The Effect of Insurance Status on Likelihood of Neonatal Interhospital Transfer

Dennis R. Durbin, MD, MS*‡; Angelo P. Giardino, MD, M.SEd*; Kathy N. Shaw, MD, MS*‡; Mary C. Harris, MD*; and Jeffrey H. Silber, MD, PhD*‡

ABSTRACT. Objective. To determine the effect of insurance status on the likelihood of interhospital transfer for neonates.


Setting. All general acute care nonpediatric hospitals in the five counties of southeastern Pennsylvania.

Patients. Fifty-six thousand, seven hundred eighty-nine infants from 0 to 28 days of age admitted to or born in study hospitals between January 1 and December 31, 1991.

Intervention. None.

Main Outcome Measure. Transfer to another general or specialty acute care hospital.

Results. The incidence (95% confidence interval) of interhospital transfer was 1.69% (1.60, 1.78). Uninsured infants were nearly twice as likely [relative risk (RR) = 1.96 (1.67, 2.31)] to be transferred as commercially insured infants, even when adjusted for the effects of prematurity, severity of illness, and the level of neonatal intensive care unit in the referring hospital. Similarly, infants with Medicaid were more likely to be transferred [RR = 1.20 (1.01, 1.43)] than similar commercially insured neonates. Uninsured and publically insured infants were also more likely to be born premature [RR 1.49 (1.39, 1.60)] than privately insured neonates, and were more likely to have both moderate [RR 1.11 (1.04, 1.23)] and high [RR 1.21 (1.11, 1.32)] illness severity on admission to the hospital than privately insured infants.

Conclusions. Neonates with no insurance and those with Medicaid coverage were more likely to be transferred than infants with private insurance. These results are consistent with those of other investigators who have studied financially motivated patient transfers—so-called patient dumping—in nonpediatric populations of patients. Our study may represent the first documentation of this phenomenon in a pediatric population. Our results are also consistent with those of other investigators who have examined the effect of insurance status on maternal interhospital transfer, thus providing further evidence for the existence of financially motivated transfers within regional systems of perinatal care. Future investigation into the effect of economic factors on variation in the utilization of transport services, and on how transfer influences ultimate patient outcome, is needed as managed care health systems become more widespread. Pediatrics 1997;100(3). URL: http://www.pediatrics.org/cgi/content/full/100/3/e8

Infants born in hospitals with neonatal intensive care units (NICUs), or transferred to such hospitals shortly after birth, have lower rates of morbidity and mortality than comparable infants born and remaining in hospitals without NICUs.1–5 This effect has led to the establishment of regionally organized and coordinated perinatal services in many areas of the country.6–9 Effective regionalization involves the antepartum identification of high-risk deliveries with timely referral of mothers (maternal transfer) or infants (neonatal transfer) to specialized institutions with resources for both high-risk maternal and infant care. Interhospital transport services are an important component of regionalized systems of perinatal care, linking hospitals with concentrated specialty services to several community hospitals serving a large population base. Investigating the practice of neonatal interhospital transport provides insight into the organization and effectiveness of regional perinatal care. In an ideal regionalized system of perinatal care, the patient’s diagnosis and severity of illness, and the resources of the birth hospital, are expected to be the primary determinants of transfer. However, evolution of managed care health systems and the development of regional networks consisting of multiple hospitals will likely change the face of regionalized perinatal care in many regions of the country. Recently, a trend toward deregionalization of perinatal care in several regions of the country has been described.8,9 In regions where multiple hospitals with the capacity to care for newborns exist, competition for certain subgroups of children, based on their insurance coverage, may occur.8

Recently, Bronstein and others10 reported that white women with high-risk pregnancies and Medicaid coverage were more likely to be transferred than similar women without Medicaid. Similarly, several investigators have described the inappropriate transfer of uninsured and minority patients from community hospitals to large public hospitals and...
academic medical centers solely for financial reasons, so called patient dumping, in populations of adult emergency department patients.\textsuperscript{11-13}

Alternatively, results of several studies suggest that uninsured or publicly insured patients, and those of low socioeconomic status, generally do not receive the same access to specialized care as patients with private insurance or higher socioeconomic class.\textsuperscript{14-16} Therefore, the objective of this study was to determine the effect of insurance status on likelihood of interhospital transfer for neonates. We hypothesized that uninsured and publicly insured newborns would be transferred at different rates than privately insured children, even when adjusted for relevant clinical characteristics of patients, and the resources in the referring hospital.

