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## Childhood Asthma in North Carolina

by

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### ABSTRACT

**Objectives:** Asthma is one of the most common illnesses among children, yet there is little reliable information on the number of children in North Carolina who are living with asthma. This study examines the prevalence of asthma among children on Medicaid and the rates of hospitalization for asthma among all children in the state.

**Methods:** Claims paid by Medicaid during state fiscal year 1997-1998 with a diagnosis of asthma or for a prescription drug used to treat asthma are examined to count the number of children ages 0-14 at the state and county level with asthma. Percentages of enrolled children with asthma are calculated, and the costs of asthma treatment are portrayed. Hospital discharge rates for the period 1995-1997, per 100,000 children ages 0-14, are presented at the state and county level.

**Results:** Approximately 13 percent of North Carolina children ages 0-14 on Medicaid had an indication of asthma. By age, the prevalence rates were: 17 percent for 0-4, 10 percent for 5-9, and 9 percent for 10-14. There were large variations in prevalence among counties in North Carolina. More than \$23,000,000 was paid by Medicaid during the fiscal year for asthma-related services for children ages 0-14. During 1995-1997 there was an average of more than 6,500 asthma-related hospitalizations per year among children, with a statewide rate of 436 discharges per 100,000 children ages 0-14. There were large variations in the hospital discharge rate by county of residence. In contrast to some other studies, asthma prevalence and hospitalization rates were found to be higher in rural than in urban areas of North Carolina.

**Conclusions:** Many children on Medicaid in North Carolina have asthma and asthma is one of the most frequent causes of hospitalization among all children in the state. State administrative databases are useful for studying asthma and other conditions among children in North Carolina. Relying on existing data systems allows quick updates of the information at the state and county level, enhancing the ability to study trends in illness and hospitalization over time.

## Introduction

Asthma is one of the most common illnesses of adults and children. Currently there is little reliable information on the number of people in North Carolina who are living with asthma. In 1997, 150 North Carolinians died with asthma listed on the death certificate as the primary cause of death. All but five of these persons were ages 25 and older. Although asthma is rarely reported as a primary cause of death among children, it is a common condition with serious consequences such as hospitalization and increased medical care costs. National data indicate that the prevalence of asthma and the rate of hospitalization among children have increased in recent years.<sup>1,2,3</sup>

Proper medical management is thought to reduce the morbidity and lost school days associated with asthma. Because of the high potential for preventing asthma-related problems among children, the North Carolina Childhood Asthma Initiative was established in 1998 by the State Health Director. There are four work groups of the Childhood Asthma Initiative: epidemiology, education, environment, and medical management. This report begins to address the epidemiology of childhood asthma in North Carolina.

## Methods

Two sources of data are used to estimate the prevalence of asthma among children in North Carolina: Medicaid paid claims data and hospital discharge data. Neither source will produce a reliable indication of the total prevalence of asthma among children. The Medicaid data indicates only those children diagnosed with asthma who received medical or prescription drug services. Other children on Medicaid with asthma may not have been diagnosed, or may not have had services paid for by Medicaid during the year. The hospital discharge data counts only those cases where the complications of asthma were serious enough to warrant one or more overnight hospital stays. Nevertheless, these data do provide estimates of the rate of serious cases of asthma among children in North Carolina.

For both types of data, ages 0-14 are used to estimate asthma in the childhood population. This age group is used by the National Center for Health Statistics for the Year 2000 objective for childhood asthma hospitalization rates. Estimates are provided for the state and for

each county of residence. The Medicaid data are for claims paid during July 1997 through June 1998. The hospital discharge data are for calendar years 1995-1997 combined. Since hospitalization for asthma is a less common event, three years hospital discharge data are used to stabilize the county-level rates.

