INVESTMENTS TO PROMOTE CHILDREN’S HEALTH:
A systematic literature review and economic analysis of interventions in the preschool period

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ABSTRACT

In this study, we argue that poor health of children is not merely a product of individual choices, but rather, it is shaped by a broad set of environmental, genetic, and socioeconomic determinants that affect children both directly and through the conditions that confront their families. Furthermore, poor child health outcomes can disadvantage everyone in the society, as both workforce productivity and community stability are greatly affected by the way that health gets built into the early brain architecture of the developing child. The present study examines both the short- and long-term economic and health impact of health promotion and disease preventive interventions on four selected health problems of particular concern to young children (prenatal to age five) – exposure to tobacco use, obesity, unintentional injury, and mental health problems. The results show compelling evidence of the long-term health impact and societal economic burdens of these four problems when manifested in the preschool years. While the evidence on the effectiveness of preventive interventions is uneven, it does show that, from society’s perspective, the benefits outweigh the costs of such interventions. We conclude this review by making the case that adopting an “investment” approach to children’s health policy offers new opportunities to enhance the health and economic well-being of the entire U.S. population.

BACKGROUND

The National Research Council/Institute of Medicine report From Neurons to Neighborhoods (2000) reviewed the biological, behavioral, social, and environmental forces that shape the growth of an infant’s brain and the development of the young child. That report and related research make the argument that interventions in the early period of children’s lives have positive benefits in strengthening school readiness. From Neurons to Neighborhoods was a catalyst for a large body of work and social policy thinking about early investments in education. While many of these investments are, technically, health-related interventions, the report did not focus specifically on “health” as an outcome or as an important mediator for lifetime human development.

AN ARGUMENT FOR SOCIETAL INVESTMENTS IN CHILDREN’S HEALTH

The idea of societal investment in education has been widely accepted and embraced. Building a parallel argument for societal investment in children’s health may be more difficult, however, for several reasons. First, there is a long history of academic interest and efforts to link early education and later economic returns, including higher productivity and a lower crime rate. In contrast, the research linking early child health to economic outcomes is more recent and less extensive. Second, the pathways that link early educational investments to economic productivity are apparent, including high school graduation and college degree attainment. It may be more difficult to identify the mechanisms through which better children’s health results in economic benefits for all of society. Also, education has been traditionally perceived as a societal responsibility, with accountability resting in the public or governmental sectors. Health, on the other hand, is generally perceived to be a matter of individual choices - for one’s own life style or for accessing good preventive and medical care for one’s children. In this study, however, we argue that the health of children is a societal responsibility, because it is shaped by a broad set of determinants that include socioeconomic status, physical and socio-emotional environments, genetic endowment and biological influences, access to preventive and curative medical technologies and others. In the case of young children, these forces act upon them both directly and through the circumstances faced and choices made by their families.

The rationale for societal investments in the health of young children must be grounded in evidence that subsequent poor health outcomes
disadvantage everyone. For example, failure to make investments in early child immunizations results in the spread of infectious diseases even to those who choose to take care of themselves. This argument has been widely used to justify mandatory vaccinations for school enrollments. The failure to address the precursors in early life of serious chronic illness - diabetes and coronary heart disease - might drive up direct medical costs required to treat these conditions in later life; and these costs may be redistributed across all of society. Societal investments in child health are linked to economic productivity by affecting learning ability and enabling children to be maximally productive in their adult workforce participation. Taking care of sick children can also limit parents’ full participation in work, and thus affect their personal productivity. This can reduce their income and employment-based benefits, and even their ability to manage their household in the way that they would find optimal. Finally, poor children’s health - particularly poor mental health - may have additional direct links to the costs borne by society related to criminal behavior and criminal justice costs and other aspects of dependency.

The case for investing in children’s health pulls together the various threads from the arguments above. Because children are the most vulnerable and dependent members of society, their health is considered to be a measure of the overall health of a society. As such, rates of infant and child mortality are accepted measures of societal health. Disparities in health are often shaped early in life and sustained across the lifespan. The social class gradient in birth weight is an example of such a disparity that begins with maternal health and has implications for future health consequences as well as for high school graduation. On the other hand, health is also a mediator of economic productivity across the lifespan. The ability of adults to be productive workers is limited by their health. Similarly, the “work” of early childhood is development and learning; the state of a child’s health affects his/her ability to do this “work.” Child health and disease patterns are linked to brain development at many stages of the growth and development process, so that separating them is difficult. The trajectories of health and development are thus closely linked.

Forces that shape fetal and child health and development also have implications for adult health five and six decades later. While these observations from Barker and others are now well supported, their mechanisms are just beginning to receive needed research attention. The intrauterine environment - including nutrition, inflammation and infection - appears to interact with the genetic make-up of the fetus, influencing organ development and creating vulnerability to later environment-gene interactions. These early influences and subsequent environmental exposures across the lifespan increase the risk of heart disease, stroke, and cancer. In addition, we now acknowledge that prenatal exposure and exposure of young children to environmental toxins - heavy metals, pesticides, and other chemicals - has enormous implications for health, development and learning.

**Goal of this paper**

The goal of this paper is to systematically review selected areas of the available research on the short- and long-term impacts of health promotion and disease preventive interventions for children from before birth to age five, including their prenatal period. The reviews include the patterns and monetary burden of poor child health, the cost-implications of preventing and treating child health problems, and cost-benefit analyses related to the interventions. Since the age range of interest includes the period before birth, this paper summarizes studies of interventions during pregnancy that report child health and economic outcomes (e.g., prevention of cigarette smoking during pregnancy). In keeping with the broad definition of health proposed in *Children’s Health, the Nation’s Wealth*, we include studies that address mental health as well as physical well-being.
METHODOLOGY

Selection of topics
We selected health topics that would be meaningful to a policy audience, reflect the priorities set in *The Year 2010 Objectives for the Nation,* and provide examples demonstrating the wide range of societal interventions that are needed to address them effectively. The four areas of review include: tobacco exposure, obesity, unintentional injury, and mental health.

