# The Great Divide:

## *When Kids Get Sick, Insurance Matters*

Families USA

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# INTRODUCTION

Extensive research has documented the positive effects that health insurance has on a child's physical, developmental, social, and emotional health.[1] Children who have health insurance are more likely to have a relationship with the same doctor over time, receive regular well-child checkups, and have their medical, dental, vision, and other health care needs met.[2] But what happens when an uninsured child is seriously injured or develops a condition that requires hospitalization? Does health insurance make a difference in the child's treatment and health outcomes? The answer is an emphatic "yes."

Studies of uninsured *adults* have shown that, compared to people with insurance coverage, the uninsured receive less health care and have poorer health outcomes across a host of conditions.[3,4,5] But there is little research that looks specifically at the effects of health insurance on *children's* health outcomes. In recent years, attention has been focused on the barriers that uninsured people face when trying to obtain primary care, as well as the effects that these barriers have on hospital emergency departments, which end up providing non-emergency care.[6,7] However, this report examines instances when hospital care is undeniably necessary. For common conditions that require hospital-level care, mortality rates, utilization rates for certain medical procedures, and lengths of stay all differ significantly between insured and uninsured children. Uninsured children also have poorer access to follow-up care when leaving the hospital after being treated for severe injuries.

In 2005, for the first time in nearly a decade, the country experienced an increase in the number of uninsured children. The findings in this report add a new sense of urgency to the problem of uninsured children. Other reports have documented that children who lack insurance miss regular checkups and visits to the doctor for less serious conditions.[8] This report takes another step and shows that, even for life-threatening conditions, when hospital care is essential, parents and physicians are forced to make hard decisions about both short-term and long-term treatment—choices that can be a matter of life and death.

## METHODOLOGY

This report analyzes data from the 2000 and 2003 Kids' Inpatient Database (KID), part of the Agency for Healthcare Research and Quality's Health Care Utilization Project (HCUP) databases. The KID contains inpatient hospitalization data for children ages 18 and younger. The 2000 KID draws its sample from 27 states, and the 2003 KID draws its sample from 36 states. Data from 2000 and 2003 were merged to provide a larger number of reliable state-level estimates.

The report examines data on several common pediatric conditions that often require hospitalization. Both state and national data are presented for general injuries, appendicitis, and middle ear infections (otitis media). National data are presented on traumatic brain injuries. We compare in-hospital mortality rates (traumatic brain injury and general injury), the use of certain treatments and interventions indicative of aggressive treatment (traumatic brain injury, appendicitis, and otitis media), and length of hospital stay (traumatic brain injury) by insurance status. For traumatic brain injury and general injuries, we also compare rates of discharge to rehabilitative care by insurance status.

Importantly, the data for each condition were adjusted to control for differences in the severity of a child's condition, as well as differences in age, health status (presence of other unrelated health conditions), and other factors that can affect health outcomes. For use of rehabilitative services, the data were adjusted for the severity of the child's condition upon discharge from the hospital. These adjustments allow for the best possible "apples-to-apples" comparisons between insured and uninsured children, and they reduce the degree to which factors other than health insurance status—such as distance from the hospital or emergency response time—drive the results.

We report data from all states with statistically reportable data. Due to small sample sizes at the state level, many states lack statistically reportable data. See the Technical Appendix on page 17 for a more detailed description of the methodology we used in this report.

## Understanding Odds Ratios

This report uses odds ratios to describe how uninsured children fare compared to insured children. Odds ratios are used to determine whether or not there is a difference between two groups (insured and uninsured children, in our case) and whether a certain outcome is more or less likely for one group compared to the other. A simple way to think of odds ratios is that, if there is no difference between the two groups' odds of having outcome *x*, the odds ratio is 1.0. If the odds ratio is above or below 1.0, there is a difference between the two groups' odds of having outcome *x*. If uninsured children are *more* likely to have outcome *x*, the odds ratio is more than 1.0, and if uninsured children are *less* likely to have outcome *x*, the odds ratio is less than 1.0.

For example, in this report:

- An odds ratio of 2.5 means that uninsured children are 2.5 times more likely than insured children to have outcome *x*.
- An odds ratio of 0.65 means that uninsured children are 35 percent less likely (1.00 – 0.65 = 0.35) than insured children to have outcome *x*.
- An odds ratio of 1.0 indicates that there is no difference between insured and uninsured children's odds of having outcome *x*.