**METHODS**

A population-based retrospective cohort study design was used to determine the effect of insurance status (exposure of interest) on risk of neonatal interhospital transfer (dependent variable). All infants from 0 to 28 days of age admitted to or born in an acute care hospital in the five counties of southeastern Pennsylvania (Bucks, Chester, Delaware, Montgomery, and Philadelphia) between January 1 and December 31, 1991 were eligible for study.

Specifically excluded were children admitted directly (not transferred) to either of the two free-standing pediatric hospitals in the study region because the study intended to focus on the transfer of children from nonspecialty hospitals. Transfers from tertiary care pediatric hospitals generally represent back transfers of a patient to a hospital closer to home after initial stabilization and treatment. These children represent a clinically distinct group of transfers, the determinants of which may differ from patients transferred from a general acute care hospital, and were not the focus of this study.

Patient data were obtained from the Pennsylvania Health Care Cost Containment Council (PHC4), an independent state agency created by the Pennsylvania General Assembly in 1986. PHC4 collects demographic, billing, clinical, and outcomes data on every patient, including newborns, admitted to every hospital in the state. Included in the discharge abstract are patient and hospital demographics, up to five discharge diagnoses coded using the International Classification of Diseases, 9th Clinical Modification (ICD-9CM), up to three procedure codes, hospital and professional charges, a method of classifying severity of illness, and discharge disposition. Data on hospital NICU level were obtained from the State Department of Health which designates and licenses NICUs for every hospital in Pennsylvania.

Severity of illness was determined using the MedisGroups severity classification system, which is a proprietary system that relies on a detailed abstraction of a patient’s medical record after discharge.\textsuperscript{17} It has been used extensively as a method to adjust case-mix for severity of illness in studies of patient outcomes and hospital effectiveness and efficiency.\textsuperscript{18-20} Severity of illness is determined by review of more than 500 key clinical findings including laboratory, radiology, pathology, history, and physical examination results. An admission severity group score, ranging from 0 (lowest severity) to 4 (highest severity), is provided to the PHC4 and is based on cutoffs of predicted probability of death determined by multivariable logistic regression models that incorporate a patient’s complement of key clinical findings (as independent variables) to calculate a continuous predicted probability of death.\textsuperscript{21} The admission severity group score (from 0 to 4) supplied to Pennsylvania was determined by MediQual in the following way: severity group 1 patients had predicted probabilities of death of 0.001 or less; level 2 patients had predicted probabilities of death of 0.012 and 0.057; level 3 patients had predicted probabilities of death between 0.058 and 0.499; and level 4 patients had predicted probabilities of death $\geq 0.5$. In the current study, patients were grouped as mild severity (MedisGroups level 0), moderate severity (levels 1 and 2), and maximum severity (levels 3 and 4). These groups were felt to define the most clinically meaningful differences in risk of death.

The presence and level of a NICU in the study hospitals were determined according to data from the Pennsylvania State Department of Health. The Department of Health categorizes NICUs as either level 1 or level 2 based on the three-tiered model recommended by the Committee on Perinatal Health.\textsuperscript{7} Level 1 hospitals were defined as those with only a full-term newborn nursery or with no newborn or maternity services. It should again be noted that the two free-standing pediatric hospitals in the study region were not included for study as primary (ie, referring) hospitals. Each has a level 3 NICU licensed by the State Department of Health.

