



# Impact of a Transition Home Program on Rehospitalization Rates of Preterm Infants

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**Objectives** To evaluate the effects of a transition home program on 90-day rehospitalization rates of preterm (PT) infants born at <37 weeks gestational age implemented over 3 years for infants with Medicaid and private insurance, and to identify the impact of social/environmental and medical risk factors on rehospitalization.

**Study design** In this prospective cohort study of 954 early, moderate, and late PT infants, all families received comprehensive transition home services provided by social workers and family resource specialists (trained peers) working with the medical team. Rehospitalization data were obtained from a statewide database and parent reports. Group comparisons were made by insurance type. Regression models were run to identify factors associated with rehospitalization and duration of rehospitalization.

**Results** In bivariable analyses, Medicaid was associated with more infants hospitalized, more than 1 hospitalization, and more days of hospitalization. Early PT infants had more rehospitalizations by 90 days than moderate ( $P = .05$ ) or late PT infants ( $P = .01$ ). In regression modeling, year 3 of the transition home program vs year 1 was associated with a lower risk for rehospitalization by 90 days (OR, 0.57; 95% CI, 0.36-0.93;  $P = .03$ ). Medicaid ( $P = .04$ ), non-English-speaking ( $P = .02$ ), multiple pregnancies ( $P = .05$ ), and bronchopulmonary dysplasia ( $P = .001$ ) were associated with increased risk. Both bronchopulmonary dysplasia and Medicaid were associated with increased days of rehospitalization in adjusted analyses. The major cause of rehospitalization was respiratory illness (61%).

**Conclusions** Transition home prevention strategies must be directed at both social/environmental and medical risk factors to decrease the risk of rehospitalization. (*J Pediatr* 2017;181:86-92).

Prematurity is a serious public health problem that costs the US more than \$26 billion annually. Early preterm (PT) infants have increased rates of neonatal and postdischarge morbidities, including increased rates of rehospitalization.<sup>1-10</sup> Recent data indicate that the increased risks associated with prematurity extend to moderate and late PT infants,<sup>11-14</sup> who often require care in a neonatal intensive care unit (NICU). Regardless of gestational age, PT infants covered by Medicaid insurance have been shown to be at greater risk of morbidity and resource utilization compared with those with private insurance.<sup>4,9,15-17</sup>

Rehospitalization of high-risk PT infants contributes to increased costs, placing a burden on both the health care system and families. A comprehensive transition home program was developed for very low birth weight infants cared for in a tertiary care center's 80-bed NICU covering the catchment area of Rhode Island, southeastern Massachusetts, and northern Connecticut. It was implemented in 2007 in collaboration with the infant's medical home to provide enhanced transition education and support to families, and also to serve as a resource for primary care providers (PCPs).<sup>1</sup> Infants with Medicaid insurance were twice as likely as infants with private insurance to be rehospitalized by age 3 months (28% vs 11%) during the first year of the program. Over 2 years, the odds of rehospitalization for very low birth weight infants receiving Medicaid were significantly reduced,<sup>1</sup> and in 2012 the program was expanded to include all PT infants <37 weeks receiving NICU care for >5 days.

The primary objective of this study was to evaluate effects of an enhanced transition home program with social workers and family resource specialists (FRSs) as team members to decrease the rate of rehospitalization in PT infants cared for in a NICU for > 5 days within the first 90 days postdischarge. A secondary objective was to identify key social/environmental and medical risk factors associated with rehospitalization. Our study hypotheses were that rates of rehospitalization would decrease between year 1 and year 3 as the programmatic components of the transition home program were implemented, and that social and environmental risk factors, including Medicaid insurance, would be important predictors of rehospitalization.

BPD	Bronchopulmonary dysplasia
FRS	Family resource specialist
NICU	Neonatal intensive care unit
NNP	Neonatal nurse practitioner
PICU	Pediatric intensive care unit
PCP	Primary care provider
PT	Preterm

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## Methods

This prospectively enrolled cohort included Rhode Island residents who were early, moderate, and late PT infants hospitalized for >5 days in an 80-bed single-room level 3-4 NICU. Infants were enrolled between October 15, 2012, and September 4, 2015. Institutional Review Board approval and informed consent were obtained. Of the families of 1294 eligible infants, 954 (74%) agreed to participate, and only those families received the enhanced services.

