The Effectiveness of Home Visiting as a Delivery Strategy for Public Health Nursing Interventions to Clients in Prenatal and Postnatal Period: A Systematic Review

Family Health
Child Health

March 1999
The Effectiveness of Home Visiting as a Delivery Strategy for Public Health Nursing Interventions to Clients in Prenatal and Postnatal Period: A Systematic Review

March 1999

Donna Ciliska¹,²
Paula Mastrilli³
Jenny Ploeg¹,²
Sarah Hayward⁴
Ginny Brunton²
Jane Underwood¹,²

1. McMaster University, School of Nursing
2. Region of Hamilton-Wentworth, Social and Public Health Services Division, PHRED Program
3. Ryerson Polytechnic University, School of Nursing
4. InfoWard Inc., Edmonton

¹.  McMaster University, School of Nursing
².  Region of Hamilton-Wentworth, Social and Public Health Services Division, PHRED Program
³.  Ryerson Polytechnic University, School of Nursing
⁴.  InfoWard Inc., Edmonton
To determine the effectiveness of interventions included in the Mandatory Health Programs and Services Guidelines (MHPSSG), the following systematic reviews were completed and funded by the Public Health Research, Education and Development (PHRED) Program of the Public Health Branch, Ontario Ministry of Health.

**1998 - 1999**

- **Health Hazard Investigation**
  - Emergency Response to Acute Environmental Hazards
  - Strategies to Enhance Public Awareness of Environmental Risks

- **Chronic Diseases and Injuries**
  - **Chronic Disease Prevention**
    - Community interventions to Enhance Fruit and Vegetable Consumption
    - Use of Coalitions in Heart Health, Tobacco Use Reduction and Injury Prevention
    - Community-Based Heart Health Programs
    - School-Based Adolescent Risk Behaviour Prevention Programs

- **Family Health**
  - **Sexual Health**
    - Adolescent Pregnancy Prevention Strategies
  - **Child Health**
    - Professionally Led Parenting Groups
    - Peer/Paraprofessional 1:1 Interventions in Improving Maternal/Child Health
    - Public Health Nurse Home Visiting
    - Curriculum Suicide Prevention Programs for Adolescents

- **Infectious Diseases**
  - Day Care Centre Infection Control Interventions
  - Adolescent STD Prevention Strategies

**1999 – 2000**

- **Chronic Diseases and Injuries**
  - Postpartum Smoking Relapse Prevention Strategies
  - Cervical Cancer Screening Interventions

- **Injury Prevention**
  - Anticipatory Care Interventions with Community Dwelling Elderly

- **Family Health**
  - **Sexual Health**
    - Youth to Youth Peer Health Promotion
  - **Child Health**
    - Healthy Feeding in Infants Under One Year of Age
    - Injury Prevention in Children & Adolescents

- **Infectious Diseases**
  - Needle Exchange Programs
  - Online Computer Support Groups for Adults

The conclusions of the reviews are based on the available evidence. They do not necessarily represent the views of the Public Health Branch, Ontario Ministry of Health. This report may be copied for circulation as appropriate. Please ensure that the PHRED Program, Public Health Branch, Ontario Ministry of Health is acknowledged.
TABLE OF CONTENTS

ACKNOWLEDGEMENTS................................................................................................................i
PREFACE ...................................................................................................................................ii
SUMMARY STATEMENT FOR PRACTITIONERS/MANAGERS.................................................1
HIGHLIGHTS FOR POLICY DEVELOPMENT ..................................................................3
ABSTRACT ...............................................................................................................................5
BACKGROUND ..........................................................................................................................7
   Introduction..........................................................................................................................7
   Review Question and Objectives......................................................................................7
METHODS .....................................................................................................................................8
   Criteria for Study Selection...............................................................................................8
   Search Strategy ..................................................................................................................8
   Quality Assessment ..........................................................................................................9
   Review Procedures..........................................................................................................9
RESULTS ....................................................................................................................................9
   Prenatal Interventions ......................................................................................................10
   Postnatal Interventions ....................................................................................................11
   Interventions through Prenatal and Postpartum Period ..................................................13
DISCUSSION.............................................................................................................................16
CONCLUSIONS ........................................................................................................................17
   Implications for Practice.................................................................................................17
   Implications for Research ..............................................................................................17
   Key Messages ..................................................................................................................18
TABLE 1: Included Studies.................................................................................................19
REFERENCES ..........................................................................................................................33
ACKNOWLEDGEMENTS

We would like to thank the fourth year nursing students Karen Yunglut and Amanda Hofsink who assisted with handsearching of the journals for this update. Also, Maureen Dobbins provided tremendous input in her previous role as project co-ordinator.
PREFACE

The Public Health Branch of the Ontario Ministry of Health released new Mandatory Health Programs and Services Guidelines (MHPSG) in December 1997. Although the MHPSG provide guidelines for a wide range of public health practices in Ontario, the strength of evidence for many of the guidelines has not been summarized in a systematic way.

In 1998-1999, the Public Health Branch provided funding for the Effective Public Health Practice Project. The mandate of the project was to complete 15 summary statements based upon systematic reviews of the effectiveness of specific requirements of the MHPSG. Each review was linked to one of the three general standards or three program standards. The reviews summarize the best available research evidence for public health practice in these areas. Research evidence is one piece of information needed to inform decision making in public health. Other factors, such as the local environment, local priorities, and available resources are also important.

The reviews were completed by review groups composed of members of the Ontario Public Health Research, Education and Development (PHRED) Program Health Units as well as representatives from other Health Units around the province. The PHRED Provincial Steering Committee has overseen the project.

Potential review topics were initially identified through a survey of public health practitioners and managers across Ontario. Each review group followed a systematic approach that included comprehensive search strategies and quality assessment of each primary research study selected for inclusion in the review.

One of the primary objectives in completing this work was to ensure that it is relevant to public health practitioners in the field. We contacted all Medical Officers of Health and asked for volunteer experts. The response was tremendous and more than 100 practitioners and managers from over 90% of health units across Ontario agreed to take on the role of peer reviewers for the draft reports.

This project already has had many benefits. Public Health professionals have developed skills in completing systematic reviews and have increased awareness of the importance and feasibility of evidence-based practice. Through this project, we have established new links with the Cochrane Collaboration. We hope that several reviews will be registered with the various Cochrane Review Groups, making them accessible to the international public health community. Finally, the process of completing this project has contributed to the development of a strong province-wide network of public health professionals.
Public Health Home Visiting

**Public Health Mandate**

Some of the goals of the Program Standards for Reproductive Health and Child Health include lowering the incidence of low birth weight, increasing the percentage of children who meet normal developmental milestones, and increasing parenting ability in high-risk families.

**Background**

Program delivery can occur through a variety of strategies such as telephone information lines, peer support, clinics and school interventions. However, some people do not access these services. Home visiting by public health nurses (PHNs) has historically been a delivery strategy to help people access services.

