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Time and Out-of-Pocket Costs Associated with Respiratory Syncytial Virus Hospitalization of Infants

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ABSTRACT

Objective: The objective of this study was to quantify time spent plus out-of-pocket costs associated with confirmed respiratory syncytial virus (RSV) hospitalization of infants not prophylaxed against RSV.

Methods: A prospective survey was carried out at multiple tertiary care hospitals in the United States.

Patients: The patients consisted of a consecutive sample of infants <12 months, born between 33 and 35 weeks of gestation. One site also enrolled full-term infants hospitalized with confirmed RSV. Daily patient census identified eligible patients. Consenting caregivers of eligible subjects (n = 84, 1 refusal) were interviewed on discharge day and by telephone ~30 days following discharge regarding time and out-of-pocket costs due to RSV.

Results: Total average out of pocket expenses were $643.69 (range $21–$16,867; SD $2,403) for premature and $214.42 (range $6–$827; SD $218) ($P$ = .0158) for full-term subjects. Total average economic burden per admission was $4517.07 for premature and $2135.30 for full-term infants, including the value of lost productivity but excluding inpatient hospital and physician bills and lost income. Premature infants (n = 48) had longer hospital stays (mean 6.9 days; SD 7.5 vs. 3.4 days; SD 2.6 days) (P = .001) with an associated mean total time spent by up to 5 adults of 281.7 hours (range 25–2819.7 hours; SD 465.8 hours) versus a mean of 139.7 hours (range 31.8–561.3 hours; SD 118.1 hours) for term infants (P = .109). Time and out-of-pocket costs continued after discharge.

Conclusions: RSV hospitalization of infants is associated with substantial, previously unmeasured time and monetary losses. These losses continued following discharge. The economic burden on families and society appears heavier for infants born at 33 to 35 weeks of gestation than for full-term infants.

Keywords: cost, premature infants, RSV.

Introduction

Respiratory syncytial virus (RSV) is the leading cause of hospitalization of infants under the age of 1 year in the United States [1]. Published studies of the economic burden associated with RSV hospitalization and the potential cost-effectiveness of passive prophylaxis with either RSV-IGIV or palivizumab (MedImmune, Inc., Gaithersburg, MD) have focused on hospital charges and, except for one US study of presumed RSV cases [2], have not directly asked families of hospitalized infants about their time and out-of-pocket costs due to RSV [3–6].

Cost-effectiveness analyses should be performed from a societal (compared to a payer's) perspective and should include all direct and indirect costs, including pain and suffering, lost productivity, and outpatient costs [7]. It is therefore important to measure directly the time and monetary impact of RSV hospitalization on families of acutely ill infants.

Objective

The purpose of this study was to measure a component of the economic burden of RSV hospitalization by asking parents or primary caregivers of hospitalized infants about time and out-of-pocket costs associated with the RSV hospitalization and estimating the societal value of lost productivity by affected adults. Specifically, the study sought to ascertain the burden on families of premature infants born between 33 and 35 weeks of gestation hospitalized for RSV. This gestational age group

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was selected because cost considerations are invoked as a reason for reserving RSV prophylaxis to infants with additional risk factors [8]. Comparable data were collected for an unmatched cohort of full-term infants hospitalized with RSV.

Methods

A prospective survey was conducted in 10 geographically diverse tertiary care hospitals with pediatric intensive care units in the United States (see Acknowledgments). The study was intended to be descriptive and was not powered to be representative of the universe of potential subjects. The survey methods have been described previously [9].

The study was initiated in February 2000 and continued through April 2001. After receiving approval from each center's institutional review board (IRB) and one IRB at an affiliated university, a daily patient census was taken to identify all inpatient infants under the age of 1 year, born between 33 and 35 weeks of gestation, with a laboratory confirmed, RSV infection who had not received prophylaxis against RSV with either RSV-IGIV or palivizumab and who were not enrolled in any clinical trial. Full-term infants were enrolled at one of the 10 sites using identical methods. All such infants were eligible for inclusion in the study. Parent/caregivers (hereafter, informants) were excluded if they were unable to understand or communicate in either English or Spanish. After receiving informed consent, demographic, diagnostic, and insurance data were abstracted from the medical and hospital records of enrolled infants. Also abstracted were the infant's admission and discharge dates and whether admission to the intensive care unit occurred during the hospital stay. A trained physician or nurse, using a printed survey instrument, interviewed informants on the day of discharge. Informants were asked about their own experiences and that of up to four other hospital visitors. All responses were recorded verbatim. Approximately 30 days later, the informant was reinterviewed by telephone. Informants received a $25 honorarium for each phase of the interview for a possible total of $50.

