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A Randomized Trial of Single Home Nursing Visits vs Office-Based Care After Nursery/Maternity Discharge

The Nurses for Infants Through Teaching and Assessment After the Nursery (NITTANY) Study

Ian M. Paul, MD, MSc; Jessica S. Beiler, MPH; Eric W. Schaefer, MS; Christopher S. Hollenbeak, PhD; Nancy Alleman, CRNP; Sarah A. Sturgis, CRNP; Stella M. Yu, ScD, MPH; Fabian T. Camacho, MS, MA; Carol S. Weisman, PhD

Objective: To compare office-based care (OBC) with a care model using a home nursing visit (HNV) as the initial postdischarge encounter for "well" breastfeeding newborns and mothers.

Design: Randomized controlled trial.

Setting: A single academic hospital.

Participants: A total of 1154 postpartum mothers intending to breastfeed and their 1169 newborns of at least 34 weeks' gestation.

Interventions: Home nursing visits were scheduled no later than 2 days after discharge; OBC timing was physician determined.

Outcome Measures: Mothers completed telephone surveys at 2 weeks, 2 months, and 6 months. The primary outcome was unplanned health care utilization for mothers and newborns within 2 weeks of delivery. Other newborn outcomes were proportion seen within 2 days after discharge and breastfeeding duration. Maternal mental health, parenting competence, and satisfaction with care outcomes were assessed. Analyses followed an intent-to-treat paradigm.

Results: At 2 weeks, hospital readmissions and emergency department visits were uncommon, and there were no study group differences in these outcomes or with unplanned outpatient visit frequency. Newborns in the HNV group were seen no more than 2 days after discharge more commonly than those in the OBC group (85.9% vs 78.8%) ($P=.002$) and were more likely to be breastfeeding at 2 weeks (92.3% vs 88.6%) ($P=.04$) and 2 months (72.1% vs 66.4%) ($P=.05$) but not 6 months. No group differences were detected for maternal mental health or satisfaction with care, but HNV group mothers had a greater parenting sense of competence ($P<.01$ at 2 weeks and 2 months).

Conclusions: Home nursing visits are a safe and effective alternative to OBC for the initial outpatient encounter after maternity/nursery discharge with similar patterns of unplanned health care utilization and modest breastfeeding and parenting benefits.

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Author Affiliations: Departments of Pediatrics (Dr Paul and Hollenbeak and Mss Beiler and Sturgis), Public Health Sciences (Drs Paul and Weisman and Messrs Schaefer and Camacho), and Obstetrics and Gynecology (Dr Weisman), Penn State College of Medicine, Hershey, Pennsylvania (Dr Weisman); Visiting Nurse Association of Central Pennsylvania, Harrisburg (Ms Alleman); and Health Resources and Services Administration–Maternal and Child Health Bureau, Rockville, Maryland (Dr Yu).

WITH OVER 4 MILLION deliveries annually, childbirth is among the most common causes of hospitalization in the United States.[1] While medical and social issues for today's term newborns and mothers are similar to those of a generation ago, the maternity and newborn hospitalizations are much different. A simple example of this is shorter length of stay (LOS): in 1970, the mean postpartum LOS following vaginal delivery was 3.9 days vs 7.8 days for cesarean delivery[2]; maternity LOSs now average 2.2 days after a vaginal delivery and 3.6 days after a cesarean section.[1]

Shorter LOSs increase the likelihood that newborn care providers will fail to recognize conditions requiring intervention such as jaundice, dehydration, cardiac lesions, and major infections.[3-7] This may be exacerbated by inconsistent or untimely follow-up after hospital discharge, and since passage of the Newborns' and Mothers' Health Protection Act (NMHPA) by the US Congress in 1996,[8] data have emerged suggesting that postdischarge care actually may have worsened for newborns in recent years.[9-13] Numerous maternal morbidities also occur in the immediate postpartum period,[14-19] and the Health Employer Data and Information Set[20] has demonstrated that women's attendance at postpartum fol-

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low-up appointments is suboptimal: 80% of women with private insurance and only 55% insured by Medicaid have a postpartum visit. Improving health care delivery for postpartum mothers is clearly important.

