

MINUTES OF THE BOARD OF SUPERVISORS
COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

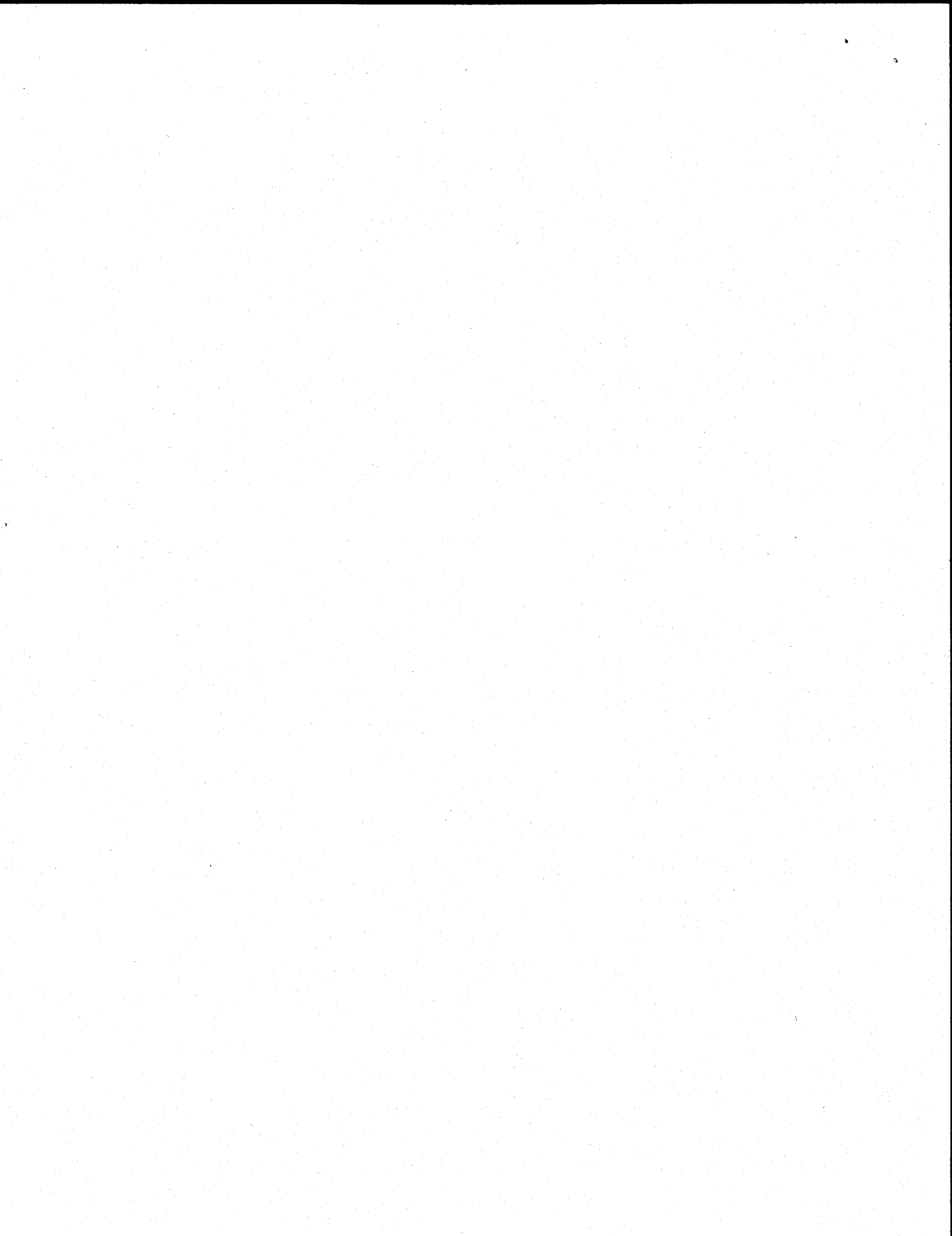


9.13

During the oral communication section of the agenda for Tuesday, June 12, 2012, Amy Larson requested the Board provide evidence based programs and requested that the Board keep the three nurses that will be let go.

**ATTACHMENTS FILED WITH
CLERK OF THE BOARD**

**AGENDA NO.
9.13**



**Riverside County Board of Supervisors
Request to Speak**

Submit request to Clerk of Board (right of podium),
Speakers are entitled to three (3) minutes, subject
Board Rules listed on the reverse side of this form.

SPEAKER'S NAME: Amy Larsen

Address: _____
(only if follow-up mail response requested)

City: Lake Elsinore **Zip:** 92532

Phone #: 951-768-6253

Date: 6/12/12 **Agenda #** ORA

PLEASE STATE YOUR POSITION BELOW:

Position on "Regular" (non-appealed) Agenda Item:

Support **Oppose** **Neutral**

Note: If you are here for an agenda item that is filed
for "Appeal", please state separately your position on
the appeal below:

Support **Oppose** **Neutral**

I give my 3 minutes to: Nurse - Family
Partnership

BOARD RULES

Requests to Address Board on "Agenda" Items:

You may request to be heard on a published agenda item. Requests to be heard must be submitted to the Clerk of the Board before the scheduled meeting time.

Requests to Address Board on items that are "NOT" on the Agenda:

Notwithstanding any other provisions of these rules, member of the public shall have the right to address the Board during the mid-morning "Oral Communications" segment of the published agenda. Said purpose for address must pertain to issues which are under the direct jurisdiction of the Board of Supervisors. YOUR TIME WILL BE LIMITED TO THREE (3) MINUTES.

Power Point Presentations/Printed Material:

Speakers who intend to conduct a formalized Power Point presentation or provide printed material must notify the Clerk of the Board's Office by 12 noon on the Monday preceding the Tuesday Board meeting, insuring that the Clerk's Office has sufficient copies of all printed materials and at least one (1) copy of the Power Point CD. Copies of printed material given to the Clerk (by Monday noon deadline) will be provided to each Supervisor. If you have the need to use the overhead "Elmo" projector at the Board meeting, please insure your material is clear and with proper contrast, notifying the Clerk well ahead of the meeting, of your intent to use the Elmo.

Individual Speaker Limits:

Individual speakers are limited to a maximum of three (3) minutes. Please step up to the podium when the Chairman calls your name and begin speaking immediately. Pull the microphone to your mouth so that the Board, audience, and audio recording system hear you clearly. Once you start speaking, the "green" podium light will light. The "yellow" light will come on when you have one (1) minute remaining. When you have 30 seconds remaining, the "yellow" light will begin flash, indicating you must quickly wrap up your comments. Your time is up when the "red" light flashes. The Chairman adheres to a strict three (3) minutes per speaker. **Note: If you intend to give your time to a "Group/Organized Presentation", please state so clearly at the very bottom of the reverse side of this form.**

Group/Organized Presentations:

Group/organized presentations with more than one (1) speaker will be limited to nine (9) minutes at the Chairman's discretion. The organizer of the presentation will automatically receive the first three (3) minutes, with the remaining six (6) minutes relinquished by other speakers, as requested by them on a completed "Request to Speak" form, and clearly indicated at the front bottom of the form.

Addressing the Board & Acknowledgement by Chairman:

The Chairman will determine what order the speakers will address the Board, and will call on all speakers in pairs. The first speaker should immediately step to the podium and begin addressing the Board. The second speaker should take up a position in one of the chamber aisles in order to quickly step up to the podium after the preceding speaker. This is to afford an efficient and timely Board meeting, giving all attendees the opportunity to make their case. Speakers are prohibited from making personal attacks, and/or using coarse, crude, profane or vulgar language while speaking to the Board members, staff, the general public and/or meeting participants. Such behavior, at the discretion of the Board Chairman may result in removal from the Board Chambers by Sheriff Deputies.

Return on Investment: Evidence-Based Options to Improve Statewide Outcomes —April 2012 Update—

In the mid-1990s, the Washington State Legislature first began to direct the Washington State Institute for Public Policy (Institute) to identify “evidence-based” policies that have been shown to improve particular outcomes.

The motivation for these assignments is straightforward: to provide Washington policymakers and budget writers with a list of well-researched policies that can, with a high degree of probability, lead to better statewide results and a more efficient use of taxpayer dollars.

This short report provides a snapshot, as of April 2012, of our current list of evidence-based policy options on many public policy topics. Where possible, we provide an independent assessment of the benefits and costs of each option from the perspective of Washington citizens and taxpayers.

In essence, this report is similar to an investment advisor’s “buy-sell” list—it contains current recommendations on policy options that can give taxpayers a good return on their investment (“buys”), as well as those that apparently cannot (“sells”). **This report replaces previously published Institute reports on these topics.**

We will occasionally add or update results for individual policy options on our website as new information becomes available. Exhibit 1 of this report includes hyperlinks to detailed results for each program.

Suggested citation: Lee, S., Aos, S., Drake, E., Pennucci, A., Miller, M., & Anderson, L. (2012). *Return on investment: Evidence-based options to improve statewide outcomes*, April 2012 (Document No. 12-04-1201). Olympia: Washington State Institute for Public Policy.

Background

The Institute was created by the 1983 Washington Legislature to carry out non-partisan research at legislative direction.

The 1997 Legislature directed the Institute to review “evidence-based” policy strategies in juvenile justice and adult corrections. We identified several programs that had been tried and evaluated elsewhere but were not then operating in Washington. We found that some, but not all, programs had the potential to reduce crime and save Washington taxpayers money.¹ In subsequent sessions, the legislature used the information to begin a series of policy reforms.² Many practical lessons have been learned about how to implement these programs with fidelity statewide.³

Based on this initial success, in the early 2000s the legislature began to direct the Institute to apply the same evidence-based and benefit-cost approach to other public policy areas, including K–12 education, early childhood education, prevention, child welfare, mental health, substance abuse, and public health.⁴

In this report, we discuss our research approach and summarize our current results on these topics.

General Research Approach

As we have carried out these legislative assignments, we have been implementing a three-step research approach.

- 1) We systematically assess evidence on “what works” (and what does not) to improve outcomes.
- 2) We calculate costs and benefits for Washington State and produce a ranking of public policy options.
- 3) We measure the riskiness of our conclusions by testing how bottom lines vary when estimates and assumptions change.

A brief description of each step follows.

Submitted by: Amy Larson

(date) 6-12-12 Item ORAC

Step 1: What Works? What Doesn't?

In the first research step, we estimate the probability that various policies and programs can improve outcomes. Once the legislature has indicated an outcome of interest, we then carefully analyze all high-quality studies from the United States and elsewhere to identify well-researched policy options that have achieved the outcome (as well as those that have not). We look for research studies with strong evaluation designs; we ignore studies with weak research methods. Our empirical approach then follows a meta-analytic framework to assess systematically all credible evaluations we can locate on a given topic. We produce an estimated effect of a policy on a particular outcome of interest, as well as an estimate of the margin of error in that effect.

Step 2: What Makes Economic Sense?

Next, we insert benefits and costs into the analysis by answering two questions.

- ✓ How much does it cost to produce the results found in Step 1?
- ✓ How much is it worth to people in Washington State to achieve the outcome? That is, in dollar and cents terms, what are the program's benefits?

To answer these questions, we have developed—and we continue to refine—an economic model that assesses benefits and costs. The goal is to provide an internally consistent monetary valuation so that one option can be compared fairly to another. Our bottom line benefit-cost measures include standard financial statistics: net present values, benefit-cost ratios, and rates of return on investment.

We present these monetary estimates from three distinct perspectives: the benefits and costs that accrue solely to program participants, those received by taxpayers, and those received by other people in society (for example, crime victims).

The sum of these three perspectives provides a "total Washington" view on whether a policy or program produces benefits that exceed costs. Our model can also restrict the focus solely to the taxpayer perspective which can be useful for fiscal analysis and state budget preparation.

Step 3: Assessing the Riskiness of the Estimates.

The third analytical step involves testing the robustness of our results. Any tabulation of benefits and costs involves some degree of speculation about future performance. This is expected in any investment analysis, whether it is in the private or public sector. To assess the riskiness of our

conclusions, we perform a "Monte Carlo simulation" in which we vary the key factors in our calculations. The purpose of the risk analysis is to determine the odds that a particular policy option will at least break even. This type of analysis is used by many businesses in investment decision making.

Thus, for each option, we produce two "big picture" findings: expected benefit-cost results (net present values and rates of return) and, given our understanding of the risks involved, the odds that the policy will at least have benefits greater than costs.

Changes Since the July 2011 Update

Since the Institute's benefit-cost findings were last published in July 2011, several findings have changed substantially, due to improvements in our benefit-cost methodology. The changes affect our previous results in two major ways, one that affects a particular topic area, and another that cuts across all topic areas.

First, we changed the method by which we monetize children's mental health disorders to more closely match the methods we use to monetize adult mental health disorders. The benefit-cost model is now able to distinguish between the effects of preventing disruptive behavior disorders compared to the effects of treating youth who already have these disorders. The effect of this modeling change, relative to our July 2011 findings, lowers the expected benefits of programs that affect child externalizing behaviors.

Second, we have updated our methods to avoid "double counting" benefits from a single monetary source. For instance, a program evaluation that measures high school graduation rates, test scores, and disordered alcohol use would be monetized, in part, via changes to lifetime earnings in the labor market from each of these outcomes. In the former version of our model, to avoid double counting, we allowed the highest of these three values to "trump" the other values. We discovered that, in a Monte Carlo simulation, consistently selecting the highest of the three values biased the results in a positive direction, and may not have accurately represented the expected monetary benefits of a policy. Thus our prior trumping method favored policies that measured multiple outcomes in their evaluations; for example, the more ways a study measured impacts on labor market earnings, the more likely our previous model would have estimated a positive overall benefit.

In the current update, we have improved our trumping method by taking a weighted average of all outcomes that derive benefits from a single monetary source. Using the new method, we more accurately represent the expected benefits from programs that measure multiple outcomes. This modeling change lowered the estimated benefits of a number of programs that measured certain monetary benefits through multiple outcomes.

For more detail on these modeling changes, see the [technical appendix](#).⁵

April 2012 Results

In this report, we summarize our results in a *Consumer Reports*-like list of what works and what does not, ranked by benefit-cost statistics and a measure of investment risk. We identify a number of evidence-based options that can help policy makers achieve desired outcomes as well as offer taxpayers a good return on their investment, with low risk of failure. Washington is already investing in several of these options. We also find other evidence-based options that do not produce favorable results.

In Exhibit 1, we have arranged the information by major topic. Some programs listed, of course, achieve outcomes that cut across these topics. The documents hyperlinked to the program titles in this exhibit provide comprehensive outcome information.

For some programs, insufficient information was available to allow a calculation of benefits and costs. We list these programs in each topic area, along with the reason for their exclusion.

Example: How to Read Exhibit 1.

To illustrate our findings, we summarize results for a program called Functional Family Therapy (FFT), designed for juveniles on probation. This program is listed under the topic of juvenile justice in Exhibit 1. FFT was originally tested in Utah; Washington began to implement the program in the mid-1990s. The legislature continues to fund FFT, and it is now used by many Washington juvenile courts.

We reviewed all research we could find on FFT and found eight credible evaluations that investigated whether it reduces crime. The appendix linked in Exhibit 1 provides specific information on the eight studies in our meta-analysis of FFT.

- In Exhibit 1, we show our estimate of the total benefits of FFT per participant (2011 dollars). These benefits spring primarily from reduced crime, but also include labor market and health care benefits due to increased probability of high school graduation.

- Of the total benefits, Exhibit 1 shows that we expect some to be received by taxpayers and the majority to accrue to others, including the participants and people who were not victimized.
- Exhibit 1 also shows our estimates of the program costs per participant in Washington.
- The columns in the right-hand side of Exhibit 1 display our benefit-cost summary statistics for FFT. We show the net present value (benefits minus costs), and the benefit-to-cost ratio. Finally, we show the results of a risk analysis of our estimated bottom line for FFT.
- Based on these findings, one would conclude that FFT is an attractive evidence-based program that reduces crime and achieves a favorable return on investment, with a small chance of an undesirable outcome. These are the central reasons why FFT continues to be part of Washington's crime-reduction portfolio.

In addition to the summary information displayed in Exhibit 1, we have prepared supplementary documents. The individually linked documents provide detailed results for each option summarized in Exhibit 1, while the technical appendix provides a comprehensive description of the research methods used to compute the results.

¹ Aos, S., Barnoski, R., & Lieb, R. (1998). *Watching the bottom line: cost-effective interventions for reducing crime in Washington* (Document No. 98-01-1201), Olympia: Washington State Institute for Public Policy.

² Barnoski, R. (2004). *Outcome evaluation of Washington State's research-based programs for juvenile offenders* (Document No. 04-01-1201), Olympia: Washington State Institute for Public Policy.

³ Drake, E.K. (2010). *Washington State juvenile court funding: Applying research in a public policy setting*. (Document No. 10-12-1201), Olympia: Washington State Institute for Public Policy. See also: Barnoski, R. (2009). *Providing evidence-based programs with fidelity in Washington State juvenile courts: Cost analysis* (Document No. 09-12-1201), Olympia: Washington State Institute for Public Policy.

⁴ Previous benefit-cost studies prepared by the Washington State Institute for Public Policy for the legislature include:

- Aos, S., Lee, S., Drake, E., Pennucci, A., Klima, T., Miller, M., Anderson, L., Mayfield, J., & Burley, M. (2011). *Return on investment: evidence-based options to improve statewide outcomes - July 2011 update* - (Document No. 11-07-1201).
- Lee, S., Aos, S., & Miller, M. (2008). *Evidence-based programs to prevent children from entering and remaining in the child welfare system: Benefits and costs for Washington* (Document No. 08-07-3901).
- Aos, S., & Pennucci, A. (2007). *Report to the Joint Task Force on Basic Education Finance: School employee compensation and student outcomes* (Document No. 07-12-2201).
- Aos, S., Miller, M., & Mayfield, J. (2007). *Benefits and costs of k-12 educational policies: Evidence-based effects of class size reductions and full-day kindergarten* (Document No. 07-03-2201).
- Aos, S., Miller, M., & Drake, E. (2006). *Evidence-based public policy options to reduce future prison construction, criminal justice costs, and crime rates* (Document No. 06-10-1201).
- Aos, S., Mayfield, J., Miller, M., & Yen, W. (2006). *Evidence-based treatment of alcohol, drug, and mental health disorders: Potential benefits, costs, and fiscal impacts for Washington State* (Document No. 06-06-3901).
- Aos, S., Lieb, R., Mayfield, J., Miller, M., & Pennucci A. (2004). *Benefits and costs of prevention and early intervention programs for youth* (Document No. 04-07-3901).

⁵ www.wsipp.wa.gov/rptfiles/12-04-1201B.pdf.