The study transition home program team comprised the study physicians and nurse practitioners partnered with a team of 4 clinical social workers and 7 trained FRSs (each of whom had her own infant previously cared for in a NICU). The FRSs were paid employees who received training in parent and infant needs and hospital and community resources by the Rhode Island Parent Information Network ([www.ripin.org](http://www.ripin.org)) and our clinical research team. The FRSs were matched with mother–infant dyads sharing common backgrounds to the extent possible. Matching included primary language (fluent in, eg, English, Spanish, Portuguese) and infant history (eg, PT, home on oxygen, monitor). The FRS provided education and supportive intervention services under the supervision and guidance of licensed independent clinical social workers. It was expected that the FRS providers would become increasingly adept at facilitating the transition home intervention over the 3-year duration of the program.

### Procedures Pre-discharge

The team made daily NICU rounds, identified eligible subjects, and obtained informed consent. The transition home team communicated closely with the NICU team, the follow-up clinic, and the PCP. A letter was sent to the PCP informing of enrollment and program purpose, and a summary of each visit was provided. Study providers met regularly with parents during the infant's hospitalization, reviewed a comprehensive education binder, and completed study questionnaires. The social worker or FRS informed all parents of indicated community resources, including early intervention, and reviewed all education binder components, including safety, nutrition, breast milk benefits, infection control, and respiratory syncytial virus prophylaxis. Attendance at an educational discharge class and a cardiopulmonary resuscitation discharge class were encouraged. Staff supported families in obtaining transportation, mental health services, housing, and infant supplies; accessing health care; and finding a primary provider. Families considered at high social, environmental, or medical risk (owing to, eg, housing, mental health issues, multiple PT infants) received a pre-discharge home visit to further assess and address home environment and family needs.

### Procedures Postdischarge

The postdischarge intervention for early and moderate PT infants included a postdischarge call within 24 hours, a neonatal nurse practitioner (NNP) home visit within the first week, transmittal of summaries to the PCP, referral to early intervention, and round-the-clock on call by study physicians up

to 90 days postdischarge. These services were provided in addition to standard visiting nurse and PCP visits. Each postdischarge home visit was conducted by 4 NNPs knowledgeable in the care and management of high-risk infants, who assessed the infant's growth, feeding, and respiratory status and the mother's comfort, concerns, and understanding of the care plan. The NNPs collaborated with the medical team, social workers, FRSs, support staff, PCPs, and follow-up clinic. Early and moderate PT infants were seen by the study providers in the follow-up clinic at 1 and 3 months, and their visit summaries were shared with the PCP and study staff. Directions for all medication doses and formula mixes were reviewed. Additional questionnaires administered will be reported in later work. Families of late PT infants were provided with the same support in the NICU, the education binder, early intervention coordination if eligible, a postdischarge call within 24 hours, and standard visiting nurse visits.

The late PT infants were considered at lower risk for re-hospitalization and were not seen in the follow-up clinic. Instead, they received phone communications from the FRS or social worker to obtain an interim history at 1 and 3 months, at which time any needed referrals were made. All families were invited to enroll in Current Care, the Rhode Island statewide secure health information exchange, which provided real-time computer notification of rehospitalizations. A separate Current Care informed consent was obtained, facilitating rapid response support and intervention, along with accurate data on rehospitalization.

In terms of predictor and outcome variables, the 2 study groups were PT infants with Medicaid and PT infants with private insurance. Predictor variables included the year of the transition home program, maternal and infant characteristics and morbidities, insurance type, and social and environmental risk factors. The primary outcome variables were number of infants rehospitalized, number of rehospitalizations, and number of days of hospitalization by 90 days postdischarge. Study data were collected prospectively.