Completed surveys were manually reviewed for clarity and logic, double verified during data entry, and analyzed using SAS, version 6.12 (SAS Institute, Cary, NC).

Continuous variables were tested for significant differences using the Wilcoxon rank sum test. Categorical variables were tested using Fisher's exact test or Pearson's chi-square, depending on the number of categories. A P value of .05 was considered statistically significant. Total out-of-pocket costs were subjected to regression analysis.

Results

A total of 48 premature and 36 full-term infants were enrolled in this study. Only one parent of an eligible full-term infant refused to participate in the survey. Follow-up interviews approximately 30 days after discharge were completed for all but 3 premature and 3 full-term infants. One of the premature infants died of SIDS the day after hospital discharge; one parent of a full-term infant lost custody of her children and efforts to contact the remaining parents were unsuccessful despite repeated efforts by telephone and in writing. Three informants were foster mothers; one was an aunt, and the remainder were parents.

Table 1 shows the demographic and insurance characteristics of the study infants. Not shown is the fact that among the premature cohort there were three sets of twins, two of which were simultaneously hospitalized and one set that overlapped while one twin had a longer stay. Each infant's hospital stay was treated as a separate event. One premature and one full-term infant were readmitted to the same hospital for RSV infection and studied twice during the same RSV season. Enrolled premature infants were significantly more likely to be African American than white (P = .001) and to have lower weight at hospital admission for RSV (P = .0009).

Table 2 describes the inpatient stay. Premature infants had a significantly longer hospital stay (P = .003) but were not more likely to be admitted to the ICU. In fact, ICU admission, which occurred in a high percentage of both groups of infants, was not significantly associated with degree of prematurity, race, or type of insurance. Length of stay (LOS) did not vary significantly by degree of prematurity, race, or type of insurance.

Inpatient Stay

In this study, numerous adults including parents, grandparents, extended family, and friends visited hospitalized infants. Premature infants were reported to have been visited by more adults with a mean of 4.5 (median 4; range 2–17; SD 2.6) adult visitors compared with a mean of 3.5 (median 3; range 2–11; SD 1.8) for full-term infants (P = .03). Total average time spent traveling to and from the hospital as well as time spent in the hospital is shown in Table 3. The time burden associated with hospital visits to premature infants was more than

Table 1 Patient characteristics

	33–35 weeks of gestation (*N* = 48)	Full-term (*N* = 36)
Sex*		
Male	28 (58)	16 (44)
Race/ethnicity*†		
Caucasian	23 (47)	32 (89)
Black	15 (31)	3 (8)
Hispanic	11 (22)	1 (3)
Native American/Pacific Islander	0 (0)	0 (0)
Asian	1 (3)	1 (3)
Age at admission (months)		
Mean (range)	4 (0.5–11.9)	4.2 (0.2–11.0)
Median	2.4	3.0
Admission weight (g)	4812.4	6480.9
Mean (range)	(801–10500)	(2400–10745)
Median	4250	6488.5
SD	2220.3	2239.9
Primary insurance*		
Commercial, BC/BS	21 (43)	21 (59)
Medicaid	23 (48)	13 (36)
CHAMPUS/VA	1 (2)	0 (0)
Indian Health Service	2 (4)	1 (3)
Uninsured	1 (2)	1 (3)

*Number (%).
†Patients who chose more than one race/ethnicity were counted multiple times.