Premature infants were identified as patients with a principal or up to four secondary ICD-9CM discharge diagnosis codes of 765.0 to 765.19. These codes correspond to patients with extreme immaturity, defined as birth weight $<1000$ g and/or gestational age $<28$ completed weeks, and other preterm infants, defined as a birth weight of 1000 to 2499 g and/or a gestation of 28 to 37 completed weeks.

Insurance status, determined at discharge, represented the principal source of payment for the patient’s hospitalization. Thirteen different categories of insurance status are recognized in the PHC4 database: self-pay, Medicaid, Medicare, Blue Cross, commercial, health maintenance organization/preferred provider organization (HMO/PPS), Health and Welfare Fund, Workman’s Compensation, CAT Fund, other government programs, commercial, other programs (both exceedingly rare among children), and both Medicaid managed care and fee-for-service coverage, HMO, including non-Medicaid managed care and PPO coverage, and commercial, including all private, commercially available indemnity insurance, and other miscellaneous forms of insurance. This categorization scheme was based on the most common ways that previous studies have classified insurance status.\textsuperscript{14-16} In some analyses, insurance status was further grouped as nonprivate, in which the Medicaid and no insurance groups were combined, and private, in which the HMO and commercial insurance groups were combined.

The outcome of interest, an interhospital transfer, was identified in the PHC4 database using discharge status codes corresponding to either transfer to an acute care facility or transfer to another type of institution. PHC4 categorizes pediatric hospitals as another type of institution. Children transferred to skilled or intermediate nursing facilities were included in the study but were not counted as an acute care interhospital transfer.

The incidence of interhospital transfer was calculated with associated 95% confidence intervals (CI). The unadjusted association of each independent variable with the outcome of transfer was determined using the $\chi^2$ test. Unadjusted relative risks (RRs) with associated 95% CIs were calculated for each covariate-outcome pair. In addition, we determined the unadjusted association of insurance status with the other covariates under study to examine its relationship to clinical variables such as prematurity and severity of illness. A multivariable logistic regression model was then constructed to determine the effect of insurance status on risk of transfer that was simultaneously adjusted for the effects of every other covariate in the model. Adjusted RRs of transfer (with 95% CIs) were calculated for each independent variable in the model. Univariate analyses were performed using EpInfo (Centers for Disease Control and Prevention, Atlanta, GA) version 6, whereas multivariable logistic regression analyses were performed using the SAS (SAS Institute, Cary, NC) statistical software package.

**RESULTS**

In 1991, neonates (n = 56 789) represented 54.3% of the 104 593 children admitted to study hospitals during the year. There were 963 acute care transfers identified, for an incidence (95% CI) of transfer of
1.69% (1.60, 1.78). Basic descriptive statistics on the study population are given in Table 1. The population was divided nearly in half between boys (51.3%) and girls (48.7%). Approximately 7% of infants were born premature according to ICD-9CM discharge diagnosis codes. The majority (82.8%) of infants were born in or admitted to hospitals with level 2 or 3 NICUs, with relatively few (17.2%) born in or admitted to hospitals with only full-term newborn nurseries. There was a great deal of variability in length of stay with an average of almost 4 days, a median of 2 days, and a range of 1 to 427 days. The vast majority (88.8%) of infants had low severity of illness on admission to the hospital. The majority of patients (81.9%) had private insurance (commercial insurance and HMO coverage). Approximately 1 in 5 children (18.1%) had nonprivate insurance, consisting of Medicaid coverage, or no identified source of payment.

The second column of Table 2 provides results of univariate analyses of the association of each covariate with the outcome of transfer. Unadjusted relative risks with 95% CIs are provided for each independent variable studied. As anticipated, severity of illness was significantly associated with transfer. A dose-dependent relationship was noted, with increasing likelihood of transfer given increasing severity. Similarly, prematurity was highly significantly associated with interhospital transfer (unadjusted RR = 6.6). The unadjusted association of referring hospital NICU with transfer varied somewhat by NICU level. Infants born in or admitted to hospitals without NICUs (level 1 hospitals) were more likely to be transferred than infants admitted to hospitals with level 3 NICUs. However, there was no significant difference in likelihood of transfer for infants admitted to level 2 NICUs when compared with those admitted to level 3 NICUs. Insurance status was also significantly associated with risk of transfer. Uninsured infants (unadjusted RR = 1.66) and those with Medicaid (unadjusted RR = 1.39) were both more likely to be transferred than commercially insured infants. However, there was no significant difference in risk of transfer between infants with HMO coverage and those with commercial insurance (unadjusted RR = .98).