### Statistical Analyses

Maternal characteristics and outcomes in the Medicaid and private insurance groups were compared using the *t* test and Wilcoxon rank-sum test for continuous variables and the  $\chi^2$  test for categorical variables. Infant variables and outcomes were analyzed using random effects models (continuous) or generalized estimating equations (categorical) to adjust for multiple births within mothers. Comparisons of maternal and infant characteristics were also made between those infants hospitalized and never hospitalized at 90 days postdischarge.

Logistic regression models were run to predict rehospitalizations by 90 days postdischarge. Independent variables in addition to the year of program implementation were those identified as significantly associated with rehospitalization in bivariable analyses and included early, moderate, and late PT; Medicaid; non-English-speaking; gravida >1; and breast milk at discharge. Birth weight, gestational age, grade 3-4 intraventricular hemorrhage, and oxygen at discharge were not

included in the model owing to collinearity with early PT and/or bronchopulmonary dysplasia (BPD). Other children in the home and level of maternal education did not reach significance and were dropped from the model. One-sided 95% CIs were used to test the directional hypothesis of lower odds of rehospitalization over study years 3 and 1, 3 and 2, and 2 and 1. A negative binomial regression model was run among only the rehospitalized children to evaluate the effects of neonatal and maternal risk factors and Medicaid on days of hospitalization.

## Results

Characteristics of the 804 mothers with Medicaid (56%) or private insurance (44%) are presented in **Table I**. Mothers with Medicaid were more likely to be younger, black or Hispanic, non-English-speaking, gravida >1, and single; to have more persons living in the home; and to have lower educational attainment. In addition, they were more likely to have a history of Protective Services involvement, domestic violence, substance abuse, and mental health problems requiring treatment.

Families on Medicaid received more transition services, including predischarge meetings with staff and enrollment in Current Care (**Table II**; available at [www.jpeds.com](http://www.jpeds.com)). The education binder was completed with 98%-99% of mothers, and 99% received the postdischarge call. The postdischarge NNP visits were completed for 92% of infants with Medicaid and private insurance.

Reasons for no visits were family not responding and family refusing the visit. Parents of early and moderate PT infants with private insurance were more likely than those with Medicaid insurance to complete the 1-month (97% vs 91%) and 3-month (94% vs 83%) visits. Parents of late PTs with private

insurance were more likely than those with Medicaid to complete the 3-month contact (81% vs 68%). Moreover, 100% of mothers of infants eligible for palivizumab injections were provided information about the importance of immunization, and 100% of pediatricians received a letter explaining the need. Only 1 eligible infant did not receive palivizumab. All infants at discharge had a confirmed appointment with a primary provider, and 100% of the infants eligible for early intervention had a confirmed intake assessment. Of the 558 parents who completed a transition home program anonymous satisfaction survey, 97% reported that staff was available to meet their needs and 97% reported that they would recommend the program to other parents.

Characteristics of the 954 infants are presented in **Table III**. Although rates of neonatal morbidities were similar overall in the 2 groups, infants with Medicaid had lower birth weight and shorter gestation and were less likely to be on breast milk at discharge, and at 1-month postdischarge, were more likely to be rehospitalized by 90 days and to have  $\geq 2$  hospitalizations, a longer mean duration of each hospitalization, and more total days of hospitalization. Eighteen of the 85 (20%) infants rehospitalized were admitted to the pediatric intensive care unit (PICU). Although the rate of admission to the PICU did not differ between the 2 groups, mean length of PICU stay and total PICU days were significantly higher in the infants on Medicaid. The rate of multiple birth was higher in the infants with private insurance.