Recognizing the possible morbidities associated with short stays as well as the desire to support new families and breastfeeding, the American Academy of Pediatrics (AAP) has published guidelines[21-28] related to newborn care, hyperbilirubinemia, and breastfeeding, which all have emphasized that timely follow-up should typically occur within 2 days of newborn discharge. While adherence to practice guidelines could diminish morbidity, solutions to achieve this goal must be practical, cost-effective, and capable of overcoming traditional barriers.[29] Members of our research group have previously demonstrated that home nursing visits (HNVs) were cost-effective for the prevention of newborn readmissions and emergency department (ED) visits for jaundice and dehydration when examined retrospectively.[30] In the present prospective trial, the Nurses for Infants Through Teaching and Assessment After the Nursery (NITTANY) study, we sought to compare the typical office-based care (OBC) model of postnatal/postpartum health care with a model using a HNV as the initial postdischarge encounter for "well" breastfeeding newborns and mothers. This study is the first to our knowledge to compare these models following both vaginal and cesarean deliveries using a community-based, private home health agency with maternal-child health visiting nurses. We hypothesized that well-timed HNVs would reduce unplanned health care utilization, improve adherence to follow-up guidelines, improve breastfeeding rates, and reduce adverse mental health outcomes, while improving parenting sense of competence and satisfaction with care.

METHODS

PARTICIPANTS

Mother-newborn dyads with deliveries at the Penn State Milton S. Hershey Medical Center (Hershey, Pennsylvania) between September 12, 2006, and August 1, 2009, were screened for participation in our study. Eligible newborns were singletons and twins born after at least 34 weeks' gestation to English-speaking mothers attempting to breastfeed during the maternity stay and with intent to continue breastfeeding after discharge. Dyads were excluded for atypical stays characterized by (1) a 2-night or longer stay after a vaginal delivery; (2) a 4-night stay or longer after a cesarean section; (3) a hospital course with atypical complications (eg, ambiguous genitalia, endometritis); or (4) newborn hyperbilirubinemia requiring phototherapy during the nursery stay. Mothers were also excluded for major morbidities and/or preexisting conditions that would affect postpartum care, lack of a telephone number, previous study participation, residence outside the coverage region of the Visiting Nurse Association of Central Pennsylvania (VNA), or if an HNV was specifically requested by a hospital social worker or child protective services owing to social concerns. The study was approved by Penn State College of Medicine's Human Subjects Protection Office and registered at http://www.clinicaltrials.gov prior to the first participant's enrollment.

STUDY DESIGN AND DATA COLLECTION

Participating mothers and their newborns were randomized to either the OBC or HNV groups after informed consent was obtained. The computer-generated randomization sequence included stratification for delivery type (vaginal, forceps- or vacuum-assisted vaginal, or cesarean section). During the maternity/nursery hospitalization, maternal interviews and hospital chart abstractions were conducted for baseline data collection using materials adapted from the Birth and Beyond Experience study.[31]

Following recommendations of 2 American Academy of Pediatrics (AAP) policy statements at the time the trial began,[22,25] HNVs were scheduled to occur within 48 hours of discharge, typically 3 to 5 days after childbirth. All HNVs were conducted by 1 of 7 VNA-employed maternal child health nurses who had a mean (SD) of 21.4 (9.1) years of experience. To supplement their baseline knowledge, all nurses received continuing education related to breastfeeding support and cultural competency prior to study initiation. Before hospital discharge, an office visit was also scheduled for HNV newborns approximately 1 week following the HNV to establish a medical home for the newborn and to ensure recovery from expected, initial weight loss after birth. Depending on individual circumstances (eg, day of the week, gestational age, early discharge), these visits were scheduled to occur 5 to 14 days after birth. Postdischarge visit timing for OBC newborns was determined by the newborn nursery physician, and maternal office follow-up was scheduled by the obstetricians for both study groups. Telephone interviews with mothers were then conducted by study coordinators blinded to study group 2 weeks, 2 months, and 6 months after childbirth.

OUTCOME MEASURES

The primary study outcome was maternal and infant use of unplanned health care services (inpatient, ED, urgent or acute care, primary care, mental health) in the 14 days after delivery. The distinction between a planned and unplanned visit was determined by a blinded study coordinator who asked the participating mother for the reason for each visit from a list of options. Examples of a planned visit for newborns would be postdischarge weight checks or health maintenance visits, while those for mothers included scheduled stitch removals and routine postpartum checks that typically occur over a month after delivery. Fourteen days was chosen as the end point for the primary analysis for 3 reasons. First, neonatal jaundice and dehydration typically occur shortly after hospital discharge and are the 2 most common and potentially preventable causes of newborn hospital readmission.[4,5,23,32-43] Second, maternal postpartum morbidities are also most likely to occur within 2 weeks of childbirth.[15-18] Third, a single HNV occurring shortly after discharge was hypothesized to have greater short-term benefits. Healthcare utilization in the first 60 days after delivery also was assessed as a secondary outcome.

