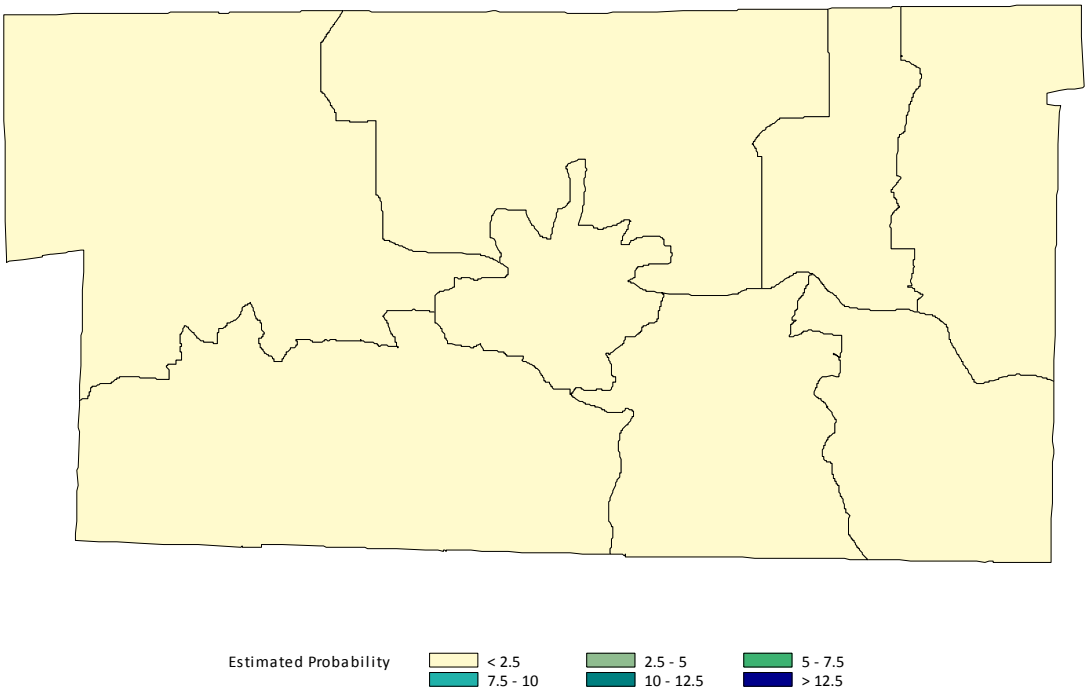
Predicted Percentage of Children with BLL >= 10 ug/dL for HIGHLAND County



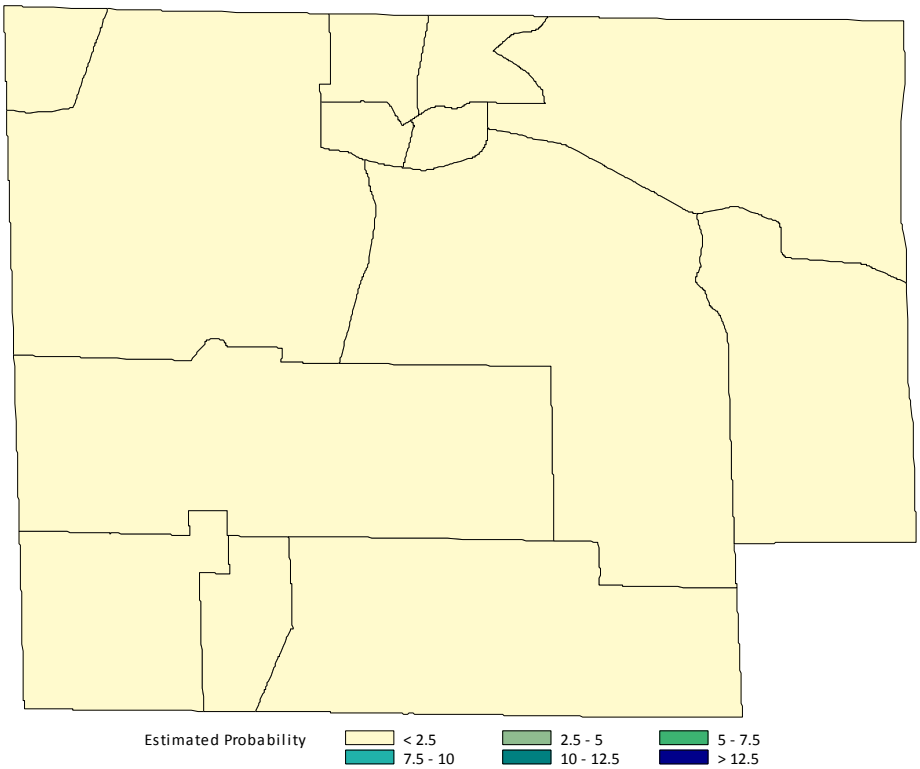
Predicted Percentage of Children with BLL >= 10 ug/dL for HOCKING County



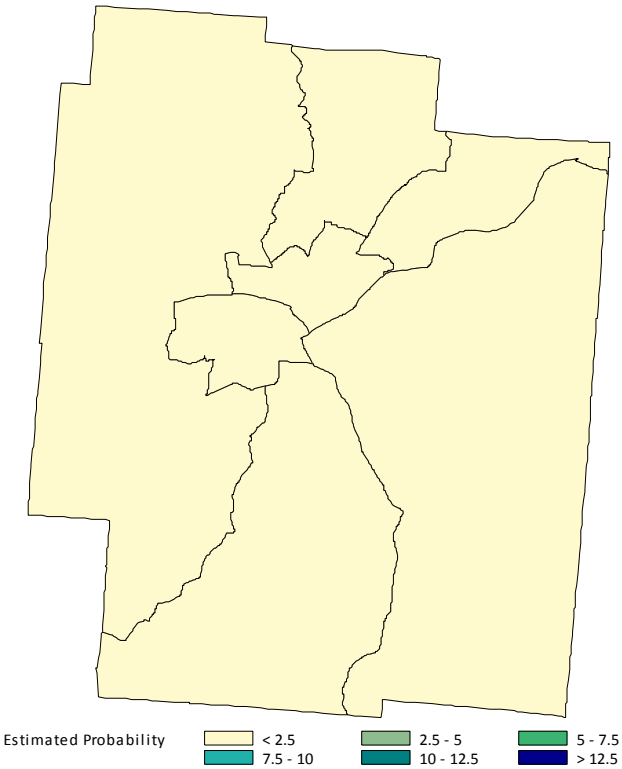
Predicted Percentage of Children with BLL >= 10 ug/dL for HOLMES County



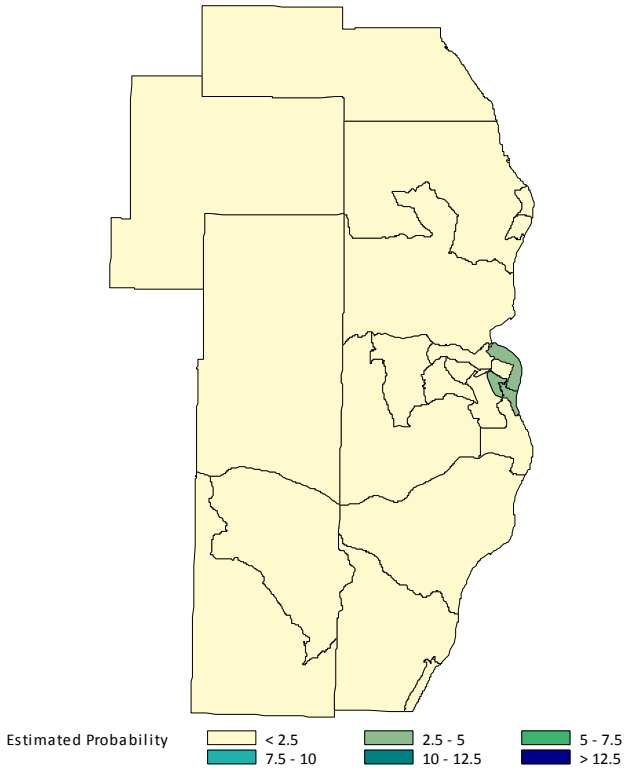
Predicted Percentage of Children with BLL >= 10 ug/dL for HURON County



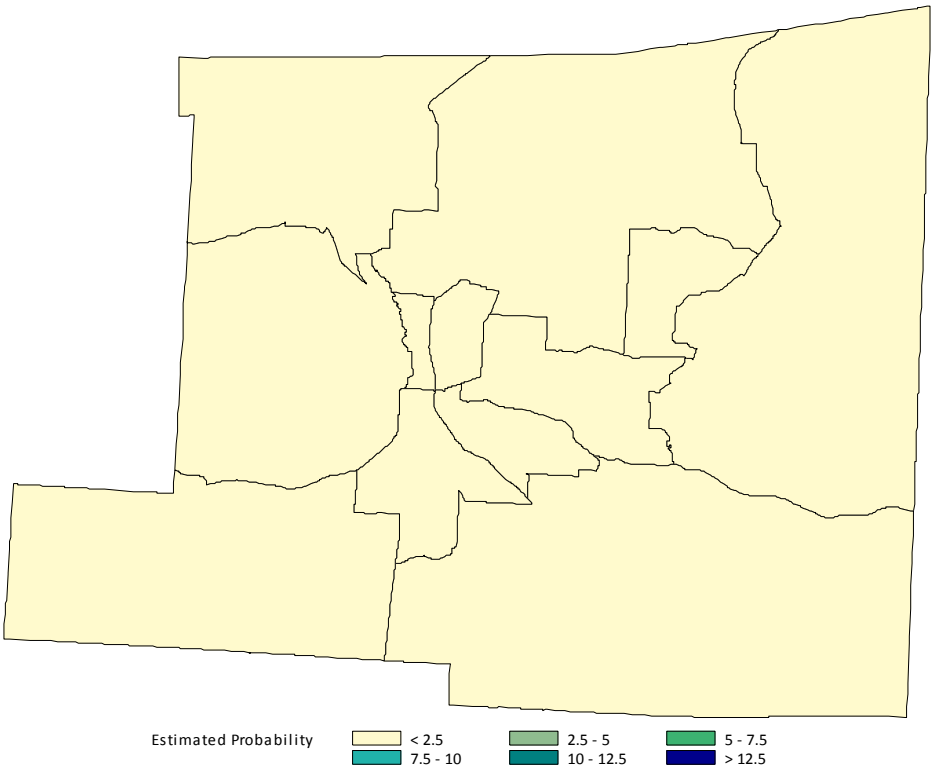
Predicted Percentage of Children with BLL >= 10 ug/dL for JACKSON County



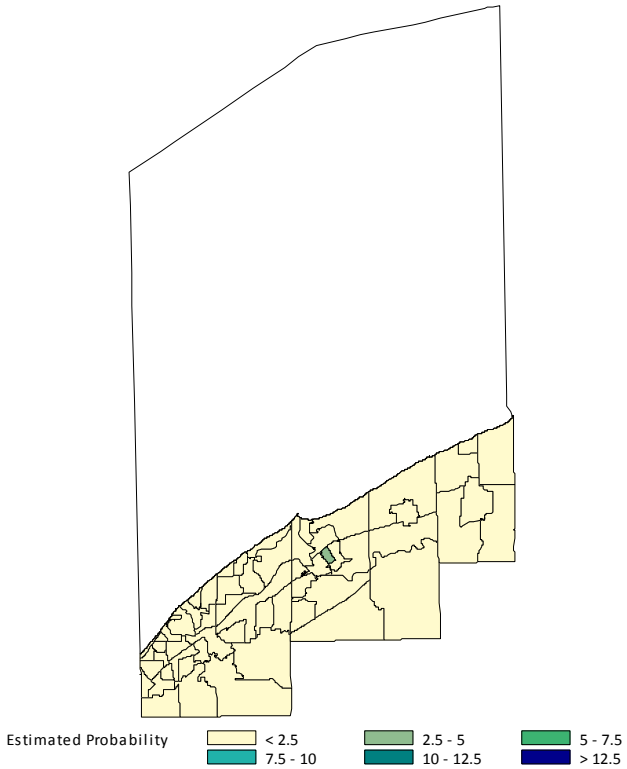
Predicted Percentage of Children with BLL >= 10 ug/dL for JEFFERSON County



Predicted Percentage of Children with BLL >= 10 ug/dL for KNOX County

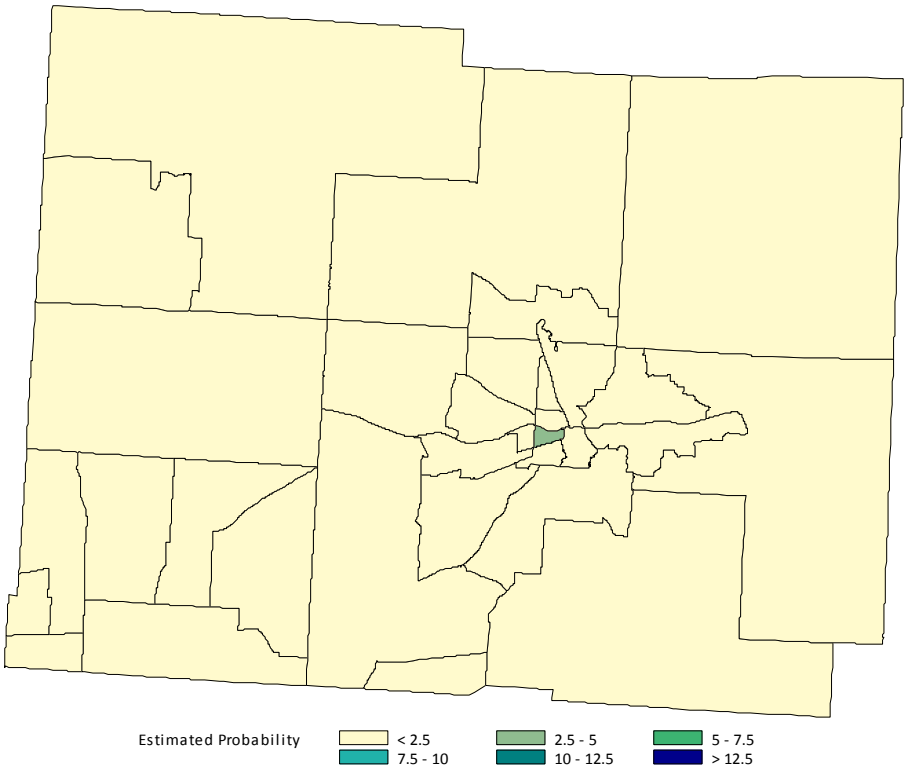


Predicted Percentage of Children with BLL >= 10 ug/dL for LAKE County

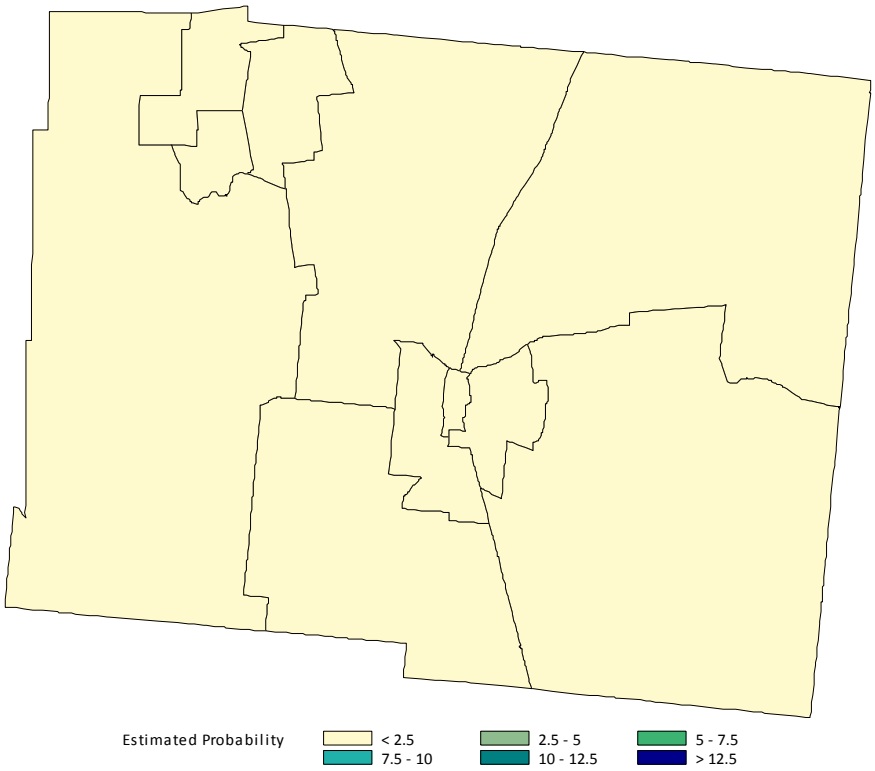


Predicted Percentage of Children with BLL >= 10 ug/dL for LAWRENCE County

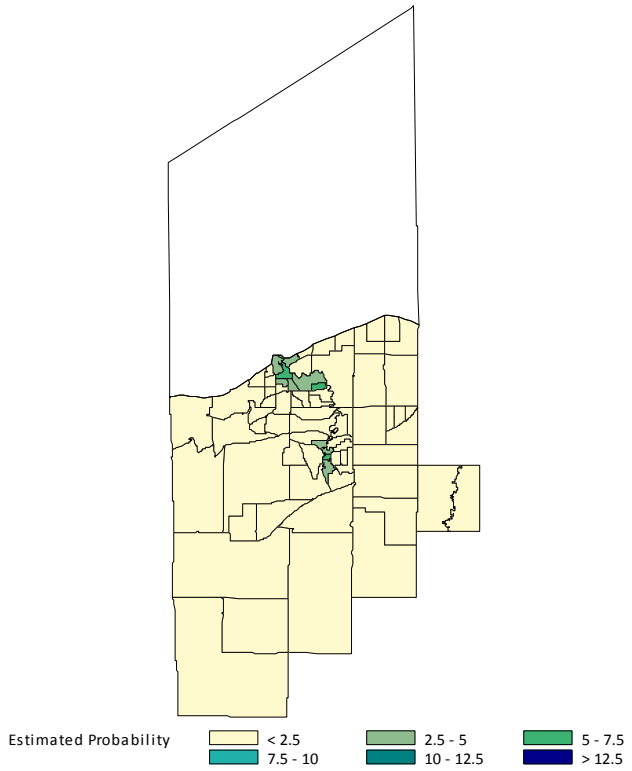
Predicted Percentage of Children with BLL >= 10 ug/dL for LICKING County



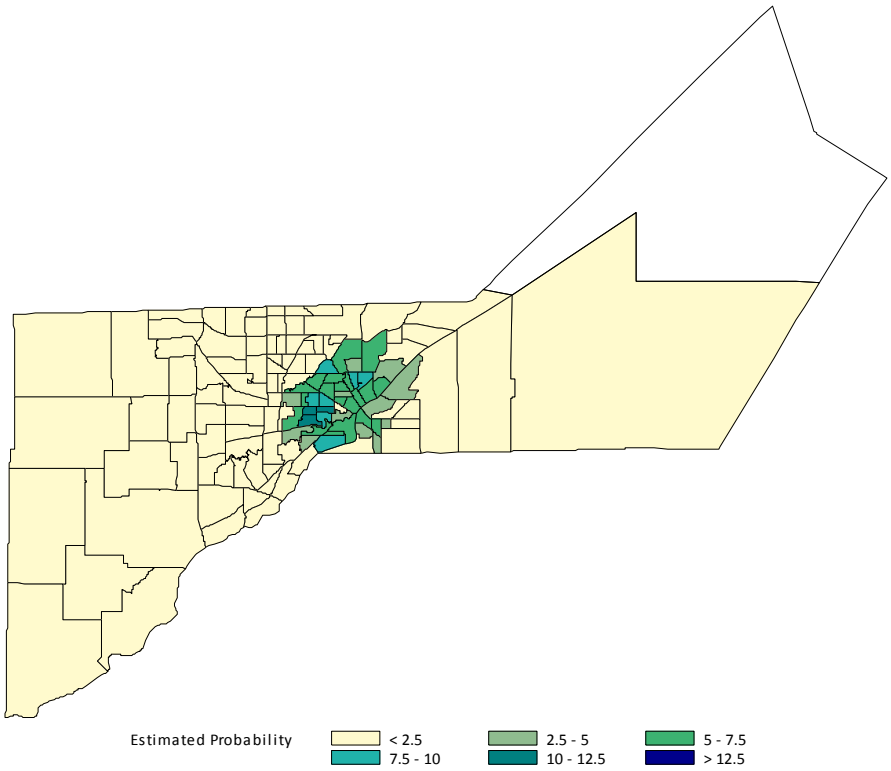
Predicted Percentage of Children with BLL >= 10 ug/dL for LOGAN County



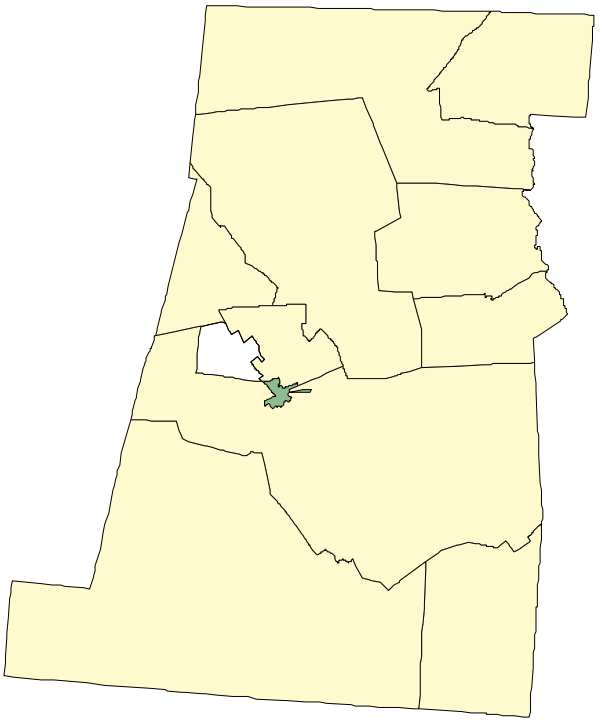
Predicted Percentage of Children with BLL >= 10 ug/dL for LORAIN County



Predicted Percentage of Children with BLL >= 10 ug/dL for LUCAS County



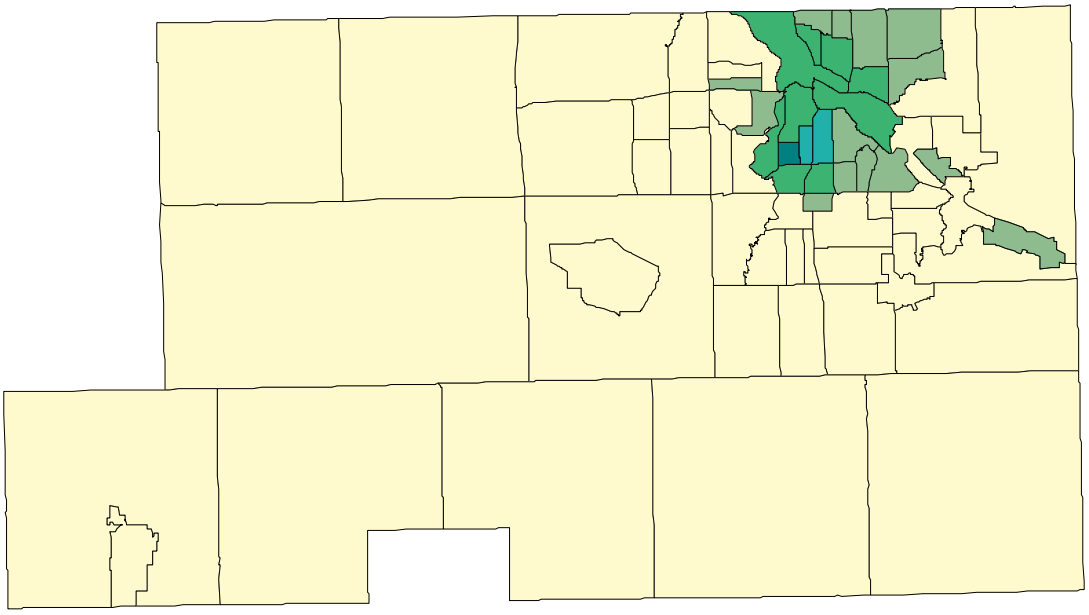
Predicted Percentage of Children with BLL >= 10 ug/dL for MADISON County



Estimated Probability

< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

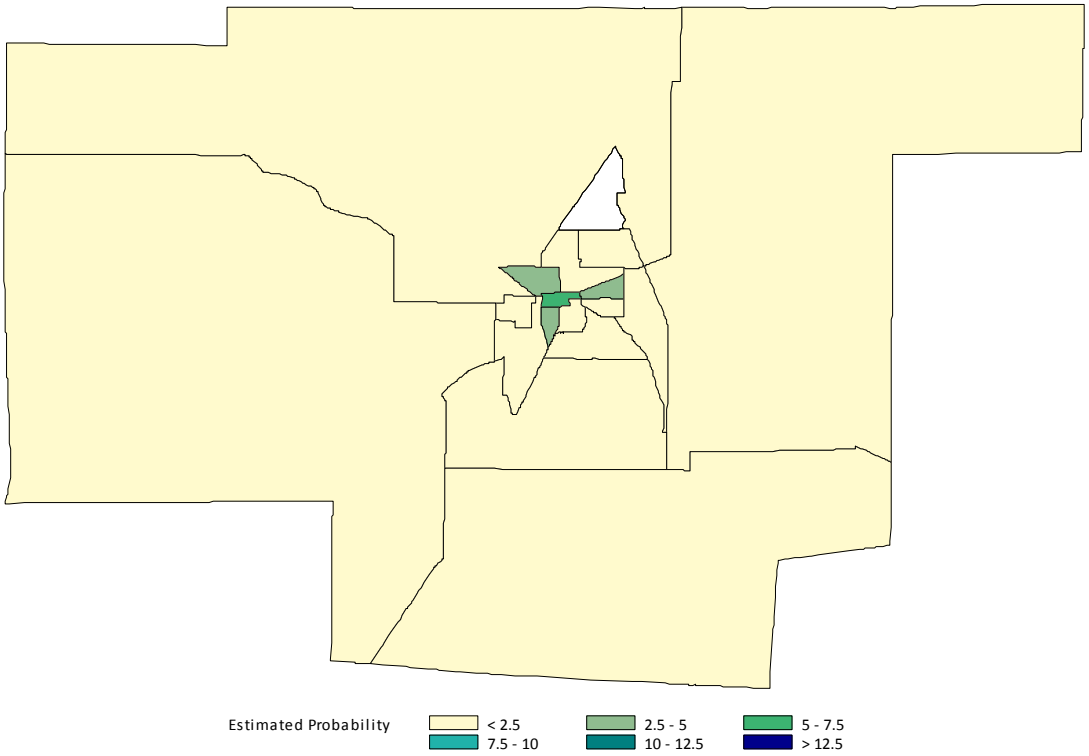
Predicted Percentage of Children with BLL >= 10 ug/dL for MAHONING County



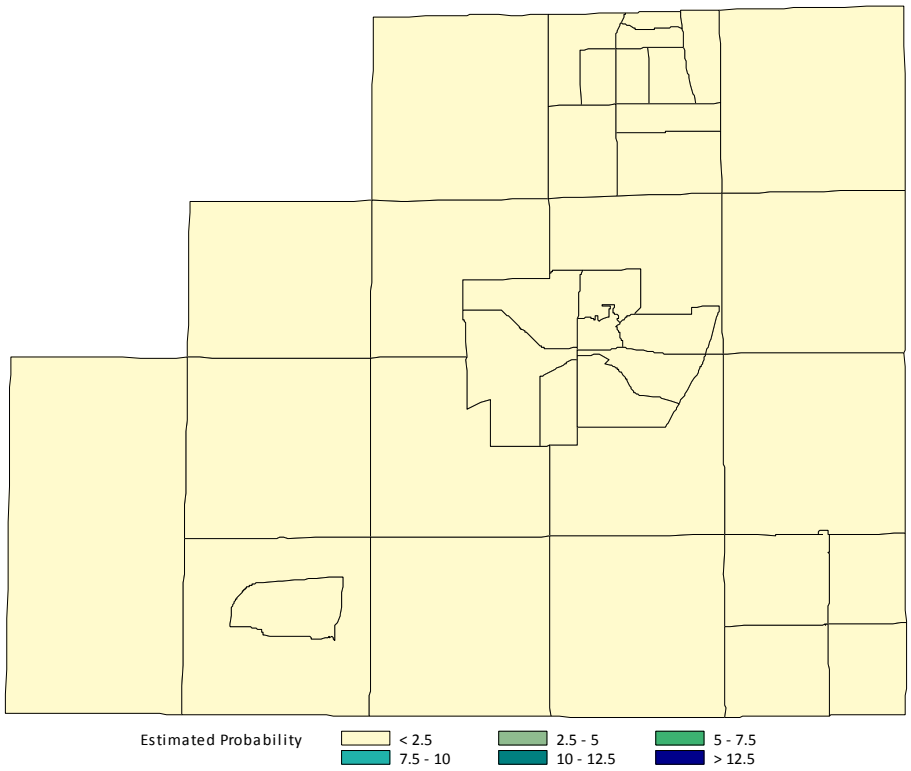
Estimated Probability

< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

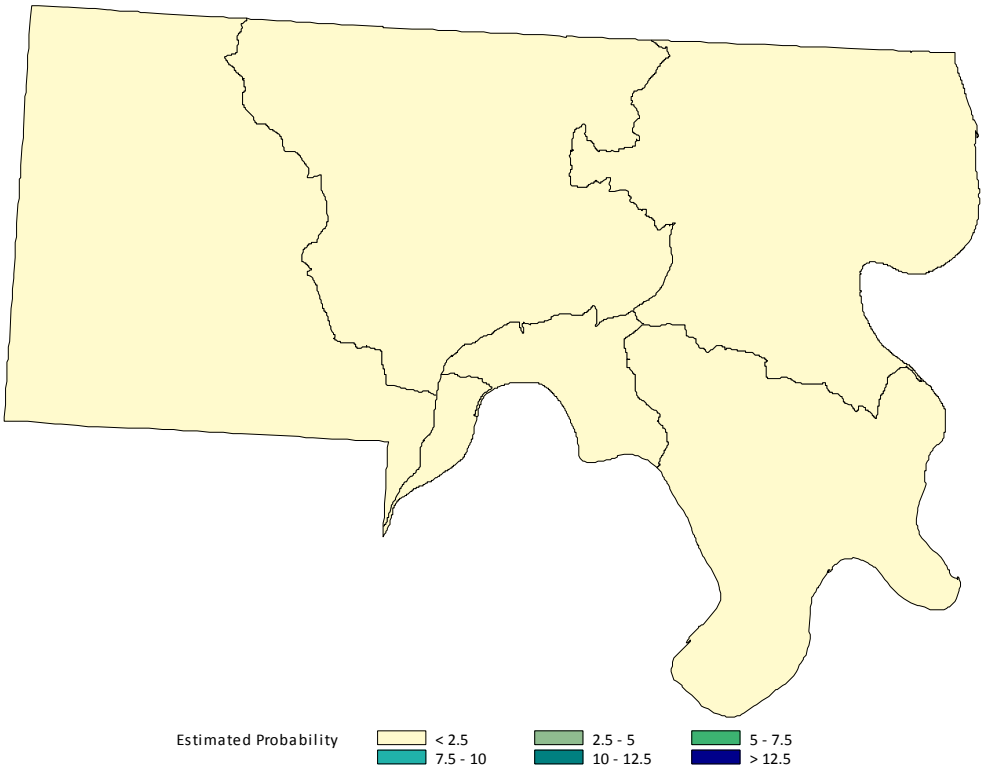
Predicted Percentage of Children with BLL >= 10 ug/dL for MARION County



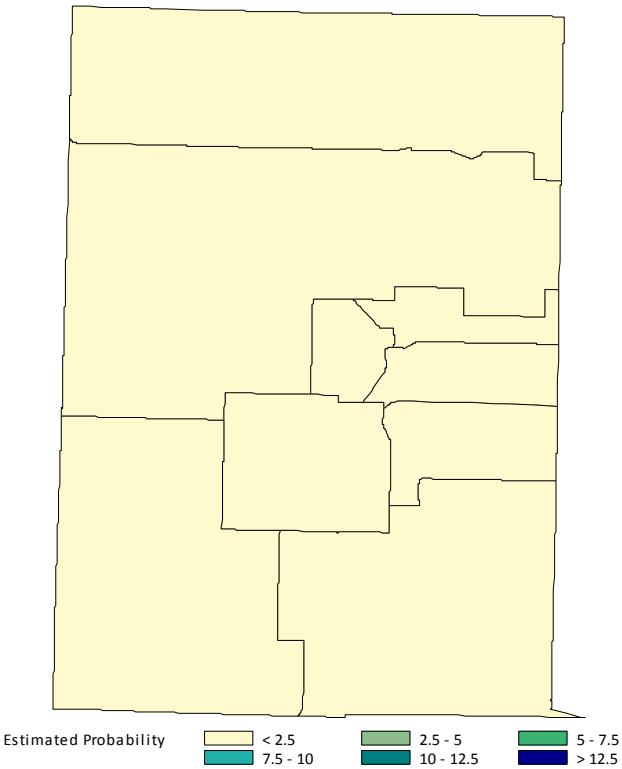
Predicted Percentage of Children with BLL >= 10 ug/dL for MEDINA County



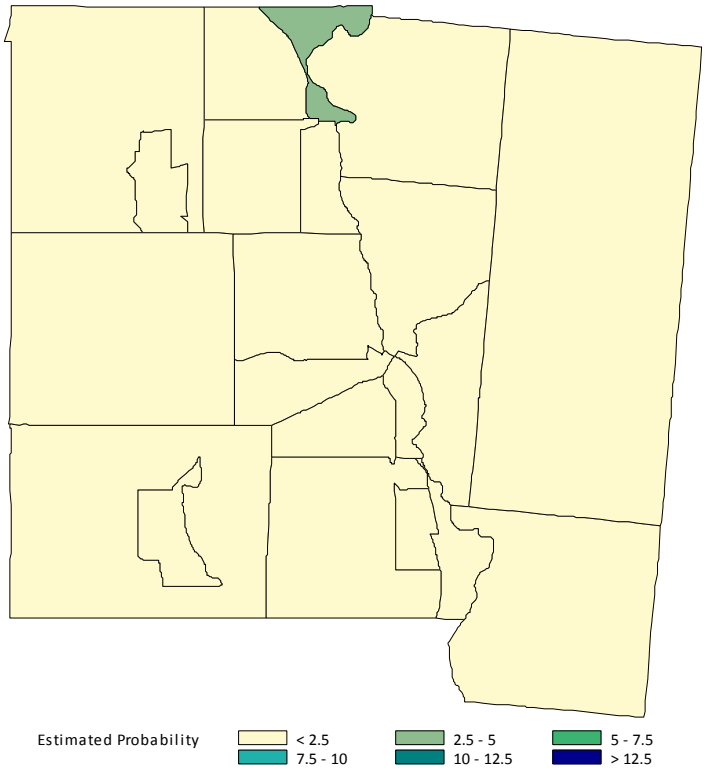
Predicted Percentage of Children with BLL >= 10 ug/dL for MEIGS County