**Issue**

Compared with clinic or telephone services, home visiting has a higher cost of time and transportation. Many articles have been published about what happens in the ‘black box’ during a home visit but it is unclear if home visiting, as a program delivery strategy, is effective for parent or child outcomes.

**Finding the Answers**

A systematic review was conducted to assess the evidence of effectiveness for home visiting as a program delivery strategy for prenatal and postnatal clients.

**What’s the Evidence?**

Twenty relevant articles reporting 12 studies of strong or moderate quality were found. The studies were trials except one of moderate quality which was a cohort design. Two studies targeted prenatal clients, six were for postnatal clients, and four included interventions for both the pre and postnatal period.

The most effective interventions:

- Involved multiple community agencies and primary care services,
Summary Statement for Practitioners/Managers

- Were more intensive with weekly home visits at least initially, either during pregnancy or after the birth of the child,
- Had a greater impact on those who would be considered at risk due to social disadvantage.

Implications for Practice and Research

- Multiple intervention strategies are most effective.
- Home visiting interventions with women at high risk due to social circumstances, age, income or education have a greater impact than those directed to more advantaged clients.
- Comparisons of effectiveness of interventions conducted by PHNs versus lay home visitors with similar client populations should be done.
- Prenatal studies of much larger sample sizes are necessary to have adequate power to assess effectiveness of interventions on low birth weight, gestational age, neonatal morbidity and mortality.

More Sources of Information


Contact Information

Donna Ciliska
Public Health Consultant
Region of Hamilton-Wentworth
Social and Public Health Services Division
Community Support and Research Branch
PHRED Program
Hamilton, Ontario
Phone: (905) 525-9140 ext. 22529
Fax: (905) 526-7949
Email: ciliska@fhs.csu.mcmaster.ca
Public Health Home Visiting

Issue

Compared with clinic or telephone services, home visiting by public health nurses has a higher cost of time and transportation. Many articles have been published about what happens during a home visit, but it is unclear if home visiting, as a program delivery strategy, is effective in improving parent or child health.

Background

Program delivery can occur through a variety of strategies, such as telephone information lines, peer support, clinics and school interventions. However, some people do not access these services. Home visiting by public health nurses has historically been a delivery strategy to help people access services.

Public Health Mandate

Some of the goals of the Program Standards for Reproductive Health and Child Health include decreasing the number of babies with low birth weights, increasing the number of children who develop normally, and increasing parenting ability in high-risk families.

What’s the Evidence?

A systematic review was conducted to assess the evidence of effectiveness for home visiting as a program delivery strategy for prenatal and postnatal clients. Twenty relevant articles reporting 12 studies of strong or moderate quality were found. Two studies targeted prenatal clients, six were for postnatal clients and four included interventions for both the pre and postnatal period.

The most effective interventions:

- Involved multiple community agencies and primary care services,
- Were more intensive with weekly home visits at least initially, either during pregnancy or after the birth of the child,
- Had a greater impact on those who would be considered at risk due to social disadvantage.
Implications

- Multiple intervention strategies are most effective.
- Interventions with women at high risk due to social circumstances, age, income, or education have a greater impact than those directed to more advantaged clients.
- Comparisons of interventions conducted by public health nurses compared to lay home visitors with similar client populations should be done.
- Prenatal research studies need to be much larger to adequately assess the effectiveness of interventions on low birth weight, prematurity, newborn illness, and death.

Contact Information

Donna Ciliska
Nurse Consultant
Region of Hamilton-Wentworth
Social and Public Health Services Division
Community Support and Research Branch
PHRED Program
Hamilton, Ontario
Phone: (905) 525-9140 ext. 22529
Fax: (905) 526-7949
Email: ciliska@fhs.csu.mcmaster.ca
ABSTRACT

Objectives
The purpose of this systematic overview was to assess the evidence for effectiveness of public health nursing interventions when carried out by the strategy of home visiting with clients in the pre and postnatal period.

Methods
This overview is an update of a larger overview based on collecting literature to 1993 and updated first to the end of 1995, and now, 1998. The search of published and unpublished literature related to home visiting resulted in a total retrieval of 211 articles: one-hundred forty-nine relevant to all age groups and including all interventions implemented by various professional and non-professional groups, in which the intervention was considered within the scope of practice of public health nursing in Ontario. When the relevance was limited to interventions in which the intervenor was known to be a nurse, and the clients were in the prenatal and/or postnatal periods, there were 20 articles with quality ratings of ‘strong’ or ‘moderate’ included in this update for the systematic review.

Results
There were no reported negative effects of home visiting in the nine strong articles. Positive outcomes included improvement in children’s mental development, mental health and physical growth, reduction in mother’s depression, improvement in maternal employment, education, nutrition and other health habits, and government cost saving. There is no proven impact on low birth weight, gestational age, or neonatal morbidity or mortality, although studies suffer inadequate sample sizes to show a difference in such relatively rare occurrences.

Conclusions
As a delivery strategy, nurses visiting pre and postnatal clients in the home can have significant benefit, particularly with interventions of high intensity and with clients considered to be ‘at risk’ due to factors such as low income and low educational achievement.
BACKGROUND

Introduction
In Ontario, one of the goals stated under the Reproductive Health Program in the Mandatory Health Programs and Services Guidelines (Ontario Ministry of Health, 1997) is to reduce low birth weight (LBW), (i.e., infants under 2500 gm), to four percent by the year 2010. Under The Child Health Standard are objectives which promote the health of children. These aim to increase the percentage of children and youth who meet physical, cognitive, communicative, and psychosocial developmental milestones. As well, they support strategies which increase access to and use of needs-based services and supports for children who are at risk of poor physical, cognitive, communicative and psychosocial development. There is recognition of the need to increase effective parenting ability in high-risk families. The document further sets out requirements and standards for provision of both reproductive health and child health programs. It specifies responsibilities of public health units in provision of education, support to families, and utilization of community agencies which offer direct care, when needed. Specific mention is made of implementation of The Healthy Babies, Healthy Children Program.

Historically, these programs have been delivered by public health nurses (PHNs) visiting the family in the home. While multiple other delivery strategies have been developed, including peer and lay support workers, telephone information and support lines, and clinics, there is usually a proportion of the population who do not access these alternate services. Thus home visiting remains one of a number of program delivery strategies.

It is acknowledged that a home visit may include many different kinds of interventions and where possible, some detail is given in this paper about the content of the home visit. It is unclear whether home visiting, as a program delivery strategy, is effective for parent or child outcomes. By reviewing and summarizing the findings of research studies, it is hoped that the most effective and efficient use of public health resources can be promoted, and issues in the debate can be clarified.

There are inherent difficulties in doing research in community health (Hayward et al., 1996). They include problems achieving sample size for adequate power, conducting a randomized trial within a community, controlling for contamination and confounders, blinding outcome assessment, and finding reliable and valid outcome measurement tools. However, this review did find studies of high quality which will be presented. This overview is an update of a larger overview based on collecting literature to 1993 (Ciliska et al., 1996). This review was first updated to the end of 1995, and in this review, to the end of 1998.

