

# Increasing Prevalence of Recurrent Otitis Media Among Children in the United States

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**ABSTRACT.** *Background.* The number of visits for otitis media, the most common diagnosis among preschool children, has increased during the past decade. This study was undertaken to determine whether there has been a concurrent increase in the prevalence of recurrent otitis media among children in the United States and to identify risk factors or demographic changes to explain the increase.

*Methods.* Secondary analyses of cross-sectional data from the Child Health Supplement to the 1981 and 1988 National Health Interview Surveys (n = 5189 [1981] and n = 6209 [1988]) were done to identify temporal changes in the prevalence and any associated risk factors of recurrent otitis media among children <6 years of age.

*Results.* Recurrent otitis among preschool children increased from 18.7% in 1981 to 26% in 1988 (odds ratio [OR] = 1.6, 95% confidence interval [CI] = 1.4, 1.7). Although the prevalence of recurrent otitis increased with age, the greatest increase in recurrent otitis media occurred in infants (OR = 1.9, CI = 1.3, 2.9). Factors independently associated with recurrent otitis were any allergic condition (OR = 1.9, CI = 1.7, 2.2); survey year (OR = 1.7, CI = 1.5, 1.9); Black race (OR = .6, CI = .5, .7); Hispanic ethnicity (OR = .8, CI = .6, .9); day care (OR = 1.5, CI = 1.3, 1.7); out-of-home care by an unrelated sitter (OR = 1.3, CI = 1.1, 1.6); and male gender (OR = 1.2, CI = 1.1, 1.3). From 1981 to 1988, there were significant increases in some risk factors associated with recurrent otitis media, including day care (11% vs 21%) and allergic conditions (14% vs 18%).

*Conclusions.* We conclude that there has been a significant increase in the prevalence of recurrent otitis media among children in the United States, particularly in infants. The increased prevalence of recurrent otitis media was associated with an increase in the use of child care and a higher prevalence of allergic conditions among children. *Pediatrics* 1997;99(3). URL: <http://www.pediatrics.org/cgi/content/full/99/3/e1>; *otitis media, recurrent otitis media, day care, child care, infection, otitis, children, allergies, infants, National Health Interview Survey, Child Health Supplement.*

ABBREVIATIONS. OR, odds ratio; CI, confidence interval; NHIS, National Health Interview Survey.

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Otitis media is a common illness among children. By 6 years of age, 75% of children have one or more episodes of otitis media.<sup>1</sup> Among infants, an estimated 17% to 29% have at least one episode of acute otitis media, and 10% of infants experience three or more episodes.<sup>1-7</sup> In 1990, otitis media was the second most common diagnosis among all age groups in the United States; >24 million clinic visits were made for otitis media, and medical care was estimated to be \$3 billion to \$4 billion annually in the United States.<sup>8,9</sup> In addition to the physical discomfort and economic costs associated with otitis media, there also is evidence that children with recurrent otitis media are at risk for both hearing loss and speech delay.<sup>10-12</sup>

Over the past 2 decades, the number of clinical visits for otitis media has increased dramatically in the United States, from 9.9 million in 1975 to 24.5 million in 1990.<sup>8</sup> The increase has predominantly involved children <15 years of age.<sup>8</sup> Although the majority of children experience at least one episode of otitis media by age 10, some children are at risk for recurrent episodes of otitis.<sup>1,4,6</sup> Several factors are known to increase children's risk of developing recurrent otitis media, including first episode in a child <12 months of age, day care, absence of breastfeeding, recurrent otitis in a sibling, male gender, white race, and passive exposure to tobacco smoke.<sup>1,6,7</sup> Although there are many risk factors for recurrent otitis media, it is unknown why the number of cases of otitis media has increased or whether there has been a corresponding increase in the proportion of children with recurrent otitis media.

The objectives of this study were to describe the epidemiology of recurrent otitis media in two nationally representative samples of preschool children, to ascertain whether there has been a significant increase in the prevalence of recurrent otitis media among preschool children in the United States, and to investigate whether changes in risk factors or demographic characteristics explain any observed increase in the prevalence of recurrent otitis media.

