

## Prevalence of Inflammatory Bowel Diseases in Puerto Rico: A Health Care Claims Analysis of an Insured Population

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**Objective:** Inflammatory Bowel Disease has increased in Hispanics. This study estimates its prevalence in Puerto Rico for 2013 and compares it with prior reports.

**Methods:** The database of commercial and government insurance claims of the Department of Health for 2013 was used. A case was defined as having at least two medical claims of outpatient services or one or more hospitalizations and emergency department visits with an ICD-9 code for Crohn's disease or ulcerative colitis. Cases with codes for both were classified as undetermined inflammatory bowel disease. Prevalence was calculated for inflammatory bowel disease, Crohn's disease, and ulcerative colitis overall and by age, sex, and health insurance.

**Results:** 5,378 persons were classified as having inflammatory bowel disease, for an overall prevalence of 181.54/100,000. Of these, 2,154 had Crohn's disease and 2,689 had ulcerative colitis, with prevalences of 72.71 and 90.77/100,000 respectively. Crohn's disease was more prevalent in males and ulcerative colitis in females. Both types were more prevalent in the government-insured population. 719 children had inflammatory bowel disease, for a prevalence of 89.8/100,000. Of these, 480 were classified as Crohn's disease and 169 as ulcerative colitis. Prevalences for pediatric Crohn's disease and ulcerative colitis were 60.0 and 21.2/100,000 respectively.

**Conclusion:** When compared with a report for 2005, the prevalence for inflammatory bowel disease in Puerto Rico for 2013 showed a 4-fold increase overall and a 3-fold increase in children. Inflammatory bowel disease was more prevalent in government-insured as opposed to commercially insured persons, in contrast with previous findings. [*P R Health Sci J* 2021;40:103-109]

*Key words:* IBD- Inflammatory Bowel Disease, CD- Crohn's disease, UC- ulcerative colitis, IRB- Institutional Review Board, EII- enfermedad inflamatoria intestinal

The inflammatory bowel diseases (IBDs), Crohn's disease (CD) and ulcerative colitis (UC), are disorders of the gastrointestinal tract that have distinct and overlapping pathologic and clinical characteristics and a pathogenesis that remains incompletely understood. Genetic studies have identified at least 231 loci associated with IBD(1). An environmental component as well as dysregulation of the gastrointestinal immune system are implicated in the development of disease (2,3,4,5). The geographical incidence of IBD varies considerably with the highest incidence rates reported in northern and western Europe as well as North America. However, the incidence continues to rise, and increases have been reported in minorities, as well as in geographic areas other than the previously named ones (6,7,8,9,10,11,12,13). The incidence of IBD and in children has also been increasing globally (14,15,16,17).

Evaluations of ethnic and racial patterns of IBD have demonstrated that there is a higher incidence of IBD in Jewish people, but that there are lower rates in black and Hispanic

populations when compared to white populations. During the past decades, these differences have been narrowing, with an increase of IBD in blacks, Hispanics, and Asians, in the United States as well as in Latin America and Asian countries (18,19,20,21,22,23,24). Puerto Rico, an island in the Caribbean, the inhabitants of which are of mainly Hispanic ethnicity, is no exception (25,26,27).

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Two studies have looked at the prevalence of IBD in Puerto Rico (25,26). A study in 1996 estimated a prevalence of 106.1 cases per 100,000 people (25). A more stringent study performed in 2005 revealed a prevalence of 38.2 cases of IBD per 100,000 inhabitants in Puerto Rico (26). Both these studies used the claims data of the largest local health insurer, coded by diagnosis. In the latter study, the prevalence was significantly different for commercially insured (62/100,000) vs government-insured (19/100,000) patients. Whether this reflected a true difference or was related to access to specialty care was not determined in this study. When stratified by age group, the prevalence of IBD for patients aged 19 and below was 25.50/100,000 in the commercially insured group and 15.21/100,000 in those with government insurance. Crohn's disease was much more prevalent than UC in children, for both the commercially insured (17.98 vs 7.60) and the government insured (2.66 vs 1.77).

