

# Childhood Chronic Illness: Prevalence, Severity, and Impact

## ABSTRACT

**Background.** Using data from the 1988 National Health Interview Survey, this article presents national estimates of the prevalence and impact of childhood chronic conditions.

**Methods.** Proxy responses to a checklist of child health conditions administered for 17 110 children under 18 years of age were used. Conditions were classified as chronic if they were first noticed more than 3 months prior to the interview or if they were the type that would ordinarily be of extended duration, such as arthritis.

**Results.** An estimated 31% of children were affected by chronic conditions. Among these children, highly prevalent conditions included respiratory allergies 9.7 per 100, repeated ear infections 8.3 per 100 and asthma 4.3 per 100. These children can be divided into three groups: 66% with mild conditions that result in little or no bother or activity limitation; 29% with conditions of moderate severity that result in some bother or limitation of activity, but not both; and 5% with severe conditions that cause frequent bother and limitation of activity. The 5% with severe conditions accounted for 19% of physician contacts and 33% of hospital days related to chronic illness.

**Conclusions.** Childhood chronic conditions have highly variable impacts on children's activities and use of health care. (*Am J Public Health*. 1992;82:364-371)

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### Introduction

Childhood illness has changed dramatically in the United States during this century. Infectious diseases that claimed the lives of thousands of children during the early 20th century have been largely eliminated through improvements in infectious disease control, sanitation, housing, and medical care. Mortality rates have fallen from 870 per 100 000 children aged 1 to 14 years in 1900 to 33 per 100 000 children in 1987.<sup>1</sup> But although this trend demonstrates progressive improvements along one critical dimension of child health, reductions in the prevalence of childhood chronic illness have not been nearly as dramatic.<sup>2</sup>

True, the prevalence of some childhood chronic conditions, such as polio and rheumatic fever, has declined markedly in the second half of this century. However, dramatic medical advances in the last few decades have resulted in many chronically ill children, who previously would have died much earlier from their illnesses, now surviving into adulthood. For example, there is evidence of a sevenfold increase in survival to age 21 among children with cystic fibrosis and of twofold or greater increases in survival for children with spina bifida, leukemia, and congenital heart disease.<sup>3,4</sup> Moreover, evidence from other quarters, albeit more controversial, suggests that the prevalence of non-life-threatening chronic conditions may have increased in recent years. According to national household survey data, the prevalence of asthma severe enough to limit a child's activities increased by 65% during the 1970s. Similar increases were reported for hearing impairments and a variety of mental and nervous system disorders.<sup>5</sup>

Despite concern over these trends, knowledge of the prevalence and distribu-

tion of childhood chronic illness is limited.<sup>6</sup> Indeed, there are not even accepted criteria for defining childhood chronic illness. Partly because such common definitional criteria are lacking, the research community has generated widely differing estimates of the prevalence of childhood chronic conditions. Additional variation results from the different methods used in collecting prevalence data. Some studies are population based; others are clinic based. Some rely on parental reports; others use medical records. Some include only chronic physical conditions; others include physical and mental conditions. As a result of these different methods, published estimates of the proportion of children with one or more chronic illnesses range from less than 5% to more than 30%.<sup>7-13</sup>

The present study provides estimates of the prevalence of childhood chronic conditions from a large population-based sample of children included in the National Health Interview Survey (NHIS) on Child Health.<sup>14</sup> Using this survey to derive prevalence estimates offers a number of advantages. First, a population-based sample provides for more representative results than could be obtained from a sample of patients appearing at clinics, hospitals, or other treatment centers. Second, a nationally representative sample eliminates geographic biases that might result

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from localized small-area samples. Third, the large sample size ( $n = 17\,110$ ) permits more precise prevalence estimates than could be obtained from smaller samples.

Data from the survey are used in this paper to examine the national prevalence of childhood chronic illness. We present prevalence estimates for 19 different categories of chronic conditions and estimates of the number of children with multiple chronic conditions. We describe how prevalence varies according to age, gender, and race. We examine the impact of chronic conditions on children's activity levels and show how childhood chronic conditions influence children's use of health services. Finally, we show how prevalence estimates change when different severity thresholds are applied.

## Methods

The NHIS is a continuing nationwide survey conducted by the Bureau of the Census for the National Center for Health Statistics (NCHS). Its purpose is to collect information on the health status and use of health care by the US population. The sample is designed to be representative of the US civilian noninstitutional population.<sup>14</sup>

In 1988, a special supplemental questionnaire on child health was included in the survey. This questionnaire, similar to one used in 1981, covered a range of topics relevant to child health, including child care, pregnancy and birth, behavioral problems, developmental problems, other child health problems, and use of health services. One child in each household was selected at random to be the subject of the supplemental interview. An adult member of the household knowledgeable about the child's health served as the respondent. In about 90% of the cases, the respondent was a parent of the sample child, usually the mother. Interviews were completed for 91% of all eligible children, resulting in a sample of 17 110 children under 18 years old.<sup>15</sup>

Of particular importance was the inclusion in the supplement of a detailed checklist of childhood health conditions. The checklist was oriented toward recurrent or chronic conditions. Respondents were read this extensive list and asked whether the sample child had any of the included conditions during the previous 12 months. From these results, annual prevalence estimates can be derived for a variety of childhood health problems as diverse as repeated ear infections, cerebral palsy, and juvenile arthritis—but exclud-

ing minor acute illnesses, such as colds and the flu. In part because of past problems of underreporting, cancers and mental health problems without physical manifestations were excluded from the checklist.

