

A Review of Prenatal Home-Visiting Effectiveness for Improving Birth Outcomes

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ABSTRACT

Objective: To determine the effectiveness of prenatal home visiting for improving prenatal care utilization and preventing preterm birth and low birth weight.

Data Sources: Medline, the Cumulative Index to Nursing and Allied Health Literature, PsycINFO, and Social Work Abstract databases were searched for articles that examined prenatal home-visiting and prenatal care utilization or neonatal outcomes, with additional ascendancy and descendancy searches. Listservs were also used to identify unpublished evaluations.

Study Selection: Quantitative studies meeting the following criteria were included in the analyses: published between 1985 and 2009, published in English, reported providing prenatal home visiting, and reported on prenatal care utilization or a neonatal outcome.

Data Extraction: Study characteristics and findings related to prenatal care utilization, gestational age, and birth weight were abstracted independently by at least two authors. Study quality was assessed across five domains.

Data Synthesis: The search yielded 28 studies comparing outcomes for women who did and did not receive prenatal home visiting, with 14 (59%) using an RCT design. Five (17%) studies reporting on prenatal care utilization found a statistically significant improvement in use of prenatal care for women with home visiting. Of 24 studies reporting an effect on birth outcomes, five (21%) found a significant positive effect on gestational age, and seven of 17 (41%) found a significant positive effect on birth weight.

Conclusions: More evidence suggests that prenatal home visiting may improve the use of prenatal care, whereas less evidence exists that it improves neonatal birth weight or gestational age. These findings have implications for implementing Title II of the Affordable Care Act.

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Pregnant women with medical or social risk factors and insufficient personal, psychological, or financial resources are at high risk for adverse pregnancy outcomes including preterm birth or low-birth-weight infants. These women require assistance, support, and guidance from a health or social service professional who can meet them where they are geographically and psychologically. Home visiting, one approach to providing such assistance to high-risk women, includes interventions other than medical care that facilitate access to and utilization of health and social services by women at risk for adverse pregnancy outcomes (Gomby, Larson, Lewit, & Berhman, 1993). Through prenatal home visiting, high-risk pregnant women receive a constellation of nonmedical interventions (e.g., care

coordination, emotional support, education) from their home visitor or case managers who most frequently are registered nurses but may also be social workers or paraprofessionals. Most home-visiting programs are based in public health departments, community clinics, or social service agencies (Issel, Forrestal, Wheatley, Slaughter, & Schultz, 2008). Home-visiting services can be structured as a distinct program within the health care agency or be integrated as a component of comprehensive routine prenatal care.

The recently enacted Affordable Care Act (Public Law 111-148), commonly referred to as health care reform, has a specific section Title II Subtitle L that designates grants to states for delivering

Fewer than one half the studies found that prenatal home visiting improved use of routine prenatal care.

evidence-based home visiting for pregnant women, expectant families, and new mothers. Federal funding agencies are drafting specifications of what will be included as an evidence-based home-visiting program. The evidence for home visiting clearly demonstrates its effectiveness for improving a variety of child development and health outcomes, such as parent-child interaction and the quality of the home environment (Kearney, York, & Deatrick, 2000; Kendrick et al., 2000; Kitzman et al., 1997, 2000; Olds, Henderson, Tatelman, & Chamberlin, 1988; Roberts, Kramer, & Suissa, 1996). Unfortunately, previous literature reviews of prenatal case management did not focus exclusively on neonatal outcomes or home visiting during the prenatal period and did not include studies with varying designs. In short, the evidence regarding prenatal home visiting as a strategy to improve neonatal outcomes, rather than child outcomes, has not received thorough attention, leading one study to conclude that its effectiveness remains unclear (Ciliska et al., 2001).

The authors of this literature review sought to address the need for a more definitive assessment of the effectiveness of home visiting with regard to neonatal outcomes and prenatal care utilization, especially given the Affordable Care Act as the current policy context for funding. The research questions were whether the evidence supports home visiting for high-risk pregnant women as effective in improving three outcomes: prenatal care utilization and preventing preterm birth and low-birth-weight infants, and whether any evidence exists for the effectiveness of a specific intervention or set of interventions used during the home visit vis-à-vis these three outcomes.

