



Published in final edited form as:

*J Perinatol.* 2016 December ; 36(12): 1112–1115. doi:10.1038/jp.2016.136.

## A Free Parking Trial to Increase Visitation and Improve Extremely Low Birth Weight Infant Outcomes

Thomas F. Northrup, Ph.D.<sup>1</sup>, Patricia W. Evans, M.D.<sup>2</sup>, Margaret L. Lillie, R.N., B.S.N.<sup>2</sup>, and Jon E. Tyson, M.D, MPH<sup>2</sup>

<sup>1</sup>Department of Family and Community Medicine, The University of Texas Health Science Center at Houston (UTHealth), McGovern Medical School, Houston, TX

<sup>2</sup>Department of Pediatrics, UTHealth, McGovern Medical School, Houston, TX

### Abstract

**Objective**—Frequent parental visits are likely to benefit infants in a neonatal ICU (NICU), particularly extremely low birth weight (ELBW; <1000g) survivors. Parking costs ( \$10/visit in our center) may deter visitation, especially for low-income parents. We assessed whether free parking (FP) decreased survivors' length-of-stay (LOS).

**Study Design**—Parents (N=138) of ELBW infants (7–14 days old) were randomized to usual care (UC; n=66) or FP (n=72). The primary outcome was LOS.

**Results**—Among survivors (n=116), LOS was not significantly less with FP than UC (*Means*: FP=89, UC=102 days; *p*=0.22; *Medians*: FP=82, UC=84 days; *p*=0.30). Groups did not differ significantly on proportion of visit days (FP=0.69, UC=0.72, *p*=0.47), parental involvement, knowledge/skills, and satisfaction. Post-hoc analyses found that parents with a greater income, a car, and fewer children visited more.

**Conclusion**—More potent interventions than FP are needed to increase parental visits and reduce LOS for ELBW infants in disadvantaged urban populations.

### Keywords

ELBW; free parking; NICU; neonatal ICU; parental visitation; visitation barriers

### Introduction

Frequent parental visits are widely recommended in neonatal intensive care units (NICUs) as part of patient- and family-centered care (PFCC) and have a variety of major potential

Users may view, print, copy, and download text and data-mine the content in such documents, for the purposes of academic research, subject always to the full Conditions of use: [http://www.nature.com/authors/editorial\\_policies/license.html#terms](http://www.nature.com/authors/editorial_policies/license.html#terms)

Correspondence concerning this article should be addressed to Patricia W. Evans, MD, 3500 Gaston Ave., Suite 3 HOB, Dallas, TX, 75246, [ [Patricia.Evans@baylorhealth.edu](mailto:Patricia.Evans@baylorhealth.edu) ], (214) 820-7604.

#### Supplementary Information

Supplementary information is available at *Journal of Perinatology's* website.

#### Conflict of Interest

The authors declare no conflicts of interest.

benefits for the infants and parents.<sup>1,2,3,4,5,6,7,8,9,10</sup> However, in our center, as in other centers, many parents visit infrequently despite our emphasis on PFCC.

Extremely low birth weight (**ELBW**; < 1000 g) survivors typically spend several months in a NICU before discharge home (median=79 days for ELBW infants).<sup>11</sup> In our center, the cost of parking ( \$10 for 2 hours) is cited by parents as a major impediment to frequent visits. Because ELBW infants are often born to low-income parents, the cost of parking may be an important unappreciated barrier to frequent visitation in many urban centers. With ongoing changes in the organization and reimbursement of healthcare, enlightened administrators in urban hospitals might consider underwriting parking costs for families of ELBW infants if it were shown to augment infant care, bolster parent satisfaction, and/or shorten hospital stay.

To test the value of such a program, our hospital administration agreed to provide free parking to the parents of a sample of ELBW infants. We then conducted a randomized trial of free parking to fairly make it available to parents and avoid biased study results.<sup>12</sup> The primary outcome was length of stay (**LOS**) as a simple objective indicator of resource costs and the potential clinical benefits of more frequent visitation (e.g., increased staff attentiveness to the infant, better feeding and growth, a reduced risk of infection, and increased parental education and readiness to care for the infant at home). Secondary aims included assessing parental visitation frequency and length, infant breast milk intake, and parent teaching/knowledge, skills, and satisfaction.