The association between insurance status and the other covariates of interest was also assessed (see Table 3). Insurance status, grouped broadly as private versus nonprivate, was significantly associated with both prematurity and admission severity of illness. Uninsured and publicly insured infants were more likely to be born premature [RR 1.49 (1.39, 1.60)] than privately insured neonates. Similarly, nonprivately insured newborns were more likely to have both moderate [RR 1.11 (1.04, 1.23)] and high [RR 1.21 (1.11, 1.32)] illness severity on admission to the hospital than privately insured infants. Insurance status was also associated with survival. Nonprivately insured neonates were more likely [RR 1.55 (1.22, 1.96)] than privately insured neonates to die in the hospital. When nonprivate insurance status was further broken down into Medicaid and no insurance, only Medicaid coverage remained significantly associated with in-hospital mortality when compared with privately insured infants [RR 1.75 (1.37, 2.23)]. There was not a significant association between insurance status and the type of hospital to which the infant was admitted. Nonprivately insured infants were just as likely as privately insured infants to be born in or admitted to hospitals with level 1 or 2, as compared with level 3 NICUs.

The third column of Table 2 provides the results of multivariable logistic regression analyses examining the independent association of each covariate of interest with interhospital transfer. Adjusted RRs with associated 95% CIs are provided for each covariate in the model. Results are consistent with those found in univariate analyses for most variables in the model. Similar to univariate analyses, there was a dose-dependent relationship between illness severity and risk of transfer. In the fully adjusted model, infants with high illness severity were nearly 25 times more likely to undergo transfer, and those with moderate severity were 13 times more likely to be transferred, than similar infants with low illness severity. Premature infants were nearly twice as likely to be transferred than full-term newborns after adjustment for the other covariates in the model. Infants admitted to hospitals with level 1 NICUs were nearly three times as likely to be transferred (adjusted RR = 2.88) as those admitted to hospitals with level 3 NICUs. Unlike the results of univariate analyses, infants admitted to hospitals with level 2 NICUs were significantly more likely to be transferred (adjusted RR = 1.25) than those admitted to level 3 NICUs after accounting for the effects of the other variables in the model.

The model also indicated that insurance status
remained a significant independent predictor of risk of interhospital transfer. Uninsured infants were nearly twice as likely [adjusted RR = 1.96 (1.67, 2.31)] to be transferred as commercially insured infants, even when adjusted for the effects of prematurity, severity of illness, and the NICU level of the referring hospital. Similarly, infants with Medicaid were 20% more likely to be transferred [adjusted RR = 1.20 (1.01, 1.43)] than similar commercially insured neonates. There was no significant difference [adjusted RR = .97 (.78, 1.2)] in likelihood of transfer between infants with HMO coverage and those with other commercially available private insurance.

**DISCUSSION**

We found that neonates with no insurance and those with Medicaid coverage were more likely to be transferred than similar infants with private insurance in a large, population-based sample of newborns in southeastern Pennsylvania. Likewise, prematurity, severity of illness, and the level of referring hospital resources for neonatal care were also all significant independent predictors of neonatal transfer. Because patients with Medicaid and no insurance were more likely to be both premature and have higher illness severity than privately insured infants, it is not surprising that they might have a higher rate of transfer. However, results of the multivariable analyses indicate that their likelihood of transfer is significantly higher than expected given adjustment for prematurity and illness severity. These results are consistent with those of other investigators who have studied financially motivated patient transfers in nonpediatric populations of patients.

