## Title

The Association Between Insurance and Transfer of Noninjured Children From Emergency Departments



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# The Association Between Insurance and Transfer of Noninjured Children From Emergency Departments

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**Study objective:** Among children requiring hospital admission or transfer, we seek to determine whether insurance is associated with the decision to either admit locally or transfer to another hospital.

**Methods:** This cross-sectional study used Healthcare Cost and Utilization Project 2012 Nationwide Emergency Department Sample. Pediatric patients receiving care in emergency departments (EDs) who were either admitted or transferred were included. Clinical Classifications Software was used to categorize patients into noninjury diagnostic cohorts. Multivariable logistic regression models adjusting for potential confounders, including severity of illness and comorbidities, and incorporating nationally representative weights were used to determine the association between insurance and the odds of transfer relative to admission.

**Results:** A total of 240,620 noninjury pediatric ED events met inclusion criteria. Patient and hospital characteristics, including older age and nonteaching hospitals, were associated with greater odds of transfer relative to admission. Patients who were uninsured or had self-pay had higher odds of transfer (odds ratio [OR] 3.84; 95% confidence interval [CI] 2.08 to 7.09) relative to admission compared with those with private insurance. Uninsured and self-pay patients also had higher odds of transfer across all 13 diagnostic categories, with ORs ranging from 2.96 to 12.00. Patients with Medicaid (OR 1.05; 95% CI 0.90 to 1.22) and other insurances (OR 1.14; 95% CI 0.87 to 1.48) had similar odds of transfer compared with patients with private insurance.

**Conclusion:** Children without insurance and those considered as having self-pay are more likely to be transferred to another hospital than to be admitted for inpatient care within the same receiving hospital compared with children with private insurance. This study reinforces ongoing concerns about disparities in the provision of pediatric ED and inpatient care. [Ann Emerg Med. 2016;■:1-9.]

Please see page XX for the Editor's Capsule Summary of this article.

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## INTRODUCTION

### Background

Each year, more than 27 million children seek care in emergency departments (EDs) in the United States.[1] Many EDs, however, are not fully equipped with the recommended pediatric supplies[2] and may not have access to the pediatric specialists and resources needed to provide definitive care.[3,4] As a result, many children receiving treatment in EDs of hospitals with limited pediatric resources are transferred to another hospital's ED or inpatient unit for admission. Although interfacility transports of children are often warranted, the process of transferring to another hospital can create emotional and economic burdens on the patient and family, may involve expensive transport services,[5] and may result in higher overall hospital costs than if the child were cared for at the local hospital.[6]

### Importance

The Emergency Medical Treatment and Labor Act (EMTALA) requires hospitals to make decisions on patient transfer and admission independent of insurance status.[7] That is, the decision to transfer a patient to another hospital for admission should only depend on clinical factors or the need for specialty services. However, patterns observed in the medical literature evaluating adult patients have suggested that factors other than medical need are associated with decisions to admit locally or transfer a patient to another hospital for admission.[8-10] For example,

**Editor's Capsule Summary**

*What is already known on this topic*

Because many emergency departments (EDs) have limited pediatric capacity, children who seek care may require interfacility transfer.

*What question this study addressed*

Is the rate of interfacility transfer from the ED related to insurance status?

*What this study adds to our knowledge*

In a nationally representative database, approximately 2% of noninjury-related pediatric ED visits resulted in an interfacility transfer. Uninsured children had higher transfer rates compared with children with either private or public insurance.

*How this is relevant to clinical practice*

Lack of insurance appears to be a factor prompting an ED to transfer children.

*Research we would like to see*

It would be beneficial for these data to be reanalyzed with hospitals grouped by profit status to determine whether effect is greatest in for-profit hospitals.

factors such as a patient's age, sex, race, and insurance status have all been identified as independent factors associated with transfer to another hospital for admission.

Whether such factors are associated with admission decisions among the pediatric population is not well understood. This is particularly important given the fact that pediatric services are more regionalized than adult services.[11] Although there is some published evidence that suggests a child's insurance status could be associated with transfer and admission decisions, these studies have been restricted to single institutions or have been limited to specific conditions.[12,13] Whether transfer decisions among noninjured pediatric patients are related to insurance status has yet to be studied on a national level and across a variety of diagnoses.

### Goals of This Investigation

In this study, we sought to investigate the relationships between patient nonclinical factors, including insurance status, and odds of transfer relative to local admission among noninjury pediatric patients receiving care in the ED. As secondary analyses, we evaluated these associations among different diagnostic categories. We hypothesized that decisions about admission versus transfer among pediatric patients would be independent of insurance status.

### Study Design and Setting

The population used in this study was obtained from 2012 Nationwide Emergency Department Sample (NEDS),[14] the largest all-payer ED database in the United States. NEDS contains discharge information on more than 31 million ED visits from 950 hospitals located in 30 states and can be used to represent the nearly 134 million ED events estimated to have occurred in the United States in 2012. NEDS is a stratified, single-stage cluster sample constructed with the Healthcare Cost and Utilization Project State Emergency Department Databases[15] with discharge data on ED visits that do not result in an admission and the State Inpatient Databases[16] with information on patients initially treated in the ED and then admitted to the same hospital. Previous research has demonstrated that estimates from the NEDS are similar to those from other national ED databases, such as the National Hospital Ambulatory Medical Care Survey and National Electronic Injury Surveillance System–All Injury Program.[17] Nearly 100 patient- and hospital-related variables are collected in this database.

### Selection of Participants

Patients in this study included those aged 17 years and younger who were admitted ("admitted as an inpatient to this hospital") or transferred ("transferred to another short-term hospital"). ED events from hospitals in which pediatric patients were either all transferred (transfer rate of 100%) or all admitted (admission rate of 100%) were excluded from the analyses to exclude hospitals that had no means of admitting pediatric patients from the ED and hospitals that never transferred pediatric patients to another hospital (eg, a tertiary referral children's hospital).