Exhibit 1

Monetary Benefits and Costs of Evidence-Based Public Policies

*Summary of policy topics assigned to the Washington State Institute for Public Policy by the Washington State Legislature
Estimates for Washington State, as of April 2012*

Topic Area/Program	Last Updated	Monetary Benefits			Costs	Summary Statistics		
		Total Benefits	Taxpayer	Non-Taxpayer		Benefits Minus Costs (net present value)	Benefit to Cost Ratio	Measured Risk (odds of a positive net present value)
Juvenile Justice								
<u>Functional Family Therapy (Institutions²)</u>	April 2012	\$70,370	\$14,476	\$55,895	(\$3,262)	\$67,108	\$21.57	100%
<u>Aggression Replacement Training (Institutions)</u>	April 2012	\$62,947	\$12,972	\$49,976	(\$1,508)	\$61,440	\$41.75	94%
<u>Multidimensional Treatment Foster Care</u>	April 2012	\$39,197	\$8,165	\$31,032	(\$7,922)	\$31,276	\$4.95	85%
<u>Functional Family Therapy (Probation)</u>	April 2012	\$33,967	\$8,052	\$25,916	(\$3,261)	\$30,706	\$10.42	100%
<u>Aggression Replacement Training (Probation)</u>	April 2012	\$31,249	\$7,423	\$23,826	(\$1,510)	\$29,740	\$20.70	96%
<u>Multisystemic Therapy (MST)</u>	April 2012	\$32,121	\$7,138	\$24,983	(\$7,370)	\$24,751	\$4.36	98%
<u>Family Integrated Transitions (Institutions)</u>	April 2012	\$28,137	\$5,751	\$22,386	(\$11,219)	\$16,918	\$2.51	91%
<u>Drug Court</u>	April 2012	\$13,667	\$3,084	\$10,583	(\$3,091)	\$10,576	\$4.42	94%
<u>Coordination of Services</u>	April 2012	\$5,501	\$1,412	\$4,089	(\$395)	\$5,106	\$13.94	82%
<u>Victim Offender Mediation</u>	April 2012	\$4,205	\$1,080	\$3,125	(\$579)	\$3,626	\$7.27	95%
<u>Scared Straight</u>	April 2012	(\$4,949)	(\$1,271)	(\$3,678)	(\$65)	(\$5,014)	(\$76.35)	0%
Juvenile justice programs for which we have not calculated benefits and costs (at this time):								
Cognitive Behavioral Therapy (general)	October 2006							See previous WSIPP publication for past findings.
Diversion Programs	October 2006							See previous WSIPP publication for past findings.
Juvenile Boot Camps	October 2006							See previous WSIPP publication for past findings.
Supervision for Juvenile Offenders	October 2006							See previous WSIPP publication for past findings.
Sex Offender Treatment for Juvenile Offenders	October 2006							See previous WSIPP publication for past findings.
Team Child	October 2006							See previous WSIPP publication for past findings.
Teen Courts	October 2006							See previous WSIPP publication for past findings.
Wilderness Challenge Programs	October 2006							See previous WSIPP publication for past findings.
Adult Criminal Justice								
<u>Offender Re-entry Community Safety Program (dangerously mentally ill offenders)</u>	April 2012	\$70,535	\$18,120	\$52,415	(\$32,247)	\$38,288	\$2.19	100%
<u>Drug Offender Sentencing Alternative (drug offenders)</u>	April 2012	\$22,365	\$5,318	\$17,047	(\$1,542)	\$20,823	\$14.51	100%
<u>Supervision with Risk Need and Responsivity Principles (high and moderate risk)</u>	April 2012	\$24,203	\$5,817	\$18,386	(\$3,543)	\$20,660	\$6.83	100%
<u>Correctional Education in Prison</u>	April 2012	\$21,426	\$5,238	\$16,188	(\$1,128)	\$20,298	\$19.00	100%
<u>Electronic Monitoring (radio frequency or global positioning systems)</u>	April 2012	\$18,745	\$4,438	\$14,307	\$1,067	\$19,812	n/e	100%
<u>Vocational Education in Prison</u>	April 2012	\$20,446	\$5,017	\$15,429	(\$1,571)	\$18,875	\$13.01	100%
<u>Mental Health Courts</u>	April 2012	\$20,424	\$4,998	\$15,425	(\$2,935)	\$17,488	\$6.96	100%
<u>Drug Treatment in the Community</u>	April 2012	\$17,711	\$4,206	\$13,504	(\$1,602)	\$16,108	\$11.05	100%
<u>Drug Courts</u>	April 2012	\$15,433	\$3,376	\$12,057	(\$4,178)	\$11,255	\$3.69	100%
<u>Drug Treatment in Prison</u>	April 2012	\$15,577	\$3,834	\$11,743	(\$4,603)	\$10,974	\$3.38	100%
<u>Drug Offender Sentencing Alternative (property offenders)</u>	April 2012	\$11,273	\$2,666	\$8,607	(\$1,540)	\$9,733	\$7.32	78%
<u>Cognitive Behavioral Therapy (moderate and high risk)</u>	April 2012	\$9,695	\$2,308	\$7,387	(\$412)	\$9,283	\$23.55	100%
<u>Intensive Supervision: With Treatment</u>	April 2012	\$15,169	\$3,610	\$11,559	(\$7,874)	\$7,295	\$1.93	96%
<u>Work Release</u>	April 2012	\$7,117	\$1,749	\$5,368	(\$661)	\$6,456	\$10.77	99%
<u>Correctional Industries in Prison</u>	April 2012	\$7,042	\$1,713	\$5,329	(\$1,417)	\$5,625	\$4.97	100%
<u>Employment Training/Job Assistance in the Community</u>	April 2012	\$5,501	\$1,311	\$4,190	(\$135)	\$5,366	\$40.76	100%
<u>Intensive Supervision: Surveillance Only</u>	April 2012	(\$578)	(\$133)	(\$445)	(\$4,140)	(\$4,718)	(\$0.14)	11%
<u>Domestic Violence Perpetrator Treatment Programs</u>	April 2012	(\$4,908)	(\$1,165)	(\$3,742)	(\$1,359)	(\$6,266)	(\$3.61)	14%
Adult criminal justice programs for which we have not calculated benefits and costs (at this time):								
Adult Boot Camps	October 2006							See previous WSIPP publication for past findings.
Drug Treatment in Jail	October 2006							See previous WSIPP publication for past findings.
Jail Diversion for Mentally Ill Offenders	October 2006							See previous WSIPP publication for past findings.
Life Skills Education Programs for Adults	October 2006							See previous WSIPP publication for past findings.
Restorative Justice for Lower-Risk Adult Offenders	October 2006							See previous WSIPP publication for past findings.
Sex Offender Community Notification and Registration	June 2009							See previous WSIPP publication for past findings.
Sex Offender Treatment	October 2006							See previous WSIPP publication for past findings.

Exhibit 1

Monetary Benefits and Costs of Evidence-Based Public Policies

*Summary of policy topics assigned to the Washington State Institute for Public Policy by the Washington State Legislature
Estimates for Washington State, as of April 2012*

Topic Area/Program	Last Updated	Monetary Benefits			Costs	Summary Statistics		
		Total Benefits	Taxpayer	Non-Taxpayer		Benefits Minus Costs (net present value)	Benefit to Cost Ratio	Measured Risk (odds of a positive net present value)
Child Welfare								
<u>Nurse Family Partnership for Low-Income Families</u>	April 2012	\$22,781	\$6,219	\$16,562	(\$9,600)	\$13,181	\$2.37	80%
<u>Parent Child Interaction Therapy (PCIT) for Families in the Child Welfare System</u>	April 2012	\$7,168	\$1,277	\$5,892	(\$1,551)	\$5,617	\$4.62	100%
<u>Intensive Family Preservation Services (Homebuilders)</u>	April 2012	\$6,942	\$3,759	\$3,183	(\$3,288)	\$3,655	\$2.11	99%
<u>SafeCare</u>	April 2012	\$1,501	\$278	\$1,223	(\$102)	\$1,399	\$14.65	100%
<u>Parents as Teachers</u>	April 2012	\$4,992	\$1,116	\$3,876	(\$4,227)	\$765	\$1.18	57%
<u>Alternative Response</u>	April 2012	\$852	\$257	\$595	(\$96)	\$756	\$8.88	100%
<u>Triple P Positive Parenting Program (System)</u>	April 2012	\$865	\$334	\$531	(\$143)	\$722	\$6.06	100%
<u>Other home visiting programs for at-risk mothers and children</u>	April 2012	\$5,138	\$1,233	\$3,904	(\$5,603)	(\$465)	\$0.92	44%
<u>Parent Child Home Program</u>	April 2012	\$3,920	\$1,082	\$2,838	(\$5,496)	(\$1,576)	\$0.71	38%
<u>Healthy Families America</u>	April 2012	\$2,589	\$1,165	\$1,424	(\$4,601)	(\$2,011)	\$0.56	26%
<u>Other Family Preservation Services (non-Homebuilders)</u>	April 2012	(\$902)	(\$208)	(\$693)	(\$3,046)	(\$3,948)	(\$0.30)	0%
Child welfare programs for which we have not calculated benefits and costs (at this time):								
<u>Family Team Decision Making</u>	April 2012							See linked document for meta-analytic results.
<u>Structured Decision Making Risk Assessment</u>	April 2012							See linked document for meta-analytic results.
Dependency (or Family Treatment) Drug Courts	July 2008							See previous WSIPP publication for past findings; update in process.
Flexible Funding via Title IV-E Waivers	July 2008							See previous WSIPP publication for past findings.
Subsidized Guardianship	July 2008							See previous WSIPP publication for past findings.
Circle of Security								Too few rigorous evaluations.
Project KEEP								Too few rigorous evaluations.
Promoting First Relationships								Too few rigorous evaluations.
Pre-K to 12 Education								
<u>Reading Recovery (K-12 Tutoring)</u>	April 2012	\$18,603	\$4,410	\$14,194	(\$1,895)	\$16,708	\$9.82	100%
<u>Early Childhood Education for Low Income 3- and 4-Year Olds</u>	April 2012	\$22,457	\$6,802	\$15,655	(\$7,523)	\$14,934	\$2.99	100%
<u>K-12 Tutoring by Peers</u>	April 2012	\$12,273	\$2,904	\$9,369	(\$1,016)	\$11,257	\$12.08	100%
<u>Tutoring (vs. No Tutoring) for English Language Learner Students</u>	April 2012	\$10,938	\$2,598	\$8,341	(\$1,362)	\$9,576	\$8.03	85%
<u>Special Literacy Instruction for English Language Learner Students</u>	April 2012	\$6,969	\$1,652	\$5,317	(\$282)	\$6,688	\$24.75	90%
<u>K-12 Tutoring by Adults</u>	April 2012	\$6,683	\$1,586	\$5,097	(\$1,992)	\$4,691	\$3.36	93%
<u>Teacher Induction Programs</u>	April 2012	\$3,648	\$866	\$2,783	(\$63)	\$3,585	\$57.79	88%
<u>K-12 Parent Involvement Programs</u>	April 2012	\$3,575	\$850	\$2,725	(\$836)	\$2,739	\$4.28	68%
<u>National Board for Professional Teaching Standards (NBPTS) Certification Bonuses</u>	April 2012	\$1,802	\$428	\$1,374	(\$69)	\$1,734	\$26.28	100%
<u>Teacher Performance Pay Programs</u>	April 2012	\$295	\$69	\$225	(\$34)	\$261	\$8.62	63%
<u>Additional Day of K-12 Instructional Time</u>	April 2012	\$86	\$20	\$65	(\$27)	\$69	\$3.18	59%
<u>K-12 Educator Content-Specific Professional Development</u>	April 2012	\$19	\$4	\$14	(\$6)	\$12	\$3.01	52%
<u>K-12 Educator Professional Development (Non-Content Specific)</u>	April 2012	(\$1)	(\$0)	(\$0)	(\$6)	(\$7)	(\$0.11)	48%
<u>Even Start</u>	April 2012	(\$1,257)	(\$296)	(\$961)	(\$4,126)	(\$5,383)	(\$0.30)	14%
<u>Early Head Start</u>	April 2012	\$2,264	\$1,516	\$748	(\$10,420)	(\$8,156)	\$0.22	17%
Pre-K to 12 education programs for which we have not calculated benefits and costs (at this time):								
<u>Pre-K and Elementary Bilingual Instructional Programs (vs. English-based) for English Language Learners</u>	April 2012							See linked document for meta-analytic results.
<u>K-12 Teachers—Impact of Having a Graduate Degree</u>	April 2012							See linked document for meta-analytic results.
<u>K-12 Teachers—Impact of Having an In-subject Graduate Degree</u>	April 2012							See linked document for meta-analytic results.
<u>K-12 Teachers—Effectiveness by Years of Experience</u>	April 2012							See linked document for meta-analytic results.
Class Size	March 2007							See previous WSIPP publication for past findings.
Full-Day Kindergarten (vs. half-day)	March 2007							See previous WSIPP publication for past findings.
Increased Per-Student Expenditures	December 2007							See previous WSIPP publication for past findings.

Exhibit 1

Monetary Benefits and Costs of Evidence-Based Public Policies

*Summary of policy topics assigned to the Washington State Institute for Public Policy by the Washington State Legislature
Estimates for Washington State, as of April 2012*

Topic Area/Program	Last Updated	Monetary Benefits			Costs	Summary Statistics		
		Total Benefits	Taxpayer	Non-Taxpayer		Benefits Minus Costs (net present value)	Benefit to Cost Ratio	Measured Risk (odds of a positive net present value)
Children's Mental Health								
<u>Cognitive Behavioral Therapy (CBT)-Based Models for Child Trauma</u>	April 2012	\$8,929	\$2,779	\$6,151	\$317	\$9,246	n/e	100%
<u>Remote Cognitive Behavioral Therapy (CBT) for Anxious Children</u>	April 2012	\$7,653	\$2,265	\$5,388	\$741	\$8,393	n/e	96%
<u>Group Cognitive Behavioral Therapy (CBT) for Anxious Children</u>	April 2012	\$7,247	\$2,143	\$5,104	\$393	\$7,640	n/e	98%
<u>Individual Cognitive Behavioral Therapy (CBT) for Anxious Children</u>	April 2012	\$7,337	\$2,170	\$5,166	(\$734)	\$6,603	\$10.00	95%
<u>Eye Movement Desensitization and Reprocessing (EMDR) for Child Trauma</u>	April 2012	\$5,804	\$1,815	\$3,989	\$155	\$5,959	n/e	79%
<u>Parent Cognitive Behavioral Therapy (CBT) for Anxious Young Children</u>	April 2012	\$3,291	\$998	\$2,293	\$608	\$3,899	n/e	81%
<u>Cognitive Behavioral Therapy (CBT) for Depressed Adolescents</u>	April 2012	\$3,441	\$1,022	\$2,419	(\$484)	\$2,957	\$7.11	99%
<u>Brief Strategic Family Therapy (BSFT)</u>	April 2012	\$3,112	\$965	\$2,147	(\$512)	\$2,601	\$6.08	69%
<u>Parent Child Interaction Therapy (PCIT) for Children with Disruptive Behavior Problems</u>	April 2012	\$3,385	\$1,120	\$2,265	(\$1,335)	\$2,049	\$2.53	100%
<u>Triple P Positive Parenting Program: Level 4, Individual</u>	April 2012	\$3,621	\$1,195	\$2,426	(\$1,833)	\$1,788	\$1.98	92%
<u>Triple P Positive Parenting Program: Level 4, Group</u>	April 2012	\$2,112	\$696	\$1,416	(\$375)	\$1,737	\$5.63	100%
<u>Multisystemic Therapy (MST) for Youth with Serious Emotional Disturbance (SED)</u>	April 2012	\$7,443	\$2,885	\$4,558	(\$6,501)	\$942	\$1.14	68%
<u>Behavioral Parent Training (BPT) for Children with Disruptive Behavior Disorders</u>	April 2012	\$768	\$252	\$516	\$105	\$873	n/e	68%
<u>Families and Schools Together (FAST)</u>	April 2012	\$2,610	\$775	\$1,834	(\$1,759)	\$851	\$1.48	52%
<u>Behavioral Parent Training (BPT) for Children with ADHD</u>	April 2012	\$430	\$126	\$304	\$106	\$536	n/e	98%
<u>Incredible Years: Parent Training</u>	April 2012	\$2,482	\$797	\$1,685	(\$2,074)	\$408	\$1.20	61%
<u>Incredible Years: Parent Training + Child Training</u>	April 2012	\$2,429	\$774	\$1,655	(\$2,135)	\$295	\$1.14	59%
<u>Multimodal Therapy (MMT) for Children with Disruptive Behavior</u>	April 2012	\$656	\$222	\$435	(\$1,274)	(\$617)	\$0.52	42%
<u>Cognitive Behavioral Therapy (CBT) for Children with ADHD</u>	April 2012	(\$37)	(\$6)	(\$28)	(\$985)	(\$1,021)	(\$0.04)	3%
<u>Multimodal Therapy (MMT) for Children with ADHD</u>	April 2012	\$1,749	\$440	\$1,309	(\$8,343)	(\$6,593)	\$0.21	11%
Children's mental health programs for which we have not calculated benefits and costs (at this time):								
Intensive Case Management (Wraparound) for Youth with Emotional Disturbance	July 2008	See previous WSIPP publication for past findings.						
General Prevention Programs for Children and Adolescents								
<u>Youth Mentoring Programs (taxpayer costs only)</u>	April 2012	\$7,207	\$1,958	\$5,249	(\$1,479)	\$5,728	\$4.87	61%
<u>Good Behavior Game</u>	April 2012	\$4,790	\$1,337	\$3,454	(\$154)	\$4,637	\$31.19	100%
<u>Quantum Opportunities Program</u>	April 2012	\$30,311	\$8,737	\$21,574	(\$25,743)	\$4,568	\$1.18	60%
<u>Youth Mentoring Programs</u>	April 2012	\$8,333	\$2,348	\$5,985	(\$4,799)	\$3,534	\$1.74	58%
<u>Seattle Social Development Project</u>	April 2012	\$5,804	\$1,686	\$4,118	(\$3,026)	\$2,779	\$1.92	59%
<u>Guiding Good Choices</u>	April 2012	\$2,540	\$598	\$1,942	(\$870)	\$1,670	\$2.92	85%
<u>Behavioral Monitoring and Reinforcement Program</u>	April 2012	\$1,995	\$531	\$1,463	(\$1,276)	\$719	\$1.56	58%
<u>Promoting Alternative Thinking Strategies (PATHS)</u>	April 2012	(\$19)	(\$6)	(\$13)	(\$115)	(\$134)	(\$0.17)	23%
<u>Strengthening Families for Parents and Youth 10-14</u>	April 2012	\$696	\$213	\$483	(\$1,077)	(\$381)	\$0.65	7%
<u>Children's Aid Society--Carrera</u>	April 2012	\$7,184	\$2,381	\$4,802	(\$14,220)	(\$7,036)	\$0.51	37%
<u>CASASTART</u>	April 2012	(\$1,574)	(\$385)	(\$1,188)	(\$6,806)	(\$8,380)	(\$0.23)	0%
<u>Fast Track prevention program</u>	April 2012	\$1,953	\$450	\$1,503	(\$58,747)	(\$56,794)	\$0.03	0%

Exhibit 1
Monetary Benefits and Costs of Evidence-Based Public Policies

*Summary of policy topics assigned to the Washington State Institute for Public Policy by the Washington State Legislature
 Estimates for Washington State, as of April 2012*

Topic Area/Program	Last Updated	Monetary Benefits			Costs	Summary Statistics		
		Total Benefits	Taxpayer	Non-Taxpayer		Benefits Minus Costs net present value	Benefit to Cost Ratio	Measured Risk (odds of a positive net present value)
Substance Abuse								
<u>Motivational Interviewing / Motivational Enhancement Therapy for Alcohol Abuse</u>	April 2012	\$9,164	\$1,926	\$7,238	(\$206)	\$8,957	\$44.38	100%
<u>Motivational Interviewing / Motivational Enhancement Therapy for Smoking</u>	April 2012	\$7,949	\$295	\$7,654	(\$206)	\$7,743	\$38.49	99%
<u>Brief Alcohol Screening and Intervention for College Students (BASICS)</u>	April 2012	\$3,110	\$771	\$2,339	(\$226)	\$2,883	\$13.75	97%
<u>Motivational Interviewing / Motivational Enhancement Therapy for Cannabis Abuse</u>	April 2012	\$2,388	\$691	\$1,697	(\$206)	\$2,182	\$11.58	100%
<u>Motivational Interviewing / Motivational Enhancement Therapy for Illicit Drug Abuse</u>	April 2012	\$2,023	\$593	\$1,430	(\$207)	\$1,816	\$9.78	97%
<u>Life Skills Training</u>	April 2012	\$1,290	\$289	\$1,001	(\$34)	\$1,256	\$37.52	100%
<u>Project Towards No Drug Abuse (TND)</u>	April 2012	\$123	\$31	\$92	(\$14)	\$109	\$8.61	76%
<u>Project STAR</u>	April 2012	\$582	\$151	\$431	(\$489)	\$93	\$1.19	71%
<u>Project ALERT</u>	April 2012	\$7	\$2	\$5	(\$145)	(\$138)	\$0.05	1%
Substance abuse prevention and treatment programs for which we have not calculated benefits and costs (at this time):								
All Stars	July 2004							See previous WSIPP publication for past findings.
DARE	July 2004							See previous WSIPP publication for past findings.
Minnesota Smoking Prevention Program	July 2004							See previous WSIPP publication for past findings.
Project Northland	July 2004							See previous WSIPP publication for past findings.
Project Towards No Tobacco Use	July 2004							See previous WSIPP publication for past findings.
Adult Mental Health								
<u>Cognitive Behavioral Therapy (CBT) for Adult Anxiety</u>	April 2012	\$17,731	\$4,938	\$12,793	(\$341)	\$17,390	\$52.01	97%
<u>Cognitive Behavioral Therapy (CBT) for Adult Depression</u>	April 2012	\$15,632	\$4,619	\$11,013	(\$227)	\$15,405	\$68.90	100%
Adult mental health treatment programs for which we have not calculated benefits and costs (at this time):								
Day Programs for Mentally Ill Adults								Review in process.
Remote Cognitive Behavioral Therapy								Review in process.
Treatments for Post-Traumatic Stress Disorder								Review in process.
Eye Movement Desensitization and Reprocessing								Review in process.
Primary Care Interventions for Depression								Review in process.
Public Health								
See Technical Appendix I for meta-analytic results for prevention programs targeting teen pregnancy and obesity. We have not have not completed our computation of benefits and costs for these programs.								
Teen Pregnancy Prevention:								
<u>Postponing Sexual Involvement</u>	April 2012							See linked document for meta-analytic results.
<u>School-Based Service Learning</u>	April 2012							See linked document for meta-analytic results.
<u>School-based Sexual Education</u>	April 2012							See linked document for meta-analytic results.
<u>Teen Outreach Program</u>	April 2012							See linked document for meta-analytic results.
<u>Adolescent Sibling Pregnancy Prevention</u>	April 2012							See linked document for meta-analytic results.
Obesity Prevention:								
<u>School programs for healthy eating to prevent obesity</u>	April 2012							See linked document for meta-analytic results.
<u>School programs for physical activity to prevent obesity</u>	April 2012							See linked document for meta-analytic results.
<u>School programs for healthy eating & physical activity to prevent obesity</u>	April 2012							See linked document for meta-analytic results.
Obesity prevention programs for which we have not calculated meta-analytic results (at this time):								
Early child care centers & homes nutrition & physical activity programs								Too few rigorous evaluations.
Taxes on sweetened beverages and snack food								Too few rigorous evaluations.
Nutrition labeling on menus & posting nutritional information								Too few rigorous evaluations.