Data on the impact of checklist conditions were also collected in the supplement. Each time a condition was reported as present during the previous year, a set of follow-up questions was asked about the frequency and amount of bother caused by the condition; the days spent ill in bed; the days missed from school; and the resultant use of medications, physician services, and hospital care. Together, these data permitted analysis of the impact of chronic conditions on children's activity levels and health care use patterns. The questions and probes used to identify the impact of chronic conditions are reproduced in Appendix A.

Data on school absences and days in bed were not collected for children experiencing hearing, vision, or speech problems or eczema and skin allergies on the assumption that these conditions result in few, if any, bed days or school absences. A follow-up question on limitations in play and sports activities was included in the supplement but was asked only for children with certain chronic conditions. However, the core questionnaire contained questions that were asked for all children regarding limitation of activity due to chronic conditions, and those results are used here. With the results from those questions, children were classified as limited in their activities if they were reported as being limited in or unable to conduct age-appropriate activities, such as school or play.

We asked a panel of eight pediatricians to review the 76 checklist conditions to determine whether any should be excluded from our analysis of chronic conditions. When a majority considered a condition not to be chronic, that condition was eliminated. A total of eight conditions were eliminated in this fashion. We then classified the remaining conditions according to chronicity using conventions similar to those developed by the NCHS's Division of Health Interview Statistics. Specifically, a condition was considered chronic if (1) the respondent indicated it was first noticed more than 3 months before the interview date, or (2) it was a type of condition that ordinarily has a duration of more than 3 months.<sup>16</sup> Examples of conditions that are considered chronic regardless of their time of onset include diabetes, heart conditions, and arthritis.

Because no severity criteria are used, this approach to defining chronic illness leads to the inclusion of a large number of conditions and thus provides an upper-bound estimate of the size of the chronically ill child population. We show how prevalence estimates diminish when we use more restrictive definitions that take into account the impact or severity of reported conditions.

To enable a manageable analysis and presentation, we grouped conditions into 19 broader categories, including 5 impairment groupings and 14 disease groupings. This categorization scheme is based on grouping conditions that are clinically related while taking into account constraints due to sample size limitations. The disease categorization includes conditions with active pathology whereas the impairment categorization includes conditions with stable pathology. The overall categorization scheme and condition groupings are illustrated in Appendix B.

The actual number of sample cases is presented in the first column of Table 1 and Table 2. All other results are weighted to reflect national population estimates. The weights were provided by NCHS and are equal to the inverse of the sampling probability for each sample child. Standard errors were calculated using software designed to take into account the complex sample design of the NHIS.<sup>17,18</sup>

## Results

### *Prevalence of Childhood Chronic Conditions*

As shown in Table 1, an estimated 31% of children under 18 years of age, or almost 20 million children nationwide, were reported to have one or more chronic conditions in 1988. Although most chronically ill children were affected by a single condition, a significant minority were afflicted by multiple chronic conditions. Among children with chronic conditions, 70% were reported to have one checklist condition, 21% had two, and 9% had three or more. It is likely that these estimates understate the true size of the child population with single and multiple conditions, given that not all childhood chronic conditions—particularly those related to mental health—were included in the checklist.

As shown in Table 2, the most commonly reported childhood chronic conditions included respiratory allergies (including hay fever) and frequent or repeated ear infections. Respiratory aller-

TABLE 1—Prevalence of Chronic Conditions among Children under 18 Years of Age, 1988.

Number of Conditions	N	Cases per 1000	Std Error	Cases in 1000s
Children with one or more chronic conditions	5332	307.6	6.8	19 556
Children with one condition	3707	214.3	5.0	13 261
Children with two conditions	1145	64.8	2.5	4121
Children with three or more conditions	480	28.5	1.9	1813

Source—Original tabulations of the 1988 National Health Interview Survey.

gies affected 97 of every thousand children and 83 of every thousand children experienced repeated ear infections. Other relatively common conditions included asthma, eczema and skin allergies, frequent or severe headaches, and speech defects. Each of these had a prevalence of 25 per 1000 or more. Conditions of low prevalence included diabetes, sickle cell disease, and cerebral palsy, each of which affected fewer than two of every thousand children in the United States.