## METHODS

The 1981 and 1988 Child Health Supplements to the National Health Interview Survey (NHIS) provide nationally representative data about children and adolescents ages 0 to 17 years. These surveys collected a wide range of information, such as demographic, medical, and behavioral information, largely by parental report, on 15 416 children in 1981 and 17 110 children in 1988 using complex, multistage probability sampling designs. Minorities were oversampled to increase the precision of the estimates. In

households with children, one individual <18 years of age was selected at random to be the subject of the Child Health Supplement, and data about this individual were collected from the adult family member responding to the full survey. Hence, responses are based almost exclusively on parental report. The response rate for the Supplement was 91%.

This analysis was limited to children ≤5 years old (5189 in 1981 and 6209 in 1988) and focused on investigation of temporal changes in the prevalence and associated risk factors of recurrent otitis media. Although most of the survey items studied were identical or similar, some questions of interest were asked in only one of the survey years. A history of recurrent otitis was obtained by an affirmative response to the question, "Has [your child] ever had frequent or repeated ear infections?" This question was identical for surveys completed in 1981 and 1988. Study variables regarding demographics included age, gender, race/ethnicity, poverty status, family size, and maternal education. These questions were similar for both survey years, although the exact income level associated with poverty in 1988 differed in the study from that in 1981. Poverty status was determined by comparing family size and household income to the federal poverty index; ≤100% of this index value was considered poverty and >100% of the poverty index as nonpoverty.

Detailed child care information, including day care and out-of-home care, was obtained in both survey years. This included whether children were in child care arrangements, the location of these arrangements, and the number of hours that the child received child care. For the purpose of this study, these data were categorized into amount and type of child care, including day care, nursery, and out-of-home care by a related or unrelated sitter.

In addition to ascertaining the presence of frequent otitis media, the surveys gathered other health-related data that included allergies, perceived health status, type of child care, number of siblings, race or ethnic background, income level, maternal employment, birth order, and shared sleeping room. Pertinent to this study, important differences existed between survey years in some variables. Breastfeeding history was ascertained only in 1981. Prenatal smoking status was determined in both years, but current maternal and household smoking was determined only for the 1988 survey. Finally, data on age when children entered child care was available only for those surveyed in 1988. Thus, for some variables, comparisons could not be made by year of survey.

## Statistical Analysis

Analyses using SUDAAN software permitted precise estimations of confidence intervals that account for the complex, multi-staged sampling design of the survey.<sup>13</sup>  $\chi^2$  tests were used to test for differences in weighted proportions for bivariate and stratified comparisons. Odds ratios (OR) were used to quantify the magnitude of the association of various factors and frequent otitis and risk ratios were used to quantify temporal changes. Ninety-five percent confidence intervals (CI) were calculated for the OR, and those that did not include the value of 1 were considered statistically significant. The independent associations of various factors with frequent otitis were estimated by using logistic regression analysis. A summary logistic regression model was developed that included all variables significantly associated with recurrent otitis media in bivariate analyses or that have been shown previously to be associated with otitis media.

## RESULTS

From 1981 to 1988, the prevalence of recurrent otitis media among children surveyed increased from 18.7% to 26.9% (OR = 1.6, 95% CI = 1.4, 1.7) (Figure). This increase affected nearly every subgroup of children, including males and females, all racial and ethnic groups, and all regions of the country (Tables 1 and 2). Although the prevalence of recurrent otitis increased with age, the greatest increase from 1981 to 1988 occurred in infants <12 months of age (OR = 1.9, CI = 1.3, 2.9) compared with children who were 1 to 5 years of age (OR = 1.6, CI = 1.4, 1.8). This difference was statistically significant ( $P < .001$ ).

### Risk Factors for Recurrent Otitis Media

In bivariate analyses, the prevalence of recurrent otitis in children was greater among males, first-born children, and children whose health was perceived to be poor or fair, as reported by the parent (Table 3). White children were at increased risk compared with other racial and ethnic groups, as were children who



**Figure.** Prevalence of recurrent otitis media by age of child and year of survey (from 1981 and 1988 Child Health Supplements of the National Health Interview Surveys).