We categorized insurance status (expected primary payer) into 4 groups: Medicaid, uninsured/self-pay, private (eg, Blue Cross, commercial carriers), and other insurance (eg, worker's compensation, other government programs). Pediatric patients with Medicare insurance were excluded because Medicare insurance is almost exclusively targeted to adults. Clinical Classifications Software[18] was used to classify illnesses and conditions into 18 categories based on individual *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) codes. We excluded pediatric patients with injuries because transfers for children with trauma frequently depend on regional hospital trauma designations. We also decided a priori to

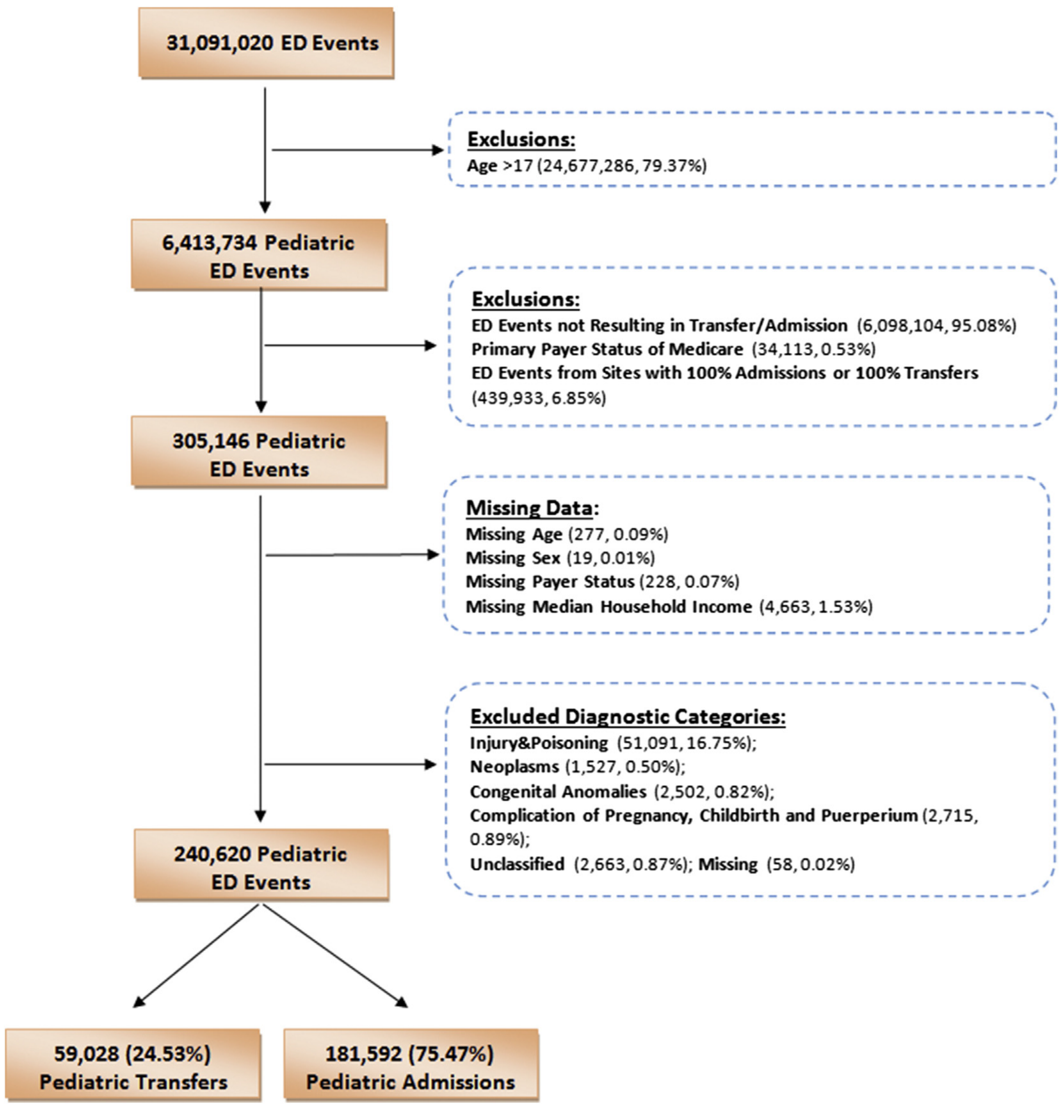


**Figure.** Overview of the study population.

exclude noninjury Clinical Classifications Software diagnostic categories that represented less than 1% of the total sample population.

### Methods of Measurement

The primary independent variable was insurance status. Other patient-level variables included age, sex, and quartile of median household income based on the patient's zip code (≥\$63,000, \$48,000 to \$62,999, \$39,000 to \$47,999, and \$1 to \$38,999). Age was categorized into tertiles of years: 0 to 1, 2 to 9, and 10 to 17 years. Hospital-level variables included hospital geographic region (Northeast, Midwest, South, and West), metropolitan setting, teaching status, and total number of annual ED visits. The NEDS metropolitan setting variable was categorized into metropolitan and nonmetropolitan in our study according to the county of the hospital as identified by the American Hospital Association. A teaching facility was defined as one having an American Medical Association–approved residency program, being a member of the Council of Teaching Hospitals, or having a ratio of full-time-equivalent interns and residents to beds of 0.25 or higher. Moreover, survey weights, with the American Hospital Association universe as the standard, were used to extrapolate NEDS sample ED events to the universe of ED events.[14]

To adjust for severity of illness and comorbidities, we generated 2 previously validated patient-level measures with *ICD-9-CM* codes. Severity scores (1=lowest severity to 5=highest severity) were generated with a consensus-derived, diagnosis-based severity classification system specifically created for emergency medical services for children.[19] Pediatric complex chronic conditions version