Exhibit 1

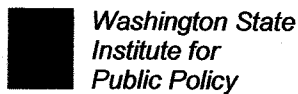
Monetary Benefits and Costs of Evidence-Based Public Policies

*Summary of policy topics assigned to the Washington State Institute for Public Policy by the Washington State Legislature
Estimates for Washington State, as of April 2012*

Topic Area/Program	Last Updated	Monetary Benefits		Costs	Summary Statistics		
Benefits and costs are life-cycle present-values per participant, in 2011 dollars. The programs are listed by major topic area, although some programs achieve benefits in multiple areas. Also, some programs achieve benefits that we cannot monetize; see linked documents for program-specific details.		Total Benefits	Taxpayer	Non-Taxpayer	Benefits Minus Costs (net present value)	Benefit to Cost Ratio	Measured Risk (odds of a positive net present value)
Housing							
See Technical Appendix I for meta-analytic results for housing programs for offenders returning to the community and adults with mental illness. We have not have not completed our computation of benefits and costs for these programs.							
<u>Housing Supports for Offenders Returning to the Community</u>	April 2012	See linked document for meta-analytic results.					
<u>Housing Support for Adults With Mental Illness</u>	April 2012	See linked document for meta-analytic results.					
<u>Housing Supports for Serious Violent Offenders</u>	April 2012	See linked document for meta-analytic results.					
Notes to Exhibit 1							
¹ Benefit to cost ratios cannot be computed in every case; we list "n/e" for those that cannot be reliably estimated.							
² Institutions = state institutionalized juvenile justice populations							

For further information, contact Stephanie Lee at slee@wsipp.wa.gov

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The Washington Legislature created the Washington State Institute for Public Policy in 1983. The Institute is governed by a Board of Directors that represents the legislature, governor, and public universities. The Board guides the development of all Institute activities. The mission of the Institute is to assist policymakers, particularly those in the legislature, in making informed judgments about important, long-term issues facing Washington State.

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Trial outcomes

For detailed findings on the three randomized, controlled trials of the Nurse-Family Partnership model, please refer to the published research below.

Elmira trial

Improving the Delivery of Prenatal Care and Outcomes of Pregnancy: A Randomized Trial of Nurse Home Visitation

David L. Olds, Charles R. Henderson, Jr, Robert Tatelbaum and Robert Chamberlin

Pediatrics, 1986;77:16-28

Preventing Child Abuse and Neglect: A Randomized Trial of Nurse Home Visitation

David L. Olds, Charles R. Henderson, Jr, Robert Chamberlin and Robert Tatelbaum

Pediatrics, 1986;78:65-78

Does prenatal and infancy nurse home visitation have enduring effects on qualities of parental caregiving and child health at 25 to 50 months of life?

David L. Olds; Charles R. Henderson Jr; Harriet Kitzman.

Pediatrics. 1994;93(1):89-98.

Long-term Effects of Home Visitation on Maternal Life Course and Child Abuse and Neglect: Fifteen-year Follow-up of a Randomized Trial

David L. Olds; John Eckenrode; Charles R. Henderson Jr.; Harriet Kitzman; Jane Powers; Robert Cole; Kimberly Sidora; Pamela Morris; Lisa M. Pettitt; Dennis Luckey.

JAMA. 1997;278(8):637-643.

Long-term Effects of Nurse Home Visitation on Children's Criminal and Antisocial Behavior: Fifteen-Year Follow-up of a Randomized Controlled Trial

David Olds; Charles R. Henderson Jr.; Robert Cole; John Eckenrode; Harriet Kitzman; Dennis Luckey; Lisa Pettitt; Kimberly Sidora; Pamela Morris; Jane Powers.

JAMA. 1998;280:1238-1244.

Interview with Dr. David Olds regarding his reanalyzed findings

January 23, 2006 (Unpublished clarification on Elmira Y15 follow-up findings)

Preventing Child Abuse and Neglect With a Program of Nurse Home Visitation The Limiting Effects of Domestic Violence

John Eckenrode; Barbara Ganzel; Charles R. Henderson Jr.; Elliott Smith; David L. Olds; Jane Powers; Robert Cole; Harriet Kitzman; Kimberly Sidora.

JAMA. 2000;284:1385-1391.

Long-term Effects of Prenatal and Infancy Nurse Home Visitation on the Life Course of Youths 19-Year Follow-up of a Randomized Trial

John Eckenrode; Mary Campa; Dennis W. Luckey; Charles R. Henderson Jr.; Robert Cole; Harriet Kitzman; Elizabeth Anson; Kimberly Sidora-Arcoleo; Jane Powers; David L. Olds.

Arch Pediatr Adolesc Med. 2010;164(1):9-15.

Memphis trial

Effect of Prenatal and Infancy Home Visitation by Nurses on Pregnancy Outcomes, Childhood Injuries, and Repeated Childbearing: A Randomized Controlled Trial

Harriet Kitzman; David L. Olds; Charles R. Henderson Jr.; Carole Hanks; Robert Cole; Robert Tatelbaum; Kenneth M. McConnochie; Kimberly Sidora; Dennis W. Luckey; David Shaver; Kay Engelhardt; David James; Kathryn Barnard.

JAMA. 1997;278(8):644-652

Enduring Effects of Nurse Home Visitation on Maternal Life Course: A Three-Year Follow-up of a Randomized Trial

Harriet Kitzman; David L. Olds; Kimberly Sidora; Charles R. Henderson Jr.; Carole Hanks; Robert Cole; Dennis W. Luckey; Jessica Bondy; Kimberly Cole; Judith Glazner.

JAMA. 2000;283:1983-1989.

Effects of Nurse Home-Visiting on Maternal Life Course and Child Development: Age Six Follow-up Results of a Randomized Trial

David L. Olds; Harriet Kitzman; Robert Cole; JoAnn Robinson; Kimberly Sidora; Dennis W. Luckey; Charles R. Henderson Jr.; Carole Hanks; Jessica Bondy; John Holmberg.

Pediatrics. 2004;114(6):1550-1559.

Effects of Nurse Home Visiting on Maternal and Child Functioning: Age Nine Follow-up of a Randomized Trial

David L. Olds; Harriet J. Kitzman; Carole Hanks; Robert Cole; Elizabeth Anson; Kimberly Sidora-Arcoleo; Dennis W. Luckey; Charles R. Henderson, Jr.; John Holmberg; Robin A. Tutt; Amanda J.



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Stevenson; Jessica Bondy.
Pediatrics. 2007;120:e832-e845.

[Enduring Effects of Prenatal and Infancy Home Visiting by Nurses on Children](#)

Harriet J. Kitzman; David L. Olds; Robert E. Cole; Carole A. Hanks; Elizabeth A. Anson; Kimberly J. Arcoletto; Dennis W. Luckey; Michael D. Knudtson; Charles R. Henderson Jr; John R. Holmberg.
Arch Pediatr Adolesc Med. 2010;164(5):412-418.

[Enduring Effects of Prenatal and Infancy Home Visiting by Nurses on Maternal Life Course and Government Spending](#)

David L. Olds; Harriet J. Kitzman; Robert E. Cole; Carole A. Hanks; Kimberly J. Arcoletto; Elizabeth A. Anson; Dennis W. Luckey; Michael D. Knudtson; Charles R. Henderson Jr; Jessica Bondy; Amanda J. Stevenson.
Arch Pediatr Adolesc Med. 2010;164(5):419-424.

Denver trial

[Home Visiting by Paraprofessionals and by Nurses: A Randomized Controlled Trial](#)

David L. Olds, JoAnn Robinson; Ruth O'Brien; Dennis W. Luckey; Lisa M. Pettitt; Charles R. Henderson Jr.; Rosanna K. Ng; Karen L. Sheff; John Korfmacher; Susan Hiatt; Ayelet Talmi.
Pediatrics. 2002;110(3):486-496.

[Effects of Home Visits by Paraprofessionals and by Nurses: Age Four Follow-up Results of a Randomized Trial](#)

David L. Olds; JoAnn Robinson; Lisa M. Pettitt; Dennis W. Luckey; John Holmberg; Rosanna K. Ng; Kathy Isacks; Karen L. Sheff; Charles R. Henderson Jr.
Pediatrics. 2004;114(6):1560-8.

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Proven effective through extensive research.

From a healthy babies program to crime prevention, Nurse-Family Partnership is validated by research.

A cornerstone of Nurse-Family Partnership is the extensive research on the model conducted over the last three decades. Randomized, controlled trials were conducted with three diverse populations beginning in Elmira, New York, in 1977; in Memphis, Tennessee, in 1988; and in Denver, Colorado, in 1994. All three trials targeted first-time, low-income mothers. Follow-up research continues today, studying the long-term outcomes for mothers and children in these three trials.

The level of proven effectiveness demonstrated is unsurpassed in evidence-based home visitation programs. The program effects that have the strongest evidentiary foundations are those that have been found in at least two of the three trials and are listed below.

Consistent program effects

- Improved prenatal health
- Fewer childhood injuries
- Fewer subsequent pregnancies
- Increased intervals between births
- Increased maternal employment
- Improved school readiness

About the research

A randomized, controlled trial is the most rigorous research method for measuring the effectiveness of an intervention. This type of trial is required by the U.S. Food and Drug Administration (FDA) for new drugs or medical devices to determine their effectiveness and safety before they are made available to the public. Because of their cost and complexity, these kinds of trials are not often used to evaluate complex health and human services.

In addition, important data from all home visits are continuously collected from Nurse-Family Partnership Implementing Agencies through the Nurse-Family Partnership National Service Office's web-based data collection system. These data are analyzed and returned to local Nurse-Family Partnership Implementing Agencies to provide them with information on their progress toward meeting Nurse-Family

**Proven results.**

The results of the three trials provide evidence that Nurse-Family Partnership makes an important difference in the lives of children, families, and communities. For more detailed findings, see published research on the program's three randomized, controlled trials.



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Partnership's implementation benchmarks in improving maternal and child health.



Help improve pregnancy outcomes
Controlled trials have show that our programs improve pregnancy outcomes.
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Unsurpassed evidence of effectiveness.

Nurse-Family Partnership is validated by research, yet continuously improved.

Over more than three decades, Nurse-Family Partnership has been developed, tested, and replicated in community settings. This work has been founded on four principles:

1. Develop the program well before testing it
2. Test it thoroughly before offering it for public investment
3. Replicate it carefully
4. Improve it continuously.

This approach has contributed to the NFP program being identified as the only early childhood program that meets the [Coalition for Evidence-Based Policy's](#) "Top Tier" of evidence¹; as the program with the strongest evidence that it prevents child abuse and neglect²; and as a program that produces significant economic return on investment.^{3,4}

Program founder Dr. David Olds, his research team, and the Nurse-Family Partnership National Service Office staff believe they have a responsibility to the families in the program — a responsibility to know whether Nurse-Family Partnership actually improves maternal life course and child health and development. It is also a responsibility to society to know if taxpayers' dollars produce returns on investment. The evidence is clear: Nurse-Family Partnership delivers on both grounds.

1. "Social Programs That Work." Coalition for Evidence-Based Policy.

2. MacMillan H, Wathen L, Barlow NC, Fergusson J, Leventhal DM, Tausig JM, Heather N. Interventions to prevent child maltreatment and associated impairment. *Lancet* 2008; 1-17.

3. Aos S, Lieb R, Mayfield J, Miller M, Pennucci A. Benefits and costs of prevention and early intervention programs for youth. *Washington State Institute for Public Policy* 2004; 1-20.

4. Karoly LA, Kilburn MR, Cannon JS. Early childhood interventions: Proven results, future promise. RAND Corporation 2005.

 <p>Help improve pregnancy outcomes Controlled trials have shown that our programs improve pregnancy outcomes. More »</p>	 <p>Newsletter Sign-up Register to receive the NewsLink e-newsletter. Sign up today »</p>
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Better Pregnancy Outcomes.

Nurse-Family Partnership's first stated goal is improved pregnancy outcomes: healthier mothers who can deliver healthier babies.

Nurse-Family Partnership is a program of prenatal and infancy home visiting for low-income, first-time mothers and their families. The nurses begin visiting their clients as early in pregnancy as possible, helping the mother-to-be make informed choices for herself and her baby. Nurses and moms discuss a wide range of issues that affect prenatal health — from smoking cessation, to healthy diets, to information on how to access proper healthcare professionals. It's this trusted, expert guidance that has been proven to lead to healthier pregnancies.

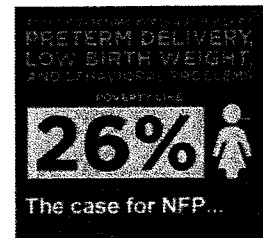
Among the improvements in pregnancy outcomes that have been observed in the randomized, controlled trials of the program are:

- Decreases in prenatal cigarette smoking
- Fewer hypertensive disorders of pregnancy
- Fewer closely-spaced subsequent pregnancies

Prenatal health problems and exposures to substances can compromise the health of the fetus, and especially the developing fetal brain. Prenatal tobacco exposure, for example, increases the risk of preterm delivery, low birth-weight, behavioral problems, and adolescent crime, and is substantially more prevalent in low-income than high-income women.^{1,2} Preterm delivery and low birth-weight, in turn, are the leading contributors to infant mortality.

In the Denver trial of the Nurse-Family Partnership program, nurse-visited women identified as smokers at registration had greater reductions in the biochemical marker of tobacco use than did women identified as smokers in the control group.³ Corresponding effects were found in the Elmira trial.⁴

Nurse-visited women in the Elmira trial also had diets that improved significantly more over the course of pregnancy than did women in the control group, and had significantly fewer kidney infections than their control group counterparts. In Memphis, nurse-visited women had significantly fewer diagnoses of pregnancy-induced hypertension, a condition that can compromise the health of the mother and the developing fetus.





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The amount of time between pregnancies also has a strong effect on the health of children. Babies born within 27 months of their older siblings are more likely to die and to have health and developmental problems than are those born with larger intervals between births. In all three trials, nurse-visited women had longer intervals between the births of first and second children, due to better pregnancy planning.

1. Kramer MS. Determinants of low birth weight: Methodological assessment and meta-analysis. *Bulletin of the World Health Association* 1987; 65:667-737.
2. Wakschlag LS, Pickett KE, Cook E Jr., Benowitz NL, Leventhal BL. Maternal smoking during pregnancy and severe antisocial behavior in offspring: A review. *Am J Public Health* 2002; 92(6):966-974.
3. Olds DL, Robinson J, O'Brien R, Luckey DW, Pettit LM, Henderson CR Jr., Ng RK, Sheff KL, Korfmacher J, Hiatt S, Talmi A. Home visiting by paraprofessionals and by nurses: a randomized, controlled trial. *Pediatrics* 2002; 110(3):486-496.
4. Olds DL, Henderson CR Jr., Tafelbaum R, Chamberlin R. Improving the delivery of prenatal care and outcomes of pregnancy: a randomized trial of nurse home visitation. *Pediatrics* 1986; 77(1):16-28.

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Preventing child abuse and neglect.

Nurse-Family Partnership is often cited as THE intervention for preventing child abuse and neglect.

The evidentiary standards for the Nurse-Family Partnership program are among the strongest available for preventive interventions offered for public investment. In fact, in medical and scientific journals, Nurse-Family Partnership is most often cited as the most effective intervention to prevent child abuse and neglect, which contributes to childhood injury. Injury, in turn, is the leading cause of death for children from age one to early adulthood.

The results from the Memphis trial document the young lives saved through Nurse-Family Partnership. While most children survive abuse and neglect, the legacy is often devastating, frequently leading to lifelong struggles. For these reasons, many in the law enforcement community across the nation praise Nurse-Family Partnership as a key prevention program.

Among the reduction in child abuse and neglect and injury outcomes that have been observed in at least two of the three randomized, controlled trials of the program are:

- Reductions in child abuse and neglect
- Reduction in health-care encounters for injuries

In the Elmira trial (where families have been followed the longest), there were long-term effects on reducing state-verified rates of child abuse and neglect (a 48% reduction¹). Also in the Elmira trial, there was a 56% relative reduction in emergency department encounters for injuries and ingestions during the children's second year of life.² In the Memphis trial, there was a 28% relative reduction in all types of health care encounters for injuries and ingestions, and a 79% relative reduction in the number of days that children were hospitalized with injuries and ingestions during children's first two years.³

In both of these trials, the impact of the program on injuries was more pronounced among children born to mothers with fewer psychological resources to manage well the care of their children while living in concentrated social disadvantage.

In addition, in the Memphis trial, children in the control group, as a trend, were 4.5 times more likely to die in the first nine years of life as were children who had been visited by nurses, a difference in mortality



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accounted for by deaths due to prematurity, Sudden Infant Death Syndrome, and injuries.⁴

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Improve school readiness.

Early language development and school performance improvements in the most at-risk families.

Children who are exposed to substances during pregnancy, maltreated, or cared for poorly early in life have difficulty with learning, memory, and early language development. It is no surprise to learn these children quickly fall behind in school functioning. But healthy pregnancies and care beginning at the earliest age can make a difference.

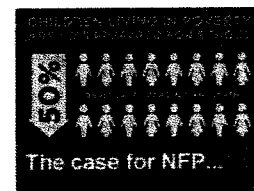
Nurse-Family Partnership can help ensure school readiness for young children born into families at risk, and prevent poor school starts that can lead to a lifelong struggle with educational achievement.

When mothers have more difficulty caring well for their children because they suffer from symptoms of depression, limited intellectual functioning and diminished belief in their ability to manage their lives, and they are surrounded by social disadvantage, research on the Nurse-Family Partnership shows that their nurse-visited children fare better in cognitive and language development, and score higher on achievement test scores in reading and math than their control-group counterparts.

Among the improvements in school readiness observed for children born to low-resource mothers in at least two of the three randomized, controlled trials of the program are:

- Improvements in language development
- Improvements in academic achievement test scores

Children's early language and cognitive development are associated with school performance and later earnings. In the Memphis trial, nurse-visited children born to mothers with low psychological resources (higher levels of depression, anxiety, and lower levels of intellectual functioning and sense of mastery over their lives) had better academic achievement in the first six years of elementary school compared to their counterparts in the control group.¹ In the Denver trial, nurse-visited four-year olds born to mothers with low psychological resources had better language development and ability to control their impulses than did their control-group counterparts.² These outcomes were seen among the most at-risk families; there were no benefits of the program for these types of outcomes among children born to mothers with relatively high psychological resources





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(those with greater wherewithal to manage caring for their children while living in poverty).

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Changes in the mother's life course.

Increase families' economic self-sufficiency and reduce government costs at the same time.

While working with their nurse home visitor, many of the young women in the Nurse-Family Partnership program set goals for themselves for the very first time. The nurses call it "finding your heart's desire" and know that goal setting is the first step toward accomplishment. Others look at this transformation and simply call it success.

One of the Nurse-Family Partnership program's three stated goals is economic self-sufficiency for the family. The program's two other goals are better pregnancy outcomes and healthy child development — foundations that help the family be prepared to succeed economically.

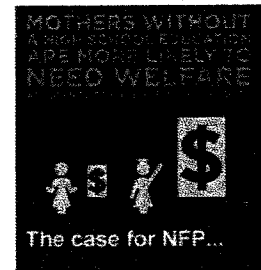
Research shows that Nurse-Family Partnership does, indeed, improve maternal life course. Nurses help the mother to feel empowered to make sound choices about her education, workplace participation, partner relationships, and the timing of subsequent pregnancies that enable her to financially take better care of herself and her child. That, in turn, brings down spending on social and other government program costs.

