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Family Risk as a Predictor of Initial Engagement and Follow-Through in a Universal Nurse Home Visiting Program to Prevent Child Maltreatment

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Abstract

Objective—As nurse home visiting to prevent child maltreatment grows in popularity with both program administrators and legislators, it is important to understand engagement in such programs in order to improve their community-wide effects. This report examines family demographic and infant health risk factors that predict engagement and follow-through in a universal home-based maltreatment prevention program for new mothers in Durham County, North Carolina.

Method—Trained staff members attempted to schedule home visits for all new mothers during the birthing hospital stay, and then nurses completed scheduled visits three to five weeks later. Medical record data was used to identify family demographic and infant health risk factors for maltreatment. These variables were used to predict program engagement (scheduling a visit) and follow-through (completing a scheduled visit).

Results—Program staff members were successful in scheduling 78% of eligible families for a visit and completing 85% of scheduled visits. Overall, 66% of eligible families completed at least one visit. Structural equation modeling (SEM) analyses indicated that high demographic risk and low infant health risk were predictive of scheduling a visit. Both low demographic and infant health risk were predictive of visit completion.

Conclusions—Findings suggest that while higher demographic risk increases families' initial engagement, it might also inhibit their follow-through. Additionally, parents of medically at-risk infants may be particularly difficult to engage in universal home visiting interventions. Implications for recruitment strategies of home visiting programs are discussed.

Keywords

home visiting; engagement; follow-through; risk; prevention; maltreatment

Postnatal home visiting by nurses or paraprofessionals has become one of the most well-researched and now widely disseminated preventive interventions for child maltreatment in the United States (Olds et al., 2009). Recent meta-analyses have shown that these programs, on the whole, produce positive effects in reducing child maltreatment as well as improving a

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range of child development and parenting outcomes (Sweet & Appelbaum, 2004; Geeraert, Van den Noortgate, Grietens, & Onghena, 2004). In addition, these programs are popular with policy makers and funding agencies and are the focus of 1.5 billion dollars in federal funding as part of the 2010 health care legislation (Patient Protection and Affordable Care Act, 2010). However, home-visiting programs have also been the subject of great debate (Chaffin, 2004; Gomby, Culross, & Behrman, 1999). Critics question whether these programs produce the desired effects and whether the intervention is beneficial for all sub-groups. Nonetheless, the Centers for Disease Control and Prevention (CDC; 2003) supports expanding home visiting and cites a “basis of strong evidence of effectiveness,” (p. 5); and the U.S. Advisory Board on Child Abuse and Neglect (1991) has called for universal implementation of home visiting so that all new mothers can reap the benefits of parenting support.

Several communities in the U.S. have heeded the call for universal home visiting for families of newborns, including the state of Rhode Island; several counties in California, Colorado, Minnesota, North Carolina, Ohio, Virginia, and Washington; and major metropolitan areas including San Francisco, Los Angeles, and New York. Numerous challenges confront programs that attempt to scale up a home visiting program to reach universal coverage. Daro and Dodge (2009) point out that population-level impact on families is not likely until problems such as penetration, fidelity, and management are solved. The penetration challenge is that home visitation is a voluntary program, but population impact relies on near-universal engagement. Participation rates in home visitation programs may be as low as 50 percent (Svenson, Kaplan, & Hatcher, 2002), and participants might represent a biased sub-group. Whereas small, targeted randomized trials do not even consider the problem of non-participants (that is, women are solicited first and then randomized to intervention or control so non-participants are equally represented), scaled-up universal programs must reach all families.

An important step in enhancing understanding of group effects of universal postnatal home visitation is studying who engages in these voluntary programs. Further, these universal prevention programs are only effective to the degree to which families actually engage and follow-through with the intervention. To date, there have been no empirical studies of the factors associated with enrollment in a truly universal postnatal home visiting program in the United States. The purpose of the current study was to analyze engagement in a universal nurse home visiting program, Durham Connects, and to compare these results with the existing research on enrollment in targeted interventions. The impact evaluation of the program is not considered in the current report but is reported elsewhere (Dodge et al., 2013).