# KEY FINDINGS

## Traumatic Brain Injury

- Among children admitted to the hospital with traumatic brain injury (TBI)—frequently the result of car, bicycle, or pedestrian accidents—uninsured children were **more than twice as likely to die** while in the hospital as insured children (Table 1).
- Among children admitted to the hospital with TBI, uninsured children were **nearly a third less likely (32 percent) to receive intracranial pressure monitoring** (a medical procedure indicative of aggressive treatment) than insured children (Table 1).

Table 1

**Treatment and Outcomes for Traumatic Brain Injury, Uninsured vs. Insured Children**

| Treatment or Outcome | Uninsured Children Compared To Insured Children |
|---|---|
| Odds of Dying | 2.26 times more likely |
| Odds of Intracranial Pressure Monitoring | 32% less likely |
| Odds of Discharge to Rehabilitative Care | 46% less likely |
| Difference in Length of Stay | Almost three days shorter (2 days, 21 hours) |

**Source:** Analysis of the 2000 and 2003 Kids' Inpatient Database (KID) by J. Mick Tilford for Families USA.

- Among children admitted to the hospital with TBI who survived, uninsured children were **46 percent less likely to be discharged to rehabilitative care** than insured children (Table 1).
- Uninsured children admitted to the hospital with TBI were **discharged from the hospital, on average, almost three days earlier** than comparable insured children (Table 1).

## General Injury

- Uninsured children admitted to the hospital due to injuries were **twice as likely to die** while in the hospital as their insured counterparts (Table 2).
- At the state level, uninsured children admitted to the hospital due to injuries were more likely to die than their insured counterparts in 26 of the 29 states with statistically reportable data (Table 2).
- Uninsured children admitted to the hospital due to injuries were **44 percent less likely to be discharged to rehabilitative care** than insured children (Table 3).

Table 2

## Odds of Death for Children Hospitalized With General Injury, Uninsured vs. Insured Children

| State | Uninsured Children: Odds of Death | |
|---|---|---|
| Arizona | 2.2 | times more likely |
| California | 1.5 | times more likely |
| Colorado | 3.1 | times more likely |
| Connecticut | 4.1 | times more likely |
| Florida | 1.5 | times more likely |
| Georgia | 1.9 | times more likely |
| Illinois | 2.0 | times more likely |
| Indiana | 3.7 | times more likely |
| Iowa | 2.0 | times more likely |
| Kansas | 2.4 | times more likely |
| Kentucky | 5% | less likely |
| Maryland | 3% | less likely |
| Massachusetts | 3.5 | times more likely |
| Minnesota | 1.2 | times more likely |
| Missouri | 2.5 | times more likely |
| New Jersey | 3.0 | times more likely |
| New York | 1.2 | times more likely |
| North Carolina | 1.4 | times more likely |
| Ohio | 1.2 | times more likely |
| Oregon | 4.5 | times more likely |
| Pennsylvania | 1.9 | times more likely |
| South Carolina | 37% | less likely |
| Tennessee | 2.1 | times more likely |
| Texas | 1.6 | times more likely |
| Utah | 2.4 | times more likely |
| Virginia | 3.1 | times more likely |
| Washington | 2.0 | times more likely |
| West Virginia | 2.1 | times more likely |
| Wisconsin | 4.7 | times more likely |
| **U.S.** | **2.0** | **times more likely** |

**Source:** Analysis of the 2000 and 2003 Kids' Inpatient Database (KID) by J. Mick Tilford for Families USA. The combined KID contains data for 38 states, but only states with adequate sample sizes are reported here. Due to inadequate sample sizes, the following states are not included in this table: HI, ME, MI, NE, NV, NH, RI, SD, and VT.

Table 3

## Odds of Discharge to Rehabilitative Care for Children Hospitalized with General Injury, Uninsured vs. Insured Children

| State | Uninsured Children: Odds of Being Discharged to Rehabilitative Care | |
|---|---|---|
| Arizona | 45% | less likely |
| California | 59% | less likely |
| Colorado | 43% | less likely |
| Connecticut | 40% | less likely |
| Florida | 52% | less likely |
| Georgia | 40% | less likely |
| Illinois | 41% | less likely |
| Indiana | No difference | |
| Iowa | 8% | less likely |
| Kansas | 79% | less likely |
| Kentucky | 64% | less likely |
| Maryland | 13% | less likely |
| Massachusetts | 35% | less likely |
| Minnesota | 1.6 | times more likely |
| Missouri | 36% | less likely |
| New Jersey | 47% | less likely |
| New York | 43% | less likely |
| North Carolina | 37% | less likely |
| Ohio | 40% | less likely |
| Oregon | 20% | less likely |
| Pensylvania | 44% | less likely |
| South Carolina | 32% | less likely |
| Tennessee | 52% | less likely |
| Texas | 36% | less likely |
| Utah | 41% | less likely |
| Virginia | 38% | less likely |
| Washington | 47% | less likely |
| West Virginia | 34% | less likely |
| Wisconsin | 24% | less likely |
| **U.S.** | **44%** | **less likely** |

**Source:** Analysis of the 2000 and 2003 Kids' Inpatient Database (KID) by J. Mick Tilford for Families USA. The combined KID contains data for 38 states, but only states with adequate sample sizes are reported here. Due to inadequate sample sizes, the following states are not included in this table: HI, ME, MI, NE, NV, NH, RI, SD, and VT.