Clinical experience suggests that IBD is increasing precipitously in Puerto Rico, with a corresponding increase in prevalence. The University of Puerto Rico Registry of IBD database (28) has over 1500 patients. Admissions to the University Hospital for 2012 through 2014 were over 200 per year (29). A study by González-Keelan et al demonstrated an increase in surgical resections for IBD at the PR Medical Center rising from 15.1 per 100,000 patients in the period of 1966 through 1973 to 125 per 100,000 in 2002 through 2008 (30). Finally, an analysis of surgery for CD at the University Hospital showed 172 procedures from 2010 through 2012 (31).

IBD cases are complex and costly. Limitations in access to specialized care and a lack of comprehensive integrated medical services impact the outcomes and the quality of life of the individuals who suffer from these diseases (32,33). To aid in the development of appropriate strategies that address the needs of these patients, and to ascertain needed public policy for adequate healthcare, determining the accurate prevalences of these diseases in Puerto Rico is imperative.

Utilizing the database of insurance claims of the Puerto Rico Department of Health, this study aimed to estimate the overall prevalence of IBD (CD and UC) in Puerto Rico for 2013, to compare these prevalences in commercially insured and government-insured patients, and to obtain data specific to the pediatric population.

## Methods

### Database and study population

A cross-sectional study using de-identified administrative claims included in the database of the Puerto Rico Department of Health (Utilization data of the health insurance companies in Puerto Rico, 2013.; Office of the Auxiliary Secretary for Planning and Development, 2015.; Puerto Rico Department of Health) was performed. The database consisted of commercial and government insurance claims for 2013 and included 2,962,409 persons or 96.9% of the insured population of Puerto Rico.

The data contained in the database include age, sex, type of insurance, county of residence, diagnosis (using ICD-9 codes), and utilization (visits to providers, emergency rooms, admissions, and total costs). At the time of our study, the database had been completed up to and through 2013. More details can be found in the supplementary data.

Other claim-based studies have used a single ICD diagnosis code to identify cases (34,35). To improve the accuracy of this definition in our study, a patient with IBD was defined as an active insured that had at least two medical claims of outpatient services or at least one hospitalization or emergency department visit plus one ambulatory visit with a diagnosis of CD (ICD-9 555.0-555.9) or UC (ICD-9 556.0-556.90). Persons having diagnostic codes for both UC and CD were classified as undetermined IBD (uIBD). Cases with a single claim with a diagnosis of IBD were not considered to have sufficient evidence of IBD and were excluded. The database has no prescription data for additional validation of the diagnosis of IBD. As the database was only for one year, two claims were required for case definition. The study population was composed of 5,378 persons ranging in age from less than one year to 60 years and greater, with the ages grouped in 5-year intervals.

Insurance type (commercial versus government) was classified according to the primary insurer responsible for the patient's healthcare costs. Thus, duplicate entries related to patients having the two types of insurance were avoided.

### Statistical methods

The prevalences of IBD (comprising uIBD, CD, and UC), overall and by specific diagnosis, age, sex, and health-insurance type were computed by dividing the relevant number of cases per demographic subgroup by the total number of insured individuals in that same subgroup and multiplying the total by 100, the total being the number of cases per 100,000 population for each subgroup.

$$Prevalence_{(IBD, CD, UC, uIBD)} = \frac{\text{Total persons with IBD, CD, UC, uIBD during period of the study}}{\text{Total persons with IBD, CD, UC, uIBD during period of the study}} \times 100$$

Prevalences were estimated with 95% confidence intervals (95% CI) using Poisson regression. The specific prevalences of CD and CU were computed by age group, sex, and type of insurance (government vs. commercial). Prevalence ratios (PR) were also estimated, with 95% CI, using Poisson regression.

The same measures were calculated for the pediatric population, defined as those persons under 19 years of age, which population totaled 800,409 children.

All analyses were performed using STATA release 15 (Stata Corp LLC, College Station, TX). The protocol was approved by the University of Puerto Rico Medical Sciences Campus Institutional Review Board (IRB # 1250416, exempt status).