Review Question and Objectives
The question for this systematic review was:

“What is the effectiveness of public health nursing interventions to prenatal and postnatal clients offered through the strategy of home visiting?”
Comparisons of interest relate to risk level of clients and timing and intensity of the interventions.

**METHODS**

**Criteria for Study Selection**
Relevance criteria determined whether the study a) evaluated an intervention or program, b) described an intervention within the scope of PHN practice in Canada (Canadian Public Health Association, 1990), c) provided information on client-focused outcomes and/or cost, d) described a prospective study and e) had a control or comparison group (i.e., could have been before/after study). To be included, an article had to meet all five inclusion criteria. In the initial overview and update, articles were considered relevant, no matter what discipline or preparation of the intervenor, if the intervention was within the scope of PHN practice in Ontario. For this update, since there is another review about lay home visiting (Wade et al., 1999), the relevance criteria included only those studies in which the intervenor was identified as a nurse. An additional limiting relevance criterion was that the target group had to be prenatal or postnatal clients.

**Search Strategy**
- For the overall project, an on-line search of MEDLINE and CINAHL was conducted for the years 1979 to 1998. Key words used were ‘PHN,’ or ‘CHN,’ and ‘effectiveness’ or ‘comparative’ or ‘control’ or ‘evaluative’ study. A focused search using the keyword ‘home visiting’ was done back to 1985.

- Prominent authors in the field were searched on-line for the years 1986-1998.


- Published bibliographies, reports from several health research programs and several government documents were hand searched for relevant articles. The abstracts of workshops and papers presented at recent CPHA, OPHA, APHA conferences and the International Conference on Community Health Nursing were reviewed. Key informants were contacted in Public Health Research Education and Development Programs in Ontario, University Schools of Nursing in Canada and through a directory of Canadian Nurse Researchers, for both published and unpublished papers.

- The content lists of 107 related journals were also reviewed monthly from September, 1992 to December, 1998.
• Relevant references (1980 onward) from each article were identified, retrieved and reviewed.

An article was retrieved for potential relevance if its title or abstract indicated that it was an evaluative study of an intervention, within the scope of public health nursing, carried out in the home with clients of any age group. For on-line searches, two reviewers independently assessed the bibliographic listings. For all other sources of retrieval, one reviewer assessed material for potential relevance.

Quality Assessment
The next phase involved rating the relevant articles for validity. A tool was developed, pretested, and modified. It included the following criteria: method of allocation to the study groups, level of agreement to participate in the study, control for confounders, method of data collection (pretesting of data collection tools, blinding of data collectors to group allocation of study participants), quantitative measure of effect, cost analysis and percent of participant follow-up. Studies were rated ‘pass,’ ‘moderate,’ or ‘fail’ on each criterion. If an article stated that the sample was ‘randomized’ without detail about how that was achieved, it was considered quasi-randomized which satisfied the ‘moderate’ rating.

In order for an article to be judged strong, a minimum of four of six criteria had to be rated as ‘pass’ with no ‘fail.’ For the ‘moderate’ category, no criterion could be a ‘fail’ and three or more had to be ‘moderate.’ A ‘weak’ rating meant that at least one criteria was a ‘fail.’

Review Procedures
For this update, all articles were read and rated independently by two reviewers blind to the rating of the other person, both for relevance and validity. The primary reader did the data abstraction.

The most frequent weaknesses identified were that the method of allocation to study groups was not random, that the method of randomization was not described, that there was inadequate control for potential confounders, and that less than 80 percent of potential participants actually participated.

RESULTS
The total search of published and unpublished literature related to home visiting resulted in total retrieval of 211 articles: one-hundred forty-nine relevant to all age groups and including all interventions done by various professional and non-professional groups, in which the intervention was considered within the scope of practice of public health nursing in Ontario. When the relevance was limited to interventions where the intervenor was known to be a nurse, and the clients were in the prenatal and/or postnatal periods, there were 15 articles (rated strong and moderate) from the previous update included in this review. Ten additional articles from this update were relevant to the narrower question; five were rated weak on quality. Therefore there were 20 articles for this systematic review.
A chart is presented (Table 1) of the 20 strong and moderate articles related to 12 studies, summarizing design, intervention and results. It is important to note that there are three studies with more than one article which are different reports concerning different follow-up times or different outcomes for the same study. The studies are grouped according to interventions in the prenatal period, the postnatal period and both.

Prenatal Interventions

One strong study considered an intervention in the prenatal period only (Villar et al., 1992). The study was designed to evaluate the effect of psychosocial support in supplementing prenatal medical care. It was done in Latin America with 2235 women who were identified as having higher-than-average risk for delivering a low-birth-weight infant based on any one of the following criteria: previous delivery of a low-birth-weight or preterm infant, previous fetal or infant death, under 18 years of age, body weight under 50 kilograms or height under 1.5 metres, low family income defined according to local cutoff points, less than three years of school, smoking or heavy alcohol consumption, and residence apart from the child's father. Participants were recruited before the 20th week of pregnancy and randomly assigned to either an intervention group (n=1115), who received four to six home visits from a nurse or a social worker in addition to routine prenatal care, or to a control group (n=1120) who received only routine prenatal care (with a mean of eight prenatal visits). The intervention was to provide social support along with health and nutrition information, and not to provide any psychological treatment or to attempt to resolve major family or social problems.

The primary outcome measures were low birth weight (<2500 g), preterm delivery (<37 weeks gestation), and maternal and neonatal morbidity. Distribution of risk factors and demographic characteristics were similar in both groups upon entry into the study. There were no statistically significant differences in rates of having a child with low birth weight, preterm delivery, intrauterine growth retardation (IUGR), type of delivery, length of hospital stay, perinatal mortality, or neonatal morbidity in the first 40 days. When the investigators analyzed the effects on women who had high base-line levels of psychological distress or low social support or both, the intervention still had no detectable effect. The authors concluded that the intervention was not sufficient to overcome a lifetime of disadvantage and poor health on the biologic outcomes of pregnancy. They also postulated that limiting study entry to women who sought prenatal care before 22 weeks of gestation and who had an adequate number of prenatal visits may have excluded women with the greatest need for this type of intervention. It is possible that a similar intervention targeted to women who received prenatal care late in pregnancy could be more effective because of these women's greater need. In addition, the intervention was more limited than the PHN role; the intervention did not address social, psychological or family problems.

Another strong study by York et al. (1997) studied women who had diabetes or hypertension in pregnancy and had been hospitalized during pregnancy. The control group was discharged routinely from hospital, while the intervention group was discharged earlier, with specific criteria regarding blood glucose and understanding of their own medical conditions. They were visited in hospital for discharge planning, and then received home follow-up by a perinatal nurse specialist. At least 5 home visits were made to the intervention group within the first three days of discharge, then follow-up was maintained by telephone and regular clinic care. The intervention group had fewer re-hospitalizations during that pregnancy (0.3 versus 2.9 in the control) with a reduced
cost of care ($772 versus $13,327 in the control). There was no impact on birth weight or gestational age of the child.