Prevalence of childhood chronic conditions is shown in Table 3 to vary by demographic status. Although chronic conditions appear slightly more prevalent among older children (315 per 1000) than among younger children (302 per 1000), the difference is not statistically significant. However, chronic conditions were more prevalent among boys (326 per 1000) than among girls (288 per 1000), and among White children (324 per 1000) than among Black children (247 per 1000).

#### *Impact of Childhood Chronic Conditions on Children's Health*

The questionnaire included several measures of the impact of chronic conditions on children's health. Included among these was both the frequency and the amount of bother caused by the condition. On average, childhood chronic conditions were reported to never bother children 25% of the time, bother them once in a while 53% of the time, and bother them often or all the time 22% of the time (Table 4). The amount of bother caused by childhood chronic conditions ranged, on average, from a great deal of bother (25%) to very little or some bother (50%) to no bother at all (25%).

The survey also collected information on limitation in usual activities and on average annual bed days and school absences (Table 5). Overall, 13% of children with one or more chronic conditions were classified as limited in their usual activi-

ties. Children with one or more chronic conditions experienced an average of slightly more than 2 bed days and 3 lost school days in the previous year. These bed days and school absences are in addition to those resulting from acute conditions such as colds, the flu, and minor injuries. Hence, they represent the added burden of chronic illness for these children.

The average numbers of bed days and school absences presented in Table 5 mask large differences among individual children even with the same condition. In fact, bed days and lost school days were quite unevenly distributed among children with chronic conditions. Most children experienced no bed days or school absences in 1988 that could be attributed to chronic conditions; it was just a small segment of the chronically ill child population that accounted for the majority of bed days and lost school days. Specifically, 72% of children with chronic conditions spent no days confined to bed in the previous year, and 59% had no school absences attributable to chronic illness. At the other end of the spectrum, 8% of children with chronic conditions spent 7 or more days confined to bed in the previous year and accounted for 74% of all bed days caused by chronic illness. Similarly, 12% of the population with chronic conditions had 7 or more school absence days and accounted for 73% of all school absences related to chronic health problems. Hence, a small segment of the chronically ill population disproportionately shoulders the burden of illness when that illness is measured in terms of bed days and school absences.

#### *Impact of Childhood Chronic Conditions on Children's Use of Services*

Use of medical services for children with chronic conditions is shown in Table 6. In 1988, 63% of all children with chronic conditions were reported by their parents

to have used medications (excluding vitamins) prescribed or recommended by a doctor. In addition, 4% of children were hospitalized to treat their chronic health problems sometime during the year prior to the interview. Nationally, an estimated 690 000 children were hospitalized for a total of nearly 7.2 million days for treatment of chronic conditions.

Children averaged slightly under five physician contacts annually for the treatment of chronic conditions (excluding those occurring during inpatient hospital episodes). Nationally, chronically ill children were estimated to have made 92 million ambulatory physician contacts in 1988, excluding visits for routine preventive care and services obtained in treating acute conditions. Hence, these results illustrate the added health care burden of childhood chronic illness.

Like bed days and school absences, physician services were used at markedly varying rates by individual chronically ill children. Some children made very high use of those services whereas many had no physician contacts during the previous year. Specifically, 30% of children with chronic conditions had no physician services related to the care of chronic illnesses in 1988. In contrast, 10% had 10 or more contacts and accounted for 63% of all ambulatory physician services for chronic illness. Hence, a small segment of the chronically ill child population appears to account for the majority of ambulatory care services.

#### *The Uneven Burden of Childhood Chronic Illness*

The data presented above suggest that, although chronic conditions are quite common among children, a comparatively small number of children are severely affected by them. For example, only one in eight children with chronic conditions had any limitation on his or her usual activities. Similarly, most children experienced only occasional bother or no bother at all from their chronic conditions. Further analysis indicates that 66% of children with chronic conditions were never or only occasionally bothered by their conditions and had no limitations on their usual activities. These data suggest that two thirds of all children with chronic conditions are mildly affected by their conditions and experience little or no adverse effects on their activities.

At the opposite end of the severity spectrum are children who were bothered by their conditions often or all of the time and limited in their usual activities

**TABLE 2—Prevalence of Specified Chronic Conditions among Children under 18 Years of Age, 1988**

Condition	N	Cases per 1000	Std Error	Cases in 1000s
All children with chronic conditions	5332	307.6	6.8	19 556
<i>Impairments</i>				
Musculoskeletal impairments	232	15.2	1.5	967
Deafness and hearing loss	241	15.3	1.1	975
Blindness and vision impairment	220	12.7	1.2	810
Speech defects	388	26.2	1.9	1666
Cerebral palsy	34	1.8	0.4	112
<i>Diseases</i>				
Diabetes	25	1.0	0.2	64
Sickle cell disease	26	1.2	0.3	74
Anemia	139	8.8	1.0	557
Asthma	747	42.5	1.8	2700
Respiratory allergies	1746	96.8	3.7	6155
Eczema and skin allergies	557	32.9	1.9	2088
Epilepsy and seizures	34	2.4	0.5	151
Arthritis	79	4.6	0.6	290
Heart disease	272	15.2	1.2	965
Frequent or repeated ear infections	1480	83.4	2.7	5304
Frequent diarrhea/bowel trouble	308	17.1	1.4	1085
Digestive allergies	398	22.3	1.4	1419
Frequent or severe headaches	419	25.3	1.5	1606
Other	344	19.8	1.2	1256

Source—Original tabulations of the 1988 National Health Interview Survey.