**Table 1.** Prevalence by diagnosis and insurance

Type of IBD	Total			Commercial			Government		
	Cases	Prevalence	CI 95%	Cases	Prevalence	CI 95%	Cases	Prevalence	CI 95%
Total IBD	5378	181.54	135.62-227.46	3247	150.12	93.97-206.28	2131	266.54	217.35-315.73
Crohn's Disease	2154	72.71	51.38-94.05	1094	50.58	34.94-66.22	1060	132.58	104.31-160.86
Ulcerative Colitis	2689	90.77	61.64-119.9	1808	83.59	42.95-124.24	881	110.19	72.52-147.87

## Results

### Overall population

The total population included in the database for 2013 was 2,962,409. Of these, 799,508 (27%) had government insurance and 2,162,901 (73%) were commercially insured. IBD was identified in 5,378 persons, of which 2,154 (40.1%) had CD, 2,689 (50.0%) had UC and 535 (9.9%) were classified as having undetermined IBD. The overall prevalence of IBD was 181.54 per 100,000; prevalences were 72.71 per 100,000 for CD, and 90.77 per 100,000 for UC (see table 1).

CD was more prevalent in males (82.2/100,000 vs 65.4/100,000;  $P < .05$ ) than females, whereas UC was more prevalent in females (97.8/100,000 vs 81.8/100,000;  $P < .05$ ), as seen in table 2. The ages of peak prevalences for IBD were 20 through 29 years for males and 60 years and older for females. For Crohn's disease, peak prevalence ages were 20 through 29 years for males and 30 through 39 years for females. Ulcerative colitis had peak prevalences at ages 50 through 59 years for males and 60 years and older for females.

### Type of insurance

Of the 5,378 cases of IBD, 2,131 (39.6%) had government-issued insurance. Both types of IBD were more prevalent in the government-insured population than they were in the commercially insured one, as seen in table 1. Crohn's disease had a prevalence of 132.58/100,000 in the government-insured vs 50.58/100,000 for the commercially insured ( $P < .05$ ), and UC had a prevalence of 110.19/100,000 in the government-insured vs 83.59/100,000 for the commercially insured ( $P < .05$ ). The total prevalence of IBD, including the undetermined cases, was 266.54/100,000 for the government insured vs 150.12/100,000 for the commercially insured.

Table 3 shows the age decades of the highest prevalences by sex and insurance type. For UC, the peak prevalence for males occurred at a younger age in the government insured than it did in those with commercial insurance, whereas for females, it was highest in those 60 years old or over in both insurance groups.

### Pediatric IBD Results

The total pediatric population in the database for 2013 was 800,409. Of these, 229,869 had government insurance and 570,541 were commercially insured. A total of 719 patients were identified as having IBD, of which 480 cases were classified as CD, 169 as UC and 70 as undetermined IBD. The

total prevalence for pediatric IBD was 89.8 per 100,000, with a prevalence of 60.0 per 100,000 for CD, 21.1 per 100,000 for UC and 8.7 per 100,000 for undetermined IBD. Figure 1 shows the distribution of pediatric IBD by diagnosis, age, and sex. The frequencies and prevalences of IBD were highest for ages 15-19 years-old (43.12%, 146.3/100,000), followed by those aged 0 through 4 years (20.86%, 80.1/100,000).

As shown in table 4, pediatric CD was more prevalent in males (64.09 vs 55.70 per 100,000) but UC prevalence was similar among both sexes (20.87 for males vs 21.36 for females).

**Table 2.** Distribution of IBD cases by sex and age

Diagnosis	Female		Male	
	Cases	Prevalence (per 100,000)	Cases	Prevalence (per 100,000)
<b>CD</b>				
≤19	219	55.70	261	64.09
20-29	164	75.78	237	166.71
30-39	176	82.55	203	139.52
40-49	153	67.29	147	89.27
50-59	156	65.95	86	51.03
≥ 60	220	58.16	132	49.01
<b>Total</b>	<b>1,088</b>	<b>65.35</b>	<b>1,066</b>	<b>82.16</b>
<b>UC</b>				
≤19	84	21.36	85	20.87
20-29	145	67.00	131	92.15
30-39	224	105.06	146	100.34
40-49	277	121.83	184	111.73
50-59	322	136.12	207	122.82
≥ 60	576	152.29	308	114.35
<b>Total</b>	<b>1,628</b>	<b>97.78</b>	<b>1,061</b>	<b>81.77</b>
<b>ALL IBD*</b>				
≤19	331	84.19	338	95.28
20-29	347	160.35	414	291.22
30-39	444	208.25	422	290.03
40-49	481	211.56	369	224.08
50-59	524	221.51	321	190.46
≥ 60	866	228.96	471	174.86
<b>Total</b>	<b>2,993</b>	<b>179.70</b>	<b>2,385</b>	<b>183.82</b>