Participant health care utilization was assessed via maternal self-report using survey questions designed for this study. Though maternal report has been shown to be a reliable indicator of actual health care utilization,[44] a subset of 144 mother-newborn dyads who received all care at the birth hospital and affiliated clinics had their reported utilization compared with electronic medical record documentation of these visits. Compared with electronic medical records, mothers had excellent recall of their own health care utilization in the first 2 postpartum weeks ($\kappa = 0.79$) but only moderate recall for the period spanning 2 weeks to 2 months postpartum ($\kappa = 0.46$). Maternal recall of infant health care was excellent at 2 weeks ($\kappa = 0.85$)

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but moderate for the period between 2 weeks and 2 months ($\kappa = 0.59$).

Secondary outcomes included breastfeeding duration and exclusivity (measured using questions adapted from the Infant Feeding Practices Study II Neonatal Questionnaire and Infant Month 2 Questionnaire[45]); maternal postpartum depression, measured using the validated Edinburgh Postnatal Depression Survey (EPDS)[46]; state anxiety, measured using the State-Trait Anxiety Inventory (STAI)[47]; perceived social support, measured using the Medical Outcomes Study Social Support Survey[48]; and parenting self efficacy, measured using the Parenting Sense of Competence scale,[49] the most widely used scale for this outcome.[50] Secondary outcomes were assessed at baseline, 2 weeks, 2 months, and 6 months, although assessments for some scales were not done at every telephone interview to reduce participant burden.

One final secondary outcome was maternal satisfaction with care. The Satisfaction with Maternal and Newborn Care scale[51] was developed for this project because no existing measure captured satisfaction with both maternal and newborn health care in the weeks following childbirth. The 11-item scale reflects the mother's satisfaction with communication and information about her own care and that of her baby following childbirth.

SAMPLE SIZE CALCULATION AND STATISTICAL ANALYSIS

Based on the data from previous studies,[31,52] we estimated that 1154 mother-newborn dyads (577 per arm) were required to demonstrate a reduction in the need for unplanned health care service utilization from 50% in the OBC arm to 40% in the HNV group with 90% statistical power and with $\alpha = .05$. Included in this calculation was the assumption that physician discretion would lead to rare crossover of study group assignment with an overall crossover and dropout rate of 10%.

All statistical analyses invoked the intent-to-treat paradigm. The primary analysis comparing unplanned health care utilization in the first 14 days after delivery between study groups was conducted using the Mantel-Haenszel test to account for randomization stratification by delivery type and was quantified using relative risks (RRs). Secondary outcomes of surveys at 2 weeks, 2 months, and 6 months were analyzed using analysis of covariance models that included 2 predictors: randomized group and baseline score (where available). Effect sizes for these models were quantified as the difference in means between study groups. Breastfeeding duration was analyzed using Kaplan-Meier methods and log rank tests.[53] Subgroup analyses were performed for study outcomes using interactions between randomized group and the following covariates: parity (primiparous vs multiparous), insurance status (private vs other), and timing of newborn discharge (<48 hours vs ≥48 hours after birth). No statistically significant interactions were found.

RESULTS

DEMOGRAPHIC AND BASELINE VARIABLES

Of the 1154 mothers intending to breastfeed during the maternity stay who participated in the trial, 576 were randomized to receive an HNV after discharge (49.9%). The mean (SD) maternal age was 29.0 (5.5) years, and most of the women were married non-Hispanic whites (**Table 1**). Nearly 50% were primiparous, and most reported that prenatal care was initiated in the first trimester. At baseline, the 2 study groups were similar for all demographic and health-related variables.

Including the 15 twin deliveries (1.3%), 1169 newborns participated in the trial at a mean (SD) gestational age of 39.2 (1.2) weeks and birth weight of 3.422 (0.485) kg (**Table 2**). A total of 554 of the newborns were girls (47.7%), and 938 were described by their mothers as non-Hispanic whites (80.5%). The median newborn LOS was 49 hours (interquartile range, 40-63 hours), and 77.4% of mothers planned to exclusively breastfeed.