Systematic reviews of the literature
Systematic reviews comprehensively identify relevant literature, hence minimizing selection bias and making explicit the methods used to conduct the review. In the present study, we intend to answer the following questions: What are the health and cost consequences of the four problem areas in early childhood and across the lifespan? What are the effectiveness, cost, and cost-effectiveness of early childhood interventions, based on recent and rigorous scientific evidence?

Search strategies and inclusion criteria
Primarily, we searched four databases for early childhood interventions: PubMed, National Health Service Economic Evaluation Database, National Bureau of Economic Research’s working paper database, and EconLit. A set of key words, such as intervention, program, prevention, or evaluation were selected to combine with specific keywords for each topic. Our search was restricted to studies focusing on children, published in English between 1996 and June 2007. Finally, we also manually checked publications of key authors in each field and bibliographies of key review articles for completeness.

Two other key criteria were used in deciding whether to include studies in the systematic review. First, we selected interventions that used an experimental or quasi-experimental design. The evaluation of an intervention is more objective when the intervention adopted a randomized controlled trial (RCT) approach. However, for social science research, a RCT is often infeasible; therefore we included quasi-experimental studies as well. The second inclusion criterion was met if the study measured a change in outcomes (such as overweight rate) or associated behaviors (such as installation of smoke detectors).

Presentation of findings

Synopses of the findings: This part of the paper contains synopses of the findings from each of the four literature reviews and figures showing the interventions in the lifespan conceptual framework. In general, only the most recent citations to the statement are provided in the present paper, due to space limitations. For a complete bibliography on a specific health topic, please refer to the full summary in each of the four appendices.

We present the effectiveness of the included interventions according to the level of the intervention (individual-, family-, community-, and national/state-level). We then review the cost implications of implementing such interventions based on available cost-effectiveness/cost-benefit studies, cost-burden studies, and the aggregated effectiveness of included interventions. We use the Consumer Price Index (CPI) to translate dollar amount presented in previous research into the relative value of the U.S. dollar in 2006.

A LIFESPAN CONCEPTUAL FRAMEWORK: Preventive interventions are often interdisciplinary and multifaceted in nature, and the effects of such interventions can be short-term as well as life-long. In order to conceptualize and visualize the interactions between the nature and the effect of interventions, we developed a lifespan impact framework (as shown in Figures 1 to 4).

The figure rows represent the strata for the level of interventions: individual, family, community, and national. These levels are defined by the identity of the intervention’s primary target, rather than by the setting in which it takes place. For example, we classify an intervention that is initiated by community leaders but delivered via home visits as a community-level intervention, even though the intervention takes place in each household, because such an intervention...
involves people and resources above the family level. This distinction is often hard to make. Our rule of thumb is to use a top-down approach examining the far periphery of a specific intervention first; if an intervention involves national-level campaigns or law enforcement, then we classify it as national-level, even though it might also incorporate family-level components. The columns represent four lifespan stages: preconception/ pregnancy, infant/childhood, adolescence, and adulthood.

For each intervention, we use dark grey shading to indicate when an intervention takes place, and light grey shading to designate the evidence of its extended impact. For example, a car safety-seat adoption campaign targets parents with very young children (age 0-3), but a long-term evaluation may find positive spillover effects in the use of booster seats and seat belts when those children grow up. In this case, we would depict this intervention in dark grey in the infant/childhood column (when it takes place) and in light grey in adolescence and adulthood columns (extended impact). Since the present study focuses on interventions targeting young children, we didn’t search for or include interventions that exclusively target other age groups. Therefore, a blank cell in the adolescent or adult period should not be interpreted as the lack of an intervention, but rather, as being beyond the search scope in the present study.

**Summary papers and evidence tables:** Appended to this overview paper are summary papers for each health topic- tobacco exposure, obesity, unintentional injury, and mental health. Each summary paper is supported by an evidence table that includes extensive details of the reviewed interventions, including principal author’s name and publication year, study question, study design (e.g. randomized controlled trial, quasi-experimental design), nature of the intervention (e.g. components, length, intensity), target population, setting in which the intervention was delivered, sample size and attrition rate, measure of outcomes, results, and our comments. A full bibliography follows each evidence table.

**Results: Synopses of the Literature Reviews**

**Tobacco exposure**

Prevention and cessation of smoking at home and in public can improve the health of children at multiple stages throughout the lifespan. Smoking impacts young children through prenatal exposure, environmental tobacco smoke (ETS), and teen smoking, as smoking habits seen during pregnancy most often form during adolescence. Almost one-half million U.S. babies are born each year to mothers who smoked during pregnancy and an estimated 25-50% of children are exposed by household members to ETS. Prenatal exposure to cigarette smoking is associated with many risks, including perterm delivery, low birth weight, Sudden Infant Death Syndrome, and Attention Deficit Hyperactivity Disorder. In turn, low birth weight, for example, has been associated with developmental setbacks, later poor school attainment, and adverse labor market outcomes. In the same vein, ETS exposure among young children can lead to health consequences that include respiratory symptoms and infections, more frequent and severe asthma attacks, allergies, and ear infections.

The monetary burdens associated with smoking during pregnancy are substantial as well: annual smoking-attributable costs of neonatal care were estimated to be $2.3 billion and the annual costs of smoking-attributable complicated births were $1.85 billion in 2006 dollars. In addition, the cost to treat childhood illnesses caused by parental smoking has been estimated at $7.9 billion per year in 2006 dollars. Based on these figures, just a 15% reduction in parental smoking could save $1 billion in direct medical costs at the prenatal and neonatal levels and into childhood.