Methods

Search Strategy

Medline, the Cumulative Index to Nursing and Allied Health Literature, PsycINFO, and Social Work Abstract databases were searched using combinations of the following keywords: *prenatal*, *pregnant*, *high risk*, *home visiting*, *case management*, *outcomes*, *birth*, *maternal*, *neonatal*, *community*, and *Medicaid*. Maternal and child health and public health nursing listservs were used to solicit unpublished reports and research findings, yielding three unpublished reports. The articles were then used as

the starting point for ancestry and descendancy searches (Cooper, 1998). Reference lists of published meta-analyses were used to identify additional studies.

Inclusion and Exclusion Criteria

To determine study eligibility, *prenatal home visiting* was defined as a nonmedical program or service focused on facilitating utilization of health or social services, provided in the home to pregnant women who were at high medical or social risk for adverse birth outcomes. Eligibility for home visiting was determined by either the researchers or the clinical staff providing the service. Quantitative studies were included if all of the following criteria were met: published between 1985 and 2009, published in English, reported providing prenatal home visiting, and reported on prenatal care utilization, preterm or gestational age, or birth weight. Studies were excluded if the published report did not provide information on any of the interventions used during the home visit, did not explicitly include home visiting whether as a distinct component of a comprehensive prenatal care or a stand-alone program, only reported on use of medical prenatal care or prenatal home visiting costs, or did not use a control or comparison group. Exclusion criterion was used to verify that the home visiting as provided in the study met our definition of *home visiting*. This criterion resulted, for example, in eliminating studies that only provided medical home fetal monitoring.

The search yielded 28 eligible publications. Care was taken not to overrepresent a single study associated with multiple published reports. For example, there were several reports of one study conducted in Elmira, NY (Olds et al., 1988, 1997; Olds, Henderson, Tatelman, & Chamberlin, 1986). One other study had multiple reports (Villar et al., 1992; Belizan et al., 1995; Langer et al., 1993). We abstracted data from across the multiple published reports, thus yielding the most complete description possible of that particular study.

Data Abstraction

Each study was reviewed and data abstracted independently by two coders. Discrepancies in data abstraction or coding of data, such as design type, were discussed among the coders until consensus was reached. In the rare instance when the two coders could not reach agreement, a third coder reviewed the study, with discussions continuing until consensus was reached among all coders. Data were abstracted on the study and sample designs and sample characteristics, as well as the depen-

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dent variables of prenatal care utilization, preterm birth or gestational age at birth, and infant birth weight. The definition used for *preterm birth* was that used in the report, usually fewer than 36 weeks gestation, to have consistency in the data abstraction. Statistical findings, such as odd ratios, difference scores, *p* values, and confidence intervals, were abstracted. To the extent that specific interventions were mentioned in the reports, these data were abstracted. The Nursing Intervention Lexicon and Taxonomy (NILT) (Grobe & Hughes, 1993) was chosen as the classification scheme for its simplicity and applicability to prenatal home visiting (Issel, 1997).

Study quality was assessed using the schema of Downs and Black (1998), which included five domains. Each domain contained several items: quality of reporting (12 items), external validity (4 items), internal validity bias (7 items), internal validity confounding (6 items), and power (1 item). Each characteristic was scored 1 for *present* or 0 for *absent*, except power which was scored 0 to 2, giving a possible range of 0 to 31 as the quality score. The assessment of Downs and Black was chosen for its comprehensiveness and applicability to studies that do not involve randomization or clinical interventions.

We were unable to conduct a meta-analysis because many studies failed to report sufficient statistical detail for us to calculate effect sizes. Therefore, study findings were synthesized using a vote count method and sign tests (Cooper, 1998). Studies were categorized based on the direction of findings (e.g., improvements for either the home-visiting group or the non-home-visiting group) regardless of statistical significance; one study that failed to report the direction of effect was excluded (Gonzalez-Calvo, Jackson, Hanford, Woodman, & Remington, 1997). Sign tests were computed to determine whether the frequency of results in favor of home visiting exceeded chance for each of the three outcomes.

Results

The review and analysis of the 28 studies was informative with regard to the variations in sample and study design, level of study quality, and inconsistencies across findings.