Among the improvements in low-income, unmarried mothers' economic self-sufficiency that have been observed in at least two of the three randomized, controlled trials of the program are:

- Reduction in use of welfare and other government assistance
- Greater employment for the mothers
- Increase in father presence and partner stability
- Fewer closely-spaced subsequent pregnancies

Low-income parents often need welfare assistance during their early years of caring for their children, but long-term reliance on government support can interfere with families' self-sufficiency. In the Elmira trial, nurse-visited low-income, unmarried women used government assistance for fewer months than did women in the control group.¹ In the Memphis trial, by child age 12, there was a \$12,300 difference between the nurse-visited and control groups in the cost of cash assistance, food stamps, and Medicaid that exceeded the cost of the program, after discounting and adjusting costs to the same year.²

The program impact on use of welfare did not hold in the Denver trial,



which began just before federal welfare reform was passed and just as the U.S. economy moved into a period of rapid growth in the late 1990s. Nurse-visited women in the Denver trial did, however, improve their economic self-sufficiency to a greater extent than did women in the control group.³

Families' economic resources are predictive of a wide range of indicators of child and family well-being. Nurse-visited low-income, unmarried women in the Elmira trial worked 82% more than their control-group counterparts through child age four;⁴ those in the Memphis trial were twice as likely to be employed at child age two,⁵ and in Denver, there were similar effects for nurse-visited women over time.³

Marriage and stable partner relationships contribute to better child and family functioning.^{6,7} Women in the Elmira trial who had been unmarried and from low socio-economic households at registration were more than twice as likely to be married 15 years following the birth of the first child than their control-group counterparts.⁸ In the Memphis trial, nurse-visited women were 60-70% more likely to be cohabiting with a partner or the child's father at child age five,⁹ and at child ages six and nine, nurse-visited women had more stable partner relationships than did women in the control group.^{10,11}

Closely spaced pregnancies make it harder for women to complete their educations and to make career advances.¹²⁻¹⁴ In all three trials, nurse-visited women had longer intervals between the births of first and second children, due to better pregnancy planning. In the Elmira trial, nurse-visited mothers who were unmarried and from low-income households at registration, compared to control-group counterparts, had a 12 ½ month greater interval between birth of the first and second child by the time the first child was four years of age⁴; in the Memphis and Denver trials, the corresponding increases in inter-birth intervals were 3.7 and 4.1 months.^{9,10}

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NFP Solutions

Preventing Child Abuse and Neglect With a Program of Nurse Home Visitation

The Limiting Effects of Domestic Violence

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THE PREVENTION OF CHILD ABUSE and neglect is an urgent public health concern. Annually, about 1 million abused children—15 of every 1000 children—are identified in the United States.¹ Home visitation has been widely promoted in recent years as a promising approach to preventing health and developmental problems among children, and thousands of home visitation programs have been started during the past decade.² The role of visitation in preventing child abuse and neglect perhaps has received the most attention. This emphasis stems in part from the magnitude of this social problem and the limited success of prevention efforts in the past. Policy makers and child advocates have actively promoted home-visit services^{3,4} despite limited evidence supporting their effectiveness in reducing child maltreatment.⁵

Much of the enthusiasm for home visitation as a tool to prevent child abuse

For editorial comment see p 1430.

Context Home visitation to families with young children has been promoted as an effective way to prevent child maltreatment, but few studies have examined the conditions under which such programs meet this goal.

Objective To investigate whether the presence of domestic violence limits the effects of nurse home visitation interventions in reducing substantiated reports of child abuse and neglect.

Design Fifteen-year follow-up study of a randomized trial.

Setting Semirural community in upstate New York.

Participants Of 400 socially disadvantaged pregnant women with no previous live births enrolled consecutively between April 1978 and September 1980, 324 mothers and their children participated in the follow-up study.

Interventions Families were randomly assigned to receive routine perinatal care (control group; n=184 participated in follow-up), routine care plus nurse home visits during pregnancy only (n=100), or routine care plus nurse home visits during pregnancy and through the child's second birthday (n=116).

Main Outcome Measures Number of substantiated reports over the entire 15-year period involving the study child as subject regardless of the identity of the perpetrator or involving the mother as perpetrator regardless of the identity of the child abstracted from state records and analyzed by treatment group and level of domestic violence in the home as measured by the Conflict Tactics Scale.

Results Families receiving home visitation during pregnancy and infancy had significantly fewer child maltreatment reports involving the mother as perpetrator ($P=.01$) or the study child as subject ($P=.04$) than families not receiving home visitation. The number of maltreatment reports for mothers who received home visitation during pregnancy only was not different from the control group. For mothers who received visits through the child's second birthday, the treatment effect decreased as the level of domestic violence increased. Of women who reported 28 or fewer incidents of domestic violence (79% of sample), home-visited mothers had significantly fewer child maltreatment reports during the 15-year period than mothers not receiving the longer-term intervention ($P=.01$). However, this intervention did not significantly reduce child maltreatment among mothers reporting more than 28 incidents of domestic violence (21% of sample).

Conclusions The presence of domestic violence may limit the effectiveness of interventions to reduce incidence of child abuse and neglect.

JAMA. 2000;284:1385-1391

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stems from the early findings of a randomized trial conducted more than 20 years ago in Elmira, NY. Home visitation by nurses prenatally and for 2 years

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postnatally resulted in a significant reduction in the rate of verified Child Protective Services (CPS) cases among a subsample of poor, unmarried teenaged mothers when the children were aged 2 years.⁶ Four percent of the nurse-visited families had a verified maltreatment report before the child's second birthday, in contrast to 19% in a comparison group receiving routine perinatal care. Support continued for home visitation despite the fact that differences in child maltreatment were no longer significant by the time the children in the Elmira trial reached age 4 years,⁷ perhaps because of increased surveillance of the families by the nurses.⁸

A recent review offers ambiguous support for the relation between home visitation and reductions in child maltreatment.² The findings from several large-scale home-visitation efforts have shown disappointing short-term results in reducing family violence and child maltreatment.^{4,9} A 15-year follow-up study of the Elmira trial families, however, provided the first evidence from a randomized trial for the long-term effects of home visitation on reducing child maltreatment.¹⁰ Results from the follow-up showed that nurse-visited families had half as many child maltreatment reports as families in the comparison group.

In addition to assessing the impact of home-visitation services on child maltreatment, it is also important to specify for whom and under what conditions these services are effective. Preventive interventions often find that treatment effects for certain outcomes vary across subgroups of study participants.^{11,12} In this study, we examine how domestic violence limits the effectiveness of the home-visitation program in preventing maltreatment. There are several reasons why domestic violence might interfere with the success of a home-visitation intervention. Research suggests that children in households with domestic violence may be at an increased risk for child maltreatment.¹³⁻¹⁶ Although some child maltreatment may be caused directly by the male perpetrators of domestic violence, other incidents may re-

sult from the effects of domestic violence on the mothers' caregiving capacities (eg, through injury, mental distress, and restricted mobility). Data¹⁷ also suggest that mothers who are in violent relationships often act violently themselves, either as initiators of the violence or in self-defense. Such reciprocally violent relationships may place children at even greater risk as violence spreads throughout the household. Children witnessing domestic violence may also exhibit more internalizing and externalizing problems,^{18,19} which, in turn, may make them more difficult to parent. We predicted that the intervention would be less effective in reducing child maltreatment in the presence of domestic violence.

METHODS

Details of the design of the original intervention can be found in earlier articles.^{6,10,20} A summary of the design is given here.

Setting and Participants

The original study was conducted in Elmira, a small, semirural community in upstate New York with a population of 40 000. Pregnant women were recruited from a free antepartum clinic sponsored by the county health department and from the offices of private obstetricians. From April 1978 through September 1980, 500 consecutive eligible women were invited to participate. Women were actively recruited for the study if they had no previous live births, registered in the study prior to the 25th week of gestation, and were either young (<19 years at registration), unmarried, or of low socioeconomic status (Medicaid status or no private insurance). Exactly 400 of the 500 eligible women enrolled in the study. Eighty-five percent of the final sample had at least 1 of the 3 risk characteristics used for recruitment: 47% were younger than age 19 years, 62% were unmarried, and 61% came from households classified as of low socioeconomic status.

There were no differences in the age, education, or marital status of those

women who chose to enroll vs those who declined, except that 80% of the whites agreed to participate vs 96% of the nonwhites (almost all African-Americans). After completing the informed consent and baseline interviews, women were stratified by sociodemographic characteristics and randomized to 1 of 4 treatment groups.

Treatment Groups

Families in treatment group 1 (n=94) were provided with sensory and developmental screening for the study child at ages 12 and 24 months. Based on these screenings, the children were referred for further clinical evaluation and treatment when needed. Families in treatment group 2 (n=90) received the same screening services offered to those in treatment 1, plus free transportation for prenatal and well-child care through the child's second birthday. Because there were no differences between those in the 2 treatment groups in use of prenatal and well-child care (both groups had high rates of completed appointments), they were combined to form a single comparison group. Families in treatment group 3 (n=100) were provided with the screening and transportation services offered to treatment 2, but were also assigned a nurse who visited them during pregnancy. Families in treatment group 4 (n=116) were provided the same services as those in treatment group 3 except that the nurse continued to visit through the child's second birthday.

During home visits, the nurses promoted 3 aspects of maternal functioning: health-related behaviors during pregnancy and the early years of the child's life, the care parents provide to their children, and maternal life-course development (family planning, educational achievement, and participation in the work force). Visits were held once every other week during pregnancy, once a week for the first 6 weeks postpartum, and then on a diminishing schedule until the children reached age 2 years. Further details on the intervention can be found in earlier publications.^{6,10,20,21} Nurses completed an average of 9 (range,

0-16) visits during the mother's pregnancy and 23 (range, 0-59) visits from the child's birth to second birthday.

Overview of 15-Year Follow-up Study

Of the 400 original mothers and their children, in 49 mother-child pairs either the child ($n=26$) or mother ($n=2$) had died, the child had been adopted ($n=15$), or the parents had requested no additional participation ($n=6$). This left 351 eligible mother-child pairs for the follow-up study. Assessments were completed for 324 of these pairs, representing 81% of those women who were originally randomized and 92% of those eligible for follow-up. The number of completed interviews did not differ by treatment group. Interviews were conducted with the mothers, adolescents, and custodial parents of the adolescents (if the biological mother no longer had custody). Mothers were offered \$75 and children \$25 for completion of the 15-year assessments. Data gatherers were blinded to treatment assignment. Social service, school, and criminal justice records provided additional sources of data. Written consent for all study procedures was obtained from the mothers and children. All research procedures were reviewed and approved by the institutional review boards of Cornell University and the University of Rochester.

Assessments

Assessment procedures are described in previous publications.^{6,7,22} Registration information collected prior to randomization included assessments of the women's sociodemographic and personality characteristics, health-related behaviors, and health conditions. Women's household socioeconomic status was estimated with the Hollingshead 4-factor method (August Hollingshead, PhD, unpublished data, 1976). Families were classified into lower (levels III and IV) and higher household economic (levels I and II) status.

At the 15-year follow-up, mothers were interviewed using a life-history calendar designed to help them recall ma-

ajor life events (including births of subsequent children, marriages and partnerships, education, employment, moves, and housing arrangements). Women were also asked to estimate the total number of months that they received Aid to Families with Dependent Children, Medicaid benefits, and food stamps.

Mothers reported their exposure to domestic violence using the violence subscales of the Conflict Tactics Scale.²³ For the purpose of these analyses, we used a measure that consisted of the total number of times the mother reported having experienced any form of partner-perpetrated violence since the birth of the study child. Variables were also constructed reflecting frequency of major and minor violence as defined by Straus.²⁴ Minor violence included throwing items, pushing, and slapping. Major violence included kicking, biting, hitting with a hand or an object, beating, choking, threatening with a knife or gun, or use of a knife or gun.

Mothers provided consent for the research staff to review CPS records. Because program effects were hypothesized to be concentrated on the mother and her first-born child, only reports involving either the mother as perpetrator or the study child as subject were coded. Substantiated reports were abstracted to ascertain key features of the maltreatment incident. All New York State CPS records were searched, as well as those of most other states in which families resided during the 15-year period. Out-of-state CPS record reviews were not as complete owing to varying state policies on expunging records and releasing case-level information. Nevertheless, our search covered an average of 13.4 years of the 15-year period. There were no treatment differences in the amount of time searched.

The primary outcome variables for this analysis were the number of substantiated reports over the entire 15-year period involving the study child regardless of the identity of the perpetrator or involving the mother as per-

petrator regardless of the identity of the child. These 2 outcomes are not independent. We present both, not as distinct findings, but as alternative ways of understanding maltreatment. Finally, we constructed separate measures distinguishing type of maltreatment reports involving neglect only and reports including abuse only. There were not enough abuse cases to examine sexual and physical abuse separately.

Methods of Analysis

Analyses were conducted on all cases in which data were available, irrespective of degree of program participation. The model included a $3 \times 2 \times 2$ factorial structure: treatment (groups 1 and 2 vs 3 vs 4), maternal marital status (married vs unmarried at study registration), and social class (Hollingshead levels III or IV vs I or II at registration) and all interactions among these classification factors. It also included the covariates maternal age and educational level at registration and level of domestic violence in the family (number of incidents of violence) measured over the 15-year study period.

Regressions of maltreatment on violence were specified separately by levels of treatment (ie, the model included the interaction of treatment with violence). This model is an extension of that presented in our earlier analysis of abuse and neglect.¹⁰ Regressions of violence specified separately by marital status and social class, in addition to treatment, were also examined. These regressions were essentially homogeneous, and for reasons of parsimony, we present only the interactions of violence with treatment. Homogeneity of regressions was also examined for age and education.²⁵

Race of the mother and sex of the child were additional classification factors examined in deriving the final model. We also examined several other covariates for possible inclusion in the model, such as father employment status at study registration, but did not include these in the final model because they had no unique relationship to the outcomes.

Table 1. Adjusted Rates of Child Abuse and Neglect*

Treatment Group	Incidence†	Log Incidence†	Log Incidence Difference	P Value‡
CPS Reports Involving Mother as a Perpetrator, No.				
T1 and T2 (comparison)	0.65	-0.44	0.81	.01
T4 (intervention)	0.32	-1.26		
CPS Reports Involving Study Child, No.				
T1 and T2 (comparison)	0.73	-0.33	0.59	.04
T4 (intervention)	0.44	-0.93		

*CPS indicates Child Protective Services; T1, treatment group 1; T2, treatment group 2; and T4, treatment group 4. See "Treatment Groups" subsection for definition of treatment groups. Treatment group 3 is omitted from table because it was not found to differ from the control group. Rates are adjusted for socioeconomic status, marital status, maternal age, and maternal education. All tests were conducted with a Poisson log-linear model corrected for overdispersion.

†Incidence represents the mean number of infrequently occurring events within the stated period. Individual cases may have values greater than 1, although the range is small.

‡P value is for log incidence difference between T1 and T2 vs T4.

The abuse and neglect outcomes are in the form of count data. Results are reported as incidence and log incidence. We examined the distribution of the outcomes and, as in our earlier research,¹⁰ used a Poisson log-linear model, which best represents these data. Variables with a Poisson distribution have variance equal to the mean. In Poisson log-linear models, this assumption is frequently not met. When the variance is larger than the mean, the data are said to be overdispersed. Correction for overdispersion by scaling the SEs from overstating significance in statistical tests.^{26,27} All tests were corrected for overdispersion.

In the linear model in which tests of mean differences depend on the value of a covariate (ie, when regressions are nonhomogeneous), the situation can be shown pictorially by graphing the estimated regression lines for groups being compared. With the effects of other covariates and the classification effects subsumed in the intercept of the equations, the vertical distance between the regression lines represents the estimated mean difference at a given covariate value on the abscissa. A test of the mean difference can be carried out for any single specific value. Alternatively, a simultaneous region of significance over which the means differ statistically can be computed. Because the region provides information about a continuum of covariate values, the use of simultaneous statistical inference is required.²⁸⁻³⁰ In an approach similar to

that taken by Olds et al,⁶ we have extended the methods for simultaneous regions of significance to the generalized case, with log-link functions and Poisson error.

RESULTS

Treatment Effects on Child Abuse and Neglect

As previously reported, there were no differences at registration in background characteristics of those assigned to the treatment and control conditions.¹⁰

TABLE 1 shows the incidence rates for each of the maltreatment outcomes for the entire sample, without adjusting for violence and its interactions. Consistent with our earlier report,¹⁰ there were significantly fewer child maltreatment reports involving the mother as perpetrator ($P=.01$) or involving the study child ($P=.04$) for families receiving home visitations during pregnancy and infancy vs families not receiving home visitation. For both outcomes, the number of maltreatment reports for the group receiving home visitation only during pregnancy (treatment group 3) fell between the other groups and was not significantly different from the comparison group. Therefore, the remaining analyses focus on contrasts from the overall model involving treatment groups 1 and 2 vs treatment group 4.

Treatment Effects and Domestic Violence

Almost half (48%) of the mothers in this sample reported some form of domes-

tic violence since the birth of the study child (range, 0-225 incidents). For all women in the sample, the mean number of incidents over the 15 years was 22.2 (median, 1.0). For those women reporting any domestic violence, the mean number of incidents was 43.1 (median, 11.7). Home visitation had no impact on the incidence of domestic violence.

Prior to estimating the interaction between treatment group and domestic violence, we examined the co-occurrence of domestic violence and child maltreatment. Because the intervention affected the incidence of child maltreatment, the best estimate of the underlying level of co-occurrence in this population is obtained for families in the control group. For these women, 22.7% experienced domestic violence in the past 15 years and were also in families with at least 1 confirmed child maltreatment report. Although we found that the number of domestic violence incidents was positively associated with child maltreatment reports (FIGURE), this effect was not statistically significant in the models we estimated.

TABLE 2 summarizes the results of a model that includes the interaction of treatment with domestic violence for 13 outcome variables. The interaction is shown as the difference in the regressions of maltreatment on domestic violence for treatment groups 1 and 2 vs treatment group 4. For each of the 4 maltreatment outcomes listed in Table 2, there was a significant difference in the regressions on domestic violence across treatment conditions ($P=.04-.001$). To illustrate this interaction, the Figure shows separate estimated regression lines for these 2 treatment groups for maltreatment involving the study child. The treatment effect decreases as the level of domestic violence increases. There were significantly fewer cases of child maltreatment in the home-visited group among mothers who reported 28 or fewer incidents of violence over the 15-year period. Of the 112 women who reported at least 1 incident of domestic violence, 71 (63.4%) had 28 or fewer

incidents. Treatment effects were non-significant for mothers reporting more than 28 incidents of domestic violence over 15 years (21% of the entire sample of mothers in treatment groups 1, 2, and 4, and 36.4% of those who had reported at least 1 domestic violence incident).

Further Specification of the Limiting Effects of Domestic Violence

We examined the robustness of the interaction effect, tested a number of alternative explanations, and investigated possible underlying mechanisms.

We examined whether the effects of domestic violence varied as a function of its severity. Separate models were tested using measures of minor and major domestic violence as defined in the "Assessments" subsection. In each model, the interaction effect remained significant ($P = .01$ for both), indicating that the limiting effect of domestic violence was not restricted to the most severe forms of violence.

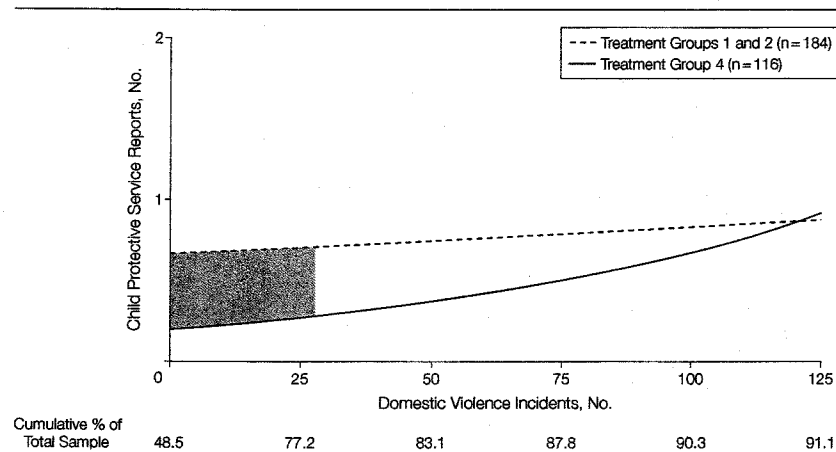
Finding a significant interaction effect when the maltreatment outcome focused on reports involving only mothers as perpetrators rules out the possibility that the effects observed were the result of the same partners committing violence against both the mothers and the children. We also examined whether the same effect held across types of maltreatment by estimating models in which the dependent variable was restricted to cases of neglect only, and cases where physical or sexual abuse (but no neglect) occurred. As shown in Table 2, domestic violence significantly moderated treatment effects for both sets of outcomes.