**TABLE 3—Prevalence of Childhood Chronic Conditions in Cases per 1000 by Age, Gender, and Race, 1988**

Condition	Age		Gender		Race	
	Under 10 Years	10 to 17 Years	Boys	Girls	White	Black
All children with chronic conditions	302.2	315.0	326.2	288.2	324.4	246.5
<i>Impairments</i>						
Musculoskeletal impairments	10.9	20.9	16.7	13.6	15.9	10.5
Deafness and hearing loss	14.1	17.0	18.3	12.3	17.7	6.0
Blindness and vision impairment	10.3	16.0	11.4	14.2	13.9	8.4
Speech defects	31.6	18.9	35.3	16.7	25.9	33.5
Cerebral palsy	2.2	1.2 <sup>a</sup>	2.0	1.5 <sup>a</sup>	1.9	0.5 <sup>a</sup>
<i>Diseases</i>						
Diabetes	0.6 <sup>a</sup>	1.5 <sup>a</sup>	1.5	0.5 <sup>a</sup>	1.2	0.1
Sickle cell disease	1.3 <sup>a</sup>	0.9 <sup>a</sup>	0.9 <sup>a</sup>	1.4	0.1 <sup>a</sup>	6.9
Anemia	11.0	5.8	8.4	9.1	8.6	10.0
Asthma	39.3	46.8	50.7	33.9	41.0	51.4
Respiratory allergies	71.8	130.3	106.5	86.7	106.1	53.2
Eczema and skin allergies	31.1	35.2	30.1	35.8	34.3	22.8
Epilepsy and seizures	1.7 <sup>a</sup>	3.3	1.7 <sup>a</sup>	3.1	2.5	2.3 <sup>a</sup>
Arthritis	1.5 <sup>a</sup>	8.7	4.2	4.9	4.5	5.3 <sup>a</sup>
Heart disease	13.6	17.4	16.4	13.9	17.3	7.5
Frequent or repeated ear infections	120.6	33.6	88.5	78.1	91.6	53.2
Frequent diarrhea/bowel trouble	22.6	9.6	18.1	15.9	17.8	13.6
Digestive allergies	23.2	21.1	25.6	18.9	24.5	9.7
Frequent or severe headaches	9.9	45.8	22.8	27.9	26.5	21.9
Other	12.1	30.0	19.3	20.3	21.9	9.9

Source—Original tabulations of the 1988 National Health Interview Survey.

<sup>a</sup>standard error exceeds 30% of estimate value.

by chronic illness. This severe group is much smaller, including only 5% of children with chronic conditions. In between these extremes are the remaining 29% of children with chronic conditions. This group includes children who experienced more than occasional bother or limitation

of activity, but not both (see Figure 1). Expressed another way, 20% of U.S. children experienced mild chronic conditions, 9% experienced chronic conditions of moderate severity, and only 2% of children experienced severe chronic conditions in 1988.

Children in the severe group spent an average of 10 days in bed and missed 11 days from school annually. Despite their small numbers, they account for 27% of all bed days and 24% of all school absences related to chronic conditions. Their use of medical services was also extraordinary.