Even simple interventions targeting pregnant women can be effective both in increasing smoking cessation and in reducing negative birth outcomes. However, a review of 18 interventions aiming to reduce children’s exposure to household ETS reported wide variation in both intervention components and impact. Three of these studies that can be generalized to the U.S. population showed a...
statistically significant impact on parent-reported smoking or household nicotine levels. Youth smoking prevention and cessation also has been effective when programs emphasize cognitive-behavioral therapy and address the social environment. The evidence supports mass media campaigns as effective, particularly when they are implemented in conjunction with other interventions targeting youth and with policy-level interventions, such as increasing the price of tobacco products. Enforcement of age bans is effective as well. In summary, there is considerable evidence that many anti-tobacco interventions, particularly those employing a multifaceted approach, are effective, can improve child health, and save healthcare dollars in the long term.

Figure 1. Lifespan Impact of Tobacco Treatment and Prevention Efforts

<table>
<thead>
<tr>
<th>LEVEL OF INTERVENTION</th>
<th>Preconception/ Pregnancy</th>
<th>Infant/Childhood</th>
<th>Adolescence</th>
<th>Adulthood</th>
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<tr>
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<td>Smoking cessation therapy with partner support 1</td>
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<td>Smoking cessation therapy targeting relapse</td>
<td>Smoking cessation therapy targeting relapse</td>
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<tr>
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<td>Smoking cessation for adults living with children 1</td>
<td>Smoking cessation for adults living with children 1</td>
<td>Smoking cessation for adults living with children 1</td>
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<tr>
<td>Local/ Community/ Workplace/ School</td>
<td>Bans/restrictions in workplaces and public 1</td>
<td>Bans/restrictions in workplaces and public 1</td>
<td>Bans/restrictions in workplaces and public 1</td>
<td>Bans/restrictions in workplaces and public 1</td>
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<td>Media campaigns 1</td>
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<td>Price increases 1</td>
<td>Price increases 1</td>
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<td>Enforcement of age ban on sales 1</td>
<td>Enforcement of age ban on sales 1</td>
<td>Enforcement of age ban on sales 1</td>
<td>Enforcement of age ban on sales 1</td>
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</table>

2 Lantz et al 2000; Thomas & Perera 2006; Levy et al 2004; Ranney et al 2006; McDonald et al 2003; Albrecht et al 2006; Colby et al 2005; Sussman 2002
3ii Donatelle et al 2000; Stanton et al 2004
6vi Hopkins et al 2001; Levy et al 2004; USDHHS 2001
7vii CDC 1999; Lantz et al 2000; Slater et al 2006

Age period when interventions take place
Age period with continuing positive impacts of intervention
Obesity

Childhood obesity\(^1\) is a significant and growing problem in our society. Over the past thirty years, the obesity rate has nearly tripled among preschool children, from five to 14%.\(^2\) The prevalence of overweight among children and youth from certain ethnic minority groups is estimated to be even higher. This surge in weight increase among young children cannot be simply attributed to uninforming parenting behaviors or bad genes, but rather, is a result of a collection of societal phenomena that contributes to increasing calorie intake and decreasing physical activity: the rise of fast food, aggressive food marketing to children, suburbanization and sprawl, and increases in computer games and TV programs.

In the absence of effective interventions, for many children, overweight persists throughout the lifespan. Preschool children ever overweight have been found to be five times more likely than preschool children with normal weights to be overweight at age 12.\(^3\) In addition, obesity persists into adulthood for an estimated 50-80% of overweight children and adolescents.\(^4\)

The physical health consequences of childhood overweight include orthopedic complications, metabolic disturbances, type 2 diabetes, disrupted sleep patterns, poor immune function, endocrine problems, impaired mobility, increased blood pressure and hypertension, and increased risk of coronary heart disease in adulthood.\(^5\)\(^6\) The psycho-social consequences include low self-esteem, social alienation, discrimination, lower self-reported quality of life, and depression.\(^7\) It is projected that pediatric obesity might shorten life expectancy by two to five years by midcentury in the United States.\(^8\)\(^9\)

In addition, obesity is associated with increased morbidity and mortality among pregnant women,\(^10\) who are also, regardless of their health prior to pregnancy, at increased risk for pregnancy complications, labor and delivery problems, and cesarean delivery.\(^11\) In addition, maternal overweight is associated with infant birth defects\(^12\) and macrosomia.\(^13\)

Researchers studying the economic costs of obesity in the United States estimate that direct costs reach $109 billion per year and indirect costs total $75 billion (in 2006 dollars).\(^14\) Among pregnant women, the costs of prenatal care for those who are overweight are estimated to be five to 16 times higher than for women of healthy weights, increasing with level of obesity.\(^15\) Among children, the economic costs also are significant. Obesity-related hospital costs for children ages six-to-17 increased almost four-fold between 1979 and 1999 from $44 million to $160 million in 2006 dollars, as the discharges for diabetes nearly doubled.\(^16\)

However, the overall effectiveness of interventions to prevent or treat overweight in childhood is unclear, and few studies target young children in particular. To date, evidence of some programmatic success among preschoolers is limited to the ‘Hip-Hop to Health Jr’ program, and only when it was implemented among a group of African-American children.\(^17\) A 2005 Cochrane Review concluded that studies to prevent childhood overweight were “heterogeneous in terms of study design, quality, target population, theoretical underpinning, and outcome measures, making it impossible to combine study findings using statistical methods.”\(^18\)