**TABLE 1.** Demographic Characteristics of Children With Recurrent Otitis Media (ROM) in the United States, 1981 and 1988

	1981		1988		RR	-CI	+CI	P Value
	% ROM	n	% ROM	n				
Total population	18.7	5189	26.9	6209	1.4	1.3	1.6	<.001
Gender								
Male	19.8	2644	29.6	3153	1.5	1.3	1.7	<.001
Female	17.5	2545	24.0	3056	1.4	1.2	1.5	<.001
Race								
Black	13.0	636	18.3	987	1.4	1.1	1.9	.02
White	20.4	4184	29.8	4597	1.5	1.3	1.6	<.001
Other	12.0	369	18.5	625	1.5	1.1	2.2	.01
Ethnicity								
Hispanic	13.5	566	21.1	920	1.6	1.2	2.0	<.001
Non-Hispanic	19.3	4623	27.9	5289	1.4	1.3	1.6	<.001
Poverty status								
<100%	13.8	999	23.4	984	1.7	1.4	2.1	<.001
≥100%	20.1	4190	27.6	5225	1.4	1.3	1.5	<.001
Urbanization								
Urban (MSA—central city)	17.9	1379	24.4	2067	1.4	1.2	1.6	<.001
Nonurban	19.0	3810	28.0	4142	1.5	1.3	1.6	<.001
Health status								
Excellent/very good	15.6	3396	24.6	4988	1.6	1.4	1.8	<.001
Good	22.3	1588	32.2	989	1.4	1.2	1.7	<.001
Fair/poor	38.8	185	59.2	167	1.5	1.2	2.0	.002
Region								
Northeast	20.2	1011	23.6	1206	1.2	1.0	1.4	.04
Midwest	17.4	1425	28.1	1616	1.6	1.4	1.9	<.001
South	19.6	1725	28.3	2111	1.4	1.3	1.6	<.001
West	17.4	1028	25.8	1276	1.5	1.2	1.9	.001
Maternal education								
<High school graduate	15.7	1092	24.7	1006	1.6	1.3	1.9	<.001
High school graduate, some college	19.0	3243	26.9	3936	1.4	1.3	1.6	<.001
College graduate, plus	23.3	791	29.7	1148	1.3	1.1	1.5	.006
Maternal age at child's birth								
<17 y	11.7	160	27.8	108	2.4	1.3	4.2	.004
≥17 y	19.1	4970	26.9	6099	1.4	1.3	1.5	<.001
Maternal employment status								
Employed	20.6	2238	29.6	3360	1.4	1.3	1.6	<.001
Unemployed	17.4	2951	24.0	2849	1.4	1.2	1.6	<.001

Abbreviations: ROM, recurrent otitis media; RR, relative risk; CI, confidence interval; MSA, metropolitan statistical area.

were more affluent. The prevalence of recurrent otitis media also were higher in children who attended child care and those with any type of allergy. Finally, recurrent otitis media was higher among children whose mothers were employed.

There are known risk factors for recurrent otitis media, including passive exposure to tobacco smoke and breastfeeding <4 months, which were not available in both years of the survey. For children surveyed in 1981, there was no protective effect of breastfeeding on recurrent otitis media ( $P = .67$ ), even when those who breastfed  $\geq 4$  months were examined. For children surveyed in 1988, there was a significant association of passive exposure to tobacco smoke and recurrent otitis media ( $P = .03$ ), but this association was only marginally associated after other predictors of recurrent otitis media were included in the model ( $P = .05$ ). Finally, the number of children each subject was exposed to in the child care settings was only surveyed in 1988. For those in a child care setting with  $\leq 4$  children, the prevalence of recurrent otitis media was 26% compared with 38% for those with  $> 4$  children (OR = 1.8, CI = 1.4, 2.1).

We also examined the association of access to medical care and prevalence of recurrent otitis media, which was only available in the 1988 survey. Overall, 5971 (96%) of children were reported to have a usual

place of routine medical care, which was significantly associated with recurrent otitis media (OR = 1.8, CI = 1.2, 2.6). However, access to routine medical care, type of insurance, and income level did not alter the association of race and ethnicity with lower prevalence of recurrent otitis.