To define asthma prevalence in the Medicaid population, paid claims were selected where there was any mention of a diagnosis of asthma (ICD-9-CM code 493). Also, claims paid for drugs used for the treatment of asthma were selected. Asthma medications fall into two general categories: long-term control medications which are taken daily to achieve and maintain control of persistent asthma, and quick-relief medications which are taken to promptly reverse acute airflow obstruction. A pharmacist and a physician with the North Carolina Medicaid agency jointly selected the drug codes that were used. These drugs were determined by them to be highly specific for asthma. The claims with a diagnosis of asthma and the drug claims were then combined and unduplicated on Medicaid ID number within county of residence, so each child was counted only once. In the few cases where a child with asthma resided in more than one county during the year, he/she was counted once in each county. These counts of children with asthma were then divided by the number of children ages 0-14 in the county who were enrolled in Medicaid (and multiplied by 100), to get the percentages of children with asthma. The dollar value of the claims paid for these children for the drug and other asthma-related services were totaled for the state and each county, and an average amount paid by Medicaid per child for asthma services was calculated.

Hospital discharge records for 1995-1997 for children ages 0-14 were selected if there was a primary or contributing diagnosis of asthma. The hospital discharge rates were computed as the number of asthma hospital discharges for the three years per 100,000 county residents ages 0-14 for the three years. These are in effect average annual rates. There is no way to unduplicate the records in the hospital discharge file. Therefore, the rates indicate the number of asthma hospital episodes per 100,000 population, not the number of children hospitalized. A strength of the hospital discharge data is that it applies to the total population of children in North Carolina, not just children on Medicaid. A problem in producing county-level data is that only discharges from hospitals in North Carolina are

included in the database. Therefore, counties on the border of North Carolina where many residents go to out-of-state hospitals will have asthma hospital discharge rates that are too low. Counties where this is likely to be a significant problem are: Camden, Caswell, Clay, Currituck, Dare, and Gates.

## Results

During state fiscal year 1997-1998, more than 70,000 children in the Medicaid program ages 0-14 had a diagnosis of or used a prescription drug for asthma. This represented 13.3 percent of the total children ages 0-14 who were enrolled in Medicaid. The amount paid by Medicaid for asthma-related medical services and drugs during this year was more than \$23,000,000, or an average of \$331 per child with asthma. Table 1 shows this information by age group. More than half of the children ages 0-14 with asthma were under age 5 and the prevalence rate was highest in this age group (17.3%). The prevalence rate decreases with age, though the average dollar amount per child expended by Medicaid for asthma-related services increases with age.

Table 2 presents the data by county of residence. Figure 1 is a county map of the prevalence of asthma (as measured here) among children on Medicaid. It can be seen that the prevalence is generally higher in the rural eastern and western counties of North Carolina. The prevalence rate in the ten most urban counties in

North Carolina is 11.7 percent, compared to a rate of 14.2 percent in the remaining more rural counties of the state. This is in contrast to some other studies that have found the prevalence of childhood asthma to be higher in urban areas.<sup>4,5,6</sup> Figure 2 shows the counties with a Medicaid asthma prevalence rate higher than the state average of 13.3 percent.

Of the approximately 70,000 children ages 0-14 on Medicaid who were identified with asthma, more than 63,000 or 90 percent were using one or more asthma prescription drugs paid for by Medicaid during the year. There was very little variation in this percentage across the three age groups: 0-4, 5-9, and 10-14. Thus, it appears that the large majority of these children with asthma are receiving some treatment with prescription drugs for their condition. The appropriateness of the treatment cannot be determined without a more detailed analysis of the drug claims.<sup>5,7</sup> It should be mentioned that the dollar amounts paid for asthma-related services are probably less than would be found in other populations, since Medicaid generally pays a smaller proportion of the amount charged by providers than other third-party payers.