Because of the limited evidence to date, researchers question the approach of single or multiple behavioral interventions targeting childhood overweight and instead suggest that, like many other public health problems, a successful approach to reducing childhood obesity will require multifaceted educational, environmental, and structural factors.\(^19\)\(^20\)

\(^{1}\) Although measures and cutoff points of defining childhood obesity have changed over time, the US Centers for Disease Control and Prevention (2000), which uses the term ‘overweight’ rather than ‘obesity’, uses a cutoff of body mass index (weight [kg] / height [m^2]) at or above the 95th percentile for age and sex based on the reference population of the CDC 2000 growth charts. The CDC designates children “at risk for overweight” if they have a BMI between the 85th and 95th percentiles.
Figure 2. Lifespan Impact of Obesity Interventions

<table>
<thead>
<tr>
<th>LEVEL OF INTERVENTION</th>
<th>Preconception/ Pregnancy</th>
<th>Infant/Childhood</th>
<th>Adolescence</th>
<th>Adulthood</th>
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<tr>
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<td>Observational studies ³</td>
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<td>Observational studies ⁴</td>
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<tr>
<td>Family</td>
<td>Preschool education ³</td>
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<td>Parent education ⁴</td>
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<td>Local/Community/Workplace/School</td>
<td>Teacher curriculum ⁵</td>
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<td>National/State</td>
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| Filled box            | Age period when interventions take place |
| Filled box            | Age period with continuing positive impacts of intervention |

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³ Eriksson et al. 2001; Nader et al. 2006  
⁴ Field et al. 2005  
⁵ Fitzgibbon et al. 2005  
⁶ Golan et al. 2006  
⁷ Summerbell et al. 2003
Unintentional Injury Prevention

Injuries are the leading cause of disability, death, and health care utilization for children and teenagers between the ages of one and 19 in the United States. It was estimated that, in 1996, unintentional injuries left approximately 150,000 children and adolescents permanently disabled. Injuries are associated with environmental hazards and poor quality of housing, poverty, poor parenting, single parenting, alcohol and substance abuse, and neglect.

Studies assessing the monetary burdens of child injuries generally take a societal perspective to estimate both immediate medical costs and longer-term costs due to productivity loss, including costs to victims, families, government, insurers, and taxpayers. One recent study that estimated cost burdens of all injuries found that both fatal and nonfatal injuries among children ages zero to four had resulted in $4.7 billion in life-long medical costs and $14 billion for both present and future productivity losses. In 1996, about three in every ten children suffered an unintentional injury serious enough to require medical treatment or cause at least half a day of restricted activity, at an estimated average cost per victim of $4,626 in 2006 dollars.

Figure 3. Lifespan Impact of Injury Prevention Efforts

<table>
<thead>
<tr>
<th>LEVEL OF INTERVENTION</th>
<th>PRECONCEPTION/PREGNANCY</th>
<th>INFANT/CHILDHOOD</th>
<th>ADOLESCENCE</th>
<th>ADULTHOOD</th>
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<td>Gun safety education i</td>
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<td>Family</td>
<td>Home visits ii</td>
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<td>Prenatal home visitation iii</td>
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<td>Education against the use of baby walkers iv</td>
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<td>Local/Community/Workplace/School</td>
<td>Community education combined with incentives distribution for road safety v</td>
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<td>Smoke detector distribution</td>
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<td>National/State</td>
<td>Changes in baby walker safety standards vi</td>
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<td>Child passenger safety laws vi</td>
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</tbody>
</table>

Legend:

- Gray box: Age period when interventions take place
- Gray shaded box: Age period with continuing positive impacts of intervention

i Hardy 2002
iii Kitzman 1997
iv Kendrick et al 2005
v Greenberg-Seth et al. 2004
vi Rodgers & Leland 2005
vii Segui-Gomez et al. 2001
Historical trends show that the occurrence of injuries can be reduced. Between 1985 and 2000, for example, the incidence rate of injuries decreased from 2,259 to 1,740 per 10,000 for children between 0-4. Many studies show that preventive interventions can effectively reduce the incidence of injuries in such areas as gun, road, home, and community safety. A majority of interventions aimed at improving road and home safety found significant changes in desired behaviors. For example, one incentive program that provided bilingual education materials and rewards for positive behavior to a low-income Hispanic community significantly increased child rear seating from 33 to 49% in the intervention city. Another program that targeted elementary school children in Quebec and included persuasive communication and activities to facilitate bicycle helmet acquisition was found to significantly increase the use of helmets for the group exposed to the program from 1.3 to 33%. In addition, a multifaceted community campaign including education, car seat training, and discount coupons for booster seats in Washington State considerably increased booster seat use. Finally, among seven home safety intervention studies, six found significant improvement in the intervention group for at least one safety measure, such as lowering tap water temperature, compared to the control group. Fewer studies investigated changes in the injury rate per se as outcomes, but some of those studies did find positive changes as well.

In sum, unintentional injury prevention is a good example of a multifaceted public health approach that has succeeded through the use of a variety of preventive strategies, including: changing engineering or environments, improving parents’ and children’s knowledge and safety behaviors, and adopting the use of safety devices.

**Mental Health**

In 1999, the Surgeon General estimated that 20% percent of children had mental disorders causing at least mild functional impairments. Younger children are not immune to mental health concerns; a significant minority of infants, toddlers and preschoolers manifest some form of problematic behavior with cost implications that are significant. For children between the ages of one and six, 3.4-6.6% exhibit externalizing behaviors—or acting out—and 3.0-6.6% manifest internalizing behaviors—withdrawal, depression or anxiety. The annual cost of treating children ages one to five nationwide was estimated at $864 million in 2006 dollars. One U.K. study found that the average total societal cost (such as health service, public sector services) for individual with unsolved conduct disorder at age ten was £70,019 by age 28 ($141,161 in 2006 dollars), ten times higher than for those without such problems.