**Table 1.** Descriptive and univariable analyses by patient- and hospital-level characteristics.

| Patient, Hospital-Level Variables | Frequency (%) Admission (n=181,592) | Frequency (%) Transfer (n=59,028) | Odds of Transfer (95% CI)* |
|---|---|---|---|
| **Age, y** | | | |
| 0–1 | 65,202 (78.61) | 17,746 (21.39) | [Reference] |
| 2–9 | 58,771 (74.61) | 19,999 (25.39) | 1.24 (1.18–1.31) |
| 10–17 | 57,619 (73.03) | 21,283 (26.97) | 1.35 (1.20–1.52) |
| **Sex** | | | |
| Male | 97,539 (75.10) | 32,342 (24.90) | [Reference] |
| Female | 84,053 (75.90) | 26,686 (24.10) | 0.97 (0.93–1.01) |
| **Primary payer status** | | | |
| Private insurance | 65,137 (76.36) | 20,165 (23.64) | [Reference] |
| Medicaid | 105,206 (76.78) | 31,824 (23.22) | 0.97 (0.77–1.21) |
| Uninsured/self-pay | 5,055 (51.69) | 4,725 (48.31) | 2.97 (1.74–5.06) |
| Other | 6,194 (72.80) | 2,314 (27.20) | 1.18 (0.85–1.65) |
| **Median household income, 2012 $US** | | | |
| ≥63,000 | 37,376 (78.92) | 9,981 (21.08) | [Reference] |
| 48,000–62,999 | 40,491 (74.10) | 14,152 (25.90) | 1.33 (1.07–1.66) |
| 39,000–47,999 | 44,437 (72.07) | 17,217 (27.93) | 1.62 (1.07–2.45) |
| 1–38,999 | 59,288 (77.03) | 17,678 (22.97) | 1.09 (0.80–1.49) |
| **Hospital region** | | | |
| Northeast | 36,917 (84.83) | 6,603 (15.17) | [Reference] |
| Midwest | 37,849 (65.70) | 19,756 (34.30) | 3.12 (1.63–5.98) |
| South | 64,404 (74.18) | 22,415 (25.82) | 1.83 (1.14–2.93) |
| West | 42,422 (80.53) | 10,254 (19.47) | 1.28 (0.73–2.26) |
| **Teaching status** | | | |
| Teaching | 126,137 (88.39) | 16,570 (11.61) | [Reference] |
| Nonteaching | 55,455 (56.64) | 42,458 (43.36) | 5.82 (3.60–9.40) |
| **Metropolitan setting** | | | |
| Metropolitan | 169,137 (77.91) | 47,961 (22.09) | [Reference] |
| Nonmetropolitan | 12,455 (52.95) | 11,067 (47.05) | 3.29 (2.41–4.50) |
| **Neurologic and neuromuscular** | | | |
| No | 173,643 (75.51) | 56,312 (24.49) | [Reference] |
| Yes | 7,949 (74.53) | 2,716 (25.47) | 1.05 (1.002–1.10) |
| **Cardiovascular** | | | |
| No | 176,385 (75.52) | 57,167 (24.48) | [Reference] |
| Yes | 5,207 (73.67) | 1,861 (26.33) | 1.09 (1.04–1.15) |
| **Respiratory** | | | |
| No | 178,832 (75.48) | 58,091 (24.52) | [Reference] |
| Yes | 2,760 (74.66) | 937 (25.34) | 1.03 (0.96–1.10) |
| **Renal and urologic** | | | |
| No | 179,860 (75.48) | 58,427 (24.52) | [Reference] |
| Yes | 1,732 (74.24) | 601 (25.76) | 1.05 (0.96–1.15) |
| **Gastrointestinal** | | | |
| No | 175,291 (75.50) | 56,888 (24.50) | [Reference] |
| Yes | 6,301 (74.65) | 2,140 (25.35) | 1.04 (0.99–1.09) |
| **Hematologic or immunologic** | | | |
| No | 175,160 (75.40) | 57,156 (24.60) | [Reference] |
| Yes | 6,432 (77.46) | 1,872 (22.54) | 0.88 (0.81–0.95) |
| **Metabolic** | | | |
| No | 178,623 (75.49) | 57,992 (24.51) | [Reference] |
| Yes | 2,969 (74.13) | 1,036 (25.87) | 1.06 (1.00–1.14) |
| **Other congenital or genetic defect** | | | |
| No | 177,497 (75.55) | 57,448 (24.45) | [Reference] |
| Yes | 4,095 (72.16) | 1,580 (27.84) | 1.19 (1.12–1.25) |
| **Malignancy** | | | |
| No | 179,458 (75.52) | 58,171 (24.48) | [Reference] |
| Yes | 2,134 (71.35) | 857 (28.65) | 1.24 (1.14–1.34) |
| **Premature and neonatal** | | | |
| No | 180,377 (75.48) | 58,606 (24.52) | [Reference] |
| Yes | 1,215 (74.22) | 422 (25.78) | 1.07 (0.95–1.21) |

**Table 1.** Continued.

| Patient, Hospital-Level Variables | Frequency (%) Admission (n=181,592) | Frequency (%) Transfer (n=59,028) | Odds of Transfer (95% CI)* |
|---|---|---|---|
| **Technology dependence** | | | |
| No | 175,021 (75.51) | 56,771 (24.49) | [Reference] |
| Yes | 6,571 (74.43) | 2,257 (25.57) | 1.04 (0.99–1.10) |
| **Transplantation** | | | |
| No | 180,778 (75.47) | 58,764 (24.53) | [Reference] |
| Yes | 814 (75.51) | 264 (24.49) | 0.98 (0.85–1.13) |

*From logistic regression models adjusted for cluster, weight, and stratum.

2 classification system[20] was used to generate 12 complex chronic conditions diagnostic categories, including neurologic and neuromuscular, cardiovascular, respiratory, renal and urologic, gastrointestinal, hematologic or immunologic, metabolic, other congenital or genetic defect, malignancy, premature and neonatal, technology dependence, and transplantation. Both the severity classification system and the complex chronic conditions were included in the analyses to minimize the potential for confounding.

### Outcome Measures and Primary Data Analysis

The outcome of interest was whether a pediatric patient was admitted locally or transferred to another hospital for further care or admission. Descriptive and univariable analyses were used to summarize ED dispositions, diagnoses, and demographic factors. Multivariable logistic regression models incorporating survey weights were used to explore associations between insurance status and odds of transfer relative to admission. Other patient- and hospital-level variables described above were included in our models. Clusters and stratums were also adjusted for the complex design of the NEDS as a stratified, single-stage cluster sample.[14] The first-level analyses evaluated the entire eligible population, whereas secondary analyses determined the same relationships among each of the noninjury Clinical Classifications Software diagnostic categories.

All analyses were carried out with SAS (version 9.4; SAS Institute, Inc., Cary, NC), given $\alpha$=.05. The specific SAS code is available in Appendix E1 (available online at http://www.annemergmed.com). The institutional review board at the University of California, Davis approved this study.

## RESULTS

### Characteristics of Study Subjects

The complete 2012 NEDS sample contains 31,091,020 ED events from 950 hospitals, representing 134,399,179 ED events after applying weight adjustments for national estimates. Of this population, 2,156,598 (1.60%) were events resulting in a patient transfer to another acute care facility and 19,070,684 (14.19%) were events resulting in an admission to the presenting hospital. Our final study population included 240,620 pediatric ED events: 59,028 (24.53%) transfers and 181,592 (75.47%) admissions (Figure).

### Main Results

The frequency of transfer and admission related to patient- and hospital-level characteristics are shown in Table 1. Pediatric patients without insurance or self-pay were more likely to be transferred to another acute care hospital (odds ratio [OR] 2.97; 95% confidence interval [CI] 1.74 to 5.06) relative to admission compared with patients with private insurance. Additional patient- and hospital-level characteristics that were associated with decisions to transfer to another hospital included older age, middle household income ranges, nonteaching and nonmetropolitan hospitals, and EDs with lower annual volumes. Relative to hospitals in the Northeast region of the United States, children presenting to EDs in hospitals in the Midwest and South were more likely to be transferred. Patients with a higher severity score and those with pediatric complex chronic conditions, including neurologic and neuromuscular, cardiovascular, other congenital or genetic defect, and malignancy, also had higher odds of transfer.