#### Changes in Risk Factors

From 1981 to 1988, there were increases in some risk factors associated with recurrent otitis media (Table 4). There was a significant increase in the proportion of children who used day care, from 11% to 21% ( $P < .001$ ), and had allergies, from 14% to 18% ( $P < .001$ ). Among infants, there also were increases in the use of day care (2.2% vs 5.0%,  $P = .007$ ) and reported allergies (7% vs 12%,  $P < .001$ ). There also was a significant increase in out-of-home care by an unrelated sitter among infants (10% vs 16%,  $P < .001$ ).

#### Surgical Procedures

There was a significant increase in the percentage of children with recurrent otitis media who reportedly had ear surgery (Table 5). In 1981, 1.3% of 5189 children were reported to have an "operation of the middle or inner ear," and in 1988, 2.4% of 6209 children "ever had ear ventilation tubes placed." This increase in surgical procedures is consistent

**TABLE 2.** Host and Environmental Characteristics of Children With Recurrent Otitis Media (ROM) in the United States, 1981 and 1988

	1981		1988		RR	-CI	+CI	P Value
	% ROM	n	% ROM	n				
Number of children in household								
<4	19.6	4771	27.6	5677	1.4	1.3	1.5	<.001
≥4	13.5	326	24.5	403	1.8	1.2	2.6	.001
Birth order								
First born	21.0	683	31.1	813	1.5	1.2	1.8	<.001
Not first born	18.8	2151	26.1	2584	1.4	1.2	1.6	<.001
Only child	17.2	2269	27.5	2685	1.6	1.4	1.8	<.001
Smoked during pregnancy								
Yes	19.3	1200	27.9	1447	1.5	1.2	1.7	<.001
No	18.5	3989	26.6	4762	1.4	1.3	1.6	<.001
Respiratory allergy								
Yes	41.6	130	46.0	212	1.1	0.8	1.5	.52
No	18.1	5059	26.2	5997	1.5	1.3	1.6	<.001
Hay Fever								
Yes	36.7	92	52.2	181	1.4	1.0	2.0	.04
No	18.3	5097	26.1	6028	1.4	1.3	1.5	<.001
Food/digestive allergy								
Yes	34.8	49	43.2	405	1.2	0.8	1.8	.26
No	18.5	5140	25.8	5804	1.4	1.3	1.5	<.001
Asthma								
Yes	32.8	195	47.5	254	1.5	1.1	1.9	.005
No	18.0	4994	26.0	5955	1.4	1.3	1.6	<.001
At least one allergy listed above								
Yes	32.9	713	40.7	1139	1.2	1.1	1.4	.004
No	16.4	4476	23.8	5070	1.5	1.3	1.6	<.001
Day care center								
Yes	28.8	413	37.9	375	1.3	1.0	1.7	.02
No	17.9	4776	26.3	5834	1.5	1.4	1.6	<.001
Nursery								
Yes	26.0	223	36.9	1065	1.4	1.1	1.8	.001
No	18.4	4966	24.8	5144	1.4	1.2	1.5	<.001
Day care or nursery								
Yes	27.6	630	37.1	1366	1.3	1.2	1.5	<.001
No	17.6	4559	24.2	4843	1.4	1.3	1.5	<.001
Related sitter								
Yes	18.0	874	27.3	1676	1.5	1.3	1.8	<.001
No	18.8	4315	26.7	4533	1.4	1.3	1.6	<.001
Unrelated sitter								
Yes	23.2	746	32.7	1285	1.4	1.2	1.7	<.001
No	16.7	3807	25.5	4924	1.5	1.4	1.7	<.001

Abbreviations: ROM, recurrent otitis media; RR, relative risk; CI, confidence interval.

with the magnitude of the increase of recurrent otitis media.