**Table IV** presents the maternal and infant characteristics for infants rehospitalized by 90 days. Mothers were more likely to have Medicaid insurance, be non-English-speaking, be gravida >1, have other young children in the household, and have a lower educational level. Infants were more likely to be early PT, lower birth weight, and shorter gestation and to have grade 3-4 intraventricular hemorrhage or cystic periventricular leukomalacia, BPD, need for oxygen at discharge, and longer

**Table I. Maternal characteristics and transition services by insurance type**

Characteristics	Medicaid	Private insurance	P value
Number of mothers enrolled	448	356	
Maternal age, yr, mean $\pm$ SD	27.6 $\pm$ 6	32.0 $\pm$ 5	<.001
Age <19 yr, n/N (%)	19/438 (4)	4/355 (1)	.007
White race, n (%)	172 (38)	268 (75)	<.001
Black, Hispanic, other race, n (%)	276 (62)	88 (25)	
Non-English-speaking, n/N (%)	343/435 (79)	82/354 (23)	<.001
Gravida >1, n (%)	329 (73)	215 (60)	<.001
Prenatal care, n/N (%)	434/447 (97)	355/355 (100)	<.001
Single, n/N (%)	343/435 (79)	82/354 (23)	<.001
Other children in home aged <5 yr, n/N (%)			
0	232/409 (57)	191/352 (54)	
$\geq 1$	177/409 (43)	161/352 (46)	.50
Total in home, n/N (%)			
2	23/413 (6)	4/353 (1)	<.001
$\geq 3$	390/413 (94)	349/353 (99)	
High school education or less, n/N (%)	273/417 (65)	60/347 (17)	<.001
Some college or more, n/N (%)	144/417 (35)	287/347 (82)	
Protective Services involvement, n/N (%)	77/441 (17)	5/355 (1)	<.001
Domestic violence, n/N (%)	63/437 (14)	6/354 (2)	<.001
Substance abuse, n/N (%)	81/440 (18)	12/354 (3)	<.001
Mental health issues, n/N (%)	182/440 (41)	107/354 (30)	.001

**Table III. Infant characteristics by insurance type in first 90 days**

Characteristics	Medicaid	Private insurance	P value
Enrolled/eligible, N (%)	506/683 (74)	448/611 (73)	
Early; moderate; late PT, %	34; 22; 44	28; 22; 50	.14
Birth weight, g, mean ± SD	1803 ± 655	1902 ± 650	.008
Gestation, wk, mean ± SD	32.0 ± 3	32.4 ± 3	.06
Multiple birth, n/N (%)	107/491 (21)	182/446 (41)	<.001
Breast milk at discharge, n/N (%)	298/505 (59)	345/447 (77)	<.001
Oxygen at discharge, n (%)	28 (6)	18 (4)	.30
NICU stay, d, mean ± SD	37.6 ± 39	34.5 ± 33	.16
Any rehospitalization, n (%)	58 (11)	28 (6)	.007
Total hospitalizations, n (%)			
0	448 (89)	420 (93)	
1	48 (9)	27 (6)	
2+	10 (2)	1(0.2)	.003
Hospital days, mean ± SD (range)	7.2 ± 11 (1-84)	3.8 ± 3 (1-15)	.002
Total days in hospital, n	669	157	.003
PICU hospitalization, n/N (%)	13/58 (22)	5/28 (18)	.6264
Days in PICU, mean ± SD (range)*	15.1 ± 15 (4-60)	6.8 ± 3 (3-11)	.01
Total days in PICU, n	306	27	.0025

\*Per child mean, for those with at least 1 rehospitalization.

There were no differences in rates of small for gestational age birth weight (22% and 22%), male sex (52% and 55%), grade 3-4 intraventricular hemorrhage/cystic periventricular leukomalacia (2% and 2%), necrotizing enterocolitis (3% and 2%), sepsis (4% and 2%), or BPD (11% and 10%).

NICU stays. Breast milk at discharge was associated with a decreased risk of rehospitalization.

Infants admitted to the PICU had a history of more severe neonatal illness compared with hospitalized infants not admitted to the PICU, including lower birth weight (1319 ± 699 g vs 1683 ± 727 g;  $P = .0005$ ), longer NICU stays (76 ± 64 days vs 49 ± 44 days;  $P = .17$ ), and higher rates of BPD (50% vs 25%;  $P = .04$ ) and need for oxygen at discharge (28% vs 6%;  $P = .007$ ). Their mothers were significantly more likely to have less than high school education (41% vs 14%;  $P = .01$ ), a history

of domestic violence (24% vs 7%;  $P = .01$ ), and showed trends toward higher rates of other children in the family (65% vs 56%;  $P = .07$ ) and Rhode Island Department of Children, Youth & Families involvement (17% vs 4%;  $P = .07$ ). Medicaid insurance among hospitalized infants was not associated with PICU admission (22% vs 28%;  $P = .62$ ).

