HEALTH EDUCATION RESEARCH Vol.22 no.2 2007
Pages 285–294
Advance Access publication 14 August 2006

Health and safety intervention with first-time mothers

Anne McDonald Culp[1]*, R. E. Culp[2], J. W. Anderson[3] and S. Carter[4]

Abstract

A health education program was evaluated which used child development specialists as home visitors and served a population of first-time mothers living in rural communities. The evaluation compared health and safety outcomes between intervention and control groups. The research staff, separate from the intervention staff, collected data in the homes of 156 intervention and 107 control mothers when the infants were 6 and 12 months old. Significant group differences were found on health and safety outcomes. As compared with controls, the intervention mothers (i) had safer homes; (ii) were more likely to use birth control, thus had fewer pregnancies since birth of their first child; (iii) reported smoking fewer cigarettes; (iv) knew more about effects of smoking on their child's health and (v) were more likely to use health department services. In sum, mothers who received early education home visits from child development specialists experienced positive health and safety outcomes. It is highly recommended that a program such as this be implemented as part of health delivery program with new mothers and infants.

[1]Department of Child, Family and Community Sciences, University of Central Florida, PO Box 161250, Orlando, FL 32816-1250, USA, [2]College of Education, University of Central Florida, Orlando, FL 32816-1250, USA, [3]Department of Family and Consumer Resources, Illinois State University, Normal, IL 61761, USA and [4]Oklahoma State Department of Health, Oklahoma City, OK 73117, USA
*Correspondence to: A. McDonald Culp.
E-mail: aculp@mail.ucf.edu

Introduction

Early intervention in the form of primary health prevention models such as home visitation has received wide-scale attention [1, 2]. Many of the well-designed intervention evaluations have shown divergent effects based on varying characteristics of the intervention and not all have reported benefits. For example, many experts advocate home visitation as an effective strategy for (i) improving the health and life course of mothers and infants [1, 3], (ii) improving cognitive and motor development for failure-to-thrive children [4] and (iii) improving parent–child interaction and maternal life course [5–9].

In a review of home visitation programs, Gomby *et al.* [10] concluded that children had 'few' health benefits. None of the home visitation programs reported greater utilization of prenatal care, an increase in well-child visits or higher immunization rates. However, some researchers have reported high immunization rates and only two infant deaths among 666 very high-risk mothers [1]; a reduction in childhood injury, accidental ingestion and abuse [8, 11, 12] and a reduction in emergency visits for child injuries and accidental ingestions at 12, 24 and 46 months [3, 13, 14]. Conversely, others have reported no significant effect on hospitalization, emergency room visits or treatments of injuries [15, 16].

A serious health concern among pregnant women is smoking. Given approximately one out of four women are smokers at the time they are

doi:10.1093/her/cyl079

pregnant, there is a high probability for exposing the fetus to tobacco [17–19]. Smoking contributes to roughly half of all unfavorable pregnancy outcomes [20] with links to low birth weight [21], preterm delivery [14], sudden infant death syndrome [22] and degraded autonomic regulation [23]. Most pregnant women who smoke state they should quit [24], but most do not [25, 26].

Although the needs of women who smoke during pregnancy exceed what can realistically be provided by home visitors [27], strategies designed to reduce maternal smoking can be cost effective and successful [28]. While information and education are critical components of smoking cessation interventions [29], many expectant mothers do not receive anti-smoking information from health care providers [19]. Visitation by nurses has produced benefits by reducing maternal smoking [14]. While mothers who have not stopped smoking by the second trimester are much less likely to quit during their pregnancy [21], it is recommended interventions begin during pregnancy even though research is inconclusive and contradictory [30].