In the adjusted multivariable analyses (Table 2), patients whose insurance status was categorized as uninsured or self-pay had almost 4 times the odds of transfer relative to admission compared with patients with private insurance (OR 3.84; 95% CI 2.08 to 7.09). Patients with Medicaid (OR 1.05; 95% CI 0.90 to 1.22) and other insurances (OR 1.14; 95% CI 0.87 to 1.48) had similar odds of transfer compared with those with private insurance. As shown in Table 2, other patient- and hospital-level characteristics were also associated with higher odds of transfer to another hospital, including older age, male sex, and those living in middle-household-income census ranges. In addition, nonteaching hospitals, hospitals in the Midwest, and EDs

**Table 2.** Adjusted odds of transfer to another hospital.

| Patient, Hospital-Level Variables (n=240,620) | Adjusted Odds of Transfer (95% CI)* |
|---|---|
| **Age, y** | |
| 0–1 | [Reference] |
| 2–9 | 1.27 (1.21–1.33) |
| 10–17 | 1.30 (1.11–1.52) |
| **Sex** | |
| Male | [Reference] |
| Female | 0.93 (0.91–0.96) |
| **Primary payer status** | |
| Private insurance | [Reference] |
| Medicaid | 1.05 (0.90–1.22) |
| Uninsured/self-pay | 3.84 (2.08–7.09) |
| Other | 1.14 (0.87–1.48) |
| **Median household income, 2012 $US** | |
| ≥63,000 | [Reference] |
| 48,000–62,999 | 1.39 (1.10–1.77) |
| 39,000–47,999 | 1.40 (1.02–1.92) |
| 1–38,999 | 1.03 (0.78–1.36) |
| **Hospital region** | |
| Northeast | [Reference] |
| Midwest | 2.07 (1.21–3.54) |
| South | 1.51 (0.92–2.46) |
| West | 0.78 (0.49–1.24) |
| **Teaching status** | |
| Teaching | [Reference] |
| Nonteaching | 3.88 (2.41–6.24) |
| **Metropolitan setting** | |
| Metropolitan | [Reference] |
| Nonmetropolitan setting | 0.88 (0.55–1.41) |
| Total number of ED visits (per 10,000) | 0.89 (0.83–0.95) |
| Severity score | 1.16 (1.10–1.22) |
| **Neurologic and neuromuscular** | |
| No | [Reference] |
| Yes | 1.03 (0.97–1.09) |
| **Cardiovascular** | |
| No | [Reference] |
| Yes | 1.09 (1.03–1.15) |
| **Respiratory** | |
| No | [Reference] |
| Yes | 0.99 (0.90–1.08) |
| **Renal and urologic** | |
| No | [Reference] |
| Yes | 0.98 (0.90–1.08) |
| **Gastrointestinal** | |
| No | [Reference] |
| Yes | 0.996 (0.93–1.07) |
| **Hematologic or immunologic** | |
| No | [Reference] |
| Yes | 0.83 (0.78–0.90) |
| **Metabolic** | |
| No | [Reference] |
| Yes | 1.05 (0.98–1.13) |
| **Other congenital or genetic defect** | |
| No | [Reference] |
| Yes | 1.18 (1.11–1.25) |
| **Malignancy** | |
| No | [Reference] |
| Yes | 1.29 (1.18–1.42) |
| **Premature and neonatal** | |
| No | [Reference] |
| Yes | 1.08 (0.95–1.24) |
| **Technology dependence** | |
| No | [Reference] |
| Yes | 0.99 (0.90–1.07) |
| **Transplantation** | |
| No | [Reference] |
| Yes | 0.95 (0.80–1.14) |

*From logistic regression models adjusted for age, sex, median household income, hospital region, teaching status, metropolitan setting, total number of ED visits, severity score, pediatric complex chronic conditions, cluster, weight, and stratum.

with lower annual volumes had higher odds of transfer. Patients with higher severity score and pediatric complex chronic conditions, including cardiovascular, other congenital or genetic defect, and malignancy, also were more likely to be transferred. The odds of transfer relative to admission also varied among diagnostic categories. Uninsured or self-pay patients had higher odds of transfer across all 13 diagnostic categories, with ORs ranging from 2.96 to 12.00 (Table 3). Patients with Medicaid were significantly more likely to be transferred with mental illness (OR 1.39; 95% CI 1.10 to 1.76) and circulatory system diseases (OR 1.30; 95% CI 1.01 to 1.68).

## LIMITATIONS

Several limitations should be considered when the findings of our study are interpreted. First, as a retrospectively collected administrative database, NEDS might be affected by inaccurate or incomplete coding. However, as noted,[14] this database is rigorously monitored and audited for coding accuracy to represent a reasonably reliable panorama of ED population characteristics. Second, the study was unable to fully account for all factors related to transfer decisions. For example, the database lacked information on other possible risk factors such as patient preference, bed availability, distance between hospitals, and the willingness of hospitals to accept a case. The database also lacked information on whether patients presenting to an ED were transferred from another ED. It is difficult to determine our findings as causal without considering this information. However, it is possible that these factors are highly correlated to variables in our multivariable models and would have been excluded from our models without affecting the final results. Third, some events were excluded from analyses because of missing variables. A total of 4,663 events (1.53%) were missing median household income, whereas 228 events (0.07%) were missing payer status. We also excluded events corresponding to noninjury Clinical Classifications