**Table V** (available at [www.jpeds.com](http://www.jpeds.com)) summarizes characteristics of the hospitalizations. Reasons for rehospitalization by 90 days were predominantly respiratory (66.7% for infants with Medicaid and 50.0% for those with private insurance),

**Table IV. Maternal and child characteristics by rehospitalization by 90 days**

Characteristics	Rehospitalized	Not rehospitalized	P value
Mothers, n	83	721	
Medicaid, n (%)	55 (66)	393 (54)	.04
White race, n (%)	40 (48)	400 (55)	
Black, Hispanic, other, mixed race, n (%)	43 (52)	321 (45)	.21
Non-English-speaking, n/N (%)	25 (30)	130/719 (18)	.009
Gravida >1, n (%)	65 (78)	479 (66)	.03
Prenatal care, n/N (%)	80 (96)	709/719 (99)	.13
Other children in home aged <5 yr, n/N (%)			
0	36/80 (45)	387/681 (57)	
≥1	44/80 (55)	294/681 (43)	.04
High school graduate or less, n/N (%)	38/80 (48)	102/684 (15)	
Some college or higher education, n/N (%)	42/80 (52)	582/684 (85)	.001
Children, n (%)	86 (9)	868 (91)	
Early PT, n (%)	38	259	.01, E vs L
Moderate PT, n (%)	15	194	.93, M vs L
Late PT, n (%)	33	415	.05, E vs M
Birth weight, g, mean ± SD	1607.3 ± 732	1873.7 ± 641	.002
Gestational age, wk, mean ± SD	31.0 ± 4	32.3 ± 3	.001
IVH grade 3-4 or cystic PVL, n (%)	8 (9)	11/867 (1)	<.001
BPD, n (%)	26 (30)	71 (8)	<.001
Oxygen at discharge, n (%)	9 (10)	37 (4)	.02
Breast milk at discharge, n (%)	50 (58)	593/866 (68)	.05
Days in NICU, n, mean ± SD	54.2 ± 50	34.4 ± 34	<.001

E, early; IVH, intraventricular hemorrhage; L, late; M, moderate; PVL, periventricular leukomalacia.

Additional characteristics that did not reach statistical significance were age <19 years (4% and 3%), single (54% and 54%), Department of Children, Youth & Families involvement (7% and 11%), domestic violence (10% and 9%), substance abuse (11% and 12%), mental health issues (35% and 37%), male sex (55% and 53%), multiple birth (26% and 31%), birth weight small for gestational age (24% and 22%), necrotizing enterocolitis (Bell stage 2-3; 6% and 2%), and sepsis (5% and 6%).

**Table VI. Regression models predicting rehospitalization**

	OR	95% CI	P value
<b>Model A: Total cohort predictors</b>			
Early vs moderate and late PT	0.7983	0.4241-1.5028	.49
Medicaid insurance	1.6936	1.0201-2.8119	.04
Nonwhite vs other	0.8684	0.5113-1.4746	.60
Non-English-speaking	2.0234	1.1036-3.7099	.02
Gravida >1	1.7406	1.0010-3.0267	.05
BPD	6.1653	2.9685-12.8049	<.001
Breast milk at discharge	0.8999	0.5346-1.5150	.69
Year 2 vs year 1*	0.6860	0.4294-1.0959	.09
Year 3 vs year 1*	0.5772	0.3589-0.9282	.03
Year 3 vs year 2*	0.8414	0.5180-1.3669	.2853
	Rate ratio <sup>†</sup>	95% CI	P value
<b>Model B: Hospitalized cohort predictors</b>			
Early PT	0.88	0.45-1.73	.71
Medicaid	2.05	1.20-3.53	.009
BPD	2.36	1.02-5.45	.04
Non-English speaking	0.90	0.47-1.72	.74
Less than high school education	1.07	0.58-2.01	.81
Domestic violence	1.18	0.59-2.36	.62
Other children aged <5 yr (per child)	0.89	0.70-1.15	.38

\*One-sided 95% CI to test the directional hypothesis of lower odds of rehospitalization over time.