### Multivariate Analysis

To identify independent predictors of recurrent otitis media, we performed logistic regression. For this analysis, survey data from both years were merged and “year of survey” was included as a variable. General health of the child, any allergy, use of day care, male gender, and out-of-home care by an unrelated sitter were directly associated with an increased prevalence of recurrent otitis media (Table 5). Year of the survey also was associated significantly with recurrent otitis media, indicating that other factors that were not identified or measured in this analysis are associated with the increase prevalence of recurrent otitis media. In contrast, Hispanic ethnicity, poverty, and Black race were inversely associated with recurrent otitis media.

### DISCUSSION

These data indicate that there has been a 44% increase in the prevalence of recurrent otitis media

among preschool children in the United States from 1981 to 1988; an excess of 1.8 million children with recurrent otitis media. In 1988, there was an estimated 5.9 million preschool children with recurrent otitis media in the United States, but if the prevalence had remained unchanged from 1981, there would only be an estimated 4.1 million children with recurrent otitis media. The increase was especially pronounced among infants and appears to be associated with the increased use of child care and the increased prevalence of allergies among children.

Child care consistently has been shown to be a risk factor for acquiring otitis media. Several prospective and cross-sectional studies have estimated that the risk of otitis media among children in various types of child care is two times higher than that found among children who are not in child care.<sup>1,3-6,14,15</sup> It is not known why there is an increased risk of otitis media associated with child care. One hypothesis is that child care is associated with increased exposure to various viral and bacterial pathogens, resulting in more frequent infections and otitis media. Recent reports of transmission of antibiotic-resistant patho-

**TABLE 3.** Risk Factors for Recurrent Otitis Media (ROM) in Children in the United States, Using Combined 1981/1988 Data

	% Otitis	OR	-CI	+CI	P Value
Total population	23.0				
Gender					
Male	24.9	1.3	1.1	1.4	<.001
Female	20.9	0.8	0.7	0.9	<.001
Race					
Black	15.7	0.6	0.5	0.7	<.001
Other	16.0	0.6	0.5	0.8	<.001
White	25.2	1.8	1.6	2.1	<.001
Hispanic					
Yes	18.0	0.7	0.6	0.8	<.001
No	23.7	1.4	1.2	1.7	<.001
Poverty					
<100%	18.2	0.7	0.6	0.8	<.001
≥100%	24.2	1.4	1.2	1.7	<.001
Urbanization					
Urban (MSA—central city)	21.6	0.9	0.8	1.01	.07
Nonurban	23.5	1.1	0.99	1.3	.07
Shares sleeping room					
Yes	20.4	0.7	0.7	0.8	<.001
No	26.2	1.4	1.3	1.5	<.001
Birth order					
First born	26.3	1.2	1.1	1.4	.004
Not first born	22.6	0.9	0.8	1.03	.17
Only child	22.5	1.0	0.9	1.1	.32
Smoked during pregnancy					
Yes	23.8	1.1	0.9	1.2	.32
No	22.7	0.9	0.8	1.1	.32
Allergies					
Yes	37.5	2.4	2.1	2.7	<.001
No	20.2	0.4	0.4	0.5	<.001
Day care center					
Yes	32.8	1.7	1.4	2.0	<.001
No	22.3	0.6	0.5	0.7	<.001
Health status					
Excellent/very good	20.8	0.7	0.6	0.7	<.001
Good	25.9	1.2	1.1	1.4	.001
Fair/poor	47.9	3.3	2.5	4.2	<.001
Region					
Northwest	21.9	0.9	0.8	1.04	.20
Midwest	22.8	1.0	0.9	1.1	.81
South	24.3	1.1	1.01	1.2	.04
West	22.0	0.9	0.8	1.1	.37
Maternal education					
<High school graduate	19.7	0.8	0.7	0.9	<.001
Some college	23.2	1.0	0.9	1.1	.53
College graduate, plus	27.0	1.3	1.1	1.5	<.001
Maternal age at child's birth					
<17 y	17.6	0.7	0.5	1.001	.03
≥17 y	23.2	1.4	0.999	2.0	.03
Maternal employment status					
Employed	25.9	1.4	1.2	1.5	<.001
Unemployed	20.5	0.7	0.7	0.8	<.001
Nursery					
Yes	35.0	2.0	1.7	2.2	<.001
No	21.5	0.5	0.4	0.6	<.001
Day care or nursery					
Yes	34.0	2.0	1.8	2.2	<.001
No	20.8	0.5	0.5	0.6	<.001
Unrelated sitter					
Yes	29.1	1.5	1.3	1.7	<.001
No	21.4	0.7	0.6	0.8	<.001