We also determined whether type of treatment interacted with domestic violence when predicting outcomes other than child maltreatment. We estimated models by using dependent variables previously associated with significant treatment effects in the follow-up study.^{10,20} These included life-course outcomes for the mother, such as number of subsequent children, months on welfare, impairments due to substance use,

and number of arrests, as well as life-course outcomes for the study children, such as number of runaway episodes and number of arrests or convictions. As shown in Table 2, there was little evidence that the presence of domestic violence had an impact on treatment effects for any other maternal or child outcomes.

We next examined whether women experiencing domestic violence may have been less engaged with the intervention, which, in turn, could have led to a diminished program effect. To the contrary, we found that for the women visited during pregnancy and their child's infancy, there was a small and nonsignificant positive correlation be-

Figure. Adjusted Number of Maltreatment Reports Involving Study Children by Treatment Group and Level of Domestic Violence



For definition of treatment groups see "Treatment Groups" subsection. Treatment groups 1 and 2 were the comparison group and treatment group 4, the intervention group. Figure shows domestic violence values, as calculated on Conflict Tactics Scale Violence subscales,²⁹ from 0 to 125, representing more than 90% of cases. Shading indicates $P < .05$ simultaneous region of significant treatment difference for maltreatment.

Table 2. Treatment Differences in Regressions on Domestic Violence for Maltreatment, Maternal Life-Course, and Child Life-Course Outcomes*

	$\beta \dagger$	χ^2	P Value
Maltreatment Variables			
Mother as perpetrator	-0.01	6.74	.01
Child as victim	-0.001	7.12	.01
Neglect without abuse	-0.01	4.12	.04
Abuse without neglect	-0.02	10.57	.001
Maternal Life-Course Variables			
Months on AFDC	-0.002	0.88	.35
Number of arrests	-0.001	0.04	.83
Number of subsequent children	-0.0001	0.004	.95
Substance use impairments‡	0.006	2.46	.12
Child Life-Course Variables			
Number of runaway episodes	0.006	1.67	.20
Number of arrests	-0.001	0.10	.75
Number of convictions	-0.006	2.52	.11
Number of sex partners	-0.004	1.20	.27
Number of days drank alcohol	0.005	2.10	.15

*AFDC indicates Aid to Families with Dependent Children. Rates adjusted for socioeconomic status, marital status, maternal age, and maternal education. All tests were conducted with a Poisson log-linear model corrected for overdispersion. $\dagger\beta$ indicates estimated differences in regressions between treatment groups 1 and 2 and treatment group 4. \ddagger One outlier was removed for the analysis of this variable.

tween domestic violence and number of prenatal and postnatal nurse visits ($r=0.13$), indicating that the presence of domestic violence was associated with slightly more, rather than fewer, nurse visits.

Finally, we examined possible mechanisms that may underlie the interaction effect. The approach was to identify variables representing changes that occurred as a result of the intervention and that might help to explain why domestic violence limited the effectiveness of the home-visitation program in preventing maltreatment. These are the same maternal life-course outcomes shown in Table 2. Adding these variables to the model for maltreatment that contained the interaction with violence did not significantly reduce the differences in the regressions. As such, these maternal life-course variables do not explain the observed interaction effects.

COMMENT

Our findings show that domestic violence represents an important part of the context for understanding the conditions under which a home-visitation intervention prevented child maltreatment. The interaction effect appears to be robust across alternative measures of both domestic violence and child maltreatment. It does not appear to reflect less engagement in the intervention on the part of women reporting domestic violence, nor does it reflect the perpetration of domestic violence and child maltreatment by the same individuals. The impact of the intervention on other maternal life-course and child outcomes was not affected in the same way by the level of domestic violence.

The data available to us did not yield further insight into the mechanisms that may explain the moderating effects of domestic violence. It is likely that domestic violence sets in motion a number of processes that compromise the parenting of the mother or other caretakers. Some may involve the mother's physical or psychological health at the time she is caring for her children. Domestic violence may also result in a

more chaotic or a less predictable environment for children, placing them at increased risk. Future research will be needed to clarify these alternative mechanisms.

There are important limitations of the present study. The intervention occurred during the late 1970s and early 1980s in a semirural New York State community. Care must be taken in generalizing our results to current interventions in other communities and with different populations. We enrolled a high-risk sample that may have experienced higher lifetime rates of domestic violence than samples drawn from lower-risk or more heterogeneous populations. For example, the National Violence Against Women Survey³¹ of a nationally representative sample of 8000 women used a modified version of the Conflict Tactics Scale and found that 22.1% of the women reported intimate partner violence at some time during their adult lives, about half the rate we have reported. Furthermore, the increased awareness in recent years of domestic violence as a social problem and the increased availability of services for battered women and their children may alter the relationships we have observed in our trial.

This report illustrates 1 element of a more general strategy for improving health and human services. By identifying groups of individuals for whom the program fails to affect targeted outcomes, approaches can be devised that may strengthen services. In the current case, we have learned that this program failed to prevent child abuse and neglect for 21% of the sample who experienced relatively higher levels of domestic violence. While issues of domestic violence have been addressed more systematically as the program evolved during the years, the current findings have led to the incorporation of even more explicit methods of addressing domestic violence^{32,33} and partner relationships³⁴ in the most recent generation of the program protocols. The promotion of partner communication is designed to strengthen the mother-partner relationship, while a do-

mestic violence assessment and education program is designed to address domestic violence effectively if it emerges. Both of these strategies have been tested previously in separate controlled studies.^{35,36} Whether such modifications will strengthen the impact of the program on child abuse and neglect will not be known until future trials of this program are conducted. Meanwhile, careful analyses that examine groups for which the program is more and less effective will enable policy makers to focus scarce resources on those who benefit the most and encourage the continuous search for more effective ways of serving those who fail to respond as expected.

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The doctor may . . . learn more about the illness from the way the patient tells the story than from the story itself.

—James B. Herrick (1861-1954)

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**Long-term Effects of Home Visitation
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and Child Abuse and Neglect**

Fifteen-Year Follow-up of a Randomized Trial

David L. Olds, PhD; John Eckenrode, PhD; Charles R. Henderson, Jr;
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Context.—Home-visitation services have been promoted as a means of improving maternal and child health and functioning. However, long-term effects have not been examined.

Objective.—To examine the long-term effects of a program of prenatal and early childhood home visitation by nurses on women's life course and child abuse and neglect.

Design.—Randomized trial.

Setting.—Semirural community in New York.

Participants.—Of 400 consecutive pregnant women with no previous live births enrolled, 324 participated in a follow-up study when their children were 15 years old.

Intervention.—Families received a mean of 9 home visits during pregnancy and 23 home visits from the child's birth through the second birthday.

Data Sources and Measures.—Women's use of welfare and number of subsequent children were based on self-report; their arrests and convictions were based on self-report and archived data from New York State. Verified reports of child abuse and neglect were abstracted from state records.

Main Results.—During the 15-year period after the birth of their first child, in contrast to women in the comparison group, women who were visited by nurses during pregnancy and infancy were identified as perpetrators of child abuse and neglect in 0.29 vs 0.54 verified reports ($P < .001$). Among women who were unmarried and from households of low socioeconomic status at initial enrollment, in contrast to those in the comparison group, nurse-visited women had 1.3 vs 1.6 subsequent births ($P = .02$), 65 vs 37 months between the birth of the first and a second child ($P = .001$), 60 vs 90 months' receiving Aid to Families With Dependent Children ($P = .005$), 0.41 vs 0.73 behavioral impairments due to use of alcohol and other drugs ($P = .03$), 0.18 vs 0.58 arrests by self-report ($P < .001$), and 0.16 vs 0.90 arrests disclosed by New York State records ($P < .001$).

Conclusions.—This program of prenatal and early childhood home visitation by nurses can reduce the number of subsequent pregnancies, the use of welfare, child abuse and neglect, and criminal behavior on the part of low-income, unmarried mothers for up to 15 years after the birth of the first child.

IN RECENT YEARS, home-visitation services have been promoted widely as a means of preventing a range of health and developmental problems in children from vulnerable families. The US Advisory Board on Child Abuse and Neglect, for example, has recommended that home-visitation services be made available to all parents of newborns as a means of preventing child abuse and neglect.¹

See also pp 644 and 680.

Many of these recommendations have been based on the results of a randomized trial of a comprehensive program of prenatal and early childhood home visitation by nurses that was conducted in Elmira, NY.²⁻¹¹ Findings from this trial indicated that the program reduced the rates of subsequent pregnancy, increased labor force participation, and reduced government spending for low-income unmarried women from the birth

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of the first child through the child's fourth birthday, ie, through 2 years after the program ended.^{8,9} Although the rates of state-verified cases of child maltreatment among high-risk families were reduced while the program was in operation (through age 2 years),⁵ the effects were attenuated during a 2-year period after the program ended,⁶ most likely because of increased surveillance for child abuse and neglect set in motion among the nurse-visited families.⁷ Children's health care encounters in which injuries were detected also were reduced from ages 1 through 4 years.^{5,6}

Although this program produced positive effects on maternal and child health from pregnancy through the child's fourth year of life,^{4,11} its long-term effects remain unexamined. The present study was conducted to determine the extent to which the beneficial effects of the program instituted early in the life cycle altered the life-course trajectories of the mothers through the child's 15th birthday. We examined the long-term effects of the program on 2 domains of maternal functioning: (1) maternal life course (subsequent number of children, use of Aid to Families With Dependent Children [AFDC], employment, substance abuse, and encounters with the criminal justice system) and (2) perpetration of child abuse and neglect. We hypothesized that the program effects, as in earlier phases of the study, would be greater for families in which the mothers experienced a larger number of chronic stressors and had fewer resources to manage the challenges of living in poverty and being a parent.

DESIGN AND METHODS

Setting

The study was originally conducted in and around Elmira, NY, a small city with a population of 40 000 in a semirural area of central New York State (NYS). Patients were recruited from a clinic offering free antepartum services sponsored by the county health department and the offices of private obstetricians.

Participants

From April 1978 through September 1980, 500 consecutive eligible women were invited to participate. Pregnant women were actively recruited for the study if they had no previous live births, could register in the study prior to the 25th week of gestation, and had at least one of the following sociodemographic risk characteristics: young age (<19 years at registration), unmarried, or low socioeconomic status (SES) (Medicaid status or no private insurance). To avoid creating a program stigmatized as being exclusively for

the poor, any woman who asked to participate and had no previous live birth was accepted into the study. Approximately 10% of the target population (low income, unmarried, or teenaged) was not recruited because of late registration for prenatal care, and another 10% was not recruited because they were not referred from the offices of private obstetricians.

Four hundred of the 500 women enrolled in the study. All enrollees completed approved informed consent procedures. There were no differences in the age, education, or marital status of women who chose to enroll and those who declined; there was a difference by race, with 80% of white women vs 96% of the African-American women agreeing to participate.

Eighty-five percent of the sample originally recruited had at least 1 of the 3 risk characteristics used for recruitment. Forty-eight percent were younger than 19 years, 62% were unmarried, and 59% were from households classified as low SES¹² at registration during pregnancy. Eleven percent of the sample was African American.

Treatment Conditions

The research design included 4 treatment conditions. Families randomized to treatment 1 (n=94) were provided sensory and developmental screening for the children at 12 and 24 months of age. Based on these screenings, the children were referred for further clinical evaluation and treatment when needed. Families randomized to treatment 2 (n=90) were provided the screening services offered those in treatment 1, plus free transportation (using a taxicab voucher system) for prenatal and well-child care through the child's second birthday. There were no differences between participants in treatments 1 and 2 in their use of prenatal and well-child care (both groups had high rates of completed appointments). Therefore, these 2 groups were combined to form a single comparison group as in earlier reports. Families randomized to treatment 3 (n=100) were provided the screening and transportation services offered those in treatment 2 in addition to being provided a nurse who visited them at home during pregnancy. Families randomized to treatment 4 (n=116) were provided the same services as those in treatment 3, except that the nurse continued to visit through the child's second birthday.

Randomization

Women were stratified by marital status, race, and 7 geographic regions within the county (based on census tract boundaries). At the end of the intake interview, women drew their treatment assignments from a deck of cards and placed them in a sealed envelope. The cards were transferred to a research as-

sociate who managed the randomization. The stratification was executed by using separate decks of cards for the groups defined by the women's race, marital status at intake, and, for white women, the geographic region in which they resided. To ensure reasonably balanced subclasses, the decks were reconstituted periodically to overrepresent those treatment groups with smaller numbers of subjects, a procedure similar to the Efron biased coin designs.¹³ Women in treatments 3 and 4 subsequently were assigned on a rotating basis, within their stratification blocks, to 1 of 5 nurse home visitors.

There were 2 deviations from this randomization procedure. First, 6 women who were enrolled were living in the same household as were other women who were already participating in the study. To avoid potential horizontal diffusion of the treatment in case of different assignments within households, the 6 new enrollees were assigned to the same treatment as their housemates. Second, during the last 6 months of the 30-month enrollment period, the number of cards representing treatment 4 was increased in each of the decks to enlarge the size of that group and to enhance the statistical power of the design to compare the infancy home-visitation program with treatments 1 and 2 on infant health and developmental outcomes. A thorough analysis conducted at earlier phases of the trial indicated that this slight confounding of treatments with time did not affect the treatment effects.

Program Plan and Implementation

The experimental home-visitation program was administered by Comprehensive Interdisciplinary Developmental Services, Inc, of Elmira. In the home visits, the nurses promoted 3 aspects of maternal functioning: (1) health-related behaviors during pregnancy and the early years of the child's life; (2) the care parents provided to their children; and (3) maternal personal life-course development (family planning, educational achievement, and participation in the workforce). In the service of these 3 goals, the nurses linked families with needed health and human services and attempted to involve other family members and friends in the pregnancy, birth, and early care of the child. The program was based on theories of self-efficacy, human ecology, and human attachment.¹⁴ The nurses used detailed assessments, record-keeping forms, and protocols to guide their work with families, but adapted the content of their home visits to the individual needs of each family. They provided a comprehensive educational program designed to promote parents' and other family mem-

bers' effective physical and emotional care of their children. The nurses also helped women clarify their goals and develop problem-solving skills to enable them to cope with the challenges of completing their education, finding work, and planning future pregnancies. Developing a close working relationship with the mother and her family, the nurses helped mothers identify small achievable objectives that could be accomplished between visits that, if met, would build mothers' confidence and motivation to manage the demands of caregiving and become economically self-sufficient. The nurses completed an average of 9 (range, 0-16) visits during the pregnancy and 23 (range, 0-59) visits from the child's birth to second birthday. Details of the program can be found elsewhere.^{14,15}

Overview of Follow-up Study

The present phase of the study consists of a longitudinal follow-up of those 400 families who were randomized to treatment and comparison conditions and in which the mother and child were still alive and the family had not refused participation in earlier phases. The flow of patients from recruitment through the 15-year follow-up is presented in Table 1. As this table indicates, we completed assessments at 15 years on 81% of participants originally randomized and on 90% of women for whom there was no miscarriage, stillbirth, death (infant, child, or maternal), or child adoption. There were no treatment differences in the rates of completed assessments at the 15-year follow-up. Table 1 also shows that reviews of children's Child Protective Service (CPS) records were completed for an average of 13.4 years for those cases on which 15-year interviews were conducted with the mother. There were no treatment differences in the number of years for which we had CPS data.

Statistical Power

Sample size and power were determined by the original design and subsequent attrition of subjects. Power calculations are given here for 3 key outcomes (number of months receiving AFDC, subsequent births, and verified reports of child abuse or neglect) with the assumption of $\alpha = .05$ and $\beta = .20$ (2-tailed tests); sample sizes as realized in the present study; and means and SDs obtained from the comparison subjects in the present study. The calculations were performed for the contrast of women in the comparison condition (treatment 1 + treatment 2) vs those in the nurse-visited-during-pregnancy-and-infancy condition (treatment 4)—for both the total sample and for the unmarried, low-SES subsample.

Table 1.—Profile of the Trial: Flow of Patients From Recruitment During Pregnancy Until 15 Years After Birth of First Child*

	Treatments 1 and 2 (n=184)	Treatment 3 (n=100)	Treatment 4 (n=116)
Program implementation			
Completed prenatal home visits, mean (range)	...	8.6 (0-16)	8.6 (0-16)
Completed postnatal home visits, mean (range)	22.8 (0-59)
Intervening years			
Fetal, infant, or child death	10	7	9
Child adopted†	7	6	2
Maternal death‡	1	1	0
15-y follow-up study			
Missing (mothers)	12	1	4
Refused to participate§			
Mothers	6	5	4
Adolescents	10	8	7
Completed assessments			
Mothers	148	79	97
Adolescents	144	77	94
Cases with CPS data	142	77	95
Years of complete CPS data, mean (SD) [range]	13.4 (3.2) [2.6-15.0]	13.3 (3.1) [2.9-15.0]	13.4 (3.1) [0.7-15.0]

*Of 500 eligible patients, 100 refused participation. The 400 participants were randomized to treatment conditions: treatments 1 and 2 were combined to form a comparison group; treatment 3, nurse visitation during pregnancy; and treatment 4, nurse visitation during pregnancy and infancy. Data are given as number, unless otherwise indicated.

†There were 2 adoptions in which interviews were conducted with the child but not the mother. They are not shown in this table.

‡For both cases in which the mother died, the adolescents were interviewed.

§Refusals include 8 mothers who refused to participate during earlier phases and were not approached for the 15-year follow-up.

||Child Protective Service (CPS) data were used to determine the number of state-verified reports of child abuse and neglect.

For the number of months receiving AFDC, a normal variable, we can detect a mean difference of 19 months in the total sample and 30 months in the higher-risk sample. For the number of subsequent births, also a normal variable, we can detect differences of 0.36 and 0.57 in the total and high-risk samples, respectively.

For the count of number of verified reports of abuse and neglect, the smallest detectable differences are 0.21 and 0.33, respectively. The actual analyses in this report use more fully specified models than those used for the power calculations, and thus have greater power.

Masking

The mothers were informed that they were being interviewed as part of a follow-up to their participation in a study in which they originally enrolled when they were pregnant with their first child. All data were gathered by staff members who had no access to the families' treatment assignments, except in a few cases in which the mothers inadvertently revealed that they were visited by a nurse. Staff members who gathered data were told that the 15-year follow-up study was designed to assess the long-range effects of prenatal and early childhood services, including home visitation by nurses. The principal investigators and statisticians had access to the families' treatment assignments, although the operationalization of vari-

ables was made explicitly without reference to this information.

Assessments and Definitions of Variables

Assessments conducted at earlier phases are specified in previous publications.^{5,6,8} Intake interviews, which were conducted with women before randomization, included assessments of women's sociodemographic and personality characteristics (including a short-form measure of the locus of control scale of Rotter¹⁶), health-related behaviors, and health conditions. Women's household SES was estimated by using the Hollingshead 4-factor method¹²; families were classified into low SES (III and IV) and higher SES (I and II) levels.

At the 15th-year interview, mothers completed a life-history calendar that was designed to help them recall major life events (such as births of additional children, marriages, employment, household moves, and housing arrangements). Women were asked to estimate the number of months that they used AFDC, Medicaid, and food stamps, as well as the number of times that they were arrested or convicted from the time of the birth of their first child to the child's 15th birthday.

Women also were asked a series of questions adapted from the National Comorbidity Survey¹⁷ regarding the impact of alcohol and other drug use on major aspects of their lives since the birth of their child. A variable was constructed

that summarized a count of 6 domains of women's lives that were affected by their use of alcohol (missing work, experiencing trouble at work, having a motor vehicle crash or traffic violation, having compromised care of their children, having received treatment). The same set of questions was repeated for their use of illegal and prescription drugs. The counts of domains affected by their use of alcohol and other drugs were summarized to create a "substance use behavioral impairment" scale with values ranging from 0 to 12.

Mothers provided consent for the research staff to review CPS records from states in which they resided during the interval from the birth of their first child (focal child) to that child's 15th birthday. All reports involving either the mother or the focal child were recorded.

Substantiated reports were abstracted to ascertain key features of the maltreatment incident. All NYS records were searched, as well as those of most other states in which families resided during the 15-year period. In some states, data were not available for the entire 15-year period because these states expunge their records on a periodic basis. A few other states prohibit the release of case-level information. Six cases had fewer than 4 years of CPS data, and although none was indicated for abuse or neglect, they are retained as valid cases for this analysis. As shown in Table 1, our search covered an average of more than 13 years of the 15-year period in each treatment group, and there were no treatment differences in the amount of time searched, either for the sample as a whole or for the low-SES, unmarried subgroups. The primary outcome variable reported herein is the total number of substantiated reports during the entire 15-year period involving the mother as perpetrator.

Mothers' records of arrests and criminal convictions were abstracted from the NYS Division of Criminal Justice Services, after the principal investigator (D.O.) signed a nondisclosure agreement. Cases were matched based on the women's names, birth dates, ethnicity, and Social Security numbers. Data on the number of arrests and convictions and types of offenses were abstracted from this database. Arrests were separated by whether they occurred before randomization or between the child's birth and 15th birthday. (No arrests occurred between randomization and the child's birth.)

Statistical Models and Methods

The study was conducted with an intent-to-treat approach. After examination of a large number of classification factors and covariates, a core statistical model was derived that was consistent

with the one used in the earlier phases of this research. It consisted of a $3 \times 2 \times 2$ factorial structure and 6 covariates. The classification factors were treatments (1 and 2 vs 3 vs 4), maternal marital status (married vs unmarried, at registration), and social class (Hollingshead I and II vs III and IV, at registration). All interactions among these factors were included. The basic conclusions reported herein were not modified by or limited to one race, and race was not included in final models.

The 6 covariates included in the final model were maternal age, education, locus of control, husband or boyfriend support, mother's employment status, and father's public-assistance status, all measured at registration. These covariates had consistently significant relationships with many of the outcomes examined in this report. All covariates were tested for homogeneity of regressions for the hypothesized contrasts.¹⁸

Dependent variables for which a normal distribution was assumed were analyzed in the general linear model and low-frequency count data (eg, number of substantiated reports of child maltreatment) in the log-linear model (assuming a Poisson distribution). In the log-linear model, the analysis was performed and estimates obtained in terms of the logs of the incidence. We use the term *incidence* in referring to the actual count or mean of counts over specific periods of measurement.

The distributions of each of the dependent variables were carefully examined, and cases with outlying values (above 20) were truncated to 20 to reduce the likelihood that the differences observed were the result of a few extreme values. This was done for 1 outcome variable, number of days jailed.

All treatment contrasts focused on the comparison of the combination of treatments 1 and 2 (the comparison group) with treatment 4 (the pregnancy and infancy nurse-visited group), because we hypothesized that the greatest treatment effect would be exerted by the combination of prenatal and postnatal home visitation, as found in earlier evaluations.^{8,9} We also show treatment effects for the group defined by women's being unmarried and from low-SES households at registration during pregnancy; this constitutes our operationalization of women's experiencing higher levels of chronic stress (being from a low-SES household) and having few personal resources to manage stress (being unmarried).

RESULTS

We conducted detailed examinations of 17 background variables to determine the extent to which the treatment

groups were equivalent for families on which 15-year assessments were completed. As indicated in Table 2, the treatment groups were equivalent both for the sample as a whole and for women who were unmarried and from low-SES households at registration.

Rates of Subsequent Births and Use of Welfare

As indicated in Table 3, in contrast to their counterparts in the comparison group, nurse-visited unmarried women from low-SES households had fewer subsequent pregnancies ($P=.03$) and live births ($P=.02$) and greater spacing between first and second births ($P=.001$). In addition, they reported using AFDC and food stamps fewer months than did unmarried, low-SES women in the comparison group ($P=.005$ and $P=.001$, respectively).

Substance Abuse, Criminal Justice Encounters, and Child Abuse and Neglect

Table 4 shows that nurse-visited, low-SES, unmarried women reported being impaired in fewer domains by alcohol or other drug use, having been arrested fewer times, having been convicted fewer times, and having spent fewer days in jail ($P=.005$, $P<.001$, $P=.008$, and $P<.001$, respectively) since the birth of their first child than did low-SES unmarried women in the comparison group. Data from NYS showed that nurse-visited, low-SES, unmarried women had fewer actual arrests ($P<.001$) and fewer convictions ($P<.001$).

New York State arrests were classified into 3 categories: property crimes (eg, theft), person crimes (assault, robbery), and other (eg, vice, major traffic offenses). Overall, 67% of the crimes were for property offenses, 14% were for person crimes, and 19% were for other offenses. The treatment differences for low-SES, unmarried women were present for arrests for property offenses (0.12 vs 0.60; $P<.001$), but not at conventional levels of statistical significance for person offenses (0.02 vs 0.13; $P=.10$), and other offenses (0.02 vs 0.17; $P=.12$) (data not shown).

Table 4 also shows that in contrast to women in the comparison group, those visited during pregnancy and the first 2 years of the child's life were identified as perpetrators of child abuse and neglect in fewer verified reports during the 15-year interval ($P<.001$). This effect was greater for women who were unmarried and from low-SES households at registration ($P<.001$). The effect of the program on number of verified reports was especially strong for the 4- to 15-year period after the birth of the child—ie,

Table 2.—Equivalence of Treatment Conditions on Background Characteristics Measured at Registration for Women Assessed at 15-Year Follow-up*

Dependent Variables	Whole Sample			Low-SES Unmarried Sample		
	Treatments 1 and 2 (n=148)	Treatment 3 (n=79)	Treatment 4 (n=97)	Treatments 1 and 2 (n=62)	Treatment 3 (n=30)	Treatment 4 (n=38)
Unmarried, %	62	59	64
Low-SES household, %	64	70	61
White, %	90	91	86	87	87	77
Smoker (>4 cigarettes/d), %	47	46	58	51	60	59
Male child, %	55	44	55	44	53	49
Mother working, %	39	36	31	24	20	20
Mother receiving public assistance, %	9	10	13	23	29	20
Father working, %	70	70	67	42	50	52
Father receiving public assistance, %	4	3	3	10	6	2
Husband or boyfriend in house, %	58	76	60	21	47	22
Maternal age, mean (SD), y	19.3 (2.9)	19.5 (3.1)	19.4 (3.7)	18.6 (2.5)	19.0 (2.8)	18.2 (3.3)
Maternal education, mean (SD), y	11.2 (1.5)	11.6 (1.5)	11.1 (1.6)	10.7 (1.4)	10.9 (1.4)	10.3 (1.5)
Husband or boyfriend education, mean (SD), y	11.4 (1.4)	11.7 (1.7)	11.5 (1.6)	11.1 (1.4)	11.0 (1.8)	10.8 (1.5)
Grandmother support†‡	100.4 (10.1)	97.7 (9.2)	101.3 (10.3)	101.6 (10.9)	98.1 (10.3)	104.1 (11.2)
Husband or boyfriend support†‡	99.6 (10.5)	102.0 (9.0)	99.0 (9.9)	94.2 (10.6)	98.6 (9.4)	96.8 (9.3)
Locus of control†	99.3 (10.1)	100.6 (9.5)	100.6 (10.2)	97.5 (10.2)	99.2 (10.3)	99.1 (9.9)
Incidence of maternal arrests in New York State prior to randomization§	0.09 (-2.50)	0.13 (-5.41)	0.06 (-8.98)	0.13 (-2.03)	0.13 (-2.02)	0.18 (-1.71)

*See first footnote to Table 1 for explanation of treatment groups. SES indicates socioeconomic status.

†Standardized to mean=100 and (SD)=10.

‡Locally developed scale that assesses degree to which individual provides emotional and material support to mother.

§Incidence (log incidence) represents the mean number of infrequently occurring events within stated period. Individual cases may have values greater than 1, although the range is small.

Table 3.—Adjusted Maternal Life-Course Outcomes From Birth of First Child to 15 Years*

Dependent Variables	Whole Sample			Estimate† (95% CI), Treatments 1 and 2 vs Treatment 4	Low-SES Unmarried Sample			Estimate† (95% CI), Treatments 1 and 2 vs Treatment 4
	Mean No.				Mean No.			
	Treatments 1 and 2	Treatment 3	Treatment 4		Treatments 1 and 2	Treatment 3	Treatment 4	
Subsequent pregnancies	2.1	1.9	1.7	0.4 (-0.1 to 0.8)	2.2	2.0	1.5	0.7‡ (0.1 to 1.3)
Subsequent births	1.6	1.4	1.3	0.3 (-0.0 to 0.6)	1.6	1.4	1.1	0.5‡ (0.1 to 1.0)
Months between birth of first and second child	37.3	39.8	41.7	-4.4 (-14.9 to 6.1)	37.3	46.6	64.8	-27.5§ (-44.1 to -10.9)
Months receiving AFDC	65.9	70.2	52.8	13.1 (-0.9 to 27.0)	90.3	81.8	60.4	29.9§ (9.0 to 50.7)
Months employed	89.7	87.5	96.4	-6.7 (-20.4 to 7.0)	80.0	74.9	95.9	-15.9 (-36.6 to 4.6)
Months receiving food stamps	56.4	62.0	47.9	8.5 (-6.3 to 23.3)	83.5	84.0	46.7	36.8§ (14.6 to 59.0)
Months receiving Medicaid	70.0	71.1	61.8	8.2 (-7.6 to 24.0)	95.4	92.4	72.3	23.1 (-0.6 to 46.8)

*Adjusted for socioeconomic status (SES), marital status, maternal age, education, locus of control, support from husband or boyfriend, working status, and husband or boyfriend use of public assistance at registration. See first footnote to Table 1 for explanation of treatment groups. AFDC indicates Aid to Families With Dependent Children; CI, confidence interval.

†Estimate = (treatments 1 and 2 mean) - (treatment 4 mean).

‡P < .05.

§P < .01.

the period not assessed in previous reports (data not shown).

COMMENT

In contrast to women in the comparison group, those visited by nurses during pregnancy and the first 2 years after the birth of their first child were identified as perpetrators of child abuse and neglect in fewer verified reports. Among women who were unmarried and from low-SES households at registration, those who were visited by nurses during pregnancy and infancy had fewer subsequent children, months receiving AFDC and food stamps, behavioral impairments from use

of alcohol and other drugs, arrests, convictions, and number of days jailed during the 15-year period after birth of their first child. For most outcomes, the group that was visited only during pregnancy exhibited levels of functioning that fell in between the comparison group and the group that was visited during pregnancy and infancy, indicating a dose-response relationship for level of home visitation.

These findings have some limitations. First, most of the positive results were concentrated among mothers who were unmarried and from low-SES households at registration during pregnancy. While we hypothesized originally that the effects

would be greater for women who experienced higher levels of stress and who had fewer personal resources, we did not fully operationalize the stress and resource variables prior to the beginning of the trial. We chose to employ characteristics used for sample recruitment as indicators of chronic stress (coming from a low-SES household) and having few personal resources (being unmarried). The marital status and poverty variables chosen to reflect the personal resource and stress constructs, however, are both well-established risk factors for several adverse outcomes. The concentration of program effects in women who are unmarried and

Table 4.—Adjusted Rates of Maternal Substance Abuse, Arrests, Convictions, and Child Abuse and Neglect Reports in the First Child to 5 Years*

Dependent Variables	Whole Sample				Low-SES Unmarried Sample			
	Incidence (Log Incidence)†			Estimate‡ (95% CI), Treatments 1 and 2 vs Treatment 4	Incidence (Log Incidence)†			Estimate‡ (95% CI), Treatments 1 and 2 vs Treatment 4
	Treatments 1 and 2	Treatment 3	Treatment 4		Treatments 1 and 2	Treatment 3	Treatment 4	
Substance use impairments§	0.43 (-1.09)	0.45 (-0.82)	0.34 (-1.33)	0.24 (-0.39 to 0.87)	0.73 (-0.31)	0.61 (-0.49)	0.41 (-0.89)	0.58 (0.04 to 1.11)
Arrests	0.22 (-2.02)	0.16 (-2.17)	0.09 (-5.21)	3.19 (-99.66 to 106.04)	0.58 (-0.55)	0.36 (-1.01)	0.18 (-1.74)	1.19 (0.49 to 1.89)
Convictions	0.13 (-2.29)	0.05 (-9.48)	0.03 (-9.62)	7.33 (-408.24 to 422.91)	0.28 (-1.28)	0.11 (-2.22)	0.06 (-2.74)	1.46 (0.38 to 2.54)
Days in jail	0.65 (-4.36)	0.13 (-9.20)	0.01 (-13.36)	9.00 (-481.52 to 499.53)	1.11 (0.10)	0.47 (-0.76)	0.04 (-3.22)	3.32 (2.16 to 4.48)
NYS arrests	0.38 (-1.57)	0.34 (-1.12)	0.12 (-5.03)	3.48 (-105.59 to 112.50)	0.90 (-0.11)	0.39 (-0.95)	0.16 (-1.85)	1.74 (0.94 to 2.54)
NYS convictions	0.27 (-4.92)	0.28 (-1.32)	0.12 (-5.30)	0.38 (-226.81 to 227.57)	0.89 (-0.37)	0.29 (-1.25)	0.13 (-2.02)	1.65 (0.79 to 2.52)
Substantiated reports of child abuse and neglect	0.54 (-0.63)	0.35 (-1.26)	0.29 (-1.40)	0.77 (0.34 to 1.19)	0.53 (-0.64)	0.63 (-0.47)	0.11 (-2.25)	1.61 (0.87 to 2.35)

*Adjusted for socioeconomic status (SES), marital status, maternal age, education, locus of control, support from husband or boyfriend, working status, and husband or boyfriend use of public assistance at registration. See first footnote to Table 1 for explanation of treatment groups. NYS indicates New York State; CI, confidence interval.

†Incidence represents the mean number of infrequently occurring events within stated period. Individual cases may have values greater than 1, although the range is small.

‡Estimate = (treatments 1 and 2 log incidence) - (treatment 4 log incidence).

§Scale summarizes the counts of behavioral impairments (eg, missing work, motor vehicle crash) reported by women resulting from their use of alcohol and illegal drugs.

||P < .01.

of lower SES suggests that they need these services and benefit from them to a greater extent than do those who are married and of higher SES. Consequently, such services should be made available to communities with high concentrations of low-income, unmarried women.

The second limitation is that several of the outcomes were based on self-report, which may be subject to treatment-related reporting bias. The data on maternal use of AFDC and food stamps, for example, were based on self-reports and covered up to 15-year time periods. We attempted to validate maternal report of welfare use by reviewing state and county records but found that they often were incomplete. Fortunately, we were able to obtain archived data from independent sources on other critical outcomes.

The child abuse and neglect findings, for example, were based on state archived data, which makes them less susceptible to reporting bias. Although we were unable to achieve complete reviews of these archived records for all families, they are substantially complete, and there is no indication that missing data resulted in any bias in favor of the nurse-visited groups. It should be noted, moreover, that the effects of the program overrode a tendency for nurse-visited families to be identified for maltreatment at lower thresholds of caregiving dysfunction than were families in the comparison group during the first 4 years of the child's life—a form of detection bias that worked against the hypothesis of program efficacy.⁷

Although it would have been preferable to have criminal records to corroborate the mothers' reports of all arrests and convictions, the analysis of their arrests and convictions archived in NYS produced a pattern of treatment effects that was even stronger than was found with maternal report. Thus, in spite of the knowledge nurse-visited women had of the purpose of

this study, they were at least as accurate in reporting this undesirable behavior as were women in the comparison group.

Finally, one may reasonably question the extent to which the findings of this study may be generalized to a wider range of low-SES, unmarried women today. This question led to a recently completed replication of this trial in Memphis, Tenn, with a sample of predominantly low-income, unmarried African-American mothers and their families.¹⁹ The findings of the replication are congruent with the Elmira trial for the 2-year period after birth of the first child and indicate that the benefits of the program, at least through the first child's second birthday, are not limited by time, geography, or the sociodemographic characteristics of the families served. We believe that the results of these 2 trials now provide sufficient evidence to form a rationale for preliminary stages of program dissemination.

One of the most fundamental considerations in planning program dissemination is cost. As indicated in a forthcoming report, the reduction in family size, use of welfare, incidence of child abuse and neglect, and maternal criminality 15 years after the birth of the first child found for this program will lead to substantial savings to government in several domains of spending.²⁰ In considering the cost of the program (estimated to be \$3300 in 1980 dollars and \$6700 in 1997 dollars for 2½ years of service), it is important to note that the investment in the service, from the standpoint of government spending, was recovered for low-SES families before the child reached 4 years of age.⁹ It would take longer for the investment to be recovered today because costs for such a program have increased more rapidly than costs of welfare benefits.

It is also important to note that the effects reported herein were produced

in the context of a controlled experiment, in which the program was conducted with high levels of fidelity to the underlying theoretical and clinical model.¹⁴ The next challenge is to determine the extent to which this program can be replicated.²¹ A modest dissemination effort is currently being conducted under the auspices of the US Departments of Justice and Health and Human Services that will shed light on community and organizational factors that contribute to or undermine fidelity of program implementation in new program sites.

Finally, it should be emphasized that although many different kinds of home-visitation programs have been promoted, it is incorrect to assume that our results can be applied to home-visitation programs that are not based on this model. While some other types of home-visitation programs have shown some promise,^{22,23} most have failed.³ At least 2 well-designed trials of other home-visitation programs are under way that should give us a better understanding of the range of program characteristics that can affect important aspects of maternal, child, and family functioning.^{24,25} In the meantime, as health and social welfare policy is redesigned in the near future, we believe that it makes sense to begin with programs that have been tested, replicated, and found to work.

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Home Visiting by Paraprofessionals and by Nurses: A Randomized, Controlled Trial

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ABSTRACT. *Objective.* To examine the effectiveness of home visiting by paraprofessionals and by nurses as separate means of improving maternal and child health when both types of visitors are trained in a program model that has demonstrated effectiveness when delivered by nurses.

Methods. A randomized, controlled trial was conducted in public- and private-care settings in Denver, Colorado. One thousand one hundred seventy-eight consecutive pregnant women with no previous live births who were eligible for Medicaid or who had no private health insurance were invited to participate. Seven hundred thirty-five women were randomized to control, paraprofessional, or nurse conditions.

Nurses completed an average of 6.5 home visits during pregnancy and 21 visits from birth to the children's second birthdays. Paraprofessionals completed an average of 6.3 home visits during pregnancy and 16 visits from birth to the children's second birthdays.

The main outcomes consisted of changes in women's urine cotinine over the course of pregnancy; women's use of ancillary services during pregnancy; subsequent pregnancies and births, educational achievement, workforce participation, and use of welfare; mother-infant responsive interaction; families' home environments; infants' emotional vulnerability in response to fear stimuli and low emotional vitality in response to joy and anger stimuli; and children's language and mental development, temperament, and behavioral problems.

Results. Paraprofessional-visited mother-child pairs in which the mother had low psychological resources interacted with one another more responsively than their control-group counterparts (99.45 vs 97.54 standard score points). There were no other statistically significant para-professional effects.

In contrast to their control-group counterparts, nurse-visited smokers had greater reductions in cotinine levels from intake to the end of pregnancy (259.0 vs 12.32 ng/ mL); by the study child's second birthday, women visited by nurses had fewer subsequent pregnancies (29% vs 41%) and births (12% vs 19%); they delayed subsequent pregnancies for longer intervals; and during the second year after the birth of their first child, they worked more than women in the control group (6.83 vs 5.65 months).

Nurse-visited mother-child pairs interacted with one another more responsively than those in the control group (100.31 vs 98.99 standard score points). At 6 months of age, nurse-visited infants, in contrast to their control-group counterparts, were less likely to exhibit emotional vulnerability in response to fear stimuli (16% vs 25%) and nurse-visited infants born to women with low psychological

resources were less likely to exhibit low emotional vitality in response to joy and anger stimuli (24% vs 40% and 13% vs 33%). At 21 months, nurse-visited children born to women with low psychological resources were less likely to exhibit language delays (7% vs 18%); and at 24 months, they exhibited superior mental development (90.18 vs 86.20 Mental Development Index scores) than their control-group counterparts. There were no statistically significant program effects for the nurses on women's use of ancillary prenatal services, educational achievement, use of welfare, or their children's temperament or behavior problems.

For most outcomes on which either visitor produced significant effects, the paraprofessionals typically had effects that were about half the size of those produced by nurses.

Conclusions. When trained in a model program of prenatal and infancy home visiting, paraprofessionals produced small effects that rarely achieved statistical or clinical significance; the absence of statistical significance for some outcomes is probably attributable to limited statistical power to detect small effects. Nurses produced significant effects on a wide range of maternal and child outcomes. *Pediatrics* 2002;110:486 – 496; home visits, paraprofessionals, nurses, pregnancy, development.

ABBREVIATIONS. SD, standard deviation; MDI, Mental Development Index.