NEWBORN HEALTH CARE UTILIZATION

Two weeks after delivery, 1065 of the 1154 participating mothers completed the follow-up phone interview (92.3%), which also yielded data on 1080 of the 1169 newborns (92.4%). Attrition was similar between groups.

For the primary outcome, an unplanned outpatient visit was reported for 217 HNV newborns (39.8%) and 222 OBC newborns (41.5%) (RR, 0.96 [95% confidence interval (CI), 0.83-1.11]). Hospital readmissions and ED visits were uncommon for newborns, with no significant differences between groups (**Table 3**).

For total (unplanned and planned) outpatient visits (OBC and HNV), 88.4% of HNV newborns had 2 or more visits vs 69.2% of OBC newborns (RR, 1.28 [95% CI, 1.20-1.36]). While HNV newborns had more visits, the first visit was more likely to be adherent to the 2004 AAP guidelines[22]; 85.9% of HNV newborns were seen within 2 days after discharge compared with 78.8% of OBC newborns (RR, 1.09 [95% CI, 1.03-1.15]).

One thousand mothers (86.7%) with a total of 1013 newborns completed the second phone interview assessing outcomes 2 months after delivery. Unplanned health care utilization was not significantly different between groups (Table 3), although HNV infants were more likely than OBC infants to have 3 or more total outpatient visits in the first 60 days after birth (71.9% vs 62.0%; RR, 1.16 [95% CI, 1.06-1.27]).

MATERNAL HEALTH CARE UTILIZATION

As listed in Table 3, at the 2 week assessment, an unplanned outpatient visit had occurred for 54 HNV mothers (10.0%) and 50 OBC mothers (9.5%) (RR, 1.05 [95% CI, 0.73-1.51]). Total outpatient visits, readmissions, and ED visits for mothers demonstrated no significant differences between groups. Similarly, there were no differences between groups in unplanned maternal health care utilization at 2 months or in the proportion with at least 1 outpatient visit within the first 2 months.

BREASTFEEDING DURATION OUTCOMES

At baseline, there was no difference in intended duration between study groups. While there were no overall differences over the 6-month follow-up period in breastfeeding duration between groups (log rank $P = .29$) (**Figure**), individual estimates at survey assessment points revealed that more HNV newborns were breastfeeding at 2 weeks than their OBC counterparts (92.3% vs 88.6%) ($P = .04$) and at 2 months (72.1% vs 66.4%) ($P = .05$), but

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Table 1. Maternal Demographic and Baseline Characteristics[a]