Abbreviations: ROM, recurrent otitis media; OR, odds ratio; CI, confidence interval; MSA, metropolitan statistical areas.

gens in the day care setting and data showing that recurrent otitis is associated with antibiotic resistant organisms suggest that the increase may be associated with these pathogens.<sup>16-20</sup> Child care also may result in earlier acquisition of particular agents, which increases the risk for recurrent otitis media. For example, Faden et al, showed that a high rate of colonization with *M cattarhalis* was associated with

an increased risk of otitis media and that otitis-prone children were colonized 44% of the time, compared with 17% of children who did not have otitis media.<sup>21</sup>

During the past decade, there has been a significant increase in the percentage of children in child care, especially among infants. Presumably, this is attributable to the economic necessity for a higher percentage of mothers both to work outside the

**TABLE 4.** Comparisons of Characteristics and Procedures of Children in the United States by Year, 1981 and 1988

	1981	1988	OR	95% CI		P Value
<b>All children &lt;6 years</b>						
Recurrent otitis media	18.7%	26.9%	1.6	1.4	1.7	<.001
Day care/nursery	11%	21%	2.2	2.0	2.5	<.001
OOHC/US	20%	18%	.9	.8	.97	.01
Allergies	14%	18%	1.4	1.2	1.5	<.001
Maternal employment	40%	51%	1.5	1.4	1.7	<.001
Ear operation	1.3%	2.4%	1.8	1.3	2.6	<.001
<b>In infants &lt;1 year</b>						
Recurrent otitis media	5.6%	10.3%	1.9	1.3	2.9	.001
Day care/nursery	2%	5%	2.3	1.3	4.0	.007
OOHC/US*	10%	16%	1.7	1.3	2.2	<.001
Allergies	7%	12%	1.9	1.3	2.7	.001
Maternal employment	33%	45%	1.6	1.4	2.0	<.001
Ear operation	0.2%	0.5%	2.7	0.3	25.8	.36

Abbreviations: OR, odds ratio; CI, confidence interval; OOHC/US, out-of-home care by an unrelated sitter.

home and to return to work sooner after childbirth. For example, in 1981, 40% of women surveyed in the NHIS reported they were employed, compared with 51% in 1988. From 1970 to 1988, the percentage of working mothers of children <5 years of age doubled, from 30% to 60%.<sup>22</sup> Maternal employment was not a risk factor for recurrent otitis media after adjusting for other variables, but it is clearly a major reason for the increased use of child care.

There was a significant increase in the frequency of ear surgery during the 1980s. Although the questions differed by survey, tympanostomy tubes are the most common surgical procedure of the ear for children with recurrent otitis media.<sup>23</sup> Moreover, because the survey identified children who had all types of ear surgery in 1981, but only tympanostomy in 1988, these data tend to underestimate any increase in the prevalence of tympanostomy tube placement. Thus, although there has been a significant increase in the proportion of U.S. children who had tympanostomy tubes placed, the increase is comparable with the higher prevalence of recurrent otitis media.

The increased prevalence of recurrent otitis media among infants is of particular concern. Several investigators have reported that early age of onset is one of the strongest predictors of recurrent otitis.<sup>1,4</sup> If the first episode of otitis occurs in infancy, the risk of recurrent otitis is two times higher than if it occurred after 12 months of age.<sup>1,4</sup> In this analysis, the increased prevalence of recurrent otitis media was

most dramatic among infants in child care or those with allergies. In fact, these data suggest that the increased prevalence of recurrent otitis media was attributable to onset at an earlier age; the rise in the prevalence of recurrent otitis in 1988 occurs during infancy and then parallels the prevalence from 1981 for older age groups (see Figure).

It has been suggested that the increased risk of recurrent otitis in infancy is attributable to anatomic, physiologic, or immunologic factors of the host.<sup>1</sup> This present analysis indicates that if a child is exposed to the child care setting during infancy, the risk of recurrent otitis media also increases. Thus, it is likely that both environmental and host factors play a role in the increased risk of recurrent otitis in those children with early onset of otitis media. Prevention of recurrent otitis media will, therefore, require an intervention or vaccine that is efficacious among infants.

These data indicate that there has been a dramatic rise in allergic conditions and that this rise appears to be associated with the increase in recurrent otitis media. It is not entirely clear why there is an increase in otitis media among children who have allergies. It is thought that nasal congestion induced by an allergic reaction is followed by reflux of nasopharyngeal secretions into the middle ear or that blockage of the eustachian tube secondary to mucosal inflammation leads to otitis media.<sup>24</sup>

The lower prevalence of recurrent otitis media in children who were of Black race, Hispanic ethnicity, or had lower household income has been described previously.<sup>1,3,25</sup> The lower prevalence may be an indicator of limited access to medical care, rather than a true difference in the risk for recurrent otitis media; that is, children with lower access to care may have otitis media, but it is underdiagnosed. Alternatively, there may be host or cultural factors to explain the lower risk in otitis media, such as anatomical differences, susceptibility to particular organisms, or differences in positioning while feeding.

Other risk factors for recurrent otitis media include health status of the child and male gender. Health status may be an indicator of other underlying health conditions that predispose a child to have recurrent otitis (eg, cleft palate, susceptibility to infections).

**TABLE 5.** Independent Predictors of Recurrent Otitis Media Among Children in the United States, 1981 and 1988

	Odds Ratio	95% CI		P Value
Poor/fair health	3.9	2.9	5.1	<.001
Any allergies	1.9	1.7	2.2	<.001
Year (1988 vs 1981)	1.7	1.5	1.9	<.001
Day care/nursery	1.5	1.3	1.7	<.001
Male gender	1.2	1.1	1.3	.001
OOHC/US	1.3	1.1	1.6	.001
Hispanic	0.8	0.6	0.9	.003
Below poverty level	0.8	0.7	0.9	.006
Black race	0.6	0.5	0.7	<.001

Abbreviations: CI, confidence interval; OOHC/US, out-of-home care by an unrelated sitter.

Alternatively, children with recurrent otitis may be viewed by their parents as less healthy than children without recurrent otitis. Male gender has been shown to be a risk factor in several epidemiologic studies, but the reason for this is not readily apparent.<sup>1,3,6</sup>

There are some potential limitations of this study. Recurrent otitis media was based on parental report rather than on medical records. Studies have shown, however, that parental report of otitis media is moderately to strongly correlated with information found in medical records ( $\kappa = .50$  to  $.65$ ) and that, in general, parents tend to underreport episodes of otitis media, except for those with six or more previous episodes of otitis media.<sup>26,27</sup> However, for this to impact our results, one must hypothesize differences in underreporting by survey year. A similar limitation was that other associated conditions, such as allergic disorders, were also based on parental report. Another limitation is that we were not able to measure whether there has been a shift in the perception of otitis media by parents or in its diagnosis by physicians over the past decade, which could account for some of these findings. For example, awareness about otitis media may have increased among both parents and physicians, and new diagnostic techniques, such as tympanometry and acoustic otoscopy, have become more routine. It also is possible that the general use of antibiotics or their specific use for "colds" has changed over the past decade. Nevertheless, although we cannot exclude these possibilities, there is no data demonstrating that physicians' diagnostic threshold has become lower over the past decade or that new techniques have increased the diagnosis of otitis media. Finally, although these data indicate that there was a significant increase in the prevalence of recurrent otitis media from 1981 to 1988, it is not clear whether this trend has continued.

We conclude that there has been a significant increase in the prevalence of recurrent otitis media among preschool children in the United States, particularly in infants. This increased prevalence appears to be associated with increased use of child care and an increased prevalence of allergic conditions among children. These data further suggest that both environmental and host factors play a role in the early onset of acute otitis media and its recurrence.

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