Home visiting has been promoted by the American Academy of Pediatrics as an important complement to office-based practice.¹ It has been advocated as a way to improve the outcomes of pregnancy,² to reduce the rates of child abuse and neglect,³ and to help low-income families become economically self-sufficient. The background of visitors, however, seems to affect program success.⁴ When examined in randomized trials, paraprofessional home visitors (those with no formal training in the helping professions) have produced small effects that rarely are statistically significant.⁵⁻⁸ Is the absence of their effect attributable to lack of professional training or underdevelopment of the program models they delivered?

We addressed this question in a 3-armed randomized trial (control, paraprofessional home visits, and nurse home visits) in which the paraprofessionals and nurses were provided well-structured home visit guidelines, training, and supportive supervision in a program model found to be effective when delivered by nurses in earlier trials.⁹⁻¹⁸ If paraprofessionals could produce significant effects in the current trial, it would mean that they have the potential to achieve important effects on maternal and child health if they are trained to deliver proven models. If the paraprofessionals produced minimal impact, it would indicate that their lack of professional training in some way impedes their effectiveness.

The nurse arm was included for 2 reasons. First, it served as a positive control. It would be easier to interpret the success or lack of success of the paraprofessionals in light of the nurses' accomplishments in the same study. Second, the nurse arm provided a third trial of the program, allowing additional examination of the generalizability of positive effects for nurses.

We hypothesized that the nurse-visitors would produce results similar to those in the previous trials. Given weak results from previous trials of paraprofessional home-visitor programs,⁵⁻⁸ we expected the paraprofessional-control differences to be somewhat smaller. The impact of the nurse home-visitor program on caregiving and child outcomes was greater in the earlier trials for cases where mothers had low psychological resources (limited intellectual functioning, mental health, and sense of control over their life circumstances),^{10,17,19} so we hypothesized corresponding effects in the current trial for both types of visitors.

Although paraprofessionals can have a range of formal preparation for their roles, we chose to examine paraprofessional visitors who share many of the social characteristics of the families they serve, as many believe that shared social characteristics increase visitors' ability to empathize with their clients who, in turn, are more likely to trust those who are similar to them.^{20,21} This segment of the paraprofessional population is important to test as the use of community health workers with limited educational backgrounds is a common service delivery strategy in many home visiting programs,^{22,23} and it is estimated that 60% of home visiting programs for children do not require visitors to have bachelors' degrees.²⁴

METHODS

The numbers of eligible women invited to participate, randomized, and assessed at various stages of research are summarized in Table 1.

Participants

From March 29, 1994, through June 15, 1995, 1178 consecutive women from 21 antepartum clinics serving low-income women in the Denver metropolitan area were invited to participate in the study. Women were recruited if they had no previous live births and either qualified for Medicaid or had no private health insurance. Women were allowed to enroll at any time before delivery. All participants completed informed consent procedures approved by the Colorado Multiple Institutional Review Board.

Given the large number of clinics in which recruitment was conducted, it was not possible to provide face-to-face explanations of the study to all prospective participants. Women thus could actively refuse participation or passively refuse (not respond before they delivered). Compared with active refusals ($n = 244$) and passive refusals ($n = 199$), those who accepted were more likely to be Hispanic (45% accepted vs 37% active refusals and 39% passive refusals), and less likely to smoke cigarettes (27% accepted vs 44% active refusals and 32% passive refusals). These groups were similar on other major sociodemographic characteristics, such as maternal age, language preference (English vs Spanish), and marital status.

Statistical Power and Assignment Ratios

Sample size was based on 80% power when using $\alpha = 0.05$ for 2-tailed tests and assuming effects in the range of 0.30 standard deviations (SD) between each treatment and control. This resulted in 600 subjects divided evenly among the 3 treatment groups. Allowing for a 20% attrition rate, an initial projected sample size of 750 was chosen, and we enrolled 735. We also were interested in detecting effects that were limited to half of the total sample that would be at higher risk (such as mothers with low psychological resources). For these comparisons, we had power to detect differences in the 0.42 SD range.

TABLE 1. Sample Composition Over Time by Treatment Through Age 24 Months

Treatment Group	Control	Paraprofessional	Nurse	Total
Eligible invited to participate		1178		
Active refusals		244		
Passive refusals		199		
Randomized		735		
Allocated to treatment	255	245	235	735
Research refusals	5	13	10	28
Fetal demises	9	7	10	26
Preterm deliveries <36 wks	20	15	14	49
Completed 36-wk interviews	182	171	162	515
Infant deaths	2	1	1	4
Adoptions	2	1	1	4
Completed 6-mo interviews	220	201	184	605
Completed 6-mo child assessments	197	180	166	543
Completed 12-mo interviews	219	206	187	612
Completed 12-mo child assessments	210	193	178	581
Completed 15-mo interviews	209	175	176	560
Completed 15-mo child assessments	188	156	149	493
Completed 21-mo interviews	225	215	202	642
Completed 21-mo child assessments	216	204	190	610
Completed 24-mo interviews	223	213	194	630
Completed 24-mo child assessments	204	188	168	560

Because of constraints of sample size and cost, the study was not designed to make direct comparisons between paraprofessionals and nurses. We nevertheless conducted secondary analyses that compared their effect sizes.

Randomization

After completion of baseline interviews, identifying information on the participants was sent to the data operations office (located separately from interviewers' offices), where an individual who knew nothing about the participants entered their data into a computer program that randomized individual women to treatment conditions.²⁵ The randomization was conducted within strata from a model with 3 classification factors: maternal race/ ethnicity (Hispanic, white non-Hispanic, African American, American Indian, or Asian), maternal gestational age at enrollment (<32 vs 32+ weeks), and geographic region of residence (4 regions). Women assigned to 1 of the 2 home-visitation groups subsequently were assigned at random to home visitors responsible for their geographic region.

Treatment Conditions

Women in the control group ($n = 255$) were provided developmental screening and referral services for their children at 6, 12, 15, 21, and 24 months old. Women assigned to the paraprofessional group ($n = 245$) were provided the screening and referral services plus paraprofessional home visitation during pregnancy and infancy (the first 2 years of the child's life). Women in the nurse group ($n = 235$) were provided screening and referral plus nurse home visitation during pregnancy and infancy.

Design and Implementation of Home-Visitation Programs

The home-visitation program delivered by both nurses and paraprofessionals was based on one tested previously¹⁹ and has 3 broad goals: 1) to improve maternal and fetal health during pregnancy by helping women improve their health-related behaviors; 2) to improve the health and development of the child by helping parents provide more competent caregiving; and 3) to enhance parents' personal development by helping them plan future pregnancies, continue their education, and find work. Visit-by-visit guidelines and detailed objectives provided direction to the visits.

Visitors adapted the program to the needs and interests of families.

Nurses were required to have BSN degrees and experience in community or maternal and child health nursing. Paraprofessionals were required to have a high school education but were excluded if they had college preparation in the helping professions or a bachelor's degree in any discipline. Both groups were required to have strong "people skills." Preference in hiring was given to paraprofessionals who had worked in human service agencies.^{26,27}

Extensive efforts were made to ensure that the paraprofessionals were well suited for this work. Paraprofessional home visitor programs in Denver were invited to send their best home visitors to serve in this experimental program. The visitors were paid an average starting wage of \$8.45 per hour, with full benefits, which was more than most paraprofessional visitors then earned in Denver. Program protocols were adapted to accommodate non-nurses by altering such things as the way maternal and child health problems were addressed. Both visitor types received 1 month of extensive training before their working with families in the study.

Each visitor managed caseloads of ~25 families. Paraprofessionals had twice the level of supervision (2 supervisors to 10 visitors) as nurses.²⁷ Nurses had greater staff retention: all 10 nurses stayed with the program for its duration whereas 7 paraprofessionals did; replacements were hired for paraprofessionals who left.²⁶

Paraprofessionals completed an average of 6.3 (range: 0–21) home visits during pregnancy and 16 (range: 0–78) visits during infancy. Nurses completed an average of 6.5 (range: 0–17) home visits during pregnancy and 21 (range: 0–71) visits during infancy. The paraprofessional-nurse difference in completed infancy home visits was significant ($P < .001$). Overall, paraprofessionals had a higher average number of scheduled visits in which the families were not at home or did not answer the door (8 vs 5, $P < .001$). By the end of the program, 48% of the paraprofessional-visited families had discontinued the program versus 38% of those visited by nurses ($P = .04$).²⁶

In 2002, the average inflation-adjusted per-family total cost of the 2.5-year program is \$9140 for nurses and \$6162 for paraprofessionals.

Masking and Assessment Procedures

Data were gathered by staff members who were unaware of the women's treatment assignment, except for a few cases in which the participants inadvertently revealed their treatment status to the interviewers. The maternal interviews were translated into Spanish for monolingual Spanish speakers.

Assessments and Definitions of Variables

To the extent possible, the outcomes examined here were selected to correspond to those in the earlier trials. The multiplicity of settings in which participants obtained health care in Denver and low rates of state-verified cases of child abuse and neglect in the target population made it impossible to use medical and child-protective-service records to assess obstetric, newborn, childhood-injury, and child maltreatment outcomes in the current trial. We therefore focused greater attention on measurement of infants' early emotional development,²⁸ as infants' emotional communications are connected to their being abused, neglected, and reared by depressed mothers.^{29,30}

Baseline Assessments and Variables

At registration, interviews were conducted with participating women to determine their socioeconomic conditions, mental health,³¹ personality characteristics,³² obstetric histories, psycho-active drug use, conflict with partners, conflict with their own mothers, and experience of domestic violence.³³ Highly sensitive questions were administered by tape recorder with earphones to increase response accuracy. Women completed brief tests to measure their intellectual functioning³⁴ and supplied urine samples that were assayed with gas chromatography/mass spectrometry for cotinine (the major nicotine metabolite) and creatinine, tetrahydrocannabinol, and cocaine metabolites. Cocaine, marijuana, and alcohol use were too infrequently occurring to serve as valid outcomes to assess changes in women's substance use (Table 2). Individuals with creatinine-adjusted cotinine values ≥ 80 ng/mL at intake were designated as smokers.^{35,36}

A variable was created to index women's psychological resources measured at registration and based on the averaged z scores of their: 1) mental health,³¹ 2) sense of mastery,³² and 3) intelligence.³⁴ It was dichotomized at raw score values that corresponded to the 50th percentile of these 3 variables used to construct a corresponding variable in an earlier trial.¹⁷ This procedure split the Denver sample into low (40% of the sample) and higher (60%) functioning groups.

End-of-Pregnancy Assessments and Variables

Women were interviewed at 36 weeks of gestation in the study office to assess their health-related behaviors, including use of psychoactive substances and use of ancillary preventive services (eg, childbirth education and mental health) and emergency services (emergency housing and food banks). Urine was collected to assess biochemical markers for nicotine, marijuana, and cocaine. Change in tobacco use from intake to 36 weeks was measured by change in creatinine-adjusted cotinine among those designated as smokers at intake.

Maternal Life Course

Women were interviewed at 12, 15, 21, and 24 months' post-partum to assess their number and timing of subsequent pregnancies; and at 24 months to assess educational achievement, participation in the workforce, and use of welfare. Variables were constructed to reflect years of education completed and number of months women were in the workforce and used welfare during the 1- to 12-month and 13- to 24-month periods.

TABLE 2 Background Characteristics of Sample at Intake

Background Variable	Whole Sample			Low Psychological Resource Sample		
	Control n = 255 %	Paraprof N = 245 %	Nurse n = 235 %	Control n = 82 %	Paraprofessional n = 115 %	Nurse n = 97 %
Married	15	13	14	15	10	9
African American	16	17	16	16	20	22
Caucasians (non-Hispanics)	35	35	37	27	29	28
Hispanic (nearly all Mexican American)	46	45	44	56	47	47
Monolingual Spanish	4	4	3	4	2	2
Cigarette smoker*	25	21	24	23	24	27
Marijuana user†	15	15	16	16	19	16
Alcohol user‡	6	6	7	6	7	8
Cocaine user‡	2	3	1	1	6	1
Registered after 28 wks of gestation	15	10	11	16	10	16
Any domestic violence in last 6 mo	16	18	16	18	30	27
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Maternal mental health inventory§	99.93 (9.83)	99.96 (9.87)	100.12 (10.36)	92.39 (9.49)	93.81 (8.86)	92.76 (9.82)
Maternal mastery§	100.79 (9.83)	99.53 (9.71)	99.63 (10.47)	92.00 (8.38)	93.38 (7.72)	91.41 (7.21)
Maternal intellectual functioning (Shipley) §	100.93 (9.27)	98.76 (10.14)	100.28 (10.52)	93.49 (8.76)	94.56 (10.88)	94.12 (10.34)
Maternal psychological resources§ ¶	100.80 (10.03)	99.16 (9.25)	100.01 (10.67)	89.29 (6.60)	91.17 (5.32)	89.50 (6.32)
Maternal education (y)	11.22 (1.88)	11.00 (1.83)	11.24 (2.04)	10.70 (1.73)	10.54 (1.82)	10.62 (2.10)
Maternal age (y)	19.70 (4.13)	19.44 (3.69)	20.24 (4.17)	19.71 (4.43)	19.04 (3.90)	19.74 (4.27)
Household annual income (dollars)	12 701 (11 295)	13 241 (13 612)	13 126 (11 966)	10 322 (11 127)	11 814 (13 328)	9517 (9973)
% Census tract below poverty	19.65 (13.98)	20.72 (13.37)	20.18 (15.07)	22.04 (15.27)	21.74 (13.90)	21.81 (14.37)
Housing density	0.83 (0.50)	0.95 (0.54)	0.83 (0.47)	0.88 (0.54)	1.01 (0.59)	0.86 (0.49)
Conflict with partner	1.66 (2.59)	1.29 (2.12)	1.41 (2.38)	1.99 (2.95)	1.68 (2.63)	1.75 (2.92)
Conflict with own mother	1.30 (2.24)	1.01 (1.93)	1.22 (2.09)	2.16 (2.80)	1.36 (2.34)	1.42 (2.29)
Gestational age (wk) at randomization	18.48 (7.48)	18.67 (7.17)	18.60 (7.04)	18.32 (7.92)	17.81 (6.88)	18.79 (7.55)

* Urine assay (adjusted cotinine \geq 80 ng/mL).

† Either self-report or urine assay.

‡ Self-report.

§ Scales standardized to mean of 100 and SD of 10.

¶ Scale consists of averaged z scores of mental health inventory, mastery, and intellectual functioning.

Mother-Infant Interaction and Quality of the Home Environment

Mother-infant interaction was videotaped either in the laboratory or at home at all postpartum assessments using 2 validated procedures.^{37,38} Factor analysis of subscale scores for maternal and infant behaviors identified a single internally consistent principal component, responsive interaction, that was standardized at each assessment to a mean of 100 and a standard deviation of 10. Infants' home environments were rated at 12 and 21 months.³⁹

Child Emotional, Mental, and Behavioral Development

At 6 months of age in the laboratory, infants' emotional reactivity (latency to react and intensity of facial, body, and vocal cues) and looking at mother were videotaped and coded separately for their responses to stimuli designed to elicit fear, joy, and anger.²⁸ The reactivity and looking-at-mother dimensions were dichotomized at the mean and cross-classified. Emotional vulnerability was defined as high distress reactions to fear stimuli coinciding with limited efforts by the infants to look at or seek assistance or comfort from their mothers. Emotional vitality was defined as the lively expression of joyful and angry affect that was shared with others.²⁸ In an earlier report from this study, 6-month-old infants classified as

“vulnerable” in response to fear stimuli (high reactivity and low looking at mother) and “low vitality” in response to joy and anger stimuli (low reactivity and low looking at mother) exhibited poorer language and cognitive development at 21 and 24 months than infants exhibiting high vitality (high reactivity and frequent looking at mother), supporting the predictive validity of these measures.²⁸

Children’s language development was tested at 21 months in their homes.⁴⁰ Their mental development (Mental Development Index [MDI]) was tested at 24 months in the laboratory.⁴¹ Language and MDI were analyzed as both continuous and dichotomous outcomes. Children with language scores <85 were classified as delayed.⁴⁰ Children with MDI scores <77 (>1.5 SD below the population mean of 100) were classified as developmentally delayed as this is a typical threshold for referring children for developmental services. Although these variables are not independent of one another, each provides different information about the outcome. Mothers reported on their children’s irritability at 6 months⁴² and behavior problems at 24 months.⁴³

Statistical Models and Methods of Analysis

Data analyses were conducted on all cases for which outcome data were available, irrespective of the degree to which families participated in the programs. The tables show trends ($P < .10$), but we report in the text only findings at $P \leq .05$ (2-tailed tests).

The primary statistical model consisted of treatments (3 levels), maternal psychological resources (high vs low), and the interaction between these 2 classification factors. In addition, 5 covariates were included to control for nonequivalence among the treatment groups at intake (ie, where the probability for any treatment contrast was <.10): maternal age, housing density, whether the mother registered in the study after 28 weeks of gestation, maternal conflict with her partner, and maternal conflict with her mother. All covariates were examined for homogeneity of regressions.⁴⁴ The results reported below are virtually identical for models both with and without covariates. Results are shown for the models with covariates. Planned contrasts focused on the test of nurse versus control and paraprofessional versus control. For mother-child interaction, home environment, and child outcomes, treatment group contrasts are reported for the low psychological resources group as well as the whole sample.

Maternal age moderated the effect of the nurse program on duration of maternal employment, a conditional effect consistent with earlier findings.¹³ Therefore, when maternal employment outcomes were analyzed, maternal age as a classification factor (<19 years vs ≥ 19 years) and its interaction with other classification factors were added to the primary model, and the maternal age covariate was removed.

Continuous dependent variables were analyzed in the general linear model and dichotomous outcomes in the logistic model.

The analysis of change in cotinine during pregnancy was limited to women identified as smokers at intake. Examination of residuals for the reduction in cotinine revealed atypical values in both positive and negative directions in all 3 treatment groups. A transformation to ranks was used to deal with this problem. To report estimates and confidence intervals in the original scale, we also analyzed the original data after replacing values beyond the inner fence of a box and whisker plot with the value at the inner fence. The P values from this truncated data analysis were virtually identical to the analysis of ranks, so the results are reported from the truncated analysis.

For variables assessed at >1 point in time (observations of maternal-child interaction and home environment), we conducted repeated-measures analyses, adding to the basic model a fixed factor for time and random factor for individuals. These analyses focused on treatment differences averaging across all time periods.

The timing of subsequent pregnancy was examined with proportional hazards analysis⁴⁵ using the primary model specified above, with tests performed on the planned treatment contrasts.

Finally, secondary analyses examined whether the performance of the paraprofessionals was attributable to their completing fewer home visits and higher rate of disrupted relationships with families.²⁶ We analyzed those dependent variables shown below in Figs 2 and 3, first in the primary models described above (but including only women in the 2 home-visited groups) and then after adding to that model covariates for number of completed home visits and whether the mother’s relationship with her home visitor was continuous, including their interactions with psychological resources.

RESULTS

Comparison of Treatment Groups on Background Characteristics

With the few exceptions described above, the treatment groups were similar at baseline—both for the sample overall as well as for women with low psychological resources (Table 2). These patterns held for those who participated in subsequent assessments.

Nurse-visited women had lower rates of completed assessments than did women in the control group at each postpartum assessment period (Table 1). The pattern of baseline differences between nurse-visited and control-group women on whom assessments were not conducted by child age 2 indicated that these nurse-visited women were higher functioning than their counterparts in the control group. For example, compared with counterparts in the control group, nurse-visited women with missing post-baseline data were 2 years older at registration, and as a trend, had less conflict with their own mothers. This suggests that whatever bias did occur worked against the detection of beneficial nurse effects.

Impact of Paraprofessional Program

Tables 3 and 4 summarize the results. Paraprofessional-visited mother-child pairs in which the mother had low psychological resources interacted with one another more responsively than their control-group counterparts (99.45 vs 97.54, $P = .05$). There were no other statistically significant effects for the paraprofessionals, although there were trends ($P < .10$) for them to reduce subsequent pregnancies and births (Table 3) and to delay

subsequent pregnancies (Fig 1).