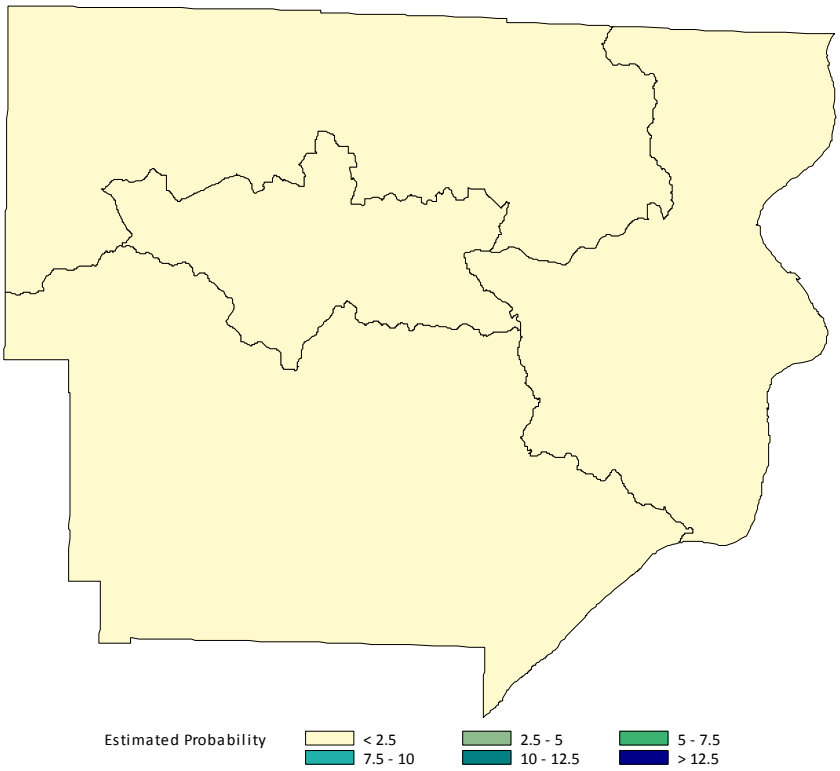
Predicted Percentage of Children with BLL >= 10 ug/dL for MERCER County



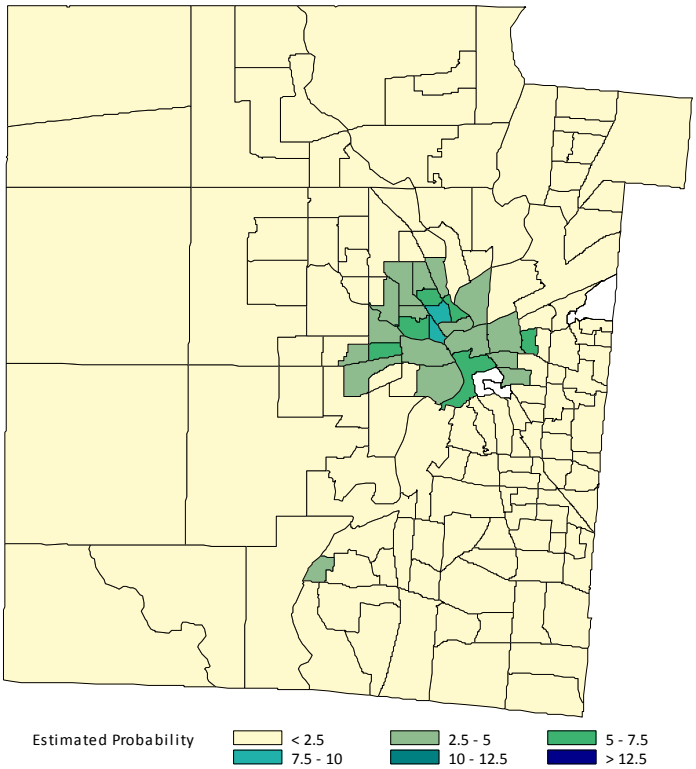
Predicted Percentage of Children with BLL >= 10 ug/dL for MIAMI County



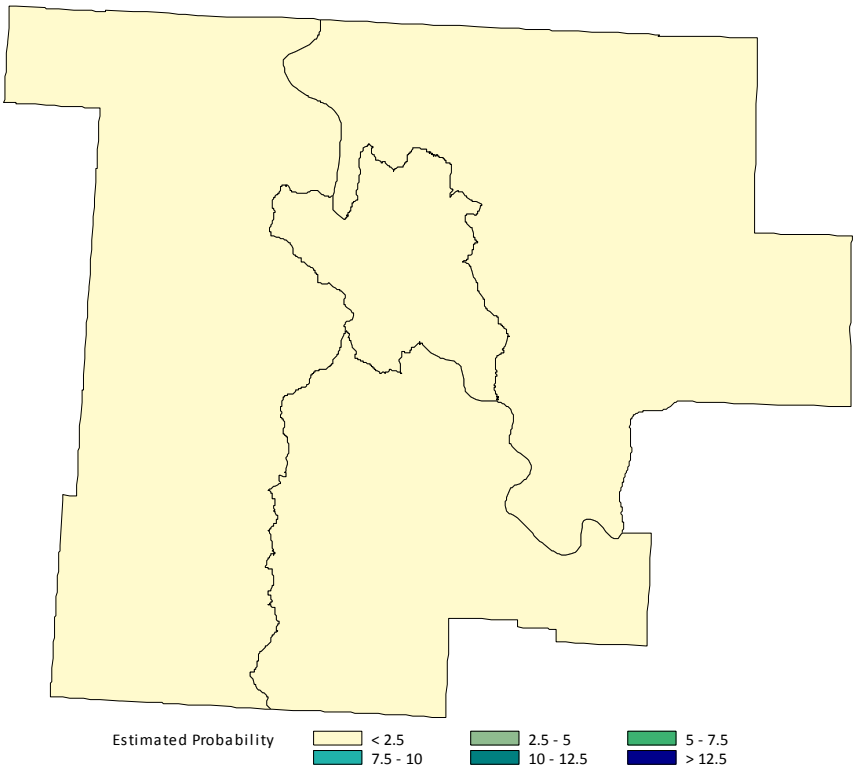
Predicted Percentage of Children with BLL >= 10 ug/dL for MONROE County



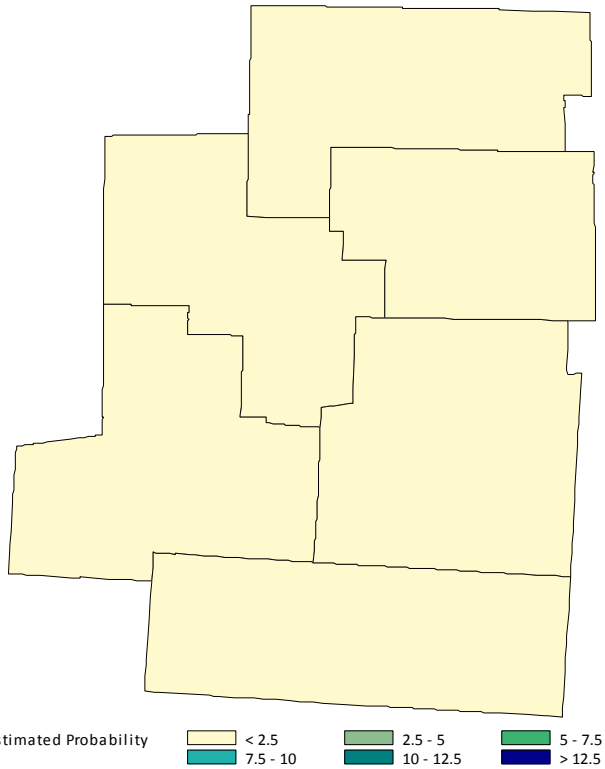
Predicted Percentage of Children with BLL >= 10 ug/dL for MONTGOMERY County



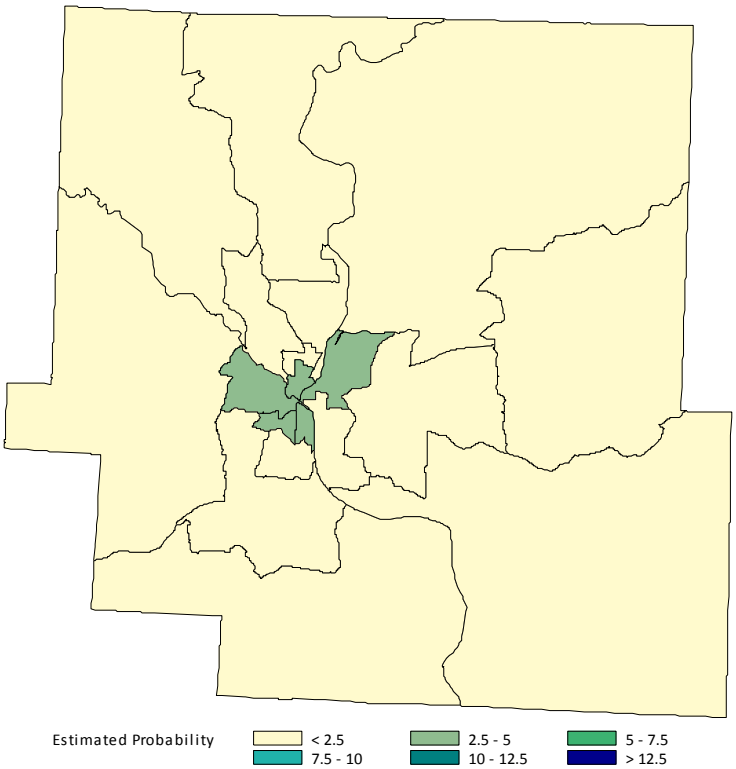
Predicted Percentage of Children with BLL >= 10 ug/dL for MORGAN County



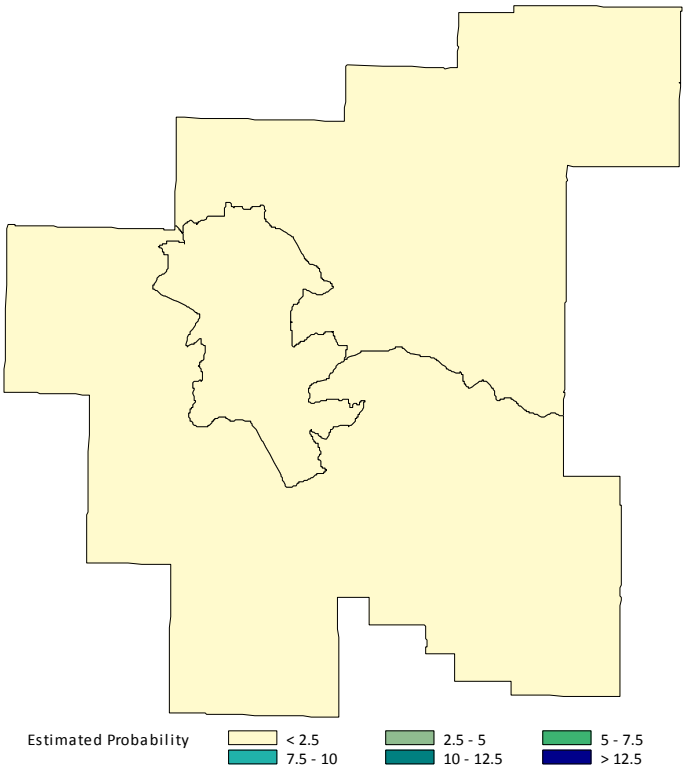
Predicted Percentage of Children with BLL >= 10 ug/dL for MORROW County



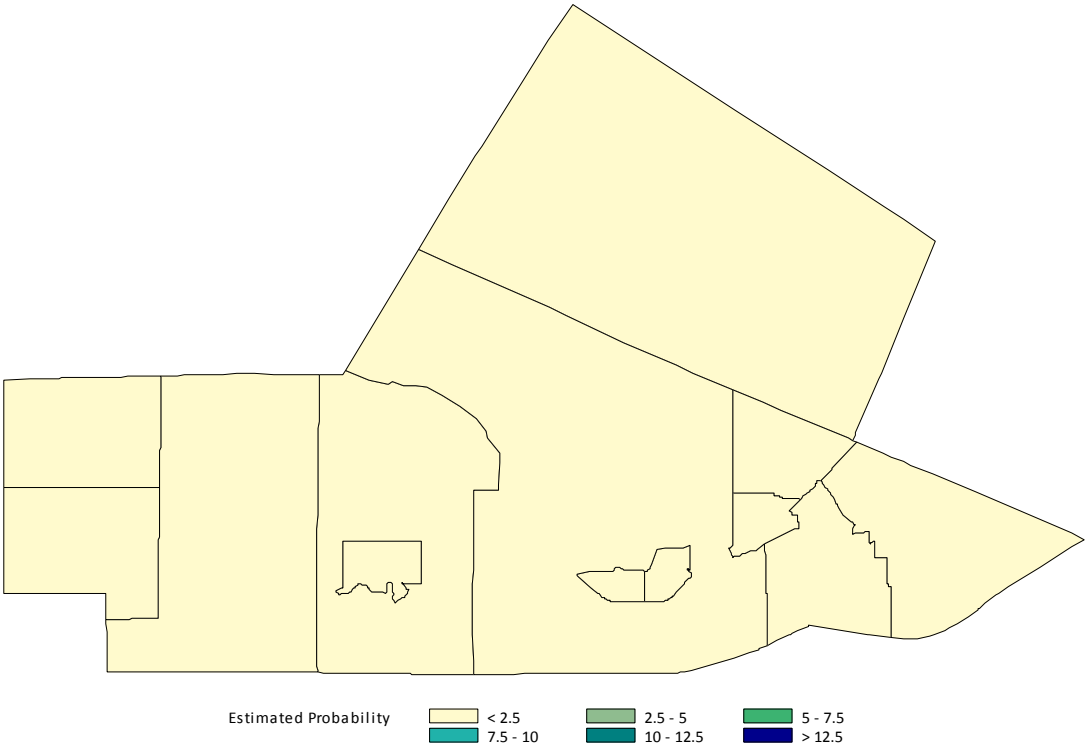
Predicted Percentage of Children with BLL >= 10 ug/dL for MUSKINGUM County



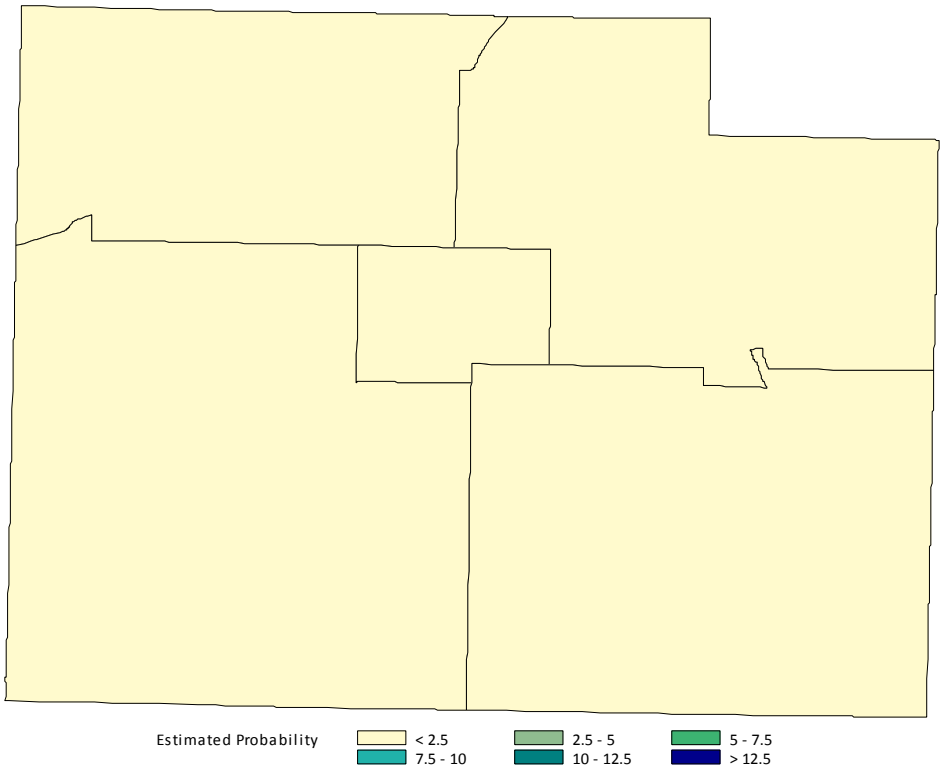
Predicted Percentage of Children with BLL >= 10 ug/dL for NOBLE County



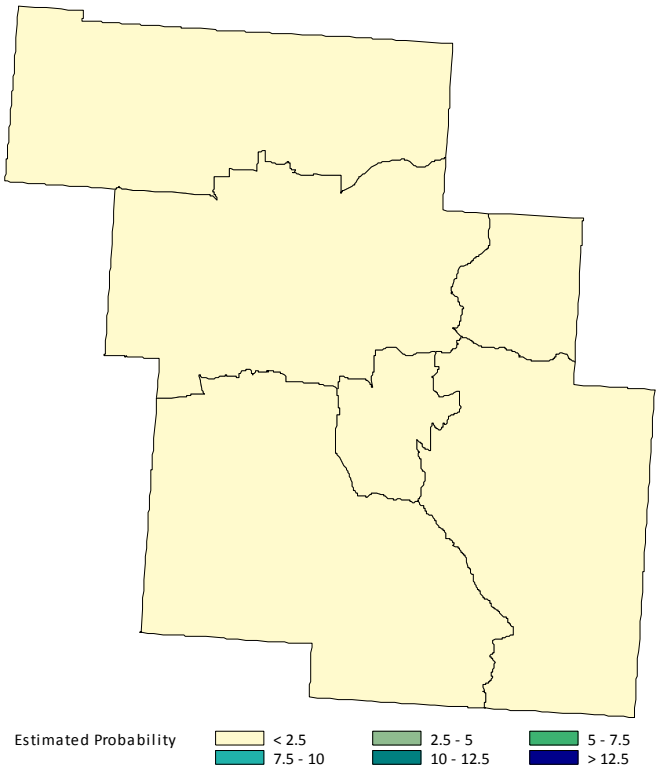
Predicted Percentage of Children with BLL >= 10 ug/dL for OTTAWA County



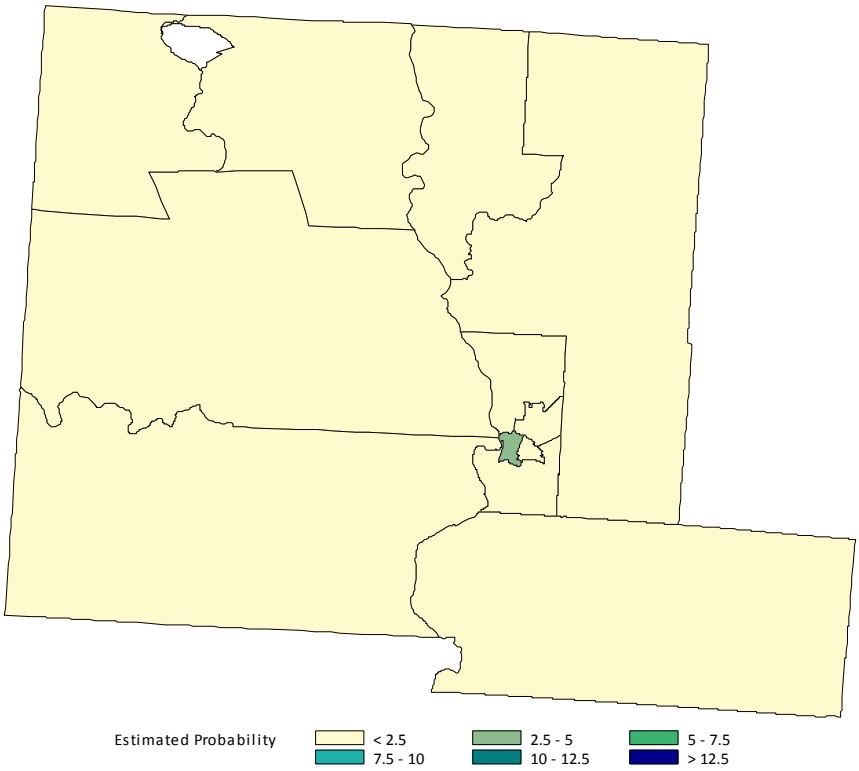
Predicted Percentage of Children with BLL >= 10 ug/dL for PAULDING County



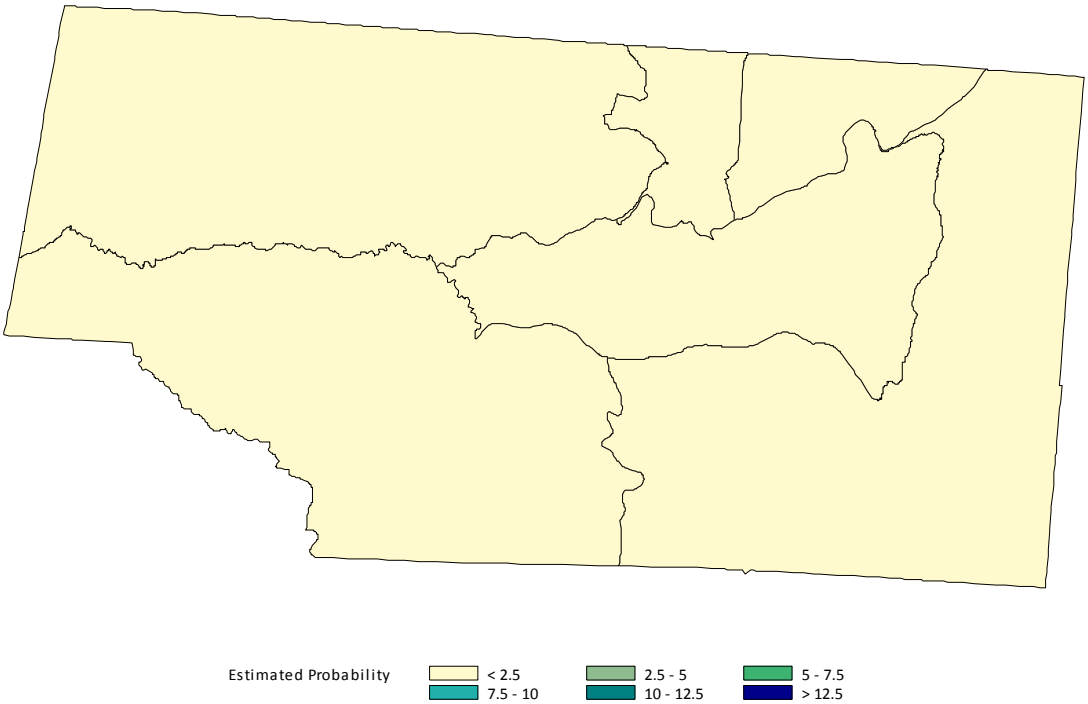
Predicted Percentage of Children with BLL >= 10 ug/dL for PERRY County



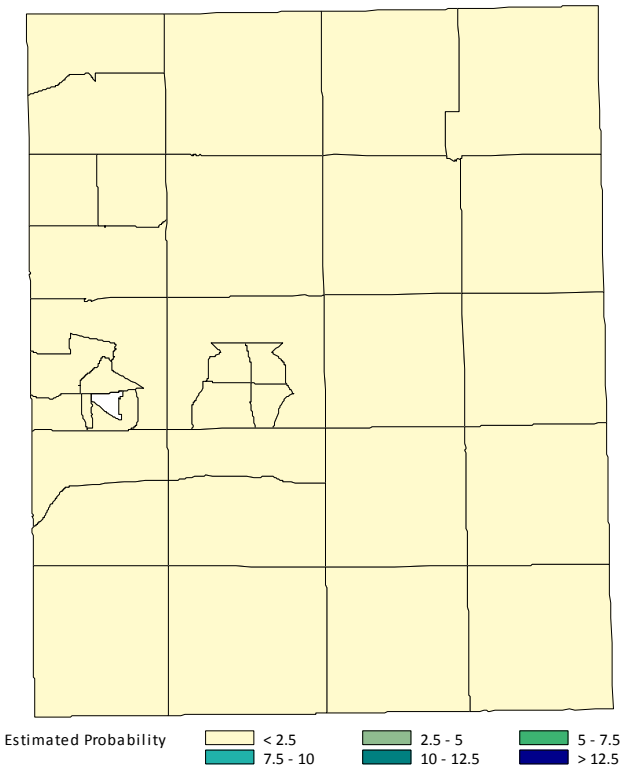
Predicted Percentage of Children with BLL >= 10 ug/dL for PICKAWAY County



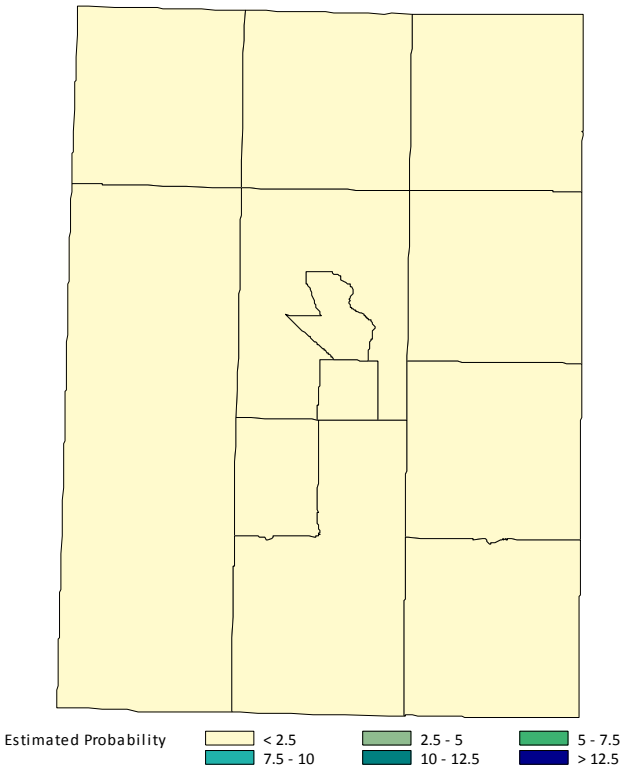
Predicted Percentage of Children with BLL >= 10 ug/dL for PIKE County



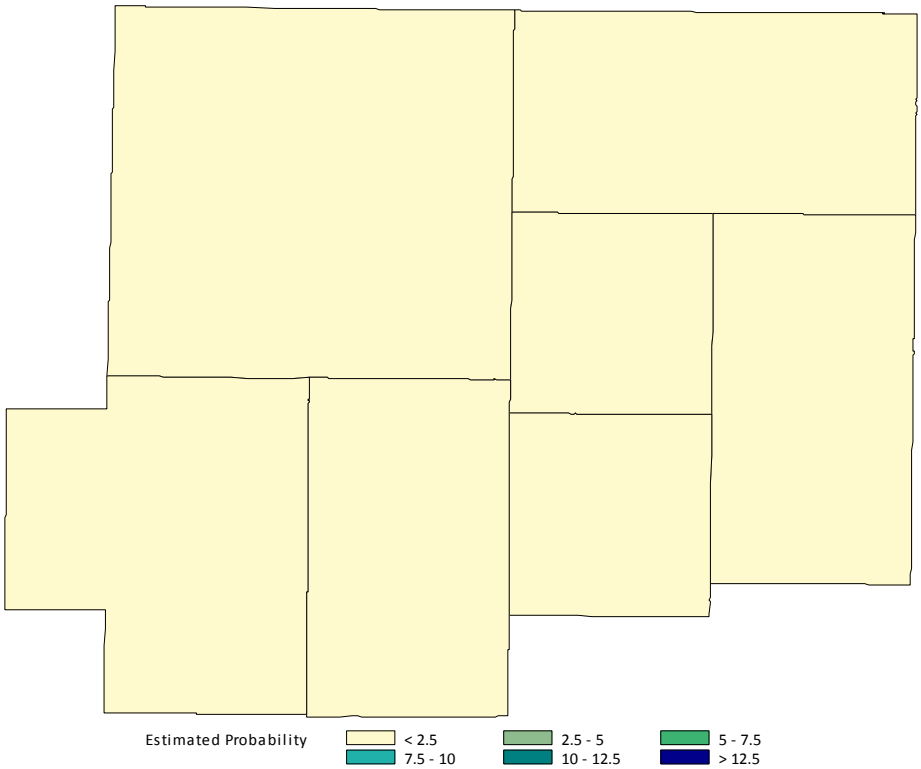
Predicted Percentage of Children with BLL >= 10 ug/dL for PORTAGE County



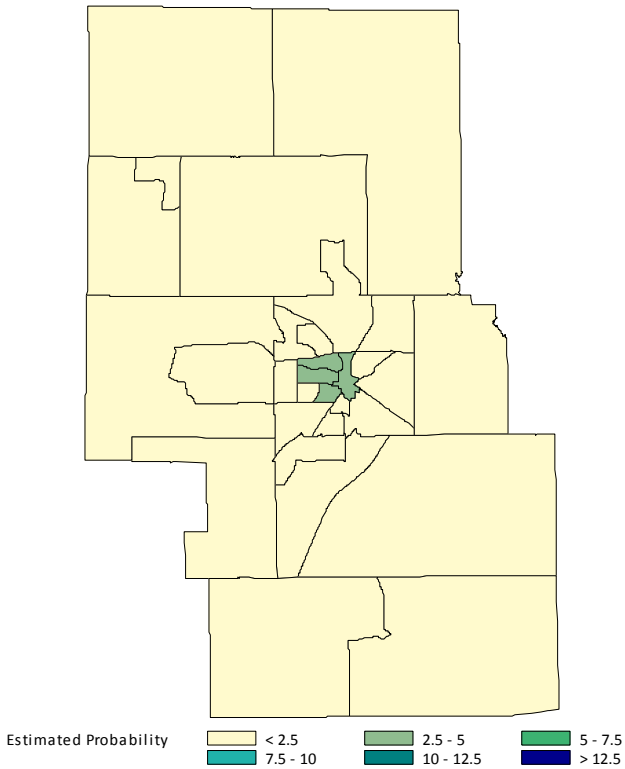
Predicted Percentage of Children with BLL >= 10 ug/dL for PREBLE County



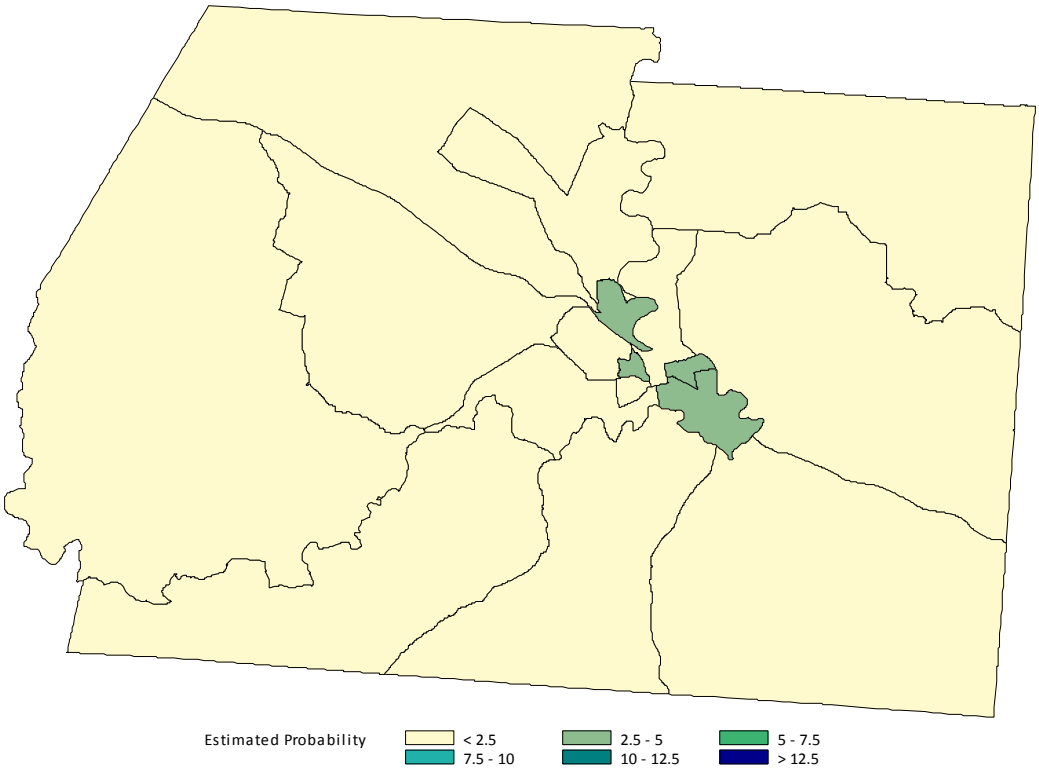
Predicted Percentage of Children with BLL >= 10 ug/dL for PUTNAM County



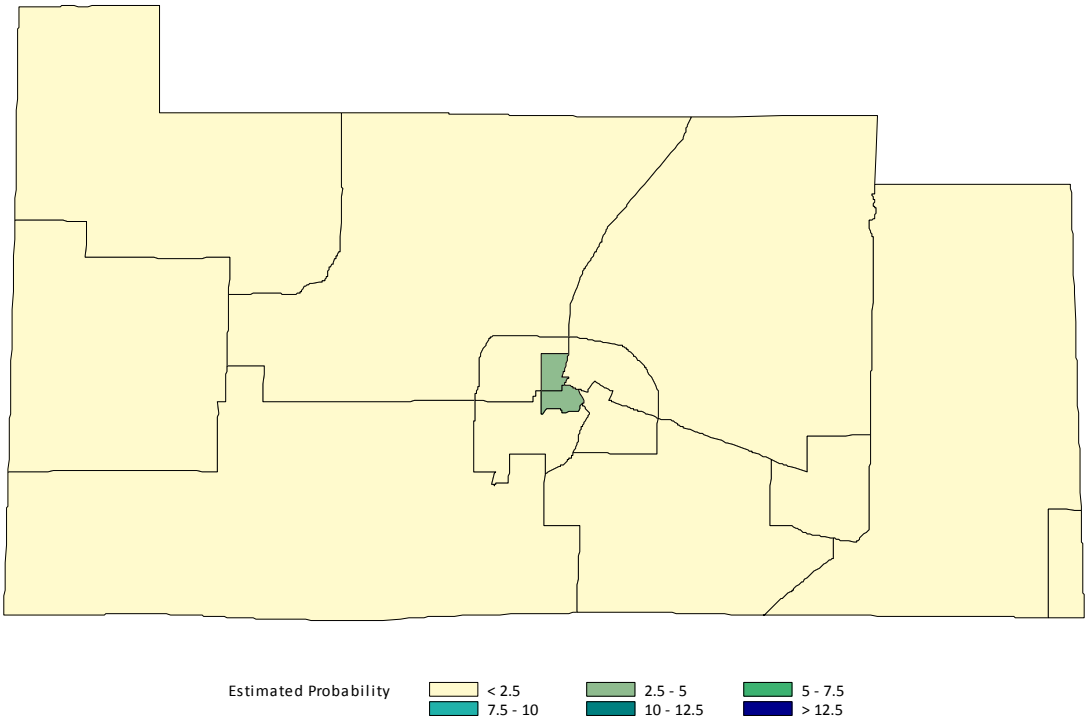
Predicted Percentage of Children with BLL >= 10 ug/dL for RICHLAND County