During 1995-1997, there were 19,584 hospitalizations of North Carolina children ages 0-14 where asthma was mentioned as the primary or a contributing cause of admission. This was an average of more than 6,500 asthma-related hospitalizations per year in this age group. The average annual hospital discharge rate

**Table 1**  
**State Fiscal Year 1998 North Carolina Medicaid Claims for Asthma\*, Ages 0 to 14**

Age Group	Total Number of Medicaid Asthmatic Children*	Total Number of Medicaid-Enrolled Children	Percent of Medicaid Enrollees with Asthma Claims	Total Amount Expended	Average Amount Expended per Asthmatic Child
<b>State Total</b>	<b>70,218</b>	<b>528,621</b>	<b>13.3%</b>	<b>\$23,245,239</b>	<b>\$331</b>
0 to 4	42,058	242,837	17.3%	\$12,391,250	\$295
5 to 9	17,386	170,646	10.2%	\$6,369,366	\$366
10 to 14	10,774	115,138	9.4%	\$4,484,623	\$416

\*Represents an unduplicated count of paid Medicaid claims from 7/1/97 to 6/30/98 with any diagnosis of asthma (ICD-9CM=493) or a drug prescribed for asthmatics.

**Table 2**  
**State Fiscal Year 1998 North Carolina Medicaid Claims for Asthma\*, Children Ages 0 to 14**

<b>County of Residence</b>	<b>Total Number of Medicaid Asthmatic Children*</b>	<b>Total Number of Medicaid-Enrolled Children</b>	<b>Percent of Medicaid Enrollees with Asthma Claims</b>	<b>Total Amount Expended</b>	<b>Average Amount Expended per Asthmatic Child</b>
<b>State Total</b>	70,218	528,621	13.3%	\$23,245,239	\$331
Alamance	891	6,255	14.2%	\$366,599	\$411
Alexander	249	1,828	13.6%	\$105,650	\$424
Alleghany	74	566	13.1%	\$14,544	\$197
Anson	345	2,929	11.8%	\$157,386	\$456
Ashe	173	1,603	10.8%	\$28,443	\$164
Avery	135	1,016	13.3%	\$34,871	\$258
Beaufort	565	4,059	13.9%	\$217,866	\$386
Bertie	427	2,645	16.1%	\$102,621	\$240
Bladen	432	3,545	12.2%	\$395,955	\$917
Brunswick	712	5,595	12.7%	\$191,603	\$269
Buncombe	1,626	12,608	12.9%	\$515,632	\$317
Burke	599	5,699	10.5%	\$132,535	\$221
Cabarrus	839	5,904	14.2%	\$214,665	\$256
Caldwell	728	4,884	14.9%	\$193,196	\$265
Camden	63	383	16.4%	\$30,687	\$487
Carteret	659	3,493	18.9%	\$105,470	\$160
Caswell	171	1,499	11.4%	\$28,654	\$168
Catawba	843	8,328	10.1%	\$174,518	\$207
Chatham	235	2,195	10.7%	\$81,211	\$346
Cherokee	642	1,983	32.4%	\$97,079	\$151
Chowan	146	1,500	9.7%	\$34,979	\$240
Clay	151	492	30.7%	\$18,590	\$123
Cleveland	901	7,410	12.2%	\$138,248	\$153
Columbus	1,233	6,385	19.3%	\$462,648	\$375
Craven	1,089	6,396	17.0%	\$291,106	\$267
Cumberland	2,765	23,533	11.7%	\$1,293,612	\$468
Currituck	163	1,108	14.7%	\$27,927	\$171
Dare	167	1,307	12.8%	\$32,088	\$192
Davidson	1,073	8,696	12.3%	\$255,268	\$238
Davie	132	1,453	9.1%	\$44,488	\$337
Duplin	576	4,233	13.6%	\$115,248	\$200
Durham	1,853	14,876	12.5%	\$1,424,015	\$768
Edgecombe	878	7,885	11.1%	\$303,016	\$345
Forsyth	1,687	17,713	9.5%	\$838,971	\$497
Franklin	393	3,215	12.2%	\$137,908	\$351
Gaston	1,274	12,722	10.0%	\$422,571	\$332
Gates	76	693	11.0%	\$36,572	\$481
Graham	151	650	23.2%	\$35,659	\$236
Granville	348	2,866	12.1%	\$112,395	\$323
Greene	199	1,692	11.8%	\$58,507	\$294
Guilford	3,232	25,359	12.7%	\$993,081	\$307
Halifax	936	7,148	13.1%	\$270,391	\$289
Harnett	871	6,998	12.4%	\$304,527	\$350
Haywood	563	3,477	16.2%	\$183,261	\$326
Henderson	568	5,181	11.0%	\$165,437	\$291
Hertford	379	2,892	13.1%	\$182,289	\$481
Hoke	420	3,255	12.9%	\$132,720	\$316
Hyde	75	502	14.9%	\$22,234	\$296
Iredell	810	6,444	12.6%	\$393,913	\$486
Jackson	501	2,123	23.6%	\$106,109	\$212