**Table 3.** Odds of transfer by diagnostic categories relative to other diagnoses.

| Disease Category | Frequency (%) Admission (n=181,592) | Frequency (%) Transfer (n=59,028) | Medicaid* | Uninsured/Self-pay* | Other* |
|---|---|---|---|---|---|
| Respiratory system diseases | 64,158 (79.82) | 16,218 (20.18) | 1.02 (0.85–1.22) | 4.28 (1.98–9.24) | 1.10 (0.79–1.54) |
| Digestive system diseases | 27,535 (81.44) | 6,275 (18.56) | 1.06 (0.93–1.21) | 3.19 (1.77–5.75) | 1.07 (0.85–1.36) |
| Mental illness | 15,325 (70.97) | 6,270 (29.03) | 1.39 (1.10–1.76) | 2.96 (1.91–4.59) | 1.00 (0.64–1.57) |
| Nervous system and sense organs diseases | 12,897 (66.08) | 6,620 (33.92) | 1.04 (0.89–1.22) | 4.72 (2.30–9.68) | 1.19 (0.84–1.70) |
| Symptoms, signs, and ill-defined conditions and factors influencing health status | 7,778 (42.35) | 10,589 (57.65) | 1.07 (0.91–1.25) | 4.31 (2.59–7.17) | 1.31 (0.91–1.90) |
| Endocrine, nutritional, and metabolic and immunity diseases | 11,780 (79.95) | 2,954 (20.05) | 1.03 (0.89–1.20) | 5.97 (2.64–13.50) | 1.23 (0.79–1.92) |
| Genitourinary system diseases | 8,824 (82.52) | 1,869 (17.48) | 1.09 (0.89–1.33) | 3.61 (1.59–8.19) | 0.88 (0.60–1.28) |
| Skin and subcutaneous tissue diseases | 8,381 (81.97) | 1,843 (18.03) | 1.13 (0.88–1.46) | 4.30 (2.17–8.51) | 0.86 (0.55–1.34) |
| Conditions originating in the perinatal period | 8,008 (82.74) | 1,670 (17.26) | 1.20 (0.98–1.48) | 3.96 (2.73–5.76) | 1.80 (0.86–3.76) |
| Infectious and parasitic diseases | 6,789 (85.26) | 1,174 (14.74) | 1.11 (0.83–1.48) | 3.60 (1.81–7.16) | 1.03 (0.61–1.73) |
| Blood and blood-forming organ diseases | 5,518 (83.66) | 1,078 (16.34) | 1.06 (0.78–1.45) | 12.00 (5.40–26.64) | 1.01 (0.62–1.65) |
| Circulatory system diseases | 2,243 (61.79) | 1,387 (38.21) | 1.30 (1.01–1.68) | 5.43 (2.56–11.53) | 1.06 (0.68–1.65) |
| Musculoskeletal system, connective tissue diseases | 2,356 (68.55) | 1,081 (31.45) | 0.94 (0.73–1.21) | 3.00 (1.60–5.61) | 0.92 (0.55–1.51) |

*From logistic regression models adjusted for age, sex, median household income, hospital region, teaching status, metropolitan setting, total number of ED visits, severity score, pediatric complex chronic conditions, cluster, weight, and stratum.

Software diagnostic categories that represented less than 1% of the sample population, and events from hospitals in which all pediatric patients were either transferred or admitted. Under this circumstance, misclassification and selection bias need to be considered. Moreover, there may have been some misclassification of patients' insurance status such that in the ED, patients' status could have been classified as uninsured but after transfer or admission could have been converted to emergency Medicaid. Last, NEDS is an ED event-level and not a patient-level database. Without unique patient identifiers, we could not link pre- and post-transfer events to evaluate patient outcomes and whether transfers were more or less appropriate. Therefore, although our study demonstrated differing transfer odds by insurance status, we could not know whether pediatric patients without insurance or reported as having self-pay received better or worse care than children with private or Medicaid insurance. Further studies are warranted to examine the effect of transfer and insurance status on patient outcomes.

## DISCUSSION

In our study of more than 240,000 noninjury-related pediatric transfers and admissions using a national sample of ED visits, we found that patients who were uninsured or reported as self-pay had almost 4 times the odds of being transferred relative to admission compared with patients with private insurance. This association was evident across all 13 diagnostic categories studied, suggesting a systematic bias toward admitting children with medical insurance and transferring those without insurance. Unlike previous studies of adult patients in the ED, our study did not find that Medicaid insurance was associated with higher odds of transfer.

An increasing focus has been placed on identifying and addressing disparities in health care among pediatric patients.[21] Our findings suggest that payer status, particularly lack of insurance, is likely to affect the care that pediatric patients receive in EDs and inpatient units. Similar findings have been documented among infants (aged 0 to 28 days)[12] and adults[8,10]: patients without insurance have been shown to have approximately 2 times the odds of transfer relative to patients with private insurance. Consistent with our results, those of a study of children with psychiatric-related ED visits demonstrated that patients with Medicaid were 10% more likely to be transferred compared with those with private insurance.[13] Patients without insurance, with Medicaid, and with other government insurance receive lower physician and hospital payments relative to those with private insurance,[8,22-24] and it is likely for this reason that we observe a similar phenomenon in EDs caring for pediatric patients. This finding is consistent with those of studies demonstrating that physicians are often reluctant to accept or provide care to patients with insurance plans providing lower reimbursement.[25-28]

Our results also suggest that insurance status is associated with transfer and admission decisions among a variety of patient diagnostic categories. Previous studies have shown similar associations among adult patients treated in EDs.[10,29-31] One potential explanation is that the availability of pediatric subspecialists varies and may influence admission and transfer decisions. Although regionalization of services can improve efficiency and outcomes for conditions such as trauma[32] and care for congenital heart disease,[33] regionalization may contribute to disparities in access for individuals living in rural and underserved communities. Regionalization also contributes to the fact that rural and underserved hospitals and EDs frequently lack equipment, experience, and personnel with subspecialty training.[2,34-37] The uneven distribution of resources and expertise[38,39] may explain some of our findings of varying odds of transfer for certain conditions, including pediatric cardiac services.[40,41]

In summary, we found that pediatric patients without insurance or reported as having self-pay are statistically more likely to be transferred to another hospital for inpatient care than to be admitted locally compared with children with private insurance. This finding was consistent across a variety of medical conditions. Our findings reinforce ongoing concerns about inequities in the delivery of care and call into question the effectiveness of the EMTALA to fully prevent differential care. Further surveillances of EDs, hospitals, and rates of transfer should be monitored to validate our findings. Future research should also evaluate the effect of admission and transfer decisions on patient outcomes and costs of care.

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*Author contributions:* YH and JPM had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the results. All authors were involved in the study concept and design and statistical analyses. YH conducted the statistical analyses and drafted the article, and all authors contributed substantially to its revision. JPM supervised the study. YH takes responsibility for the paper as a whole.