Characteristic	Overall Cohort (n=1154)	OBC (n=578)	HNV (n=576)
Age, mean (SD), y	29.0 (5.5)	29.0 (5.4)	29.0 (5.5)
Age <20 y	49 (4.2)	20 (3.5)	29 (5.0)
Race/ethnicity			
White/non-Hispanic	971 (84.4)	488 (84.4)	483 (84.3)
Black/non-Hispanic	63 (5.5)	28 (4.8)	35 (6.1)
White/Hispanic	49 (4.3)	21 (3.6)	28 (4.9)
Black/Hispanic	8 (0.7)	5 (0.9)	3 (0.5)
Asian	50 (4.3)	31 (5.4)	19 (3.3)
Other	10 (0.9)	5 (0.9)	5 (0.9)
Marital status			
Married	908 (79.0)	456 (79.2)	452 (78.7)
Not married, cohabitating	102 (8.9)	51 (8.9)	51 (8.9)
Single	131 (11.4)	65 (11.3)	66 (11.5)
Other	9 (0.8)	4 (0.7)	5 (0.9)
Education			
Some high school	31 (2.7)	17 (3.0)	14 (2.4)
High school graduate	171 (14.9)	88 (15.3)	83 (14.4)
Some college and/or technical school	287 (25.0)	134 (23.3)	153 (26.6)
College graduate	427 (37.1)	212 (36.9)	215 (37.4)
Postgraduate training	234 (20.3)	124 (21.6)	110 (19.1)
Insurance type			
Private	904 (79.1)	450 (78.5)	454 (79.6)
Medicaid	153 (13.4)	85 (14.8)	68 (11.9)
Other	74 (6.5)	37 (6.5)	37 (6.5)
Self-pay	9 (0.8)	1 (0.2)	8 (1.4)
None	3 (0.3)	0 (0)	3 (0.5)
Annual income, $US			
<25 000	98 (8.5)	49 (8.5)	49 (8.5)
5000-49 999	210 (18.2)	99 (17.1)	111 (19.3)
50 000-74 999	251 (21.8)	123 (21.3)	128 (22.2)
75 000-99 999	222 (19.2)	118 (20.4)	104 (18.1)
≥100 000	244 (21.1)	127 (22.0)	117 (20.3)
Missing data/refused/unknown	129 (11.2)	62 (10.7)	67 (11.6)
WIC participation	197 (17.1)	103 (17.9)	94 (16.3)
Food stamp participation	96 (8.3)	54 (9.4)	42 (7.3)
Primary language spoken at home			
English	942 (81.6)	469 (81.1)	473 (82.1)
Other	212 (18.3)	109 (18.9)	103 (17.9)
Pregnancy history			
Parity			
Primiparous	548 (47.5)	268 (46.4)	280 (48.6)
1 prior live birth	378 (32.8)	190 (32.9)	188 (32.6)
2 or more live births	228 (19.8)	120 (20.8)	108 (18.8)
Trimester began prenatal care			
First	1086 (94.8)	543 (94.8)	543 (94.9)
Second	49 (4.3)	25 (4.4)	24 (4.2)
Third	10 (0.9)	5 (0.9)	5 (0.9)
Prenatal class attendance	420 (36.4)	208 (36.0)	212 (36.8)
Tobacco smoking	110 (9.5)	50 (8.7)	60 (10.4)
Hypertension	101 (8.8)	58 (10.1)	43 (7.5)
Preeclampsia	49 (4.3)	21 (3.6)	28 (4.9)
Diabetes	62 (5.4)	32 (5.6)	30 (5.2)
Breastfeeding baseline data			
Previous breastfeeding experience	556 (48.6)	282 (49.4)	274 (47.9)
Intended duration of breastfeeding, median (IQR), mo	6.0 (6.0-12.0)	6.0 (6.0-12.0)	6.0 (6.0-12.0)
Planned feeding mode			
Exclusively breastfeeding	893 (77.4)	439 (76.0)	454 (78.8)
Breastfeeding and formula feeding	261 (22.6)	139 (24.0)	122 (21.2)
Mental health, social support, satisfaction with care			
EPDS			
Score, mean (SD)	4.9 (3.7)	4.9 (3.7)	4.9 (3.7)
Score ≥12	63 (5.5)	31 (5.5)	32 (5.6)
STAI score, mean (SD)	31.0 (8.6)	31.1 (8.5)	31.0 (8.7)
MOS-SSS score, mean (SD)	90.5 (12.5)	90.2 (12.7)	90.9 (12.3)
SMNC score, mean(SD)	47.9 (7.1)	47.6 (7.3)	48.1 (6.9)
Delivery history			
Delivery type			
Unassisted vaginal	738 (64.0)	371 (64.2)	367 (63.7)
Vaginal with forceps and/or vacuum	56 (4.9)	28 (4.8)	28 (4.9)
Cesarean section	361 (31.3)	180 (31.1)	181 (31.4)
Twin delivery	15 (1.3)	8 (1.4)	7 (1.2)

Abbreviations: EPDS, Edinburgh Postnatal Depression Survey[46]; HNV, home nursing visit; IQR, interquartile range; MOS-SSS, Medical Outcomes Study Social Support Survey[48]; OBC, office-based care; SNMC, Satisfaction with Maternal and Newborn Care scale[51]; STAI, State-Trait Anxiety Inventory[47]; WIC, Women, Infants, and Children program.

[a] Unless otherwise noted, data are reported as number (percentage) of subjects.

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Table 2. Newborn Demographic and Baseline Characteristics[a]

Characteristic	Overall Cohort (n=1169)	OBC (n=586)	HNV (n=583)
Sex			
Female	554 (47.7)	263 (45.2)	291 (50.2)
Male	608 (52.3)	319 (54.8)	289 (49.8)
Gestational age, mean (SD), wk	39.2 (1.2)	39.2 (1.2)	39.2 (1.2)
Late preterm, 34 to <37 wk	66 (5.6)	38 (6.5)	28 (4.8)
Birth weight, mean (SD), kg	3.422 (0.485)	3.454 (0.475)	3.390 (0.494)
Birth weight <2.50 kg	34 (2.9)	11 (1.9)	23 (3.9)
Race/ethnicity			
White/non-Hispanic	938 (80.5)	473 (80.9)	465 (80.2)
Black/non-Hispanic	81 (7.0)	36 (6.2)	45 (7.8)
White/Hispanic	70 (6.0)	35 (6.0)	35 (6.0)
Black/Hispanic	11 (0.9)	6 (1.0)	5 (0.9)
Asian	51 (4.4)	29 (5.0)	22 (3.8)
Other	14 (1.2)	6 (1.0)	8 (1.4)
Nursery LOS, median (IQR), h	48.7 (40.3-62.9)	48.6 (40.3-61.7)	48.8 (40.3-64.8)
Following vaginal delivery, h			
<48	536 (45.9)	270 (46.1)	266 (45.6)
≥48	268 (22.9)	135 (23.0)	133 (22.8)
Following cesarean delivery, h			
<48	26 (2.2)	14 (2.4)	12 (2.1)
48-72	186 (15.9)	105 (17.9)	81 (13.9)
≥72	153 (13.1)	62 (10.6)	91 (15.6)

Abbreviations: HNV, home nursing visit; IQR, interquartile range; LOS, length of stay; OBC, office-based care.
[a] Unless otherwise noted, data are reported as number (percentage) of subjects.

Table 3. Infant and Maternal Health Care Utilization 2 Weeks and 2 Months After Childbirth[a]

Outcomes	2 Weeks				2 Months			
	OBC	HNV	RR[b] (95% CI)	*P* Value	OBC	HNV	RR[b] (95% CI)	*P* Value
Newborn								
Total No.	535	545	NA	NA	497	516	NA	NA
Hospital readmission	7 (1.3)	8 (1.5)	1.13 (0.41-3.09)	.82	16 (3.2)	16 (3.1)	0.97 (0.49-1.91)	.92
ED visit	8 (1.5)	13 (2.4)	1.50 (0.63-3.57)	.29	35 (7.0)	33 (6.4)	0.91 (0.57-1.44)	.68
Unplanned outpatient visit	222 (41.5)	217 (39.8)	0.96 (0.83-1.11)	.59	287 (57.8)	292 (56.6)	0.98 (0.88-1.09)	.71
Total	227 (42.4)	224 (41.1)	0.97 (0.84-1.12)	.67	302 (60.8)	298 (57.8)	0.95 (0.86-1.05)	.33
Maternal								
Total No.	527	538	NA	NA	491	509	NA	NA
Hospital readmission	4 (0.8)	7 (1.3)	1.71 (0.50-5.85)	.38	7 (1.4)	13 (2.6)	1.79 (0.72-4.46)	.20
ED visit	20 (3.8)	28 (5.2)	1.35 (0.77-2.37)	.29	30 (6.1)	41 (8.1)	1.31 (0.83-2.05)	.25
Unplanned outpatient visit	50 (9.5)	54 (10.0)	1.05 (0.73-1.51)	.79	97 (19.8)	118 (23.2)	1.17 (0.92-1.48)	.20
Total	64 (12.1)	76 (14.1)	1.15 (0.85-1.57)	.36	113 (23.0)	142 (27.9)	1.21 (0.98-1.49)	.08

Abbreviations: CI, confidence interval; ED, emergency department; HNV, home nursing visit; IQR, interquartile range; NA, not applicable; OBC, office-based care; RR, relative risk.
[a] Unless otherwise noted, data are reported as number (percentage) of subjects.
[b] Mantel-Haenszel RRs stratified by delivery for HNV with OBC as the reference value.

not at 6 months (49.8% vs 48.9%) ($P=.80$). Notably, a log rank test applied to the first 2 months of breastfeeding duration data demonstrated a significant difference between groups ($P=.03$). Furthermore, because the effect of a single home visit would be expected to have a bigger impact on breastfeeding proximal to the visit, and because the greater time span that existed between the 2- and 6-month surveys reduced the precision that women reported their breastfeeding duration (eg, more women reported stopping at round numbers of months rather than days or weeks), a weighted log rank test ($\rho=3$) showed significant differences in breastfeeding duration between groups ($P=.03$).