TABLE 3 Estimates of Program Effects on Maternal Outcomes

	Sample	Treatment Group Estimates			Treatment Comparisons and 95% CIs	
		Control	Paraprofessional	Nurse	Paraprofessional Versus Control	Nurse Versus Control
Prenatal use of tobacco and other services		LS Mean	LS Mean	LS Mean	Mean Difference (95% CI)	Mean Difference (95% CI)
Cotinine reduction (ng/mL)	Smokers	12.32	88.51	259.00	-76.19 (-302.21-149.82)	-246.68 (-466.19- -27.16)§
Use of preventive services‡	Whole	0.69 %	0.67 %	0.80 %	-0.02 (-0.19-0.15) OR (95% CI)	0.11 (-0.07-0.28) OR (95% CI)
Use of emergency services†	Whole	9	9	6	1.01 (0.51-2.00)	0.64 (0.29-1.39)
Subsequent fertility						
Subsequent pregnancy (24 mo)	Whole	41	33	29	0.70 (0.46-1.06)‡	0.60 (0.39-0.93)§
Subsequent birth (24 mo)	Whole	19	13	12	0.63 (0.37-1.07)‡	0.58 (0.33-1.01)§
Maternal education, employment, and welfare		LS Mean	LS Mean	LS Mean	Mean Difference (95% CI)	Mean Difference (95% CI)
Education achievement (21 mo)	Whole	11.51	11.62	11.51	0.11 (-0.17-0.39)	0.00 (-0.28-0.28)
No. of months						
Employed (1-12 mo)	Whole	3.97	4.21	4.35	0.23 (-0.67-1.14)	0.38 (-0.55-1.31)
Employed (13-24 mo)	Whole	5.73	6.14	6.87	0.42 (-0.55-1.38)	1.14 (0.15-2.13)§
On Aid to Families With Dependent Children (1-12 mo)	Whole	2.35	2.60	2.31	0.25 (-0.59-1.09)	-0.04 (-0.89-0.82)
On Aid to Families With Dependent Children (13-24 mo)	Whole	1.92	2.31	1.95	0.39 (-0.41-1.18)	0.03 (-0.79-0.84)

LS indicates least squares; OR, odds ratio; CI, confidence interval.

* Preventive services =mental health + legal aid + drug/alcohol treatment + child birth classes + rent and utility assistance + education and employment.

† Emergency services =emergency housing + emergency food banks.

‡ $P < .10$.

§ $P \leq .05$.

TABLE 4 Estimates of Program Effects on Mother-Child Interaction, Home Environment, and Child Outcomes

	Sample	Treatment Group Estimates			Treatment Comparisons and 95% Confidence Intervals	
		Control	Paraprofessional	Nurse	Paraprofessional Versus Control	Nurse Versus Control
Mother-infant interaction and home score		LS Mean	LS Mean	LS Mean	Mean Difference (95% CI)	Mean Difference (95% CI)
Mother-infant responsive interaction	Whole	98.99	100.15	100.31	1.16 (-0.11-2.42)*	1.32 (0.03-2.60)‡
	Low resource	97.54	99.45	99.50	1.91 (-0.03-3.85)‡	1.97 (-0.09-4.02)*
Home environment	Whole	37.10	37.40	37.79	0.30 (-0.49-1.10)	0.69 (-0.12-1.50)*
	Low resource	35.93	36.92	37.12	1.00 (-0.23-2.23)	1.20 (-0.11-2.50)*
Infant emotional vitality and vulnerability, language, and mental delay		%	%	%	OR (95% CI)	OR (95% CI)
Vulnerable: fear stimuli (6 mo)	Whole	25	18	16	0.67 (0.40-1.13)	0.57 (0.32-1.00)‡

	Low resource	21	17	12	0.77 (0.34–1.72)	0.51 (0.20–1.31)
Low vitality: joy stimuli (6 mo)	Whole	34	31	26	0.88 (0.57–1.38)	0.68 (0.42–1.09)
	Low resource	40	30	24	0.64 (0.33–1.24)	0.46 (0.22–0.98)†
Low vitality: anger stimuli (6 mo)	Whole	28	26	19	0.89 (0.55–1.43)	0.62 (0.37–1.05)*
	Low resource	32	22	13	0.63 (0.31–1.29)	0.33 (0.14–0.79)†
Language delay (21 mo)	Whole	12	11	6	0.90 (0.48–1.66)	0.48 (0.23–1.01)†
	Low resource	18	13	7	0.66 (0.28–1.58)	0.32 (0.11–0.97)†
Mental development delay (24 mo)	Whole	13	14	11	1.07 (0.59–1.94)	0.83 (0.44–1.57)
	Low resource	19	19	10	0.97 (0.44–2.13)	0.48 (0.18–1.24)
Child cognitive and behavioral development		LS Mean	LS Mean	LS Mean	Mean Difference	Mean Difference
Language development (21 mo)	Whole	99.49	99.89	101.22	0.40 (–1.94–2.74)	1.73 (–0.64–4.11)
	Low resource	96.85	97.83	101.52	0.98 (–2.65–4.62)	4.67 (0.85–8.49)†
MDI (24 mo)	Whole	89.38	89.45	90.13	0.07 (–2.39–2.53)	0.75 (–1.77–3.28)
	Low resource	86.20	88.54	90.18	2.33 (–1.46–6.12)	3.98 (–0.07–8.02)†
Irritable temperament (6 mo)	Whole	2.84	2.83	2.80	–0.01 (–0.17–0.15)	–0.04 (–0.21–0.12)
	Low resource	2.92	2.95	2.88	0.02 (–0.22–0.27)	–0.04 (–0.30–0.22)
Behavior problems score (24 mo)	Whole	45.26	45.49	43.71	0.23 (–3.58–4.03)	–1.56 (–5.45–2.33)
	Low resource	49.25	48.79	48.13	–0.46 (–6.37–5.45)	–1.12 (–7.39–5.14)

LS indicates least squares; CI, confidence interval; OR, odds ratio.

* $P < .10$.

† $P \leq .05$.

Impact of Nurse Program

Maternal Outcomes

Table 3 shows that, in contrast to their control-group counterparts, nurse-visited smokers had greater reductions in cotinine levels from intake to the end of pregnancy (259.00 vs 12.32 ng/mL, $P = .03$). By 24 months after delivery of their first child, nurse-visited women, in contrast to those in the control group, were less likely to have had a subsequent pregnancy (29% vs 41%, $P = .02$) and birth (12% vs 19%, $P = .05$). Figure 1 shows that in contrast to women in the control group, nurse-visited women had longer intervals until the next conception ($P = .02$). Women visited by nurses were employed longer during the second year after the birth of their first child than were controls (6.83 vs 5.65 months, $P = .02$), an effect that was greater for older women (≥ 19 at intake— data not shown).

Caregiving and Child Outcomes

Table 4 shows that nurse-visited mother-infant dyads interacted with one another more responsively than control pairs (100.31 vs 98.99 standard score points, $P = .05$). At 6 months of age, nurse-visited infants, in contrast to control-group counterparts, were less likely to exhibit emotional vulnerability in response to fear stimuli (16% vs 25%, $P = .05$) and those born to women with low psychological resources were less likely to display low emotional vitality in response to joy and anger stimuli (24% vs 40%, $P = .04$ and 13% vs 32%, $P = .01$, respectively). At 21 months, nurse-visited children were less likely to exhibit language delays than children in the control group (6% vs 12%, $P = .05$), an effect concentrated among children born to mothers with low psychological resources (7% vs 18%, $P = .04$). Nurse-visited children born to women with low psychological resources also had superior average language and mental development in contrast to control-group counterparts (101.52 vs 96.85, $P = .02$; and 90.18 vs 86.20, $P = .05$, respectively).

There were no significant nurse effects on women's use of ancillary services during pregnancy, educational achievement, use of welfare, or their

children's temperament or behavior problems.

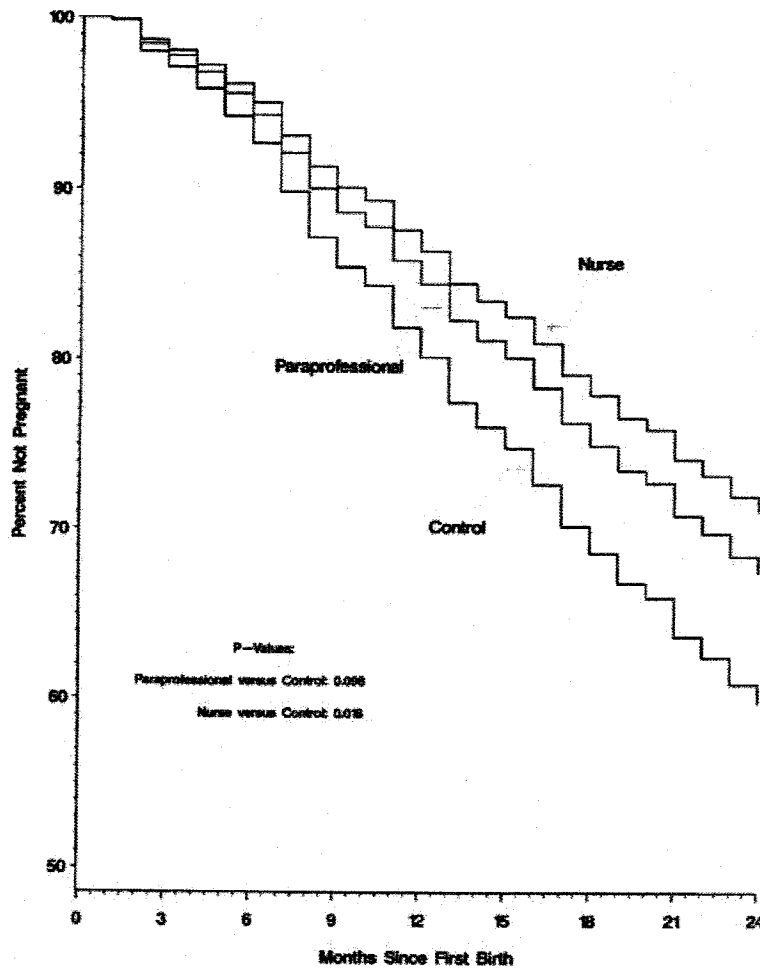


Fig 1. Curves from proportional hazard model of time to first subsequent pregnancy by treatment group.

Estimates of Nurse Versus Paraprofessional Effects

The effects of paraprofessionals and nurses on those outcomes for which there was a significant effect or trend for either visitor are summarized in Figs 2 and 3 for continuous and dichotomous outcomes, respectively. Figure 2 shows effects in standard deviation units (effect sizes) as well as original units, and both figures show estimates with standard errors. These figures show that for most outcomes paraprofessional effects were approximately half the size of those produced by nurses. Aside from significantly superior language development for the nurse-visited versus paraprofessional-visited children born to mothers with low psychological resources, none of these differences was statistically significant.

Does Controlling for Program Implementation Differences Improve Performance of the Paraprofessionals?

Table 5 shows the estimated effects for the nurse versus paraprofessional contrasts for those outcomes displayed in Figs 2 and 3 before and after adding to the statistical model the number of completed visits and whether the mother had a continuous relationship with her visitor. This table shows that after adjustment for these differences in program implementation, the nurse-paraprofessional differences sometimes decreased, sometimes increased, and often stayed essentially the same, indicating that the performance of the paraprofessional group was not because of fewer completed home visits or disruption in the visitor relationship.

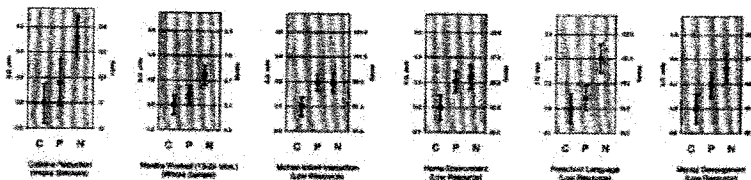


Fig 2. Effect sizes (in standard deviation units) and means \pm standard errors for continuous outcomes that correspond to those in Tables 3 and 4 where there were significant effects or trends for any treatment contrast. Mother-infant interaction, home environment, and child outcomes are shown for children born to women with low psychological resources. C indicates control; P, paraprofessional; and N, nurse.

DISCUSSION

This study was designed to determine whether paraprofessional home visitors could produce important effects on maternal and child health if given structured guidelines, excellent training, and supportive supervision in a model that had been effective when delivered by nurses. We did not design it to determine whether nurses are better than paraprofessionals, as the more important question was whether we could enhance paraprofessionals' performance, given their sobering results in previous trials.⁵⁻⁸

In this study, paraprofessionals improved mother-child interaction in those dyads in which mothers had low psychological resources, and there were trends for them to reduce the rates of subsequent pregnancies and births, effects that were clinically significant. None of the other paraprofessional effects approached statistical significance. Although some of these other effects might have achieved statistical significance with a much larger sample, their clinical significance may be questioned.

Nurses produced significant and important effects on women's prenatal use of tobacco, timing and likelihood of subsequent pregnancies, subsequent births, and participation in the workforce; mother-child responsive interaction; and the emotional, language and mental development of children born to mothers with low psychological resources. For most outcomes on which the nurses produced beneficial effects, the paraprofessionals' effects were approximately half the size.

It is reasonable to ask whether this trial provided a fair test of the paraprofessional concept, given the paraprofessionals' implementation challenges and that they were expected to follow a program model developed originally for nurses. The literature is replete with descriptions of paraprofessional home-visiting programs that have experienced implementation challenges at least as severe as those encountered here,^{7,46,47} suggesting that such challenges may be inherent in paraprofessional programs. Although other paraprofessional program models might perform better than the one tested here, the absence of clinically or statistically significant effects for most paraprofessional models tested in randomized trials makes this unlikely.

One also might ask whether the nurse-paraprofessional performance discrepancies are explained by differences in their understanding of the study outcomes. Both groups had equal access to the goals and objectives of the program through the visit-by-visit guidelines and paraprofessionals were provided twice the level of supervision as nurses to help them use these guidelines effectively, so differential access to the information is not the cause. Some paraprofessionals had difficulty making good use of the visit guidelines and their supervision,²⁷ however, so part of the discrepancy may be explained by differences in motivation and clinical skill.

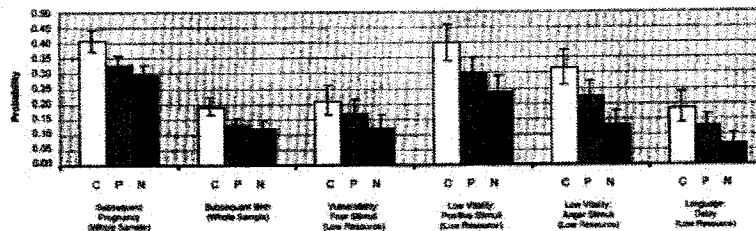


Fig 3. Probabilities \pm standard errors that correspond to estimates for dichotomous outcomes presented in Tables 3 and 4 where there were significant effects or trends for any treatment contrast. Child outcomes are shown for children born to women with low psychological resources. C indicates control; P, paraprofessional; and N, nurse.

TABLE 5 Nurse-Paraprofessional Effect Sizes After Standard Model Adjustments and After Adjustment for Number of Visits Completed and Whether the Mothers Had Continuous Relationships With Their Visitors

Dependent Variables	Sample	Adjustment	
		Standard Model*	Standard Model + Process Covariates†
		LS Mean Difference (95% CI)	LS Mean Difference (95% CI)
Cotinine reduction	Intake smokers	189.16 (-51.38-429.69)	266.75 (-3.34-536.84)
Months worked 13-24 mo	Whole sample	0.71 (-0.28-1.69)	0.62 (-0.44-1.68)
Mother-infant interaction	Low resource	0.06 (-1.87-1.98)	0.08 (-1.99-2.16)
Home environment	Low resource	0.26 (-0.95-1.47)	-0.05 (-1.35-1.24)
Preschool language	Low resource	3.63 (0.11-7.16)	4.59 (0.82-8.36)
Mental development	Low resource	1.26 (-2.52-5.03)	1.33 (-2.71-5.37)

		OR (95% CI)	OR (95% CI)
Subsequent pregnancy	Whole sample	0.88 (0.57–1.36)	0.82 (0.51–1.31)
Subsequent birth	Whole sample	0.99 (0.54–1.79)	1.10 (0.57–2.13)
Vulnerability: fear stimuli	Low resource	0.70 (0.27–1.77)	0.84 (0.31–2.30)
Low vitality joy stimuli	Low resource	0.76 (0.37–1.59)	0.92 (0.42–2.01)
Low vitality anger stimuli	Low resource	0.53 (0.22–1.28)	0.57 (0.23–1.42)
Language disorders	Low resource	0.53 (0.18–1.59)	0.37 (0.12–1.16)

LS indicates least squares; OR, odds ratio; CI, confidence interval.

* Estimates are based on model with the following terms: maternal psychological resources and its interaction with treatments, plus 5 covariates (maternal age, housing density, registration after 28 weeks of pregnancy, conflict with partner, and conflict with own mother). Estimates of cotinine changes for smokers are based on a model that includes maternal psychological resources as a continuous covariate in addition to the 5 core covariates listed above.

† Number of home visits completed and continuous relationship with home visitor (yes or no) and their interactions with psychological resources.

Importantly, the performance of the paraprofessional program tested here was not explained by the paraprofessionals simply delivering less of the program or their having higher rates of disrupted relationships with their families compared with nurses. As explanations for the small effects produced by paraprofessionals are narrowed, it is reasonable to ask whether paraprofessionals have legitimacy in the eyes of families during pregnancy and infancy. Nurses are likely to have engagement and persuasive power with pregnant women and parents of young children because pregnant women have natural concerns about complications of pregnancy, labor and delivery, and care of newborns with which nurses are viewed as authorities.⁸ Paraprofessionals probably lack this natural legitimacy. Moreover, nurses are rated by the public as having the highest honesty and ethics standards of all professionals.⁴⁸ This gives nurses significant power to engage parents and bring about adaptive behavior change and probably accounts for their lower number of attempted visits in which women were not at home compared with paraprofessionals.²⁶

The concentration of beneficial nurse effects on the emotional, language, and mental development of children born to mothers with low psychological resources in the current trial is consistent with corresponding nurse effects on child abuse, neglect, and injuries among children born to low-resource mothers in earlier trials of this program.^{10,17,19} The vulnerable and low-vitality emotion classifications are relevant to child maltreatment. Children who have been abused and neglected have distorted emotional expressions and patterns of communication with their mothers, including lack of social responsiveness, affective withdrawal, lack of pleasure, and heightened negative affect.²⁹

The effect of the nurses and paraprofessionals on responsive mother-child interaction indicates that the program was operating as intended in helping parents provide more sensitive and responsive care for their children, which is thought to promote secure attachment and healthy emotional and behavioral development.⁴⁹ The reductions in subsequent pregnancies and increases in interpregnancy intervals are particularly important as short interpregnancy intervals increase the risk of child maltreatment (including infant homicide among teen parents)⁵⁰ and compromise families' economic self-sufficiency.⁵¹

While the cost of the nurse visitation program (now known as the Nurse Family Partnership) is not insignificant, it has been developed in over 270 counties in the United States outside of research contexts since 1996. Public officials have invested in the nurse visitor program in light of replicated evidence of its effectiveness from randomized trials.⁵² Economic analyses have been conducted in the first trial of this program, where its cost to government was recovered with dividends when focused on higher risk families,^{14,53} and this undoubtedly has influenced public investment. Corresponding economic analyses are being conducted in the current trial, but results will not be available for some time. Paraprofessional programs can cost more than nurse programs when paraprofessionals' caseloads are smaller.

We need to address the limitations of these findings. First, given the higher rate of refusal to participate in the study among women who smoked cigarettes, this trial has limited generalizability to the entire population of smokers and probably users of other substances. Substance users may respond better to paraprofessional visitors than to nurses, but the nurses' success in helping women reduce prenatal tobacco use and the paraprofessionals' lack of effect is not consistent with this hypothesis.

Second, there was higher study attrition among nurse-visited women. Although the risk profiles of (biasing the study against the nurses), the nurse-visited drops may have unmeasured characteristics that place them at greater risk, which would bias the study in favor of the nurses.

Third, women visited by nurses and paraprofessionals may have altered their interview responses and behavior during the observations to coincide with what they thought was expected of them. Some of the strongest effects for the nurse-visited group, however, were on outcomes that do not depend on maternal report or behavioral observation (eg, cotinine markers for tobacco use, observations of infant emotional expressions, tests of child language development), suggesting that differences observed in other domains are valid as well.

Fourth, given the large number of dependent variables, some findings may be spurious. All of the significant effects and trends, however, are in favor of the 2 visited groups. Moreover, the nurse home visitor program has now produced effects in 3 separate trials on the outcome domains examined in this study and the current sample includes a large portion of Hispanics (compared with whites and blacks in previous trials), extending the validity and generalizability of beneficial nurse effects.

Finally, several of the outcome measures (such as subsequent pregnancies and births, language development and language delay) are not independent of one another. They are included to provide a more complete description of program effects on clinically important outcomes.

It is likely that professionals other than nurses can serve as effective home visitors for low-income parents of infants if they are given the right program resources,^{8,54} and effective paraprofessional models eventually may be developed. But until there is consistent evidence from well-conducted randomized trials to support paraprofessional home visiting with any program model, the small effects observed here and elsewhere sound a cautionary note for the many maternal and child health and early intervention programs that purport to promote the health and development of pregnant women and infants with visitors who have limited professional training.

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