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## REFERENCES

1. Bourgeois FT, Shannon MW. Emergency care for children in pediatric and general emergency departments. *Pediatr Emerg Care*. 2007;23:94-102.
2. Middleton KR, Burt CW. Availability of pediatric services and equipment in emergency departments: United States, 2002-03. *Adv Data*. 2006;367:1-16.
3. Li J, Monuteaux MC, Bachur RG. Interfacility transfers of noncritically ill children to academic pediatric emergency departments. *Pediatrics*. 2012;130:83-92.
4. Walls TA, Chamberlain JM, Klein BL. Factors associated with emergency department discharge after pediatric interhospital transport: a role for outreach education? *Pediatr Emerg Care*. 2015;31:10-14.
5. Goh AY, Mok Q. Centralization of paediatric intensive care: are critically ill children appropriately referred to a regional centre? *Intensive Care Med*. 2001;27:730-735.
6. Odetola FO, Clark SJ, Gurney JG, et al. Effect of interhospital transfer on resource utilization and outcomes at a tertiary pediatric intensive care unit. *J Crit Care*. 2009;24:379-386.
7. Bitterman RA. *Providing Emergency Care Under Federal Law: EMTALA*. Dallas, TX: American College of Emergency Physicians; 2000:15-22.
8. Kindermann DR, Mutter RL, Cartwright-Smith L, et al. Admit or transfer? the role of insurance in high-transfer-rate medical conditions in the emergency department. *Ann Emerg Med*. 2014;63:561-571.e568.
9. Lee TM. An EMTALA primer: the impact of changes in the emergency medicine landscape on EMTALA compliance and enforcement. *Ann Health Law*. 2004;13:145-178.
10. Babu MA, Nahed BV, Demoya MA, et al. Is trauma transfer influenced by factors other than medical need? an examination of insurance status and transfer in patients with mild head injury. *Neurosurgery*. 2011;69:659-667.
11. Marcin JP. Telemedicine in the pediatric intensive care unit. *Pediatr Clin North Am*. 2013;60:581-592.
12. Durbin DR, Giardino AP, Shaw KN, et al. The effect of insurance status on likelihood of neonatal interhospital transfer. *Pediatrics*. 1997;100:E8.
13. Mahajan P, Alpern ER, Grupp-Phelan J, et al. Epidemiology of psychiatric-related visits to emergency departments in a multicenter collaborative research pediatric network. *Pediatr Emerg Care*. 2009;25:715-720.
14. Healthcare Cost and Utilization Project (HCUP). Overview of the Nationwide Emergency Department Sample (NEDS). 2016. Available at: http://www.hcup-us.ahrq.gov/nedsoverview.jsp. Accessed March 6, 2016.
15. Healthcare Cost and Utilization Project (HCUP). Overview of the State Emergency Department Databases (SEDD). 2016. Available at: http://www.hcup-us.ahrq.gov/seddoverview.jsp. Accessed March 6, 2016.
16. Healthcare Cost and Utilization Project (HCUP). Overview of the State Inpatient Databases (SID). 2016. Available at: http://www.hcup-us.ahrq.gov/sidoverview.jsp. Accessed March 6, 2016.
17. Owens PL, Barrett ML, Gibson TB, et al. Emergency department care in the United States: a profile of national data sources. *Ann Emerg Med*. 2010;56:150-165.
18. Healthcare Cost and Utilization Project (HCUP). Clinical Classifications Software (CCS) for ICD-9-CM. 2016. Available at: http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp. Accessed March 6, 2016.
19. Alessandrini EA, Alpern ER, Chamberlain JM, et al. Developing a diagnosis-based severity classification system for use in emergency medical services for children. *Acad Emerg Med*. 2012;19:70-78.
20. Feudtner C, Feinstein JA, Zhong W, et al. Pediatric complex chronic conditions classification system version 2: updated for *ICD-10* and complex medical technology dependence and transplantation. *BMC Pediatr*. 2014;14:199.
21. Fiscella K, Franks P, Gold MR, et al. Inequality in quality: addressing socioeconomic, racial, and ethnic disparities in health care. *JAMA*. 2000;283:2579-2584.
22. Spain DA, Bellino M, Kopelman A, et al. Requests for 692 transfers to an academic level I trauma center: implications of the Emergency Medical Treatment and Active Labor Act. *J Trauma*. 2007;62:63-67.
23. Nathens AB, Maier RV, Copass MK, et al. Payer status: the unspoken triage criterion. *J Trauma*. 2001;50:776-783.

24. Tershakovec AM, Watson MH, Wenner WJ Jr, et al. Insurance reimbursement for the treatment of obesity in children. *J Pediatr*. 1999;134:573-578.
25. Mann C, Weil AR. Medicaid moving forward. *Health Aff (Millwood)*. 2015;34:1092-1095.
26. Wilson JJ, Harris EF. Compliance by state-subsidized and self-pay orthodontic patients. *Am J Orthod Dentofacial Orthop*. 2015;148:628-632.
27. Menchine MD, Baraff LJ. On-call specialists and higher level of care transfers in California emergency departments. *Acad Emerg Med*. 2008;15:329-336.
28. Rudkin SE, Langdorf MI, Oman JA, et al. The worsening of ED on-call coverage in California: 6-year trend. *Am J Emerg Med*. 2009;27:785-791.
29. Archdeacon MT, Simon PM, Wyrick JD. The influence of insurance status on the transfer of femoral fracture patients to a level-I trauma center. *J Bone Joint Surg*. 2007;89:2625-2631.
30. Thakur NA, Plante MJ, Kayiaros S, et al. Inappropriate transfer of patients with orthopaedic injuries to a Level I trauma center: a prospective study. *J Orthop Trauma*. 2010;24:336-339.
31. Gurwitz JH, Goldberg RJ, Malmgren JA, et al. Hospital transfer of patients with acute myocardial infarction: the effects of age, race, and insurance type. *Am J Med*. 2002;112:528-534.
32. Husain A, Fuchs S. A national effort requiring local solutions: regionalization of pediatric emergency care. *Clin Pediatr Emerg Med*. 2014;15:79-88.
33. Klitzner TS, Chang R-KR. Regionalization of pediatric cardiac services: from theory to practice. *Prog Pediatr Cardiol*. 2003;18:43-47.
34. Menke TJ, Wray NP. When does regionalization of expensive medical care save money? *Health Serv Manag Res*. 2001;14:116-124.
35. Lyon M, Sturgis L, Lendermon D, et al. Rural ED transfers due to lack of radiology services. *Am J Emerg Med*. 2015;33:1630-1634.
36. Schappert SM, Bhuiya F. Availability of pediatric services and equipment in emergency departments: United States, 2006. *Natl Health Stat Rep*. 2012;47:1-21.
37. Athey J, Dean JM, Ball J, et al. Ability of hospitals to care for pediatric emergency patients. *Pediatr Emerg Care*. 2001;17:170-174.
38. Cone DC, Brooke Lerner E, Band RA, et al. Prehospital care and new models of regionalization. *Acad Emerg Med*. 2010;17:1337-1345.
39. Institute of Medicine. IOM report: the future of emergency care in the United States health system. *Acad Emerg Med*. 2006;13:1081-1085.
40. Chang RK, Klitzner TS. Can regionalization decrease the number of deaths for children who undergo cardiac surgery? a theoretical analysis. *Pediatrics*. 2002;109:173-181.
41. Chang RK, Klitzner TS. Resources, use, and regionalization of pediatric cardiac services. *Curr Opin Cardiol*. 2003;18:98-101.

## APPENDIX E1

### SAS commands used for survey regression analyses

We present an overview of steps performed in our study with actual SAS commands.