Several investigators have described the phenomenon of patient dumping in populations of adult emergency department patients. De Vise first described the phenomenon at Cook County Hospital (Chicago, IL) in 1971. He identified 18,000 patients refused admission to private hospitals in Chicago due to their lack of insurance who were forced to go to County Hospital, frequently without prior stabilization, resulting in an estimated 50 patient deaths. During the ensuing two decades, further reports of inappropriate emergency department transfer of uninsured and minority patients were noted in Alameda County, California, Chicago, Memphis, Milwaukee, and New York.

More recently, Bronstein and others reported that white women with high-risk (very low birth weight) pregnancies and Medicaid coverage were more likely to be transferred than similar women without Medicaid. The authors suggested that this finding might indicate that some hospitals selectively retain privately insured women for high-risk deliveries but refer less well-insured women to regional specialty centers. The population of patients studied by Bronstein, maternal interhospital transfers, provides the most relevant complementary group to our study population, neonatal interhospital transfers. Taken together, the two study populations account for all the interhospital transfer activity in regional systems of perinatal care. Our results indicating that publicly insured and uninsured neonates are more likely to undergo interhospital transfer than similar privately insured infants are consistent with those of Bronstein, and provide further evidence for the presence of financially motivated patient transfers in regional systems of perinatal care.

The predictive model constructed during this project was limited in scope. Because of the complex nature of the decision to transfer a child, several potential confounders of the relationship between the independent variables studied and risk of transfer likely exist that were not included. Factors such as...
physician experience and level of comfort with a particular patient, or preexisting protocols for transfer between two institutions, may contribute to a decision to transfer but were not included in any of the sources of data used for this project. In particular, the association of insurance status with transfer may be explained by an unidentified confounder such as parental request for transfer or other sociodemographic factors (eg, race, employment status, poverty status) with which insurance status is associated.

The data provided by the PHC4 is obtained primarily for nonresearch purposes. Because of this, data sets like it often suffer from the problem of missing data elements. However, missing data were not a significant problem in the 1991 data set as <0.1% of patients were missing insurance information, only 1.2% of patients were missing MedisGroups admission severity scores, and none were missing data on discharge status. In addition, some misclassification of variables (eg, insurance status) is possible in large databases such as this. However, the misclassification is likely to be random in nature, thus biasing the magnitude of any observed association (such as between insurance status and risk of transfer) toward the null.

Our PHC4 database did not contain a unique patient identifier, making it impossible to link information from both hospitalizations for transferred patients. Therefore, whether interhospital transfer leads to important differences in ultimate patient outcome could not be determined. For example, the proportion of transferred patients among those who died, and the risk of death posttransfer could not be determined. Therefore, one cannot assume that either privately or publicly insured children received more appropriate care. Further studies will be required to clarify the effect of transfer and insurance status on ultimate patient outcomes.

As managed care becomes more widespread, the effect of insurance status on interhospital transfer practices is likely to change. During the time period of the current study, managed care coverage was not prominent in southeastern Pennsylvania (13% of the current study population), but more recently, it has rapidly escalated. Kerr and others25 in Milwaukee found that the emergency department transfer of HMO patients increased from 14% of transferred patients in 1985–1986 to 27% in 1988–1989 despite the fact that the proportion of the local population belonging to an HMO did not change. The authors proposed that these HMO transfers were financially driven because the receiving hospitals did not offer a higher level of care than the transferring hospitals.

Further investigation into the effect of economic factors on variation in the utilization of transport services is particularly compelling at this point in time. The rapidly evolving effects of managed care coverage and the merging of multiple hospitals into regional networks will undoubtedly affect the regionalization of health care resources, particularly high-cost resources such as NICUs. Protocols for patient transfer between hospitals within a single health system, and between hospitals participating in similar managed care programs have been developed. These arrangements will undoubtedly further influence the movement of patients between hospitals. The effect of these influences on the volume and outcomes of neonatal transfer has not been previously studied. Future studies will be required to ensure that access to appropriate neonatal intensive care is assured, and that outcomes of all infants are optimized.

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