- At the state level, uninsured children admitted to the hospital due to injuries were less likely to be discharged to rehabilitative care than their insured counterparts in 27 of the 29 states with statistically reportable data (Table 3).

## Appendicitis

- Among children admitted to the hospital with appendicitis, uninsured children were **18 percent less likely to receive a laparoscopic appendectomy**, a less invasive and less painful way to remove the appendix than regular, open surgery (Table 4).
- At the state level, uninsured children admitted to the hospital with appendicitis were less likely to receive a laparoscopic appendectomy than their insured counterparts in 11 of the 14 states with statistically reportable data (Table 4).

## Ear Infections

- Among children admitted to the hospital with otitis media (middle ear infection), uninsured children were **less than half as likely to get ear tubes inserted** than insured children (Table 5).
- At the state level, uninsured children admitted to the hospital with otitis media were less likely to get ear tubes inserted than their insured counterparts in 14 of the 15 states with statistically reportable data (Table 5).

### Hospitals: A Vital Part of the Safety Net for the Uninsured

Hospitals are often the "provider of last resort" when it comes to serving the uninsured. The uninsured can be turned away from primary care or specialty providers' offices, but hospitals treat patients regardless of ability to pay, even though they may never be reimbursed for the services they supply.

- In 2004, the cost of health care to the uninsured–provided by hospitals, physicians, and other health care providers–totaled almost $125 billion. Of this, nearly $41 billion, one-third, went uncompensated.[a]
- Hospitals carry the bulk of the uncompensated care burden–63 percent.[b]
- Uninsured children accounted for $5.4 billion in uncompensated care, but most uncompensated care is provided to uninsured adults ($35.1 billion, or about 86 percent of all uncompensated care).[c]

[a] Jack Hadley and John Holahan, *The Cost of Care for the Uninsured: What Do We Spend, Who Pays, and What Would Full Coverage Add to Medical Spending?* (Washington: The Kaiser Commission on Medicaid and the Uninsured, May 2004).

[b] Ibid.

[c] Ibid.

Table 4

## Odds of Receiving a Laparoscopic Appendectomy, Uninsured vs. Insured Children

| State | Uninsured Children: Odds of Receiving a Laparoscopic Appendectomy | |
|---|---|---|
| Arizona | 36% | less likely |
| California | 30% | less likely |
| Colorado | 29% | less likely |
| Florida | 31% | less likely |
| Georgia | 28% | less likely |
| Illinois | 1.3 | times more likely |
| Massachusetts | 1.3 | times more likely |
| New Jersey | 21% | less likely |
| New York | 46% | less likely |
| North Carolina | 44% | less likely |
| Ohio | 23% | less likely |
| Oregon | 1.5 | times more likely |
| Texas | 7% | less likely |
| Wisconsin | 30% | less likely |
| **U.S.** | **18%** | **less likely** |

**Source:** Analysis of the 2000 and 2003 Kids' Inpatient Database (KID) by J. Mick Tilford for Families USA. The combined KID contains data for 38 states, but only states with adequate sample sizes are reported here. Due to inadequate sample sizes, the following states are not included in this table: CT, HI, IA, IN, KS, KY, ME, MD, MI, MN, MO, NE, NV, NH, PA, RI, SC, SD, TN, UT, VT, VA, WA, and WV.

Table 5

## Odds of Receiving Ear Tubes for Children Hospitalized with Otitis Media, Uninsured vs. Insured Children

| State | Uninsured Children: Odds of Receiving Ear Tubes | |
|---|---|---|
| California | 71% | less likely |
| Colorado | 62% | less likely |
| Florida | 55% | less likely |
| Georgia | 68% | less likely |
| Illinois | 17% | less likely |
| Iowa | 73% | less likely |
| Kansas | 41% | less likely |
| Kentucky | 12% | less likely |
| New Jersey | 80% | less likely |
| New York | 32% | less likely |
| North Carolina | 24% | less likely |
| Ohio | 1.4 | times more likely |
| Pennsylvania | 38% | less likely |
| South Carolina | 78% | less likely |
| Texas | 54% | less likely |
| **U.S.** | **57%** | **less likely** |

**Source:** Analysis of the 2000 and 2003 Kids' Inpatient Database (KID) by J. Mick Tilford for Families USA. The combined KID contains data for 38 states, but only states with adequate sample sizes are reported here. Due to inadequate sample sizes, the following states are not included in this table: AZ, CT, HI, IN, ME, MD, MA, MI, MN, MO, NE, NV, NH, OR, RI, SD, TN, UT, VT, VA, WA, WV, and WI.