**TABLE 4—Percent Distribution of Childhood Chronic Conditions by Frequency and Amount of Bother, 1988**

Condition	Frequency of Bother			Amount of Bother		
	Never	Once in Awhile	Often or All the Time	Never	Very Little or Some	Great Deal
All conditions	24.7	53.0	22.3	24.7	50.1	25.2
Impairments						
Musculoskeletal impairments	48.6	33.2	18.2	48.6	36.4	15.0
Deafness and hearing loss	57.0	23.8	19.2	57.2	25.5	17.3
Blindness and vision impairment	66.9	15.7	17.4	67.3	23.1	9.6
Speech defects	72.8	16.1	11.1	72.8	20.0	7.2
Cerebral palsy	45.4	30.2	24.4 <sup>a</sup>	45.4	33.7	20.8 <sup>a</sup>
Diseases						
Diabetes	46.7	25.8 <sup>a</sup>	27.5 <sup>a</sup>	46.7	37.9 <sup>a</sup>	15.4 <sup>a</sup>
Sickle cell disease	79.2	12.2 <sup>a</sup>	8.6 <sup>a</sup>	79.2	17.9 <sup>a</sup>	2.9 <sup>a</sup>
Anemia	71.9	21.7	6.4 <sup>a</sup>	71.9	24.6	3.5 <sup>a</sup>
Asthma	10.3	67.6	22.1	10.3	55.3	34.4
Respiratory allergies	9.2	70.7	20.1	9.3	71.2	19.5
Eczema and skin allergies	29.0	51.1	19.9	29.1	56.3	14.6
Epilepsy and seizures	44.1	40.8	15.2 <sup>a</sup>	44.1	36.9	19.1 <sup>a</sup>
Arthritis	18.5 <sup>a</sup>	47.0	34.5	18.5 <sup>a</sup>	40.4	41.1
Heart disease	74.5	15.7	9.8	74.5	15.5	10.0
Frequent or repeated ear infections	5.3	63.4	31.3	5.3	55.9	38.7
Frequent diarrhea/bowel trouble	16.1	56.1	27.8	16.1	60.6	23.3
Digestive allergies	30.9	54.0	15.1	30.9	49.7	19.4
Frequent or severe headaches	0.8 <sup>a</sup>	63.4	35.8	0.8 <sup>a</sup>	41.9	57.3
Other	36.1	39.5	24.3	36.1	36.1	27.8

Source—Original tabulations of the 1988 National Health Interview Survey.  
<sup>a</sup>standard error exceeds 30% of estimate value.

**TABLE 5—Impact of Childhood Chronic Conditions on Children's Activity Levels, 1988**

Condition	Percent Limited in Usual Activities Due to Chronic Conditions	Average Annual Bed Days Due to Chronic Conditions	Average Annual School Absence Days Due to Chronic Conditions
All children with chronic conditions	13.3	2.2	3.1
Impairments			
Musculoskeletal impairments	39.6	1.4 <sup>a</sup>	2.3 <sup>a</sup>
Deafness and hearing loss	35.5	— <sup>b</sup>	— <sup>b</sup>
Blindness and vision impairment	19.4	— <sup>b</sup>	— <sup>b</sup>
Speech defects	33.1	— <sup>b</sup>	— <sup>b</sup>
Cerebral palsy	89.2	1.7 <sup>a</sup>	2.3 <sup>a</sup>
Diseases			
Diabetes	30.0 <sup>a</sup>	3.6 <sup>a</sup>	3.1 <sup>a</sup>
Sickle cell disease	15.2 <sup>a</sup>	0.2 <sup>a</sup>	0.2 <sup>a</sup>
Anemia	14.7	0.8 <sup>a</sup>	0.8 <sup>a</sup>
Asthma	28.6	2.8	4.6
Respiratory allergies	12.3	0.8	1.4
Eczema and skin allergies	10.5	— <sup>b</sup>	— <sup>b</sup>
Epilepsy and seizures	58.0	3.0 <sup>a</sup>	3.4 <sup>a</sup>
Arthritis	24.6	3.3 <sup>a</sup>	3.2 <sup>a</sup>
Heart disease	21.6	3.2 <sup>a</sup>	2.2 <sup>a</sup>
Frequent or repeated ear infections	9.1	1.7	2.8
Frequent diarrhea/bowel trouble	16.7	0.9 <sup>a</sup>	1.4
Digestive allergies	15.7	0.4	1.1
Frequent or severe headaches	16.9	2.9	3.3
Other	24.7	2.8	3.4

Source—Original tabulations of the 1988 National Health Interview Survey.  
<sup>a</sup>standard error exceeds 30% of estimate value.  
<sup>b</sup>information on bed days and school absences was not obtained for these conditions.

Children in this group had an average of 16 physician contacts annually, and 16%

were hospitalized during the previous year. Together they account for 19% of all

physician contacts and 33% of all hospital days resulting from chronic conditions. In addition, 85% of children in this group received physician-recommended medications.

As one might expect, the diagnostic case mix differs substantially at each extreme of the severity spectrum. Children with mild chronic conditions were much more likely than children with severe chronic conditions to have respiratory allergies and repeated ear infections. In contrast, children in the severe group were more likely than children in the mild group to have musculoskeletal impairments, hearing and speech impairments, cerebral palsy, diabetes, asthma, epilepsy, and arthritis. In addition, children in the severe group had an average of 2.6 conditions, compared with an average of only 1.3 conditions per child in the mild group.

**Discussion**

In reviewing the NHIS results presented here, the reader should keep in mind that the results are based on household interviews, not on diagnostic tests or medical examinations. These results represent the mother's or other adult's *perception* of the child's health. Respondents are more likely to report conditions that have some impact on a child's activities.