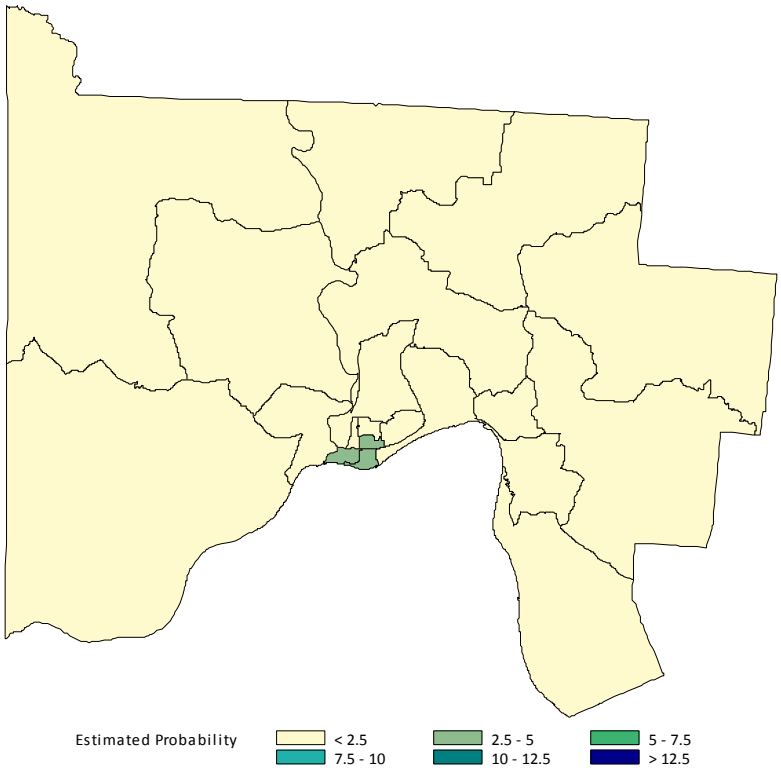
Predicted Percentage of Children with BLL >= 10 ug/dL for ROSS County



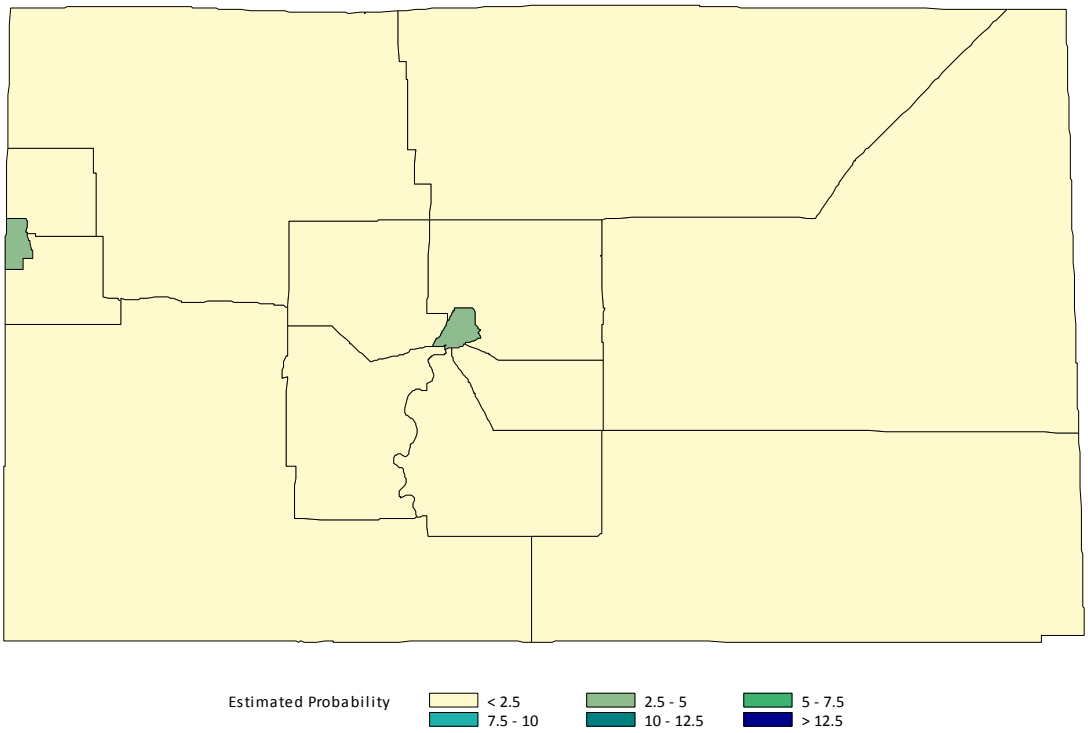
Predicted Percentage of Children with BLL >= 10 ug/dL for SANDUSKY County



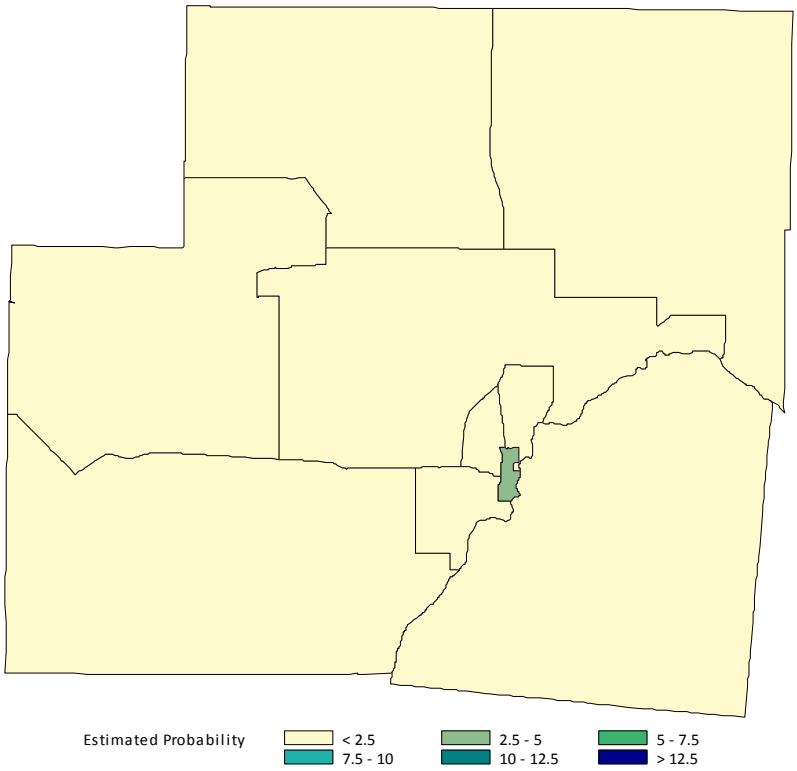
Predicted Percentage of Children with BLL >= 10 ug/dL for SCIOTO County



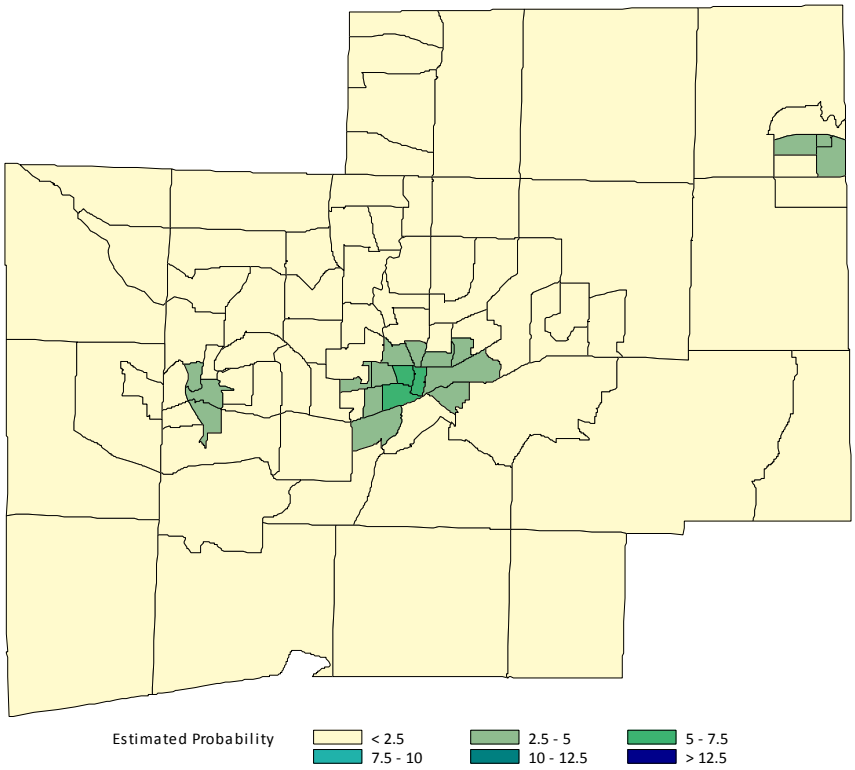
Predicted Percentage of Children with BLL >= 10 ug/dL for SENECA County



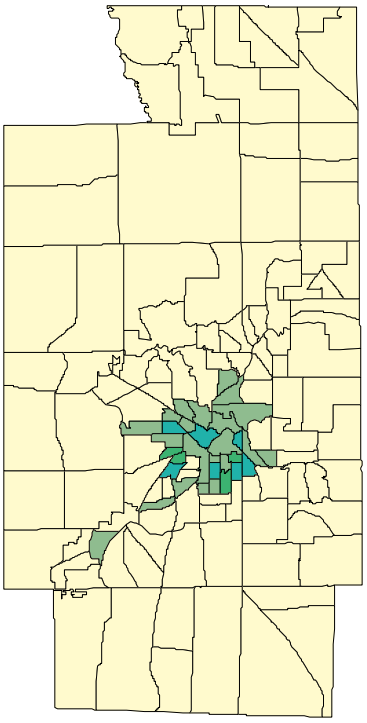
Predicted Percentage of Children with BLL >= 10 ug/dL for SHELBY County



Predicted Percentage of Children with BLL >= 10 ug/dL for STARK County



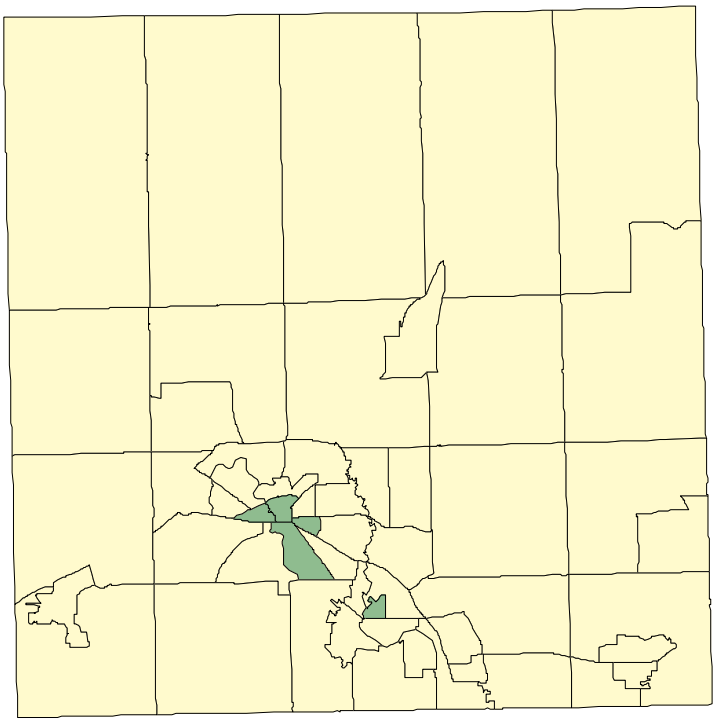
Predicted Percentage of Children with BLL >= 10 ug/dL for SUMMIT County



Estimated Probability

< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

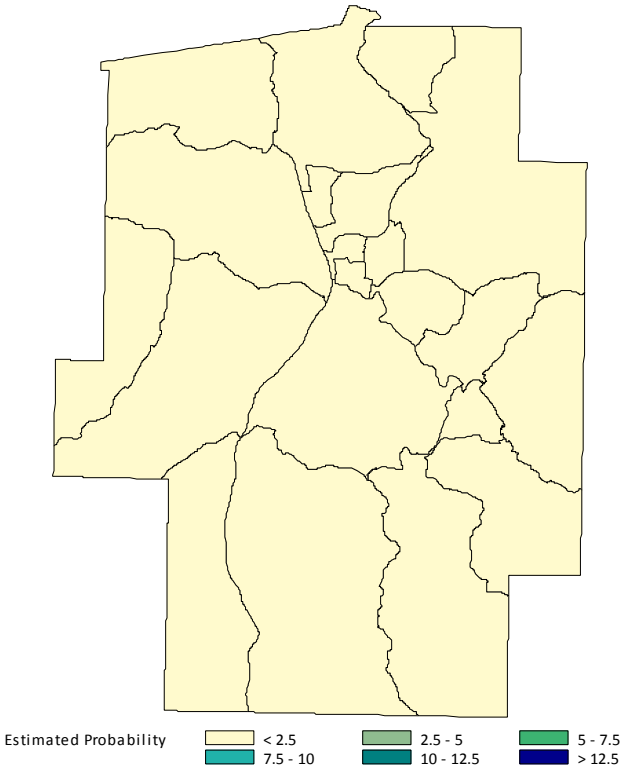
Predicted Percentage of Children with BLL >= 10 ug/dL for TRUMBULL County



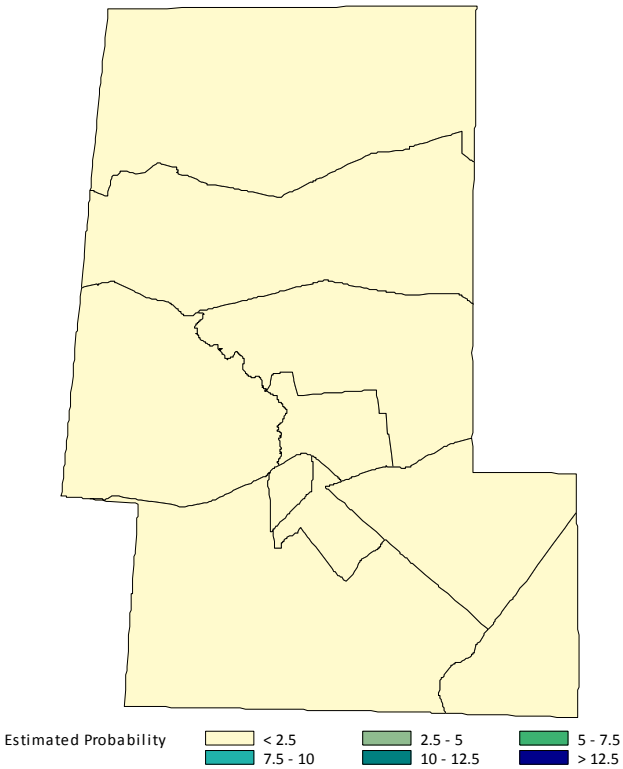
Estimated Probability

< 2.5
2.5 - 5
5 - 7.5
7.5 - 10
10 - 12.5
> 12.5

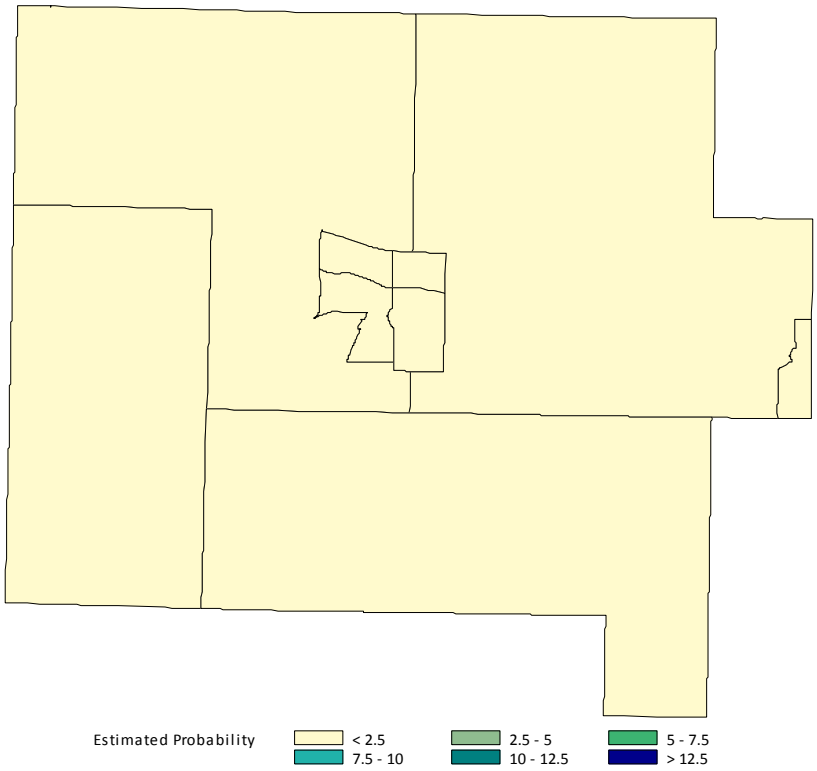
Predicted Percentage of Children with BLL >= 10 ug/dL for TUSCARAWAS County



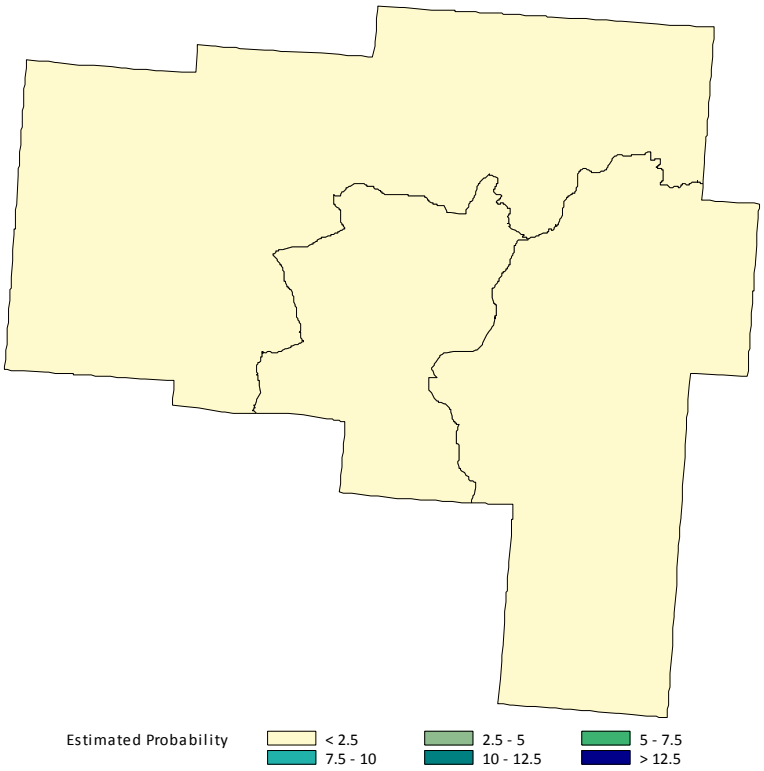
Predicted Percentage of Children with BLL >= 10 ug/dL for UNION County



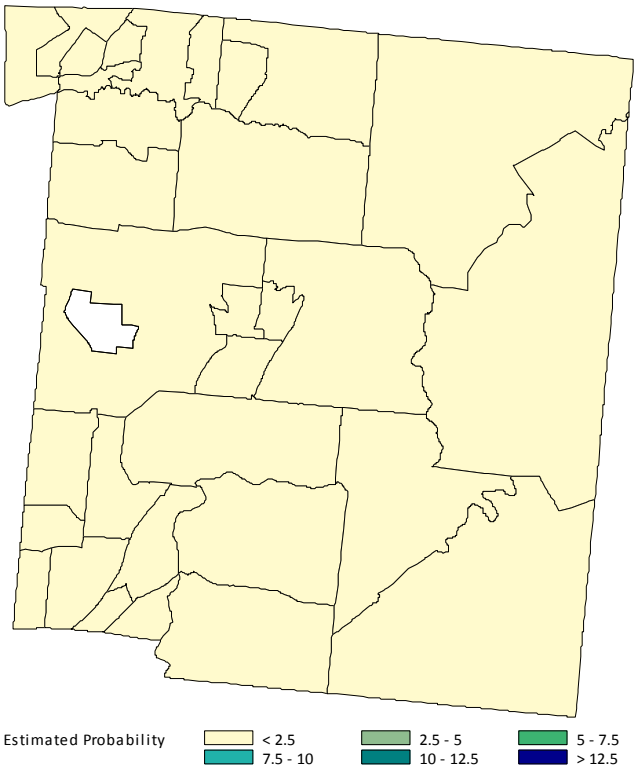
Predicted Percentage of Children with BLL >= 10 ug/dL for VAN WERT County



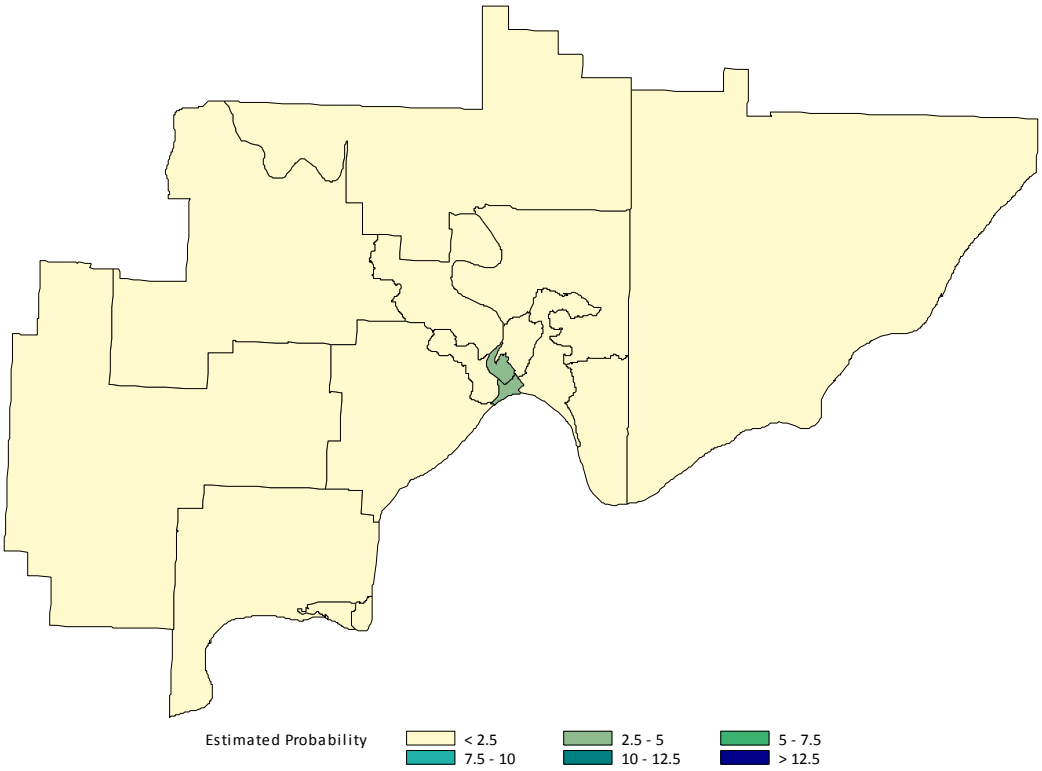
Predicted Percentage of Children with BLL >= 10 ug/dL for VINTON County



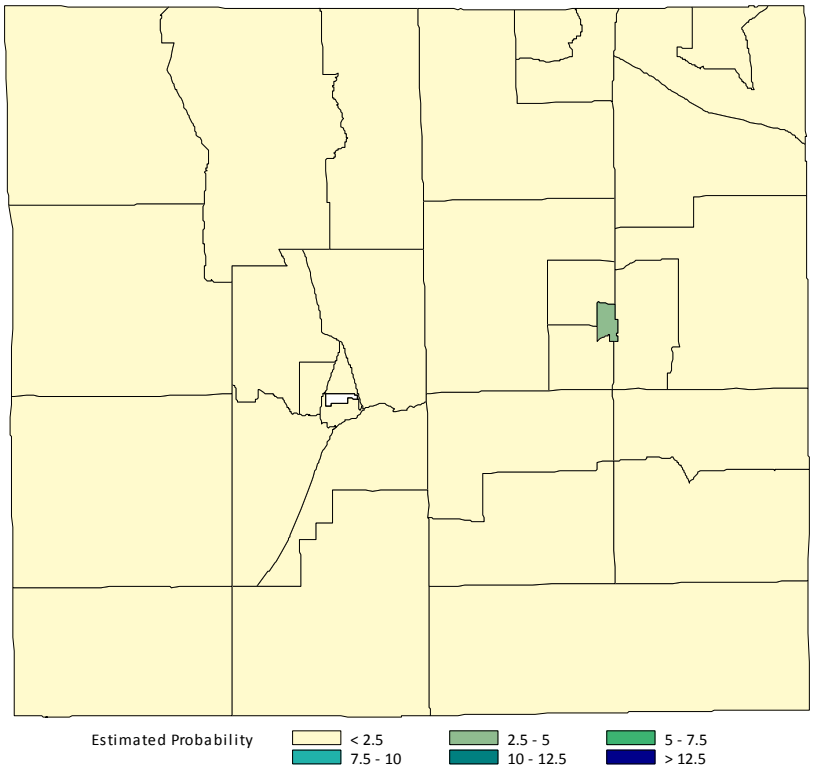
Predicted Percentage of Children with BLL >= 10 ug/dL for WARREN County



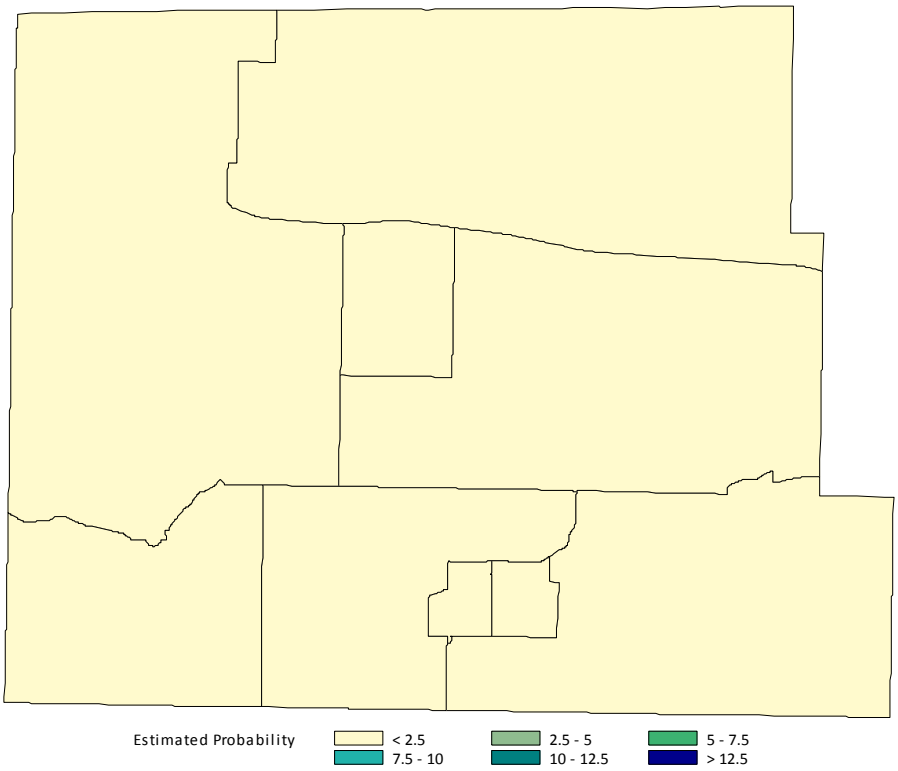
Predicted Percentage of Children with BLL >= 10 ug/dL for WASHINGTON County



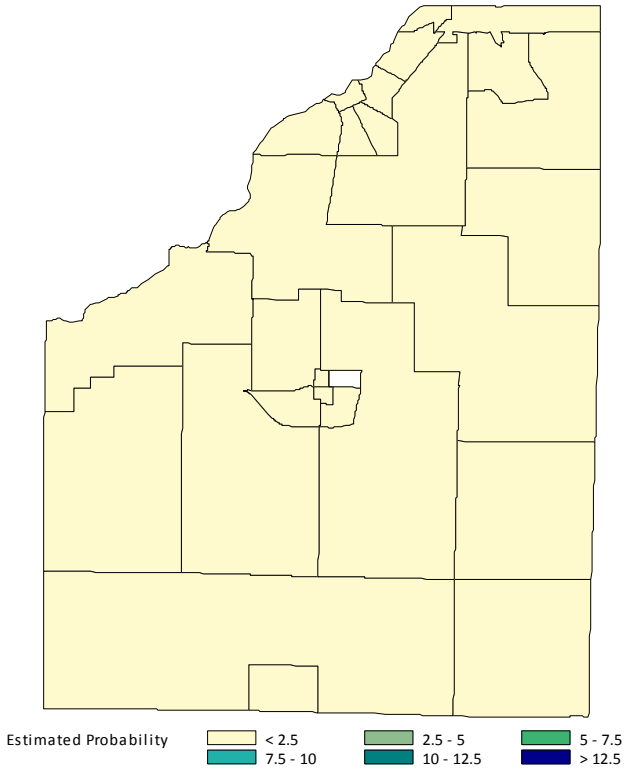
Predicted Percentage of Children with BLL >= 10 ug/dL for WAYNE County



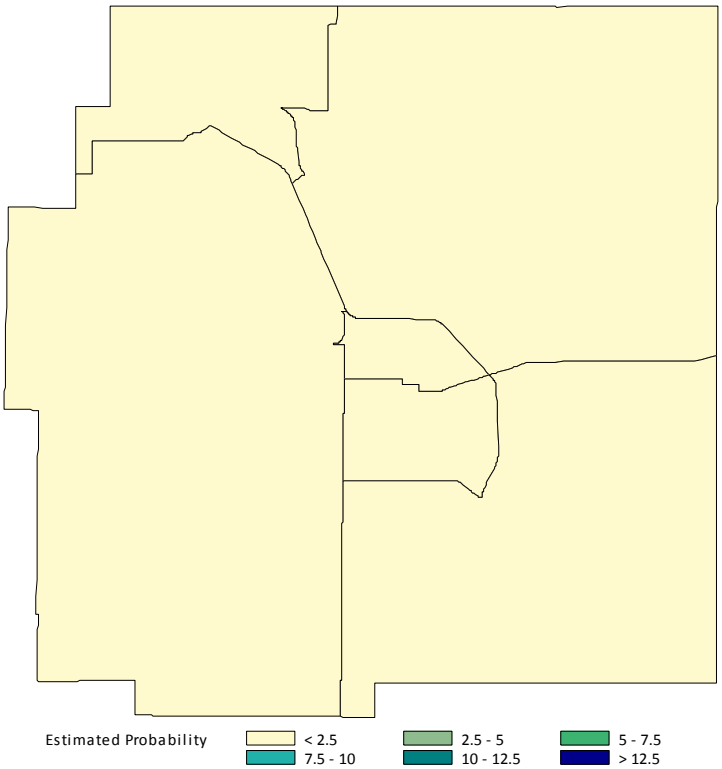
Predicted Percentage of Children with BLL >= 10 ug/dL for WILLIAMS County



Predicted Percentage of Children with BLL >= 10 ug/dL for WOOD County



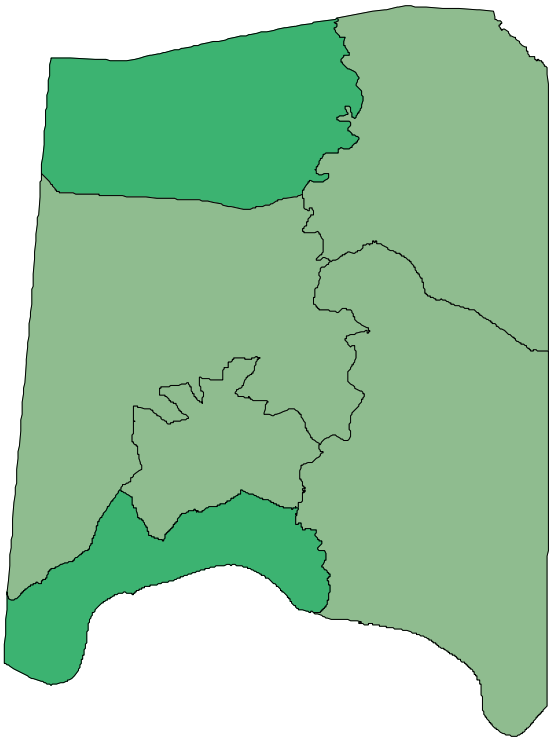
Predicted Percentage of Children with BLL >= 10 ug/dL for WYANDOT County



Appendix C

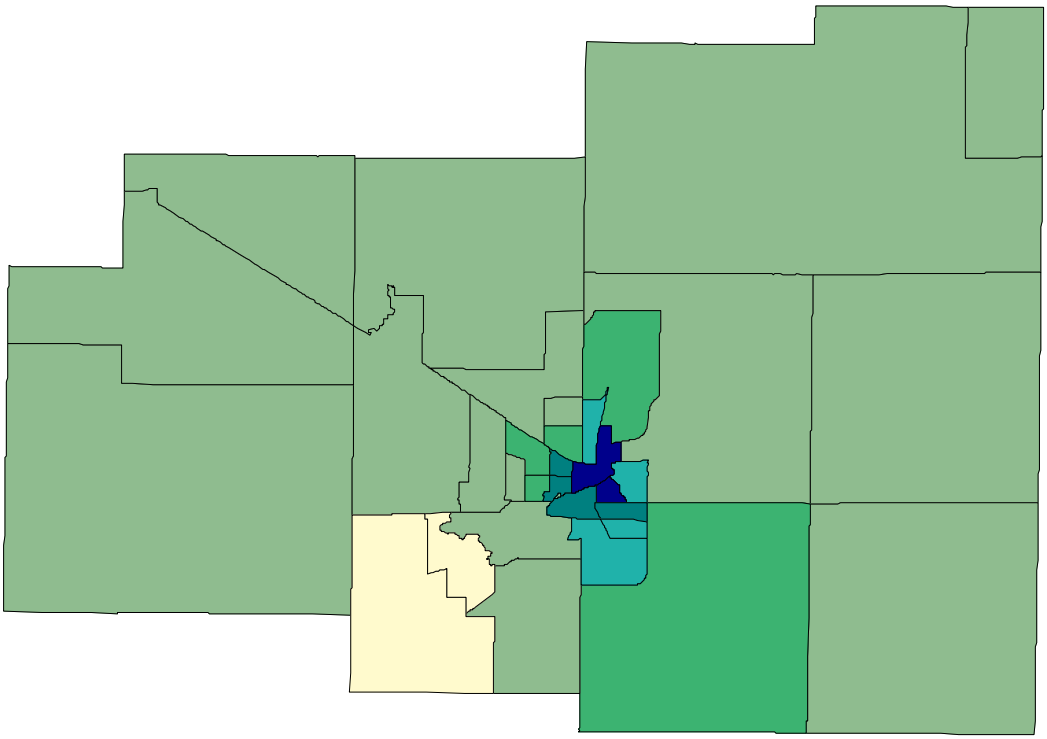
Plots of Predicted Proportion of Children with Blood Lead Levels Greater than 5 μg/dL by Census Tract within County