\*Includes undetermined IBD; CD= Crohn's disease; UC=ulcerative colitis; IBD= Inflammatory Bowel Disease

### Type of insurance in the pediatric group

Of the 719 patients with pediatric IBD, 469 (65.23%) were government insured, whereas 250 (34.77%) were commercially insured. These patients were distributed as follows: 338 (72.07%) of the government-insured patients had CD, 95 (20.26%) had UC and 36 (7.68%) were undetermined. Of the commercially insured, 142 (56.8%) had CD, 74 (29.6%) had UC and 34 (13.6%) were undetermined. Table 5 shows the prevalence of pediatric IBD by type of health insurance. Both CD and UC were more prevalent in the government-insured population than in the commercially insured one. The total prevalence, including undetermined IBD cases, was 204 per 100,000 for government-insured patients vs 44 per 100,000 for those with commercial insurance.

## Discussion

In the past decades, there has been a shift in the ethnic and geographic predilection of IBD. It is now a global disease that is increasingly found in non-Caucasian populations (2,10,11). Because of the complexity of the disease, patients with IBD require access to specialized services. The individual complications of each disease subtype account for a higher utilization of medical services, including emergency department visits, hospitalizations and surgery (36,37,38,39). New medications that achieve better control of the diseases are costly and of limited access across the world (40). Defining the epidemiology of IBD in a specific country is necessary for developing strategies to address the healthcare needs of this population.

Over the past 20 years, we have observed an increase in the number of patients of all ages with IBD in Puerto Rico. Older studies placed the island's population in the lower ranks of incidence and prevalence (2,25,26,27). Although previous Puerto Rican prevalence studies included both commercial and government-insured persons, the database used was that of only one insurer, and included approximately one third of the population of Puerto Rico (25,26). The current study used a Puerto Rico Department of Health claims database composed of mandatory reports from all the insurers on the island. For the year 2013, this database contained 96.9% of the insured population of Puerto Rico. Since this was an anonymous centralized database, our findings were limited by the inability to confirm a given case's diagnosis by reviewing corresponding medical records. Medication utilization is not part of the database, and therefore not available as an additional validation criterium. These limitations were addressed by requiring that each case have at least two outpatient claims, or one hospitalization or emergency room visit plus one ambulatory visit with the diagnostic codes for IBD. We recognize this definition is imperfect, as medications, imaging and procedure data were not available as corroborating evidence. However, we consider the information obtained from this study, despite its limitations, gives an important insight into the evolving epidemiology of IBD in Puerto Rico.

**Table 3.** Distribution and prevalence of IBD cases by age and type of insurance

Diagnosis	Commercial		Government	
	Cases	Prevalence (per 100,000)	Cases	Prevalence (per 100,000)
<b>CD</b>				
≤19	142	24.89	338	147.04
20-29	179	69.84	222	217.09
30-39	192	81.06	187	153.47
40-49	178	68.09	122	93.39
50-59	128	44.52	114	96.93
≥ 60	275	49.97	77	79.14
<b>Total</b>	<b>1,094</b>	<b>50.58</b>	<b>1,060</b>	<b>132.58</b>
<b>UC</b>				
≤19	74	12.97	95	41.33
20-29	131	51.11	145	141.79
30-39	204	86.13	166	136.24
40-49	308	117.82	153	117.12
50-59	347	120.70	182	154.75
≥ 60	744	135.20	140	143.90
<b>Total</b>	<b>1,808</b>	<b>83.59</b>	<b>881</b>	<b>110.19</b>
<b>ALL IBD*</b>				
≤19	250	43.82	469	204.03
20-29	342	133.43	419	409.73
30-39	468	197.59	398	326.64
40-49	540	206.58	310	237.30
50-59	534	185.75	311	264.44
≥ 60	1,113	202.25	224	230.24
<b>Total</b>	<b>3,247</b>	<b>150.12</b>	<b>2,131</b>	<b>266.54</b>