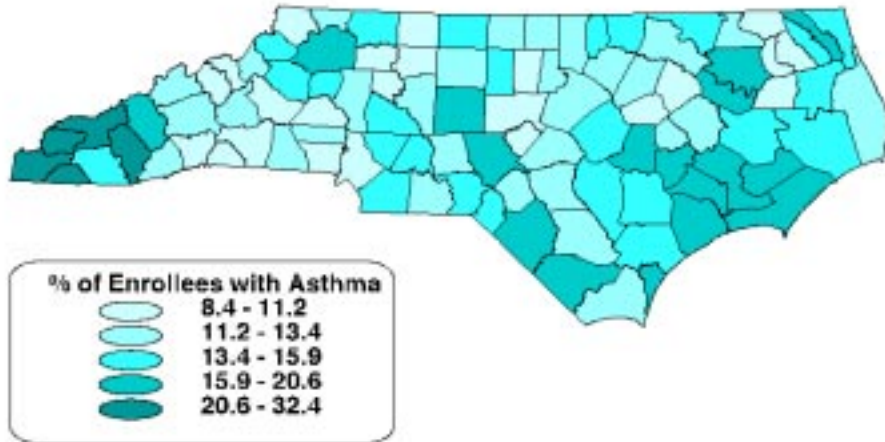
\*Represents an unduplicated count of paid Medicaid claims from 7/1/97 to 6/30/98 with any diagnosis of asthma (ICD9-CM=493) or a drug prescribed for asthmatics.