Predicted Percentage of Children with Elevated BLL for ADAMS County



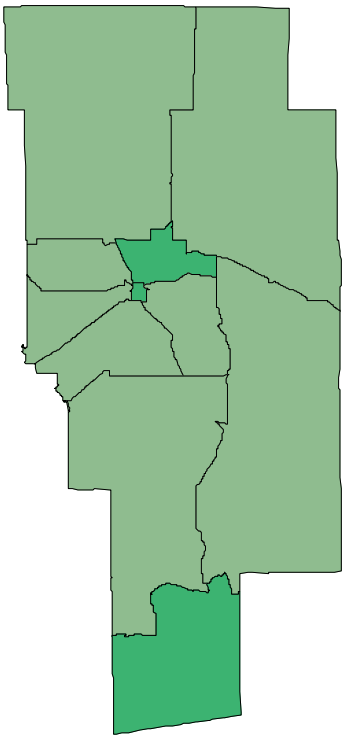
Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

Predicted Percentage of Children with Elevated BLL for ALLEN County



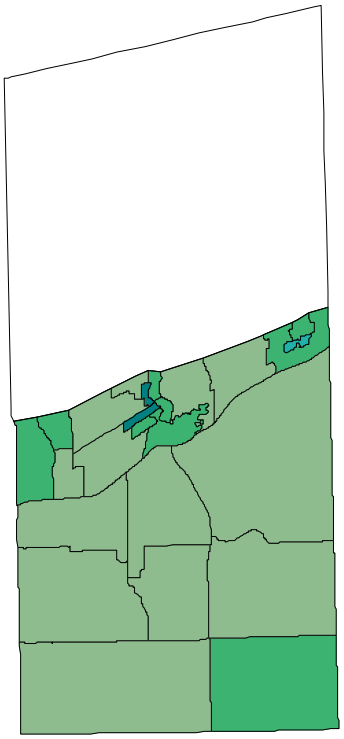
Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

Predicted Percentage of Children with Elevated BLL for ASHLAND County



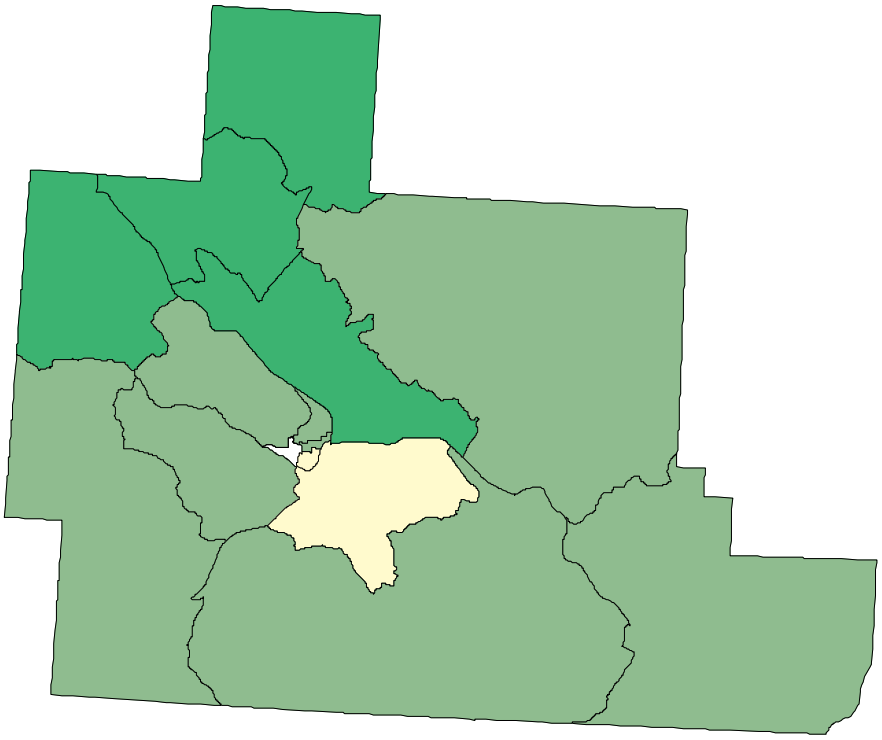
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for ASHTABULA County



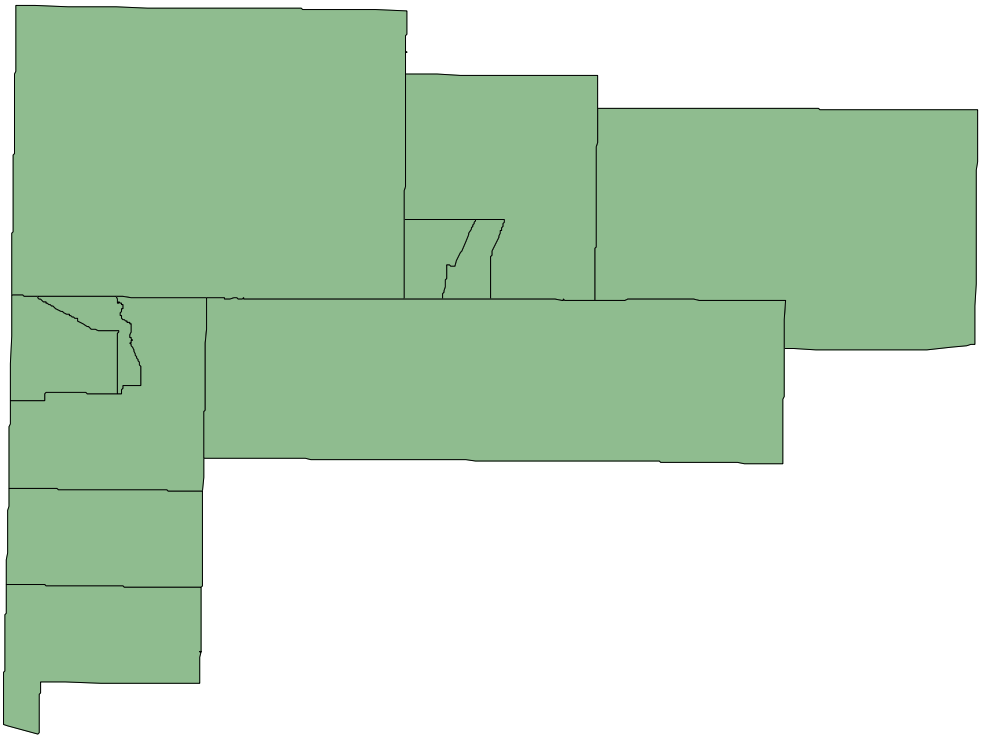
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for ATHENS County



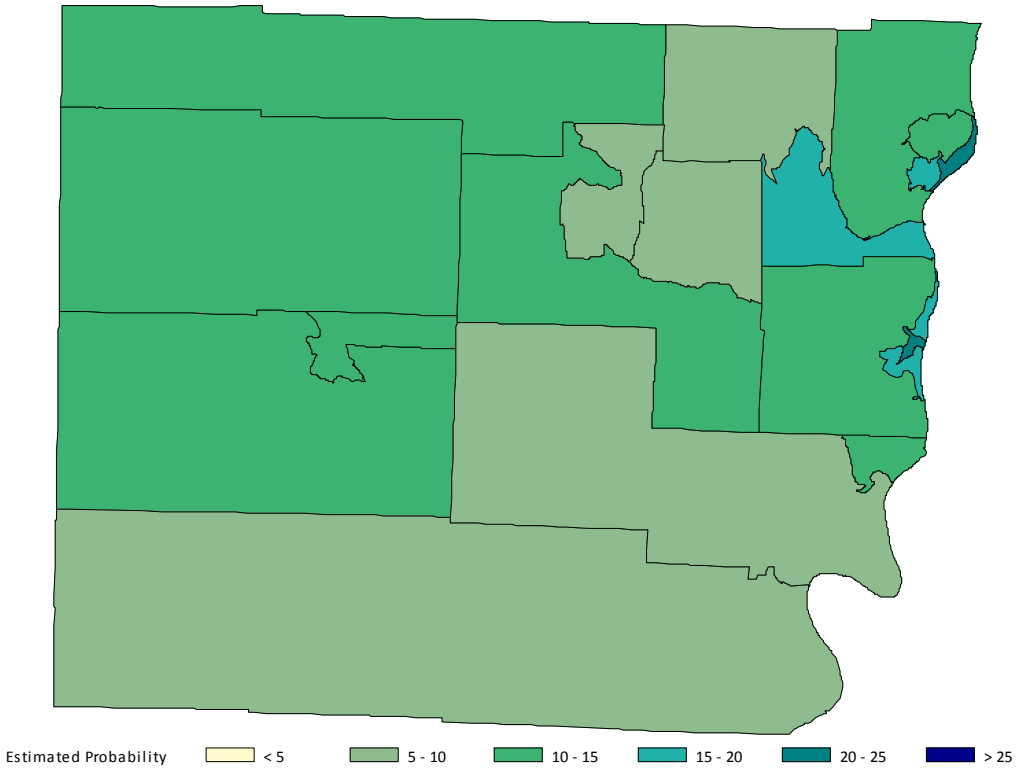
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for AUGLAIZE County

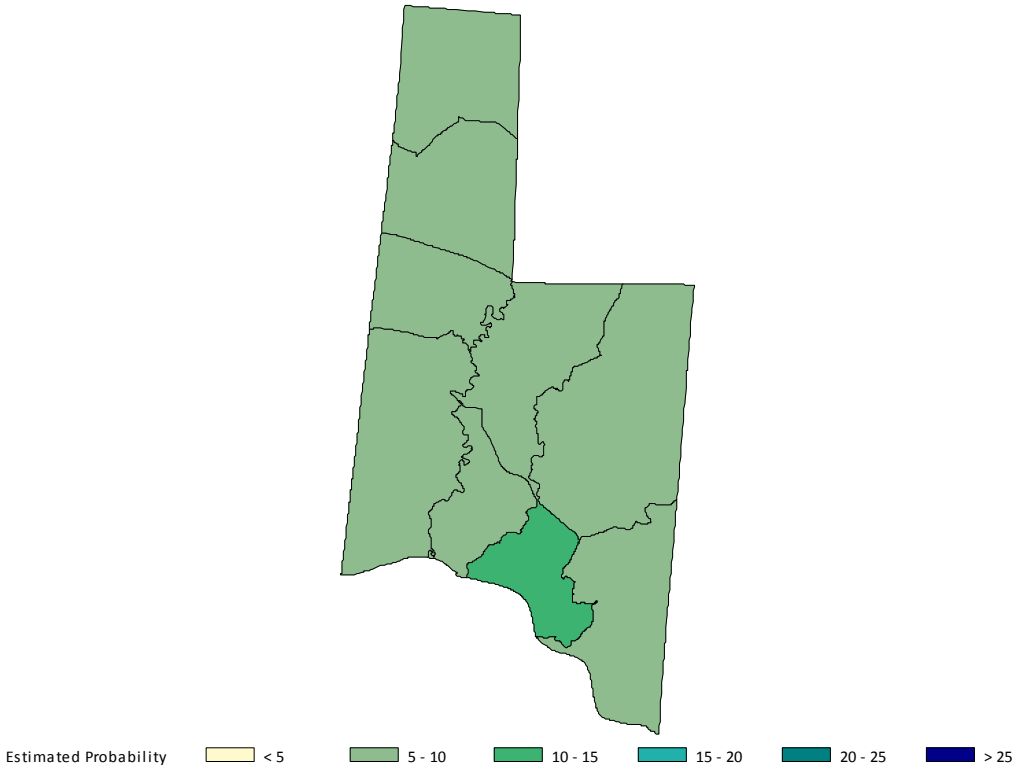


Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

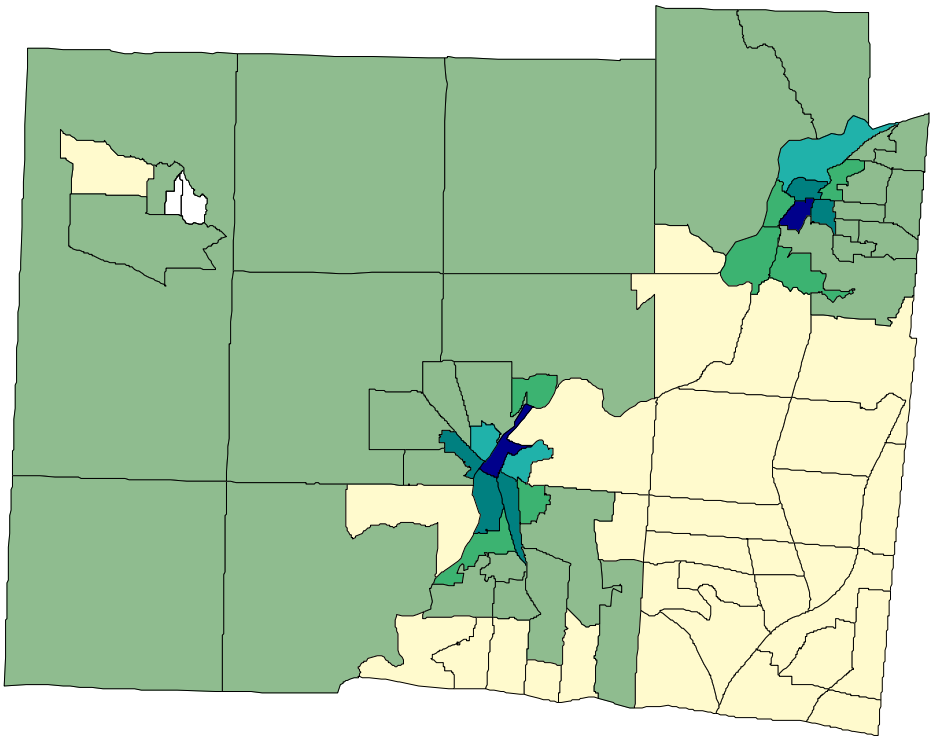
Predicted Percentage of Children with Elevated BLL for BELMONT County



Predicted Percentage of Children with Elevated BLL for BROWN County

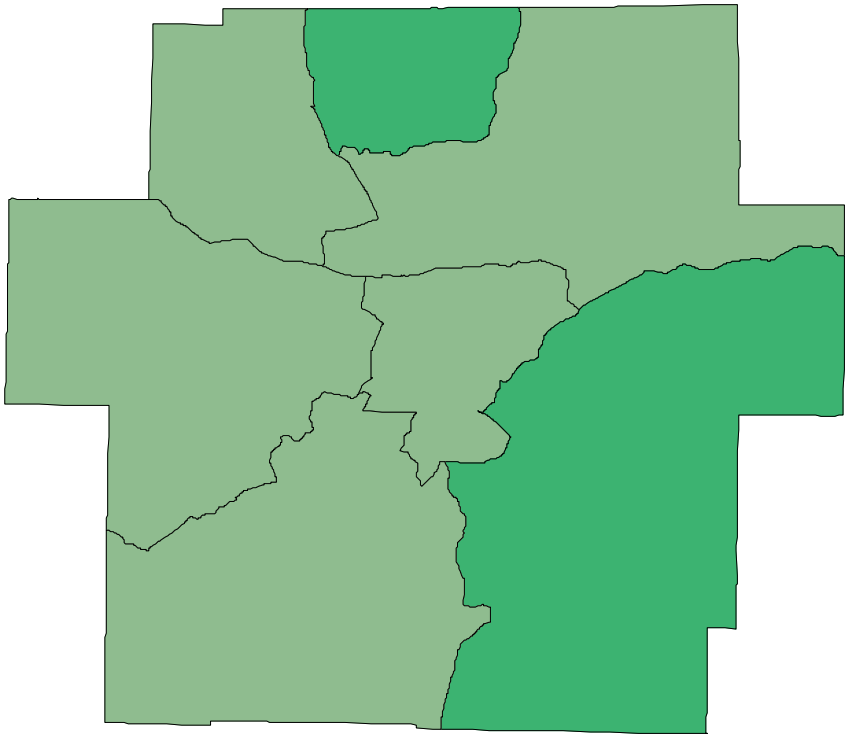


Predicted Percentage of Children with Elevated BLL for BUTLER County



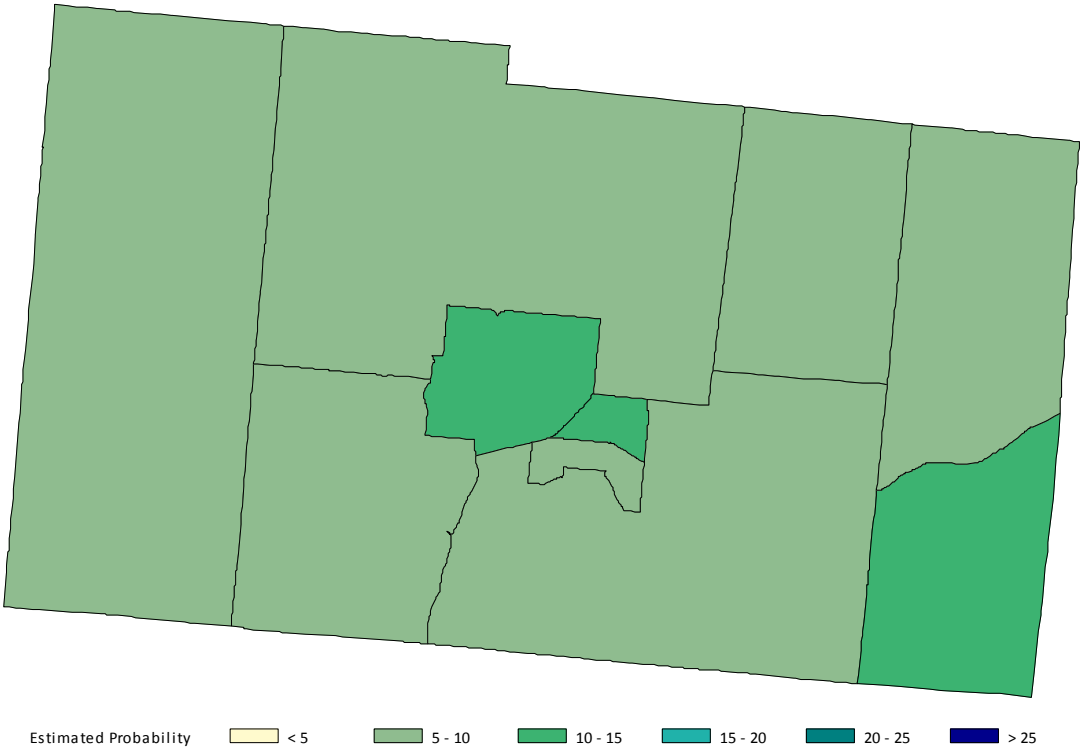
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for CARROLL County

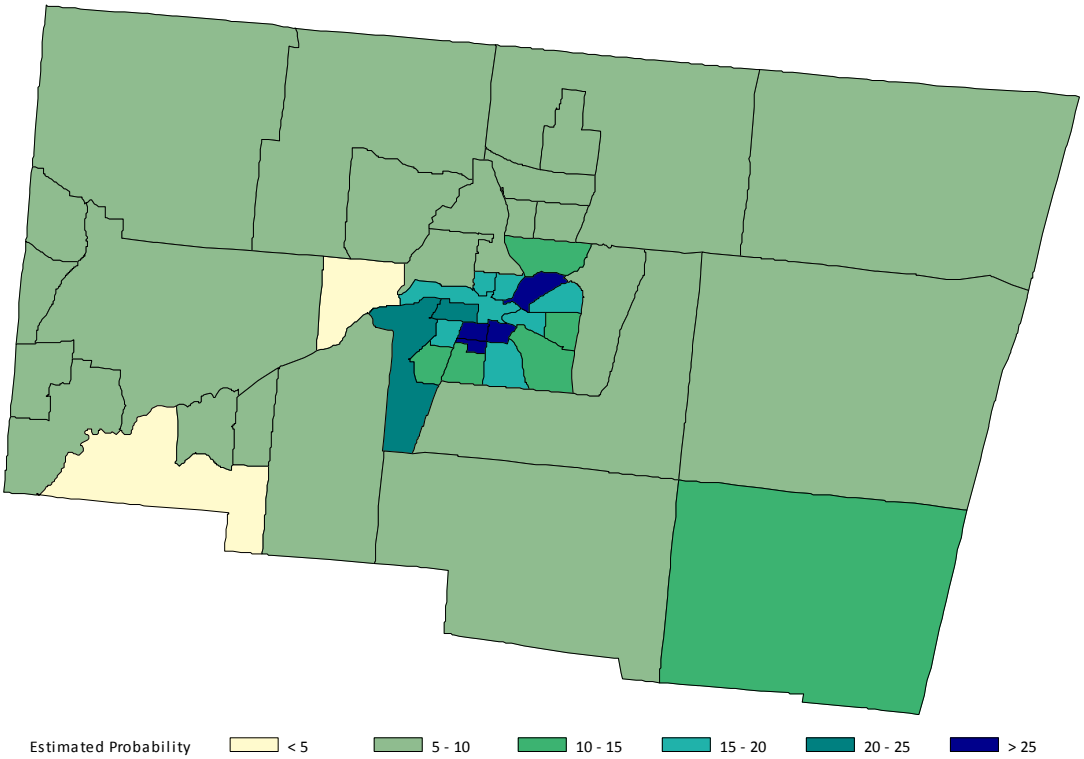


Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

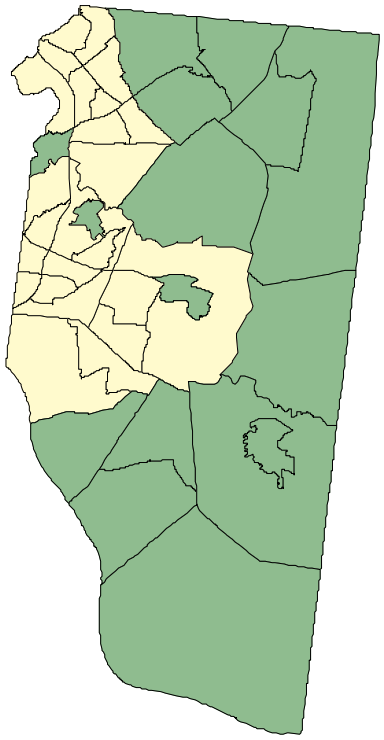
Predicted Percentage of Children with Elevated BLL for CHAMPAIGN County



Predicted Percentage of Children with Elevated BLL for CLARK County

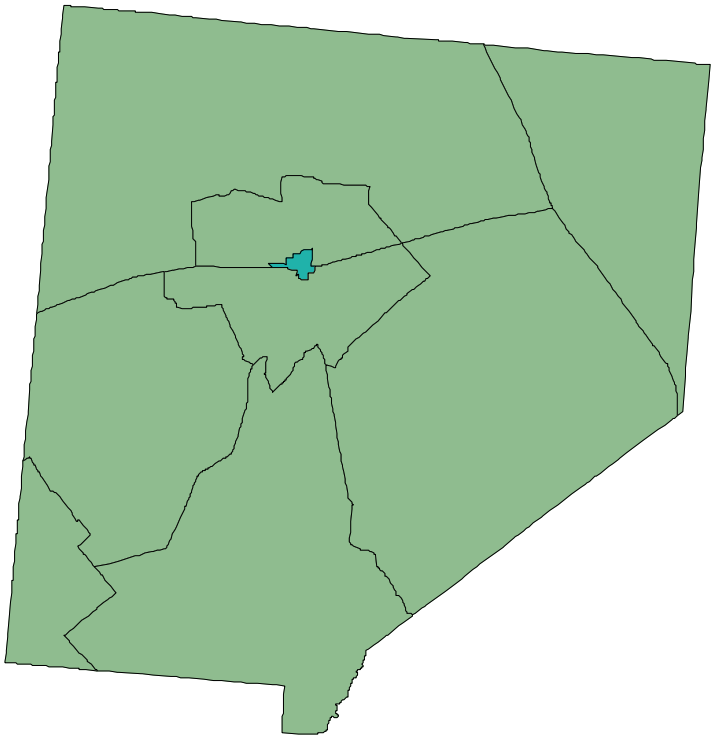


Predicted Percentage of Children with Elevated BLL for CLERMONT County



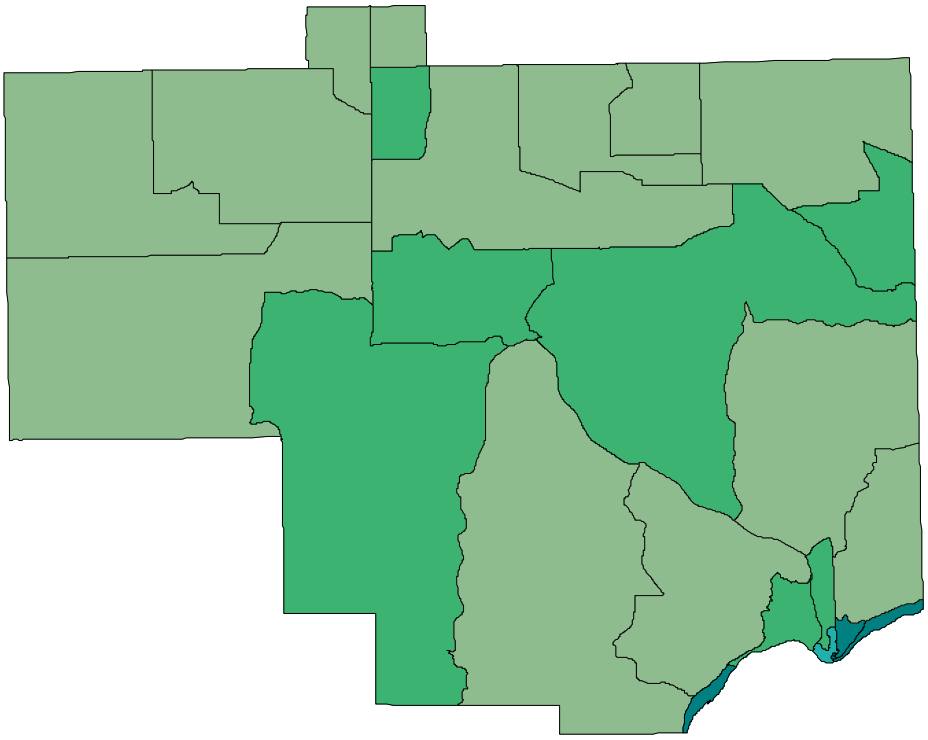
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for CLINTON County



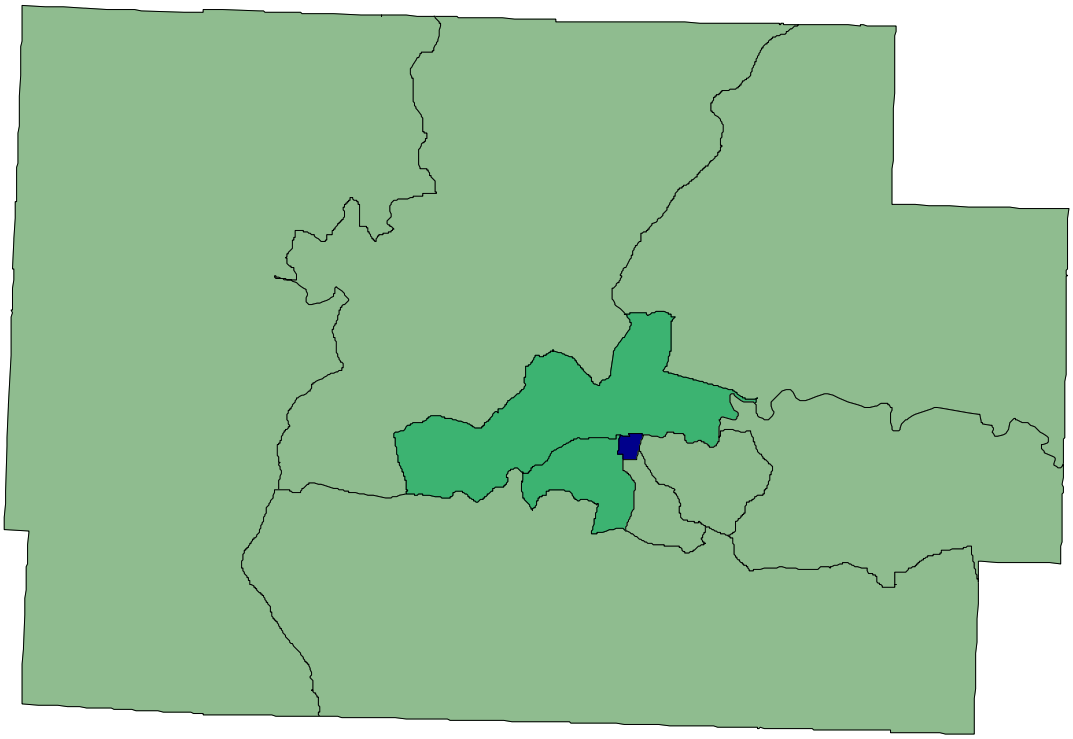
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for COLUMBIANA County



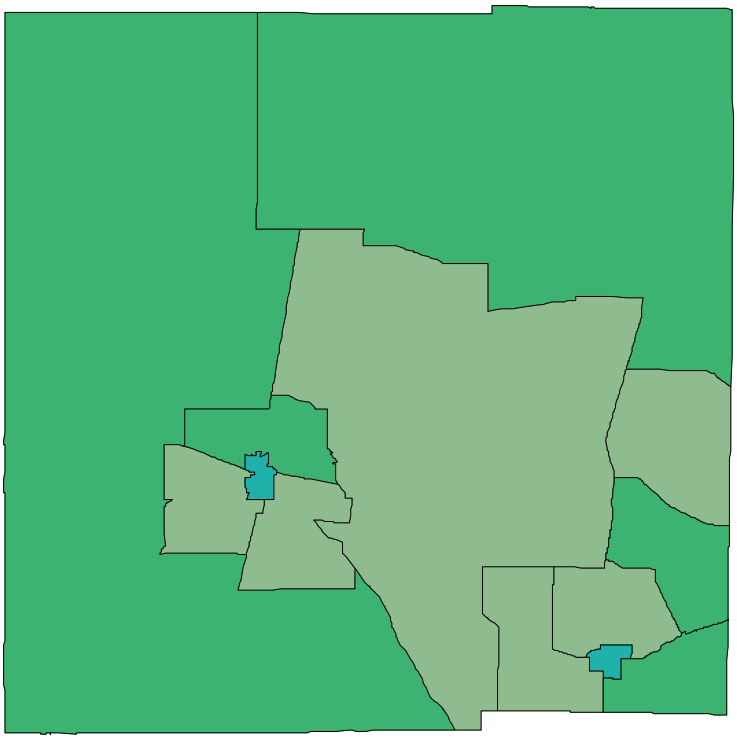
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for COSHOCTON County



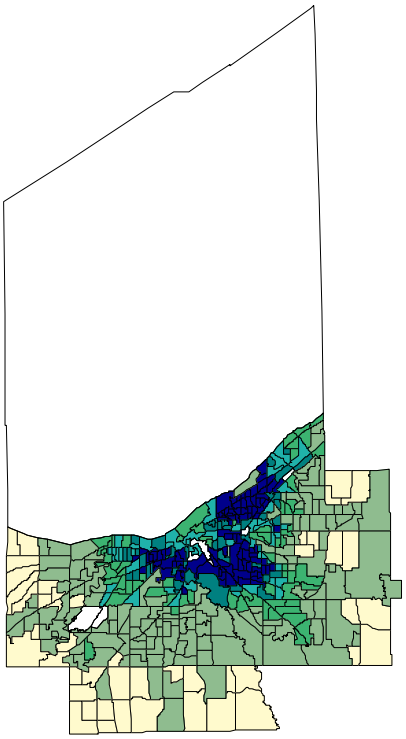
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for CRAWFORD County



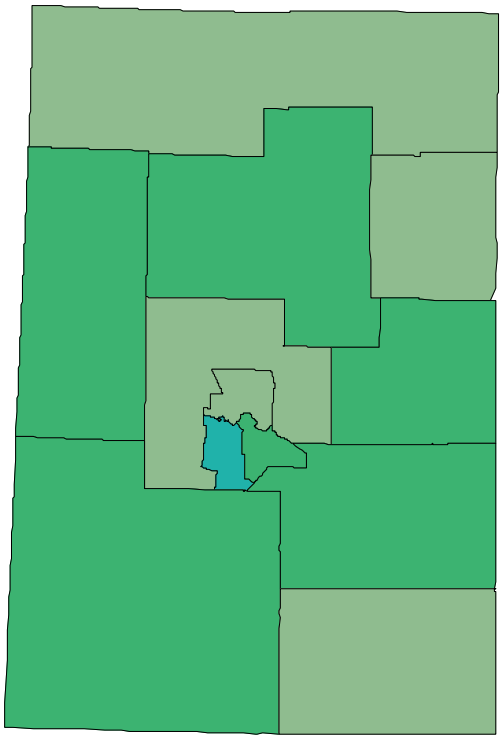
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for CUYAHOGA County