## DISCUSSION

As the Key Findings demonstrate, uninsured children have drastically different outcomes than insured children when hospitalized for severe, yet common, medical conditions. Differences in treatment, outcomes, and discharge to rehabilitative care suggest that parents and physicians may be making unavoidable, tough choices about treatment for uninsured children. Sadly, elevated mortality rates for uninsured children mean that these choices can have tragic consequences.

We looked at specific courses of treatment—intracranial pressure monitoring for traumatic brain injury, laparoscopic appendectomy for appendicitis, and insertion of ear tubes for ear infections—not to suggest that these interventions are clinically appropriate for *all* children with those diagnoses, but because they are indicative of whether a child is receiving the most aggressive treatment. When an uninsured child with the *same severity of condition* as an insured child has a lower chance of receiving these treatments, it indicates that the child may not be receiving the level of treatment that he or she truly needs.

Although neither parents nor physicians want cost concerns to influence their decisions about what kinds of treatment a child will receive, the reality is that uninsured children are less likely to receive some of the most aggressive treatments, which also happen to be more expensive. Likewise, shorter lengths of hospital stay compared to insured children also indicate that uninsured children may not be getting all the hospital-based care that they need before they are discharged. Parents must consider the financial impact of keeping a child in the hospital for additional days when there is no insurance coverage. In 2003, the average cost of a child's hospital stay was $4,009,[9] and the cost of health care has risen each year since then. Most uninsured children live in families with incomes below twice the federal poverty level ($33,200 for a family of three in 2006[10]), putting the high cost of hospital care well out of their reach.

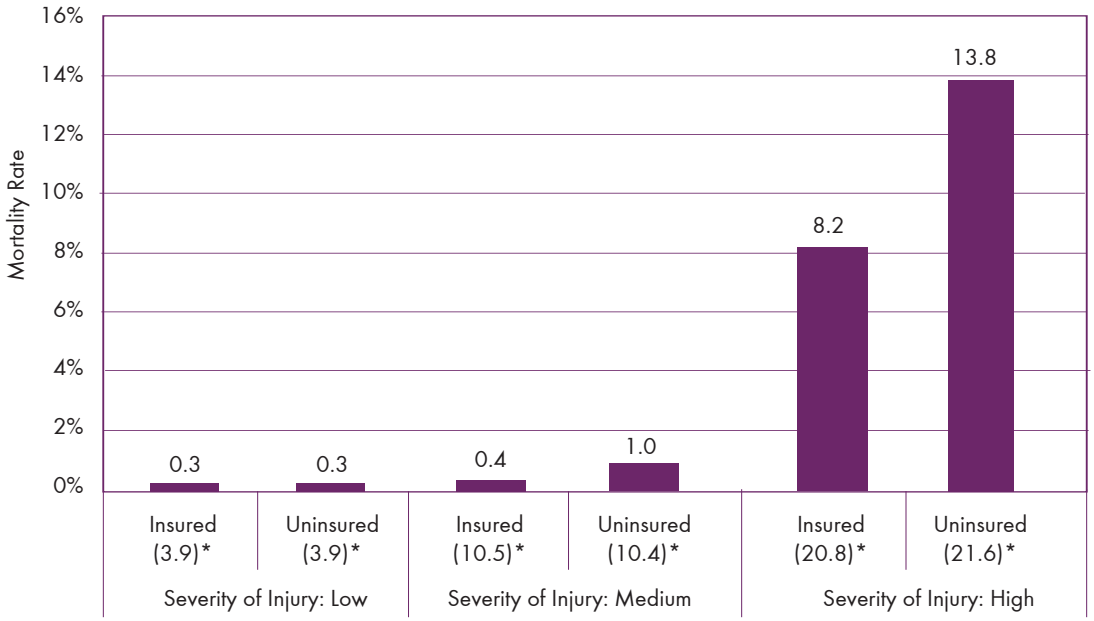
### ■ Traumatic Brain Injury

Traumatic brain injury (TBI) is a condition that results from an open or closed head injury, most often caused by car accidents, falls, and sports injuries.[11] TBI can lead to functional disability or psychosocial impairment, and it affects more than 1 million children every year.[12] In 2004, TBI accounted for an estimated 2,685 deaths, 37,000 hospitalizations, and 435,000 emergency room visits among children ages 0-14.[13]