**Postnatal Interventions**

A strong study was conducted in the UK to determine whether counselling by health visitors (nurses) was helpful in managing postnatal depression (Holden et al., 1989). Fifty women, identified as depressed upon screening at six weeks postpartum in a community clinic, and as assessed by psychiatric interview at about 13 weeks postpartum, were randomly assigned to receive the intervention. This consisted of eight successive weekly counselling visits by health visitors. The intervention emphasized the importance of social support or listening to clients and encouraging them to make decisions based on their own judgement, rather than the health visitor giving advice.

Goldberg's Standardized Psychiatric Interview and the Edinburgh Postnatal Depression Scale were used before and after the intervention for outcome measurement. The two groups were similar on distribution of social and obstetric factors. The results showed that significantly more counselled women than controls recovered (69% versus 38%), with a difference in recovery rate of 31.7%. In addition, the counselled women showed a significant (p<0.01) reduction in mean scores from the first to second interview on all measures of depression. The reduction in scores in the control group was not significant. Information was available regarding antidepressant medication use, and the improved rate of recovery was not explained by medication use. The authors concluded that while some cases of postnatal depression remit spontaneously within three months, the counselling intervention led to the recovery of an additional one third of the women in the study.

In Project CARE (Wasik et al., 1990), families with children at risk for cognitive difficulties (disadvantaged by education or social circumstances of the parents) were randomized at birth to home visits by a nurse for family education, family education plus day care, or to control where children were referred to community agencies as a usual care group. The intervention group received five days per week of care in a child development centre plus home visits weekly for the first three years, then continued at a reduced frequency for years four and five. Cognitive performance was measured by the Bayley Scales of Infant Development at six, 12, and 18 months, the Stanford-Binet Intelligence Test at 24, 36, and 48 months, and The McCarthy Scales of Children's Abilities at 30, 42, and 54 months. The children in the family education group did not differ from the control group on any outcome at any measurement time. The family education plus daycare group had higher scores at 12, 18, 24, and 36 months than either of the other two groups, and over the control group at 42 and 54 months. There were no differences in the home environment on the HOME scale or child rearing attitudes. Home visiting alone did not appear to have an impact on the outcomes measured. The authors concluded that early day care environment had a positive influence on the cognitive development of children in the study.

Several studies have used home visiting interventions with LBW and Very Low Birth Weight (VLBW) infants. An intervention of telephone support and home visits by nurses to very-low-birth-weight infants discharged early from hospital (Brooten et al., 1986) found statistically significant positive differences between that group and the control group who stayed in hospital longer, on number of rehospitalizations, number of acute care visits, incidence of failure to thrive, and reports of child abuse and foster placement.
at an 18 month follow-up. There were no differences in development quotient. In the cost analysis, the mean combined hospital and physician charges for the early discharge group were $190, $136 or 26.4% less than for the control group, and the mean cost of the intervention per family was $576, which resulted in considerable cost savings. Weaknesses of this study include no description of the method of randomization, and inability to achieve follow-up of 80 percent of initial participants.

Casiro et al. (1993) also studied early discharge of LBW infants. The early discharge group received eight weeks of public health nursing and homemaker service. The PHN intervention was based on assessed need and included support, referral, and teaching about infant development, environment, and economic adequacy. The intervention group received means of 3.8 home visit and 8.4 telephone contacts by the PHN and 2298 hours of homemaking. At one year there were no significant differences in use of health services or infant growth. The intervention group had more positive home environments based on the HOME scale on total score, increased provision of play material, and less use of restriction and punishment. However, these differences did not impact on mental or psychomotor scores. The study found that infants under 1500 grams did not meet the readiness criteria early enough to allow for significant reductions in the length of stay; however, early discharge of infants over 1500 grams was feasible and cost-effective. A total cost saving of the intervention was achieved through reduced time in hospital.

Similarly, several authors (Achenbach et al., 1993; Achenbach et al., 1990; Rauch et al., 1988) reported on a study which used a combination of hospital and home sessions by neonatal intensive care nurses for an intervention with LBW infants. This was a randomized trial where the control group received usual care and the intervention consisted of seven hospital sessions before discharge and four home sessions (up to 90 days after discharge). In addition, the study had a cohort of normal weight infants as a comparison group. The intervention consisted of the Mother-Infant Interaction Program, directed to enabling mothers to appreciate specific behavioural and temperamental characteristics of their baby, to sensitize mother to baby’s cues, and to teach mothers to respond to the cues. The initial follow-up was up to four years. At six months the intervention mothers had greater self-confidence, satisfaction, and lower perception of difficulty with the infant than the control mothers (Rauch et al., 1988). As well, the intervention infants had significantly higher scores on cognitive ability at 36 and 48 months on the McCarthy Scale than the control infants. Their cognitive scores were not statistically different from the normal weight comparison group. There were no differences in maternal anxiety or the child’s mental development before 36 months. The differences in cognitive ability between the intervention group and the LBW controls were maintained at seven years (Achenbach et al., 1990) and nine years (Achenbach et al., 1993). The scores of the LBW intervention group did not differ from the scores of the normal weight control group at either of those longer follow-up periods. The intervention seemed to prevent cognitive lags normally found in LBW infants.

The Avon Premature Infant Project (Robinson et al., 1998) tested the effectiveness of a home-based developmental education program in very preterm (32 weeks gestation or less) children in Bristol with a randomized trial. The intervention was based on Portage, an education program for parents about child development. To test the effects of this intervention compared with attention versus no attention there was a second home intervention group based on non-directional support in a parent-advisor model, and a control group of usual care. Nurses in both active interventions had training and ongoing supervision. Visiting in both groups occurred weekly for the first few months, then every
two to four weeks for the next year, then monthly until the child was two years old. Frequency of visits could be somewhat limited by the family, but both interventions had a mean of 42 total visits averaging 45 minutes in length. There were no significant differences between groups at two years of age on children’s mental development. Social variables were found to be independently associated with the mental development scores and, when controlled in the analysis, showed both interventions to have a small significant effect on developmental scores.