**Table 2**  
**State Fiscal Year 1998 North Carolina Medicaid Claims for Asthma\*, Children Ages 0 to 14**

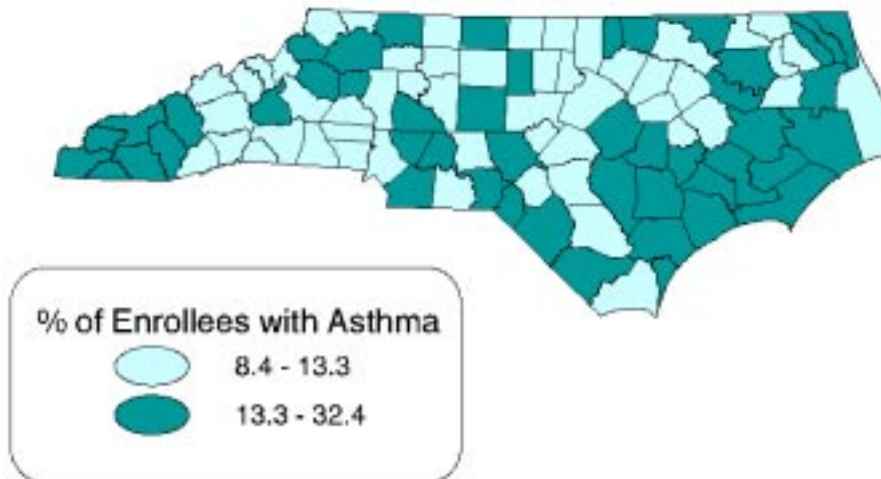
<b>County of Residence</b>	<b>Total Number of Medicaid Asthmatic Children*</b>	<b>Total Number of Medicaid-Enrolled Children</b>	<b>Percent of Medicaid Enrollees with Asthma Claims</b>	<b>Total Amount Expended</b>	<b>Average Amount Expended per Asthmatic Child</b>
Johnston	1,081	7,367	14.7%	\$406,342	\$376
Jones	182	885	20.6%	\$40,195	\$221
Lee	426	4,065	10.5%	\$94,161	\$221
Lenoir	1,094	6,250	17.5%	\$409,850	\$375
Lincoln	427	3,286	13.0%	\$76,888	\$180
Macon	272	1,839	14.8%	\$41,977	\$154
Madison	153	1,320	11.6%	\$24,014	\$157
Martin	466	2,632	17.7%	\$107,421	\$231
McDowell	358	2,674	13.4%	\$87,631	\$245
Mecklenburg	3,374	36,314	9.3%	\$754,604	\$224
Mitchell	71	814	8.7%	\$17,782	\$250
Montgomery	271	2,257	12.0%	\$45,894	\$169
Moore	758	4,390	17.3%	\$231,184	\$305
Nash	792	6,474	12.2%	\$237,402	\$300
New Hanover	1,606	9,774	16.4%	\$486,300	\$303
Northampton	363	2,640	13.8%	\$124,255	\$342
Onslow	1,525	8,914	17.1%	\$370,180	\$243
Orange	349	3,500	10.0%	\$160,634	\$460
Pamlico	171	969	17.6%	\$36,566	\$214
Pasquotank	533	3,358	15.9%	\$167,953	\$315
Pender	470	3,240	14.5%	\$99,596	\$212
Perquimans	116	1,075	10.8%	\$40,015	\$345
Person	286	2,179	13.1%	\$180,348	\$631
Pitt	1,355	10,514	12.9%	\$786,891	\$581
Polk	82	841	9.8%	\$13,278	\$162
Randolph	1,292	7,417	17.4%	\$277,507	\$215
Richmond	750	5,122	14.6%	\$285,097	\$380
Robeson	2,666	16,055	16.6%	\$1,115,099	\$418
Rockingham	913	5,907	15.5%	\$329,112	\$360
Rowan	1,227	8,540	14.4%	\$255,875	\$209
Rutherford	481	4,294	11.2%	\$60,448	\$126
Sampson	692	5,144	13.5%	\$204,969	\$296
Scotland	647	4,468	14.5%	\$220,205	\$340
Stanly	560	3,694	15.2%	\$111,345	\$199
Stokes	198	2,291	8.6%	\$51,416	\$260
Surry	555	3,953	14.0%	\$158,899	\$286
Swain	267	1,180	22.6%	\$62,156	\$233
Transylvania	222	1,819	12.2%	\$46,410	\$209
Tyrell	57	412	13.8%	\$16,052	\$282
Union	903	6,071	14.9%	\$269,698	\$299
Vance	739	5,345	13.8%	\$319,124	\$432
Wake	3,214	24,739	13.0%	\$995,930	\$310
Warren	273	1,997	13.7%	\$77,705	\$285
Washington	169	1,684	10.0%	\$69,603	\$412
Watauga	223	1,496	14.9%	\$52,615	\$236
Wayne	1,750	9,620	18.2%	\$669,685	\$383
Wilkes	791	4,252	18.6%	\$195,476	\$247
Wilson	767	7,283	10.5%	\$203,291	\$265
Yadkin	160	1,914	8.4%	\$115,213	\$720
Yancey	103	1,132	9.1%	\$13,981	\$136

\*Represents an unduplicated count of paid Medicaid claims from 7/1/97 to 6/30/98 with any diagnosis of asthma (ICD9-CM=493) or a drug prescribed for asthmatics.

**Figure 1**  
**State Fiscal Year 1997-98 Percent of North Carolina Medicaid Enrollees**  
**with Paid Claims for Asthma, Ages 0 to 14**



**Figure 2**  
**State Fiscal Year 1997-98 Percent of North Carolina Medicaid Enrollees**  
**with Paid Claims for Asthma, Ages 0 to 14**  
**(Compared with 13.3% for the State)**



was 435.9 discharges per 100,000 children ages 0-14. Table 3 shows this information by age group. Again, the highest rate is in the youngest age group. Table 4 presents the data by county of residence. (Note that the population is three years added together.) Figure 3 is a map of the county hospital discharge rates, which shows the same general pattern as Figure 1 of elevated rates in the rural counties. The hospital discharge rate in the ten most urban counties of the state was 380.5, compared to a rate of 475.0 in the remaining more rural counties. Figure 4 shows the counties with an asthma hospital discharge rate for children higher than the state average of 435.9.