The etiology of early childhood mental health problems is multi-factorial, with important contributions made by genetic, dispositional, and environmental factors. The incidence of early childhood behavior problems has been shown to be associated with poverty, maternal depression, and insecure attachment to caregivers, as well as harsh, inconsistent discipline. Early disruptive and aggressive behavior tends to persist and develop into chronic and severe forms of anti-social behavior. As such, behavior problems are found to have a large negative effect on other outcomes, such as educational attainment, unemployment, and violent crimes committed.

A variety of early intervention strategies having different targets and theoretical underpinnings have been tested in the past decade. The majority (34 of 59) of the studies examined here used parent-focused training, in which parents learn from a psychologist or educator [or video tape] about effective behavior management skills. In general, more intensive versions yielded better results than less intensive ones. Other programs focus on improving the quality of the relationship between parents and children and providing parents with skills to manage disruptive behavior; 13 of the 14 studies reported that such interventions improved either infant/toddler-parent interaction, children’s security or
behaviors, or maternal depressive symptoms. In addition, nine studies targeted various risk factors and provided family-level training programs, both parent- and child-focused, in group settings. It appears that child- and parent-training each made a unique contribution to the improvement of children’s outcomes. At the system-level, New Hope, an employment-based antipoverty program for adults living in poverty, with strong work support through extensive child-care assistance and health care subsidies, had a positive effect on teacher-reported child behavior problems.111

There is limited data on the sustained impact of these interventions, with the longest follow-up data from the Carolina Abecedarian Project, a comprehensive early education program for preschoolers at-risk. Researchers using these data found that, at age 21, individuals who had child-care treatment reported fewer depressive symptoms than those in the control group (26 vs. 37 percent).112

Figure 4. Lifespan Impact of Interventions for Mental Health Disorders

<table>
<thead>
<tr>
<th>LEVEL OF INTERVENTION</th>
<th>LIFESPAN STAGE INTERVENTION AND IMPACT</th>
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<tbody>
<tr>
<td></td>
<td>Preconception/ Pregnancy</td>
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<td>Individual</td>
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<td></td>
<td>Infant/Childhood</td>
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<td>Parent- and child-focused programs</td>
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<td></td>
<td>Collaborative problem solving</td>
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<tr>
<td>Local/ Community/ School</td>
<td>School-based: Fast Track</td>
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<tr>
<td>National/State</td>
<td>New Hope</td>
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</tbody>
</table>

Age period when interventions take place

Age period with continuing positive impacts of intervention

1 Abecedarian project
2 Healthy Steps, Early Head Start
3 Incredible Years’ Dinosaur Curriculum
4 Triple P
7 Conduct Problems Prevention Research Group 2004
8 Huston AC et al. 2005
DISCUSSION, INFERENCES AND CONCLUSIONS

Overall magnitude of children’s health burden
We selected four children’s health topics to review: tobacco exposure, obesity, unintentional injury and mental health. These topics are not specific disease conditions, but represent a broad array of health problems and exposures. They were selected, in part, because they constitute a significant burden of the health problems faced by children and because solutions to these major health concerns go well beyond the simple medical model of a doctor treating a sick child. Addressing the underlying health needs of American children will require policy makers to understand the complexity and multiple determinants of health conditions.

We attempted to estimate the magnitude of the burden of these four topics on the overall health of America’s children by summarizing findings from a variety of prevalence studies. First, an estimated 25-50% of children are exposed to environmental tobacco smoke by household members; 10.2% of women giving birth in 2004 in the United States smoked during pregnancy. Second, over the past thirty years, the prevalence of obesity has nearly tripled for preschool children (from five to 14%). Third, annually, about three in ten children suffer an unintentional injury serious enough to require medical treatment or cause at least a half-day of restricted activity. Finally, for children between the ages of one and six, 3.4-6.6% are estimated to have externalizing behaviors, or acting out, and 3-6.6% manifest withdrawal, depression or anxiety—often referred to as internalizing behaviors. The rate of co-morbid (both externalizing and internalizing) mental health conditions is estimated to be around 3.3%.

There is no simple way to aggregate the impact of these conditions on preschool children in the United States. We cannot simply add the prevalence estimates, because there are high correlations among the four health problems; for example, obese girls are often also depressed. Furthermore, all four health problems are highly correlated with disadvantaged socioeconomic status, so children from poor families are more likely to experience more than one problem. Regardless of the exact number, it is clear that the prevalence and impact of these four problems impose a universal risk on American children and society’s overall health and well-being. This assessed burden is consistent with Markel and Golden’s recommendation for improving children’s health: “[A]ttack the biggest health problems. Not the most scientifically interesting ones.”

As emerging health problems, such as autism, attract increasing attention and resources, it is critical that researchers, policy-makers and investors remember that “less interesting” health problems, like smoking exposure and unintentional injury, still affect a sizable proportion of U.S. children and lead to tremendous health and economic consequences. Considerable preventive intervention efforts still remain to be made in those “aging” fields to benefit the majority of the child population.

Inferences from the literature
Some general themes emerge from the literature reviews and economic analyses. First, the evidence of the health impact and economic costs and long-term consequences of these four health problems among preschool children is compelling. Since the economic data come from a wide variety of sources and types of studies, it is not possible to create an exact estimate of their total economic cost. However, it is likely that the lifetime societal burden of these problems attributable to the preschool period, if untreated, is well into the hundreds of billions of dollars for each birth cohort; assuming that the four health problems combined may affect approximately 50% of each birth cohort — about two million children each year — an average
of total lifetime societal costs (including health care, special education, productivity loss, civil justice, etc.) of $50,000 per child will translate to $100 billion for the whole birth cohort.