**Interventions through Prenatal and Postpartum Period**

Seven of the articles which were rated as having a ‘strong’ methodology came from a series of outcome reports from the same study by Olds and his colleagues (Olds et al., 1986a; Olds et al., 1986b; Olds et al., 1988; Olds, 1993; Olds et al., 1994; Olds et al., 1997; Olds et al., 1998), which is sometimes known as the ‘Elmira’ study. This is a study of intensive pre and postnatal home visiting by nurses to mothers in semi-rural upstate New York who were enrolled before the 30th week of pregnancy, had no previous live births, and had one or more of the following risk factors: adolescent, unmarried, or of low socioeconomic status. The sample was stratified by marital status, race, and geographic region. Four hundred women were enrolled and randomized to one of four groups: 1) controls who received no additional treatment from that which they sought out on their own; 2) families who were provided with free transportation for regular prenatal and well-child care at the local clinics and physician’s offices; 3) families who received the services of condition #2 plus a nurse home visitor who visited every two weeks (average of nine visits with average duration of 75 minutes) during pregnancy; and 4) families who received the services of group #3 plus the nurse continuing to visit until the child was two years old, visiting weekly for six weeks following delivery, then every two weeks from four to 14 months, then every four weeks from 14 to 20 months, every six weeks from 20-24 months, and more frequently if a crisis occurred.

The content of the home visits was designed to emphasize family strengths while giving parent education regarding fetal and infant development, involving family members and friends in child care and support of the mother, and linking family members with other health and human services. The nurses followed a detailed curriculum with specific objectives related to improving parents’ understanding of infant temperament (especially crying and its meanings) and infants’ socioemotional and cognitive needs (for responsive caregiving and for progressively more complex motor, social, and intellectual experiences). Physical health care needs such as nutrition and bathing, managing common health problems, and need for routine health care and immunizations were also included in the curriculum.

Interviews and infant assessments were carried out at registration (prior to 30 weeks of pregnancy), at six, ten, 12, 22 and 24 months of the infant’s life. Medical records were abstracted for the infant’s first two years of life, and the records of child abuse and neglect registries for 15 states in which families had lived were reviewed. There were no significant group differences in demographic variables between the groups at entry to the study. Children and mothers were followed up to 15 years. Outcome measures included maternal health, health habits, and obstetrical complications; birth weight and length of gestation, infant behaviour problems and temperament; child cognitive, motor and physical development; home environment, discipline, reports to state department social service workers for presence of verified cases of abuse or neglect, child’s criminal and antisocial behaviour, mother’s
employment, education, subsequent pregnancies and use of welfare. In most of the analyses, treatment groups 1) and 2) were combined as the no-treatment group and 3) and 4) were combined as the nurse-visited group.

One of the articles reported outcomes of pregnancy and maternal health habits (Olds et al., 1986b). Statistically significant findings were that mothers in the nurse-visited groups were more aware of community services available to them, attended childbirth education classes more frequently, reported talking more frequently with service providers and members of their networks about stresses of pregnancy and family life, and indicated that the babies’ fathers showed greater interest in the pregnancy. They were accompanied by someone to the labour room more frequently, had fewer kidney infections, had better nutrition, and smoked a reduced number of cigarettes per day. There were no overall treatment effects on birth weight or length of gestation.

Another article (Olds et al., 1986a) reported statistically significant improvements for the nurse-visited mothers versus the control group in their reports of baby’s mood, their level of concern with the infant’s behaviour, their frequency of restricting their children, frequency of visiting the emergency department, and experiencing accidents and poisonings as shown by medical records. Differences in cases of verified child abuse were in the direction of favouring the nurse-visited group, but the difference was not statistically significant (p=0.07).

A third article reported on parental caregiving qualities and child health at 25 and 50 months (Olds et al., 1994). There were still no differences in reported rates of child abuse or neglect or on children’s intellectual functioning. However, nurse-visited children lived in homes with fewer environmental hazards and had fewer injuries, ingestions and visits to the emergency department, and fewer physician-recorded behavioural and parenting coping problems than the unvisited group.

Olds et al. (1988) reported the four-year follow-up of mothers and the effects on their life course. At study entry, nurse-visited unmarried women had a greater sense of control and nurse-visited poor, unmarried teens reported receiving greater support from boyfriends. These variables were consistently related to outcomes of the study; the potential bias was handled by including these variables in the statistical model as covariates. Although there were early treatment differences in educational achievement, by the 22nd and 46th month postpartum, the differences did not remain. However, by 46 months, the number of months worked by the nurse-visited poor, unmarried women (teens and older) was greater. At 22 months, nurse-visited poor unmarried mothers had one-third as many subsequent pregnancies as the poor unmarried mothers in the comparison group. This reduction in number of pregnancies was present for the whole sample (23% reduction) at 46 months postpartum. At the 15 year follow-up of mothers (Olds et al., 1997), women visited by the nurses had statistically fewer verified reports of perpetration of child abuse and neglect; the unmarried low income group had fewer subsequent births, longer time between the birth of the first and second child, less time on family aid, fewer arrests, both by self-report and state records, and less drug and alcohol use.

Fifteen-year follow-up (Olds et al., 1998) of the children showed that in the group of mothers who were unmarried and from households of low socioeconomic status the nurse-visited group benefited in many ways. There was significantly lower incidence of children running away, fewer arrests, fewer convictions, fewer lifetime sex partners,
fewer cigarettes smoked per day, and fewer days when alcohol was consumed in the last 6 months than in the non-visited group.

A cost analysis of the intervention was conducted (Olds, 1993). The average cost of the intervention in 1980 dollars was $3246 per family in the sample as a whole and $3133 for low-income families. Government savings were calculated by summing expenses for social assistance, food stamps, Medicaid, and child protective services, then subtracting tax revenues due to maternal employment; savings were $1772 per family for the intervention group as a whole and $3498 for the low-income intervention families. Within two years after the program ended the net cost of the program (program costs minus savings) for the intervention group as a whole was $1582 per family, after discounting. For low-income families, costs were totally recovered, and a dividend of $180 per family was realized.

The effects of the intervention were generally greater as the number of risk factors increased. Combining this information with the economic analysis leads to the conclusion that intensive home intervention had the greatest ‘pay-off’ for those living in the highest risk conditions. The intervention led to enduring effects on social aspects of both the mothers’ and the children’s lives and affected parental caregiving, safety in the home, and use of the health care system.

Kitzman et al. (1997) replicated the Elmira study with an African-American group in an urban area (Memphis) of primarily low-income, unmarried women. Data were collected up to 24 months after birth. Study participants who were visited during pregnancy had statistically lower rates of pregnancy-induced hypertension (13% versus 20%) and fewer health care encounters or days hospitalized related to childhood injuries or ingestions, and second pregnancies (36% versus 47%) than the unvisited women. There were no effects on preterm delivery, low birth weight, children’s immunization rates, mental development, behavioural problems, or mother’s education and employment, as had been found on Old’s (1986) Elmira study. The differences in findings between the Memphis and Elmira groups may be partly due to the length of follow-up (for social outcomes in the mothers and behavioural outcomes in the children), or cultural groups (the Memphis group were predominately inner-city African-American, and the Elmira group were predominately rural Caucasian). It may be that the cultural group difference may dictate use of different interventions to effect change.