The asthma hospital discharge rate during 1995-1997 was 2.5 times as high for minority children in North Carolina (who are predominantly African American) as for white children. Much of this difference is due to socioeconomic and environmental risks for asthma being more prevalent in the minority population.<sup>8,9</sup>

The national Year 2000 Objective for the asthma hospital discharge rate for ages 0-14 is 225 per 100,000 population. This national goal is based on a primary diagnosis of asthma only, and thus is not comparable to the rates presented above. The 1995 United States asthma hospital discharge rate for children ages 0-14 was 369, while the comparable rate for North Carolina for 1995-1996 was 264. Therefore, the rate for North Carolina is substantially lower than the national average, but still above the Year 2000 Health Objective.

Excluding normal newborn diagnoses, asthma is the most common primary diagnosis among North Carolina children ages 0-14 who were hospitalized, accounting for nearly 8 percent of all hospitalizations of children in this age group during 1995-1997.

## Discussion

The data presented here show that more than 13 percent of children ages 0-14 on Medicaid in North Carolina in fiscal year 1997-1998 had a diagnosis of or used a prescription drug for asthma. There were large variations among the counties in North Carolina. For children ages 0-4 the statewide figure was more than 17 percent. These are probably minimum levels of asthma prevalence among children on Medicaid in North Carolina, since a substantial number of cases are likely to be undiagnosed or untreated. On the other hand, among

**Table 3**  
**Asthma Hospitalizations\* and Rates\*\* by Age**  
**North Carolina CY 1995-97**

Age Group	Total Discharges	Rate
0 to 4	11,646	765.9
5 to 9	5,057	327.1
10 to 14	2,881	202.1
<b>Total 0 to 14</b>	<b>19,584</b>	<b>435.9</b>

\*Represents Hospitalizations with Any Mentioned Diagnosis ICD-9-CM=493.

\*\*Rates are per 100,000 population.

children under age 5, a definitive diagnosis of asthma is more difficult, and so some children in this age group with asthma-like conditions may have been improperly diagnosed as having asthma.

In Mecklenburg County, North Carolina a large number of Medicaid patients were enrolled in HMOs during 1998. HMOs are paid on a capitated basis for these patients, and do not generally submit claims to be paid for individual services. Thus, the data in Table 2 for Mecklenburg County may understate the true figures, especially the amounts expended in the last two columns of the table. However, in Mecklenburg County the prescription drugs are still paid on a fee-for-service basis, so the drug claims will be included in our paid claims data file. Since about 90 percent of the asthma patients are identified through drug claims, the prevalence rate for Mecklenburg County may be a reasonably good estimate.

Though deaths of children from asthma are rare, many children are hospitalized each year in North Carolina due to complications of asthma. Minority children have a much higher rate of hospitalization from asthma than white children, and some counties in the state have an asthma hospitalization rate for children that is more than twice the state average.

The data on asthma prevalence among children on Medicaid and the data on childhood hospitalization for asthma both show rates to be higher in rural areas of North Carolina. This is in contrast to many other studies that have shown higher rates in urban areas.

**Table 4**  
**1995-97 North Carolina Resident Asthma Hospitalizations\* and Rates\*\***  
**by County of Residence, Children Ages 0 to 14**