Home intervention programs differ among themselves in the onset, duration, goals, measurements and intensity of services. Some programs begin during pregnancy, while others begin at birth or later. Programs last from a few weeks to several years, and scheduled visits range from weekly to quarterly. There is no definite evidence of the most advantageous time to begin home visitation intervention [30, 31]. However, participants who begin during pregnancy report improved prenatal and postnatal health outcomes [7, 14]. Also, early participants are less likely to neglect or abuse their child [32, 33], are more likely to have fewer subsequent pregnancies [32] and have longer program involvement [27]. In addition, home interventions providing regular, frequent prenatal services through the first year are likely to succeed in making positive changes in family circumstances leading to positive changes in the children and the family [5, 8, 13, 14, 30, 33, 34].

For a variety of reasons, all home visitation clients do not receive identical services and intensity [7, 11, 31] with families receiving from 40 to 60% of the number of visits originally specified. Gomby [35] concluded that the intended intensity level of intervention services is basically not practical. Related to this, Gomby *et al*. [10] identified the lack of uniform curriculum delivery as a common problem among home visitation programs. But others see certain individualizations of program content as inherent characteristics of home visitation, with families perhaps being likely to respond differently in different stages of the program [8, 36].

Program description

The Community-Based Family Resource and Support (CBFRS) Program is a federally funded program administered by the state's department of health. In collaboration with university personnel, an evaluation study had the goals of promoting the health and development of first-time mothers and infants through home visits using an individualized manualized curriculum delivered by professional home visitors with college degrees in child development. The three major foci were maternal health, child health and safety and family functioning and parenting. The current paper presents the health and safety data.

First-time mothers were recruited prior to the 28th week of pregnancy and received home visits weekly during the first month after enrollment, biweekly for the remainder of their pregnancy, weekly for the first three postpartum months and biweekly from 3 to 12 postpartum months. County health departments hired and supervised the home visitors. Home visitors were female professionals, mean age of 32 years, with bachelor degrees in child development (80%) or with a minimum of 5 years experience working with families and a high school degree. All home visitors received >40 hours of pre-service training, ongoing training and weekly supervision. The home visitors were 65% White, 18% African–American and 12% Native American closely matched the demographics of the overall population of the participating counties. Supervisors held masters' degrees in child development and at least 2 years of supervisory experience.

The mothers received curriculum on maternal health, infant health and safety and child development

and parenting. This paper focuses on the health and safety curriculum outcomes. The health curriculum during the prenatal phase included a minimum of four visits sharing information on nutrition, alcohol, smoking, fetal growth and development, labor and delivery and family planning. Most mothers were visited on average 10.9 times prior to the baby being born. The health curriculum from birth to 12 months focused on effects of second-hand smoke on infant's growth and development, family planning, immunizations, infant nutrition and healthy food preparation. A special emphasis was placed on teaching household safety when the infants were crawling through the end of the intervention period at 12 months. On average, the mothers were visited an additional 20.7 times from when their infants were born until the infants' first birthdays.

Evaluation

A 3-year quasi-experimental evaluation design, with an intervention and a control group, assessed the effectiveness of CBFRS. The research staff was independent of the intervention staff. Fidelity of model implementation data was collected as an ongoing component of the intervention to determine if the home visitors were making home visits in a timely fashion and if the content was in compliance with the program model. Outcome data included questionnaire, survey and interview measures.

It was hypothesized that the intervention mothers and infants would be healthier than the control mothers and infants across seven outcomes: (i) number of cigarettes smoked, (ii) knowledge on the effects of smoking on child growth and development, (iii) use of birth control, (iv) number of subsequent pregnancies, (v) how often health department services used, (vi) percentage of infant immunizations and (vii) household safety.

Methods

Participants

Across 24 months, 355 pregnant women were recruited from county health departments in 12 rural counties in a southwestern state. The university's institutional review board approved the evaluation study. All completed written consent forms at intake and at the 6- and 12-month assessments. Women living in one of five counties where home visitation services were available were assigned to the intervention group; women living in one of the other seven counties where home visitation was not available were assigned to the control group. It was not feasible given the nature of the small rural counties—only one health department and low population density where families frequently know one another—to randomly assign mothers to the intervention group and the control group within the same county without large spillover effects. In fact, in many instances, for ethical and practical considerations, when random assignment of intervention programs is not possible, a quasi-experimental design is necessary and thus should be implemented [37, 38].