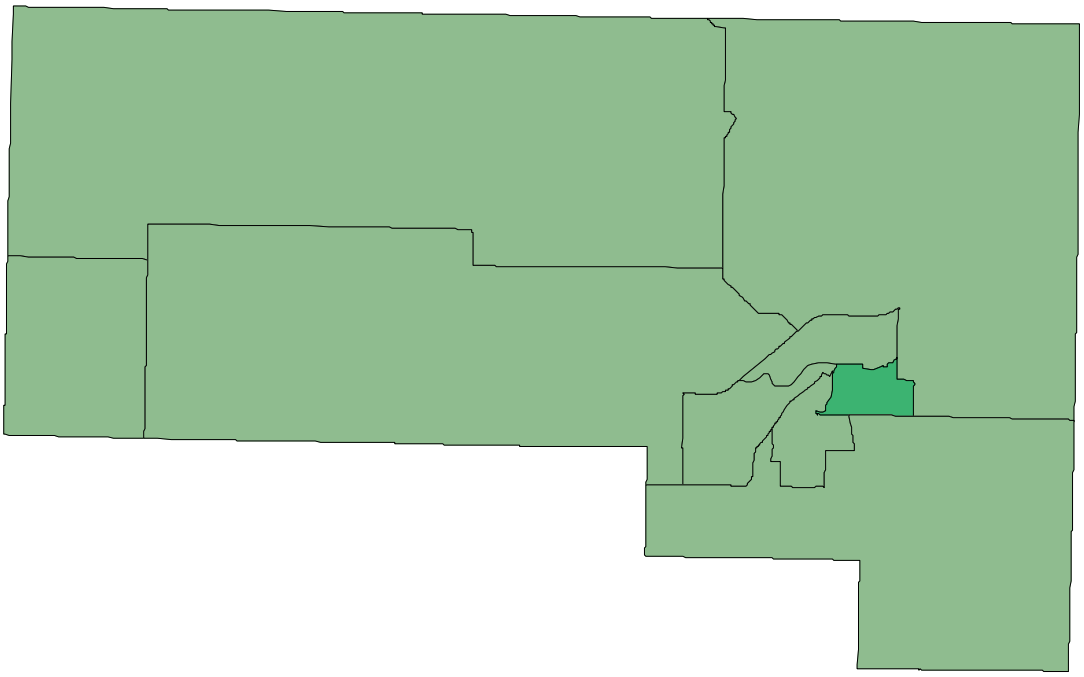
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for DARKE County



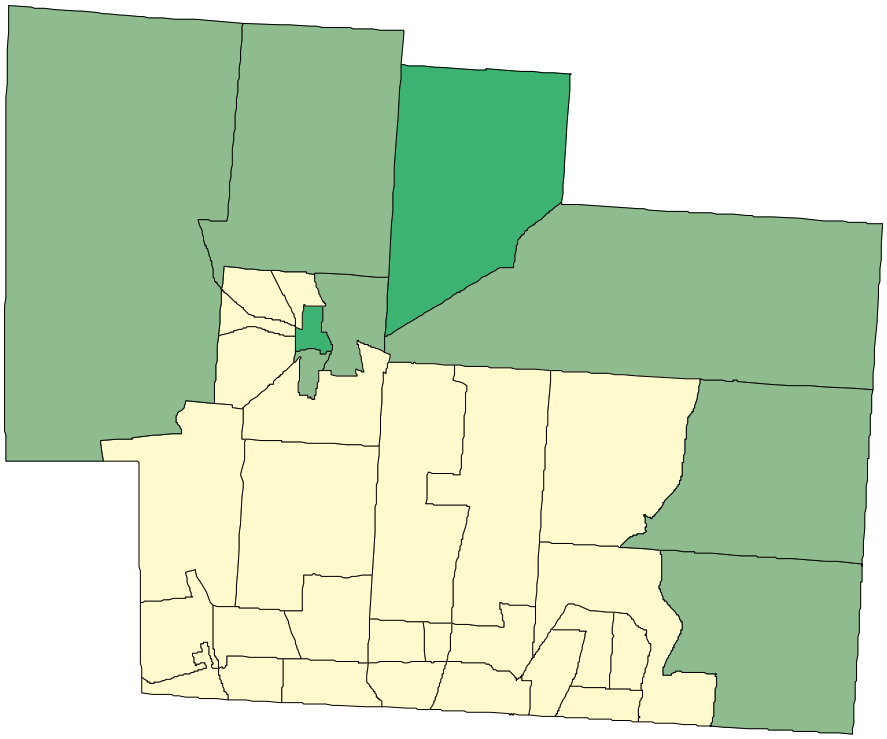
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for DEFIANCE County



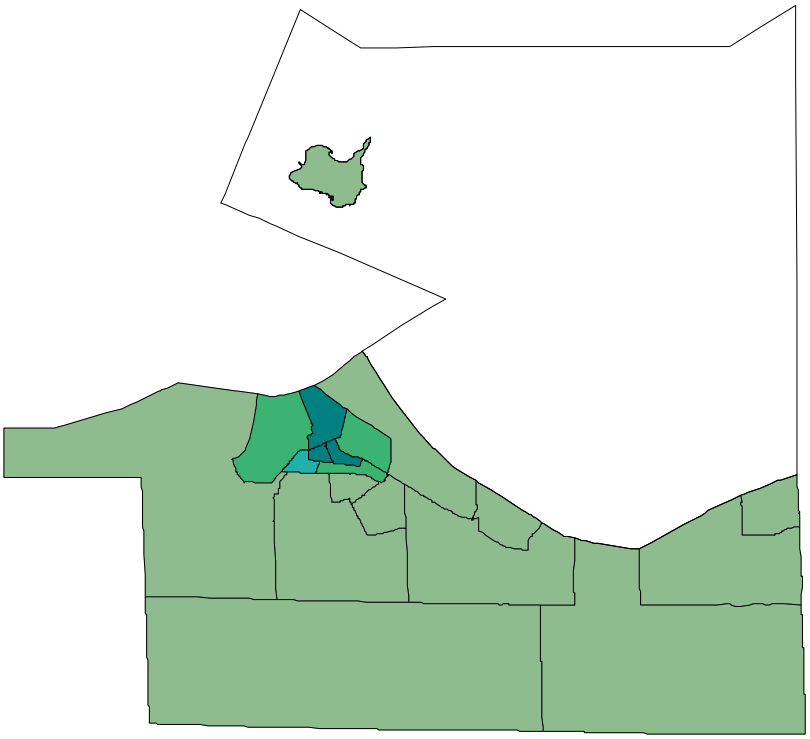
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for DELAWARE County



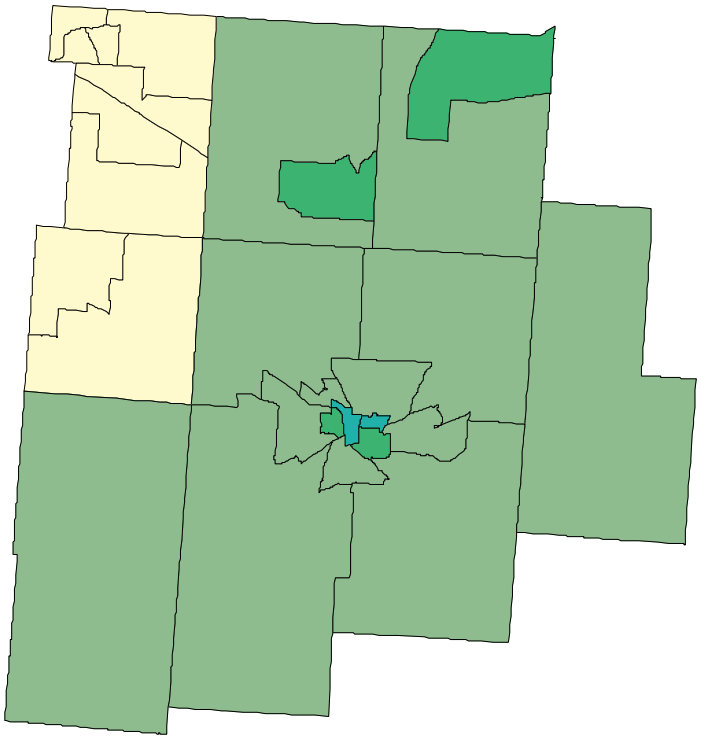
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for ERIE County



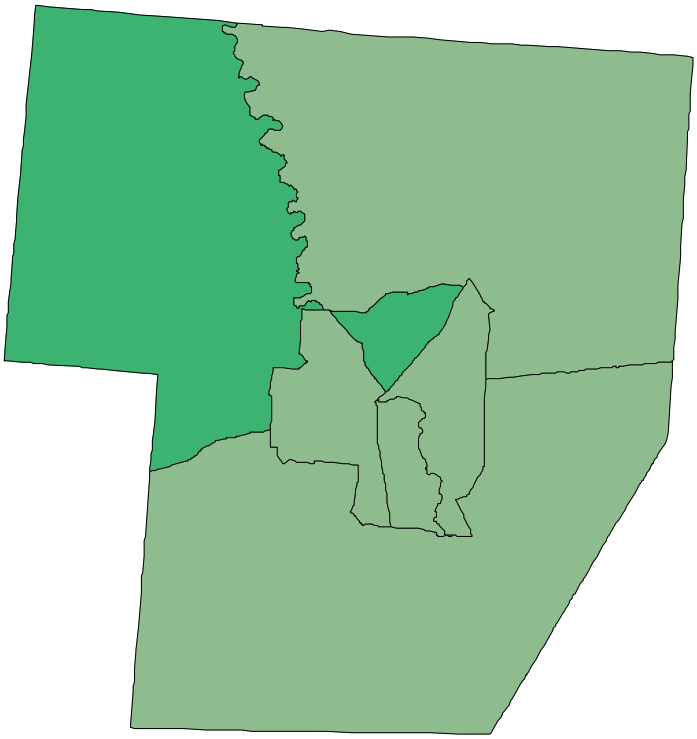
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for FAIRFIELD County



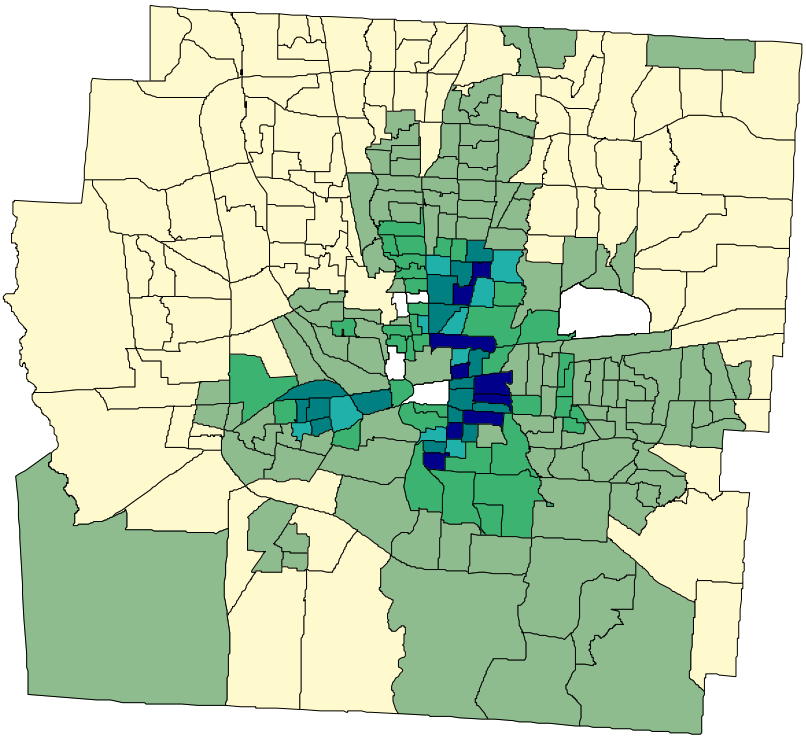
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for FAYETTE County



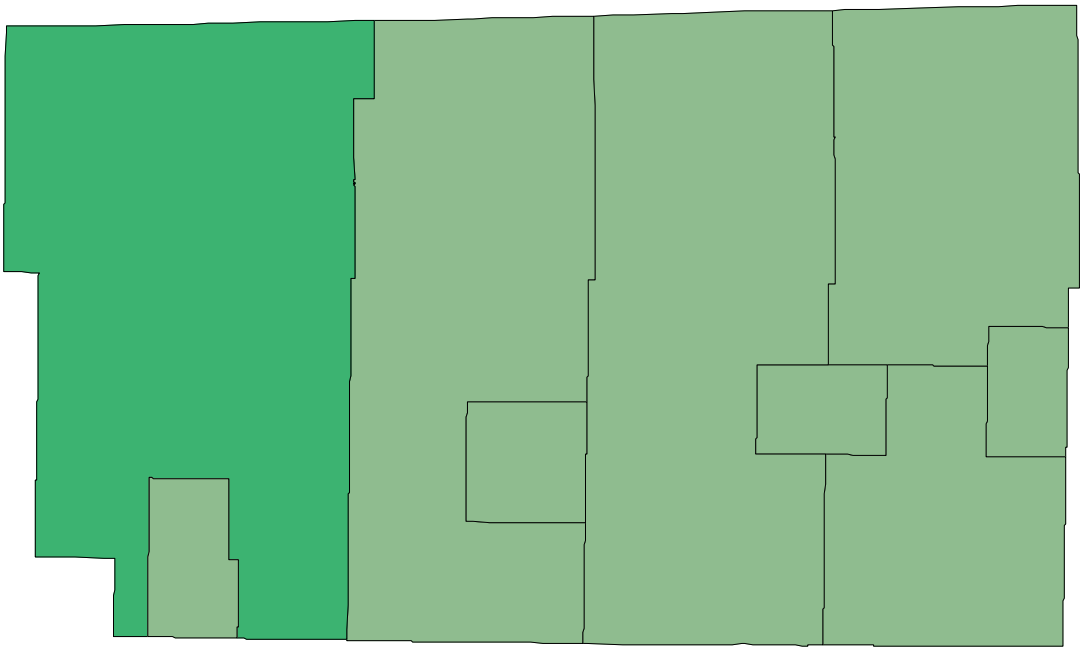
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for FRANKLIN County



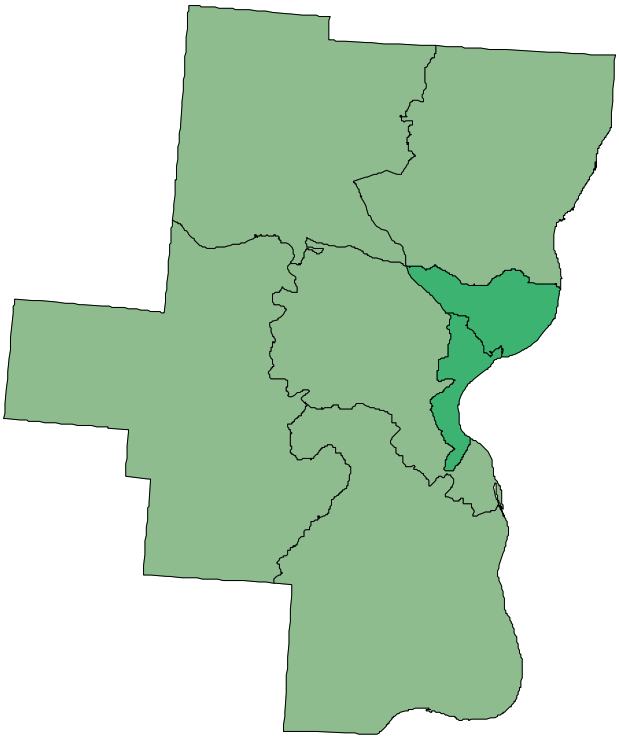
Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

Predicted Percentage of Children with Elevated BLL for FULTON County



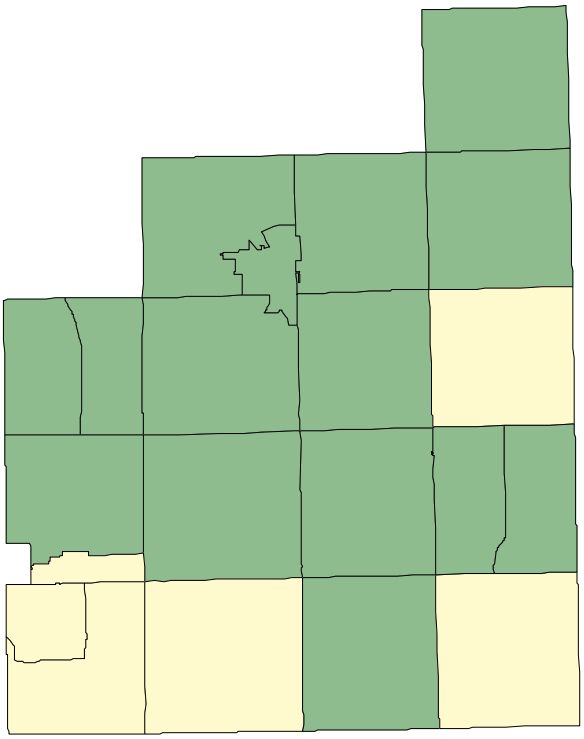
Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

Predicted Percentage of Children with Elevated BLL for GALLIA County



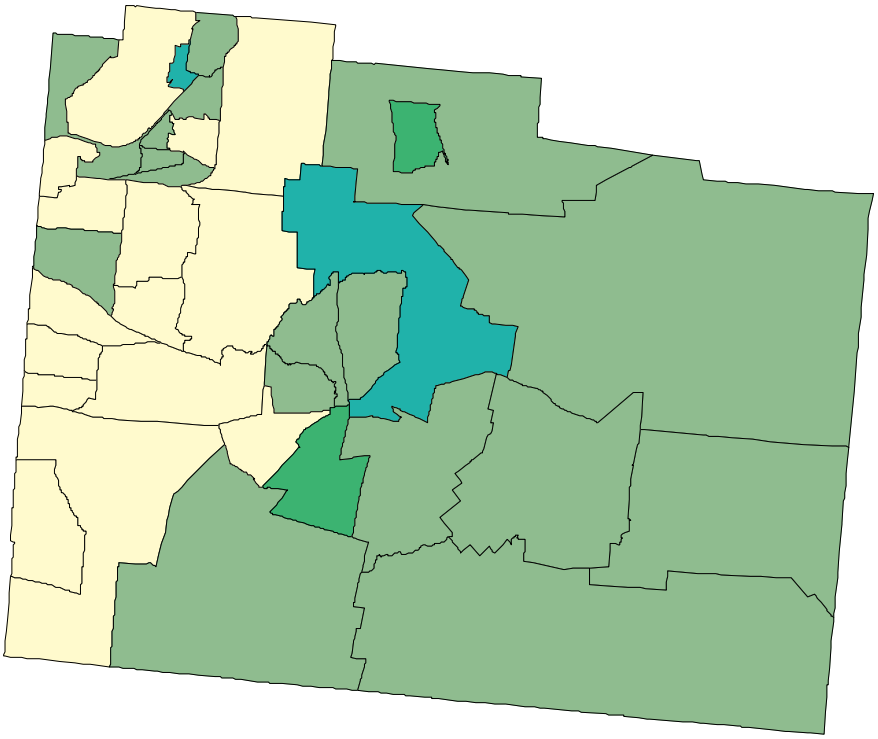
Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

Predicted Percentage of Children with Elevated BLL for GEAUGA County



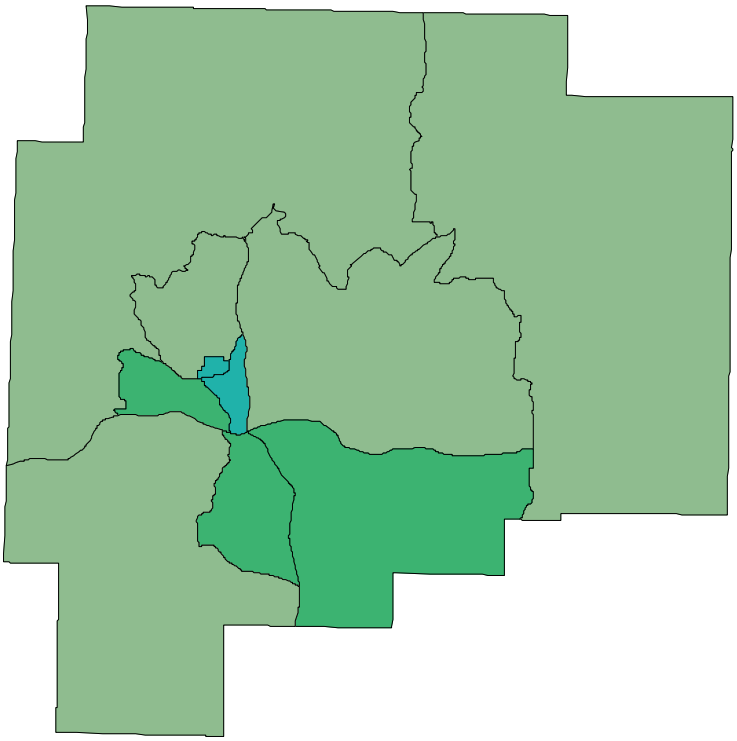
Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

Predicted Percentage of Children with Elevated BLL for GREENE County



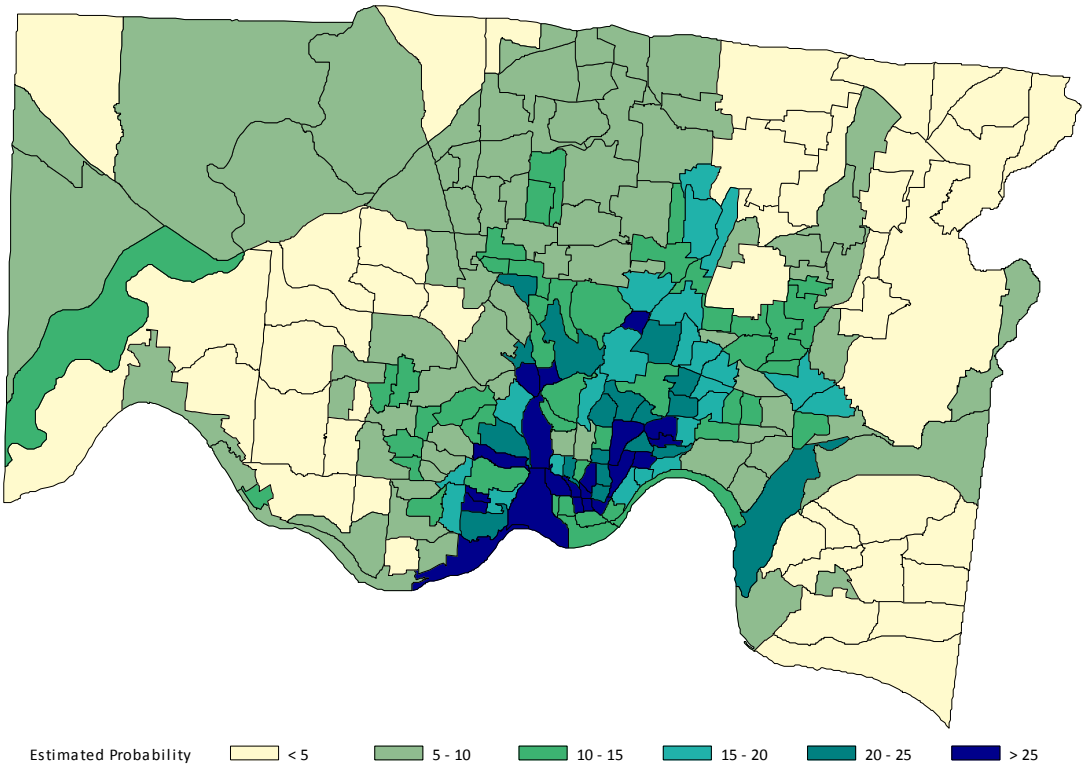
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for GUERNSEY County

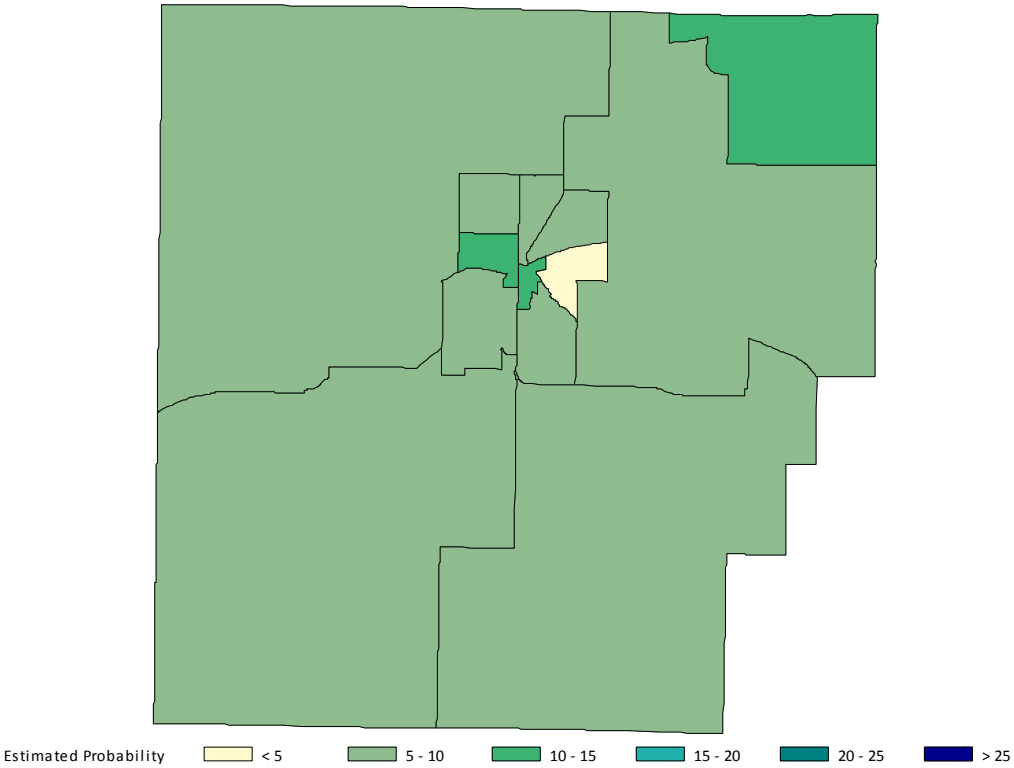


Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

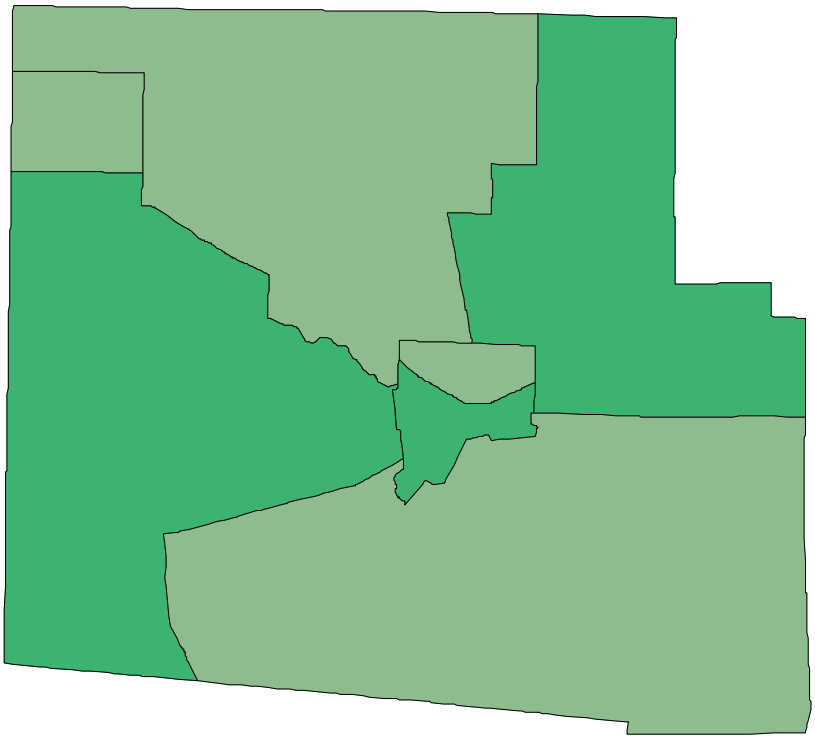
Predicted Percentage of Children with Elevated BLL for HAMILTON County



Predicted Percentage of Children with Elevated BLL for HANCOCK County

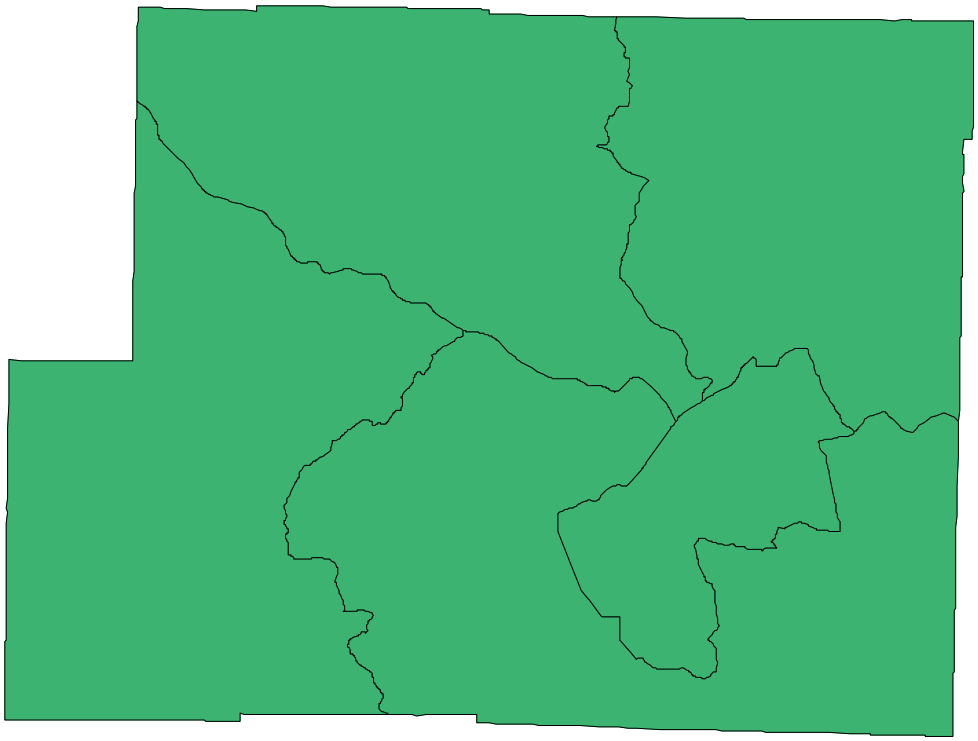


Predicted Percentage of Children with Elevated BLL for HARDIN County



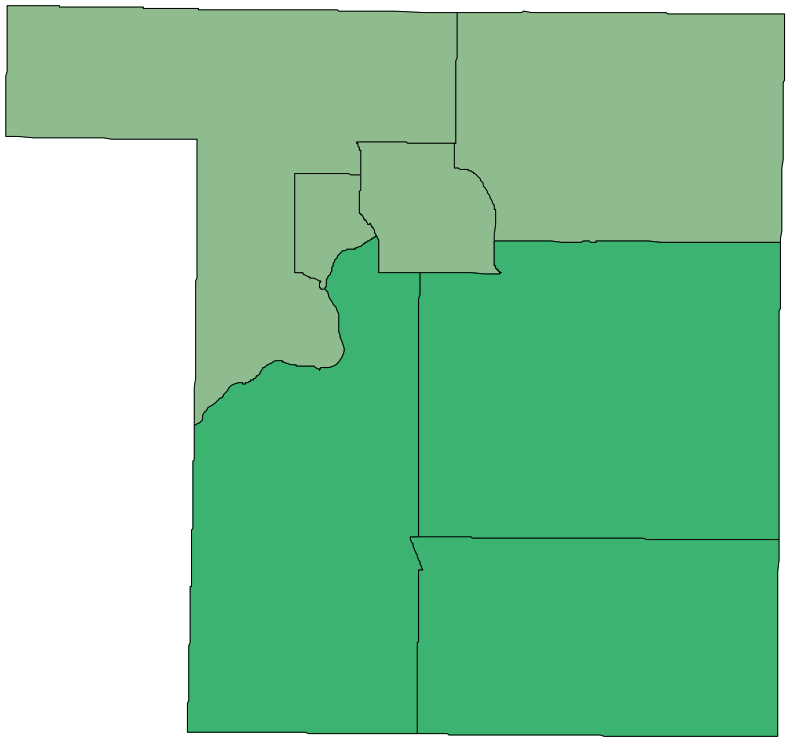
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for HARRISON County



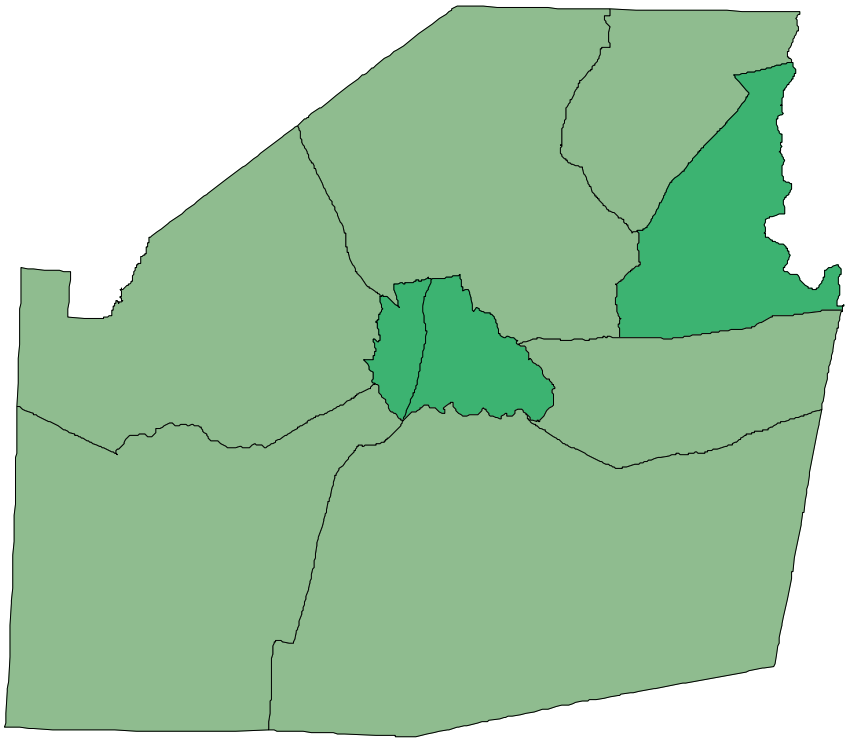
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for HENRY County