Durham Connect's goal was to enroll every family with a new baby residing in Durham County by use of several empirically validated engagement techniques. The first step involved visiting new mothers in the hospital prior to discharge. This initial interaction with a trained recruiter began the engagement process and provided some intervention to all families, including framing the task of parenting, getting the mother excited about receiving support services, and answering questions about working with public health nurses. As such, acceptance of a visit in the hospital is interpreted in this study as positive initial engagement in the program. Durham Connects also utilized other empirically-validated recruitment procedures including collection of multiple contact numbers, phone reminders prior to the appointment, delivering services in the home, and providing material incentives for participation (Damashek, Doughty, Ware, & Silovsky, 2011). Durham Connects sought to provide one session of intervention during the period three to eight weeks post-birth at which time families were linked with community support services for further assistance. Families could receive up to four visits, depending on need. Only the initial visit is

considered when assessing follow-through because of variability in the duration of intervention. These best-practice engagement procedures resulted in nurses completing a home visit with 66 percent of mothers who gave birth within the intervention timeframe. However, the remaining 34 percent of families who did not receive any intervention can be viewed as treatment failures. Thus, understanding patterns of non-engagement is integral to understanding the intervention's effect. Our empirical analyses focused first on predictors of scheduling (called initial engagement) and then predictors of actual completion of at least one home visit (called follow-through) among those who scheduled a visit.

The current analysis focuses on known health and demographic risk factors for child maltreatment and their relation to engagement. Health and demographic variables are treated as distinct due to high levels of conceptual and statistical overlap within these categories. However, infant health and demographic risk are also correlated (Collins, Wambach, David, & Rankin, 2009; O'Campo, Xue, Wang, & Caughy, 1997), and thus covariation between these constructs is also considered. The predictors addressed are available from medical records for all new births in the Durham Connects catchment area, regardless of whether or not the family engaged in the intervention. Results of this analysis will be useful to other interventionists because medical records are generally the first information available to staff members in similar community-level programs, and understanding how these variables relate to engagement can help staff members predict whether a family will be more or less difficult to engage and tailor their recruitment efforts accordingly. Further, the results of these analyses will help inform design and implementation within the burgeoning field of universal home visiting.

Research with targeted home visiting programs has shown mixed results with regard to enrollment of high-risk families. Some researchers have found that families at higher risk for child maltreatment and poor child development outcomes are more likely to engage. Duggan and Windham (2000) found that families at greater psychosocial risk were more likely to enroll in paraprofessional home visiting. Parents at increased risk for child abuse also enrolled at higher rates in a targeted nurse home visit program (Fraser, Armstrong, Morris, & Dadds, 2000). However, it is difficult to generalize these findings to universal interventions; targeted programs, by definition, deal with populations with limited variability on measures such as income, maternal age, and infant health risk because these are the groups singled out for intervention.

Maternal Demographic Risk Factors for Maltreatment

One of the most consistent predictors of child maltreatment is poverty (e.g., Coulton, Korbin, Su, & Chow, 1995; Molnar, Buka, Brennan, Holton, & Earls, 2003). Parents living in impoverished neighborhoods have been found to experience increased stress related to parenting (Gavidia-Payne & Stoneman, 1997), which, in turn, can be related to abusive behaviors (Mackenzie, Kotch & Lee, 2011; Stith et al., 2009). Home visiting programs generally report success in *recruiting* low-income families, such as a universal nurse home visiting program in Ontario, Canada (Sword, Krueger & Watt, 2006). However, interventions frequently struggle with *retaining* these mothers in the intervention (Baker, Piotrkowski, & Brooks-Gunn, 1999; Wagner, Spiker, Linn, Gerlach-Downie, & Hernandez, 2003), although this paradox has never been demonstrated empirically in one study.

Along with poverty, a related risk factor for child maltreatment is maternal age (Brown, Cohen, Johnson, & Salzinger, 1998; Goerge & Lee, 1997). Connelly and Straus (1992) found that younger maternal age at the time of the child's birth was correlated with higher rates of self-reported abuse. As observed with low-income mothers, young mothers are as likely (Ramey et al., 1992) or more likely (Duggan et al., 1999; Herzog, Cherniss, &

Menzel, 1986; Sword et al., 2006) to enroll in targeted prevention programs as older mothers. However, they are at an increased risk for missing appointments (Josten et al., 1995; Hansen & Warner, 1994).

Infant Health Risk Factors for Maltreatment

Children with health issues are at increased risk for maltreatment. Kienberger Jaudes and Mackey-Bilaver (2008) found that children with a chronic physical illness were 10 percent more likely to experience maltreatment than healthy comparisons. Similarly, premature infants and infants who experienced birth complications suffer abuse at higher than average rates (Hunter, Kilstrom, Kraybill, & Loda, 1978; Brown et al., 1998). Researchers posit that parents of sick infants experience elevated stress levels and may require extra postnatal support (Liaw & Brooks-Gunn, 1994; Trout, 1983). As such, home visiting programs have historically targeted populations such as low birth-weight and premature infants (Liaw & Brooks-Gunn, 1994). However, even programs that do not target these groups have found mothers of premature and medically fragile infants to be more likely to engage in services (Daro, McCurdy, & Nelson, 2005; Duggan & Windham, 2000; Raikes et al., 2006; Ramey et al., 1992).