1. Used Clinical Classification Software (CCS) to classify diagnoses into a limited number of categories through aggregating individual *ICD-9-CM* codes.[18]

2. Merged NEDS Core File with multi-level CCS file generated in step 1.

3. Final data preparation.

```
/*Defined Library*/
Libname NEDS "C:\Work File\2012 NEDS\SAS Data"; run;
/*Excluded Emergency Department (ED) Events from Sites with 100% Admissions or 100% Transfers*/
/*Obtained hospital rate=transfer/admission
1. Generated an Excel file
2. Calculated hospital rate in the Excel file
3. Imported the updated Excel file into SAS */
Ods csv file="C:\Work File\2012 NEDS\SAS results\newrate.csv";
proc freq Data=NEDS. new_multi_ccs;
table hosp_ed*EDevent/ nocol norow nopercent;
where EDevent in (2,3); run;
ods csv close;
Data NEDS. rate; set rate;
NewRate=.;
NewRate=Rate;
if NewRate gt 0;
keep hosp_ed;
run;
/*Combined dataset generated in step 2 and NEDS. rate file*/
Proc sql noprint;
create table NEDS. new3 as
select a. *, b. NewRate
from NEDS.new_multi_ccs a, NEDS. rate b
where a. hosp_ed=b. hosp_ed;
quit;
/*Data selection criteria
1. Age ≤17
2. ED events resulting in transfer/admission
3. Primary payer status: private insurance, Medicaid, uninsured and other*/
Data new1; set NEDS. new3;
if AGE le 17; /*pediatric*/
if PAY1 ne 1; /*no Medicare*/
if EDevent in (2,3); /*outcomes: transfer/admission*/
keep DX1-DX15 PR1-PR15 L1DCCS1 AGE FEMALE PAY1 EDevent discwt ZIPINC_QRTL hosp_ed NEDS_stratum;
run;
/*Excluded missing data after checking frequencies of all variables in the dataset */
Data new2; set new1;
if FEMALE ge 0;
if ZIPINC_QRTL gt 0;
if AGE ge 0;
if PAY1 ge 1;
run;
/*Excluded diagnostic categories that did not meet our data selection criteria
1. Injury&poisoning
2. Neoplasms
3. Congenital anomalies
4. Complication of pregnancy, childbirth and puerperium
5. Unclassified
6. Missing*/
Data NEDS.new3; set new2;
if L1DCCS1 ne "16" and L1DCCS1 ne "2" and L1DCCS1 ne "14" and L1DCCS1 ne "18" and L1DCCS1 ne "11" and L1DCCS1 ne " ";
run;
/*Define New Variables*/
Data NEDS.new4; set NEDS.new3;
/*transfer status*/
Transfer=.;
if EDevent=2 then transfer=0;/*admission*/
if EDevent=3 then transfer=1;/*transfer*/
/*Insurance*/
Pay=.;
if PAY1=2 then Pay=1; /*Medicaid*/
if PAY1=3 then Pay=0; /*private insurance__reference*/
if PAY1 in (4, 5) then Pay=2; /*uninsured*/
if PAY1=6 then Pay=3; /*others*/
/*Age*/
Age_v2=.;
if Age ge 0 and Age le 1 then Age_v2=0;/*0-1*/
if Age ge 2 and Age le 9 then Age_v2=1; /*2-9*/
if Age ge 10 and Age le 17 then Age_v2=2; /*10-17*/
keep L1DCCS1 DX1-DX15 PR1-PR15 transfer Pay Age_v2 FEMALE ZIPINC_QRTL discwt hosp_ed NEDS_stratum;
run;
/*Obtained severity scores
Used diagnosis-based severity classification system using ICD-9-CM codes across all 15 diagnoses to obtain severity scores (1=lowest severity to 5=highest severity).19
Treated the highest severity scores of all 15 diagnoses as the final severity score for the event. If all were missing, we treated its severity score as 1.*/
```

```
Data serv2; set Serv1;
S1=.;
S1=Severity_Score1;
S2=.;
S2=Severity_Score2;
S3=.;
S3=Severity_Score3;
S4=.;
S4=Severity_Score4;
S5=.;
S5=Severity_Score5;
S6=.;
S6=Severity_Score6;
S7=.;
S7=Severity_Score7;
S8=.;
S8=Severity_Score8;
S9=.;
S9=Severity_Score9;
S10=.;
S10=Severity_Score10;
S11=.;
S11=Severity_Score11;
S12=.;
S12=Severity_Score12;
S13=.;
S13=Severity_Score13;
S14=.;
S14=Severity_Score14;
S15=.;
S15=Severity_Score15;
xDX1=.; xDX1=DX1;
xDX2=.; xDX2=DX2;
xDX3=.; xDX3=DX3;
xDX4=.; xDX4=DX4;
xDX5=.; xDX5=DX5;
xDX6=.; xDX6=DX6;
xDX7=.; xDX7=DX7;
xDX8=.; xDX8=DX8;
xDX9=.; xDX9=DX9;
xDX10=.; xDX10=DX10;
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xDX15=.; xDX15=DX15;
xPR1=.; xPR1=PR1;
xPR2=.; xPR2=PR2;
xPR3=.; xPR3=PR3;
xPR4=.; xPR4=PR4;
xPR5=.; xPR5=PR5;
xPR6=.; xPR6=PR6;
xPR7=.; xPR7=PR7;
xPR8=.; xPR8=PR8;
xPR9=.; xPR9=PR9;
xPR10=.; xPR10=PR10;
xPR11=.; xPR11=PR11;
xPR12=.; xPR12=PR12;
xPR13=.; xPR13=PR13;
xPR14=.; xPR14=PR14;
xPR15=.; xPR15=PR15;
severity=.;
if S1=5 or S2=5 or S3=5 or S4=5 or S5=5 or S6=5 or S7=5 or S8=5 or S9=5 or S10=5 or S11=5 or S12=5 or S13=5 or S14=5 or S15=5 then severity=5;
else if S1=4 or S2=4 or S3=4 or S4=4 or S5=4 or S6=4 or S7=4 or S8=4 or S9=4 or S10=4 or S11=4 or S12=4 or S13=4 or S14=4 or S15=4 then severity=4;
else if S1=3 or S2=3 or S3=3 or S4=3 or S5=3 or S6=3 or S7=3 or S8=3 or S9=3 or S10=3 or S11=3 or S12=3 or S13=3 or S14=3 or S15=3 then severity=3;
else if S1=2 or S2=2 or S3=2 or S4=2 or S5=2 or S6=2 or S7=2 or S8=2 or S9=2 or S10=2 or S11=2 or S12=2 or S13=2 or S14=2 or S15=2 then severity=2;
else if S1=1 or S2=1 or S3=1 or S4=1 or S5=1 or S6=1 or S7=1 or S8=1 or S9=1 or S10=1 or S11=1 or S12=1 or S13=1 or S14=1 or S15=1 then severity=1;
else severity=1;
keep L1DCCS1 transfer Pay Age_v2 FEMALE ZIPINC_QRTL discwt hosp_ed NEDS_stratum severity xDX1-xDX15 xPR1-xPR15;
run;
/*Obtained pediatric complex chronic conditions (CCC)
Used pediatric CCC version 2 classification system using ICD-9-CM codes to generate 12 CCC diagnostic categories, including neurologic and neuromuscular, cardiovascular, respiratory, renal and urologic, gastrointestinal, hematologic or immunologic, metabolic, other congenital or genetic defect, malignancy, premature and neonatal, technology dependence, and transplantation.[20] */
/*Combine severity score, CCC and NEDS.new4*/
/*Hospital data
1. Checked missing data__no missing data
2. Defined new variables */
Proc freq; table HOSP_UR_TEACH TOTAL_EDvisits HOSP_URCAT4; run;
Data NEDS. hospital; set NEDS. neds_2012_hospital;
/*Teaching status*/
teaching=.;
if HOSP_UR_TEACH in (0,2) then teaching=0; /*non-teaching*/
```

```
if HOSP_UR_TEACH =1 then teaching =1;
/*teaching*/
/*Total number of ED visits (/10,000)*/
volume=TOTAL_EDvisits/10000;
/*Metropolitan setting*/
metropolitan=.;
if HOSP_URCAT4 in (1,2,7,8) then metropolitan=1;
/*metropolitan*/
if HOSP_URCAT4 in (3, 4, 9) then metropolitan=0;
/*non-metropolitan*/
keep hosp_ed NEDS_stratum HOSP_REGION
teaching volume metropolitan;
run;
/*Combined all datasets and obtained the final targeted
dataset*/
Proc sql noprint;
create table new5 as
select a. *, b. HOSP_REGION, b. teaching, b. volume,
b. metropolitan
from serv1 a, NEDS. hospital b
where a. hosp_ed=b. hosp_ed;
quit;
/*Obtained the final dataset
Considered the design of NEDS, we need to use the whole
data to conduct analyses.
We used the method suggested by the Healthcare Cost and
Utilization Project.
(http://www.hcup-us.ahrq.gov/reports/methods/2003_02.
pdf) */
Data NEDS. new6;
set new5 NEDS. hospital(in=inhosp keep=hosp_ed
NEDS_stratum);
insubset = 1;
if inhosp Then do;
insubset = 2; /*Assign a value outside the subset*/
discwt = 1; /*Assign a valid weight*/
transfer= 0; /*Set analysis variables to zero*/
teaching = 0;
volume = 0;
metropolitan = 0;
Age_v2=0;
Pay=0;
ZIPINC_QRTL=4;
FEMALE=0;
HOSP_REGION=1;
severity=0;
neuromusc_ccc=0;
cvd_ccc=0;
respiratory_ccc=0;
renal_ccc=0;
gi_ccc=0;
hemato_immu_ccc=0;
metabolic_ccc=0;
congeni_genetic_ccc=0;
malignancy_ccc=0;
neonatal_ccc=0;
tech_dep_ccc=0;
transplant_ccc=0;
end;
run;
```