Study Characteristics

Randomized controlled trials (RCTs) were the most common design, but accounted for fewer than one half of the studies ($n = 13, 46\%$) (Table 1). The majority of the other studies relied on convenience samples of women who were either referred or

recruited into the study ($n = 5, 18\%$); followed by population-wide examinations of vital records, Medicaid, or hospital data ($n = 9, 32\%$); with one study have an unclear sampling strategy. Study participants ranged in age from an average of 16.7 years in one study (Koniak-Griffin, Anderson, Verzemnieks, & Brecht, 2000) up to 34 years (Keeton, Saunders, & Koltun, 2004). Of the 28 studies, 16 (57%) had participants who were only adolescents or had at least 20% of participants who were 20 years or younger. The sample sizes ranged from 109 (Wells et al., 2008) up to 74,665 in one statewide cohort study (Keeton et al.), with a total of 270,822 participants represented in this review.

The total quality scores for the 28 studies ranged from 10 to 28, of a possible 31 points (Table 1). The mean score was 18.6 ($SD = 4.2$). Nearly one half the studies ($n = 12, 43\%$) had quality rating scores of 20 or higher, and 14% ($n = 4$) of the studies had scores of 14 or less. Only four (14%) of the 28 studies mentioned a calculation of statistical power (Bryce, Stanley, & Garner, 1991; Kitzman et al., 1997; Oakley, Rajan, & Grant, 1990; Olds et al., 1986). Overall, attention to bias affecting internal validity was the weakest aspect of the studies, with virtually no studies blinding to treatment, adjusting for exposure to the intervention, or using a theory to guide the intervention.

Dosage and Interventions

We abstracted gestational age at the time study participants were enrolled in the home-visiting program as a possible indicator of home-visit dosage. Of the 28 studies, 12 (43%) did not report the gestational age at which the pregnant women were enrolled into the home-visiting program (Baldwin et al., 1998; Gonzalez-Calvo et al., 1997; Hardy, King, & Repke, 1987; Heins, Nance, & Ferguson, 1987; Julnes, Konefal, Pindur, & Kim, 1994; Kitzman et al., 1997; Norbeck, DeJoseph, & Smith, 1996; Olds et al., 1997; Rogers, Peoples-Sheps, & Suchindran, 1996; Sangalang, Barth, & Painter, 2006; Wells et al., 2008; Zotti & Zahner, 1995). Among the 16 (57%) studies providing the information, none reported exclusively enrolling women during their first trimester. Only eight (29%) studies reported enrolling women at 26 weeks gestation or fewer (Bradley & Martin, 1994; Brooten et al., 2001; Bryce et al., 1991; Dawson, Van Doorninck, & Robinson, 1989; Keeton et al., 2004; Koniak-Griffin et al., 2000; Oakley et al., 1990; Villar et al., 1992), with the remaining nine (32%) studies enrolling women as late as 32 weeks gestation.

Descriptions of the interventions provided during the home visit varied from detailed lists to general statements (data not shown) (Issel, Slaughter, &

Table 1: Characteristics of Prenatal Home Visiting Studies (N = 28)

Author(s) (Year)	Study Design	Sample Type	Study Outcomes	Study Quality Score
Olds et al. (1986, 1988, 1997) [Elmira]	RCT	Conv	BW, GA	28
Bryce et al. (1991)	RCT	Conv	GA	25
Kitzman et al. (1997, 2000) [Memphis]	RCT	Conv	BW, GA	23
Margolis et al. (2001)	Retro Cohort	Conv	PNC, BW, GA	23
Koniak-Griffin et al. (2000)	RCT	Conv	PNC, BW, GA	22
Hardy et al. (1987)	Retro Cohort	Conv	PNC, GA	22
Norbeck et al. (1996) ^a	RCT	Conv	BW	22
Graham, Frank, Zyzanski, Kitson, and Reeb (1992)	RCT	Conv	BW	21
Lee et al. (2009)	RCT	Conv	BW	21
Ricketts, Murray, and Schwalberg (2005) ^a	Static group	U	BW	21
Rogers et al. (1996)	Retro Cohort	Conv, Pop	PNC, BW	21
Villar et al. (1992)	RCT	Conv	BW, GA	20
Tessaro et al. (1997)	Prosp Cohort	Pop, U	PNC, BW	19
Sangalang et al. (2006) ^a	Retro Cohort	Pop	PNC, BW, GA	19
Baldwin et al. (1998)	Ecological	Pop	PNC, BW	18
Donovan et al. (2007)	Retro CC	Pop	GA	18
Carabin et al. (2005)	Prosp Cohort	Pop	BW, GA	18
Brooten et al. (2001)	RCT	Conv	BW, GA	17
Oakley et al. (1990)	RCT	Conv	BW, GA	17
Bradley and Martin (1994)	Retro Desc	U	PNC	15
Heins et al. (1987)	Matched CC	Conv	PNC, BW, GA	15
Dawson et al. (1989)	RCT	Conv	BW, GA	15
Wells et al. (2008)	Retro Cohort	Conv	BW, GA	15
Nguyen et al. (2003)	RCT	Conv	BW, GA	15
Zotti and Zahner (1995) ^a	Retro Cohort	Pop	BW	14
Keeton et al. (2004) ^a	Retro Cohort	Pop	PNC, BW	13
Julnes et al. (1994)	RCT	Pop	PNC, BW, GA	12
Gonzalez-Calvo et al. (1997)	Descriptive	Conv	BW	10