## Methods

The Committee for the Protection of Human Subjects at the University of Texas Health Science Center at Houston (**UTHealth**) approved this randomized trial, with all participants providing verbal consent.

### Participants and Procedures

The project was conducted between November 2007 and February 2011 at Memorial Hermann Hospital (Houston, TX) in our 118-bed NICU (housing 38 private rooms with beds available for parents to sleep). Eligibility criteria included birth weight < 1000 grams, age 7–14 days, and deemed “likely to survive.” Exclusion criteria were uncertain custody status or anticipated hospital transfer. Participants who did not own a car were eligible if they reported reliable automobile access from another household member or family/friends. Infants were randomized using opaque, consecutively numbered, sealed envelopes stratified by birth weight (< 750g; >750g) and mechanical ventilation status (yes/no) on postnatal day seven.

The free parking (**FP**) group received 7 parking vouchers at a time (value: \$10/each) from the hospital’s central research coordination office, a 3-minute walk from the NICU, and continued to receive vouchers until infant discharge. Each voucher allowed free entry and exit for a 24-hour period (including reentry). The garage is a 5–7 minute walk from the NICU and connected by an enclosed skybridge. The usual care (**UC**) group did not receive vouchers.

## Assessments

Health data were collected from medical records, including LOS after randomization until discharge home (including days in another NICU/convalescent facility). Number of visit days, hours/visit, feeding (breastfed, expressed breastmilk, formula fed), and parent involvement in infant care (e.g., feeding, kangaroo care) were extracted from nursing notes by blinded research assistants. Parental knowledge and infant-care skills were assessed on a 100-point scale (greater scores indicated greater knowledge/skills) with a research-staff interview, during the first high-risk-infant clinic visit after discharge. For example, medication familiarity and car seat safety were assessed. A multi-area, 11-item survey assessed parental satisfaction with NICU care.<sup>13</sup> Seven items were summed (range: 7–35) to measure “Support” (e.g., information sharing; see the Supplementary Table Note for specific items). Three items measured “Emotional Connection” to the infant (range: 3–15) and one item assessed family involvement in infant care (responses: not enough, just right, too much). Greater scores indicated higher perceived support, connection, and satisfaction.

## Data Analyses

Based on LOS data available from the NICHD Neonatal Research Network (i.e., total LOS  $SD=24$  days), a type II error rate of  $\beta=0.2$ ,  $\alpha=0.05$  (two-sided), and a projected mean LOS reduction of 12 days in the parking group, the required sample size was 64 per treatment group. Adjusting for an 8.6% expected number of infant deaths after enrollment, the recruitment goal was 140.

Frequency counts were compared using chi-squared tests. Continuous variables (including our primary outcome) were assessed via a mixed effects regression model (PROC MIXED), accounting for sibling correlation, due to the enrollment of 7 sets of twins, using SAS 9.4 (Cary, NC). When mixed effects models failed to converge, ANOVA (PROC GLM) was used, accounting for singleton status as a covariate (where necessary). Pearson correlations were used to provide magnitudes of associations. No correction for multiple comparisons was employed.

## Results

Five infants met exclusion criteria. Patients who met inclusion criteria ( $N=278$ ) were not enrolled if staff could not contact parents of infants between 7–14 days old ( $n=85$ ) or if the infant died prior to randomization ( $n=53$ ). Two participants were excluded due to staff inability to determine group allocation (i.e., randomization errors). Randomized participants ( $N=138$ ) were allocated to FP ( $n=72$ ) and UC ( $n=66$ ) groups.

Mean gestational age was 25.8 weeks and mean birth weight was 782g. Half of the infants were female (48.5%); 24.3% were White, 34.6% Black, 30.2% Hispanic, 3.7% Asian, and 7.4% identified as “Other” races/ethnicities. On postnatal day seven, 46.7% of the infants were receiving mechanical ventilation. Participants (most often mothers’) average age was 29 years, 82.5% had a high school diploma/GED, 35.5% reported an annual income \$20,000, and 50.4% were married. No significant differences were found across group characteristics at baseline (See Supplementary Table).