Second, there is enough evidence from the intervention studies to indicate that, particularly in the case of tobacco control and injury prevention, effective interventions are available, and the cost savings from their implementation would be considerable. Unfortunately, the evidence from intervention studies across all four areas is uneven; the strategies for intervention are different, and the effectiveness of programs is mixed. For example, to date, few interventions have targeted obesity among preschoolers.

Third, the evidence for cost-effectiveness of interventions is also limited. Economic evaluations in the areas of obesity prevention and mental health treatment are particularly underdeveloped; these are areas of more recent concern and have less completed research. This is not because we are unaware of the substantial potential savings from preventing the public health problems, but, rather, because we have little data on the cost of effective interventions that have long-term consequences. Data are absent at all points along the continuum—we lack any cost data, effectiveness data, and links to long-term consequences.

Fourth, our ability to draw global inferences is limited by the variability of the preventive strategies according to problem area. For example, most interventions to address emotional and behavioral problems adopted tertiary strategies that provide intensive interventions to a small percentage of children and families who have serious and persistent challenging behaviors; few examples currently exist of primary prevention of mental health problems. For tobacco exposure, obesity, and injury, however, universal or primary interventions were implemented to target most children.

Fifth, across all four health problem areas, few intervention studies demonstrate long-term effects. This limitation of the literature reflects the well-known problem that research funders have been generally unwilling to support longitudinal research. Thus, the scientific evidence linking early childhood health policy to adult health outcomes remains theoretical and observational. While complex epidemiological, mathematical models can be constructed to link early childhood interventions with later outcomes, only well-designed longitudinal studies will demonstrate causality.

Lastly, we were struck repeatedly by the paucity of research data on these important health problems and on their prevention. Unlike areas of adult health policy, where enormous bodies of preventive intervention research have formed the basis of policy, the children’s health area is much neglected. Thus, in the very age group in which we believe there may be the biggest opportunity for long-term health gains, there is the least evidence on both effectiveness and the cost of achieving effective changes.

**CONCLUSION**

This review shows that our society has failed to take advantage of opportunities to approach the health of young children as an investment; the high costs experienced by unhealthy adolescents and adults could be mitigated by helping young children be healthier. There is evidence that the costs of interventions for young children are relatively low in comparison with the later costs, when the problems are more prevalent and costly. Further, the costs of unhealthy children can be large even in childhood, and there are interventions that can effectively bring change.
We conclude that adopting an “investment” approach to children’s health policy offers new opportunities to enhance the health of the U.S. population. Investors generally expect returns on their investments. While, in theory, preventive interventions promise such gains, the hard evidence is not yet strong enough to support the theory. We have identified only a handful of rigorous intervention studies during this review of four major child health topics. Those studies begin to support the case for investing in effective interventions to promote early child health, but they need to be reinforced by a larger body of evidence and a policy process that is willing to wait for returns on investments to support a major policy agenda.

As a nation, we have, for a long time, invested relatively small amounts in children’s health. A recent study estimated that the Federal government’s total investment spending for children in 2006 was 1.6% of GDP, and the share of the federal budget is projected to decline by 14-29% between 2006 and 2017. Now may be the time to reverse this trend of disinvestment, if we are to improve the health of children and avert future health and cost consequences. There is an urgent need for more rigorous research to examine the longitudinal causal relationships and provide solid economic data to convince policy-makers to invest more heavily and more urgently in improving the health of children and their families. The recently launched Children’s Health Study (www.nationalchildrensstudy.gov) may represent a good start to building such a body of research, but other efforts will be needed to address the broad range of policy-relevant questions. The failure to strengthen prevention research and practice in this young age group brings with it the risk that future researchers a decade from now will still find the literature inadequate to make a strong policy case, and that the magnitude of the burden of poor health attributable to missed opportunities for early prevention will be even greater.
APPENDIX A: TOBACCO USE PREVENTION AND INTERVENTION

MAGNITUDE: Cigarette smoking is the leading cause of preventable death in the United States, resulting in more than 440,000 deaths each year. Approximately 21% of adults, 23% of high-school students, and 8% of middle school students smoke. Additionally, an estimated 25-50% of children are exposed to environmental tobacco smoke (ETS) by household members and the median exposure level of children ages four to eleven years is twice as high as that of adults. Further, almost one-half million US babies are born each year to mothers who smoked during pregnancy.

DETERMINANTS: Several factors are associated with tobacco use and exposure within the maternal and child health population. Among pregnant women, identified factors include partners’ and friends’ smoking habits, socioeconomic status, age at first pregnancy, educational attainment, and parity. Among adolescents, factors include parental education, family socioeconomic status, parental smoking, and personal/psychological traits. Poor educational attainment and single parenthood is associated with children’s exposure to ETS at home.

HEALTH CONSEQUENCES: Smoking impacts young children through prenatal exposure, ETS, and teen smoking, where smoking habits seen during pregnancy most often form during adolescence. Prenatal exposure to cigarette smoke is associated with increased risks of preterm delivery, premature rupture of membranes, placenta previa, low birth weight, spontaneous abortion, ectopic pregnancy, and Sudden Infant Death Syndrome. Smoking during pregnancy is also associated with a reduced likelihood of breastfeeding, and, for the child, increased risks for Attention Deficit Hyperactivity Disorder and wheezing during the first few years of life. Studies have shown that exposure to ETS among young children can lead to health consequences that include respiratory symptoms (including cough, wheezing, and breathlessness), acute lower respiratory infections, asthma, more frequent and severe asthma attacks, allergies, ear infections, and recurrent otitis media.

ECONOMIC CONSEQUENCES: Tobacco use also has significant economic consequences. The total cost of smoking among US adults was estimated at more than $167 billion per year between 1997-2001 due to direct medical expenses and lost productivity. In addition, adult smokers cost their employers an extra $960 each year [$1,636 in 2006 dollars] and have 30% more absenteeism than their non-smoking colleagues. The monetary burden associated with smoking during pregnancy is substantial as well: Nationally, costs of neonatal care attributed to smoking were estimated to be $1.8 billion in 1996 [$2.3 billion in 2006 dollars] and the added costs of complicated births were $1.4 billion [$1.85 billion dollars]. Another study, conducted in 1999, estimated that if smoking prevalence among pregnant women were to drop by just 1%, $21 million [$25 million in 2006 dollars] in direct medical costs would be saved in the first year alone. If the prevalence continued dropping by 1% annually, $572 million in direct medical costs would be saved over 7 years. Smoking during pregnancy has a well-documented association with low birth weight, which is linked to developmental setbacks, future poor school attainment, and, finally, adverse labor market outcomes. An economic study based on data of female twins estimated that a mother who smoked one pack of cigarettes per day would reduce the lifetime earnings of her child by over 10%.
In addition, the cost to treat childhood illnesses caused by parental smoking has been estimated at $7.9 billion, with costs due to loss of life as high as $13.76 billion [in 2006 dollars]. A 15% reduction in parental smoking could save $1 billion in direct medical costs.

**Evidence for Successful Prevention and Treatment:** There is considerable evidence that many anti-tobacco interventions are effective and can improve child health and save healthcare dollars. For example, the literature examining the impact of interventions targeting pregnant women demonstrates that even simple interventions can be effective both in increasing smoking cessation and in reducing negative birth outcomes, such as low birth weight and preterm birth, while increasing birth weight.

Successful examples include:

- Incorporating augmented or extended psychosocial interventions that exceed minimal physician advice tripled cessation rates among pregnant women.
- A brief 5-15 minute counseling session with pregnancy-specific educational materials delivered by a trained provider increased cessation rates among pregnant women (risk ratio 1.7 [95% CI = 1.3-2.2]).
- The involvement of a member of the pregnant woman’s social network to provide support tripled cessation rates (p<.0001).

While there is good evidence for effective prevention of smoking during pregnancy, relapse during the postpartum period poses as a challenge. Suggestions to improve programs’ effectiveness include addressing postpartum stresses, incorporating the programs into routine health care, and involving the woman’s social support network, including her partner.

Addressing postpartum smoking is particularly important because of its direct link to childhood exposure to ETS.

Evidence of the effectiveness of interventions that target child household ETS exposure is mixed. A review of 18 interventions aimed at reducing children’s exposure to household ETS reported wide variation in both intervention components and impact. Three of the studies reviewed that can be generalized to the U.S. population, all of which provided intensive counseling to smoking parents, showed a statistically significant impact on parent-reported smoking or household nicotine levels.

Preventing smoking and increasing smoking cessation among youth has also been a major focus of interventions. Among those based in schools, sufficient evidence exists that many interventions, particularly those that emphasize cognitive-behavioral therapy and the social environment (including peers, family and culture), can have at least a short-term impact. Evidence suggests that mass media campaigns are effective, particularly when they are implemented in conjunction with other interventions targeting youth.

There is also strong evidence for the effectiveness of adolescent anti-smoking interventions implemented at the policy level, such as increasing the price of tobacco products and enforcing age bans.

**Cost Implications of Interventions:** Several studies have shown the results of cost-benefit studies of anti-tobacco interventions. For example, one meta-analysis of programs that disseminate smoking cessation materials among pregnant women estimates that, if this simple intervention were implemented among all US expectant women who smoked and resulted in an additional four percent cessation rate, it would yield $77 million of savings for direct medical costs.
costs in the first year (adjusted to 2006 dollars).\textsuperscript{187} The authors suggest that this program has an estimated cost-to-benefit ratio of 1:12.\textsuperscript{188} An earlier analysis concluded that even a single 5 to 15 minute counseling session by a trained provider can save $3 in neonatal intensive care costs for every $1 spent.\textsuperscript{189} Similarly, the CDC estimates that giving Medicaid participants one counseling session that costs $30 and can be expected to result in an 18% quit rate can save almost $3.50 in averted neonatal care expenditures for every $1 spent.\textsuperscript{190}

Anti-tobacco policies targeting adolescents can be cost-effective as well. For example, one 2001 study estimated that a program to enforce age bans (including licensing of tobacco vendors, quarterly inspections of all vendors for underage shopping, and civil penalties for vendors who made illegal sales to underage shoppers) costed between $44 and $3,100 per year of life saved, depending on assumptions on cost and efficacy. These estimates show this program to be more cost-effective than mammographies, and the cost could be funded by a one cent per-pack tax.\textsuperscript{191} Another study concluded that a 10% increase in the price of tobacco products would reduce teen smoking by four percent.\textsuperscript{192} The smoking rates of adolescent males and minorities especially may be sensitive to changes in price.\textsuperscript{193}

Neither the cost nor the cost-effectiveness of interventions to reduce childhood ETS exposure has been examined to date.\textsuperscript{194}

**CONCLUSION:** Prevention and cessation of smoking can improve the health of children and their families at multiple stages throughout the lifespan. Effective interventions exist, although the evidence base for those implemented among maternal and child health populations is mixed and, in some cases, still limited, particularly regarding long-term effects and the cost-effectiveness of programs to reduce childhood ETS exposure.