Note. BW = birth weight; Conv = convenience; GA = gestational age; Matched CC = matched case-control; PNC = prenatal care utilization; Pop = population; Prosp Cohort = prospective cohort; RCT = randomized controlled trial; Retro CC = retrospective case-control; Retro Cohort = retrospective cohort; Retro Desc = retrospective descriptive; U = unknown.

^aHome visiting was mixed with office visits or telephone visits.

Forrestal, 2011). The reports mentioned or described home visitors using at least two and up to six different interventions. The three most frequently mentioned types of interventions were coordination ($n = 17, 61\%$), teaching ($n = 17, 61\%$), and support ($n = 16, 57\%$). There was no discernable pattern to

the combinations of interventions nor between the combination of interventions used and prenatal home-visiting effectiveness. The extent to which home visitors followed a standardized intervention protocol could not be determined in the majority of the reports.

Prenatal Care Utilization

Eleven of the studies (39%) reported on prenatal care utilization, including one report that analyzed African American and White women separately (Table 2). Utilization was reported as prenatal care adequacy, using the Kotelchuck (Baldwin et al., 1998; Sangalang et al., 2006) or Kessler (Keeton et al., 2004; Rogers et al., 1996; Tessaro et al., 1997) indices, or as an absolute number of prenatal care visits given the trimester began prenatal care. Significant differences between the percent of the home-visiting and non-home-visiting groups who received adequate prenatal care ranged from less than 1% (Hardy et al., 1987) to 4.5% (Keeton et al.). In five comparisons (42%), the home-visiting group had significantly more or more adequate prenatal care use than the comparison group; one study (8%) found a significant decrease in utilization among African Americans in the home-visiting group. Four comparisons (33%) found a small improvement that was either not significant or significance was not reported. In the remaining two

Table 2: Effect of Prenatal Home Visiting on Prenatal Care Utilization (PNC), Listed in Order of Decreasing Study Quality (N = 11)

Author (Year)	Effect on PNC	Significance
Margolis et al. (2001)	Same or decrease	ns
Koniak-Griffin et al. (2000)	Same or decrease	ns
Hardy et al. (1987)	Increase	Signif
Rogers et al. (1996)	Increase	Signif
Sangalang et al. (2006)	Increase	ns
Tessaro et al. (1997) ^a	Same or decrease	Signif (African American women only)
	Increase	ns (White women only)
Baldwin et al. (1998)	Increase	U
Bradley and Martin (1994)	Increase	Signif
Heins et al. (1987)	Increase	Signif
Keeton et al. (2004)	Increase	Signif
Julnes et al. (1994)	Increase	ns

Note. ns = not statistically significant; U = unknown significance.

^aTessaro findings were reported separately for two groups.

Prenatal home visiting was associated with higher infant birth weight in 30% of studies and longer gestational age in 27% of studies.

comparisons (17%), no difference between groups was found (Table 2). Neither RCT found a significant effect of home visiting on use of prenatal care (Julnes et al., 1994; Koniak-Griffin et al., 2000).