Table 2 Inpatient experience

	33–35 weeks of gestation (*N* = 48)	Full-term (*N* = 36)
Length of stay (days)		
Mean (range)	7.0 (0–45)	3.4 (1–10)
Median	4	2.0
SD	7.5	2.6
Primary discharge diagnosis*		
RSV bronchiolitis	45 (94)	28 (78)
RSV pneumonia	2 (4)	2 (6)
Other RSV	0 (0)	6 (17)
Hyponatremia	1 (2)	0 (0)
ICU admission	20 (42)	12 (33)

*Number (%).

Table 3 Time burden associated with hospital visits

	33–35 weeks of gestation (*N* = 48)	Full-term (*N* = 36)
Primary caregiver		
Total travel time (hours)		
Mean (range)	6.8 (0.13–48)	2.2 (0.17–9)
Median	4.5	2.0
SD	8.5	1.9
Time together in hospital (hours)		
Mean	133.6 (14–1080)	80.5 (10–240)
Median	84	58
SD	176.0	65.1
Other visitors (up to 4)		
Time traveling and in hospital (hours)		
Mean (range)	139.1 (0–1728)	52.8 (0–342)
Median	47.5	27.5
SD	293.4	73.0
Total average time (range)	281.7 (25–2819.7)	139.7 (31.8–561.3)
Median	142.4	94.2
SD	465.8	118.1

Table 4 Out-of-pocket costs associated with hospital visits

	33–35 weeks of gestation (*N* = 49)	Full-term (*N* = 36)
Travel and parking ($)		
Mean (range)	43.7 (1–404)	13.5 (0–116.3)
Median	25	9.0
SD	63.1	20.6
Cost of meals ($)		
Mean (range)	75.8 (5–500)	49 (1–300)
Median	32.5	30
SD	92.3	64
Child care ($)		
Mean (range)	148.4 (30–600)	59.5 (0–205)
Median	100	22.5
SD	155.9	80.8
Other expenses ($)		
Mean (range)	1018.2 (5–15,000)	79.1 (3–486)
Median	62.5	20
SD	3852.9	128

twice the total average time associated with full-term infants.

Informants were asked about their own out-of-pocket payments for travel, parking, meals in the hospital, added costs for child care, and other expenses incurred due to the RSV hospitalization as well as those incurred by up to four other visitors, if known (Table 4).

Responses to the question (exclude medical and hospital bills) "Did you or other caregivers have any additional expenses you didn't mention yet because the baby was in the hospital?" were affirmative for 21 of the full-term infants and 16 of the premature infants. Those who answered "yes" to the question were asked to specify the type of expense and were asked, "Altogether, about how much did that cost?" Not shown are categories of reported expenses such as purchase of a nebulizer (5 infants), a humidifier (6 infants), and specific amounts of lost wages during the hospital stay.

Informants were also asked for the number of siblings to direct questions about altered child-care arrangements for siblings at home. The premature infants had significantly more siblings (mean 2; median 2; range 0–6; SD 1.8) than full-term infants (mean 1.2; median 1; range 0–4; SD 0.9) ($P = .08$). Informants for premature infants with siblings ($n = 18$) reported higher direct costs for altered child care during the hospital stay than for full-term infants ($n = 10$) (mean $148.39 vs. $59.50; median $100 vs. $22.50; SD 155.9 vs. 80.8) ($P = .017$).

After Discharge

Full-term infants in this study were reported to have more follow-up physician visits (mean 2.5; median 2; range 1–5; SD 1.4) than premature infants (mean 1.8; median 1; range 1–5; SD 1.1). Associated time for these visits averaged 4.7 hours (median 2.5 hours; range 0.1–20 hours; SD 4.9 hours) for full-term infants compared to a mean of 3.1 hours (median 2.5 hours; range 0.5–10 hours; SD 2.5 hours) for the premature infants. Out-of-pocket costs following discharge averaged $48.40 (median $13; range $0–$341; SD $77.3) for premature infants compared with $71.64 (median $34; range $0–$650; SD $114.0) for full-term infants ($P = .1757$).