\*Includes undetermined IBD

CD= Crohn's disease; UC=ulcerative colitis; IBD= Inflammatory Bowel Disease

The study for 2005 used the database from a single insurer that provided commercial and government coverage to approximately one third of the population. The diagnosis of IBD required 2 claims with an IDC-9 code for CD or UC, one of them being from a gastroenterologist (26). Although the 2013 database could not identify the specialty of the health provider, the facts that all commercial and government insurers were included, the population included was close to 3 million, and two claims were required for a diagnosis, support our belief that the data is meaningful. The prevalence was higher in the government-insured population for both CD and UC in 2013, contrasting with the findings for 2005, in which the total prevalence for IBD was higher in commercially insured patients. Health insurance in Puerto Rico is related to economic status. Commercial insurance is either provided by the employer or acquired directly by the customer. Government insurance includes Medicare (age or disability based) and Medicaid (41). Eligibility for Medicaid is based on a maximum monthly income of US\$550 for a one-



person household and increases US\$100 for each additional household member (medicaid.gov/state-overviews/puerto-rico, accessed 09/07/2020), Patients with extraordinary medical expenses not covered by their commercial insurance and with limited ability to cover them out-of-pocket may be eligible for Medicaid as the secondary insurer. In our study, if a subject had commercial plus government coverage, the patient was classified as having commercial insurance. When a person has both commercial and government coverage, the government health plan is always the secondary. The shift in prevalence of IBD from commercial to government insured when comparing 2013 to 2005 may reflect socioeconomic changes in the population as suggested by the decrease in employment rate and increase in unemployment (<https://tradingeconomics.com/puerto-rico/> accessed 09/07/2020), a limited economic growth (<https://www.macrotrends.net/countries/PRI/puerto-rico/economic-growth-rate>>Puerto Rico Economic Growth 1960-2020</>), and population migration to the United States. The poverty rate of Puerto Rico was 45.4% for 2013 (<https://www.census.gov/library/stories/2019/09/puerto-rico-outmigration-increases-poverty-declines.html>, accessed 09/07/2020). Thus, the increase in prevalence of IBD in cases with government insurance may simply reflect the overall worsening of the economy of the island and not an association between IBD and economic status.

Our study showed an IBD prevalence of 181.54 per 100,000 population, representing a four-fold increase over the 38.2 per 100,000 reported for 2005 (26). The difference noted supports the clinical observations over the same period. Increases in prevalence have also been reported in Hispanics living in the United States (42) and across Latin America (24,43,44,45). Unfortunately, incidence of IBD could not be calculated given the information contained in the database.

The present study revealed a three-fold increase in prevalence in the pediatric population of Puerto Rico compared with the data from 2005 (26). In 2011, a systematic review from Benchimol et al (which review included 32 countries) identified an international trend regarding the increase of pediatric IBD (14). Of note, Crohn's disease appeared to be the main driver for these rising rates. Studies from Canada (15), France (16) and Denmark (17) have reported increases in the incidence of pediatric cases, with Canada having one of the highest prevalences in the world for the range of time covering from 1999 through 2010: 38.2 per 100,000 population (15). A prevalence study of a commercially insured pediatric population in the United States in 2009

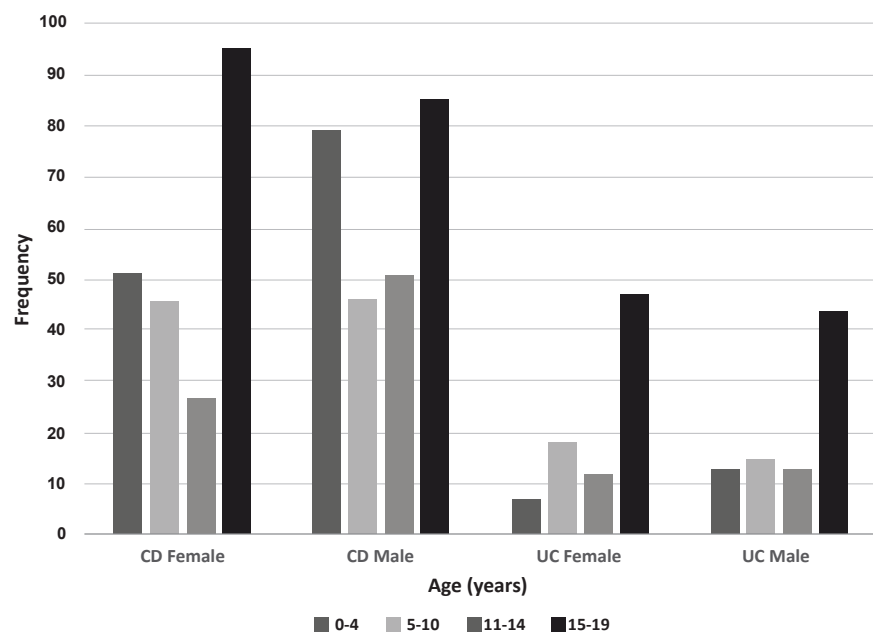
by Kappelman et al showed prevalences of 58 per 100,000 for CD and 34 per 100,000 for UC (46). Using the relevant data for 2013, we determined that the prevalence of pediatric IBD in Puerto Rico is similar to that of the United States and higher than that of Canada.