Neonatal Outcomes

Of the 28 studies, 26 (93%) reported on the association between home visiting and a neonatal outcome (Table 3). Twenty-four reports evaluated birth weight as an outcome, including one study that analyzed findings for African American and White women separately (Tessaro et al., 1997). Seven (28%) found a significant increase in birth weight for women who received prenatal home visiting compared to those who did not, including only three of the 12 RCTs (Brooten et al., 2001; Lee et al., 2009; Norbeck et al., 1996). The reported difference between the intervention and control groups ranged from 23 g (Olds et al., 1986) to 64 g (Nguyen, Carson, Parris, & Place, 2003), with one outlier study reporting a difference of 405 g (Julnes et al., 1994).

Of the 15 studies that reported infant gestational age or preterm birth as an outcome (Table 3), 10 were RCTs. However, of the four (27%) studies that detected a statistically significant effect of home visiting on gestational age (Bryce et al., 1991; Carabin et al., 2005; Heins et al., 1987; Sangalang et al., 2006), only one was a RCT (Bryce et al.) and their significant findings were only for women in the high-income group compared to the low-income group. Sangalang et al. reported preterm births in 15.0% of women with home visiting compared to 22.6% of women in the control group. Carabin et al. reported adjusted odd ratio of .86 (95% CI [0.75, 0.98]) for low-birth-weight infants among women with home visiting. An additional three studies found a nonsignificant but positive effect in those home visited.

Sign Tests for Study Outcomes

Table 4 displays the results of the sign tests. For prenatal care utilization, the majority of the studies reported findings in favor of home visiting. Thus, the frequency of positive outcomes exceeded chance ($p = .04$). However, for infant birth weight and gestational age or preterm birth, one half of the studies found that outcomes were either the same or worse for home visiting, and neither sign test was significant ($p = .50$ for both).

Table 3: Effect of Prenatal Home Visiting Studies on Birthweight (BW) or Gestational Age (GA), Listed in Order of Decreasing Study Quality (N = 26)

Author (Year)	Effect on BW		Effect on GA	
	(n = 24)	Significance	(n = 15)	Significance
Olds et al. (1986, 1988, 1997)	Same or worse	ns	Same or worse	ns
Bryce et al. (1991)	—	—	Improvement	Signif
Kitzman et al. (1997, 2000)	Same or worse	ns	Same or worse	ns
Margolis et al. (2001)	Same or worse	ns	Same or worse	ns
Koniak-Griffin et al. (2000)	Same or worse	ns	Improvement	U
Hardy et al. (1987)	—	—	Improvement	ns
Norbeck et al. (1996)	Increase	Signif	—	—
Graham et al. (1992)	Same or worse	ns	—	—
Lee et al. (2009)	Increase	Signif	—	—
Ricketts et al. (2005)	Increase	ns	—	—
Rogers et al. (1996)	Same or worse	ns	—	—
Villar et al. (1992)	Increase	ns	Improvement	ns
Sangalang et al. (2006)	Increase	Signif	Improvement	Signif
Tessaro et al. (1997) ^a	Increase	ns (African American women only)	—	—
	Same or worse	ns (White women only)	—	—
Baldwin et al. (1998)	Increase	Signif	—	—
Carabin et al. (2005)	Increase	Signif	Improvement	Signif
Brooten et al. (2001)	Increase	Signif	Same or worse	ns
Oakley et al. (1990)	Same or worse	ns	Same or worse	ns
Heins et al. (1987)	Same or worse	ns	Improvement	Signif
Dawson et al. (1989)	Same or worse	ns	Same or worse	ns
Wells et al. (2008)	Increase	U	Improvement	ns
Nguyen et al. (2003)	Increase	U	Same or worse	ns
Zotti and Zahner (1995)	Same or worse	ns	—	—
Keeton et al. (2004)	Increase	Signif	—	—
Julnes et al. (1994)	Same or worse	ns	Same or worse	ns
Gonzalez-Calvo et al. (1997)	Unknown direction of effect	ns	—	—

Note. ns = not statistically significant; U = unknown significance.

^aTessaro findings were reported separately for two groups.