A total of 21 infants died before discharge. The number of deaths and days from randomization to death were not significantly different between groups (See Supplementary Table). One infant was transferred (and LOS data could not be obtained). The analyzable sample of survivors was 116.

There was no significant difference between FP and UC groups with respect to mean LOS (FP=89 [ $SD=37$ ], UC=102 [ $SD=66$ ] days;  $F=2.44$ ,  $p=0.22$ ), median LOS (FP=82, UC=84 days; non-parametric [2-sided] t-test approximation:  $p=0.30$ ) or proportion of days that parents visited (FP=0.69 [ $SD=0.27$ ], UC=0.72 [ $SD=0.21$ ];  $F=0.59$ ,  $p=0.47$ ). Similarly, there was no difference in mean hours per visit between groups (FP=2.5 [ $SD=1.8$ ], UC=2.8 [ $SD=2.0$ ];  $F=0.57$ ,  $p=0.47$ ). The groups also did not differ significantly with respect to breast or bottle feeding; infant holding; or, parent knowledge, skill, or satisfaction (Supplementary Table).

In post hoc analyses, collapsing across both groups, visit frequency and length increased with higher household incomes (i.e., <\$50,000 compared to \$50,000,  $p<0.01$ ) and the proportion of visit days and hours per visit decreased significantly as the number of other children in the household increased ( $p<0.01$ ) (Table 1). Though not statistically significant, parents who owned cars tended to visit more often ( $p=0.12$ ) and for shorter periods of time ( $p=0.11$ ). Mothers who worked were not significantly different than those who did not on proportion of visit days ( $p=0.26$ ) or hours per visit ( $p=0.43$ ).

Proportion of visit days was not significantly associated with LOS ( $F=0.28$ ,  $p=0.65$ ). A small-to-moderate positive correlation ( $r=0.17$ ) was observed between average hours per visit and LOS but the relationship was not significant ( $F=3.04$ ,  $p=0.22$ ). However, proportion of visit days and hours per visit were significantly and *positively* associated with several parental involvement indices (Table 2). The highest associations were found between visitation frequency ( $r=0.55$ ;  $p<0.01$ ) and hours of visitation with kangaroo care (i.e., skin-to-skin contact;  $r=0.72$ ;  $p<0.01$ ). Small-to-moderate positive associations were found for breast pumping with both visitation indices, and bottle feeding, diapering, bathing, and medication provided by the parent correlated with one or both of the visitation indices.

## Discussion

Low parental visitation to ELBW infants is a multi-faceted and complex problem, particularly for families with few financial and other resources. Indeed, free parking was not a sufficient intervention strategy to significantly increase parental visitation in a sample for which a third of households fell below the U.S. federal poverty level for a family of three.<sup>14</sup> Parents of ELBW infants will likely need greater psychosocial support, as well as other incentives, to achieve infant health and parent satisfaction gains with similarly socioeconomically disadvantaged families.

Observational studies have shown that when families are more involved in the care of their infants, the families and the infants do better.<sup>9,15,16,17</sup> Other work suggests establishing parental involvement early in life may have lasting effects. A small observational study from Finland reported that NICU infants visited daily had fewer behavioral and emotional

problems at 7 years of age. Interestingly, visitation was a stronger determinant of outcome than gestational age, birth weight, or the medical risks of the infant.<sup>18</sup>

Randomized controlled trials (RCTs) focused on increasing visitation or reducing LOS have produced encouraging results with similar NICU populations.<sup>7,17,19</sup> For example, an RCT with preterm infants (N=260) demonstrated that a 4-session educational/behavioral intervention with parents led to a 3.8-day shorter NICU stay compared to infants in the control condition. The effect was more pronounced for a sub-sample of very-low-birth-weight infants (< 1500g), as the intervention group had a stay reduction of 8.3 days.<sup>7</sup> Our free-parking approach did not demonstrate similar effects on LOS for our sample of ELBW infants.