Hypotheses

McCurdy and Daro (2001) have proposed that enrollment in a prevention program is preceded by an “intent to engage” on the part of the family. They theorize that the intent to engage is determined by family perception of need for assistance, and that parents of at-risk infants would be more likely to enroll in services. Similarly, Wagner and her colleagues (2003) differentiated “say yes” engagement, or assenting to services, and “be there” engagement in which the family is physically present at the appointed time. In this vein, we hypothesized that there would be two levels of engagement in this intervention: initial engagement (scheduling an appointment for a home visit in the hospital or over the phone) and follow-through (completing at least one visit). We hypothesized that families who initially engaged in the program would have *higher* demographic and health risk than families who declined participation. Based on McCurdy & Daro’s (2001) theory, these families would engage at higher rates because they were likely looking for support and would be more apt to perceive the utility of the program. In contrast, we hypothesized that among those who initially engaged, *lower* demographic risk would be predictive of follow-through, because these families would have fewer stresses and crises that would prohibit their involvement. In addition, we tested maternal race/ethnicity as a potential moderator of these effects. Based on previous empirical study, we theorized that maternal ethnic minority status would be predictive of both increased initial engagement and follow-through (Daro & Harding, 1999; McGuigan, Katzev & Pratt, 2003; Olds, 2002). However, we did not anticipate ethnic group differences in how family risk predicts engagement.

Method

The Duke University Health System Institutional Review Board approved all procedures.

Participants

All women who reside in Durham County, NC and gave birth in Durham County at one of two area hospitals on even-numbered dates between July 1, 2009, and December 31, 2010, were included in the analyses. Odd-date births were excluded because these families served as the control group for the Durham Connects intervention; and, as such, they were not eligible for participation. During this period, there were 2,325 eligible deliveries. Records for 46 of these families were lost due to a participating hospital failing to transfer discharge

data to Durham Connects staff. Analysis of participation trends focus on the remaining 2,279 families. There were 57 cases of multiple births in the sample. Each instance of multiple births was counted as one case because this analysis examined the presence or absence of *family* risk factors for maltreatment. Eligible participants were ethnically diverse (35.9% African American, 29.4% Caucasian, 21.9% Latina, 4.9% Asian/Asian American, 7.9% Multiracial, other, or unknown ethnicity). Families in which the infant died prior to hospital discharge ($N = 5$) were excluded.

Recruitment Procedures

Three trained recruiters (two bilingual Spanish-speakers) visited mothers in the hospital and introduced the program to family members. The recruiter described the benefits of nurse home visiting in terms of an opportunity for additional support and advice prior to well-baby doctor visits. Recruiters then answered parents' questions about the program. Families who expressed interest at that time were scheduled for a visit three to five weeks after discharge. Mothers received a reminder card for the appointment and filled out a postcard reminder that was mailed to their residence that same day. All mothers completed a contact card with several alternate contacts. Families who declined the program in the hospital were informed that they would be contacted again and given another opportunity to schedule a visit, in case new issues had arisen. Some women were discharged before the recruitment could occur. These women were contacted as soon as possible by phone or in person. They received the same recruitment effort as did women in the hospital. The majority (68%) of eligible mothers were scheduled for a home visit while still in the hospital. Another 10% were scheduled soon after discharge, leading to an initial engagement rate of 78%.

Home Visit Completion

Nurses called families two days in advance of the scheduled home visit to confirm the appointment and to remind the family of the scheduled time. When this contact was not possible, nurses relied on alternate contacts and impromptu home visits in an effort to maximize the receipt of the initial home visit. Successful completion of home visits was recorded by the nurse.

Birth Record Information

The two hospitals participating in the intervention transmitted family information to Durham Connects staff via electronic birth records of every birth. Birth records were available for all eligible participants due to a partnership among Durham Connects, the Durham County Health Department, and the participating hospitals. All records were de-identified prior to analysis. *Maternal age* was coded using the mother's date of birth and the date of delivery. *Maternal race* was coded as White, Black, Asian, American Indian, Native Hawaiian, unknown, or other (including multiracial). Doctors coded *maternal ethnicity* separately from race, indicating first if the mother was of Hispanic origin, then selecting from the list of racial groups. For this analysis, Hispanic-origin mothers were coded as "Latina" regardless of racial group membership. These families were believed to be more culturally similar to one another than to non-Hispanic families. Dummy codes were created for 4 racial/ethnic groups with sufficient numbers for individual group analysis: Latina, Non-Hispanic White ("White"), Non-Hispanic African American ("African American"), "Other" race (e.g., Asian/Asian American, American Indian, Pacific Islander, Non-Hispanic other/multiracial) with White treated as the reference group. Maternal race data for four families coded as "unknown" were recovered from the initial nurse interview. However, six families reported "unknown" race/ethnicity to the nurse visitor as well as the doctor; these cases were included in the "other" race group. The *mother's health care insurance status* was coded as "Public" (i.e., Medicaid, S-CHIP), "Private" (employer or individual plans), or "None." Uninsured and publicly funded insurance status serves as an approximation of family

socioeconomic status, as both are more likely to be low-income than privately insured families. Additionally, the family's address, available on birth records, was geocoded by 2000 US Census tract. Each family was assigned an aggregate value for the estimated percentage of individuals (adults and children) within the tract living below the poverty line in 2005–2009 (*neighborhood poverty*).

Birth records also included *infant health diagnoses*, based on the International Classification of Diseases, Clinical Modification (ICD-9-CM). Diagnoses spanned a broad range of medical categories. However, this analysis focused largely on the category “Certain conditions originating in the perinatal period” which is defined as codes 760 – 779. Babies were coded as “Low birthweight” (764 – 765.1; less than 2500 grams), “Low Gestational Age” (765.2; less than 37 weeks), and experiencing “Birth complications/trauma” (760.0 – 760.6, 760.9, 763, 767 – 769). Infants with “Any other diagnosis” were grouped together. Infants were coded as having or not having a diagnosis in each category.

Data Analytic Approach and Procedures

Based on high levels of collinearity between family-level risk variables (see Table 1), latent-variable structural equation modeling (SEM) was chosen to analyze how family-level risk predicts engagement in this universal nurse home visiting program. Latent predictor variables of demographic risk and health risk were derived during modeling, described below. Two separate analyses were planned. First, demographic and health risk were tested as predictors of initial engagement (scheduling a visit) within the full sample of eligible births. We hypothesized that *higher* risk of both types would predict initial engagement. Second, the same latent risk variables were tested as predictors of follow-through (completion of at least one home visit) among the subgroup of families who had scheduled a visit. We hypothesized that *lower* risk would predict follow-through. See Figure 1 for theoretical model. All SEM analyses were conducted in Mplus Version 6 (Muthén & Muthén, 2010).

Measurement models and main effect analyses utilized the mean- and variance-adjusted weighted least squares (WLSMV) extraction procedure. WLSMV is a robust estimator that is commonly used for modeling categorical data since it does not assume normally distributed variables (Brown, 2006). Multiple goodness-of-fit statistics are presented including the Tucker-Lewis Index (TLI), comparative fit index (CFI), and the root-mean square approximation (RMSEA). The TLI and CFI are incremental fit indices that measure the extent to which the structural model improves the fit of the baseline or structural model. TLI and CFI values that exceed .90 suggest that the model provides adequate fit to the data; values above .95 suggest good fit (Hu & Bentler, 1999). RMSEA is an absolute fit measure that indicates how closely the specified model fits the observed pattern of variances and covariances. RMSEA values less than .08 are considered close fit (Browne & Cudeck, 1993). Differences between nested models were tested with the adjusted chi-square DiffTest (Muthén, du Toit, & Spisic, 1997). The DiffTest statistic in Mplus allows for model comparison when using the WLSMV estimator because it accounts for the fact that the difference between these models is not distributed as a chi-square (Muthén & Muthén, 2010). DiffTest analyses were conducted to obtain pared parsimonious structural models.

A secondary goal of this analysis was to establish whether family risk predicted program engagement in the same manner for the various ethnic groups in the sample. However, low base rates of medical risk factors lead to small cell sizes for several ethnic groups, which prohibited a traditional multiple group comparison analysis. Thus, a Multiple Indicators Multiple Causes (MIMIC) model was selected to test the effects of ethnicity on the hypothesized models. The MIMIC model allowed for analysis of main effects on each latent predictor as well as the observed outcome variable. Additionally, the XWITH procedure in

the MIMIC framework was used to test for interactions between ethnicity and family risk in predicting engagement. The XWITH procedure is recommended for testing interactions between an observed categorical variable and a continuous latent predictor variable as an alternative to multiple group analysis (Muthén & Muthén, 2010). All models with an interaction term were fitted with the robust maximum likelihood estimator (MLR), which is recommended for use with the XWITH procedure (Woods & Grimm, 2011). Mplus estimation of models with XWITH variables does not produce standard fit indices. Thus the Akaike information criterion (AIC; Akaike, 1987) and Bayesian information criterion (BIC; Schwartz, 1978) were used to measure model fit in models with interaction terms. Together the AIC and BIC can be used to compare alternative models, with lower values indicating a better fitting model.

Results

Preliminary multilevel logistic regression models were estimated using SAS PROC GLIMMIX (SAS Version 9.2), assuming a binomial distribution and logit link function, with family as level 1 and neighborhood as level 2. However, results of this analysis indicated almost no systematic variance attributed to the neighborhood level (intraclass correlation = 0.068 for scheduling a visit, 0.001 for completion of scheduled visit); as such a single-level analysis technique was selected for significance testing.

Measurement Models

Following the conventions of SEM analysis, initial Confirmatory Factor Analyses (CFA) were conducted to establish valid measurement models prior to evaluation of the structural models. In these initial analyses the two latent predictor variables (infant health risk and family demographic risk) were allowed to covary. Results of these preliminary analyses suggested that low gestational age and low birth weight were too highly correlated to serve as independent indicators of health risk ($r(2279) = 0.88, p < 0.0001$; Table 1). Low birth weight was believed to be more highly predictive of parental engagement (McCurdy et al., 2006), and as such, low gestation was removed as an indicator. In the final measurement model, ICD-9 codes for low birth weight, birth complications, and “other” medical diagnosis were used as indicators of health risk. Maternal age at the time of delivery, family health insurance status, and rate of neighborhood poverty were used as indicators of demographic risk. This model demonstrated good fit to the data for the full sample of eligible participants (χ^2 (d.f. = 8, $N = 2279$) = 27.05; CFI = .99; TLI = .97; RMSEA = .03) and within the subsample of families who scheduled an initial visit (χ^2 (d.f. = 9, $N = 1765$) = 33.69; CFI = .97; TLI = .96; RMSEA = .04).

Predictors of Initial Engagement

The first set of structural analyses examined the predictive power of family risk on initial engagement, as indicated by scheduling a home visit either at the hospital or over the phone. One thousand seven hundred and sixty-five families (77.4%) agreed to schedule a home visit for the Durham Connects intervention. We hypothesized that both demographic and health risk would be positively predictive of initial engagement (Figure 1). Maternal race/ethnicity (dummy coded) was also included as a covariate to account for differential rates of risk and engagement across ethnic groups. Results of the main effects MIMIC analysis indicated that the saturated structural model, which included all covariate effects on the latent predictor variables and the observed outcome, provided adequate fit to the data: χ^2 (d.f. = 24, $N = 2279$) = 116.36; CFI = .96; TLI = .93; RMSEA = .04. As hypothesized, demographic risk was positively predictive of initial engagement ($\beta = .26, p < .001$), controlling for main effects of maternal ethnicity. Health risk, on the other hand, was negatively predictive of initial engagement at the marginally significant level ($\beta = -.08, p < 0.07$). Standardized path

coefficient estimates for this saturated main effects model are presented at the top of Table 2.

A second goal of this analysis was to determine if the effects of family risk on initial engagement in Durham Connects differed across ethnic groups. To answer this question, a separate model was constructed measuring the main effects of ethnicity and risk as well as their multiplicative interactive effects (using the XWITH command). Standardized coefficients for these interaction terms are presented at the bottom of Table 2. Results of this analysis indicated that no interactions were significant at the $p < .10$ level, suggesting that the effects of family risk on initial engagement were consistent across the four ethnic groups in this sample. Removing these interaction terms resulted in improved model fit as indicated by decreased AIC (43121.06 vs. 43114.16) and BIC (43190.03 vs. 43167.80) values.

The final step of the analysis of initial engagement was to generate a parsimonious model, retaining only pathways that significantly added to model fit. This analysis was conducted by systematically removing each path and comparing the overall fit of the new model with the saturated model using the adjusted chi-square DiffTest. The following non-significant paths were removed from the saturated model: the effect of maternal ethnicity on health risk and the covariance between health and demographic risk. Eliminating these paths did not significantly hurt overall model fit: adj. $\chi^2\Delta$ (4) = 5.71, $p = .22$; CFI = .97; TLI = .95; RMSEA = .04. Figure 2 shows the final pruned model with standardized path coefficients. Results of this analysis suggest that family demographic risk is positively predictive of initial engagement ($\beta = .21$, $p < .001$) while infant health risk is negatively predictive of initial engagement ($\beta = -.12$, $p < .05$), controlling for the main effects of maternal ethnicity.

Predictors of Follow-Through

The second set of structural analyses examined demographic and health risk as predictors of follow-through (completion of the first nurse home visit). Of the 1,765 scheduled families, Durham Connects nurses were successful in completing a home visit with 1,505 (85.3%). We hypothesized that both demographic and health risk would be predictive of lower rates of follow-through among those families who initially engaged in the intervention (Figure 1). The initial saturated model measured main effects of health and demographic risk on follow-through, controlling for all main effects of maternal ethnicity. This model provided adequate fit to the data: χ^2 d.f. = 25, $N = 1765$) = 101.74; CFI = .95; TLI = .92; RMSEA = .04. In this structural model both family demographic and infant health risk were negatively predictive of follow-through, as predicted ($\beta = -.21$, $p < .001$ and $\beta = -.16$, $p < .02$, respectively). In other words, higher demographic risk and higher health risk were each correlated with decreased odds of follow-through. See the top of Table 3 for detailed information on standardized path coefficients.

An interaction analysis was also conducted to test for invariance of this main effects model across ethnic groups utilizing the XWITH command. Estimates of interaction terms are provided at the bottom of Table 3. Once again no interaction effects were significant at the $p < .10$ level suggesting that the main effects model holds for each of the ethnic groups in the study. Removal of the interaction terms resulted in improved model fit as indicated by decreased AIC (32970.14 vs. 32960.01) and BIC (33032.21 vs. 33008.29).

Finally, a parsimonious model was generated as described above and only paths that added significantly to model fit were retained. Non-significant effects of maternal ethnicity on health risk were removed. Eliminating these paths did not significantly hurt overall model fit: adj. $\chi^2\Delta$ (3) = 2.50, $p = .48$; CFI = .96; TLI = .94; RMSEA = .04. The final model with standardized path estimates is presented in Figure 3. Both family demographic and infant

health risk were predictive of decreased follow-through ($\beta = -.21, p < .001$ and $\beta = -.16, p < .02$, respectively), controlling for maternal ethnicity.

Predictors of Ultimate Program Reach

Overall, the 1,505 families completing at least one home visit represented 66 percent of the total 2,279 families that were eligible for the Durham Connects intervention. Given that demographic risk was positively predictive of initial engagement and negatively predictive of follow-through, we tested whether these demographic risk variables were predictive of home visit completion within the full sample of eligible births. To this end, each variable (maternal age, neighborhood poverty, health insurance status) was entered into a separate multiple logistic regression analysis to measure its unique effect in predicting home visit completion. Each model controlled for maternal race/ethnicity and was estimated using SAS Version 9.2. Results of this analysis (Table 4) suggested that none of the demographic variables significantly predicted completion of a home visit at the $p < .05$ level when collapsing across initial engagement and subsequent follow-through.

Discussion

The findings of this study indicate the paradox of engagement in a postnatal nurse home-visiting program: Families with higher demographic factors are more likely than those at low risk to schedule a home visit, but they are less likely to complete their scheduled visit. Results of this two-part analysis suggest that interventionists should not interpret lower rates of participation among high-risk families as an indication of their lack of engagement in these programs. Rather, our findings suggest that these families are more likely than low risk families and to *initially* engage with program staff. However, they are relatively unlikely to *follow through* with the home visit. Findings from this study also suggest that only measuring predictors of ultimate program reach may overlook group differences in initial engagement versus follow-through.

This study identified a number of variables generally available to home visiting staff members via birth records that are predictive of initial engagement and follow-through. Low socioeconomic status, as indicated by neighborhood poverty and lack of private medical insurance, along with low maternal age, were predictive of initial engagement in this home visiting program. However, these same variables were predictive of lack of follow-through in completing a scheduled visit. These findings were consistent with our hypotheses. These variables can be used in clinical practice to signal to staff members that special attention should be paid to ensuring that the family follows through with home visiting. Procedures might be put into place, such as providing an infant-sitter during the visit, an interpreter for translation, reminders about the visit, and willingness to reschedule if stressors intrude on the scheduled time. Staff members should not interpret missed visits as lack of interest.

On the other hand, infant health risk, measured by low birth weight, birth complications, and other medical diagnoses, was predictive of both lower rates of initial engagement and follow-through. This did not follow our hypothesized pattern, but it points toward a specific challenge with visiting families with infants who present health issues.