4. Ran descriptive and univariable analyses by patient and hospital level characteristics using survey weights to approximate US estimates.

```
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
model transfer (ref="0") =severity;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class Pay (ref="0")/param=ref;
model transfer (ref="0") =Pay;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class FEMALE (ref="0")/param=ref;
model transfer (ref="0") =FEMALE;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class HOSP_REGION (ref="1")/param=ref;
model transfer (ref="0") =HOSP_REGION;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class ZIPINC_QRTL(ref="4")/param=ref;
model transfer (ref="0") =ZIPINC_QRTL;
```

```
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class metropolitan(ref="1")/param=ref;
model transfer (ref="0") =metropolitan;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class Age_v2(ref="0")/param=ref;
model transfer (ref="0") =Age_v2;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class teaching(ref="1") /param=ref;
model transfer (ref="0") =teaching;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class neuromusc_ccc (ref="0") /param=ref;
model transfer (ref="0") =neuromusc_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class cvd_ccc (ref="0") /param=ref;
model transfer (ref="0") =cvd_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class respiratory_ccc (ref="0") /param=ref;
model transfer (ref="0") =respiratory_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class renal_ccc (ref="0") /param=ref;
model transfer (ref="0") =renal_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class gi_ccc (ref="0") /param=ref;
model transfer (ref="0") =gi_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class hemato_immu_ccc (ref="0") /param=ref;
model transfer (ref="0") =hemato_immu_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class metabolic_ccc (ref="0") /param=ref;
model transfer (ref="0") =metabolic_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class congeni_genetic_ccc (ref="0") /param=ref;
model transfer (ref="0") =congeni_genetic_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class malignancy_ccc (ref="0") /param=ref;
model transfer (ref="0") =malignancy_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
```

```
class neonatal_ccc(ref="0") /param=ref;
model transfer (ref="0") =neonatal_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class tech_dep_ccc(ref="0") /param=ref;
model transfer (ref="0") =tech_dep_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class transplant_ccc(ref="0") /param=ref;
model transfer (ref="0") =transplant_ccc;
run;
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
model transfer (ref="0") =volume;
run;
```

5. Ran multivariable logistic regression incorporating survey weights and adjusting for cluster, stratum, and confounders.

```
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class HOSP_REGION (ref="1")
ZIPINC_QRTL(ref="4") Age_v2(ref="0") Pay (ref="0")
metropolitan(ref="1") teaching(ref="1") /param=ref;
model transfer (ref="0") =teaching Pay FEMALE
HOSP_REGION ZIPINC_QRTL metropolitan Age_v2
volume neuromusc_ccc cvd_ ccc respiratory_ccc renal_ccc
gi_ccc hemato_immu_ccc metabolic_ccc
congeni_genetic_ccc malignancy_ccc neonatal_ccc
tech_dep_ccc transplant_ccc severity;
run;
```

6. Ran multivariable logistic regression in different diagnoses incorporating survey weights and adjusting for cluster, stratum, and confounders.

```
Proc surveylogistic Data=NEDS. new6 Rate=0.2;
domain insubset*L1DCCS1;
strata NEDS_stratum;
cluster hosp_ed;
weight discwt;
class HOSP_REGION (ref="1")
ZIPINC_QRTL(ref="4") Age_v2(ref="0") Pay (ref="0")
metropolitan(ref="1") teaching(ref="1")/param=ref;
model transfer (ref="0") =teaching Pay FEMALE
HOSP_REGION ZIPINC_QRTL metropolitan Age_v2
volume neuromusc_ccc cvd_ccc respiratory_ccc renal_ccc
gi_ccc hemato_immu_ccc metabolic_ccc
congeni_genetic_ccc malignancy_ccc neonatal_ccc
tech_dep_ccc transplant_ccc severity;
run;
```