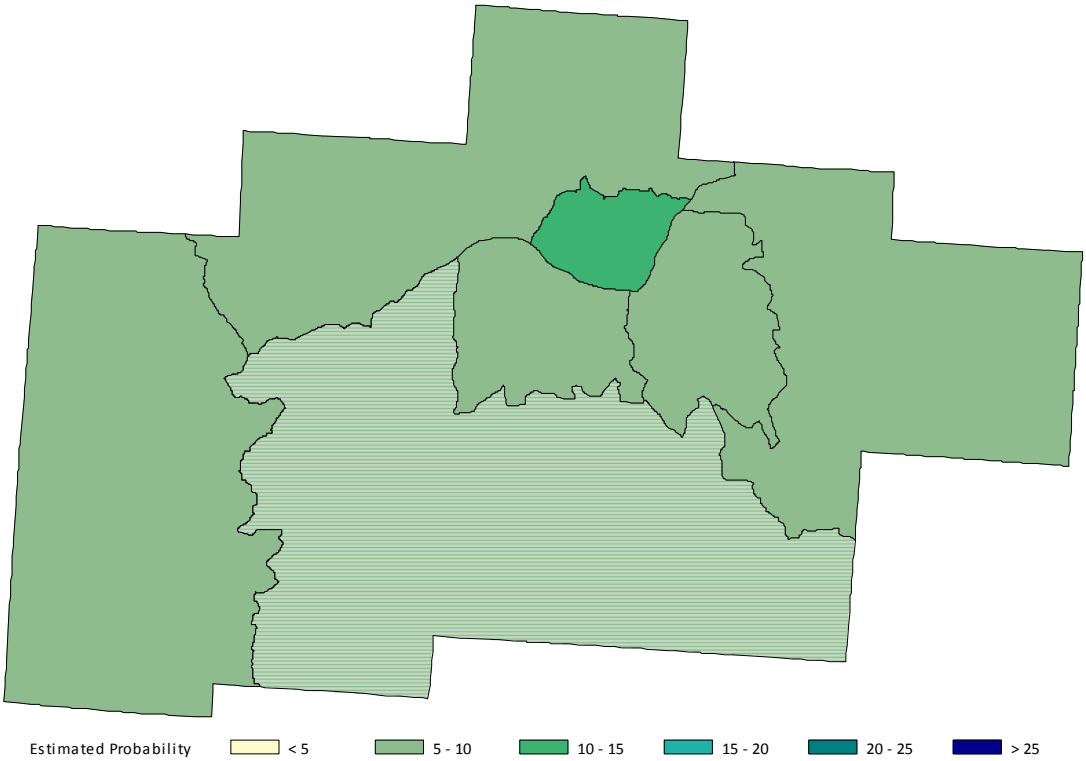
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for HIGHLAND County

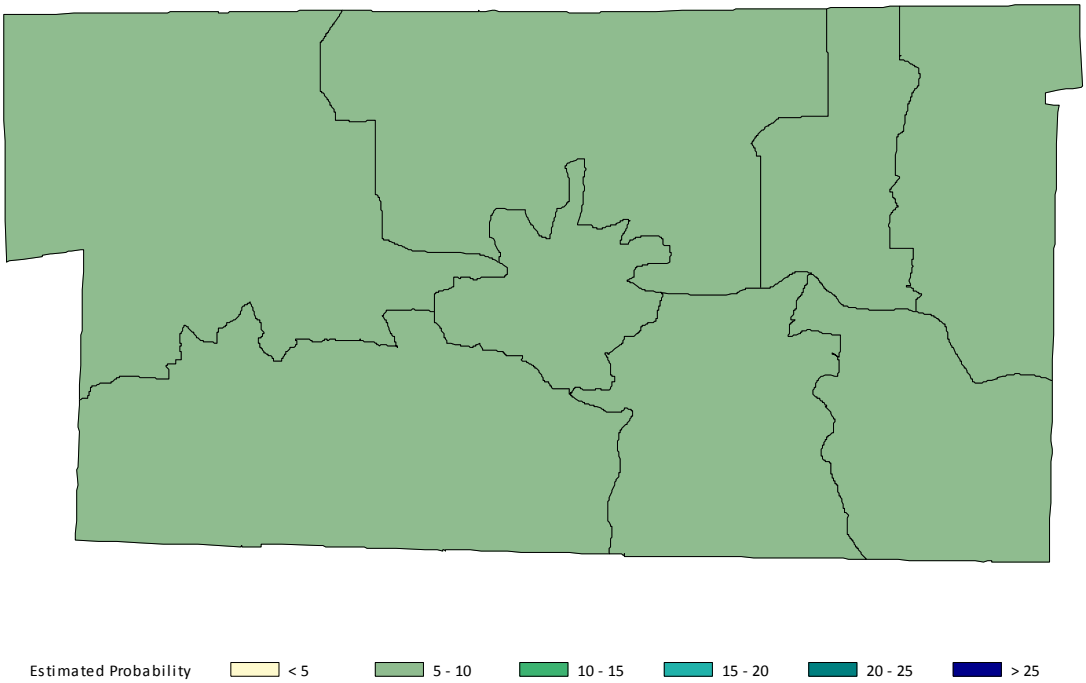


Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

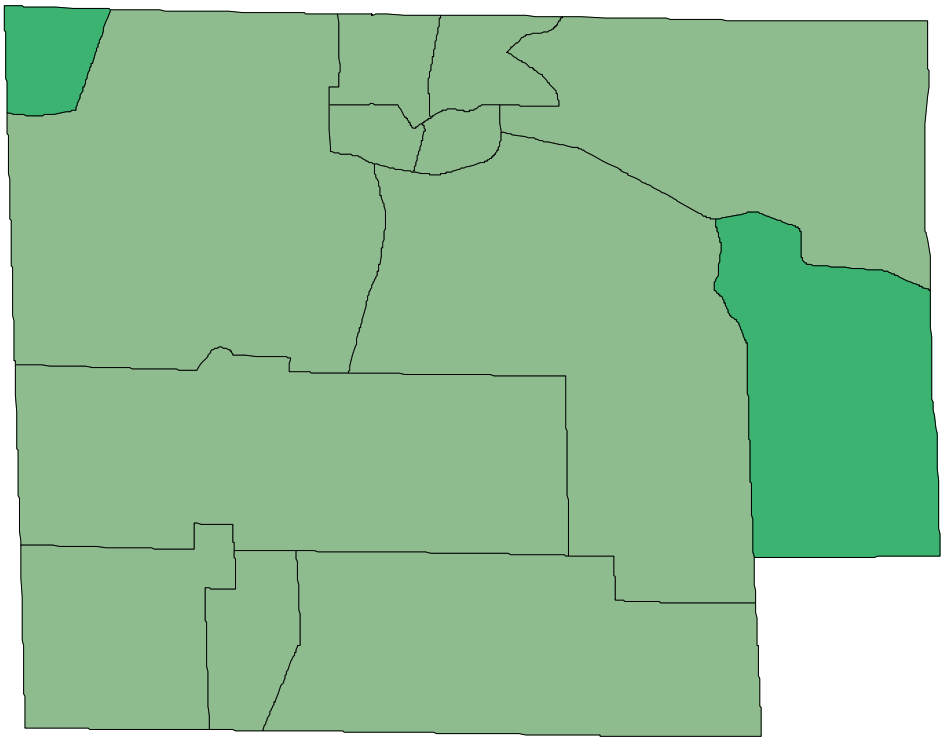
Predicted Percentage of Children with Elevated BLL for HOCKING County



Predicted Percentage of Children with Elevated BLL for HOLMES County

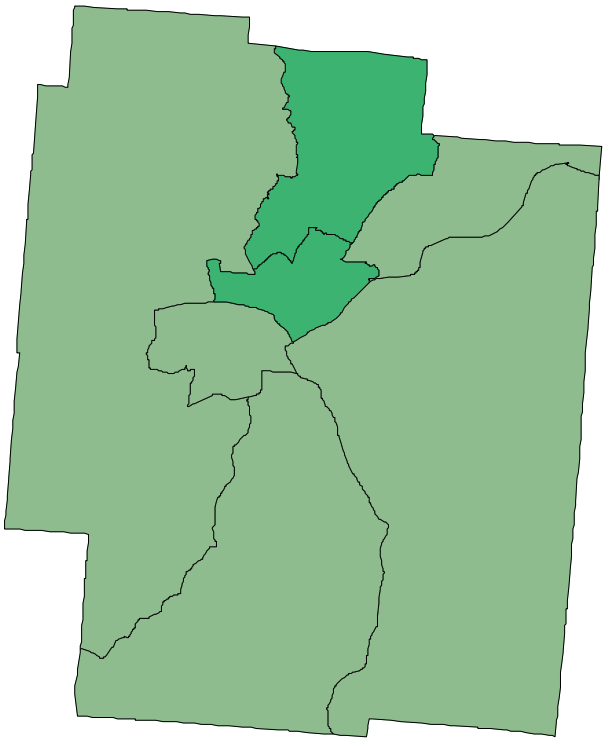


Predicted Percentage of Children with Elevated BLL for HURON County



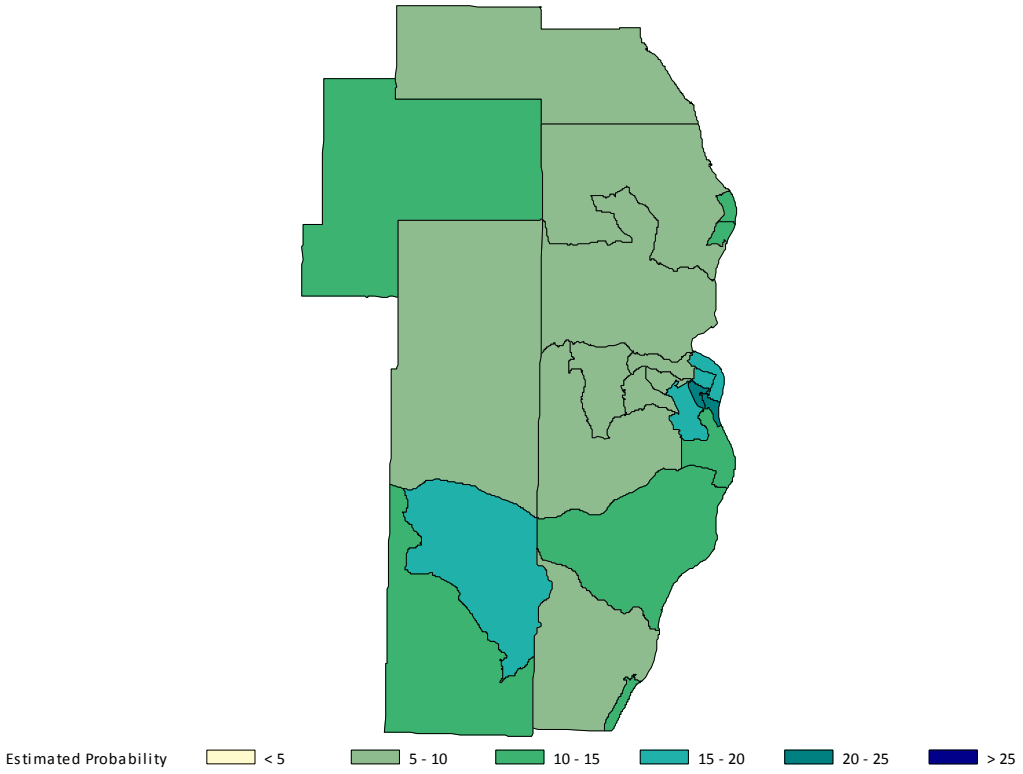
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for JACKSON County

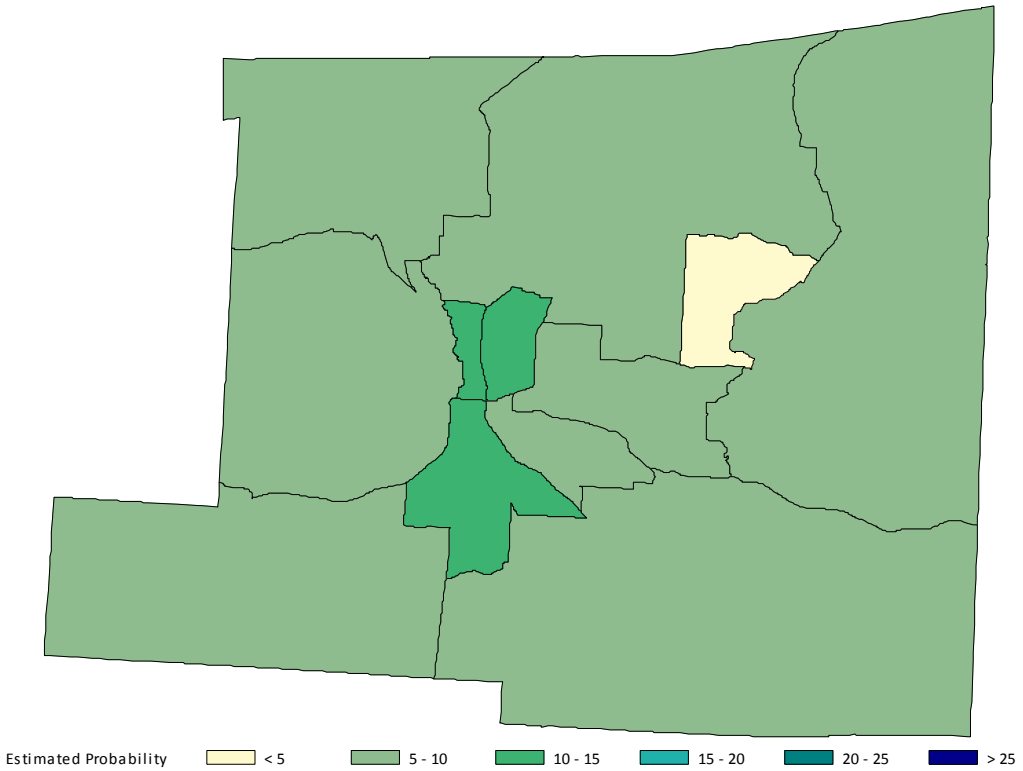


Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

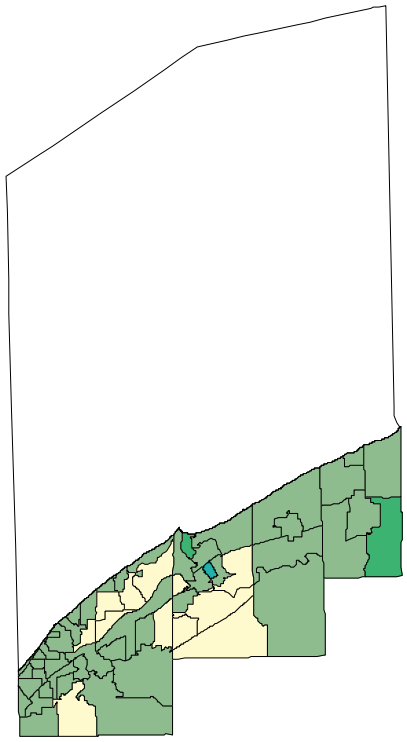
Predicted Percentage of Children with Elevated BLL for JEFFERSON County



Predicted Percentage of Children with Elevated BLL for KNOX County

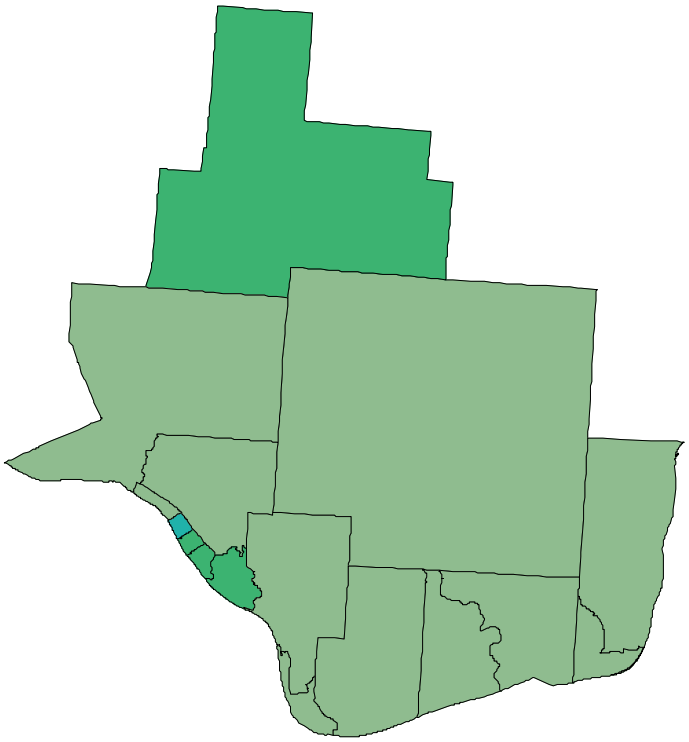


Predicted Percentage of Children with Elevated BLL for LAKE County



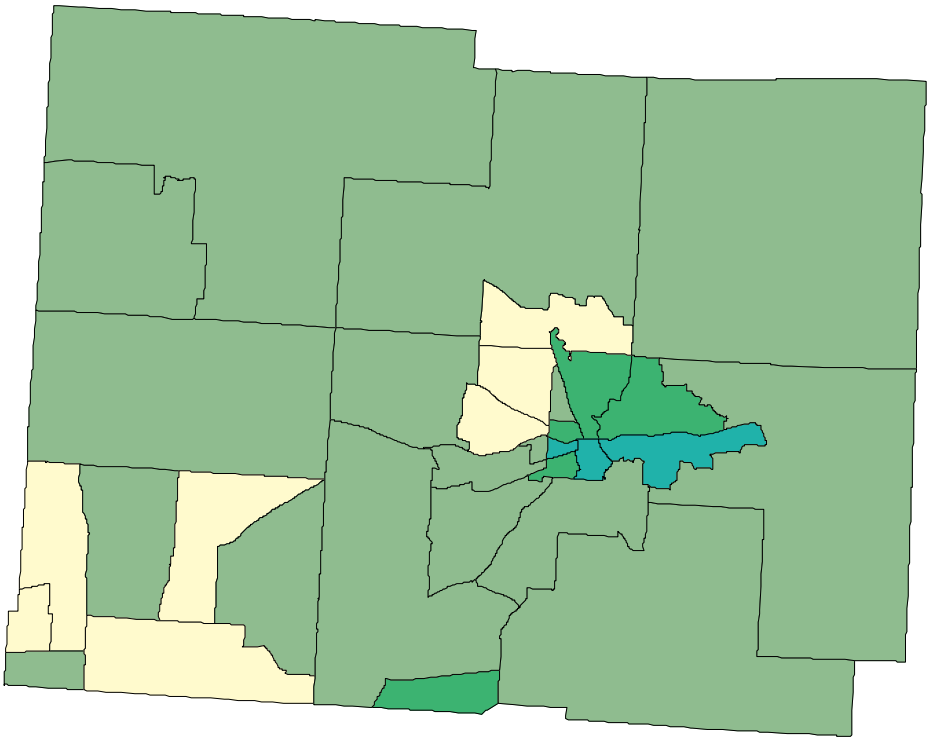
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for LAWRENCE County



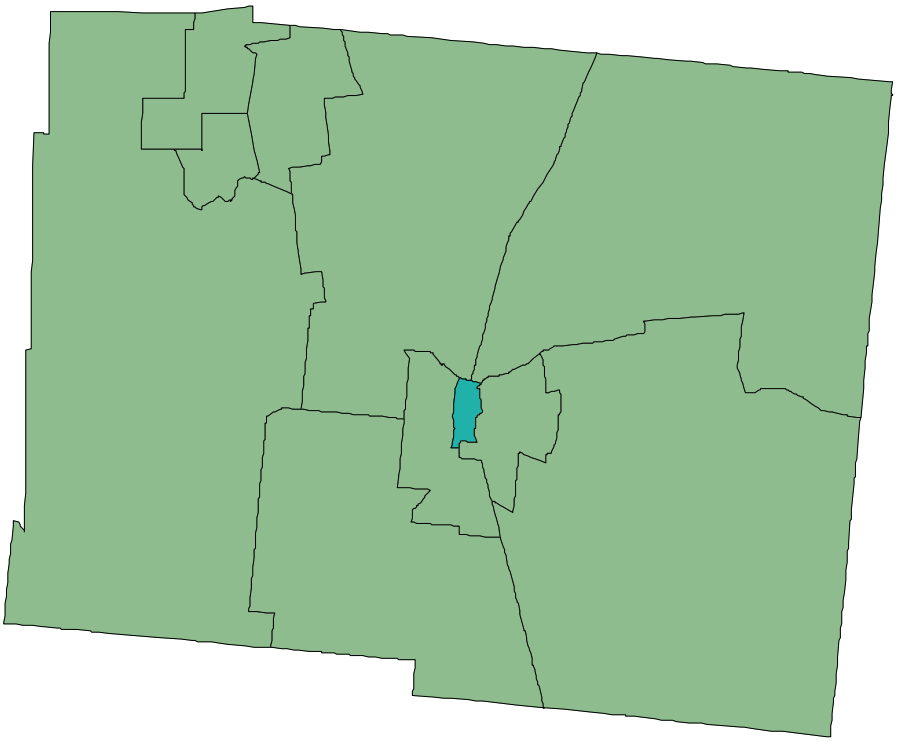
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for LICKING County



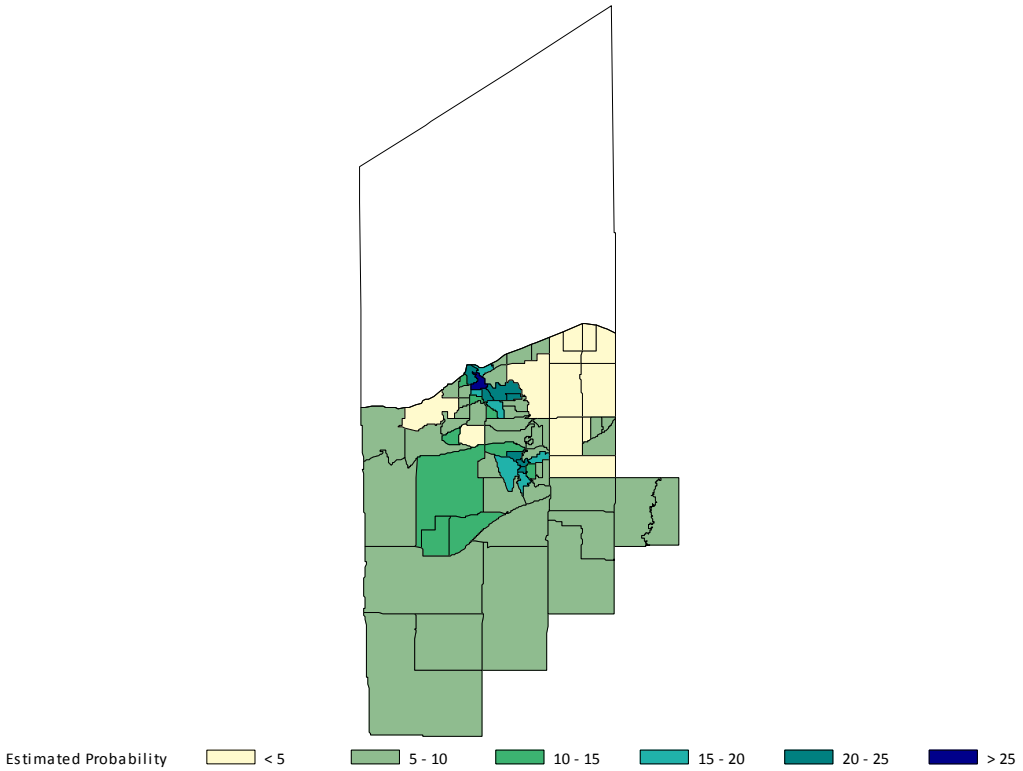
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for LOGAN County

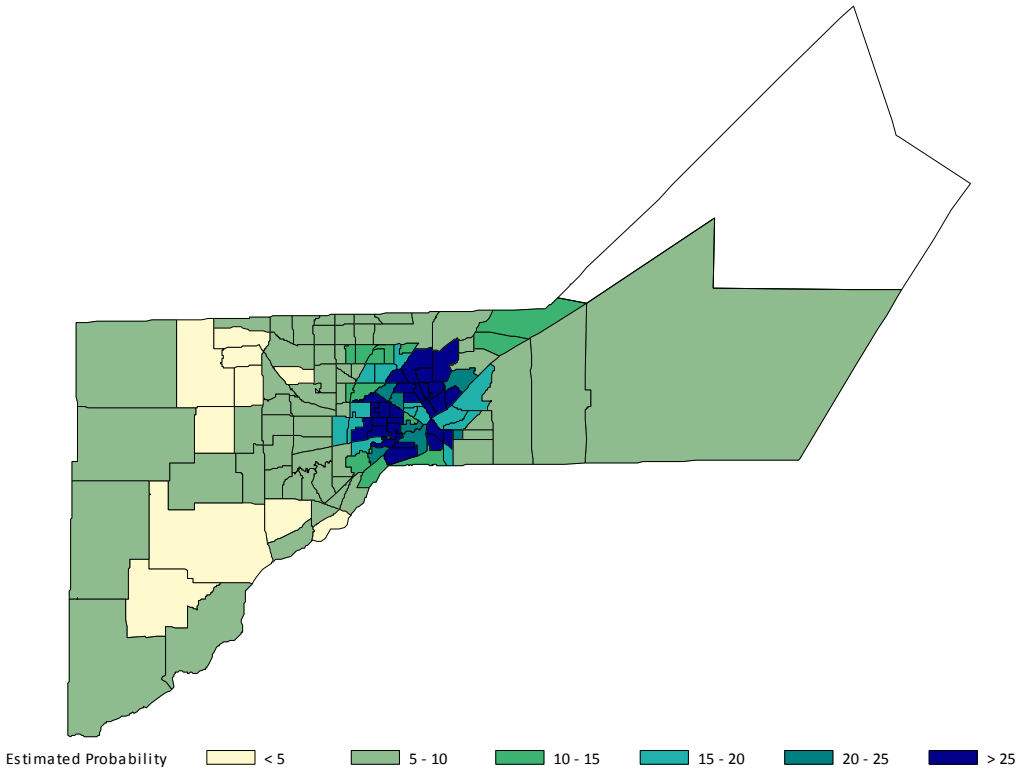


Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

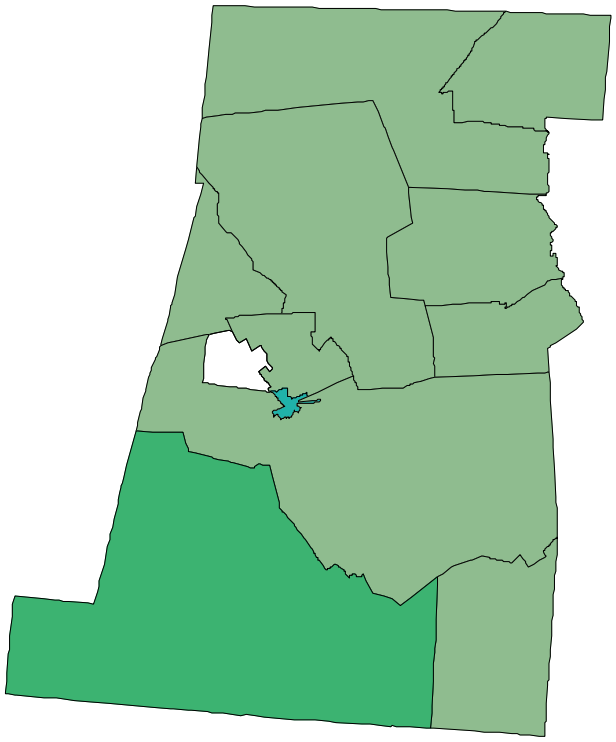
Predicted Percentage of Children with Elevated BLL for LORAIN County



Predicted Percentage of Children with Elevated BLL for LUCAS County

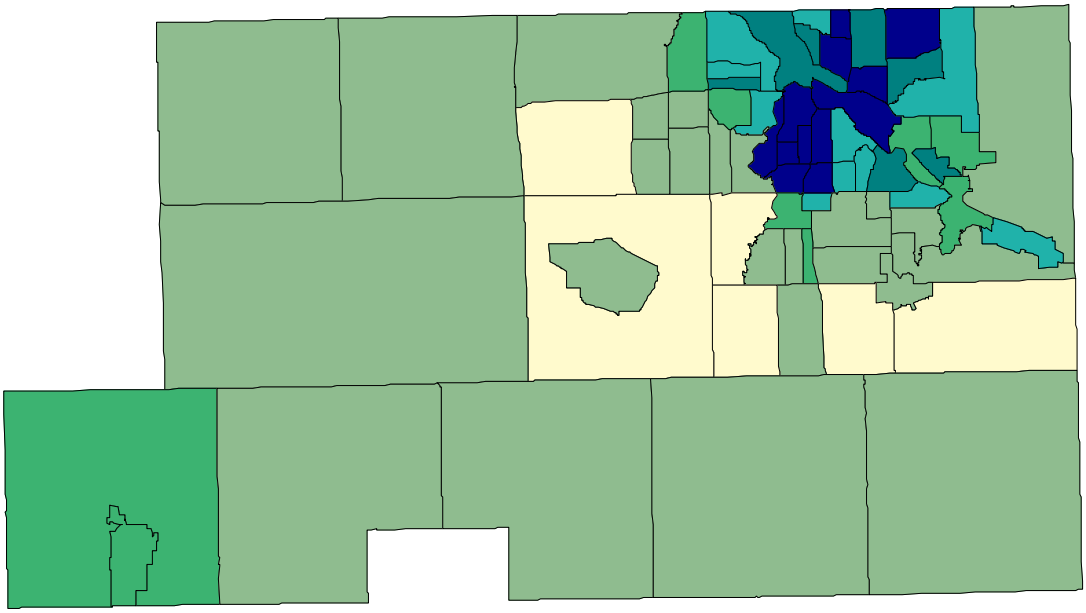


Predicted Percentage of Children with Elevated BLL for MADISON County



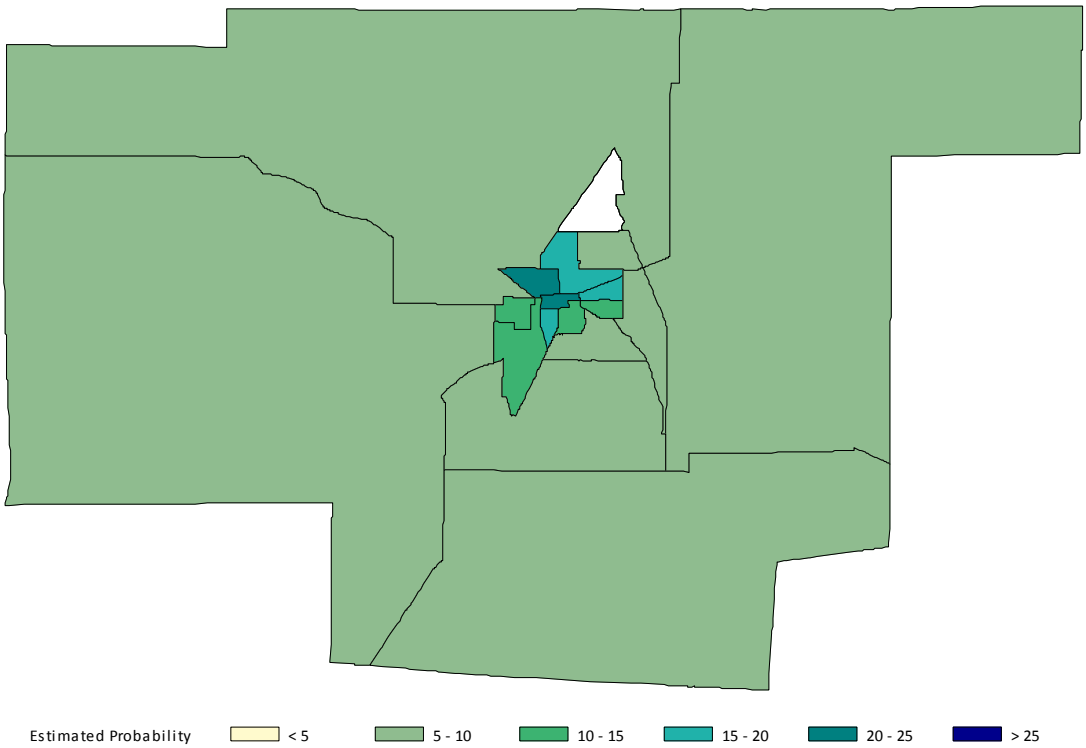
Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

Predicted Percentage of Children with Elevated BLL for MAHONING County

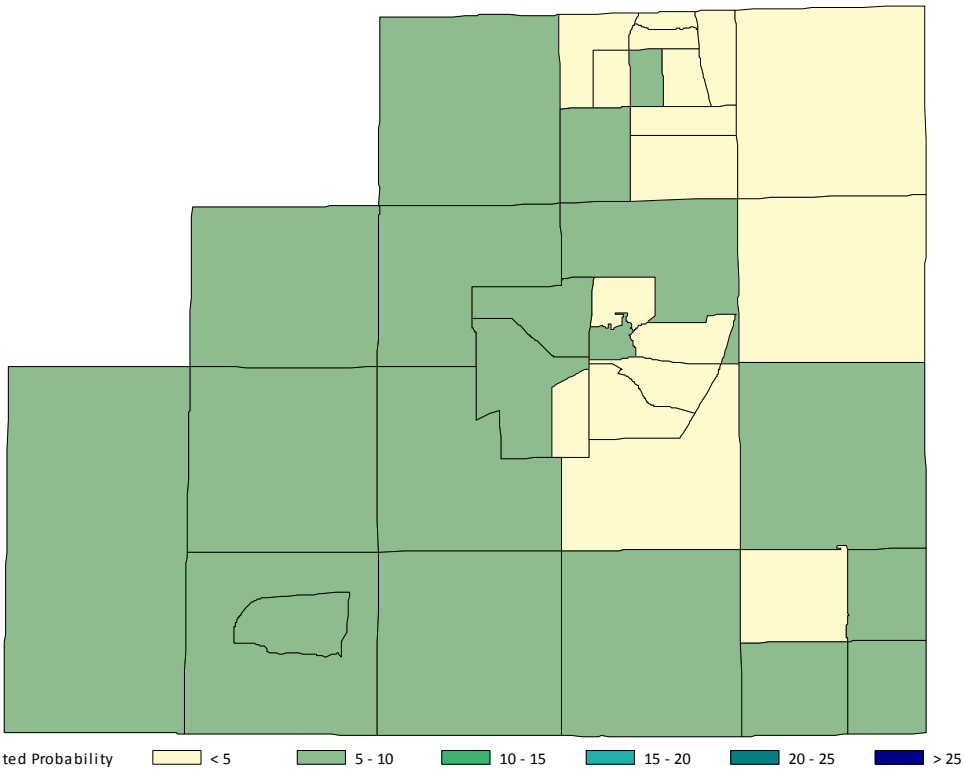


Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

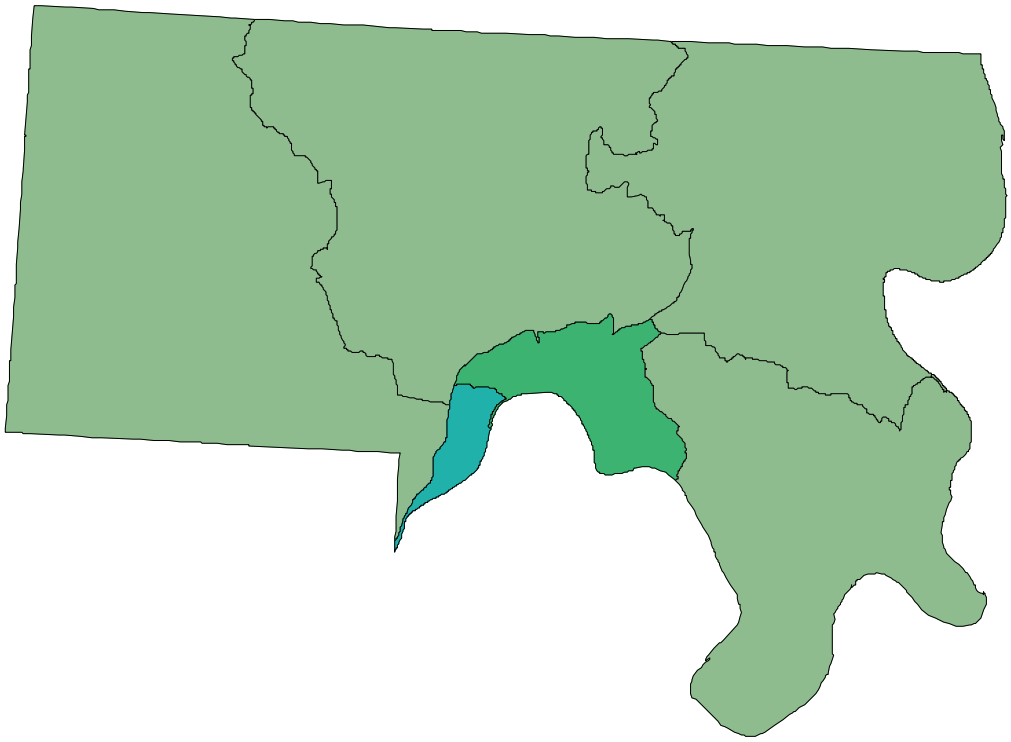
Predicted Percentage of Children with Elevated BLL for MARION County