A quasi-experimental design implemented in this study was strengthened in the following ways: (i) the identification of how and where the control group would be selected occurred prior to providing the program to the intervention group [38]; (ii) mothers at the control sites were screened for motivational factors and were asked if their health department had a home visitation program, would they participate in it (mothers who said yes were considered to have similar motivation to the mothers in the intervention group, and were asked to join the control group; those who said no were not included in the study); (iii) the county demographics between the intervention and control sites were matched and (iv) the individual demographics between groups in *post hoc* analysis were similar. A strong argument is to be made that the intervention caused any observed changes in the intervention group over time if the construction of the control group was similar as possible to the intervention group [10, 38].

The professional staff of the state department of health selected the CBFRS intervention sites from a pool of sites that had been involved in home visitation services for several years and had the expertise to carry out the program model.

The control sites were selected from a pool of counties in which risk and demographic statistics were similar to the intervention sites.

By the time the infants were 12 months of age, 156 mothers provided intervention group data and 107 mothers provided the control group data. Forty-nine of the intervention mothers and 43 of the control mothers had dropped out of the study (92 of the original 355 mothers; 26%). This attrition group did not complete the 12-month assessment. While there were many reasons for dropping out of the study, the highest percentages of drop outs moved during the assessment period and were unable to be located after three attempts at other addresses. At the 6-month assessment, four of the intervention mothers and eleven of the control mothers were unable to meet with the evaluation team although they met with them at the 12-month visit. The reasons for missing the 6-month assessments were primarily due to child illness or busy schedules. Intervention participants received standard health department services plus CBFRS. Control participants received standard health department services that did not include home visitation.

Assessments

The research staff members, all obtaining graduate degrees, visited the participants' homes when the infants were 6 and 12 months of age. Of the assessments administered, the ones relevant to the present study include (i) an interview with each mother that asked about her demographic information, her health habits such as the number of cigarettes she smoked per day, her use of contraceptives, the number of subsequent pregnancies, how often she went to the health department; (ii) an interview with a set of six questions which asked about the effects of smoking on their child's growth and development and (iii) an extensive 42-item Household Safety Inventory [39] which was completed by the research staff while in the mothers' homes at the final 12-month visit in addition to the interviews.

The study presented here is unique in that the home visitors are child developmentalists, not paraprofessionals or nurses, as is the case in many home visitation programs. The study has strengths that include quasi-experimental design (intervention and control group) and data that substantiates high fidelity in program curriculum and delivery.

Results

Demographic information

No significant demographic differences were found among the three groups (intervention, control, attrition) in terms of maternal age (M = 19.71), minority status (70% White, 13% Native American, 11% African–American, 6% Other), Hispanic status (5% Hispanic), marital status (65% single, never married; 32% married; 3% divorced/separated) or enrollment in Medicaid (72%). There was a statistically significant difference in number of years of education among the groups, $F(2, 352) = 3.65$, $P = 0.027$. *Post hoc* analyses revealed a difference between the attrition and the intervention group with the attrition group, on average, having completed ~1.5 year less of school. So, the intervention and control groups did not differ in education level (see Table I).

Mothers' smoking behavior

Smokers were defined as mothers who had smoked within 2 years of being interviewed during the prenatal interview. Sixty percent of the intervention mothers and 61% of the control mothers reported as smokers χ^2 (1, $N = 262$) = 0.075, $P = 0.80$. We relied on mothers' report of her smoking habits rather than salivary cotinine due to support in the literature that there is good agreement between parent reporting of smoking habits and biochemical measures of tobacco consumption in households with young children [40, 41]. At the initial interview, while the mothers were pregnant, the number of cigarettes per day did not significantly differ between the intervention group (M = 2.43, SD = 4.69) and the control groups (M = 3.32, SD = 5.58), $t(157) = 1.08$, $P = 0.294$.

At the 6-month interview, the number of cigarettes per day significantly differed between the intervention group (M = 6.34. SD = 6.95) and the

control groups (M = 8.72, SD = 7.26), $t(147) = 2.00$, $P = 0.023$. The intervention smokers reported smoking ~2.4 fewer cigarettes less a day than the control smokers.

At the 12-month interview, the number of cigarettes per day differed between the intervention group (M = 7.28, SD = 6.79) and the control groups (M = 9.41, SD = 7.09), $t(147) = 1.82$, $P = 0.071$. The intervention smokers reported smoking ~2.1 fewer cigarettes less a day than the control smokers.

Knowledge of the effects of smoking on child development

As shown on Table II at 6 and 12 months, there were statistically significant differences between intervention and control mothers' knowledge about the effects of smoking on child growth and development, with a higher percentage of intervention smokers compared with control smokers responding correctly to effects of smoking questions (e.g. 'Compared to mothers who do not smoke during pregnancy, mothers who do smoke have children who weigh less at birth'.). See Table II for the full set of questions.

Household safety

At 12 months, the intervention group had significantly safer homes (M = 38.1, SD = 2.4) than did the control group (M = 36.9, SD = 2.6) based on the Massachusetts Home Safety Questionnaire, $t(261) = 3.9$, $P = 0.0001$. For example, intervention mothers' homes as compared with control mothers'

Table I. *Maternal characteristics at recruitment*

Characteristics	Intervention (n = 156)	Control (n = 107)	Attrition (n = 92)	Test	P
Age at time of birth	19.8	19.6	19.36	$F = 0.42$	NS
Mother Peabody Picture Vocabulary Test at 12 months	95.5 (11.2)	95.4 (9.8)	—	$F = 0.09$	NS
Years of education	11.72	11.48	10.99	$F = 3.65$	0.05*
Minority (%)	31.4 (49/156)	27.1 (29/107)	26.1 (24/92)	$\chi^2 = 0.99$	NS
Medicaid usage (%)	58.7 (91/155)	63.6 (68/107)	56.5 (52/92)	$\chi^2 = 1.11$	NS
Marital status				$\chi^2 = 4.11$	NS
Married (%)	30.1 (47/156)	35.5 (38/107)	26.1 (24/92)		
Single, never married (%)	67.9 (106/156)	59.8 (64/107)	69.6 (64/92)		
Divorced/separated (%)	1.9 (3/156)	4.7 (5/107)	4.3 (4/92)		

*Mothers were significantly different between the attrition and the intervention groups only; mothers were not significantly different between intervention and control groups. NS = not significant.

Table II. *Effects of smoking on child health and development: percentage of mothers answered correctly*

Questions	6 months intervention (152)	Control (96)	χ^2	12 months intervention (156)	Control (107)	χ^2
Babies weigh less at birth	79.6%	79.2%	0.007	78.0%	80.4%	0.294
Impaired brain development	59.2%	41.7%	7.28**	58.1%	47.7%	2.76*
Lower mental health scores	52.6%	32.3%	9.99***	47.7%	40.2%	1.46
More likely to get colds	78.3%	68.8%	2.78*	76.1%	74.8%	0.064
Takes longer to get well	78.3%	77.1%	0.049	80.6%	72.0%	2.70*
More behavior problems at school	25.7%	24.0%	0.091	31.0%	24.3%	1.34

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

homes were more likely to have hot water adjusted to a safe temperature and electrical cords beyond child's reach.

Subsequent pregnancies

At 12 months, intervention mothers (M = 66.7%) reported using birth control more often than the control mothers (M = 54.2%), $\chi^2(2, N = 263) = 4.17$, $P = 0.02$. At 12 months, intervention mothers (M = 12.2%) reported fewer pregnancies since the birth of the target child than the control mothers (M = 20.6%), $\chi^2(2, N = 263) = 3.39$, $P = 0.03$ and intervention mothers (M = 6.4%) were less often pregnant at the time of the 12-month interview than the control mothers (M = 13.1%), $\chi^2(2, N = 263) = 3.41$, $P = 0.03$ (see Table III).

Health services and immunizations

There were no significant differences between the intervention and control groups on number of hospital visits, emergency room visits and child immunization rates at either 6 or 12 months. Between birth and 6 months, 11% of both groups of children were admitted to the hospital and 47% to an emergency room. Between 6 and 12 months, 8% were admitted to the hospital and 46% to an emergency room. Almost all of the children (93%) at 6 and 12 months of age were current with immunizations. However, at 12 months, intervention mothers were more likely to make use of the county health department for services than control mothers, $\chi^2(3, N = 263) = 8.25$, $P = 0.04$.

Table III. *Maternal pregnancy variables at 12 months by group*

	Intervention (n = 156)	Control (n = 107)	χ^2	P
Using birth control	66.7%	54.2%	4.17	0.021
Pregnant since birth of first child	12.2%	20.6%	3.39	0.033
Pregnant at time of 12 months interview	6.4%	13.1%	3.41	0.033

Implementation fidelity

The implementation fidelity data revealed that mothers were visited on average 10.9 (SD = 4.3) times from recruitment until birth, 13.2 times (SD = 4.8) from birth through month 6 and 7.5 (SD = 3.9) times during months 7 through 12. Each visit between recruitment to birth, birth through month 6 and months 7 through 12 averaged 57.9 (SD = 20.2), 59.3 (SD = 18.6) and 63.1 (SD = 25.6) min, respectively. The mean length of each home visit was 1 hour with 91% of the time spent on the treatment plan.

The content of the topics discussed at each home visit were as predicted. During the prenatal period, maternal health was covered on average 30% of the time for each home visit, child health ~16.3% and environmental health/safety 1.4%. From birth through 6 months, child health was covered 16.3% for each home visit, maternal health 7.5% and health/safety 1.4%; from 6 months through 12 months, child health was covered 11.1%, maternal health 3.8% and health/safety 3.2% of the time. The individualized curriculum allowed the child development professionals to use their judgment in determining variations in timing and dosage of curriculum content. Examples of other curriculum themes were maternal life course (education and career), infant development and parenting.

Discussion

The purpose of this study was to document positive health and safety outcomes in a sample of rural, first-time mothers compared with a control sample. Our findings indicate health and safety outcomes were more positive for the intervention group than the control group: (i) higher household safety levels; (ii) higher use of birth control methods, thus lower number of subsequent pregnancies; (iii) lower smoking behavior; (iv) higher maternal knowledge of smoking effects on child development and (v) higher use of county health well baby clinics. In some past reports, home visitation programs have reported little positive change in

the home environment [11, 15, 16]. However, this study found several positive findings.

Household safety

The infants in the intervention group were living in safer homes than the infants in the control group. This means they were less likely to get hurt or have accidents involving hot water, electrical cords, medicines, poisons or fall down stairs. In addition, the intervention mothers were more likely to have first aid kits and emergency phone numbers available at a moment's notice. Overall, the awareness that accidents can be prevented was more prevalent in the intervention homes than in the control homes.

Subsequent pregnancies

The notion of waiting to have a second baby until the first child is old enough to be in pre-school was a goal among the county health departments' intervention programs. This study found that intervention mothers were more apt to use birth control and reported subsequent pregnancies at the 6- and 12-month assessments less often than the control mothers. At 12 months, control mothers were substantially more likely to be pregnant than intervention mothers.

Smoking behavior

Our data support the finding that most smokers do not quit smoking during pregnancy; however, this study found that while the mothers still smoked, the mothers in the intervention group smoked fewer cigarettes than the mothers in the control group at both the 6- and 12-month assessment times. The 6-month data were significantly different; the 12-month data barely missed significance. Both groups of mothers looked the same in their smoking patterns during their pregnancies. They stated they wanted to quit and should not be smoking during their pregnancy. The mothers expressed this knowledge during one of the first visits in the program, so their knowledge of not smoking during their pregnancy came most probably from public advertisements and the media.

The outcome that the intervention mothers smoked significantly fewer cigarettes than the control mothers at 6 months appears to be linked to the prenatal and perinatal curriculum's strong focus on the effects of smoking. Around the time the infants were 6 months, there was a curriculum shift to other topics, in particular infant developmental milestones and infant safety. In other words, the child development specialists discussed smoking and second-hand smoke more heavily from birth to 6 months than from 6 to 12 months. Further analysis could determine if the health curriculum on smoking dropped off across time. This would seem to have happened with the increase in infant health and safety topics taking time during the sessions. A recommendation to keep 'no smoking' on each visit's agenda may be important in future intervention programs. Another recommendation found in recent literature is to have partners stop smoking at the same time as the pregnant mothers [41], in order to give the mother support to refrain from smoking.

Knowledge on smoking effects

The knowledge that the intervention mothers had about second-hand smoke was significantly higher than the control mothers at both 6 and 12 months with the intervention mothers understanding the effects more often than the control mothers. For example, the knowledge that second-hand smoke could hurt brain development during pregnancy and negatively affect their children's mental health scores on cognitive tests was apparent to the intervention mothers more often than the control mothers. The research literature on second-hand smoke continues to show the detrimental effects in the infants [42].

Immunizations, emergency room visits and health department visits

There were no significant differences between the groups on the number of immunizations. Both groups of infants were highly immunized. There was a huge state effort within the time of this study to get all infants immunized. All of the county health departments prided themselves in their high rates of immunization.

In addition, there were no group differences in the number of times that mothers took their infants

to the emergency rooms. The child development specialists and the members of the research team later reported that both groups of mothers used the emergency room as a physician's office for all illnesses. In many of these rural counties, across both groups, pediatricians were not available for designated days of the week and the mothers were asked to take their children to the emergency room.

Interestingly, though the intervention mothers reported visiting the health department clinics for well child care more often than the control mothers. Having a home visitor be a link to the community resources is a big help for mothers. This is evident for the intervention group. So, this finding is important for future planning—home visitors increase the number of mothers attending the county health department clinics.

Program fidelity

The intensity of services received by participants compares well to existing research where intensity levels of ~50% are the norm [3, 8]. Korfmacher *et al.* [43] report similar results with nurses achieving 51% and paraprofessionals 40% of the planned number of visits. Mothers participating in CBFRS were actually visited at extremely high rates of compliance prenatally (close to 100% for most mothers) and >60% postnatally which is higher than the norm. This is evidence that the child development specialists were working hard and performing their jobs.

Korfmacher *et al.* [44] found that much of the research concerning home visitation focuses only on outcomes, and suggested future studies should focus on 'process variables' in order to determine what intervention factors relate to outcomes. Thus, it is important to assess and report the length of the visit and the content of the visit. The mean length of each home visit was 1 hour with 91% of the time spent on the treatment plan. Most relevant to the present study is time spent on health and safety factors. The individualized manualized curriculum allowed the child development specialists to use their judgment in determining variations in timing and dosage of curriculum content. For example, it appears that changes in cigarette smoking may be related to the prenatal curriculum's strong focus on the effects of smoking and the curriculum's postnatal shift in focus to other topics, in particular infant safety.

In conclusion, the effects of an early intervention home visitation program on infant and maternal health outcomes with families receiving weekly and bimonthly home visits from child development specialists were positive and were significantly different from the mothers in the control group who did not receive home visitation services. Mothers in the intervention program set up environments for their 1-year-old children that were safer and healthier than mothers in a control group. The healthy environments involve safety devices and safety practices throughout the household; less smoke, fewer siblings if any and the use of well baby clinics. This set of environmental circumstances provides protection for the children of these homes. The infants have a better chance of staying healthy and not being injured intentionally or non-intentionally. This kind of preventive, community-based program is highly recommended as part of every health care delivery plan for new mothers and children.

Acknowledgements

This research was supported by the Oklahoma State Department of Health, Office of Child Abuse Prevention. The authors thank the numerous clinical staff members at the intervention sites and the research staff team: C. Howell, T. Saathoff-Wells, T. Hechtner-Galvin, A. Staudt and K. Masri.

Conflict of interest statement

Conflicts of Interests forms are being sent.

References

1. Barnes-Boyd C, Norr KF, Nacion K. Promoting infant health through home visiting by a nurse-managed community worker team. *Public Health Nurs* 2001; **18**: 225–35.

2. Behrman R. Home visiting: recent program evaluation. *Future Child* 1999; **9**: 1.
3. Olds DL, Henderson C, Kitzman H *et al*. Prenatal and infancy home visitation by nurses: recent findings. *Future Child* 1999; **9**: 44–65.
4. Hutcheson J, Black M, Talley M *et al*. Risk status and home intervention among children with failure-to-thrive: follow-up at age 4. *J Pediatr Psychol* 1997; **22**: 651–68.
5. Culp AM, Culp RE, Howell CS *et al*. First-time mothers in home visitation services utilizing child development specialists. *Infant Ment Health J* 2004; **25**: 1–15.
6. Culp AM, Culp RE, Blankemeyer M *et al*. Parent education home visitation program: adolescent and nonadolescent mother comparisons after six months of intervention. *Infant Ment Health J* 1998; **19**: 111–23.
7. Daro DA, Harding KA. Healthy Families America: using research to enhance practice. *Future Child* 1999; **9**: 152–76.
8. Duggan A, McFarlane E, Windham A. Evaluation of Hawaii's Healthy Start Program. *Future Child* 1999; **9**: 66–90.
9. Kitzman H, Olds DL, Sidora K *et al*. Enduring effects of nurse home visitation on maternal life course: a 3-year follow-up of a randomized trail. *J Am Med Assoc* 2000; **283**: 1983–9.
10. Gomby DS, Culross PL, Behrman RE. Home visiting: recent program evaluations—analysis and recommendations. *Future Child* 1999; **9**: 4–26.
11. Culross PL. Summary of home visiting: program evaluation outcomes. *Future Child* 1999; **9**: 195–223.
12. Campbell TL. Impact of prenatal/early infancy home visitation on family health. *Fam Syst Med* 1994; **12**: 81–5.
13. Olds DL, Eckenrode J, Henderson C *et al*. Long-term effects of home visitation on maternal life course and child abuse and neglect. *J Am Med Assoc* 1997; **278**: 637–43.
14. Olds D, Henderson C, Kitzman H *et al*. The promise of home visitation: results of two randomized trials. *J Community Psychol* 1998; **26**: 85–100.
15. St Pierre RG, Layzer JI. Using home visit for multiple purposes: the comprehensive child development program. *Future Child* 1999; **9**: 134–51.
16. Wagner M, Clayton S. The parents as teachers program: results from two demonstrations. *Future Child* 1999; **9**: 91–115.
17. Center for Disease Control. Women and Smoking: A Report of the Surgeon General. Morb Mortal Rep 2002; **51**: 1–30.
18. Ebrahim SH, Merritt RK, Floyd RL. Smoking and women's health: opportunities for reducing the burden of smoking during pregnancy. *Can Med Assoc J* 2000; **163**: 288–90.
19. Zapka J, Pbert L. Smoking cessation counseling with pregnant and postpartum women. *Am J Public Health* 2000; **90**: 78–85.
20. Aaronson LS, Macnee CL. Tobacco, alcohol, and caffeine use during pregnancy. *J Obstet Gynecol Neonatal Nurs* 1989; **18**: 279–87.
21. Sexton M, Hebel R. A clinical trial of change in maternal smoking and its effect on birth weight. *J Am Med Assoc* 1984; **251**: 911–5.
22. Pollack HA. Sudden infant death syndrome, maternal smoking during pregnancy, and the cost-effectiveness of smoking cessation intervention. *Am J Public Health* 2001; **91**: 432–6.
23. Schuetze P, Zeskind P. Relations between maternal smoking during pregnancy and behavioral and physiological measures of autonomic regulation in neonates. *Infancy* 2001; **2**: 371–83.
24. Lowe JB, Wakefield M. Smoking and pregnancy: time to implement evidence-based solutions. *Aust N Z J Public Health* 1998; **22**: 523–4.
25. Blair PS, Fleming PJ. Smoking and the sudden infant death syndrome: results from 1993–5 case-control study for confidential inquiry into stillbirths and deaths in infancy. *Br Med J* 1996; **313**: 195–9.
26. Severson H, Andrews J, Lichtenstein E *et al*. Predictors of smoking during and after pregnancy: a survey of mothers of newborns. *Prev Med* 1995; **24**: 23–8.
27. Navaie-Waliser M, Martin S. Factors predicting completion of a home visitation program by high-risk pregnant women. *Am J Public Health* 2000; **90**: 121–4.
28. Floyd RL, Rimer BK, Giovino GA *et al*. A review of smoking in pregnancy: effects on pregnancy outcomes and cessation efforts. *Annu Rev Public Health* 1993; **14**: 379–411.
29. Pollack H, Lantz PM, Frohna JG. Maternal smoking and adverse birth outcomes among singletons and twins. *Am J Public Health* 2000; **90**: 395–400.
30. Kitzman H, Olds D, Henderson C *et al*. Effect of prenatal and infancy home visitation on pregnancy outcomes, childhood injuries, and repeated childbearing. *J Am Med Assoc* 1997; **278**: 644–52.
31. Berlin LJ, O'Neal CR, Brooks-Gunn J. What makes early intervention programs work? The program, its participants, and their interaction. *Zero Three* 1998; **16**: 4–15.
32. Honig A, Morin C. When should programs for teen parents and babies begin? Longitudinal evaluation of a teen parents and babies program. *J Prim Prev* 2001; **21**: 447–54.
33. Nelson G, Laurendeau M, Chamberland C. A review of programs to promote family wellness and prevent the maltreatment of children. *Can J Behav Sci* 2001; **3**: 1–13.
34. Hill P. The prenatal and early childhood nurse home visitation program: a preventative intervention for young families. *Fam Futures* 1997; **1**: 9–11.
35. Gomby DS. Understanding evaluations of home visitation programs. *Future Child* 1999; **9**: 27–43.
36. Korfmacher J. Home visiting: promise or peril. *Signal* 1999; **7**: 1–8.
37. Hauser-Cram P, Warfield ME, Upshur CC *et al*. An expanded view of program evaluation in early childhood intervention. In: Shonkoff JP, Meisels SJ (eds). *Handbook of Early Childhood Intervention*, 2nd edn. Cambridge, UK: Cambridge University Press, 2000, 489–509.
38. Rossi PH, Freeman HE, Lipsey MW (eds). *Evaluation: A Systematic Approach*, 6th edn. Thousand Oaks, CA: Sage Publications, 1999.
39. Massachusetts Department of Public Health. *Massachusetts Home Safety Questionnaire*. Boston: Department of Public Health, 1996.
40. Dell'Orca M, Forastiere F, Agabati N *et al*. Household and community determinants of exposure to involuntary smoking: a study of urinary cotinine in children and adolescents. *Am J Epidemiol* 1995; **142**: 419–27.
41. Nafstad P, Kongerud J, Botten G *et al*. The role of passive smoking in the development of bronchial obstruction

during the first 2 years of life. *Epidemiology* 1997; **8**: 293–385.
42. Blackburn CM, Bonas S, Spencer NJ *et al*. Parental smoking and passive smoking in infants: fathers matter too. *Health Educ Res* 2005; **20**: 185–94.
43. Korfmacher J, O'Brien R, Hiatt S *et al*. Differences in program implementation between nurses and paraprofessionals providing home visits during pregnancy and infancy: a randomized trial. *Am J Public Health* 1999; **89**: 1847–51.
44. Korfmacher J, Kitzman H, Olds D. Intervention process as predictors of outcomes in a preventive home-visitation program. *J Community Psychol* 1998; **26**: 49–64.

Received on February 16, 2006; accepted on June 23, 2006