According to 2000 and 2003 KID data, 4.3 percent of insured children who were admitted to the hospital with TBI died, compared to 7.6 percent of uninsured children. After controlling for the severity of injury, uninsured children who were hospitalized for TBI were more than twice as likely to die as insured children. This supports previous research on disparities in TBI treatment by insurance status.[14] Again, these differences were not caused by uninsured children being in worse condition when they arrived at the hospital, because the report methodology takes into account (controls for) the severity of the injury (Table 1 and Figure 1). Figure 1 shows mortality rates for children hospitalized with TBI by insurance status and risk level, with Injury Severity Scores in parentheses following insurance status. Although the Injury Severity Scores are nearly identical for insured and uninsured children in each of the three risk categories, the mortality rates differ widely in all but the lowest risk category. This suggests that the differences in mortality rates are not due to differences in severity of injury.

Figure 1

Mortality Rates among Children Hospitalized with Traumatic Brain Injury




**Source:** Analysis of the 2000 and 2003 Kids' Inpatient Database (KID) by J. Mick Tilford for Families USA.

* Injury Severity Scores

One diagnostic tool sometimes used with TBI patients to guide appropriate treatment is intracranial pressure monitoring. This involves a physician, typically a neurosurgeon, inserting a device into the area surrounding the patient's brain to monitor the pressure around the brain. An increase in pressure can indicate that not enough oxygen is getting to the brain, which can cause brain damage. When intracranial pressure monitoring indicates increased pressure, other medical interventions can be used to reduce the pressure and prevent further brain damage.[15]

Use of intracranial pressure monitoring is indicative of an aggressive overall course of treatment for TBI.[16,17,18] After controlling for severity, uninsured children are 32 percent less likely to receive intracranial pressure monitoring than insured children (Table 1). This means that uninsured children may not receive the most aggressive course of treatment for their TBI and could be suffering adverse health outcomes as a result. The fact that uninsured children with TBI are discharged from the hospital an average of nearly three days earlier than insured children also suggests that uninsured children are not receiving all the care they could benefit from due to their insurance status (Table 1).

Finally, many children who have experienced TBI require additional care for their injury after they are discharged from the hospital. This could take place in a skilled nursing facility, a rehabilitation hospital, or through ongoing home health care. These children may require medical services from many types of providers, including rehabilitation specialists, psychologists, speech pathologists, physical and occupational therapists, and social workers.[19] Among hospitalized children who survived their injury, uninsured children were 46 percent less likely than insured children to be discharged to one of these sources of rehabilitative care (after controlling for severity) (Table 1).

## ■ General Injury

According to the Centers for Disease Control and Prevention (CDC), injuries were the leading cause of death among children ages 1-18 in 2003 (the most recent year for which data are available), accounting for 42.3 percent of all child deaths.[20] The majority of these were due to car accidents (63 percent), but children get injured in countless different ways, from playing sports, to normal play, to cases

of violence and abuse. After controlling for severity, uninsured children who were admitted to the hospital with injuries were twice as likely to die as insured children (Table 2). Uninsured children admitted to the hospital with injuries were more likely to die than insured children in 26 of the 29 states with reportable data (Table 2). The increased odds of death ranged from 1.2 times greater in New York and Ohio to 4.7 times greater in Wisconsin.

Still, most injuries do not result in death. Most children admitted to the hospital due to injuries eventually go home, although some of them require continued care in a rehabilitation hospital, skilled nursing facility, or through home health care services. Controlling for the severity of the condition, uninsured children were 43.5 percent less likely to be discharged into these types of rehabilitative care than insured children (Table 3). Uninsured children were less likely to receive continued rehabilitative care in 27 of the 29 states with reportable data (Table 3).

## ■ Appendicitis and Ear Infections (Otitis Media)

Appendicitis and otitis media are less common than childhood injuries, but they are still common, unpredictable reasons for hospitalizing a child. Appendicitis affects around 80,000 children each year[21] and is the most common reason for emergency abdominal surgery.[22] When a person has appendicitis, the infected appendix typically needs to be surgically removed. There are two different types of surgery that can be done to remove an appendix—the standard open surgery method and the laparoscopic method. The latter offers a smaller incision, less pain during the recovery period, and a faster return to the patient's normal lifestyle.[23] However, a laparoscopic appendectomy is more costly and takes longer to perform than the open surgery method.[24,25]

Controlling for the severity of the condition, uninsured children were 18 percent less likely to receive laparoscopic surgery than insured children (Table 4). Uninsured children were less likely than insured children to receive laparoscopic surgery for appendicitis in 11 of the 14 states with reportable data (Table 4). The odds of uninsured children not receiving laparoscopic surgery ranged from 7 percent less likely in Texas to 46 percent less likely in New York.