The high prevalence for the 0 through 4 years subgroup was unexpected. Although the pathophysiology of IBD is incompletely understood, genetic factors contribute to the disease process. IL-10RA mutations are associated with IBD onset in infancy, perianal fistulas, poor response to medical management and early surgical interventions. Very early onset IBD in infancy is phenotypically and genetically different from adult-onset or older child-onset IBD (47). Whether the high prevalence of IBD in the very young patients in our study reflects a genetic component is an area to be explored.

The high prevalence of IBD, including early onset IBD, in the pediatric population of Puerto Rico mandates further investigation to identify possible risk factors. This is essential to the design and implementation of early diagnosis, management, and prevention strategies.

Recent studies from Latin America show an increasing trend in incidence and prevalence of IBD (24,48). With the exception of some areas in Brazil, UC has a much higher prevalence than CD, although the incidence and prevalence of CD has increased between 2005 and 2015 (11,13,48). Socioeconomic and environmental changes across Latin America, including diet, infrastructure and industrialization may play a role in these increases. The shift from an agrarian to an industrial society in Puerto Rico started in the 1950's, earlier than in most of Latin America. This different timeline parallels

**Figure 1.** Frequency of pediatric IBD cases by age, diagnosis, and sex



CD=Crohn's disease; UC= ulcerative colitis; IBD= Inflammatory Bowel Disease

that of increasing IBD prevalence in Puerto Rico preceding that of the rest of Latin America.

In conclusion, our study has documented a significant increase over the past decade in the prevalences of pediatric and adult IBD in Puerto Rico. Crohn's disease has emerged as the most frequent IBD in children and young adults. Our experience in a Hispanic population in Latin America provides additional evidence of the global rise in IBD. Awareness of these trends should result in proactive strategies that address the needs of these populations and establish cost-effective healthcare strategies.

## Resumen

**Objetivos:** La enfermedad inflamatoria intestinal (EII) ha aumentado en Hispanos. Este estudio estima la prevalencia de las EII en Puerto Rico para el 2013 y la compara con resultados anteriores. **Métodos:** Se utilizó el banco de datos del Departamento de Salud de reclamaciones de seguros comerciales y del gobierno para el 2013. Un caso de EII es aquel que tuvo 2 reclamaciones por servicios ambulatorios u hospitalarios con un código ICD-9 para enfermedad de Crohn o colitis ulcerosa. Los casos con códigos para ambos diagnósticos se clasificaron como EII indeterminada. Se calculó la prevalencia total para enfermedad inflamatoria intestinal, enfermedad de Crohn, y colitis ulcerosa, y por edad, sexo y seguro médico. **Resultados:** 5,378 personas fueron identificadas con EII, para una prevalencia de 181.54/100,000. De estas, 2,154 tenían enfermedad de Crohn y 2,689 colitis ulcerosa, con prevalencias de 72.71 y 90.77/100,000 respectivamente. Crohn fue más prevalente en hombres y colitis ulcerosa en mujeres. Ambas enfermedades fueron más prevalentes en la población asegurada por el gobierno. 719 niños tenían EII, para una prevalencia de 89.8/100,000. De estos, 480 fueron Crohn y 169 colitis ulcerosa. Las prevalencias para Crohn y colitis ulcerosa pediátricos fueron 60.0 y 21.2/100,000. **Conclusiones:** Al comparar estos datos con un estudio del 2005, la prevalencia para EII en Puerto Rico en el 2013 fue 4 veces mayor, y 3 veces más alta en el grupo pediátrico. La prevalencia fue mayor en asegurados por el gobierno, en contraste con hallazgos anteriores.

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