We did not conduct interviews with the families that might elucidate the reasons for (or lack of) initial engagement and follow-through. We theorize that families with increased demographic risk may have recognized their need for services and were thus more likely to initially engage in the program. However, anecdotal information from the nurse visitors suggests that a number of barriers continue to impede completion of visits with low-resource families. For instance, these families were more mobile than their high resource counterparts, and address changes and disconnected phone numbers often interfered with

completion of scheduled visits. Likewise, many of these families lacked backup contingencies or childcare alternatives, and were thus more frequently pulled out of the home to attend to family crises or last minute work obligations during scheduled appointments. Future qualitative or quantitative studies would be necessary to identify how these kinds of barriers impede engagement in home visiting.

The Durham Connects program utilized empirically validated engagement procedures to maximize rates of engagement. These strategies included discussing the intervention with families face-to face, providing services in the home, and offering material incentives for follow-through (Damashek et al., 2011; Ingoldsby, 2010). However, these strategies failed to compensate for continued barriers to follow-through among high-risk families. The findings of this study suggest that home visiting staff should utilize focused techniques to increase follow-through with such families. An important first step is developing rapport and maintaining frequent contact to remain abreast of changes in location and contact numbers. Programs could also consider providing services to address continued barriers to treatment such as a childcare worker to attend to other children during the visit or transportation to if necessary for a family's participation. Future empirical studies should test the effects of such focused engagement efforts for high-risk families in home visiting programs.

Contrary to our hypothesis, health risk (low infant birth weight, birth complications, other medical issues) was associated with decreased initial engagement as well as follow-through. This finding is concerning given that evaluations of targeted programs suggest that home visiting is particularly effective in producing beneficial health outcomes for medically at-risk infants (Bugental et al., 2002). It is possible that the increased stress of having a medically fragile infant caused these families to miss appointments or made it difficult to find time for home visiting. Alternatively, it is possible that these families decided not to participate in Durham Connects because they were already receiving services from the hospital or other organizations related to their baby's increased medical need. Qualitative interviews would be necessary to understand why families of infants with health problems make the decision not to engage in home visits. This information would assist program administrators in tailoring their recruitment procedures to increase engagement of families with medically at-risk infants.

As anticipated, low demographic risk families were less likely to initially engage in this program. The actual risk of maltreatment among these families is unknown, and thus their non-engagement in this program is also of concern. Future research is needed to examine the factors that determine why low-risk families decide not to participate in an intervention that is offered to all new parents. It would be especially important to examine if the universal recruitment procedures are as successful in removing the stigma associated with risk-targeted home visitation as intended (Daro, 2009). Specifically, it would be important to assess how all families viewed the purpose of the intervention and whether they believed the program was intended to serve exclusively families in need. Families may be reluctant to engage if they view participation as a sign of inability to deal with parenthood or risk for maltreatment and poor outcomes. Further research on engagement in universal home visiting programs is needed in conjunction with effectiveness trials to determine the viability of this intervention strategy.

Alternatively, it is possible that this universal intervention has positive impacts that do not depend on family engagement and follow-through. Families who were initially approached for enrollment but did not complete a visit might experience indirect benefits of the Durham Connects program by virtue of increased awareness of community support for new mothers and seeing other families benefit from the intervention. Thus exposure to the program without a home visit may increase families' collective efficacy and create a community

norm of mutual assistance for all parents, regardless of class. Evaluations of Durham Connects and other universal programs that utilize an “intent-to-treat” design rigorously capture the sum of all of these effects, but analyses of mediation should attempt to isolate the impact of engagement.

The use of medical record data is both a strength and a limitation of this analysis. Birth records are generally the first information source home visitors receive about an intervention family, and these records are generally available in most settings. Thus, the results of this analysis can help to inform recruitment and engagement strategies prior to the first contact with the family. At the same time, this information source does not address individual families’ reasons for deciding whether or not to participate in a nurse home visit, and as such we can only conjecture on the psychological underpinnings of group-level differences. Additionally, medical records do not include information on parity. This is a potential confound of our finding of lower engagement among older mothers. The mothers in this study were older, on average, than most targeted home visiting programs, which often recruit solely first-time and teen mothers. The older mothers in this sample are more likely to have previous children, feel confident with the task of parenting, and feel that parenting support is unnecessary.

Further, the intervention in this study is distinct from many other home visiting programs across the country. Namely, its reach is universal and not dependent on family risk. In addition, this intervention utilized staff members who actively attempted to recruit every family at the time of the baby’s birth, whereas other universal home visiting programs use more passive recruitment styles such as pamphlets or referrals. Finally, this intervention provides as little as one nurse visit, which is considerably lower intensity than many currently adopted programs. Thus, the results of this analysis may not be generalizable to all postnatal home visiting interventions. However, it is notable that high demographic risk families were lost to follow-up at higher rates than low-risk families even with universal, active recruitment utilizing empirically supported engagement strategies and relatively low intensity of involvement. This finding suggests that visiting families in the home removes many, but not all barriers to postnatal intervention and that more empirical study is needed to identify the most effective strategies for improving follow-through among those who desire services.