Seitz et al. (1985) conducted a study of home visiting, paediatric care, and day care which achieved ten year follow-up and was rated as moderate. The intervention started during the prenatal period and extended over thirty months. Statistically significant differences were that the intervention group mothers attained higher levels of education and had higher involvement in children’s schooling, while intervention children had better school attendance and adjustment. No differences were found in maternal employment, family socioeconomic status, parenting style, marital status of mothers, child’s level of intelligence or academic achievement, or teachers’ rating of child attributes. It was not possible to determine the impact of home visiting alone. Threats to the validity of this study included the fact that it was a cohort study and not a randomized trial, less than 80 percent of potential participants agreed to be in the study, and investigators did not control for all the confounders.

Black et al. (1994) randomized 60 women who were identified prenatally as drug abusers. The women were primarily African-American, single, multiparous, non-high
school graduates, poly-drug users. Forty percent were HIV positive, and 62 percent had a history of incarceration. The intervention group received bi-weekly home visits from a public health nurse before delivery to 18 months after birth. For safety reasons, the nurses were provided with an armed, non-uniformed escort. The content of the program was the provision and promotion of maternal support, education about parenting and child development, and available resources. The nurses also acted as client advocates when necessary. There were no statistically significant differences in gestational age, APGAR scores, length of hospital stay, mothers report of being drug-free, attendance at primary care appointments for their children, or provision of opportunities for stimulation. Based on the HOME scale, women in the intervention group were more emotionally responsive. Infants had marginally better cognitive scores at six months but not at 12 and 18 months. While the program provided access to care that the participants may otherwise not have received, the cost of the nurse and escort may make the outcomes of this program not cost-effective, although this analysis is not presented in the paper.

**DISCUSSION**

In summarizing the literature, there are no negative effects of home visiting, that is, home visits have not been shown to do any harm. Moreover, the studies have demonstrated a positive impact of nurses doing interventions through the delivery strategy of home visiting on physical health, mental health and development, social health, health habits, knowledge and service utilization. Home visiting can increase the effectiveness of other medical, social, and educational services. Some of the articles report no effect or selective effects, but the effects seems to be mediated by intensity of the intervention and preexisting level of health and social status of the client. Greater treatment differences are associated with higher intensity. Effectiveness can be marred by inadequate intensity or poor timing of home visits. Interventions generally have more impact on clients of higher risk (e.g., unmarried, low income, teen mothers) than on those of moderate or low risk. The exception to the findings in high-risk groups is the study with young pregnant women who were multiple drug users (Black et al., 1994).

There is no evidence of an effect of prenatal programs delivered by nurses through home visiting on low birth weight or gestational age, neonatal morbidity or mortality. Most of these outcomes are fortunately, quite rare, and the sample sizes have not allowed adequate power to detect small differences between groups. Furthermore, many studies lack a strong theoretical framework linking the intervention to the expected outcome. The weakness of the theoretical causal link between social support and low birth weight may account for this limited impact. Similar theoretical weaknesses are found in many of the studies.

One criticism of this body of literature is the difficulty in separating out the effects of home visiting in multi-pronged approaches. However, the Elmira study shows significant additive effects of home visiting. The Olds et al. (1986) study is often criticized for the intensity of the intervention, yet some of the other studies of less intensity have not demonstrated a measurable effect.
CONCLUSIONS

Despite variations in quality of the research about home visiting, the positive direction of effect found through high quality trials is generally supported by the results of weaker evaluations. Although there are limitations inherent in public health research, there is adequate existing evidence to draw the conclusion that home visiting by nurses has important impacts on many otherwise intransigent health problems. There is evidence to support the offer of home visiting as a means to access pre and postnatal care.

Implications for Practice  
Although home visiting interventions have not been effective in altering rates of low birth weight, adequate (in intensity, duration, and content) home visiting interventions for pre and postnatal women with risk factors are effective and, in some cases, have been shown to be cost effective, when compared with control groups who are receiving usual care services. Home visiting allows for a program delivery strategy for high-risk clients who may not access other means of care delivery.

Implications for Research  
Public health policy-makers, managers, and clinicians want to know how intense an intervention needs to be to make a significant impact. Does it need to have the intensity and duration of the Elmira intervention? Can a paraprofessional be as effective as a baccalaureate educated PHN? These are the questions that are of primary importance in the next generation of research related to home visiting as a strategy for delivering interventions by public health nurses.

From conducting this review, there arise several suggestions for researchers in reporting their studies. One is to make very explicit how randomization was achieved. Another is to develop tracking strategies or other ways to achieve follow-up of at least 80 percent of the people who enter a study. Collecting information about possible confounders and controlling for these at data analysis would also improve the validity of findings. These were the major weaknesses of this literature as a whole. Increased funding of public health nursing research will be necessary for the design and conduct of high quality studies where adequate sample sizes and follow-up are achieved. There is also a need for studies of outcomes which clients think are important, rather than those solely predefined by the researcher. Finally, there is a tremendous need for cost analysis of public health interventions.
Key Messages

• Multiple intervention strategies are most effective for improving children’s development, reducing maternal depression, improving maternal nutrition, education and employment, and effecting government cost saving.

• Interventions with women at high-risk due to social circumstances of age, income or education have a greater impact than those directed to more advantaged clients.

• Comparisons of effectiveness of interventions conducted by PHNs versus lay home visitors with similar client populations should be done to study cost-effectiveness in particular.

• Prenatal studies of much larger sample sizes are necessary to have adequate power to assess effectiveness of interventions on low birth weight, gestational age, neonatal morbidity and mortality.
### Table 1: Included Studies
Summary of Strong and Moderate Articles

<table>
<thead>
<tr>
<th>Study</th>
<th>Design/ Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
<th>Results/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Villar et al. (1992)</td>
<td>RCT Strong</td>
<td>Women considered at high-risk during pregnancy for delivery of LBW infant</td>
<td>Social support</td>
<td>Non-significant:</td>
<td>• For eligibility - had to seek prenatal care before 22 weeks and have attended at least 1 prenatal visit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Randomized</td>
<td>Health and nutrition information</td>
<td>• LBW</td>
<td>• Preterm delivery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Preterm delivery</td>
<td>• IUGR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Neonatal and maternal morbidity, mortality</td>
<td>• May have excluded women at greatest need, for whom it would have had greatest effect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1115 clinic care plus home visit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1120 prenatal clinic care</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>York et al. (1997) U.S.A.</td>
<td>RCT Strong</td>
<td>Women with diabetes or hypertension during pregnancy who were hospitalized during the pregnancy</td>
<td>Discharge planning and home follow-up by perinatal nurse specialist</td>
<td>Significant:</td>
<td>• Reduced cost of care for intervention group ($772 vs. $13,327 US)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Randomized</td>
<td>5 home visits (day of discharge and 2 visits each in next 2 days)</td>
<td>• Fewer rehospitalizations during pregnancy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Follow-up phone or clinic contact</td>
<td>Non-significant:</td>
<td>• Birth weight</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Gestational age</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Design/Quality</td>
<td>Participants</td>
<td>Intervention</td>
<td>Outcomes*</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------</td>
<td>-------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Holden et al. (1989)</strong></td>
<td>RCT Strong</td>
<td>Depressed postpartum women</td>
<td>8 weekly counselling sessions</td>
<td>Significant:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Randomized</td>
<td></td>
<td>• Reduction in depression (Goldberg), (Edinburgh Postnatal Depression Scale)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 26 counselling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 24 control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Brooten et al. (1986)</strong></td>
<td>CCT Moderate</td>
<td>72 VLBW infants discharged early from hospital</td>
<td>Visits at 1 week, 1, 9, 12, + 18 months</td>
<td>Significant:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Randomized</td>
<td>Weekly telephone contact</td>
<td>• Decrease in number of re-hospitalizations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 36 early discharge with home support</td>
<td>Education, support re: physical care, developmental screen, parents’ coping, infant stimulation</td>
<td>• Decrease in acute care visits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 36 control</td>
<td></td>
<td>• Decrease in incidence of failure to thrive</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(usual hospital discharge and clinic follow-up)</td>
<td></td>
<td>• Decrease in child abuse, foster placement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Results/Comments</strong></td>
<td></td>
<td></td>
<td></td>
<td>• Costs of intervention 26.4% less than cost for control group</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Included Studies
### Postnatal Interventions