Similarly, conditions associated with recent medical encounters are more likely to be accurately reported in household interviews. In contrast, conditions with little functional impact are often underreported, as are conditions that are associated with embarrassment or stigma.<sup>19,20</sup>

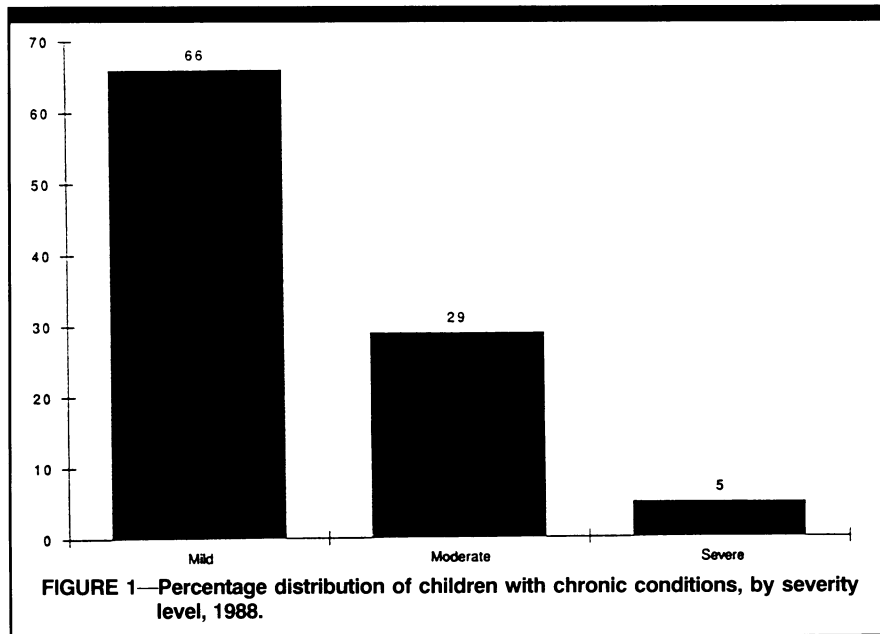
Although NCHS has undertaken validation studies, none of these studies has focused on children. Comparison of NHIS interview data from the early 1960s with information derived from medical records for *adults* suggests that chronic conditions, particularly those not causing significant disability, are generally underreported in household interviews. The most recent study of NHIS interviewing methodology found that between 35% and 45% of conditions found in medical records were unreported in household interviews whereas between 8% and 12% of conditions reported in interviews were not found on medical records. Conditions most likely to be underreported in household interviews include those related to the urinary and reproductive systems, mental illness, and cancer.<sup>19,20</sup> The results presented here for children contain at least one instance to suggest that misreporting may occur among respondents. Specifically, 18% of child diabetics were reported as unmedicated in the last year, indicating that either parents overreport diabetes or underreport use of medications.

With these limitations in mind, results from this investigation suggest that childhood chronic conditions are quite common in the United States. Using a broad definition of chronic illness, approximately 31% of all children under 18 years of age were classified as having chronic conditions in 1988. The overall prevalence of chronic conditions was similar for adolescents and younger children. Chronic conditions were reported more frequently for boys than for girls and for Whites than for Blacks. In fact, differences in prevalence were especially large for the two racial groups; however, whether these racial differences are attributable to reporting biases or underlying differences in health cannot be discerned from this data set.

Our results indicate that children with chronic conditions experience a substantial added burden of illness. In 1988, chronically ill children tallied 37 million bed days and 41 million school absence days attributable to chronic conditions. As previously noted, they also made 92 million physician contacts and accounted for over 7 million hospital days related to the treatment of chronic conditions. Using an average daily cost of \$581 for hospital

Condition	Percent Using Medications in Last Year Due to Chronic Conditions	Percent Hospitalized in Last Year Due to Chronic Conditions	Average Annual Physician Contacts Due to Chronic Condition
All children with chronic conditions	63.1	3.8	4.7
Impairments			
Musculoskeletal impairments	15.4	4.9 <sup>a</sup>	3.1
Deafness and hearing loss	27.1	1.8 <sup>a</sup>	2.1
Blindness and vision impairment	7.1	1.5 <sup>a</sup>	1.5
Speech defects	1.8 <sup>a</sup>	— <sup>b</sup>	4.8 <sup>a</sup>
Cerebral palsy	23.5 <sup>a</sup>	12.1 <sup>a</sup>	10.3 <sup>a</sup>
Diseases			
Diabetes	81.7	35.5 <sup>a</sup>	7.9 <sup>a</sup>
Sickle cell disease	22.8 <sup>a</sup>	<0.1	2.2 <sup>a</sup>
Anemia	42.7	0.6 <sup>a</sup>	2.3
Asthma	84.9	7.4	4.9
Respiratory allergies	63.4	0.5 <sup>a</sup>	2.8
Eczema and skin allergies	66.8	— <sup>b</sup>	1.6
Epilepsy and seizures	84.3	19.1 <sup>a</sup>	3.7
Arthritis	32.8	5.6 <sup>a</sup>	6.3 <sup>a</sup>
Heart disease	15.2	7.9	2.7
Frequent or repeated ear infections	93.2	2.3	4.3
Frequent diarrhea/bowel trouble	46.0	2.7 <sup>a</sup>	1.9
Digestive allergies	36.0	1.0 <sup>a</sup>	2.8
Frequent or severe headaches	47.5	1.3 <sup>a</sup>	1.6
Other	38.9	8.4	4.5