Otitis media, commonly known as a middle ear infection, is one of the most common infections among children. Three-quarters of all children experience an ear infection by the time they are three years old.[26] A child develops otitis media when fluid collects in the middle ear and causes an infection. Most of these infections either clear up on their own over time or can be treated with an antibiotic. However, in a small portion of severe cases, a surgical procedure called a myringotomy is used, which involves inserting a small tube in the eardrum to allow fluid to drain and pressure to equalize between the middle ear and the outside environment.

Uninsured children admitted to the hospital with otitis media were 57 percent less likely to receive a myringotomy than children with insurance (Table 5). Among children hospitalized with otitis media, uninsured children were less likely to receive a myringotomy than insured children in 14 of the 15 states with reportable data, with differences ranging from 12 percent less likely in Kentucky to 80 percent less likely in New Jersey.

## What Explains These Differences?

Exploring all the reasons why these differences between insured and uninsured children occur is beyond the scope of this study. The course of treatment for any condition is chosen for complex reasons based on both physician and family input. However, there is no doubt that cost is a factor when a family has no insurance coverage for their child. Hospital visits for these kinds of common conditions can be very expensive, and without health insurance, few families could afford the price of health care. Still, incidents like severe injuries and appendicitis are unpredictable and demand hospital-level care. The disparities in mortality rates and treatments uncovered in this study point to yet another reason why health insurance makes an important difference in children's lives.

When urgent health problems arise, uninsured people receive medical care, despite their inability to pay. The uninsured pay about one-third of their health care costs out of their own pockets, but hospitals provide billions of dollars worth of uncompensated care each year. In 2004, uncompensated care for uninsured children alone totaled $5.4 billion.[27]

Every part of the nation's health care system is affected by the growing number of uninsured Americans, and hospitals face a special challenge, as they are often the provider of last resort. Hospitals use a host of financing mechanisms to cover the costs of providing care to the uninsured, including charity care, debt collection, and cost-shifting. People with private coverage are charged more for their health care, and the insurance companies that pay for their care shift these additional costs on through higher premiums. People with employer-based health coverage paid an average of $922 more for family coverage in 2005 just to cover the costs of health care for the uninsured. (For a full explanation of this cost shift, see the Families USA publication *Paying a Premium: The Added Cost of Care for the Uninsured*.[28])

The families of uninsured children, the hospitals and physicians who care for uninsured children, and every person lucky enough to have his or her own health insurance coverage all help to carry the burden of uncompensated care for uninsured children. Obviously, however, this arrangement is far from perfect. The ultimate price is paid by uninsured children themselves, who do not receive the most appropriate and effective care available, who see their course of treatment cut short, and whose lives are put at increased risk.

## CONCLUSION

Hospitals provide a great deal of charity care, but their efforts alone are not the answer to ensuring that all children get the high-quality health care they need. Children who are eligible for Medicaid or the State Children's Health Insurance Program (SCHIP) must be enrolled, and these programs must be fully funded. Children's coverage should be expanded through Medicaid and SCHIP so that children in working families that do not have access to employer-based coverage can still get the high-quality, affordable health care they deserve. It is time for Congress to bridge the great divide.

## Insurance Makes a Difference for Kids!

A substantial body of research speaks to the many benefits health insurance brings to children's lives. Having health insurance means children are more likely to see a doctor, have a regular source of health care, get well-child checkups, and get the dental, vision, and mental health care and prescription drugs they need.[*]

Compared to children with health insurance, uninsured children are:

- Three times more likely *not* to have seen a doctor in the past year;
- More than 13 times as likely to lack a usual source of medical care;
- Almost five times more likely to have a delayed or unmet health care need;
- Five times more likely to have an unmet dental need;
- Five times more likely to have an unmet vision care need;
- Almost four times more likely to have an unmet need for prescription drugs; and
- More than three times as likely to have an unmet need for mental health services.

Having health insurance also improves children's social and emotional development and can help them be better prepared to do well in school.[**] Children who lack insurance are more likely to miss hearing and vision screenings—simple tests to help catch problems that, if untreated, can impair a child's ability to use language to communicate and participate in social situations. Having health insurance means that a child is more likely to get the health care he or she needs, which allows children to come to school healthy and ready to learn. Studies have also linked health insurance to better school attendance.