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Figure 1.
Theoretical model for directionality of effects of infant health and family demographic risk on engagement outcomes.

Figure 2. Final “pruned” structural model for initial family engagement in Durham Connects ($n = 2279$). *Notes:* Circles represent latent variables. Squares represent observed variables. Standardized path coefficients are presented. $^\dagger p < .10$, $^* p < .05$, $^{**} p < .01$, $^{***} p < .001$.

Figure 3.

Final “pruned” structural model for family follow-through in Durham Connects ($n = 1765$).

Notes: Circles represent latent variables. Squares represent observed variables. Standardized path coefficients are presented. $^{\dagger} p < .10$, $^* p < .05$, $^{**} p < .01$, $^{***} p < .001$.

Table 1

Bivariate correlations between study variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
<i>Demographic risk</i>												
1. Maternal age	-	-.241**	-.431**	.019	.028	.038	.018	-.122**	-.255**	-.143**	.142**	.062**
2. Neigh poverty		-	.374**	.012	-.003	-.054*	.009	.141**	.233**	-.078**	.153**	-.043
3. Med Insurance ^a			-	.014	.015	-.063**	.009	.395**	.242**	.171**	.190**	-.032
<i>Health risk</i>												
4. Birth weight				-	.876**	.151**	.241**	-.077**	.077**	.008	-.041	-.048*
5. Premature					-	.166**	.240**	-.062**	.062**	-.020	-.045*	-.039
6. Birth complications						-	.211**	-.071**	.018	.012	-.036	-.051*
7. Other diagnosis							-	.021	.019	-.041*	-.023	-.042
<i>Maternal ethnicity^b</i>												
8. Latina								-	-.407**	-.189**	.150**	.116**
9. African American									-	-.268**	.081**	-.112**
10. Other										-	-.031	.023
<i>Engagement</i>												
11. Scheduled visit											-	N/A ^c
12. Completed visit												-

^aPrivate medical insurance coded 1, uninsured or public insurance coded 0^bCaucasian reference group^cCorrelation could not be computed due to invariance of having scheduled a visit among subsequent visit completers*
 $p < .05$,**
 $p < .01$,***
 $p < .001$,

Table 2

Initial Engagement (Scheduled Visit) - Structural Model Standardized Coefficients and R² Values for Latent Variables

	Initial Engagement	Demographic Risk	Health Risk
Saturated – Main Effects			
R ²	-	.45	.01
Race: African American	.09 *	.60 ***	.05
Race: Latina	.16 **	.68 ***	-.05
Race: Other	.05 †	.09 ***	-.03
Demographic Risk	.26 ***	-	-
Health Risk	-.08 †	-	-
Saturated – Interactions			
Demographic Risk × African American	.04	-	-
Demographic Risk × Latina	.02	-	-
Demographic Risk × Other Race	.04	-	-
Health Risk × African American	-.12	-	-
Health Risk × Latina	.01	-	-
Health Risk × Other Race	.03	-	-

† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 3

Follow-Through (Completion of Scheduled Visit) – Structural Model Standardized Coefficients and R² Values for Latent Variables

	Follow-Through	Demographic Risk	Health Risk
Saturated – Main Effects			
R ²	-	.42	.01
Race: African American	.05	.62 ***	.02
Race: Latina	.31 ***	.71 ***	-.07
Race: Other	.05	.10 ***	-.03
Demographic Risk	-.21 **	-	-
Health Risk	-.16 *		-
Saturated – Interactions			
Demographic Risk × African American	.00	-	-
Demographic Risk × Latina	.05	-	-
Demographic Risk × Other Race	.02	-	-
Health Risk × African American	-.12	-	-
Health Risk × Latina	-.12	-	-
Health Risk × Other Race	-.11	-	-

[†]
p < .10

*
p < .05

**
p < .01

p < .001

Table 4

Results of Multivariate Logistic Regressions of Demographic Predictors of Overall Durham Connects Program Reach

Variable	Odds Ratio	95% CI	$\chi^2(1)$	<i>p</i>
Maternal Age	0.99	0.98, 1.01	1.07	0.300
Neighborhood Poverty ^a	1.01	1.00, 1.01	3.17	0.075
Public or No Insurance (vs. Private)	1.08	0.86, 1.34	0.43	0.510

Note. OR = odds ratio; CI = confidence interval.

^aPercentage of census tract residents living below poverty level.