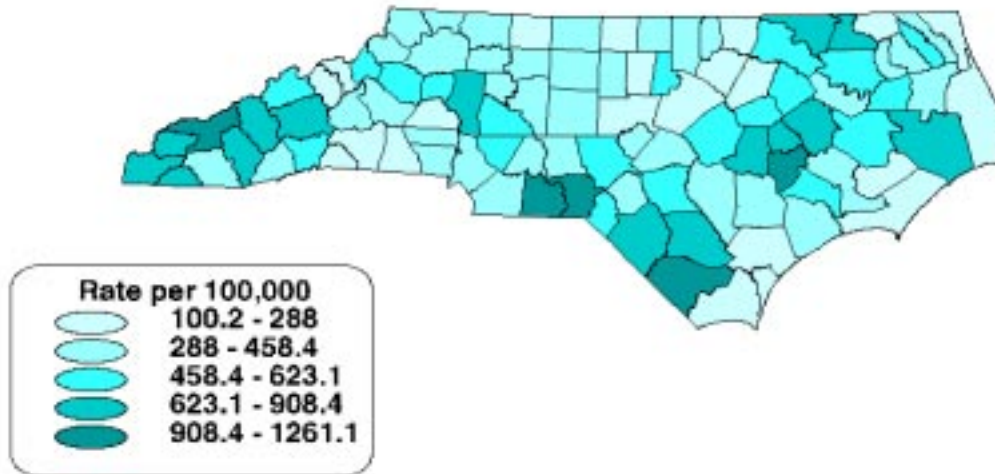
	<b>Number of Hospitalizations</b>	<b>3-Year Population Total</b>	<b>Rate</b>		<b>Number of Hospitalizations</b>	<b>3-Year Population Total</b>	<b>Rate</b>
<b>State Total</b>	19,584	4,492,358	435.9				
Alamance	307	67,467	455.0	Johnston	369	62,196	593.3
Alexander	99	17,671	560.2	Jones	34	6,016	565.2
Alleghany	14	4,587	305.2	Lee	127	30,657	414.3
Anson	187	14,842	1259.9	Lenoir	391	36,992	1057.0
Ashe	40	10,916	366.4	Lincoln	138	35,002	394.3
Avery	43	8,070	532.8	McDowell	70	21,015	333.1
Beaufort	152	26,254	579.0	Macon	55	12,757	431.1
Bertie	76	14,107	538.7	Madison	54	9,264	582.9
Bladen	130	18,587	699.4	Martin	49	16,419	298.4
Brunswick	97	34,486	281.3	Mecklenburg	1,245	383,942	324.3
Buncombe	686	105,690	649.1	Mitchell	19	7,592	250.3
Burke	154	47,582	323.7	Montgomery	48	15,513	309.4
Cabarrus	372	69,902	532.2	Moore	178	37,452	475.3
Caldwell	269	43,172	623.1	Nash	143	53,581	266.9
Camden	16	3,553	450.3	New Hanover	217	80,121	270.8
Carteret	76	30,843	246.4	Northampton	93	12,298	756.2
Caswell	16	12,124	132.0	Onslow	412	106,057	388.5
Catawba	174	75,604	230.2	Orange	115	52,001	221.2
Chatham	44	25,271	174.1	Pamlico	13	6,504	199.9
Cherokee	80	11,475	697.2	Pasquotank	135	23,490	574.7
Chowan	30	9,188	326.5	Pender	59	21,776	270.9
Clay	26	3,717	699.5	Perquimans	27	6,142	439.6
Cleveland	127	55,005	230.9	Person	84	19,755	425.2
Columbus	353	33,004	1069.6	Pitt	535	76,323	701.0
Craven	255	57,702	441.9	Polk	17	7,748	219.4
Cumberland	1,117	217,673	513.2	Randolph	315	73,127	430.8
Currituck	17	9,932	171.2	Richmond	324	29,850	1085.4
Dare	15	14,969	100.2	Robeson	677	83,557	810.2
Davidson	249	82,751	300.9	Rockingham	195	51,934	375.5
Davie	64	17,123	373.8	Rowan	449	73,527	610.7
Duplin	101	28,098	359.5	Rutherford	39	35,644	109.4
Durham	631	121,718	518.4	Sampson	131	32,069	408.5
Edgecombe	203	39,847	509.5	Scotland	144	24,748	581.9
Forsyth	591	171,172	345.3	Stanly	107	34,530	309.9
Franklin	55	26,134	210.5	Stokes	39	24,425	159.7
Gaston	349	114,785	304.1	Surry	120	36,566	328.2
Gates	12	6,322	189.8	Swain	88	6,978	1261.1
Graham	28	4,073	687.5	Transylvania	54	13,963	386.7
Granville	96	25,654	374.2	Tyrrell	8	2,271	352.3
Greene	70	9,953	703.3	Union	233	70,914	328.6
Guilford	829	220,068	376.7	Vance	126	27,489	458.4
Halifax	206	38,602	533.7	Wake	964	334,782	288.0
Harnett	191	51,463	371.1	Warren	25	10,608	235.7
Haywood	169	25,209	670.4	Washington	51	8,981	567.9
Henderson	196	38,435	510.0	Watauga	69	16,332	422.5
Hertford	134	14,752	908.4	Wayne	498	71,622	695.3
Hoke	73	20,639	353.7	Wilkes	140	34,401	407.0
Hyde	23	3,140	732.5	Wilson	235	43,647	538.4
Iredell	476	64,693	735.8	Yadkin	78	19,474	400.5
Jackson	110	13,820	796.0	Yancey	20	8,462	236.4