Predicted Percentage of Children with Elevated BLL for MEDINA County

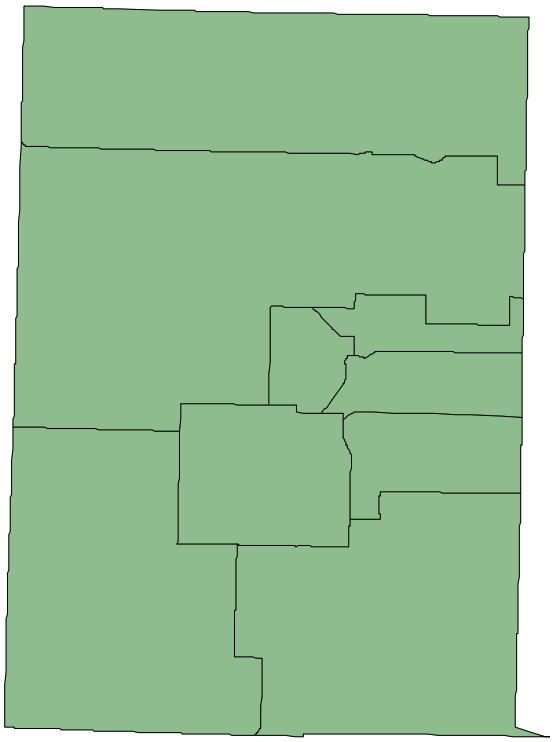


Predicted Percentage of Children with Elevated BLL for MEIGS County



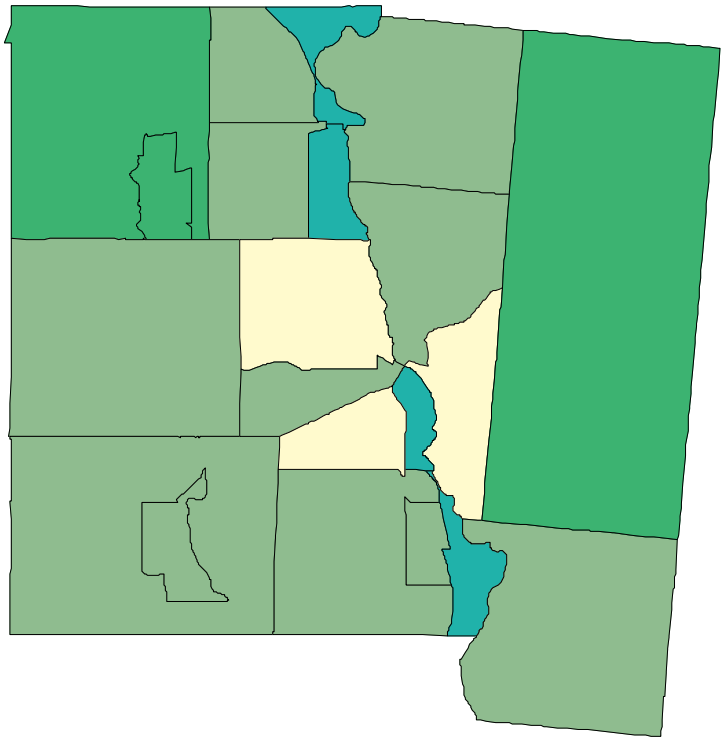
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for MERCER County



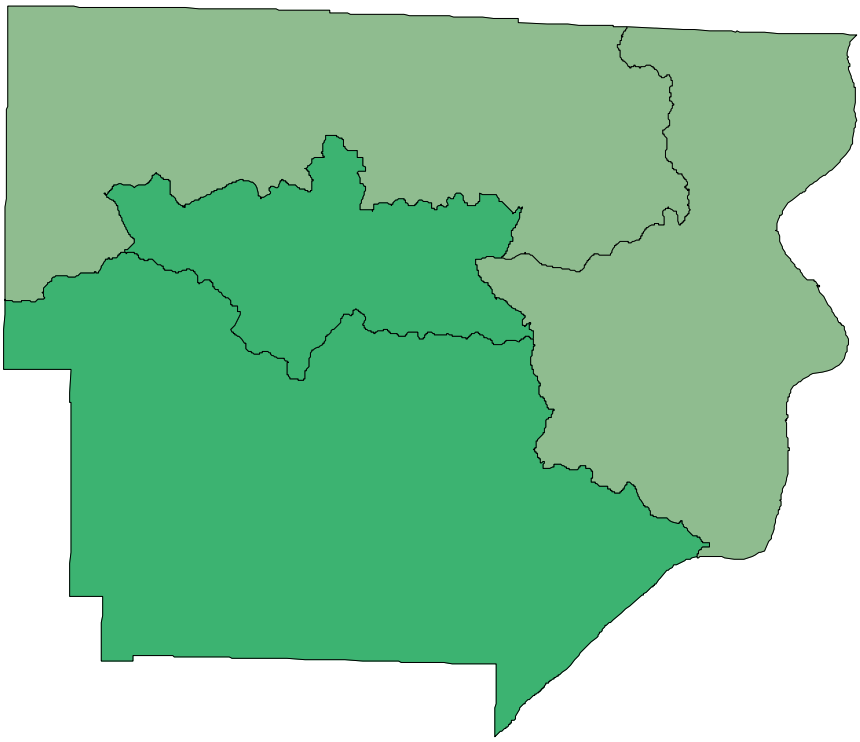
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for MIAMI County



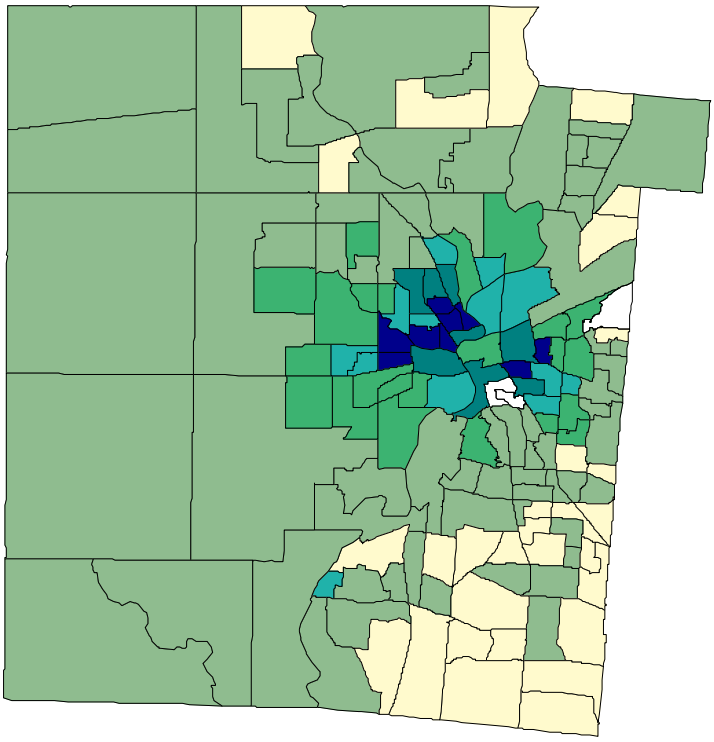
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for MONROE County



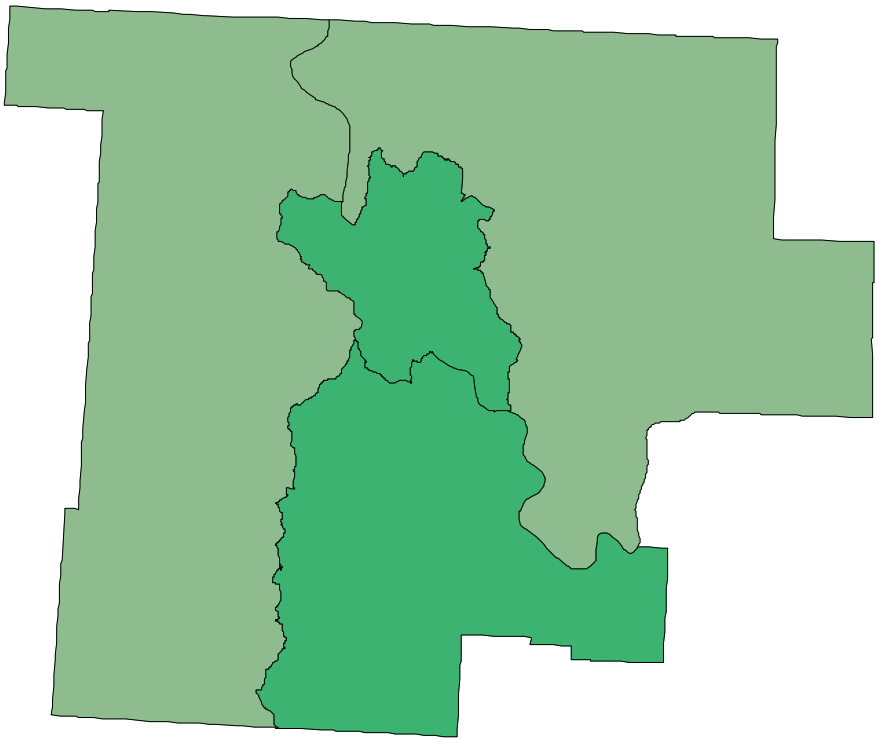
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for MONTGOMERY County



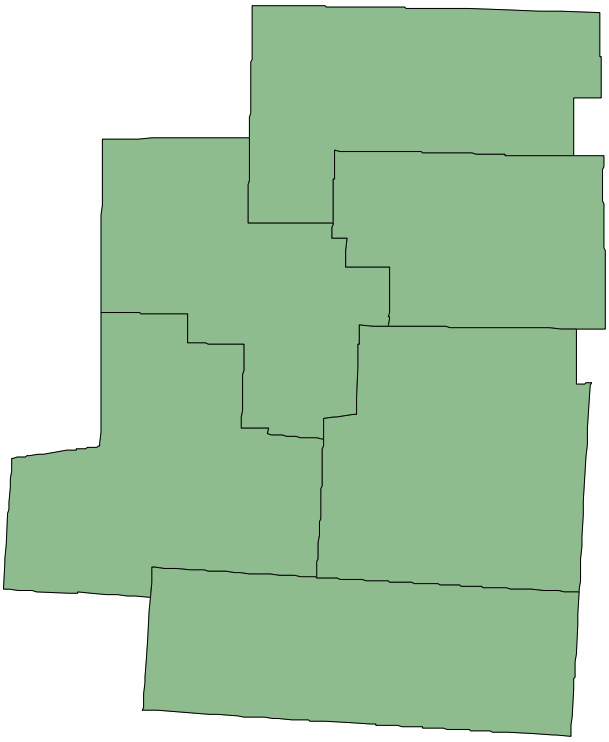
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for MORGAN County



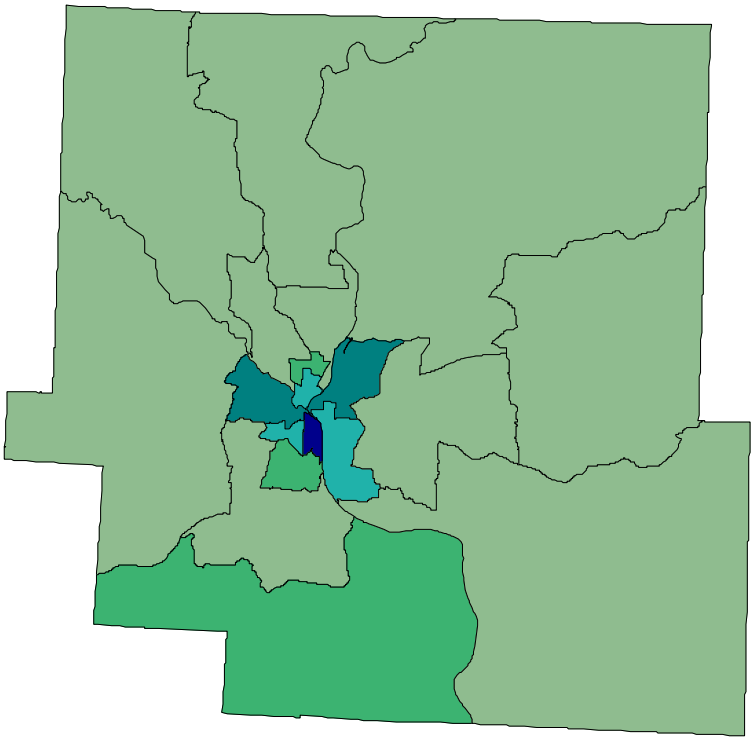
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for MORROW County



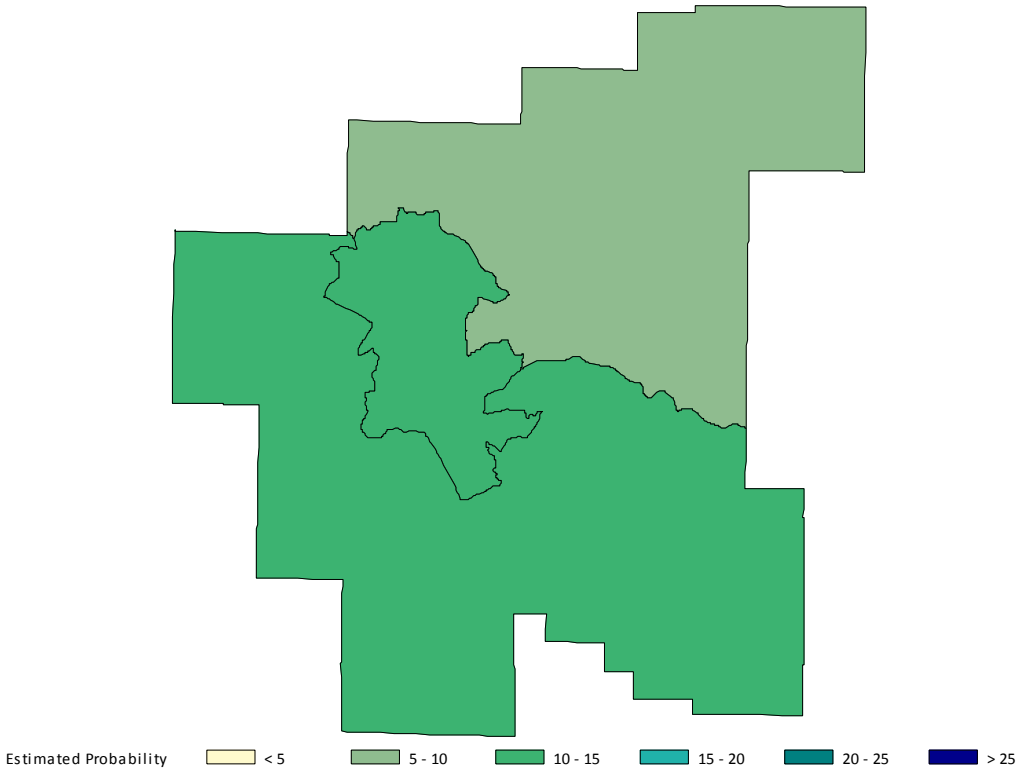
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for MUSKINGUM County

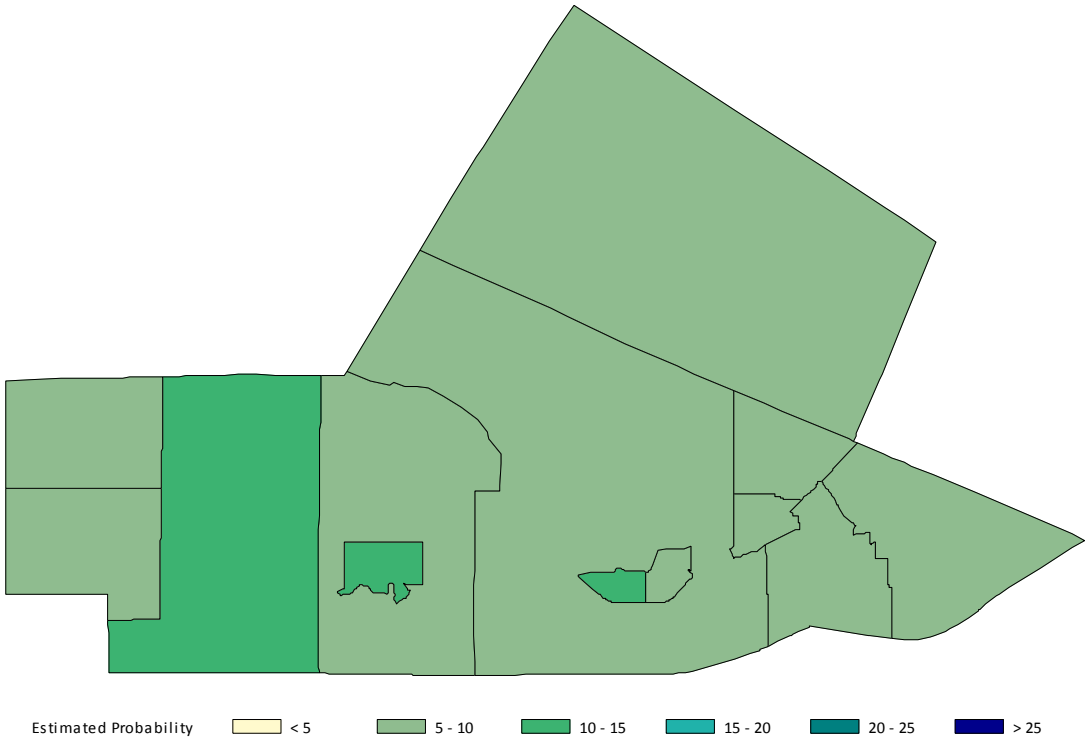


Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

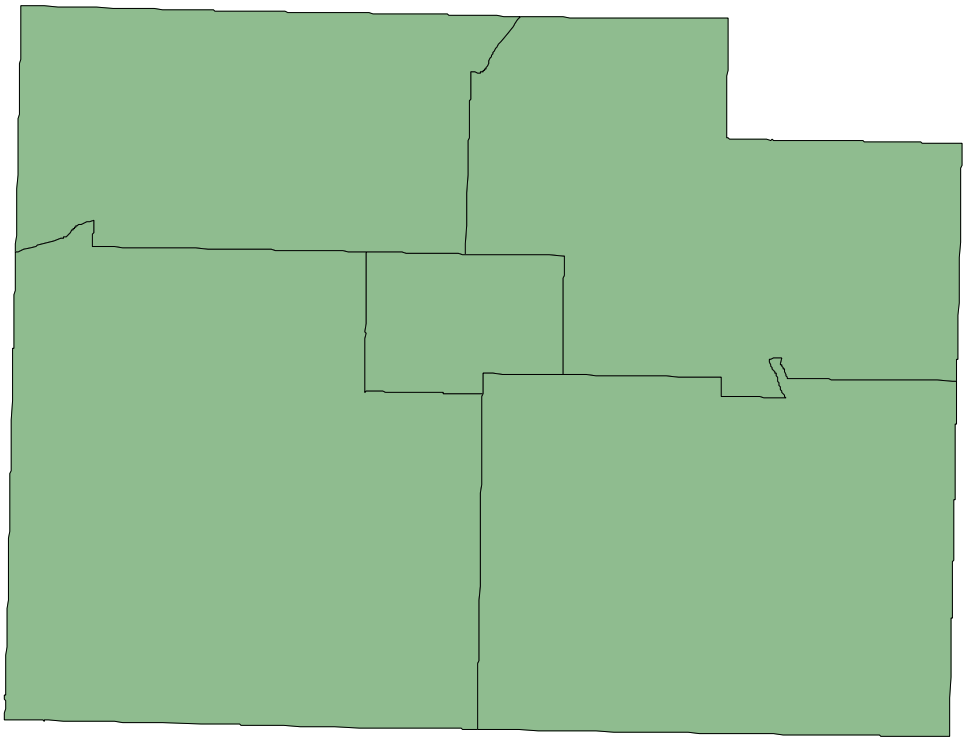
Predicted Percentage of Children with Elevated BLL for NOBLE County



Predicted Percentage of Children with Elevated BLL for OTTAWA County

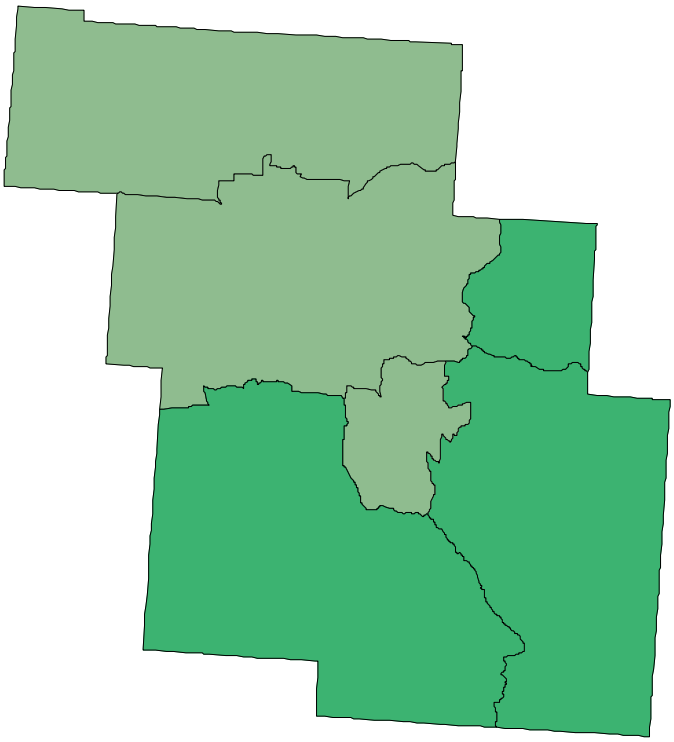


Predicted Percentage of Children with Elevated BLL for PAULDING County



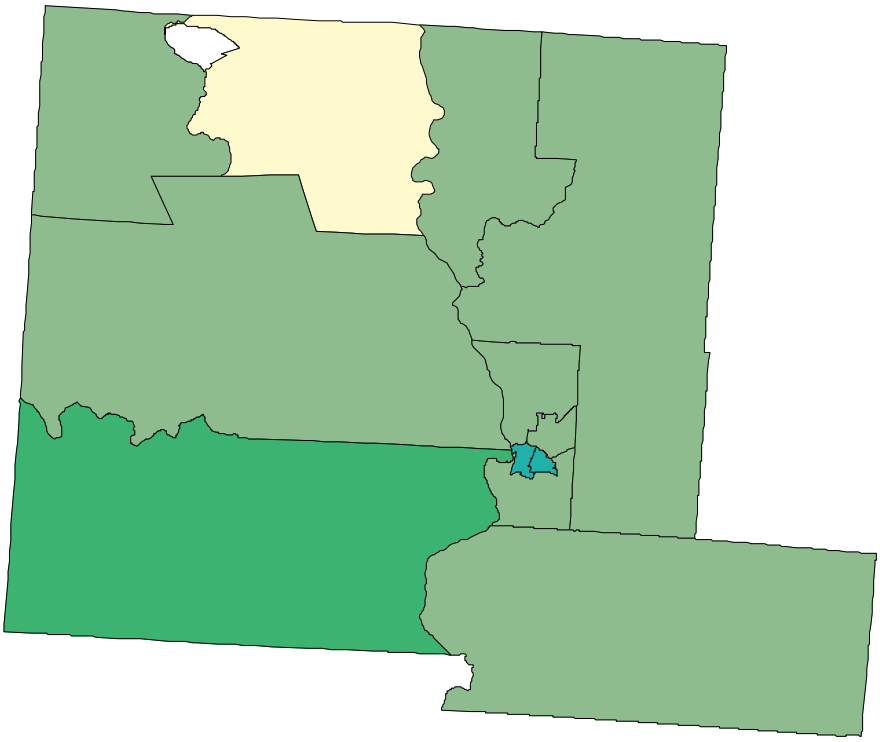
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for PERRY County



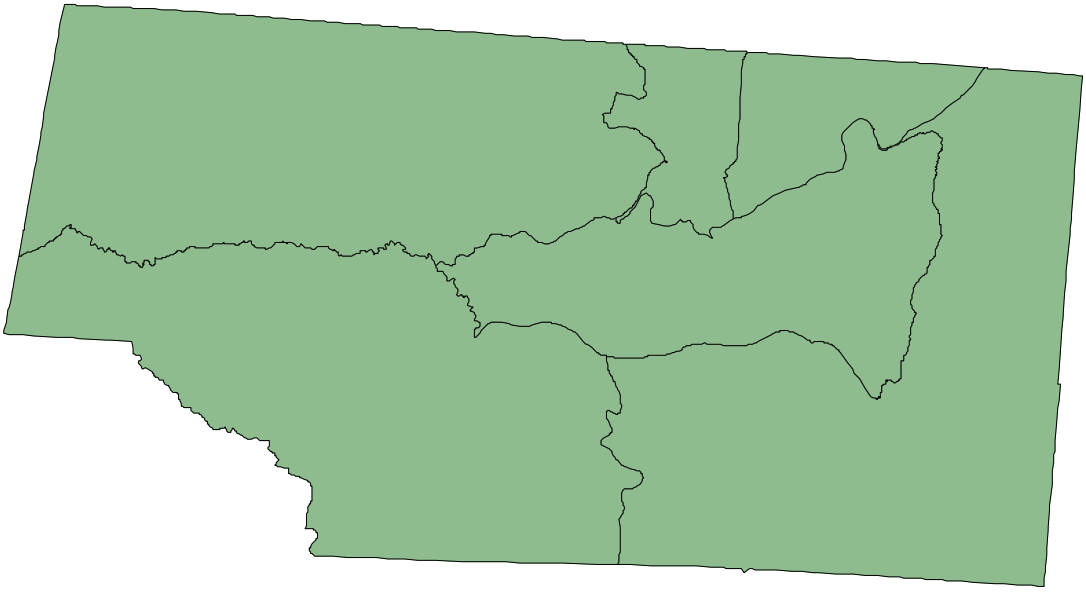
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for PICKAWAY County



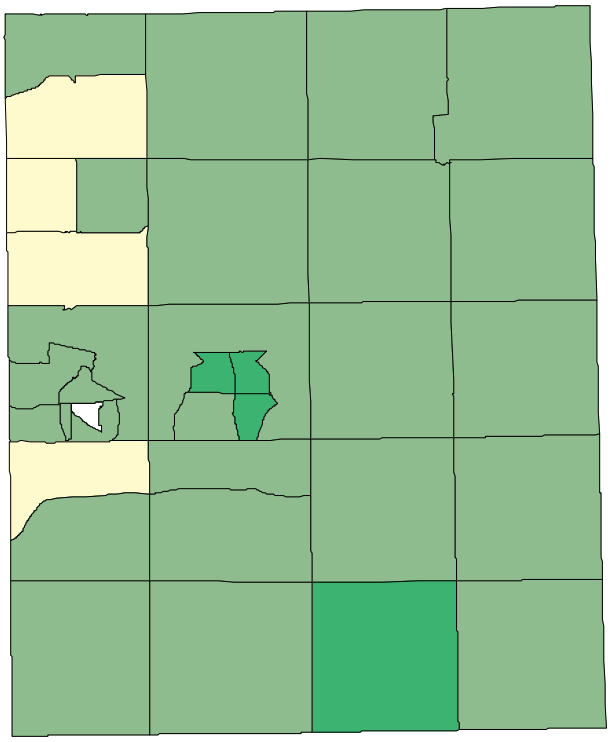
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for PIKE County



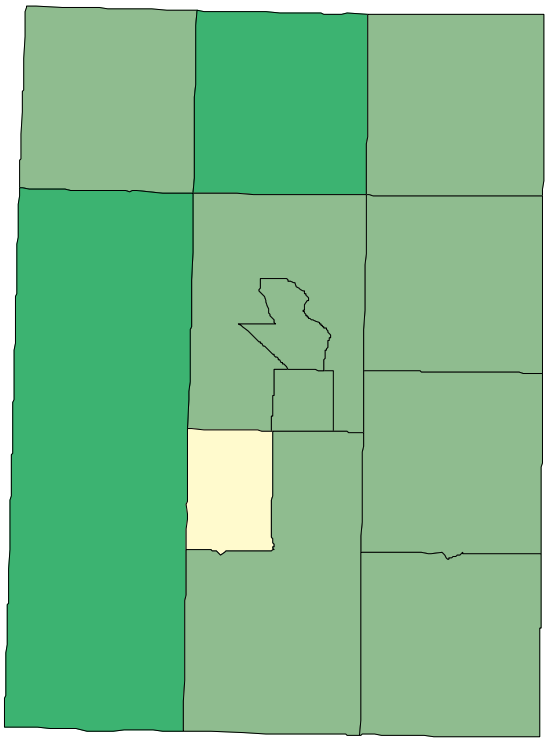
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for PORTAGE County



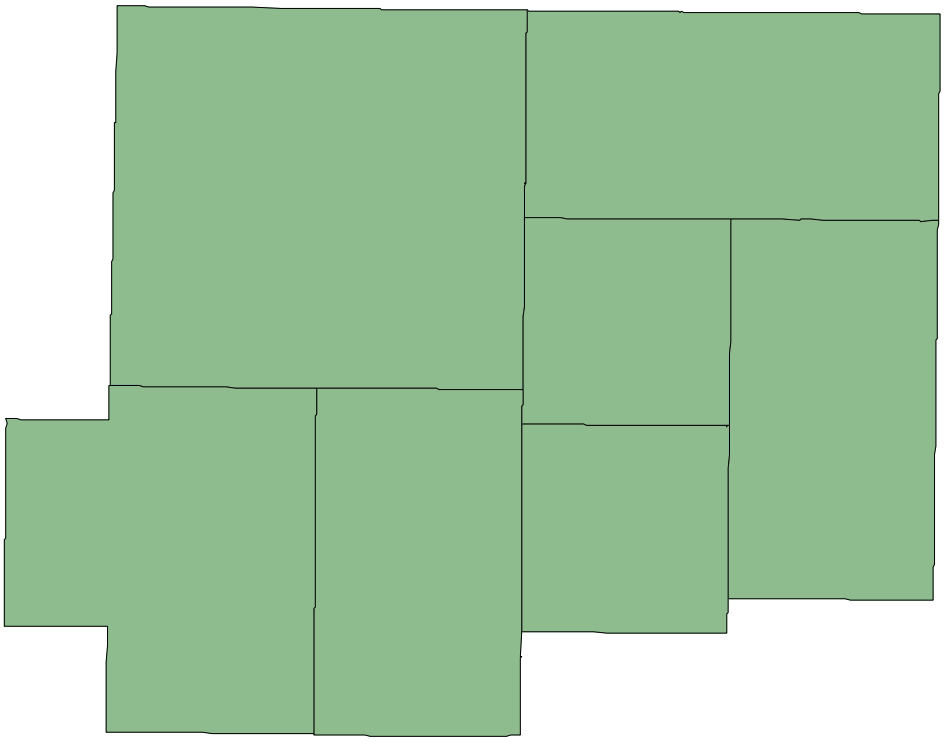
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for PREBLE County



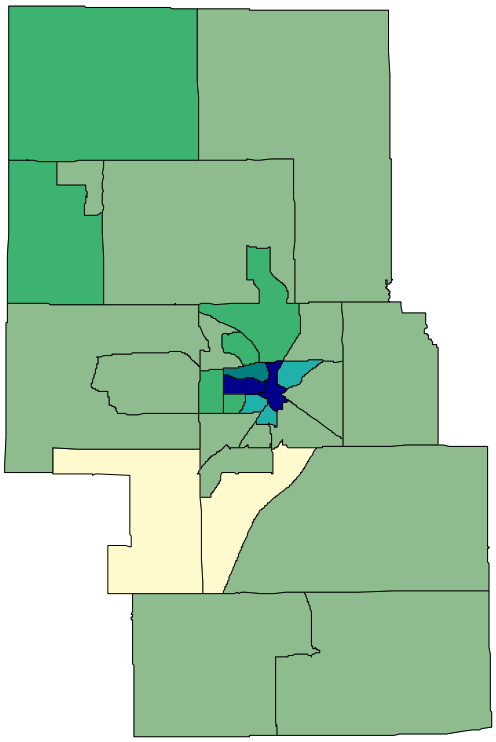
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for PUTNAM County



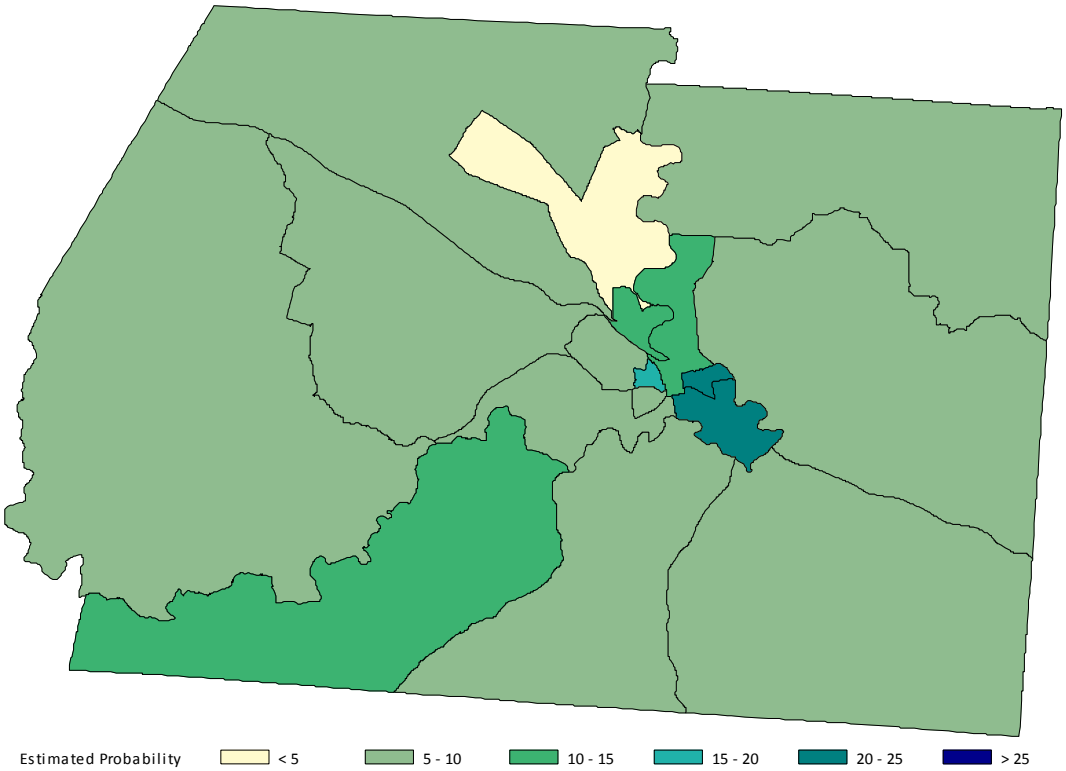
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for RICHLAND County