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[*] Jennifer Sullivan, *No Shelter from the Storm: America's Uninsured Children* (Washington: Campaign for Children's Health Care, September 2006).

[**] Campaign for Children's Health Care, *Why Insurance Matters for Children* (Washington: Campaign for Children's Health Care, July 2006).

# ENDNOTES


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# TECHNICAL APPENDIX

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## Hospitalization Data

Data for this study come from the Kids' Inpatient Database (KID) for the years 2000 and 2003. The KID is part of the family of databases from the Healthcare Cost and Utilization Project (HCUP) provided by the Agency for Healthcare Research and Quality.[1, 2] The KID provides information on hospitalizations involving children ages 0-18. It contains a 10 percent sample of normal newborn discharges and an 80 percent sample of all other discharges from 27 states in 2000 and 36 states in 2003.[3] The database contains weighting variables to generate nationally representative estimates of hospitalizations involving children and their associated outcomes.

The data elements in the KID include the child's age, all-payer insurance status, up to 15 primary and secondary ICD-9-CM diagnosis and procedure codes, the patient's length of stay in the hospital, other patient demographic characteristics, and hospital characteristics. A patient disposition variable describes four outcomes for the child: 1) discharged routinely to home; 2) discharged to another facility, such as a skilled nursing or rehabilitation facility; 3) discharged to home heath care; or 4) died in the hospital. For this study, all children ages 18 and under were included in national and state-specific estimates. Children identified as "self-pay" or "no charge" in the database were coded as uninsured. Uninsured children were compared to insured children in all analyses. Insured children included children with public sources of insurance, such as Medicaid, Medicare, and other public insurance, as well as private sources of insurance.

## Case Identification and Outcomes

Case identification was based on all of the 15 primary and secondary diagnostic codes provided with the database. Appendix Table 1 provides information on the diagnostic codes used in case identification for the four conditions: 1) traumatic brain injury, 2) general injury, 3) appendicitis, and 4) otitis media. Appendix Table 1 also provides information on procedure codes used to generate specific outcomes. These outcomes included whether the child received an intracranial pressure monitor in the treatment

of traumatic brain injury; whether the child received laparoscopic surgery in the treatment of appendicitis; and whether the child received a myringotomy with tube insertion in the treatment of otitis media. All children were hospitalized for treatment. Treatments performed in outpatient settings were not included in the database.

Outcomes for traumatic brain injury and general injury hospitalizations included whether the child died during the hospital stay and whether he or she was discharged to a rehabilitation facility or home health care (conditioned on whether they survived the hospitalization). Such outcomes were not considered in the other conditions because the number of deaths and discharges other than routine were too small for analysis. To avoid double-counting and bias in the estimation of death rates and procedure rates, pre-transfer hospitalizations that resulted in discharge to another acute care hospital were dropped from the analyses.[4]

## Statistical Analyses and Severity Adjustment

Statistical analyses to generate national estimates were performed with routines to handle complex survey data using Stata Version 8. In particular, weighted estimation was performed with variance calculation accounting for both the strata and primary sampling unit following guidelines provided by AHRQ.[5] In state analyses, we did not use weighted analysis, and because of the complex survey design, the number of hospitalized children within a given state could not be estimated. Estimates were conditioned on outcome differences for insured and uninsured children.

We performed both bivariate and multivariate analysis to test whether outcomes differed between insured and uninsured children. In state-specific analyses, tests were based on 90 percent confidence intervals because of the relatively small sample sizes in each state. In multivariate analysis, we controlled for the severity of the condition, the age of the child, additional comorbid conditions, and other relevant variables where appropriate. For the general injury and traumatic brain injury analyses, severity measures were created with ICDMAP-90, a software program that generates Injury Severity Scores based on the primary and secondary diagnoses.[6] Injury Severity Scores have been validated for use in pediatric injury research.[7]

The Injury Severity Score is derived from the abbreviated injury scale where six body systems are scored on a scale from 1 (minor) to 6 (untreatable). The Injury Severity Score is calculated by squaring the abbreviated injury scale for the three body systems with the

## Appendix Table 1. ICD-9-CM Codes Used for Case Definition, Procedure Use, and Outcomes

### Codes for Traumatic Brain Injury

Case Definition

| | |
|---|---|
| 800 | Fracture of Vault of Skull |
| 801 | Fracture of Base of Skull |
| 803 | Other and Unqualified Skull Fractures |
| 804 | Multiple Fractures Involving Skull or Face with Other Bones |
| 850-854 | Intracranial Injury, Excluding Those with Skull Fracture |