Free parking was chosen based on anecdotal parental statements to our staff that parking costs were a major visitation deterrent. In hindsight, a more thorough assessment of the causes of infrequent visitation may have generated additional worthwhile intervention strategies. Such an assessment would likely uncover other significant time and financial costs, potentially more important to parents, such as other childcare and other transportation barriers (e.g., gasoline costs). Indeed, our data and others have found that childcare responsibilities for other children in the home affects visitation.<sup>20</sup>

Parental stress and perceived communication with NICU staff have been hypothesized as important factors affecting visitation<sup>21</sup> and potentially infant LOS.<sup>7</sup> Specifically, it has been postulated that NICU staff may subtly and inadvertently discourage families from visiting their infants, instead of encouraging infant holding and active participation. For example, most NICUs have 24-hour visitation policies but exclude parents from aspects of care that they might provide or ask parents to leave during shift changes or procedures—a practice that may communicate potentially conflicting messages to families about their role and increase parental stress.<sup>22</sup> Parents and medical staff should view themselves as joint caregivers, working toward a common goal of timely discharge of a healthy infant.

Distance from the hospital and difficulties with transportation are also major contributing elements to visitation,<sup>20,23</sup> which may be exacerbated in large metropolitan areas. Parents visiting from greater distances (>1 hour travel time) may stay for longer periods on days when they visit, making both frequency and duration of visitation important variables to measure accurately in future research.<sup>24</sup> Further, car ownership (compared to relying on other family/friends for rides) emerged as a likely determinant of visitation. Visitation data from fathers and other family/household members may be important for understanding mothers' visitation and infants' LOS as well, with observational studies tending to show that fathers visit less often and are less active in their infants' care.<sup>22,23</sup>

Failing to educate families about benefits of participating in care could also lessen visitation. For example, breast milk feeding has been associated with a reduced incidence of necrotizing enterocolitis.<sup>25</sup> Kangaroo care (skin-to-skin holding) has been reported to reduce infection,<sup>26</sup> improve neurodevelopment,<sup>27,28</sup> and a randomized trial found it was associated with increased head growth compared to traditional holding among premature (< 32 weeks; 1500g) infants. However, most NICUs may not go far enough to highlight the likely

benefits of parental participation in the infants' care. Further, associations between visitation frequency and length and care-by-parent measures shown with our data underscore the importance of increasing parental visitation to potentially increase these positive parenting behaviors.

Our power to identify benefits from free parking was limited as over 15% of infants in our sample died after randomization (almost twice as many as projected). Further our approach to providing free parking might have been more effective. For instance, distributing free parking passes at the front desk at all hours might have increased visitation. Of the 85 parents not approached within the inclusion window, intervening sooner and continuing attempts beyond 14 days may have increased enrollment and ultimately reduced the length of this trial for this difficult-to-reach population.

Frequent parental visitation is a necessary component for ELBW infants to receive numerous benefits while being cared for in the NICU.<sup>10</sup> Our design was not powerful enough to recommend free parking as a stand-alone intervention in similar urban NICUs to increase visitation. We encourage more work on this understudied area by interviewing parents about reasons for non-visitation (including perceptions about the NICU staff and environment). These data may generate simple ways to increase parental visitation that could reduce overall costs if hospital stays were shortened. Transportation, other childcare duties, work-related demands, and a multitude of other psychosocial stressors will likely emerge as worthwhile investigative targets.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

The authors would like to acknowledge the diligence and dedication of Josephine Turner at the UTHealth Clinical Research Unit at Memorial Hermann-TMC, Michelle Celestin for her help preparing the references' section of this manuscript, and the staff of the UTHealth High-Risk Infant Clinic. This study was supported by a Clinical and Translational Science Award (NCATS UL1 TR000371 & UL1 RR 024148, PI=McPherson; NCATS KL2 TR000370 & KL2 RR 024149, PI=Evans). Dr. Northrup's data analysis and writing time were supported in part by the National Heart, Lung, and Blood Institute (R01 HL107404, PI=A.L. Stotts) at the U.S. National Institutes of Health, and Department of Health and Human Services.

## References

1. Institute of Medicine. Crossing the quality chasm: A new health system for the 21st century. Washington, D.C.: National Academy Press; 2001. Committee on Quality of Health Care in America.
2. Gooding JS, Cooper LG, Blaine AI, Franck LS, Howse JL, Berns SD. Family support and family-centered care in the neonatal intensive care unit: Origins, advances, impact. *Semin Perinatol.* 2011; 35(1):20–28. [PubMed: 21255703]
3. Cooper L, Gooding J, Gallagher J, Sternesky L, Ledsky R, Berns S. Impact of a family-centered care initiative on NICU care, staff and families. *J Perinatol.* 2007; 27:S32–S37. [PubMed: 18034178]
4. Obeidat HM, Bond EA, Callister LC. The parental experience of having an infant in the newborn intensive care unit. *The J of Perinatal Ed.* 2009; 18(3):23.