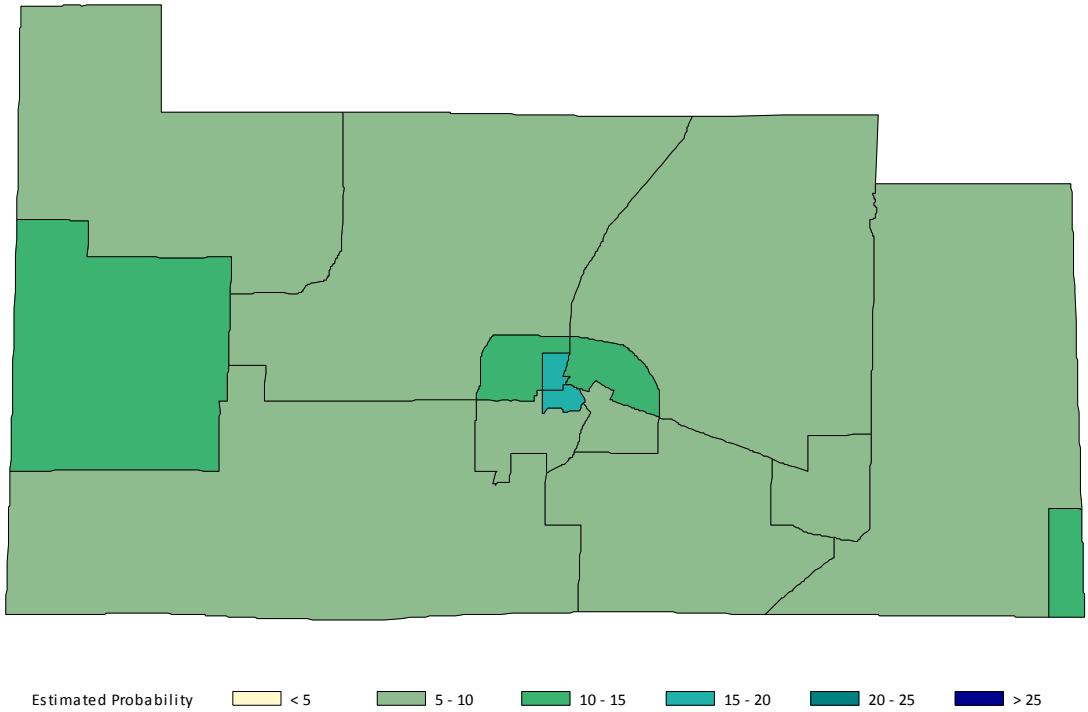


Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

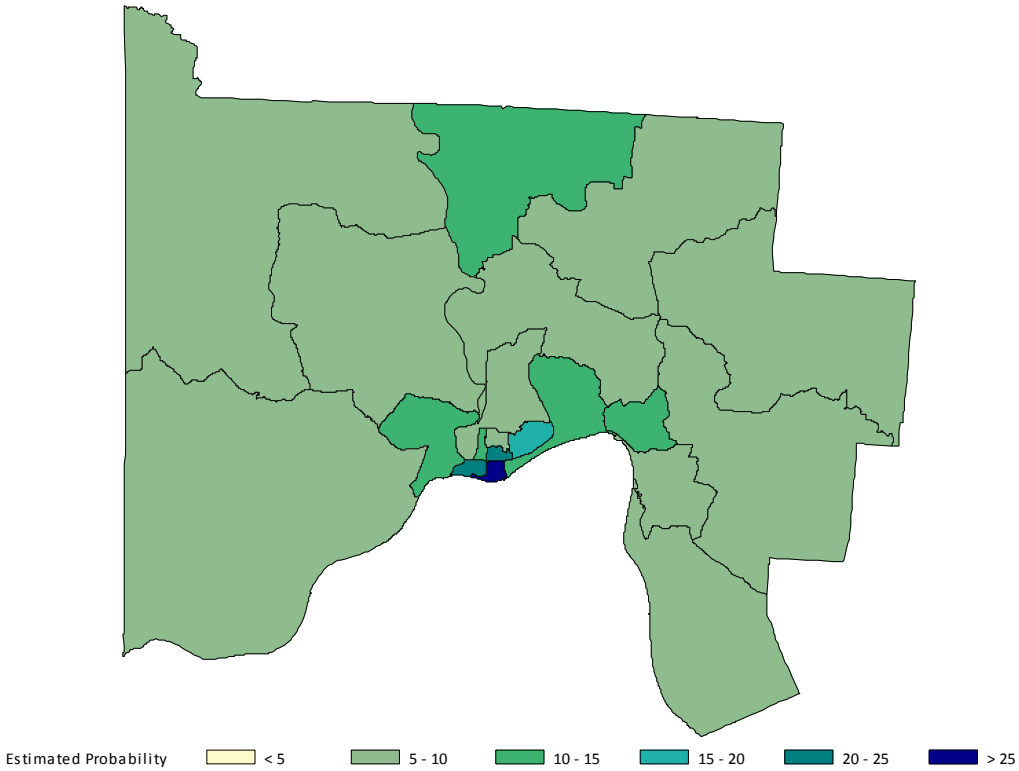
Predicted Percentage of Children with Elevated BLL for ROSS County



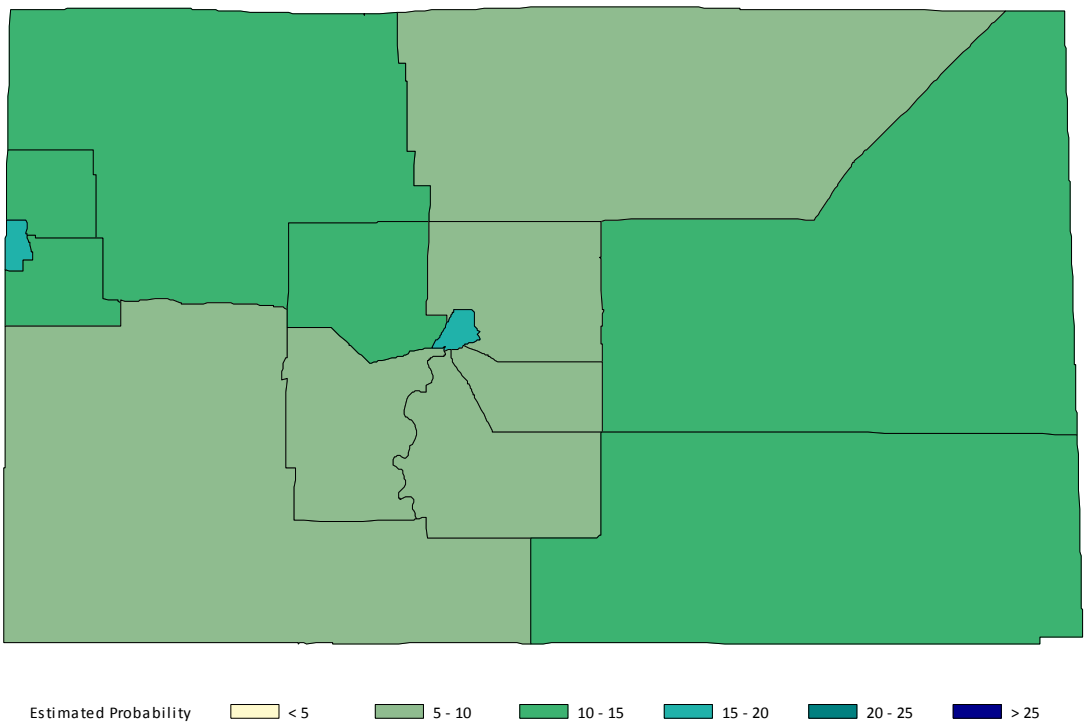
Predicted Percentage of Children with Elevated BLL for SANDUSKY County



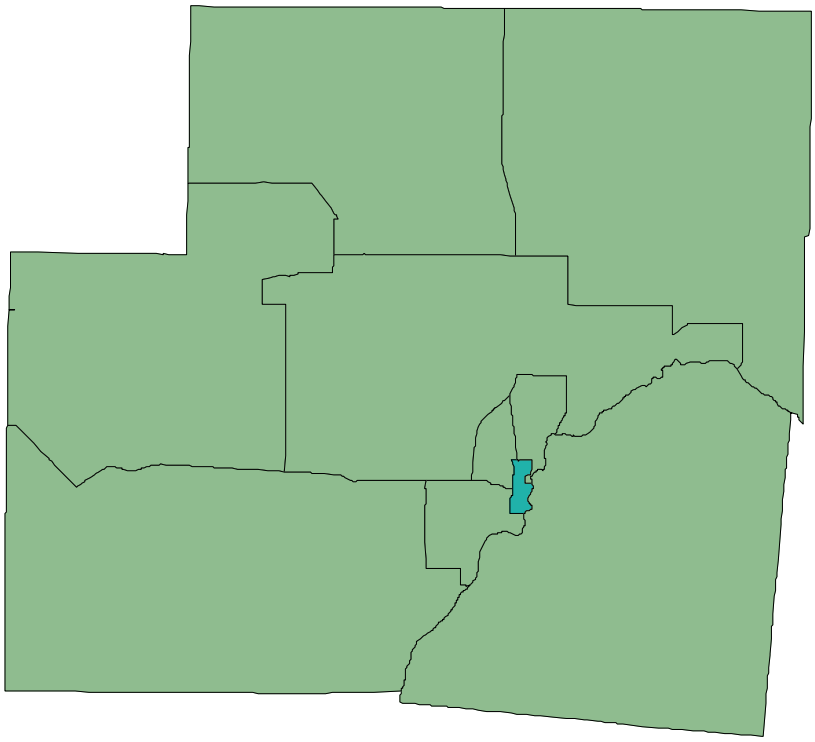
Predicted Percentage of Children with Elevated BLL for SCIOTO County



Predicted Percentage of Children with Elevated BLL for SENECA County

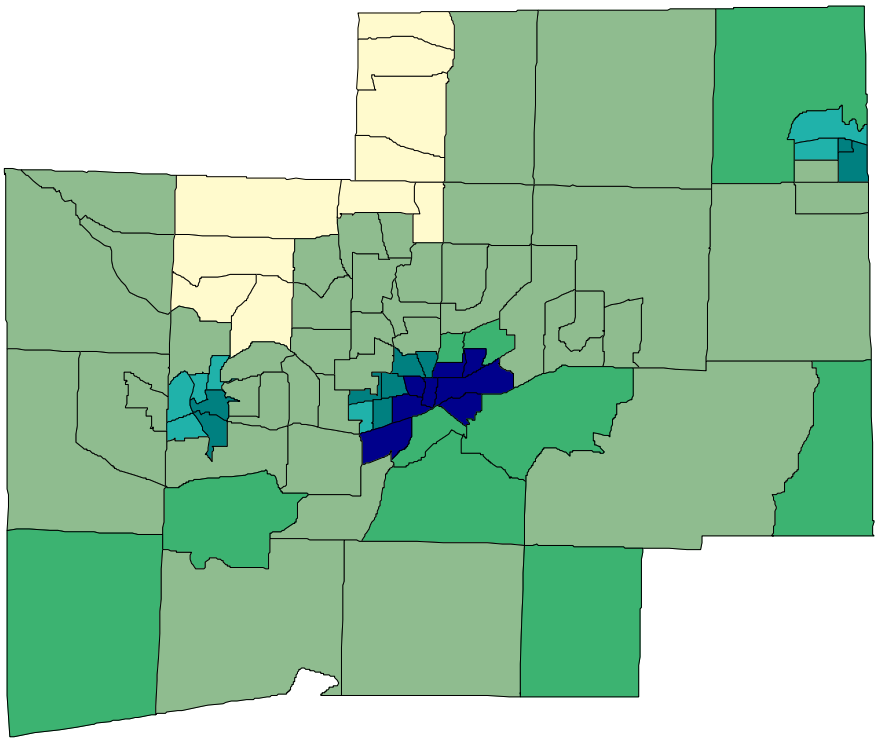


Predicted Percentage of Children with Elevated BLL for SHELBY County



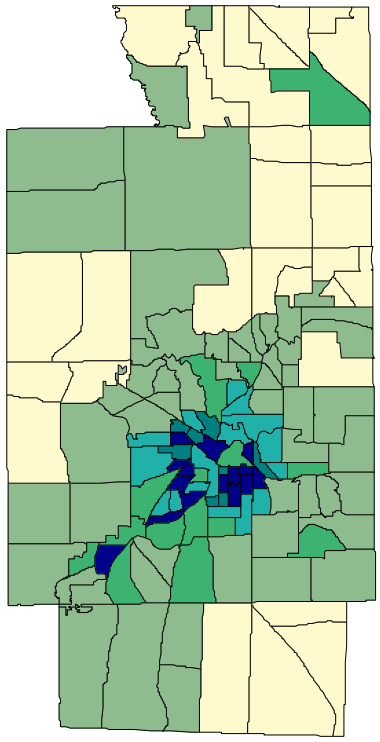
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for STARK County



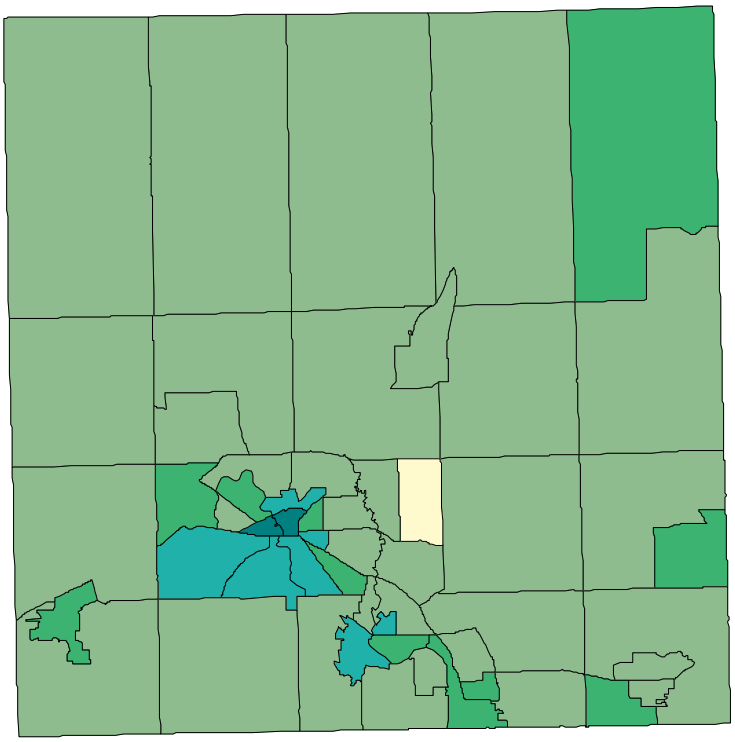
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for SUMMIT County



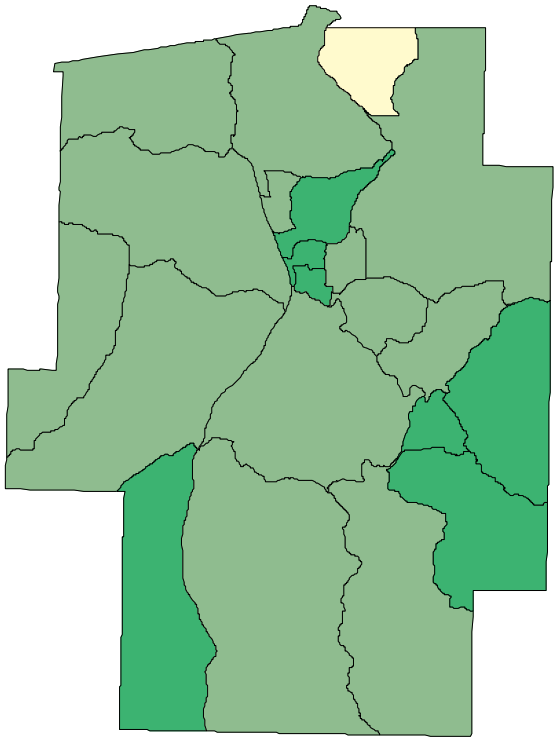
Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

Predicted Percentage of Children with Elevated BLL for TRUMBULL County



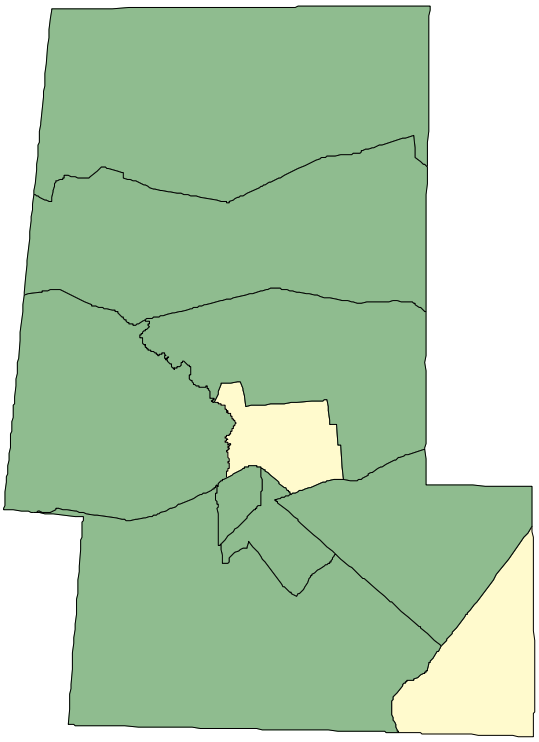
Estimated Probability < 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | > 25

Predicted Percentage of Children with Elevated BLL for TUSCARAWAS County



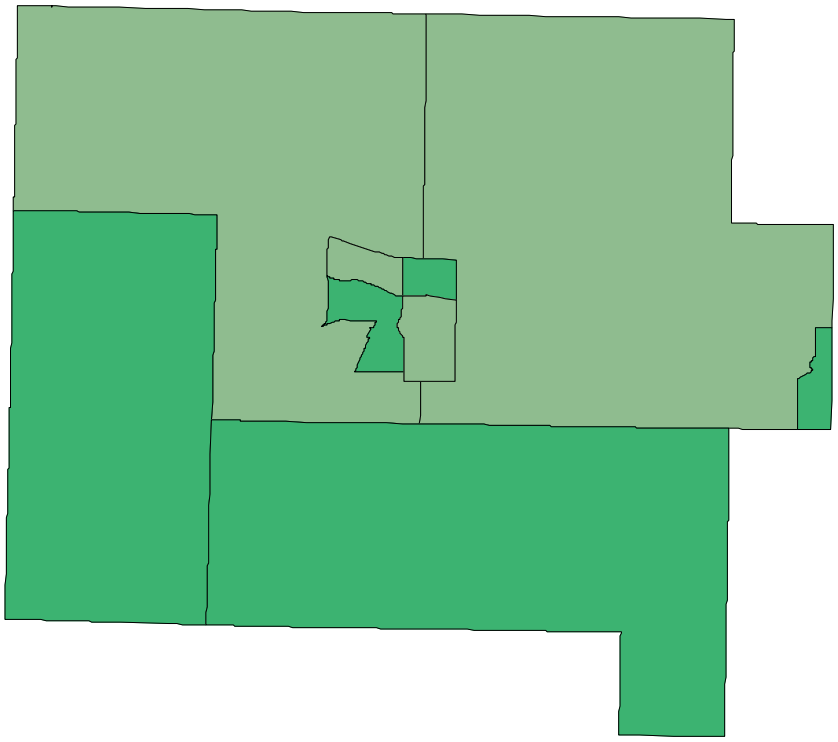
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for UNION County



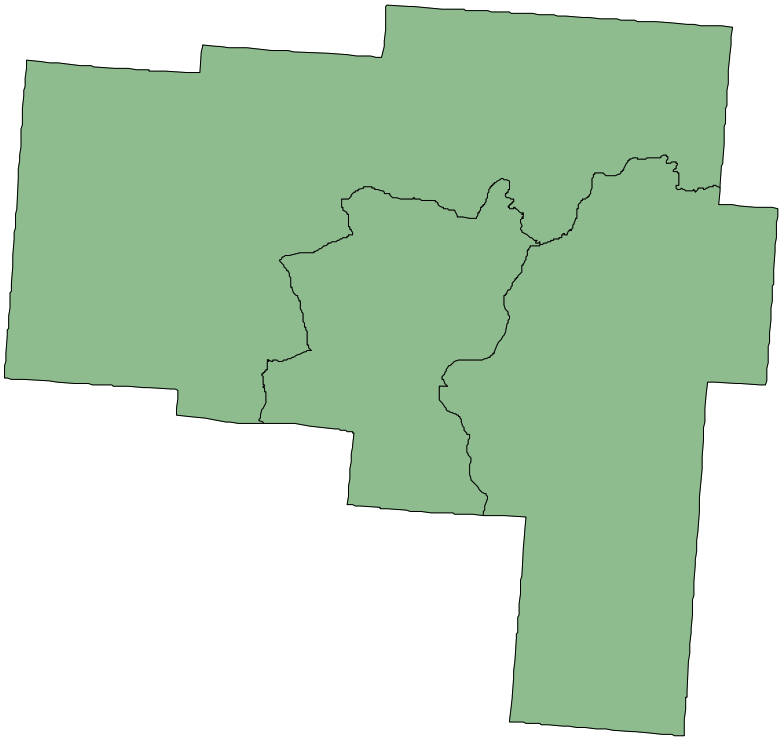
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for VAN WERT County



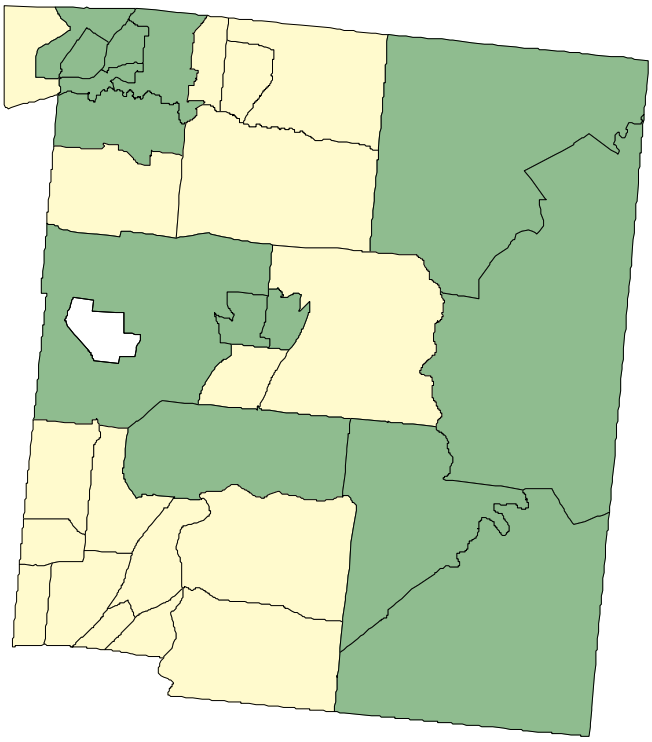
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for VINTON County



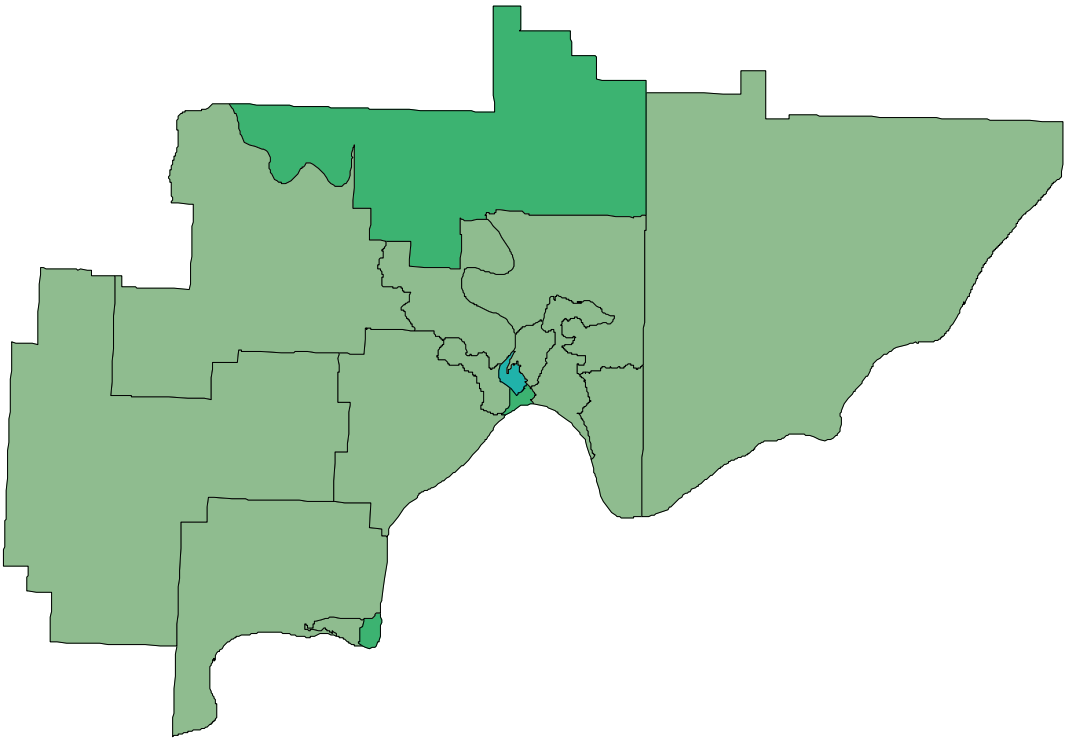
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for WARREN County



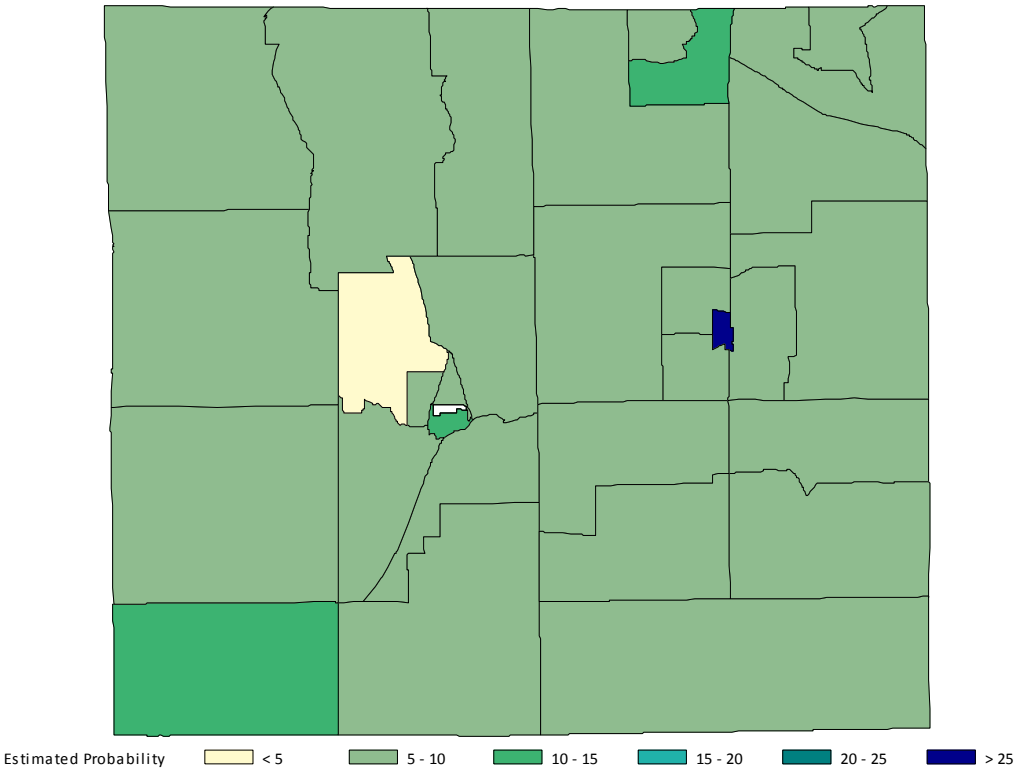
Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for WASHINGTON County

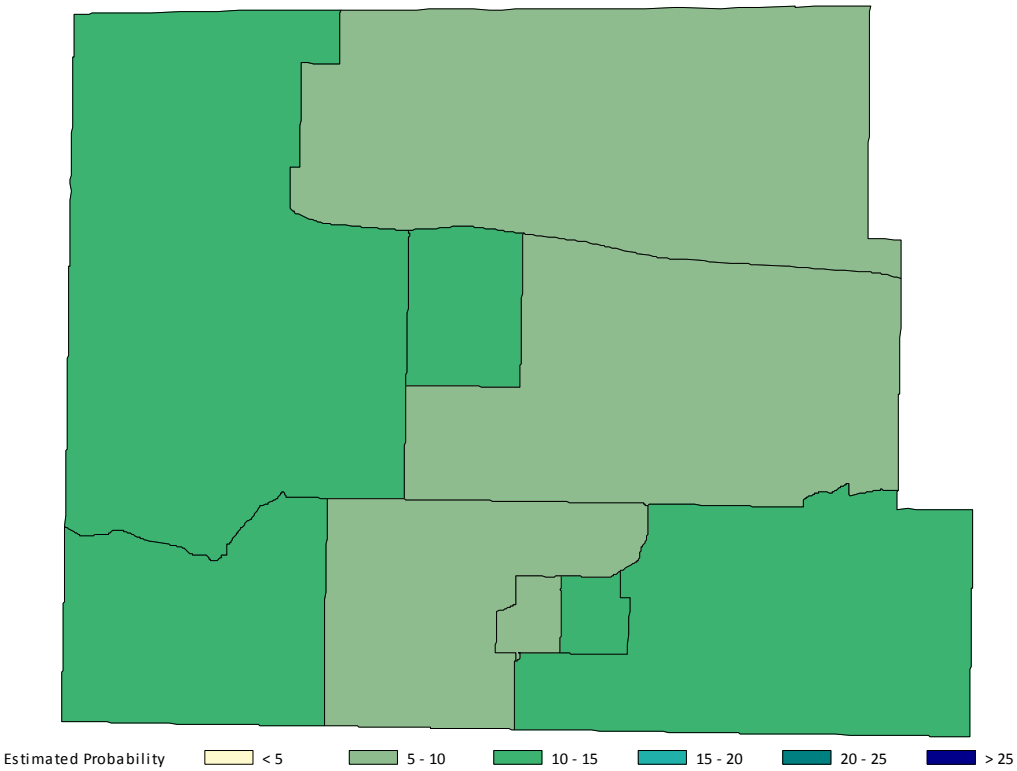


Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

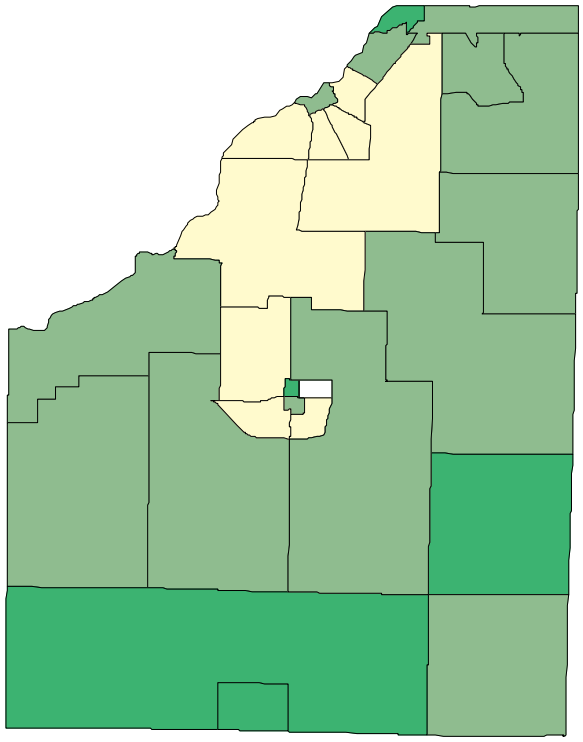
Predicted Percentage of Children with Elevated BLL for WAYNE County



Predicted Percentage of Children with Elevated BLL for WILLIAMS County

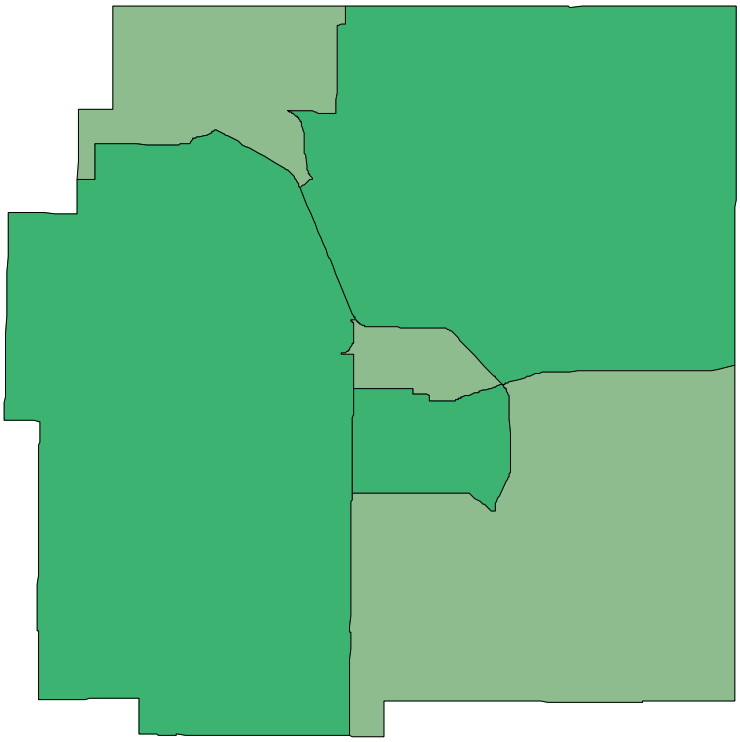


Predicted Percentage of Children with Elevated BLL for WOOD County



Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25

Predicted Percentage of Children with Elevated BLL for WYANDOT County



Estimated Probability < 5 5 - 10 10 - 15 15 - 20 20 - 25 > 25