†Estimated by negative binomial regression, not significant: IVH 3-4, necrotizing enterocolitis, breast milk.

Model A: Logistic model to predict at least 1 rehospitalization by 90 days for the total cohort. Model B: Negative binomial regression to assess the risks associated with days of hospitalization for those infants hospitalized.

gastrointestinal (16.7% and 10.0% respectively), and infection/fever (12.5% and 20.0%, respectively). The mean duration of hospitalization for respiratory problems was longer for the infants with Medicaid, and total days of hospitalization for respiratory illness over the 3-year study period was 9-fold higher for infants on Medicaid compared with those with private insurance (443 days vs 48 days). There were 3 cases of injury/abuse, involving 1 child with Medicaid and 2 children with private insurance.

Rates of infant rehospitalization by 90 days trended down in bivariable analyses but did not reach significance for years 1, 2, and 3 for the total cohort (11%, 8%, and 8%, respectively) and for infants on Medicaid (15%, 11%, and 10%) or private insurance (8%, 5%, and 6%).

**Table VI** presents 2 separate regression models. Model A was run to predict at least 1 rehospitalization by 90 days. Year 3 vs year 1 of the transition program was associated with decreased risk of hospitalization (OR, 0.58; 95% CI, 0.36-0.93). Factors associated with higher rate of rehospitalization were Medicaid insurance, non-English-speaking, gravida >1, and BPD. BPD was the most powerful predictor (OR, 6.17; 95% CI, 2.97-12.80). PT group and breast milk at discharge did not reach significance.

Model B, a negative binomial regression model, was run on the subgroup of infants rehospitalized to examine factors associated with the number of days of hospitalization. BPD again was highly significant, associated with a 135% increase in the number of days of hospitalization. Having Medicaid

insurance was associated with a 105% increase in the number of days.

## Discussion

Our first hypothesis, that rates of rehospitalization would decrease between year 1 and 3 as a result of our FRSs' increased experience with the transition protocol over time, was supported by our regression model in which the odds for year 3 vs year 1 for reduced rehospitalization was 0.58, indicating a 42% decrease in risk. We believe that the success of the transition home program is related to providing comprehensive family-centered care for both the infant and mother in a 4-pronged approach of psychosocial support, parent education, medical support continuing postdischarge, and enhanced partnering with parents, NICU staff, and community providers. Key components contributing to this success include the addition of social workers to the team to address multiple psychosocial morbidities, the teaming of FRSs with social workers to provide additional contacts with families in the NICU and home for individualized cost-effective support and education, initiation of family assessment and services as soon as the infant is stable, the partnership with Current Care to receive real-time alerts of Emergency Department visits and hospitalizations, bilingual staff, round-the-clock on-call for families, postdischarge NNP home visits, and improved communication and partnering with community providers. This multifaceted individualized approach is gaining recognition as a key factor in successful discharge planning of the high-risk NICU mother-infant dyad.<sup>18,19</sup>

We also hypothesized that rates of rehospitalization would be higher for infants on Medicaid and those with more social environmental risk factors, as we found in our previous study<sup>1</sup> and also reported by others.<sup>4,9,20</sup> Our findings indicate a combination of illness severity and social adversities contributed to readmission. Eighteen (20%) of the 85 rehospitalized infants were admitted to the PICU; there was no difference in the rate of PICU admission between rehospitalized infants on Medicaid and those with private insurance (22% [12 of 58] vs 28% [5 of 18]), although the mean PICU stay was significantly longer and total PICU days were significantly higher for the infants on Medicaid. In bivariable analyses, infants hospitalized in the PICU had a history of significantly more severe neonatal illness compared with infants with non-PICU hospitalizations. In addition, their mothers were more likely to have less than a high school education and a history of domestic violence and to show trends for higher rates of having other children in the home and Department of Children, Youth, & Families involvement.