Responses to all questions about out-of-pocket costs were summed to ascertain total average out-of-pocket payments per infant during and following the RSV hospitalization. Average payments per premature infant were $644 (median $216; range $21–$16,867; SD 2403.2); three times the amount reported for full-term infants (mean $214; median $131; range $6–$827; SD $218.3) ($P = .0158$). Excluding the one premature infant with extremely high out-of-pocket costs resulted in a mean of $299 (median $202; range $21–$1203; SD $240.3). Total average time spent was 281.67 (median 142.4; range 25–2819.7; SD 464.8) hours per premature infant compared with 139.72 hours per full-term infant (median 94.2 hours; range 31.8–561.3 hours; SD 118.1 hours) ($P = .1086$). To estimate the value to society of lost productivity during the RSV hospitalization and the subsequent month, reported total average time spent by up to five adults per infant was multiplied by the average hourly wage of employees in 2000 ($13.75) [10]. When reported out-of-pocket payments by up to five adults per infant were added to the estimated value of lost productivity due to RSV, the total economic burden to families and society was calculated to have been $4457.07 per premature infant and $2135.30 per full-term infant (Fig. 1). These dollar amounts do

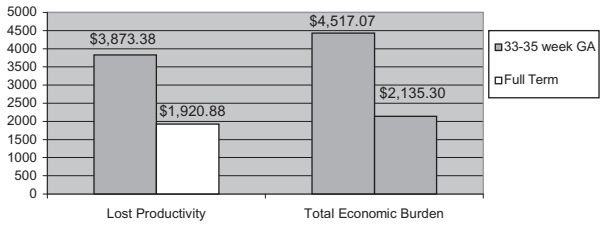

Figure 1 Estimated lost productivity and total economic burden per hospitalized infant. Total time (281.7 hours premature and 139.7 hours for full-terms infants) × $13.75 per hour [10].

not include lost income reported by those self-employed and those without sick leave benefits. It also does not include the value of lost productivity of volunteers who looked after siblings during the hospital stay. Also not included is the families' financial liability for the hospital stay.

We compared the reported direct out-of-pocket expenses for all infants who were either enrolled in Medicaid or the Indian Health Service or who were uninsured (n = 39) with infants covered by either commercial insurance or Blue Cross/Blue Shield (n = 42). One subject, insured by CHAMPUS, and two with insurance described as "other" were excluded from this analysis. Total average out-of-pocket payments were $652.36 for the latter families (median $169; range $21–$16,867; SD $2571.8) compared with $267.39 for families with either public or no insurance (median $189; range $6–$1203; SD $261.1) ($P$ = .514). Mean out-of-pocket expenses for premature infants with public or no insurance (n = 25) was $333.84 (median $285; range $42–$1203; SD 281.2) compared with $1052.19 (median $180; range $21–$16,867; SD $3628.3) for premature infants with private insurance (n = 21) (P = .724).

We also examined the impact of ICU admission on total out-of-pocket cost within the cohort of premature infants. Total mean cost for infants in the ICU was $1,192.05 (median $372.5; range $47–$16,867; SD $3,699.6) versus $252 (median $171.5; range $21–$770; SD $200.8) for those infants who were not in the ICU (P = .058).

LOS, infant age, weight, prematurity status, sex, race, and insurance source were entered into a regression model of total out-of-pocket cost. Only LOS was significant (P = .02).

Discussion

This survey about the time and out-of-pocket costs incurred during and following an infant's hospitalization for a laboratory-confirmed RSV infection is the first such effort in the United States. The survey revealed that each such hospitalization resulted in time, out-of-pocket, and productivity losses by numerous concerned adults. Furthermore, these costs continued for at least 1 month after discharge. These costs have not been fully accounted for in published studies of the cost-effectiveness of passive prophylaxis against RSV hospitalization.

Kaplan-Machlis and Beane [2] conducted a telephone interview of parents of both premature and full-term infants with chronic lung disease about their time and monetary costs, but the presumed RSV cases had not been virologically confirmed. A cost-effectiveness model of RSV-IGIV included an estimate of the value of time for one parent to bring an infant for prophylaxis but did not include parental time or out-of-pocket costs associated with a RSV hospitalization [3]. Another cost-effectiveness model included an estimate of the value of one parent's time in either seeking outpatient prophylaxis or remaining continuously with their infant in the hospital during a RSV stay but no other time or monetary costs were included [5].