5. Committee On Hospital Care And Institute For Patient- And Family-Centered Care. Patient-and family-centered care and the pediatrician's role. *Pediatrics*. 2012; 129(2):394–404. [PubMed: 22291118]
6. Institute for Health care Improvement. Person- and Family-Centered Care. 2015 [cited 2015 December 21, 2015] Available from: <http://www.ihc.org/topics/PFCC/Pages/default.aspx>.
7. Melnyk BM, Feinstein NF, Alpert-Gillis L, Fairbanks E, Crean HF, Sinkin RA, et al. Reducing premature infants' length of stay and improving parents' mental health outcomes with the Creating Opportunities for Parent Empowerment (COPE) neonatal intensive care unit program: A randomized, controlled trial. *Pediatrics*. 2006; 118(5):e1414–e1427. [PubMed: 17043133]
8. Örténstrand A, Westrup B, Broström EB, Sarman I, Åkerström S, Brune T, et al. The Stockholm Neonatal Family Centered Care Study: Effects on length of stay and infant morbidity. *Pediatrics*. 2010; 125(2):e278–e285. [PubMed: 20100748]
9. Kohn, LT.; Corrigan, JM.; Donaldson, MS. To err is human: Building a safer health system. Washington, D.C.: National Academies Press; 2000.
10. Davidson JE, Powers K, Hedayat KM, Tieszen M, Kon AA, Shepard E, et al. Clinical practice guidelines for support of the family in the patient-centered intensive care unit: American College of Critical Care Medicine Task Force 2004–2005. *Crit Care Med*. 2007; 35(2):605–622. [PubMed: 17205007]
11. Lee HC, Bennett MV, Schulman J, Gould JB. Accounting for variation in length of NICU stay for extremely low birth weight infants. *J Perinatol*. 2013; 33(11):872–876. [PubMed: 23949836]
12. Fan E, Laupacis A, Pronovost PJ, Guyatt GH, Needham DM. How to use an article about quality improvement. *JAMA*. 2010; 304(20):2279–2287. [PubMed: 21098772]
13. Dunn MS, Reilly MC, Johnston AM, Hoopes RD, Abraham MR. Development and dissemination of potentially better practices for the provision of family-centered care in neonatology: The family-centered care map. *Pediatrics*. 2006; 118(Supplement 2):S95–S107. [PubMed: 17079629]
14. U.S. Centers for Medicare & Medicaid Services. [cited 2016 June 21, 2016] Federal Poverty Level (FPL). 2016. Available from: <https://www.healthcare.gov/glossary/federal-poverty-level-FPL/>
15. Fanaroff AA, Kennell JH, Klaus MH. Follow-up of low birth weight infants—the predictive value of maternal visiting patterns. *Pediatrics*. 1972; 49(2):287–290. [PubMed: 5059535]
16. Latva R, Lehtonen L, Salmelin R, Tamminen T. Visits by the family to the neonatal intensive care unit. *Acta Paediatr*. 2007; 96(2):215–220. [PubMed: 17429908]
17. Bhutta ZA, Khan I, Salat S, Raza F, Ara H. Reducing length of stay in hospital for very low birthweight infants by involving mothers in a stepdown unit: An experience from Karachi (Pakistan). *BMJ*. 2004; 329(7475):1151–1155. [PubMed: 15539671]
18. Latva R, Lehtonen L, Salmelin RK, Tamminen T. Visiting less than every day: A marker for later behavioral problems in Finnish preterm infants. *Arch Pediatr Adolesc Med*. 2004; 158(12):1153–1157. [PubMed: 15583100]
19. Zeskind PS, Iacino R. Effects of maternal visitation to preterm infants in the neonatal intensive care unit. *Child Dev*. 1984:1887–1893. [PubMed: 6510059]
20. Giacoia GP, Rutledge D, West K. Factors affecting visitation of sick newborns. *Clin Pediatr (Phila)*. 1985; 24(5):259–262. [PubMed: 3987165]
21. Gonya J, Nelin LD. Factors associated with maternal visitation and participation in skin-to-skin care in an all referral level IIIc NICU. *Acta Paediatr*. 2013; 102(2):e53–e56. [PubMed: 23088567]
22. McGrath JM. Strategies for increasing parent participation in the neonatal intensive care unit. *The Journal of Perinatal & Neonatal Nursing*. 2011; 25(4):305–306. [PubMed: 22071611]
23. Franck LS, Spencer C. Parent visiting and participation in infant caregiving activities in a neonatal unit. *Birth*. 2003; 30(1):31–35. [PubMed: 12581037]
24. Callahan EJ, Brasted WS, Myerberg DZ, Hamilton S. Prolonged travel time to neonatal intensive care unit does not affect content of parental visiting: A controlled prospective study. *J Rural Health*. 1991; 7(1):73–83. [PubMed: 10109838]
25. Quigley M, McGuire W. Formula versus donor breast milk for feeding preterm or low birth weight infants. *The Cochrane Library*. 2014
26. Ludington-Hoe S, Hadeed A, Anderson G. Physiologic responses to skin-to-skin contact in hospitalized premature infants. *J Perinatol*. 1991; 11(1):19–24. [PubMed: 2037883]