MATERNAL MENTAL HEALTH, SOCIAL SUPPORT, PARENTING COMPETENCE, AND SATISFACTION WITH CARE

The EPDS scores revealed that the odds of screening test results indicative of postpartum depression (score ≥12) were similar for the HNV and OBC groups at every assessment point after adjustment for baseline values. Mean EPDS scores between groups were similar (**Table 4**). In addition, scores for state anxiety, perceived social support, and satisfaction with newborn and maternal care after discharge were not significantly different between groups at any assessment point after adjustment for baseline survey

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values. However, mean differences between groups (HNV–OBC) were significant for the Parenting Sense of Competence scale at 2 weeks (mean difference, 1.43 [95% CI, 0.40-2.46]) and at 2 months (mean difference, 1.44 [95% CI, 0.36-2.51]), each indicating more favorable scores for HNV mothers ($P=.007$ and $P=.009$, respectively).

COMMENT

The results of this study suggest that HNVs are a safe and effective alternative to OBC for the initial outpatient encounter for newborns and mothers after hospital discharge with some modest added benefits to visit timeliness, breastfeeding, and parenting sense of competence. Unplanned health care utilization was similar between groups, and while HNV newborns had more total outpatient visits, the initial visit was more likely to be timed according to guidelines for postdischarge care. With other recent studies demonstrating a lack of timeliness for or access to newborn outpatient follow-up, particularly for those insured by Medicaid,[9-12,32,54-61] HNVs are an alternative that can bridge the gap between nursery care and primary care.

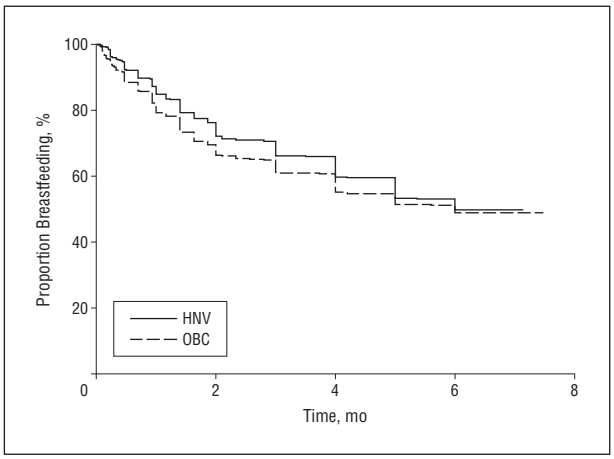

Figure. Kaplan-Meier plot of infant breastfeeding duration by randomized study group. Overall Kaplan-Meier log rank, $P=.29$. Individual estimates at the 3 important assessment points were as follows (home nursing visit [HNV] vs office-based care [OBC]): 2 weeks, 92.3% vs 88.6% ($P=.04$); 2 months, 72.1% vs 66.4% ($P=.05$); and 6 months, 49.8% vs 48.9% ($P=.80$).

Our prospective study has similarities to those conducted by Lieu et al[62] and Escobar et al,[31] who compared HNVs with outpatient clinic visits or hospital-based group visits on the third or fourth day after delivery. Those studies did not find differences in health care utilization, breastfeeding rates, or maternal mental health outcomes, but differed from our study in that they were limited to privately insured mothers and infants born vaginally. In addition, their visiting nurses did not have a specific maternal-child health focus. Other studies have shown the safety of home-based follow-up after short maternity/nursery stays.[3,63-69]

Consistent with our group's previous retrospective study,[30] retrospective analyses of single HNVs have found benefits. Braveman et al[70] showed that acute care visits, rehospitalizations, and missed well-baby visits were less common among newborns who received a home nurse visit. Similarly, Cooper et al[71] found that home visitation for infants discharged early resulted in earlier and more consistent follow-up at primary care offices and decreased ED utilization compared with a cohort that did not receive HNVs. Indeed, World Health Organization[72] has opined that HNVs should be the preferred form of postnatal follow-up. In preferring the HNV model, the ANA wrote that OBC may be

Table 4. Maternal Depression, Anxiety, Social Support, Parenting Competence, and Satisfaction With Care[a]