These findings indicate that both greater illness severity and increased psychosocial risk factors contribute to PICU admissions. In bivariable analyses, there were higher rates of single rehospitalization and repeated hospitalizations, and longer duration of hospitalization. Regression analyses confirmed the independent association of Medicaid insurance with both the occurrence of rehospitalization and days of rehospitalization. Our transition home program staff specifically

addressed and facilitated needed interventions and supports and had more contacts with families on Medicaid in the hospital. However, families sometimes face additional challenges, including domestic violence, poor education, and non-English-speaking, that cannot easily be resolved, and these were prevalent in our Medicaid population. The 3 social risk factors that almost doubled the risk of rehospitalization were Medicaid insurance, non-English-speaking, and gravida >1. The fact that these social risk factors were predictors after adjusting for BPD and PT group reminds us that vulnerable families with vulnerable infants have social complexities and needs that go beyond state-of-the-art medical management of their infant. The maternal characteristics of our Medicaid families demonstrate these families' increased prevalence of multiple social and environmental risk factors. Non-English-speaking is a risk factor that must be addressed, given the increasing population of immigrants in the US and the known negative impact of language barriers.<sup>9,21,22</sup> Although 2 of our FRSs and 2 social workers were multilingual and were able to communicate effectively with families, non-English-speaking remained an independent contributing factor to rehospitalization.

Another issue is the presence of other children in the household, which may result in increased exposure to infection, a particularly concerning risk for PT infants with BPD.<sup>1</sup> Important components of our program were teaching infection control and coordinating with PCPs to ensure palivizumab treatment for eligible infants.

Breast milk has been found to be protective of rehospitalization in a number of studies<sup>23-25</sup> and was significant in our bivariable analyses at discharge, but not in the regression model. In our previous study, we identified a dose effect by entering volume of breast milk into the model; however, this information was not available for the present study.<sup>23,24</sup>

We analyzed rehospitalization rates for subgroups of early, moderate, and late PT infants. The inclusion of moderate and late PT infants is important because they represent the majority of PT infants, which means although their rate of rehospitalization may be lower, the prevalence and consequent economic burden are high.<sup>12,13,26,27</sup> In our bivariable analysis, the rate of rehospitalization by 90 days was 12.8% in the early PT subgroup, 7.2% in the moderate PT subgroup, and 7.4% for the late PT subgroup. The rehospitalization rate was significantly higher in the early PT subgroup than in either the moderate or the late PT subgroup, although the combined number of rehospitalizations in the moderate and late PT subgroups exceeded the number in the early PT subgroup (48 vs 38). Our previously reported preintervention rehospitalization rate for early PT infants<sup>1</sup> at 90 days was 20% at baseline and 15% after a transition intervention. The early PT rate in the present study cohort was 12.8%, supporting the effectiveness of the transition program.

In the present study, BPD was an important independent medical risk factor for rehospitalization and days of rehospitalization, consistent with our previous findings<sup>1</sup> and findings of others.<sup>8,9</sup> Infants with BPD often have comorbidities, and sometimes rehospitalization cannot be avoided. In bivariable analyses, along with BPD, risk factors for rehospi-

talization included a smaller and more immature infant, longer duration of hospitalization, and discharge on oxygen. In our adjusted regression model, BPD was a powerful medical predictor of rehospitalization, associated with a 6-fold greater risk than prematurity without BPD, consistent with previous reports.<sup>1,9,28</sup> In addition, in our regression model for days of hospitalization among all hospitalized infants, both BPD and Medicaid were associated with increased length of readmission stay.

Despite the FRSs' instructions in infection control, hand-washing, and smoking cessation and the administration of palivizumab, BPD/respiratory illness was the major contributing factor to rehospitalization. Unfortunately, infants with BPD often have limited pulmonary reserve and hence increased susceptibility to respiratory infection and rehospitalization despite compliance with recommendations. This is supported by our finding that almost 67% of Medicaid and 50% of private insurance rehospitalizations were for respiratory illness. In addition, total days of rehospitalization for respiratory causes over the 3-year study period were almost 10-fold higher for infants with Medicaid compared with those with private insurance. This important finding merits further evaluation. We speculate that it is a combination of social or environmental adversities and language barriers delaying discharge and increased illness severity secondary to repeated exposures to infection, smoking, and poor air quality.