27. Feldman R, Eidelman AI. Skin-to-skin contact (Kangaroo Care) accelerates autonomic and neurobehavioural maturation in preterm infants. *Dev Med Child Neurol.* 2003; 45(4):274–281. [PubMed: 12647930]
28. Reynolds LC, Duncan MM, Smith GC, Mathur A, Neil J, Inder T, et al. Parental presence and holding in the neonatal intensive care unit and associations with early neurobehavior. *J Perinatol.* 2013; 33(8):636–641. [PubMed: 23412640]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript



Visitation Frequency and Hours of Visitation by Household Income, Parental Car Ownership, Maternal Work Status, and Number of Other Children.

**Table 1**

Characteristic	n	Proportion of Days with a Visit		Hours of Visitation	
		M(SD)	F, p	M(SD)	F, p
Income			F=18.8, p<0.01		F=13.9, p<0.01
<\$50,000	72	0.63(0.25)		2.1(1.5)	
\$50,000	45	0.82(0.17)		3.3(2.0)	
Parental car ownership			F=3.1, p=0.12		F=3.2, p=0.11
Yes	95	0.72(0.24)		2.2(1.2)	
No	30	0.64(0.21)		2.8(2.0)	
Mother working			F=1.5, p=0.26		F=0.7, p=0.43
Yes	44	0.74(0.24)		2.9(2.0)	
No	94	0.69(0.24)		2.6(1.9)	
Number of other children			F=15.5, p<0.01		F=22.9, p<0.01
0	69	0.77(0.22)		3.4(2.1)	
1	36	0.67(0.21)		2.2(1.4)	
2	24	0.60(0.29)		1.7(1.0)	
3 or more	7	0.52(0.21)		1.4(1.3)	

Note. Where numbers do not add up to the total sample size, the remainder represents missing data.

**Table 2**

Pearson Correlations between Visitation Frequency and Hours of Visitation by Care-by-Parent Measures

Care-by-Parent Index	Visit Frequency ( <i>r</i> )	Hours of Visitation ( <i>r</i> )
Breast milk (% fed)	0.23 <sup>*</sup>	0.15
Number of breast feedings	-0.02	-0.03
Bottle feeding	0.28 <sup>*</sup>	0.30 <sup>*</sup>
Diapering	0.27 <sup>*</sup>	0.24 <sup>*</sup>
Breast pumping	0.23 <sup>*</sup>	0.28 <sup>*</sup>
Bathing	0.24 <sup>*</sup>	0.28 <sup>*</sup>
Medication	0.16	0.18 <sup>*</sup>
Kangaroo care	0.55 <sup>*</sup>	0.72 <sup>*</sup>

*Note.* "Breast milk (% fed)" was calculated as the percentage of breast milk the infant received over an entire day's feedings (e.g., 2 feedings out of 8 = 25%).

<sup>\*</sup>*p*<0.01

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript