

Hawaii's Healthy Start Home Visiting Program: Determinants and Impact of Rapid Repeat Birth

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ABSTRACT. *Objective.* *Healthy People 2010* calls for reductions in rapid repeat births (RRBs), defined as births occurring within 24 months after a previous birth for women of all ages, and prevention of repeat births during adolescence, regardless of the birth interval. Home visiting has been promoted as a mechanism to prevent child abuse and neglect and to improve pregnancy outcomes. This study aims to assess the impact of home visiting in preventing RRB and its malleable determinants and assesses the influence of RRB on the mother and the index child. We hypothesized that maternal desire to have a RRB, access to a family planning site, and use of birth control would be significant malleable determinants and that the effects of the program in preventing RRB would be mediated through its influence on these variables. We also hypothesized that the occurrence of RRB would result in increased stress and family dysfunction, resulting in adverse maternal and child outcomes such as severe maternal stress, maternal neglect of the index child, decreased maternal warmth toward the index child, and increased behavior problems of the index child.

Methods. The Healthy Start Program (HSP) is a home visiting program to prevent child abuse and neglect and to promote child health and development among newborns of families identified as being at risk for child maltreatment. This study was a randomized, controlled trial of Hawaii's HSP, in which eligible families were randomly assigned to home-visited and control groups. A total of 643 families at risk for child abuse were enrolled between November 1994 and December 1995. Data to measure RRB and malleable determinants were collected through structured maternal interviews and observation of the home environment. We measured RRB through maternal self-report by asking about a subsequent birth in follow-up interviews at 1, 2, and 3 years. To measure the malleable determinants, we measured the mother's desire for a RRB at baseline and at the 1-year interview and determined whether she had access to a family planning site. The mother was also asked which contraceptive methods she had ever used in the past and which methods, if any, she used in the year following the index

child's birth. We measured 3 maternal parenting outcomes at the year 3 follow-up interview, ie, parenting stress, neglectful behavior toward the index child, and warmth toward the index child. We used odds ratios with 95% confidence intervals (CIs) to measure the strength of associations. Multiple logistic regression was used to assess 1) program effects on RRB and its malleable determinants, 2) the impact of the malleable determinants on RRB, and 3) the association between RRB and adverse maternal and child outcomes.

Results. Each year, 88% of the sample completed a follow-up interview; 81% completed all 3 follow-up interviews. There was no program impact on RRB for mothers overall (HSP: 21%; control: 20%; adjusted odds ratio [AOR]: 1.05; 95% CI: 0.69–1.58). HSP and control groups did not differ significantly in any of the malleable determinants of RRB. When we combined the 2 study groups, malleable determinants had significant effects on RRB. Mothers with a desire to have a child within 2 years after the index birth were significantly more likely to have a RRB, whether this desire was expressed at baseline (AOR: 2.48; 95% CI: 1.32–4.64) or at the year 1 interview (AOR: 2.86; 95% CI: 1.57–5.22). Lack of access to a family planning site at baseline was not associated with RRB, but there was a trend toward a greater likelihood of RRB among those lacking a site at 1 year (AOR: 1.61; 95% CI: 0.93–2.79). Women who had never used birth control before the index birth were more likely to have a RRB (AOR: 1.89; 95% CI: 1.20–2.98), and there was a trend toward a greater likelihood of RRB among women who did not use birth control in the year following the index child's birth (AOR: 1.67; 95% CI: 0.98–2.82). At the 3-year follow-up interview, mothers with a RRB were more likely to have adverse maternal and child outcomes. There was greater likelihood of severe maternal parenting stress (AOR: 2.29; 95% CI: 1.17–4.48), neglectful behavior toward the index child (AOR: 2.42; 95% CI: 1.41–4.18), and poor warmth toward the index child (AOR: 2.84; 95% CI: 1.71–4.42). In families with a RRB, the index child was more likely to exhibit internalizing behavior (AOR: 1.64; 95% CI: 1.04–2.58) and there was a trend toward higher odds of externalizing behavior (AOR: 1.56; 95% CI: 0.98–2.49).

Conclusions. Overall, 20% of the mothers in our sample of at-risk families had a RRB, which was far greater than the national average of 11%. RRB was associated with a greater likelihood of adverse consequences for both the mother and the index child. The lack of program effects can be traced to shortcomings in the program's design and implementation system. HSP contracts required only that family planning be introduced any time during a family's first year of enrollment. Because conception can occur very soon after the index birth, a better design would be to introduce family planning counseling early in a family's enrollment in home visiting. An-

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other shortcoming was that, although fathers could be included in counseling, they took part in only approximately one-fifth of home visits. It is possible that program effects were attenuated in families in which the father wanted a child. In conclusion, the Hawaii HSP did not reduce RRB or alter its malleable determinants. RRB was associated with adverse outcomes for both the mother and the index child. This is particularly relevant for this population of families that are already at risk for child maltreatment, for which we have found parenting stress to be associated with abusive parenting behavior by the mother. Our findings support and broaden the rationale for the *Healthy People 2010* objective to reduce RRB. We think our findings are valuable for guiding the future development of home visiting in general and this widely replicated paraprofessional model in particular. *Pediatrics* 2004;114:e317–e326. URL: <http://www.pediatrics.org/cgi/content/full/114/3/e317>; repeat births, pregnancy outcomes, home visiting, child abuse.

ABBREVIATIONS. AOR, adjusted odds ratio; OR, odds ratio; CETA, Comprehensive Employment Training Act; RRB, rapid repeat birth; CI, confidence interval; HSP, Healthy Start Program.

Rapid repeat birth (RRB) is defined as a birth occurring within 24 months after a previous birth or, for an adolescent mother, a repeat birth while still a teen, regardless of the interval between births.¹ RRB has been identified as a risk factor for adverse perinatal outcomes.² Women who wait 18 to 23 months after delivery before conceiving their next child lower their risks of adverse perinatal outcomes, such as low birth weight, preterm birth, and small size for gestational age.^{3,4} One objective of *Healthy People 2010* is to reduce the proportion of births occurring within 24 months after a previous birth for women of all ages and to prevent second and repeat births during adolescence, regardless of the interval between births. Health care providers can help all new mothers understand that they can become pregnant again soon after delivery and should assist them with contraceptive education and supplies.⁵

Home visiting has been recommended by the American Academy of Pediatrics as a means to ensure ongoing parental education, social support, and linkage with community services.⁶ It has also been promoted as a mechanism to prevent child abuse and neglect⁷ and improve pregnancy outcomes.⁸ Home visitors can be an important link to needed services, such as child care, housing, income assistance, nutritional assistance, legal aid, health care and professional counseling, and educational and vocational training.⁹ Home visiting is not a single, uniform intervention but rather a strategy for service delivery, in which individuals are sent into the homes of families with young children to improve the lives of the children by encouraging changes in the attitudes, knowledge, and behavior of the parents. Home visiting programs differ in their specific goals, services offered, staffing, and target populations. Randomized controlled trials studying the effects of home visiting programs on a range of outcomes, including maternal health, parenting skills and functioning, childhood injuries, and child devel-

opment, have found modest effects, bringing to light the challenges of this strategy.¹⁰

Scientific evidence of the impact of home visiting on repeat pregnancy or birth is scarce in the peer-reviewed literature. We searched 3 computerized literature databases (Medline, PsychInfo, and the Cochrane Controlled Trials Register) and the citations of a randomized trial¹¹ and 3 home visiting review articles^{10,12,13} to identify randomized trials of home visiting effects on repeat pregnancy or birth. Our search yielded 11 reports of 7 studies of 5 home visiting models.^{14–24}

Overall, study findings were mixed. Two of the 5 models reported significant reductions or delays in repeat pregnancy or birth.^{15,20–23} Of the 3 models without significant effects on fertility, 1 had not targeted fertility per se as an outcome¹⁴ and the other 2 suffered from shortcomings in program implementation and limitations in the study design and execution.^{18,19,24}

The study reported here focused on Hawaii's Healthy Start Program (HSP), a widely replicated paraprofessional home visiting model for families at risk for child abuse and neglect. The model aims to improve family functioning in general and parenting behavior, with the ultimate goal of promoting child health and development. Previous publications focused on overall adherence to the HSP program model,²⁵ overall outcomes in the first 2 years of service,⁹ effects on fathers,²⁶ prevention of child maltreatment,²⁷ and reduction of parent psychosocial risks for maltreatment.²⁸

Implicit in the aim of the HSP to improve family functioning and parenting is the reduction of stress, and a potential source of stress is RRB. One of the explicit strategies of the HSP to delay subsequent births is the provision of family planning information.²⁹ This report describes the program's impact on RRB and its malleable determinants and assesses the influence of RRB on the mother and the index child. We hypothesized that maternal desire for a RRB, access to a family planning site, and use of birth control would be significant malleable determinants and that the effects of the program in preventing RRB would be mediated through its influence on these variables. We also hypothesized that the occurrence of RRB would result in increased stress and family dysfunction, resulting in adverse maternal and child outcomes such as severe maternal stress, maternal neglect of the index child, decreased maternal warmth toward the index child, and increased behavior problems of the index child.

METHODS

The HSP Model

The HSP model has been described in detail elsewhere.⁹ In brief, it is an intensive home visiting program to prevent child abuse and neglect and to promote child health and development among newborns of families identified as being at risk for child maltreatment. It has 2 components, ie, 1) population-based screening and assessment to identify at-risk families and 2) long-term, intensive, home visiting of at-risk families by trained paraprofessionals.

The HSP began with a single site in 1975 and in the subsequent 2 decades grew to 14 sites statewide, operated by 7 community

agencies. The program is supported primarily by the Hawaii State Department of Health, through contracts with community-based organizations to provide early identification and home visiting services. At the time of this study, community agencies provided screening and assessment in target communities including ~70% of births statewide; home visiting capacity was adequate to enroll ~40% of identified at-risk families.

Prenatal providers refer some families to the program for assessment, but most families are screened and assessed at the hospital when their children are born. HSP or hospital staff members screen for risk by reviewing the mother's medical records. When a mother's record suggests risk or provides too little information to permit a judgment, HSP staff members conduct a semi-structured assessment interview with the mother, using the Family Stress Checklist described by Kempe.³⁰ The Family Stress Checklist focuses on 10 risk factors for child abuse, such as parental substance use, poor mental health, domestic violence, a history of abuse as a child, unrealistic expectations of the child, and the child being unwanted or at other risk for poor bonding. The HSP considers a family to be at risk, and thus eligible for home visiting, if either parent scores ≥ 25 on the Family Stress Checklist and the family is not already known to child protective services. If a family is identified as eligible on a day when intake is open in the HSP site serving the family's community, then the family is invited to enroll in the HSP home visiting component. If a family is identified on a day when HSP intake is closed, then the family is referred to other community resources.

Home visits are to be conducted for 3 years and, if needed, up to 5 years. Home visitors are to establish a trusting relationship with parents, using empathic nonjudgmental listening and helping parents with crisis intervention and informal counseling. Once immediate crises are resolved, home visitors are to help families build on their strengths to improve family functioning. The home visitors are to model problem-solving skills and to help families obtain needed resources, such as housing, financial assistance, legal aid, health care, nutrition services, respite care, child care, employment, professional counseling, and transportation services.²⁹ They are to promote child health and development by providing parenting education, modeling effective parent-child interactions, and ensuring that each child has a medical home (pediatric primary care provider). The program model calls for services to be directed to the mother and, as possible, to the father.³¹ Of special relevance to this report, the Hawaii Department of Health contracts with community-based organizations that provide HSP services specify that home visitors are to provide family planning information.²⁹

Setting

When the study began, there were 6 HSP programs serving communities on Oahu and 5 programs serving the state's 4 other major islands. We focused on the 6 HSP programs on Oahu, which is home to 80% of the state's residents, to allow close monitoring of fieldwork while limiting costs. The 6 HSP programs were operated by 3 community-based agencies; each agency operated 2 programs. All home visitors received the same core training at a single agency on Oahu. Families enrolled in the study were assigned to 54 different home visitors.

Study Design and Data Collection Methods

The main study was a randomized, controlled trial.⁸ Eligible families were randomly assigned to home-visited and control groups. Study group assignments were predetermined with a table of random numbers. Evaluation staff members completed a baseline interview with the mother at the hospital before discharge or at home within 1 month after delivery, if a hospital interview was not possible. Follow-up data were collected annually for 3 years, through structured maternal interviews and observation of the home environment. Precautions to minimize measurement bias included independence of evaluation staff from the HSP itself, blinding of interviewers to families' group status, and use of an observational measure of the home environment to augment self-report measures of parenting. The study was approved by the Hawaii Department of Health Research Review Committee and by the institutional review boards of the Johns Hopkins University School of Medicine and the 6 hospitals where families were assessed and enrolled in the study.

Study Sample

HSP staff members identified 1803 families as eligible for the HSP between November 1994 and December 1995. An at-risk family was eligible for the study if the mother understood English well enough to be interviewed, the family was not already enrolled in the HSP for a prior birth, and the family was identified on a day when HSP intake was open. Overall, 1520 of the 1803 families met the first 2 criteria; 897 of the 1520 were identified on days when HSP intake was open. Of the 897 families, 730 (81%) agreed to take part in both the HSP and the study, 4 declined the study but were receptive to HSP services, and 163 declined both the HSP and the study. The families were initially randomized to 3 study groups, ie, the HSP and main control groups (monitored at 1, 2, and 3 years) and a testing control group (monitored only at 3 years). By design, more families were assigned to the HSP group ($n = 390$) than to the main control ($n = 294$) and testing control ($n = 46$) groups.

Overall, 684 of the 730 randomized families (94%) were interviewed at baseline (373 in the HSP group, 270 in the main control group, and 41 in the testing control group); the remainder declined the baseline interview. Therefore, 76% of the 897 families eligible for the study completed baseline interviews and became study participants; this is comparable to HSP participation rates on Oahu before the study. Of the 684 families that completed a baseline interview, we excluded the 41 in the testing control group because, by design, we measured their outcomes only at 3 years. Compared with the HSP-eligible families that did not take part in the research, study participants in the HSP group and main control group were younger (mean \pm SD: 23.4 \pm 5.8 years vs 24.5 \pm 6.2 years; $P < .01$) and were more likely to be having their first child (45% vs 41%, $P < .01$).

Description of Measures

Sociodemographic Features

Mother's age, race, and employment in the year before the index birth were ascertained in the baseline interview. Poverty level was based on the total household income for the number of people living in the same house with the mother, in relation to the federal poverty level for Hawaii.

Family Risk Factors

Maternal mental health was measured with the 5-item version of the Mental Health Index, which gives an overall measure of anxiety and depressive symptoms.³² The response values for each item, which ranged from 0 to 5, with higher values indicating better mental health, were summed and calibrated on a scale of 0 to 100.^{32,33} A score of ≤ 67 was used to define poor mental health.³⁴ Maternal substance use was measured as any problem alcohol use or illicit drug use in the past year. Problem alcohol use was defined as self-report of alcohol use in the past year with a history of alcohol problems, measured as a score of ≥ 2 on the CAGE questionnaire.³⁵ We used the Conflict Tactics Scale developed by Straus³⁶ to measure partner violence. A family was considered violent if the mother reported that either she or her partner had committed acts of physical violence toward the other on ≥ 3 occasions in the preceding year. Mothers without a partner were categorized as negative for partner violence.

RRB

The occurrence of a subsequent birth was measured by maternal self-report in follow-up interviews at 1, 2, and 3 years. If the mother had a repeat birth within 24 months after the index birth or if she was a teen and had a repeat birth at any time through the age of 19 years, then she was considered to have had a RRB.

Hypothesized Malleable Determinants of RRB

At the baseline interview, the mother was asked which contraceptive methods, if any, she ever used in the past, which methods, if any, she planned to use in the coming year, and whether she had access to a family planning site. At the 1-year follow-up interview, we asked which contraceptive methods the mother was using, which ones she had used since the index child's birth, whether she had access to a family planning site, and, if she did, where it was. To measure the mother's desire for a RRB at baseline and at the 1-year interview, the mother was asked whether she wanted to

have another child and, if so, how old she wanted the index child to be when she had her next child.

Hypothesized Adverse Outcomes of RRB on the Mother and the Index Child

At the 3-year follow-up interview, we measured 3 maternal parenting outcomes, namely, parenting stress, neglect of the index child, and warmth toward the index child. Severe parenting stress was measured with the short form of the Parenting Stress Index described by Abidin.³⁷ A mother was considered positive for severe parenting stress if she scored positive for personal adjustment problems, child abuse potential, or high child abuse potential, as defined by Abidin.³⁷ To assess neglect of the index child, we used the Conflict Tactics Scale developed by Straus.³⁶ This instrument measures how often in the past year the mother engaged in specific behaviors ranging from nonviolent discipline to psychologically and physically abusive acts and indicators of neglect. Straus aggregated the behaviors into 6 subscales, 1 of which contains 5 items that characterize neglect. Because previous research demonstrated variation in the factor structure of the parent-child version of the Conflict Tactics Scale, we conducted factor analysis to determine whether the traditional subscale was most appropriate for our sample or whether a different subscale might be indicated.²⁷ Our subscale for neglect contained 3 of the 5 items traditionally categorized as neglect, ie, being too caught up in one's problems to express love to the child, being unable to provide necessary food, and being unable to provide necessary medical care. The other 2 items did not load on the same factor and were not used in the analysis.

To measure maternal warmth toward the index child at 3 years, we used the early-childhood version of the Home Observation for Measurement of the Environment (HOME) inventory described by Bradley.^{38,39} The early-childhood HOME inventory is designed for use between 3 and 6 years of age. It contains 55 items clustered into 8 subscales, ie, 1) learning materials, 2) language stimulation, 3) physical environment, 4) parental responsiveness, 5) learning stimulation, 6) modeling of social maturity, 7) variety in experience, and 8) acceptance of the child. In this report, we focused on the fourth subscale, parental responsiveness, as indicative of maternal warmth toward the index child. This subscale consisted of 7 items and had a possible range of 0 to 7. We converted the score into a dichotomous variable (low warmth toward the index child [scores of 0–4] versus high warmth toward the index child [scores of 5–7]).

To assess child behavior, we used the parent form of the Child Behavior Check List for ages 2 to 3 years described by Achenbach.⁴⁰ This is a 99-item questionnaire, with an open-ended item for additional problems, that records data on children's competencies and problems, as reported by their parents or parent-surrogates. The Child Behavior Check List for ages 2 to 3 years is used to measure several aspects of behavior, including levels of internalizing and externalizing behavior. We generated *T* scores for internalizing and externalizing behavior, which were dichotomized as normal (scores of <60) or borderline/clinical (scores of ≥60) according to the protocol described by Achenbach and Rescorla.^{41(p72)}

Analysis

Analysis was limited to families in the HSP and main control groups that completed a baseline interview (total *N* = 643). Student's *t* test and χ^2 test were used to assess the comparability of the intervention and control groups with respect to demographic variables and malleable risk factors for RRB at the baseline interview and after 1 year of intervention. We used odds ratios (ORs) with 95% confidence intervals (CIs) to measure the strength of associations. Multiple logistic regression was used to assess 1) the impact of the program on RRB and its malleable determinants, 2) the impact of the malleable determinants on RRB, and 3) the association between RRB and the adverse maternal and child outcomes. We repeated the analyses with the sample limited to first-time mothers to evaluate whether parity moderated program impact. Statistical significance was defined with 2-tailed tests and an α of .05; a statistical trend was defined as $.05 < P < .10$. All statistical analyses were performed with SPSS for Windows, Release 11.0.1 (SPSS Inc, Chicago, IL).

RESULTS

Baseline Data

The prevalence of poor maternal general mental health, maternal substance use, and partner violence was high at baseline for both groups, because families had been targeted for service on the basis of such risks for child abuse (Table 1). The HSP and control groups were comparable with respect to most demographic variables and malleable determinants for RRB at baseline. Maternal employment in the year before delivery was more common in the HSP group (52% vs 44%, $P = .05$); poor maternal general mental health and partner violence were less common in the HSP group (43% vs 50%, $P = .05$, and 43% vs 52%, $P = .02$, respectively). First-time mothers in the HSP and control groups were also comparable (Table 1) except for partner violence, which was less common in the HSP group (40% vs 55%, $P = .01$). Group baseline differences were controlled for in subsequent analyses.

Follow-up Rates

Each year, 88% of the sample completed a follow-up interview, including families that had dropped out of the HSP itself. Eighty-one percent of the sample completed all 3 follow-up interviews. There was no significant difference in follow-up completion rates between study groups; 89% of HSP families and 86% of control families were monitored at 1 year; 88% of each group was monitored at 2 years, and 88% of each group was monitored at 3 years. At 1 year, families who were lost to follow-up monitoring did not differ significantly from those who were monitored. At 2 and 3 years, follow-up rates were slightly higher for Native Hawaiian families and lower for other Pacific Islander groups. This was consistent across study groups.

Program Effects on RRB and on Hypothesized Malleable Risk Factors

There was no program impact on RRB for mothers overall, after adjustment for the significant baseline differences in demographic variables (HSP: 21%; control: 20%; adjusted OR [AOR]: 1.05; 95% CI: 0.69–1.58; $P = .83$) (Table 2). There was no program impact on RRB for first-time mothers (HSP: 25%; control: 21%; AOR: 1.23; 95% CI: 0.68–2.25; $P = .50$). We also performed a subgroup analysis to evaluate HSP program effects on RRB for low-income, first-time mothers, compared with control subjects, and found no significant effect (HSP: 26%; control: 20%; OR: 1.45; 95% CI: 0.83–2.54; $P = .20$). The HSP and control groups did not differ significantly with respect to any of the malleable determinants of RRB (maternal desire for RRB, access to a family planning site, or use of birth control) at the 1-year follow-up interview, either among mothers overall or within the subgroup of first-time mothers (Table 2).

Association of Demographic Variables and Malleable Determinants With RRB

No baseline demographic variable was significantly associated with RRB (all $P > .21$) except ma-

TABLE 1. Baseline Attributes of HSP and Control Groups for All Mothers and First-Time Mothers

	All Mothers*			First-Time Mothers†		
	Control, %	HSP, %	<i>P</i>	Control, %	HSP, %	<i>P</i>
Demographic variables						
Maternal age, y (mean ± SD)	23.2 ± 5.8	23.7 ± 5.8	0.34	20.9 ± 4.9	20.8 ± 4.6	.89
Mother is teen (<19 y) at index birth	33	30	0.34	55	58	.64
Mother employed in year before delivery	44	52	0.05	57	62	.40
Household income below poverty level	67	63	0.34	59	59	.99
Index child is first birth	47	43	0.27			
Mother's primary ethnicity			.70			.98
Native Hawaiian or Pacific Islander	33	34		27	27	
Asian or Filipino	28	28		35	33	
Caucasian	13	10		10	11	
No primary ethnicity or unknown	26	27		28	28	
Parents' relationship			.57			.79
None	13	11		16	15	
Friends or going together	37	35		39	43	
Living together	29	29		35	33	
Married	21	26		11	8	
Poor maternal general mental health‡	50	43	.05	51	43	.19
Maternal substance use§	23	19	.19	27	24	.57
Partner violence	52	43	.02	55	40	.01
Malleable maternal determinants for RRB						
Desire an RRB	7	10	.23	9	12	.51
No family planning site	29	26	.41	30	28	.70
Never used any birth control	23	21	.48	28	26	.63
Not planning to use birth control	7	7	.86	8	6	.46

* Control, *n* = 270; HSP, *n* = 373.† Control, *n* = 127; HSP, *n* = 159.

‡ Mental Health Index-5 score of ≤67.

§ Either used illicit drugs in the past year or drank alcohol in the past year with a lifetime-positive CAGE response.

|| Three or more incidents of partner violence in the past year. Mothers without a partner were categorized as negative for partner violence.

TABLE 2. HSP Effects on RRB and Malleable Determinants of RRB at 1-Year Follow-up Time, According to Study Group, for All Mothers and First-Time Mothers

	All Mothers*					First-Time Mothers†				
	HSP, %	Control, %	AOR‡	95% CI	<i>P</i>	HSP, %	Control, %	AOR‡	95% CI	<i>P</i>
RRB	21	20	1.05	0.69–1.58	.83	25	21	1.23	0.68–2.25	.50
Malleable determinants at year 1										
Maternal desire for RRB	9	11	0.80	0.45–1.43	.45	8	11	0.62	0.25–1.51	.29
No family planning site	15	14	1.06	0.64–1.77	.81	16	15	1.02	0.49–2.12	.96
Did not use birth control after index birth§	18	20	0.85	0.53–1.34	.48	14	19	0.69	0.34–1.40	.31

* HSP, *n* = 332; control, *n* = 232.† HSP, *n* = 141; control, *n* = 112.

‡ Adjusted for significant baseline variables between mothers (all mothers and first-time mothers) receiving HSP home visiting services and control subjects, ie, mother worked in the year before delivery, poor maternal general mental health, partner violence, study group, and agency.

§ Not using birth control now and did not use any birth control since the index birth.

ternal age. Mothers who had a RRB were younger at the birth of the index child than were those who did not have a RRB (22.7 years vs 24.3 years, *P* < .01).

For mothers overall, RRB was significantly more likely among mothers who desired to have a child within 2 years after the index birth (Table 3). This was true for desire for RRB both at baseline (AOR: 2.48; 95% CI: 1.32–4.64; *P* < .01) and at the 1-year interview (AOR: 2.86; 95% CI: 1.57–5.22; *P* < .01). Lack of access to a family planning site at baseline was not associated with RRB, but there was a trend

toward a greater likelihood of RRB among those lacking a site at 1 year (AOR: 1.61; 95% CI: 0.93–2.79; *P* = .09). Women who had never used birth control before the index birth were more likely to have a RRB (OR: 1.89; 95% CI: 1.20–2.98; *P* < .01), and there was a trend toward a greater likelihood of RRB among women who did not use birth control in the year following the index child's birth (AOR: 1.67; 95% CI: 0.98–2.82; *P* = .06).

Among first-time mothers, baseline desire for RRB was strongly predictive of RRB (OR: 3.22; 95% CI:

TABLE 3. Association of Malleable Determinants for RRB at Baseline and at 1 Year With Occurrence of RRB, Among All Mothers and First-Time Mothers

	All Mothers*				First-Time Mothers†			
	RRB, %	AOR‡	95% CI	P	RRB, %	AOR‡	95% CI	P
Baseline								
Maternal desire for RRB								
Yes	37	2.48	1.32–4.64	<.01	46	3.22	1.41–7.34	<.01
No	19				20			
Family planning site								
Yes	19				20			
No	22	1.21	0.80–1.83	.36	27	1.56	0.86–2.81	.14
Ever used any birth control								
Yes	18				21			
No	29	1.89	1.20–2.98	<.01	30	1.58	0.84–2.96	.15
Planning to use birth control								
Yes	20				23			
No	27	1.51	0.75–3.05	.25	30	1.48	0.48–4.57	.49
Year 1 follow-up								
Maternal desire for RRB								
Yes	40	2.86	1.57–5.22	<.01	41	2.27	0.91–5.68	.08
No	19				24			
Family planning site								
Yes	21				26			
No	29	1.61	0.93–2.79	.09	20	0.75	0.32–1.79	.52
Used birth control after index birth								
Yes	18				23			
No	27	1.67	0.98–2.82	.06	24	1.04	0.45–2.37	.94

* Baseline, *n* = 596; year 1, *n* = 564.

† Baseline, *n* = 270; year 1, *n* = 254.

‡ Adjusted for baseline variables, i.e., mother was a teen at the time of the index birth, mother worked in the year before delivery, poor maternal general mental health, partner violence, study group, and agency.

1.41–7.34; *P* < .01). The other hypothesized baseline determinants had associations with RRB similar to those for women overall but did not achieve statistical significance. Maternal desire for RRB at 1 year achieved our cutoff for a trend (OR: 2.27; 95% CI: 0.91–5.68; *P* = .08). Birth control use since the index birth and having a family planning site at 1 year were not predictive of RRB.

Adverse Consequences of RRB for the Mother and the Index Child at 3 Years

When the index children were 3 years of age, families with a RRB were more likely to have adverse maternal and index child outcomes (Table 4). Mothers with a RRB were more likely to have severe

parenting stress (AOR: 2.29; 95% CI: 1.17–4.48; *P* = .02) and to neglect the index child (AOR: 2.42; 95% CI: 1.41–4.18; *P* < .01). They were more likely to show poor warmth toward the index child (AOR: 2.84; 95% CI: 1.71–4.42; *P* < .01). In families with a RRB, the index child was more likely to score positive for internalizing behavior (AOR: 1.64; 95% CI: 1.04–2.58; *P* = .03), and there was a trend toward higher odds of externalizing behavior (AOR: 1.56; 95% CI: 0.98–2.49; *P* = .06).

The results were similar, although not as pronounced, for first-time mothers (Table 4). In this subgroup, mothers with a RRB were more likely to demonstrate poor warmth toward the index child (AOR: 2.97; 95% CI: 1.44–6.13; *P* < .01). There was a

TABLE 4. Odds of Maternal and Index Child Adverse Outcomes at 3 Years for Those with RRB, Among All Mothers and First-Time Mothers

	Severe Parenting Stress	Maternal Neglect	Poor Warmth Toward the Index Child	Internalizing Behavior in Index Child	Externalizing Behavior in Index Child
RRB among all mothers (<i>n</i> = 535)					
AOR*	2.29	2.42	2.84	1.64	1.56
95% CI	1.17–4.48	1.41–4.18	1.71–4.42	1.04–2.58	0.98–2.49
<i>P</i>	.02	<.01	<.01	.03	.06
RRB among first-time mothers (<i>n</i> = 243)					
AOR*	2.03	2.01	2.97	1.87	1.56
95% CI	0.63–6.58	0.85–4.78	1.44–6.13	0.97–3.58	0.80–3.06
<i>P</i>	.24	.11	<.01	.06	.64

Mothers who completed the year 3 follow-up interview and who had custody of the index child for ≥6 months in the year were included. * Adjusted for the mother being a teen, the mother having worked in the year before the index child's birth, poor maternal general mental health, and HSP intervention group.

trend toward higher odds of internalizing behavior for the index child (AOR: 1.87; 95% CI: 0.97–3.58; $P = .06$).

DISCUSSION

Overall, 20% of the mothers in our sample of at-risk families had a RRB, which is far higher than the national average of 11%.⁵ Part of this might be attributable to cultural norms for large families; overall, Hawaii has a higher fertility rate than the nation as a whole.⁴²

Unfortunately, RRB was associated with a greater likelihood of adverse consequences for both the mother and the index child. Furthermore, we found no significant effects of home visiting in the prevention of RRB or on the malleable determinants that we assessed at the index birth and at 1 year after the index birth.

Previous Research on Home Visiting Effects on Fertility

How does our research compare with previous studies of home visiting effects on fertility? This is best understood by considering variations in the design and implementation of home visiting programs and studies and how these are related to findings.

First, let us consider models that were found not to influence fertility. One of these, the Infant Health and Development Project, was not intended to influence fertility.¹⁴ It did not include family planning or maternal postnatal care service. Rather, the investigators hypothesized that fertility might be influenced indirectly, through increased health care use. Because the model did not aim to influence fertility, the negative findings are not surprising.

The second model that failed to show a positive effect on fertility had been designed to improve this outcome.^{18,19} Home visits included case management, individualized life planning and counseling, and standardized protocols for family planning. Although the model was targeted to teenage mothers, a population that might be expected to have a high rate of RRB, the sample's actual rate of RRB was comparable to the national average of 11%. In addition, although the intervention and control groups had substantially different rates of repeat pregnancy at 2 years (32% vs 47%; OR: 0.53), the small sample size precluded the achievement of statistical significance. Because there was relatively little room for improvement in this outcome and the sample size was small, the study was underpowered for detecting a clinically meaningful group difference in RRB. Therefore, although the model was designed to affect fertility and the odds of repeat pregnancy for the home-visited group were only approximately one-half of those for the control group, study limitations yielded negative findings, as defined by statistical significance.

The third model that failed to show a positive effect on fertility had also been designed to improve this outcome.²⁴ Home visits included protocols addressing attitudes and behaviors that predate repeat conception. The program was targeted to a population with a high rate of repeat pregnancy at 2 years

(32% overall). However, the implementation system was inadequate, leading to substantial program dropout, which in turn attenuated adherence to the model. In addition, substantial study attrition reduced the statistical power. Therefore, although the home-visited group showed an early benefit of intervention (a greater likelihood of initiating a reliable form of contraception after the birth of the index child), there were no group differences in repeat birth by 2 years.

In contrast, one of the successful models, the Nurse Home Visitation Model, was intended to influence fertility, used protocols to address the antecedents of unintended pregnancy and birth, was targeted to populations with high rates of RRB, was faithfully implemented, and was assessed with adequately powered studies. In 3 different studies, with a variety of populations, the model was found to reduce or delay repeat birth.^{16,17,20,22,23} The last study included 2 intervention arms, 1 with nurses and the other with paraprofessional home visitors, both using the Nurse Home Visitation Model.²³ For repeat birth within 2 years after the index birth, both intervention arms showed trends for positive effects, compared with the control arm (nurse arm: 12%; paraprofessional arm: 13%; control arm: 19%).

Field et al¹⁵ also reported home visiting success in a study with a control arm and 2 intervention arms. The first intervention arm was the home visiting model. It incorporated 6 months of biweekly home visits to train mothers in infant stimulation. Visits were made by a graduate student and a Comprehensive Employment Training Act (CETA) aide (an African American teenager), who demonstrated the exercises. The other intervention arm was based in an infant nursery that provided daytime care for the infants of medical school and hospital staff members. Teenage mothers assigned to this group received the same training in infant stimulation as did those in the home visit group. They also served as CETA aides in the nursery. In that setting, they were exposed to modeling of parenting and child care techniques by the staff, were involved in the care of their own and other infants, and received job training and an income.

At the 2-year follow-up assessments, control mothers had the highest rates of repeat pregnancy; home-visited teenage mothers had significantly lower rates than did control mothers, and nursery group mothers had significantly lower rates than did either of the other groups. Control mothers had the lowest rates of return to school or work; home-visited mothers had significantly higher rates than did control mothers, and nursery group mothers had significantly higher rates than did either of the other groups.

Beyond targeting populations with a high rate of repeat pregnancy, the reasons for the success of the home visiting intervention are unclear. The authors thought that the nursery intervention positively affected the mothers' interest in their own life course development.¹⁵ They thought that the home-based intervention was effective because it was very much like visiting nurse programs (T. Field, personal com-

munication, March 5, 2004). It is possible that the home-visited group, through exposure to the graduate student and a teenage CETA worker, also perceived the benefits of furthering their own educational and work course, although indirectly and to a lesser extent. This could have contributed to their lower rates of repeat pregnancy.

Home visiting models that targeted fertility as an outcome were more likely to demonstrate positive effects than were models that did not. For programs that targeted fertility, those showing a substantial decrease in fertility for study subjects (even if the sample size was inadequate to achieve statistical significance) used strategies beyond providing family planning information and service linkage. Strategies included promoting other aspects of the parents' life course, such as career planning and education and job training, as well as addressing attitudes and beliefs about the impact of subsequent births on the quality of parenting for the index child. The model that failed to affect fertility, despite its use of such strategies, was compromised by problems of attrition and visit frequency that was lower than intended.

In summary, programs that are successful in delaying subsequent births seem to be those that influence mothers to view a RRB not as merely an end in itself but as part of the means to achieve other valued goals. This notion is consistent with research showing that motivation to prevent additional childbearing is a more powerful antecedent of birth control use and subsequent fertility than is ambivalence about having another child.⁴³⁻⁴⁵

HSP Design and Implementation System

How do the design and implementation system of the HSP explain our negative findings? It is clear that fertility was an intended HSP outcome. HSP services were provided by community-based organizations through contracts with the Department of Health. The contracts specified that families were to be provided family planning information and that families were to be referred and linked to appropriate community resources. However, the contracts required only that family planning information be provided to at least 90% of families that remained in the program for ≥ 12 months. This benchmark suggested that family planning could be introduced at any time during a family's first year of enrollment. Because conception can occur very soon after the index birth, a better design would be to introduce family planning counseling early in a family's enrollment in home visiting.

Another shortcoming of the HSP design and implementation system was that there was no evidence that family planning was linked to motivating the parents to avoid RRB to achieve personal life course goals and to promote effective parenting of the index child. Family planning was included in home visitor training.^{31,46} However, our review of training manuals and service records did not find evidence of protocols for addressing fertility and for relating subsequent births to parents' abilities to achieve their personal goals for life course development and for parenting of the index child and older siblings.

Research has shown that record format can influ-

ence the actual process of care.⁴⁷ In the larger study from which this report is derived, we found that HSP forms required the home visitor to document the child's primary care provider periodically and that the program achieved its goals of promoting access to pediatric primary care (A. Duggan, S.M. Higman, L. Fuddy, E. McFarlane, L. Burrell, and C. Sia, manuscript in preparation). We think that the record format contributed to this positive effect by prompting the home visitor to ascertain whether the family had a regular source of pediatric primary care and, if the family lacked a regular provider, to address this need. In contrast, HSP records did not incorporate cues to ascertain and address issues involving family planning. We think that this undermined the program's intent to include this as a regular part of care.

Actual HSP services also departed from the model in terms of family retention rates and home visit frequency. As reported earlier, many families left the program prematurely, and home visit frequency fell short of goals.⁹ These departures from the program model are likely to have attenuated HSP effects on fertility.

HSP services were to be provided not only to mothers and children but also to fathers and other family members as possible. We did not measure whether or how the biological father or other partners influenced maternal attitudes and behaviors regarding repeat childbearing. We do know, however, that fathers took part in only approximately one-fifth of home visits, for an average of 2.4 visits in the first year.²⁶ Therefore, home visitors had few opportunities to work directly with fathers. It is possible that program effects were attenuated in families in which the mother's partner wanted a child.

Methodologic Considerations

Our failure to detect an impact on RRB is unlikely to result from inadequate study power. The program's targeted population had a high rate of RRB. The lower limit of the 95% CI for our sample estimate of the odds of RRB in HSP versus control mothers was 0.69. Therefore, it is highly unlikely that population group differences in fertility were of the magnitude reported for the Nurse Home Visitation Model^{16,17,20,22,23} or the interventions tested by Field et al¹⁵ and Koniak-Griffen et al.^{18,19}

Although the study was a randomized trial, the HSP and control groups differed at baseline, with systematic advantage for the HSP group. We assessed 2 aspects of the study methods, to determine whether they contributed to this imbalance. First, we assessed adherence to the recruitment and randomization protocols and found no departures. Second, we assessed whether the timing of the baseline interview contributed to the imbalance. By design, mothers consented to the study before randomization but completed the baseline interview after randomization. This design allowed us to minimize intrusion of the study methods into regular program operations. Overall, 96% of mothers assigned to the HSP group and 92% of those assigned to the control group completed the baseline interview. We compared families with versus without a baseline inter-

view to determine whether they differed in screening or assessment measures. There were no significant differences overall or within either study group. Therefore, group differences in baseline interview completion do not seem to have contributed to the groups' baseline imbalance with respect to maternal employment, mental health, and partner violence. We controlled for these baseline group differences in analyses, but it is possible that the groups also differed with respect to other factors that were not measured at baseline.

In analyses of RRB effects on outcomes, the study used a prospective cohort design. Although we found that RRB was associated with maternal and child outcomes, we cannot infer causality. Mothers with versus without a RRB might differ in other ways (for example, in their plans for themselves and their children). Future research is needed to develop a conceptual framework for determinants and consequences of RRB.

Our use of annual maternal interviews to measure RRB outcomes introduced the potential for recall and reporting biases. However, we think that this threat was minimal. Questions about subsequent pregnancies and births were part of a large battery of questions regarding family composition and the use of a range of health care services. Outcome measures included an observational measure of parenting, to augment our self-report measures.

We did not measure the gestational ages of the subsequent children. Therefore, we could not identify the subset of RRBs resulting from preterm births. Although we could not distinguish this subset, our study does address the *Healthy People 2010* objective, which is to reduce the proportion of RRBs overall and not just those that are term births.

CONCLUSIONS

The Hawaii HSP did not reduce RRB or alter its malleable determinants. RRB was associated with adverse outcomes for both the mother and the index child. This is particularly relevant for this population of families that are already at risk for child maltreatment, for which we have found parenting stress to be associated with abusive parenting behavior by the mother.⁴⁸ Our findings support and broaden the rationale for the *Healthy People 2010* objective to reduce RRB.

We think that our findings are valuable for guiding the future development of home visiting in general and this widely replicated paraprofessional model in particular. Lack of program effects can be traced to the program's design and implementation system. Additional research is needed to test the effectiveness of interventions to refine the model, strengthen staff competence, and improve service quality.

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Hawaii's Healthy Start Home Visiting Program: Determinants and Impact of Rapid Repeat Birth

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