\*Represents hospitalizations with any listed diagnosis of asthma (ICD-9CM=493).

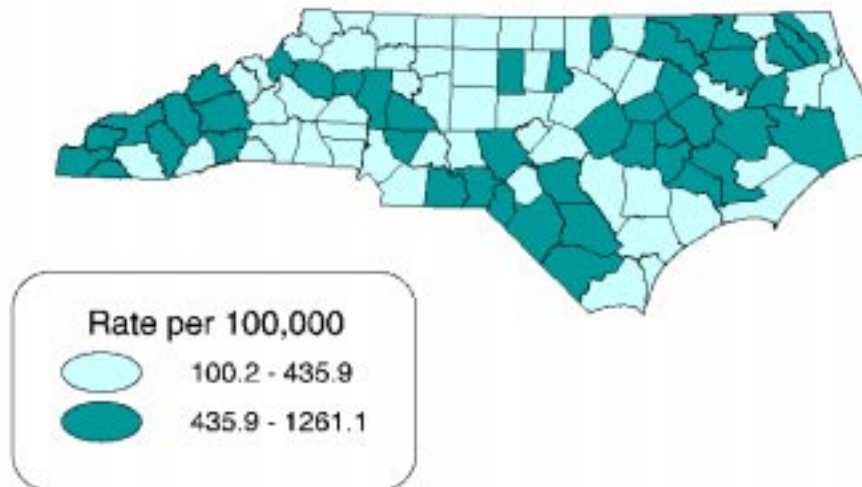
\*\*Rates are per 100,000. Rates based on small numbers (less than 20 cases) may be statistically unstable and therefore unreliable.



**Figure 3**  
**1995-97 North Carolina Asthma Hospitalization Rates**  
**State Residents Ages 0 to 14**



**Figure 4**  
**1995-97 North Carolina Asthma Hospitalization Rates**  
**State Residents Ages 0 to 14**  
**(Compared with State Rate of 435.9)**



This study shows that existing state administrative databases can be used to portray the prevalence of asthma among children and the rates of hospitalization. These databases could also be used to measure asthma in the population of all ages. Special surveys to determine the prevalence of asthma among children, such as the International Study of Asthma and Allergies in Childhood (ISAAC), can produce valuable population-based information.<sup>10</sup> A pilot survey using the ISAAC protocol is being carried out in North Carolina and the resulting data will provide an important comparison to the results of the present study. But these surveys are fairly expensive and time-consuming to implement, and cannot feasibly be done regularly on a statewide basis. The state prevalence rates found here among North Carolina children on Medicaid are comparable to the prevalence rates of serious asthma found among children ages 13-14 in some ISAAC surveys,<sup>11,12</sup> although very large variations in prevalence have been found from one country to another using the ISAAC protocol.<sup>10,13</sup> Relying on existing state data systems allows quick and easy updates of the information, enhancing the ability to study trends in the prevalence of asthma over time.

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