<table>
<thead>
<tr>
<th>Study</th>
<th>Design/ Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
<th>Results/Comments</th>
</tr>
</thead>
</table>
| Wasik et al. (1990)   | CCT Moderate    | 65 families  | • Day care: child development centre – 5 days/week (addressed both cognitive & social domains)  
                     |                 | • Children at risk for cognitive difficulties at birth  
                     |                   | • Education through home visits (weekly for 3 years, then less frequent for years 4 & 5)  
                     |                   | • Home visits provided support, information, advocacy, referral, promoted coping, modelled positive parent & child interactions, taught problem solving and developmentally, appropriate activities.  
                     |                   | • Randomized Group 1:  
                     |                   | • 16 education & day care  
                     |                   | • Randomized Group 2:  
                     |                   | • 25 education only  
                     |                   | • Randomized Group 3:  
                     |                   | • 23 control       |                                                                                                  | Significant:  
                     |                 |              | • Group 1 increased over Group 2 & 3 in mental development at 12, 18 months (Bayley) at 24, 36 months (Stanford-Binet)  
                     |                 |              | • Group 1 increased over Group 3 in mental development At 30, 42, & 54 months (McCarthy)  
                     |                 |              | Non-significant:  
                     |                 |              | • Home environment (HOME)  
                     |                 |              | • Child rearing attitudes (child rearing and education research instrument) up to 36 months after birth  
                     |                 |              | All three groups had available monthly parent support group plus social worker available for crisis counselling  
                     |                 |              |                                                                                                  | Family education alone did not significantly differ from the control group                           |

*All outcomes reported achieved p<0.05.*
<table>
<thead>
<tr>
<th>Study</th>
<th>Design/Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casiro et al.</td>
<td>RCT Strong</td>
<td>100 LBW infants and families</td>
<td>Home visits by PHN started day after discharge for up to 8 weeks</td>
<td>Significant:</td>
</tr>
<tr>
<td>(1993) Canada</td>
<td></td>
<td></td>
<td>PHN provided</td>
<td>• Increase in avoidance of restriction and punishment (HOME)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Assessment and teaching</td>
<td>• Increase in provision of play materials (HOME)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Support</td>
<td>• Higher total score (HOME)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Referral</td>
<td>Non-significant:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Liaison</td>
<td>• Rates of rehospitalization</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Use of ambulatory services</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Mental or psycho- motor development (Bayley)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Infant growth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Results/Comments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Attending physicians were notified if infants randomized to intervention, which may have introduced a bias</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Outcomes were measured at 12 months of age</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Intervention group:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Mean home visits = 3.8/family</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Mean phone calls = 8.4/family</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Cost savings $5,289/family</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Homemaker service for 8 weeks</td>
<td></td>
</tr>
<tr>
<td>Rauch et al.</td>
<td>RCT Moderate</td>
<td>LBW infants</td>
<td>7 hospital sessions (week before discharge)</td>
<td>4 year follow-up</td>
</tr>
<tr>
<td>(1988) U.S.A.</td>
<td></td>
<td></td>
<td>4 home sessions (3, 14, 30 &amp; 90 days after discharge)</td>
<td>Significant:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mother-Infant Transaction Program:</td>
<td>• Mothers in intervention group had greater self-confidence &amp; satisfaction, lower perception of infant difficulty at 6 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>a) Enabled mother to appreciate</td>
<td>• Intervention group scored higher than LBW group on</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Intervention prevented cognitive lags normally present in LBW children</td>
</tr>
</tbody>
</table>

*All outcomes reported achieved p<0.05.
<table>
<thead>
<tr>
<th>Study</th>
<th>Design/ Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
<th>Results/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auchenbach et al. (1990)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7-year follow-up)</td>
<td></td>
<td></td>
<td>b) Sensitized her to baby’s cues</td>
<td>Non-significant:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>c) Taught mother appropriate response to cues</td>
<td>• Maternal anxiety</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7-year follow-up</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Significant:</td>
<td>• Intervention group scored higher than LBW control on Kauffman mental processing scales: composite, sequential, simultaneous</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-significant:</td>
<td>• Intervention group did not differ from normal weight control group</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9-year follow-up</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Significant:</td>
<td>• Intervention group scored higher score on Kauffman mental processing scales: composite, sequential, simultaneous, achievement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>At 7-year follow-up:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Intervention group maintained gains in mental ability equal to normal weight control group</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>At 9-year follow-up:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Intervention group maintained gains up to level of normal weight control group</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• LBW controls still lagged behind intervention group in cognitive functioning</td>
<td></td>
</tr>
</tbody>
</table>