In our previous smaller cohort study,<sup>1</sup> the transition intervention did not include moderate and late PT infants, and our staff included only 1 social worker and 1 FRS. The effectiveness of the original model convinced us of the benefit of a team that includes a FRS-social worker partnership. The FRSs in our study were able to enroll and complete a transition home protocol for families with and without social environmental complexities under the guidance and support of an experienced social worker. An integral component of the Affordable Care Act is reducing costs while improving care and outcomes. Our model of incorporating trained parents into the team especially for the underserved is effective.<sup>1</sup> Other reports have described parents as peer counselors, mentors, and navigators who provide effective interventions for combating childhood obesity,<sup>29</sup> recruitment for health insurance,<sup>30</sup> asthma management,<sup>31</sup> and reduction of hospitalization.<sup>1</sup>

Strengths of this study are the enrollment of 74% of eligible infants over a 3-year period, collection of social/environmental and medical risk factors, participation of bilingual FRSs and social workers, and enrollment of 66% in the statewide electronic database, which provides real-time alerts of rehospitalizations. Weaknesses include the lack of a concurrent comparison group that did not participate in the transition program and limited power for subgroup analyses.

In summary, transition home programs for high-risk PT infants that address both social/environmental and medical risk factors of the mother-infant dyad can effectively decrease the risk of rehospitalization. Expansion of comprehensive family-centered individualized transition home programs provided by teams which include FRSs and social workers is needed. ■

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**Table II. Transition home services provided by insurance type**

Transition services	Medicaid (n = 448)	Private insurance (n = 356)	P value
Number of predischARGE meetings, mean $\pm$ SD*	3.8 $\pm$ 4	3.2 $\pm$ 3	.01
Reviewed education binder, n (%) <sup>*</sup>	438 (98)	353 (99)	.12
Enrolled in current care, n (%) <sup>†</sup>	360 (71)	272 (61)	.001
Postdischarge phone call, n (%) <sup>*</sup>	442 (99)	353 (99)	.50
Early-moderate PT home visit by NNP, n (%) <sup>†</sup>	258 (92)	207 (92)	.83
Early-moderate PT 1-mo visit, n/N (%) <sup>†</sup>	257/281 (91)	218/225 (97)	.04
Early-moderate PT 3-mo visit, n/N (%) <sup>†</sup>	232/281 (83)	211/225 (94)	.003
Late PT 1-mo contact, n/N (%) <sup>†</sup>	199/225 (88)	206/223 (92)	.13
Late PT 3-mo phone contact, n/N (%) <sup>†</sup>	154/225 (68)	181/223 (81)	.005

\*Based on number of mothers.

†Based on number of infants.

**Table V. Characteristics of hospitalizations by insurance type**

	Reason for hospitalization, n (%) <sup>*</sup>		Days of hospitalization, n, mean $\pm$ SD (median)		Total hospital days during the study period, n	
	Medicaid	Private	Medicaid	Private	Medicaid	Private
Accidents	0 (0)	1 (3)	—	2	0	2
Gastrointestinal	12 (17)	3 (10)	5 $\pm$ 5 (3)	4.3 $\pm$ 5 (2)	60	13
Infection/fever	9 (13)	6 (20)	3.8 $\pm$ 4 (2)	4.8 $\pm$ 5 (3)	34	29
Injury-abuse	1 (1)	2 (7)	15	9 $\pm$ 3 (9)	15	18
Neurologic	2 (3)	3 (10)	7.0 $\pm$ 7 (7)	2.7 $\pm$ 2 (2)	14	8
Respiratory	48 (67)	15 (50)	9.2 $\pm$ 15 (3)	3.2 $\pm$ 3 (2)	443	48

\*In addition, there were 5 infants with scheduled admissions for planned surgical procedures.