Measurement Survey	Mothers, No. OBC	Mothers, No. HNV	Mean Difference Between Groups (95% CI) at Postpartum Assessments, HNV – OBC[b]	*P* Value
EPDS score				
2 wk	527	538	0.06 (–0.32 to 0.44)	.75
2 mo	491	515	–0.07 (–0.44 to 0.29)	.70
6 mo	453	491	–0.24 (–0.62 to 0.14)	.21
STAI score				
2 wk	529	539	–0.29 (–1.10 to 0.51)	.47
2 mo	493	511	0.51 (–0.35 to 1.37)	.25
6 mo	458	494	–0.26 (–1.23 to 0.72)	.61
Transformed MOS-SSS score[c]				
2 wk	526	535	0.41 (–0.67 to 1.48)	.46
6 mo	453	491	–1.05 (–2.45 to 0.34)	.14
SMNC score				
2 wk	527	535	0.39 (–0.45 to 1.22)	.36
2 mo	484	509	0.25 (–0.6 to 1.14)	.58
PSOC score				
2 wk	528	538	1.43 (0.4 to 2.46)	.007
2 mo	481	501	1.44 (0.36 to 2.51)	.009
6 mo	449	480	0.93 (–0.13 to 1.99)	.08

Abbreviations: EPDS, Edinburgh Postnatal Depression Survey[46]; HNV, home nursing visit; IQR, interquartile range; MOS-SSS, Medical Outcomes Study Social Support Survey[48]; OBC, office-based care; PSOC, Parenting Sense of Competence scale[49]; SNMC, Satisfaction with Maternal and Newborn Care scale[51]; STAI, State-Trait Anxiety Inventory.[47]

[a] For EDPS and STAI, higher scores suggest worse outcome, whereas for MOS-SSS, SMNC, and PSOC, higher scores suggest better outcome.

[b] Mean differences estimated from analysis of covariance models that adjusted for baseline score.

[c] Scores converted to 0 to 100 scale.

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difficult for the healing mother, interrupts breastfeeding, and often does not allow ample time for health teaching and evaluation of family dynamics.

The benefits in our HNV group for breastfeeding are noteworthy. While the differences between groups are admittedly modest, studies of generalizable posthospital discharge interventions to improve breastfeeding continuation are few, and those few have found that benefits are centered around providing extra professional or lay support for breastfeeding.[73] Furthermore, while the absolute difference between groups in the present study was relatively small, from a population-based perspective, the differences are potentially important. With US 2007 breastfeeding initiation rates at 75.0%[74] and a Healthy People 2020 goal of 81.9%,[75] the differences of breastfeeding continuation between groups we discovered among women intending to breastfeed at 2 weeks (92.3% vs 88.6%) and 2 months (72.1% vs 66.4%) seem meaningful and suggest HNV could be a potential intervention to help US women achieve Healthy People 2020 objectives for breastfeeding.

The results of this study are somewhat limited by the exclusively English-speaking population that included a relatively low percentage of minority and low-income participants from the single academic center where the trial was conducted. Therefore, it is not clear whether these findings are generalizable to more diverse populations or to urban and nonacademic settings. It could be argued, however, that in those settings where postdischarge follow-up is less optimal, the timely visit provided by HNVs could produce more positive effects than we found in the current study. Finally, because those in the HNV group also had an office visit 1 week following the HNV, it is impossible to know whether the modest benefits seen for those in this group were due to the HNV, the subsequent office visit a week later, or from the combined effect of having 2 visits.

In conclusion, HNVs are a safe and effective alternative to OBC for the initial outpatient encounter after maternity and nursery discharge. Especially for hospitals and communities where access to timely postdischarge care is problematic, HNVs should be considered as an option, especially given the potential benefits for breastfeeding and parenting sense of competence.

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Correspondence: Ian M. Paul, MD, MSc, Department of Pediatrics, HS83, Penn State College of Medicine, 500 University Dr, Hershey, PA 17033 (ipaul@psu.edu).
Author Contributions: Dr Paul had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Paul, Beiler, Hollenbeak, Yu, and Weisman. *Acquisition of data:* Beiler, Alleman, and Sturgis. *Analysis and interpretation of data:* Paul, Beiler, Schaefer, Hollenbeak, Camacho, and Weisman. *Drafting of the manuscript:* Paul, Schaefer, and Weisman. *Critical revision of the manuscript for important intellectual content:* Beiler, Schaefer, Hollenbeak, Alleman, Sturgis, Yu, Camacho, and Weisman. *Statistical analysis:* Schaefer, Hollenbeak, Camacho, and Weisman. *Obtained funding:* Paul and Yu. *Administrative, technical, and material support:* Beiler, Hollenbeak, Sturgis, and Weisman. *Study supervision:* Paul, Beiler, and Alleman.
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