**Source.**—Original tabulations of the 1988 National Health Interview Survey.  
<sup>a</sup>standard error exceeds 30% of estimate value.  
<sup>b</sup>information on hospitalization was not obtained for these conditions.



care<sup>21</sup> and \$36 for intermediate-level visits for established pediatric patients (CPT 90060),<sup>22</sup> we estimate the cost of hospital and physician care related to childhood chronic conditions to be approximately \$7.5 billion annually. This estimate may be somewhat inflated because physician contacts as defined in the questionnaire in-

clude consultations in person or by telephone. At the same time, however, this estimate does not include charges for non-physician professional services, medications, supplies and equipment, and other specialized services used by chronically ill children.

Our results also indicate that the bur-

den of chronic illness is not borne evenly by these children. Chronic conditions fall along a continuum that begins with those that have essentially no impact on the child and ends with those that affect the child and the family profoundly. Using this continuum approach, the 31% of US children with chronic conditions can be divided into three groups: 20% with mild conditions that result in little or no bother or activity limitations; 9% with conditions of moderate severity that result in some bother or limitation of activity, but not both; and 2% with severe conditions that cause frequent bother and limitation of activity.

In prior prevalence studies using other data sources, prevalence estimates for childhood chronic conditions have ranged from less than 5% to more than 30%. The overall prevalence estimate of 31% from the 1988 NHIS is clearly at the upper extreme of previous prevalence estimates whereas our 2% estimate for the prevalence of severe conditions is clearly at the lower extreme. This illustrates the sensitivity of prevalence estimates to the definition used.

Results from the NHIS clearly demonstrate the wide variability with which specific conditions affect the health of children. The impact of chronic conditions on a given child is influenced by their type, number, and severity. The impact is also determined by external factors, such as psychosocial support within the family, access to medical and other services, effectiveness of treatment and rehabilitative interventions, and acceptance by the community of children with chronic conditions. With a goal to diminish the impact of illness and prevent dysfunction in children, the variability in impact on health warrants further study to determine which external factors could be modified to improve health. □

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## References

1. National Center for Health Statistics. *Prevention profile. Health, United States, 1989*. Hyattsville, Md: Public Health Service; 1990.
2. Hobbs N, Perrin JM, Ireys HT, eds. *Chronically Ill Children and Their Families*. San Francisco, Calif: Jossey-Bass Inc; 1985.
3. Gortmaker S, Sappenfield W. Chronic childhood disorders: prevalence and impact. *Pediatr Clin North Am*. 1984;31:3-18.
4. Gortmaker SL. Demography of chronic childhood diseases. In: Hobbs N, Perrin JM, eds. *Issues in the Care of Children with Chronic Illness*. San Francisco, Calif: Jossey-Bass Inc; 1985.
5. Newacheck PW, Budetti PP, Halfon N. Trends in activity-limiting chronic conditions among children. *Am J Public Health*. 1986;76:178-184.
6. Starfield B. The state of research on chronically ill children. In: Hobbs N, Perrin JM, eds. *Issues in the Care of Children with Chronic Illness*. San Francisco, Calif: Jossey-Bass Inc; 1985.
7. Stewart W. The unmet needs of children. *Pediatrics*. 1967;39:157-160.
8. Cadman D, Boyle M, Szatmari P, et al. Chronic illness, disability, and mental and social well-being: findings from the Ontario Child Health Study. *Pediatrics*. 1987;79:805-813.
9. Pless I, Roghman K. Chronic illness and its consequences: observations based on three epidemiologic surveys. *J Pediatr*. 1971;79:351-359.
10. Walker D, Gortmaker S, Weitzman M. *Chronic Illness and Psychosocial Problems among Children in Genesee County*. Cambridge, Mass: Harvard School of Public Health; August 1981.
11. Gortmaker SL, Walker DK, Weitzman M, Sobol AM. Chronic conditions, socioeconomic risks, and behavioral problems in children and adolescents. *Pediatrics*. 1990;85:267-276.
12. Newacheck PW, Halfon N, Budetti PP. Prevalence of activity-limiting chronic conditions among children based on household interviews. *J Chron Dis*. 1986;39:63-71.
13. Collins JG. Prevalence of selected chronic conditions, United States, 1983-85. *Vital and Health Statistics* (advance data). Series, No. 155. Hyattsville, Md: Public Health Service, National Center for Health Statistics; May 1988. Dept of Health and Human Services publication PHS 88-1250.
14. Adams PF, Hardy AM. Current estimates from the National Health Interview Survey: United States, 1988. *Vital and Health Statistics*. Series 10, No. 173. Hyattsville, Md: National Center for Health Statistics; October 1989.
15. Bloom B. Health insurance and medical care: health of our nation's children: United States, 1988. *Vital and Health Statistics* (advance data). Series, No. 188. Hyattsville, Md: National Center for Health Statistics; 1990.
16. US Dept of Health and Human Services. Public use data tape documentation: part III. medical coding manual and short index. *National Health Interview Survey 1987*. US Dept of Health and Human Services: Hyattsville, Md; November 1988.
17. Shah BV. *SESUDAAN: Standard Errors Program for Computing of Standardized Rates from Sample Survey Data*. Research Triangle Park, NC: Research Triangle Institute; April 1981.
18. Shah BV. *RTIFREQS: Program to Compute Weighted Frequencies, Percentages, and Their Standard Errors*. Research Triangle Park, NC: Research Triangle Institute; October 1982.
19. National Center for Health Statistics. Interview data on chronic conditions compared with information derived from medical records. Series 2, No. 23. Washington, DC: US Govt Printing Office; 1967. Public Health Service publication 1000.
20. Jabine TB. *Reporting Chronic Conditions in the National Health Interview Survey: A Review of Findings from Evaluation Studies and Methodological Tests*. Washington, DC: US Govt Printing Office; 1985. Dept of Health and Human Services P.O. 85A046165001D.
21. American Hospital Association. *Hospital Statistics 1989-90*. Chicago, Ill; 1988.
22. Kirchner M. Where do your fees fit in? *Medical Economics*. October 1990:76-105.

**APPENDIX A—Questions Used to Determine Impact of Childhood Conditions**

- 1) During the past 12 months, did \_\_\_\_ (*condition/AIP*) cause \_\_\_\_ to miss any time from school?
- 2) How many days in the past 12 months did \_\_\_\_ miss all or part of the day?
- 3) During the past 12 months, did \_\_\_\_ (*condition/AIP*) cause \_\_\_\_ to stay in bed more than half of the day?
- 4) How many days in the past 12 months did \_\_\_\_ stay in bed more than half of the day?
- 5) During the past 12 months, about how many nights did \_\_\_\_ spend in the hospital because of (*condition/AIP*)?
- 6) During the past 12 months, about how many times did [\_\_\_\_/anyone] see or talk to a medical doctor or assistant about this (*condition/AIP*)? (Do not count doctors seen while an overnight patient in a hospital.)
- 7) During the past 12 months, did this (*condition/AIP*) make it necessary for \_\_\_\_ to use any medicine, other than vitamins, that a doctor prescribed OR told \_\_\_\_ to take?
- 8) In the last 12 months, how often did [this condition/the conditions resulting from the (*AIP*)] cause \_\_\_\_ pain or discomfort or upset — all of the time, often, once in a while, or never?
- 9) When this condition did bother \_\_\_\_, was \_\_\_\_ bothered a great deal, some, or very little?

Note: *AIP* = accidents, injuries, or poisonings.

**APPENDIX B—Categorization Scheme**

Condition Category	Checklist Conditions Included
<i>Impairments</i>	
Musculoskeletal impairments	missing limbs, fingers, or toes <sup>a</sup> permanent impairment; stiffness or deformity of back or side, limbs, fingers, or toes <sup>a</sup>
Deafness and hearing loss	deafness or trouble hearing in one ear <sup>a</sup> deafness or trouble hearing in both ears <sup>a</sup>
Blindness and vision impairment	blindness in one eye <sup>a</sup> blindness in both eyes <sup>a</sup> crossed eyes <sup>a</sup> any other trouble seeing <sup>a</sup>
Speech defects	stammering or stuttering any other speech defect
Cerebral palsy	cerebral palsy <sup>a</sup>
<i>Diseases</i>	
Diabetes	diabetes <sup>a</sup>
Sickle cell disease	sickle cell anemia <sup>a</sup>
Anemia	anemia
Asthma	asthma <sup>a</sup>
Eczema and skin allergies	eczema or any other skin allergy <sup>a</sup>
Epilepsy and seizures	epilepsy or convulsions without fever <sup>a</sup>
Arthritis	arthritis or other joint problem <sup>a</sup>
Heart disease	congenital heart disease <sup>a</sup> any other heart disease or condition <sup>a</sup>
Frequent ear infections	frequent or repeated ear infections
Frequent diarrhea/bowel trouble	frequent or repeated diarrhea or colitis any other persistent bowel trouble
Digestive allergies	any food or digestive allergy
Frequent or severe headaches	frequent or severe headaches, including migraines
Other	mononucleosis hepatitis meningitis rheumatic fever <sup>a</sup> seizures associated with fever other bone, cartilage, muscle, or tendon problem conditions requiring surgery conditions lasting more than 3 months

<sup>a</sup>Denotes conditions deemed chronic regardless of date of onset; other conditions deemed chronic if present more than 3 months.