*All outcomes reported achieved p<0.05.
<table>
<thead>
<tr>
<th>Study</th>
<th>Design/Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robinson et al. (1998)</td>
<td>RCT Moderate</td>
<td>Infants born at ≤ 32 weeks gestation</td>
<td>Discharge from hospital to age 2</td>
<td>Non-significant:</td>
</tr>
<tr>
<td>Avon Premature Infant Project</td>
<td></td>
<td>Randomized</td>
<td></td>
<td>• Intervention group did not differ from normal weight control group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>116 developmental education program</td>
<td>• Intervention (Portage): Developmental education program introduces parents to aspects of child development</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>106 non-directional counselling</td>
<td>• Attention Control: Non-directional support, based on parent-advisor model</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>106 control</td>
<td>• Control: Usual care to appropriate primary care and community support groups</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-significant:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• No differences in scores at 2 years of age on Griffiths Mental Development Scale</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean number of visits on each intervention group was 42, length 45 minutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Social variables may have confounded results</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Social variables were all independently associated with scores</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Included Studies
<table>
<thead>
<tr>
<th>Study</th>
<th>Design/Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
<th>Results/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olds et al. (1986a) Elmira study U.S.A.</td>
<td>RCT Strong</td>
<td>400 pregnant women</td>
<td>Minimum visits:  • Prenatal-Home visit every 2 weeks  • Post partum – Weekly visits to 6 weeks,  • Every 2 weeks to 14 months, every 6 weeks to 24 months  Content:  • Emphasis on family strengths  • Education re: fetal and infant development  • Involvement of family and friends in child care and support of mother  • Use of other health and social services</td>
<td>1986  Significant:  • Improved mother’s report of baby’s mood  • Lower level of concern of infant behaviour  • Lower level of restricting children (Caldwell)  • Decrease in visits to emergency  • Decrease in records of accidents and poisoning  Non-significant:  • Verified cases of child abuse</td>
<td>Groups 1 + 2 and Groups 3 + 4 combined for analysis</td>
</tr>
<tr>
<td>Study</td>
<td>Design/Quality</td>
<td>Participants</td>
<td>Intervention</td>
<td>Outcomes*</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Olds et al.</td>
<td></td>
<td></td>
<td></td>
<td>All outcomes reported achieved p&lt;0.05.</td>
<td></td>
</tr>
<tr>
<td>(1986b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(cont’d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td></td>
<td></td>
<td></td>
<td>Significant:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Increase in awareness of community services</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Increase in attendance at childbirth education classes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Increase in numbers who talked about stresses of parenting</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Decrease in kidney infections</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Improvement in nutrition</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Decrease in number of cigarettes smoked/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-significant:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Infant birth weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Length of gestation</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Included Studies
## Pre and Postnatal Interventions

<table>
<thead>
<tr>
<th>Study</th>
<th>Design/ Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
<th>Results/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olds et al. (1988)</td>
<td>follow-up</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>1988</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Significant:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Early increase in educational attainment by mothers (no longer different at 2 years)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Increase in employment among unmarried women</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Decrease in subsequent pregnancies</td>
<td></td>
</tr>
<tr>
<td>Olds et al. (1993)</td>
<td>follow-up</td>
<td></td>
<td></td>
<td><strong>1993</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Net costs 2 years after program = program costs minus savings (social assistance, Medicaid, food stamps) =$1582 (US) for intervention group as a whole</td>
<td>Cost effective for low income families</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• $180 (US) for low income families</td>
<td></td>
</tr>
</tbody>
</table>

*All outcomes reported achieved p<0.05.
### Pre and Postnatal Interventions

<table>
<thead>
<tr>
<th>Study</th>
<th>Design/ Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
<th>Results/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olds et al. (1994)</td>
<td>follow-up</td>
<td></td>
<td></td>
<td>1994</td>
<td>Outcomes measured at 25-48 months of age</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Significant:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Lower level of hazardous exposure in the home</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Higher scores (HOME) for poor unmarried teens</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Higher level of functional punishment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 30% fewer visits to emergency</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 40% fewer injuries &amp; ingestions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 45% fewer behavioural parent coping problems</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-significant:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• New cases of child abuse or neglect</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Children’s intellectual functioning (Stanford-Binet)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Mother’s warmth, control</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Design/ Quality</td>
<td>Participants</td>
<td>Intervention</td>
<td>Outcomes*</td>
<td>Results/Comments</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------</td>
<td>--------------</td>
<td>--------------</td>
<td>-----------</td>
<td>------------------</td>
</tr>
<tr>
<td>Olds et al. (1997)</td>
<td>follow-up</td>
<td>1997-15-year follow-up</td>
<td>Women in nurse-visited group less often identified as perpetrators of child abuse and neglect</td>
<td>All outcomes reported achieved p&lt;0.05.</td>
<td>Program had long-term effect on social outcomes of mothers in high-risk group</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Unmarried, low income mothers in intervention group had fewer subsequent births, longer time interval between births of 1st and 2nd child, less time on family aid, less alcohol and drug use, fewer arrests by self-report and fewer state records of arrest, fewer days consuming alcohol in past 6 months</td>
<td></td>
<td>Program had significant impact on children of mothers in high-risk group</td>
</tr>
<tr>
<td>Olds et al. (1998)</td>
<td>follow-up</td>
<td>15-year follow-up</td>
<td>Children of unmarried low income nurse-visited mothers had fewer reported instances of running away, arrests, convictions, life time sexual partners</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Included Studies
<table>
<thead>
<tr>
<th>Study</th>
<th>Design/ Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
<th>Results/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitzman et al. (1997)</td>
<td>RCT Strong</td>
<td>1290 women &lt;29 weeks pregnant recruited from medical centre.</td>
<td>Prenatal: Assessment and Support re: healthy diets, substance use. Education re: pregnancy complications</td>
<td>Significant: Nurse-visited mothers had: Lower rate of pregnancy-induced hypertension Fewer injuries or ingestions in children Fewer second pregnancies</td>
<td>Non-significant: LBW Preterm delivery Children's immunization, mental development or behavioural problem Mother's educational achievement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Randomized</td>
<td>Postpartum: Education re: care of child, signs of illness Promotion of parent-child interaction, play environment, safety and stimulation Problem-solving re: education, work and family planning</td>
<td>Nurse-visited group had mean of 7 prenatal and 26 postpartum visits</td>
<td>This study is a replication of Old's study with different population (inner city African-Americans vs. rural Caucasian)</td>
</tr>
</tbody>
</table>
### Pre and Postnatal Interventions

<table>
<thead>
<tr>
<th>Study</th>
<th>Design/Quality</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes*</th>
<th>Results/Comments</th>
</tr>
</thead>
</table>
| Seitz et al. (1985) U.S.A. | Cohort Analytic Moderate  | Pregnant, inner city, low income families who had no complications in delivery | Home visiting over 30 months:  
• Support and problem solving  
re: housing, food, safe environment, education, marital and career issues  
• 18 families in intervention group  
• 17 families in comparison group | 10 year follow-up  
Significant:  
• Increase in maternal education  
• Increase in maternal involvement in child’s schooling  
• Increased school attendance | Families received average of 28 visits over 30 months                                                                 |
| Black et al. (1994) U.S.A. | CCT Moderate  | 60 prenatal women identified as drug abusers  
Randomized  
• 31 intervention  
• 29 comparison | Bi-weekly home visits before delivery to 18 months after:  
• Promote maternal support, parenting, child development, utilization of resources, advocacy | Significant:  
• More emotionally responsive (HOME)  
• Provided more stimulation (HOME)  
Non-significant:  
• Gestational age  
• 1 minute APGAR  
• Hospital stay  
• Maternal abstinence  
• Cognitive scores | Nurses were provided with a uniformed escort for safety  
Study participants single, multiparous non-high-school graduates, low family income, 40% HIV-positive, 62% history of incarceration, all used cocaine and/or heroin |
REFERENCES