One survey of parents of 79 children hospitalized with RSV in the Netherlands asked about lost workdays, cost of travel and extra child care, prescribed drugs, and physician consultations 2 weeks before and after the hospital stay. However, the infants studied were predominantly full-term. The infants were reported to have been ill for 4 days and to have had a median of two doctor visits before hospital admission. The authors concluded that 15% of the total cost of the RSV hospitalization was borne by parents and that the costs would likely be higher for a high-risk population and for infants admitted to the intensive care unit [11]. Our data show that costs were higher for premature infants hospitalized with RSV. While we did calculate tests of significance for observed variance between the premature and full-term infants, the cohorts were not truly comparable because the full-term infants were only enrolled at one participating hospital.

Although we believe that our survey data are the most comprehensive evaluation to date of time and out-of-pocket costs due to RSV hospitalization in the United States, there are several reasons why the results may underestimate actual costs. First, time and out-of-pocket costs incurred before the hospitalization were not captured. Costs more than 1 month after discharge were also captured in this study.

A retrospective chart review of confirmed RSV cases admitted to one US hospital between 1995

and 1998 found that 61% of the cases had been treated by a physician for respiratory related illness during the week before admission, 46% had a prior respiratory-related emergency room visit, 38% had a related emergency room visit after discharge, and 43% were referred to a respiratory specialist for follow-up care [12]. These data suggest that the economic burden of RSV is greater than the costs associated with the inpatient stay alone and the follow-up period evaluated here.

In this survey, total direct medical costs to families were also not captured because that information was not likely to be known during the interviews (medical bills often take months to be finally adjudicated with insurance companies). Because of this anticipated delay, the survey did not ask for the direct cost of insurance deductibles, copayments for the inpatient stay, or uncovered portions of medical bills. Therefore, the total reported out-of-pocket amounts might understate the family's financial burden. Many informants reported specific amounts of lost income and other financial losses. However, that information was not specifically requested of all informants, and thus true financial burden may be further understated.

Because informants were asked, "While the baby was here in the hospital, including the day you brought him or her, did you have to pay a baby sitter or day care center for any new or additional help in watching these other children because the baby was sick?" we did not systematically capture information about the amount of time volunteers donated as babysitters. A number of informants reported extensive time and monetary losses by these volunteers, but these amounts are not included in the totals reported above. Additionally, no information about ongoing RSV-related costs beyond the 30th day after discharge were captured.

Of interest, informants reported that 22% of the premature infants and 25% of the full-term infants had more than one "RSV" admission. While these reports were not confirmed from the medical record during the study, if correct, this could add significantly to the time and out-of-pocket costs. Unfortunately, the costs of multiple RSV admissions during a single season were not specifically captured. Future studies should examine costs incurred before hospitalization as well as those associated with multiple RSV admissions.

As with any survey, there may have been recall bias and most of the time and monetary costs were not independently verified except for logical consistency (e.g., the visit time in the hospital could not exceed the infant's length of stay). We did not verify reported costs for other visitors and do not know how reliable this information is. However, there is no reason to assume that results for full-term infants would be systematically remembered differently than those for premature infants. Because informants were interviewed on the day of discharge, their memories should have been fresh. Informants were also told in advance when they would be telephoned about their postdischarge experiences, so they may have been making a conscious effort to remember their RSV-related experiences during that period.

Finally, while the specific dollar amounts reported here may not be confidently generalized to the universe of such admissions, the inpatient experiences of our subjects do not seem atypical. For example, the observed ICU admission rates are consistent with a recent report from 10 children's medical centers [13].

Conclusion

The results of this survey indicate that RSV hospitalization is associated with substantial time and direct monetary losses to affected families and significant losses in productivity from a societal perspective. We found that RSV hospitalization of premature infants born between 33 and 35 weeks of gestation imposes substantial economic burdens on families and society. The comparable burdens were less for full-term infants at one of the study sites. Because the results of this survey did not include prehospitalization costs, all medical expenses, or costs of multiple RSV hospitalizations, the total economic burden of RSV hospitalization of infants remains to be documented. But, evidence from this survey demonstrates that the economic burden from RSV hospitalization is much greater than hospital charges alone.

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