Discussion

The 28 studies included in this review varied with regard to study quality, study design, and sample size, as well as the combinations of interventions used. Nonetheless, prenatal home visiting was associated with increased prenatal care utilization in more than one third of the studies. An increase in

use of prenatal care can be clinically important, even when not statistically significant, thus making prenatal home visiting potentially valuable. Unfortunately, the studies reporting an increase in prenatal care use typically did not explain how the improvement was achieved, and in several studies it was unclear whether they adjusted amount of prenatal

Table 4: Sign Test Assessment of the Evidence for Home Visiting Effects on Prenatal Care Utilization and Neonatal Outcomes

Outcome	Home Visiting Effects		p value
	Improved	Same or worse	
Prenatal care utilization	9	3	.04
Birth weight ^a	12	12	.50
Gestational age	8	8	.50

^aOne study did not report direction of effect and was excluded from the sign test calculation.

care for when prenatal care began. In addition, the studies did not discuss which specific home-visiting interventions were responsible for the positive effect. For example, coordination of support services (e.g., transportation, insurance coverage, child care) provided by the home visitor is a possible cause of improved utilization (Issel, 2000) but was not directly discussed in any of the studies.

Most studies included in this review did not find improvements in neonatal outcomes, suggesting that prenatal home visiting, as implemented in those studies, was ineffective as a means to improve neonatal health. Explanations for the overall lack of effect on neonatal outcomes can focus either on the woman’s health, experiences, and environment or on the nature of the interventions provided during the home visit. Women’s prior health status, socio-economic condition, individual physiology, and reproductive history play strong roles in determining pregnancy outcomes (Misra, Guyer, & Allston, 2003). Many of these factors would not be amenable to the interventions provided in prenatal home visiting, especially if provided only during the last two trimesters. However, women’s nutritional habits, current health status, and lifestyle behaviors would be amenable to education, referral, and coaching interventions provided by prenatal home visitors. For these types of interventions to have an effect on neonatal outcomes would require a substantial and sustained effort, making the timing of the initiation of prenatal home visiting as well as the dosage extremely important. Unfortunately, none of the home visiting programs examined in these studies enrolled women into the study during the first trimester. Similarly, the studies provided insufficient information to estimate the actual dose of interventions provided during home visits: specifically the number and duration of the visits per woman were not reported in most studies reviewed.

More rigorous research is needed that documents initiation of enrollment and standardization of interventions provided during the home visits.

The overall lack of attention to interventions used, protocols, and dose may be one explanation for the disappointingly low percent of studies finding prenatal home visiting to be effective.

The results of this literature review have potential policy implications in terms of the implementation of the Title II, Section L of the Affordable Care Act, especially the section that addresses evaluation of home-visiting program funded under the Act. One recommendation would be to create a standardized approach to measuring the dose of interventions and then to mandate reporting for continued funding. Having such a system would enable the states to direct resources to programs delivering a high enough dose to have an effect. That no studies reported enrolling women during their first trimester suggests that federal or state guidelines may need to specifically address early enrollment into home visiting programs as a means to assure adequate dose of interventions provided via home visiting programs.

Limitations

As with any literature review, some potentially relevant studies may not have been found. However, given our comprehensive search strategy, we remain confident that we minimized the “file drawer” and “grey literature” problems. Another limitation of our synthesis stems from the quality of the research reports. The lack of statistical information in many reports precluded conducting a meta-analysis, which would have been preferable over the vote count method. Although vote counts are conservative, this approach does not take into account either the magnitude of associations or sample sizes. Although the vote count approach is less rigorous than a meta-analysis, it is substantively superior to a purely narrative synthesis.

Conclusions

Although this synthesis of the prenatal home-visiting literature suggests that home visiting of pregnant women is associated with improved prenatal care utilization, the evidence is not overwhelming. In addition, we did not find clear support for prenatal home visiting as a means to improve infant birth weight or preterm or gestational age at birth. Two considerations may have

contributed to these disappointing results. First, fewer than one half of the 28 studies were of high quality. Second, women may have been enrolled in home visiting as late as 32 weeks of gestation, and none of the studies reported limiting enrollment to the first trimester only. The lack of findings for neonatal outcomes may be due to insufficient home visiting dosage.

Several avenues for future research are suggested by our findings. High-quality research is needed to focus on the effect of dose (e.g., number and duration of visits) as well as specific home-visiting interventions. The Affordable Care Act includes a mandate to document outcomes of home visiting. Given the equivocal findings of our review on neonatal outcomes, the mandated documentation could be useful in unraveling the benefits of prenatal home visiting and the mechanisms through which it has an effect on prenatal care utilization and newborn health.

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