Codes for TBI and Mechanical Ventilation or Endotracheal Intubation

| | |
|---|---|
| 93.90 | Continuous Positive Airway Pressure |
| 93.91 | Intermittent Positive Pressure Breathing |
| 96.04 | Insertion of Endotracheal Tube |
| 96.70 | Continuous Mechanical Ventilation of Unspecified Duration |
| 96.71 | Continuous Mechanical Ventilation for Less Than 96 Consecutive Hours |
| 96.72 | Continuous Mechanical Ventilation for 96 Consecutive Hours or More |

Procedures

| | |
|---|---|
| 01.18 | Other Diagnostic Procedures on Brain and Cerebral Menenges |
| 02.2 | Ventriculostomy |

Severity Adjustment: Used ICDMAP90 software to create Injury Severity Scores from primary and secondary ICD-9-CM diagnosis codes.

### Codes for General Injury

Case Definition

| | |
|---|---|
| 800-829 | Fractures |
| 830-839 | Dislocations |
| 840-848 | Sprains and Strains of Joints and Adjacent Muscles |
| 850-854 | Intracranial Injury, Excluding Those with Skull Fracture |
| 860-869 | Internal Injury of Thorax, Abdomen, and Pelvis |
| 870-897 | Open Wound |
| 900-904 | Injury to Blood Vessels |
| 905-909 | Late Effects of Injury and Other External Injuries |
| 910-919 | Superficial Injury |
| 920-924 | Contusion with Intact Skin Surface |
| 925-929 | Crushing Injury |
| 950-957 | Injury to Nerves and Spinal Cord |
| 958-959 | Certain Traumatic Complications and Unspecified Injuries |

Severity Adjustment: Used ICDMAP90 software to create Injury Severity Scores from primary and secondary ICD-9-CM diagnosis codes.

### Codes for Appendicitis

Case Definition

Acute Appendicitis

| | |
|---|---|
| 540.9 | Without Mention of Peritonitis |

Complex Appendicitis

| | |
|---|---|
| 540.0 | With Generalized Peritonitis |
| 540.1 | With Peritoneal Abscess |

Procedures

| | |
|---|---|
| 47.0 | Appendectomy |
| 47.01 | Laparoscopic Appendectomy |
| 47.09 | Other Appendectomy |

### Codes for Otitis Media

Case Definition

| | |
|---|---|
| 381 | Nonsuppurative Otitis Media and Eustachian Tube Disorders |
| 382 | Suppurative and Unspecified Otitis Media |

Procedures

| | |
|---|---|
| 20.01 | Myringotomy with Insertion of Tube |

Comorbidities

| | |
|---|---|
| 276.5 | Volume Depletion |

highest scores. The Injury Severity Score ranges from 0 to 75, with a score of 75 being assigned whenever any body system is scored as untreatable.

Injury Severity Scores less than 9 are considered to be of mild severity, scores between 9 and 16 are considered moderate severity, and scores above 16 are considered high severity. The Injury Severity Score correlates linearly with hospital mortality, morbidity, and hospital length of stay. This score is the cornerstone of injury research, in that it permits reliable assessment of risk-adjusted outcomes.

For conditions other than injury, we created indicator variables to describe the presence of comorbid conditions or whether the case was considered complex. ICD-9-CM diagnostic codes to describe complex cases and comorbid conditions are provided in Appendix Table 1.

In the outcomes analysis, logistic regression analysis was used for dichotomous outcomes to generate odds ratios comparing whether uninsured children were more or less likely to have the outcome of interest. An odds ratio significantly higher than 1 indicates the child is more likely to have the outcome, while an odds ratio significantly less than 1 indicates the child is less likely to have the outcome. For the hospital length of stay analysis, child length of stay was transformed by taking logarithms, and then linear regression was used to estimate predicted log-transformed length of stay as a function of age, severity of illness variables, and hospital characteristics. Finally, length of stay for insured and uninsured children was compared using retransformed outcomes based on normal theory methods with 90 percent confidence intervals.

---

[1] HCUP Databases, *Healthcare Cost and Utilization Project* (HCUP) (Rockville, MD: Agency for Healthcare Research and Quality, 2004).

[2] HCUP Kids' Inpatient Database (KID) (Rockville, MD: Agency for Healthcare Research and Quality, 2003).

[3] The 2000 sample includes: AZ, CA, CO, CT, FL, GA, HI, IA, KS, KY, MD, MA, ME, MO, NC, NJ, NY, OR, PA, SC, TN, TX, UT, VA, WA, WI, and WV. The 2003 sample includes all the states from the 2000 sample, except for ME and PA, and adds IL, IN, MI, MN, NE, NH, NV, OH, RI, SD, and VT.

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