A review of the literature suggests that comprehensive strategies attempting to build on synergies across settings may have the greatest impact.\textsuperscript{195,196,197,198,199} Further, interventions that prevent or stop early exposure to tobacco can have significant effects throughout the lifespan (Figure). Given the significant health and economic costs associated with tobacco use, future interventions should build upon the current evidence base to guide the development of the most effective strategies to protect young children and their families from its consequences.
Figure 1: Lifespan Impact of Tobacco Treatment and Prevention Efforts

<table>
<thead>
<tr>
<th>Level of Intervention</th>
<th>Preconception/ Pregnancy</th>
<th>Infant/Childhood</th>
<th>Adolescence</th>
<th>Adulthood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>Smoking cessation therapy (^{xxxi})</td>
<td></td>
<td>Smoking cessation therapy (^{xxii})</td>
<td></td>
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<tr>
<td></td>
<td>Smoking cessation therapy with partner support (^{xxxiii})</td>
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<tr>
<td></td>
<td>Smoking cessation therapy targeting relapse</td>
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<tr>
<td>Family</td>
<td>Smoking cessation for adults living with children (^{xxxiv})</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local/ Community/ Workplace/ School</td>
<td></td>
<td>Media campaigns (^{xxxv})</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Bans/restrictions in workplaces and public (^{xxxvi})</td>
<td></td>
<td>Community mobilization (^{xxxvii})</td>
<td></td>
</tr>
<tr>
<td>National/State</td>
<td></td>
<td>Price increases (^{xxxviii})</td>
<td>Enforcement of age ban on sales (^{xxxix})</td>
<td></td>
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</tbody>
</table>

- **Age period when interventions take place**
- **Age period with continuing positive impacts of intervention**

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\(^{xxii}\) Lantz et al 2000; Thomas & Perera 2006; Levy et al 2004; Ranney et al 2006; McDonald et al 2003; Albrecht et al 2006; Colby et al 2005; Sussman 2002

\(^{xxxiii}\) Donatelle et al 2000; Stanton et al 2004


\(^{xxxvi}\) Hopkins et al 2001; Levy et al 2004; USDHHS 2001

\(^{xxxvii}\) CDC 1999; Lantz et al 2000; Slater et al 2006

\(^{xxxviii}\) CDC 2000; Levy et al 2004; Task Force on Prev Services 2000; Ranney et al 2006

\(^{xxxix}\) Pbert et al 2003; Task Force on Prev Services 2000; DiFranza et al 2001
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Perspective</th>
<th>Study type and design</th>
<th>Population and Setting</th>
<th>Results/Comments</th>
</tr>
</thead>
</table>
| Adams et al      | To derive estimates of the smoking-attributable costs for direct medical expenditures (i.e., inpatient, physician, hospital outpatient, and emergency department costs) related to pregnancy outcomes | Societal    | • Cost estimate  
• Analysis of 1987 National Medical Expenditures Survey data  
• Cost estimates based on amounts paid by all insurers and by persons paying out-of-pocket for health care  
• The probability of pregnancy complications and expected expenditures were estimated based on socio-demographic factors, receipt and timing of prenatal care, and smoking status | Civilian, non-institutionalized US population                                                                 | Medical-care expenditures attributable to smokers with complicated births (e.g., hemorrhage from placenta previa, maternal infection, fetal distress, or mal-position of the fetus) were an estimated $791 million, representing 11% of the total medical expenditures for all complicated births ($7 billion). When a smoking prevalence during pregnancy of 27% was used in the calculation, the estimated smoking-attributable costs were $1.1 billion (15% of total expenditures). Smoking-attributable costs of complicated births were updated to 1995 by accounting for medical-care cost inflation and the number of live-born infants in 1995 (3.9 million). The estimated smoking-attributable costs were $1.4 billion (11% of costs for all complicated births) in 1995 dollars, based on a smoking prevalence during pregnancy of 19%, and an estimated $2.0 billion (15%) based on a smoking prevalence of 27%. |
| Aligne & Stoddard| To determine the economic influence of pediatric disease attributable to parental smoking | Payer       | • Cost estimate  
• US population  
Inclusion: Neonate to 18 years old | Setting:  
Direct Medical: $1.2 billion; Loss of Life: $3.7 billion  
Cost attributable to LBW:  
Direct Medical: $1.2 billion; Loss of Life: $3.7 billion  
Cost attributable to SIDS:  
Loss of Life: $2.7 billion  
Cost attributable to RSV:  
Direct Medical: $130 million; Loss of Life: $1.5 billion  
Cost attributable to Otitis Media:  
Direct Medical: $150 million  
Cost attributable to Otitis Media with Effusion:  
Direct Medical: $290 million  
Cost attributable to Asthma:  
Direct Medical: $180 million; Loss of Life: $19 million  
Cost attributable to Burns:  
Direct Medical: $24 billion; Loss of Life: $330 million | Total Costs:  
Direct Medical: $4.6 billion; Loss of Life: $8 billion  
Cost attributable to LBW:  
Direct Medical: $1.2 billion; Loss of Life: $3.7 billion  
Cost attributable to SIDS:  
Loss of Life: $2.7 billion  
Cost attributable to RSV:  
Direct Medical: $130 million; Loss of Life: $1.5 billion  
Cost attributable to Otitis Media:  
Direct Medical: $150 million  
Cost attributable to Otitis Media with Effusion:  
Direct Medical: $290 million  
Cost attributable to Asthma:  
Direct Medical: $180 million; Loss of Life: $19 million  
Cost attributable to Burns:  
Direct Medical: $24 billion; Loss of Life: $330 million |
**TOBACCO USE PREVENTION AND CESSATION—ECONOMIC STUDIES**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Perspective</th>
<th>Study type and design</th>
<th>Population and Setting</th>
<th>Results/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armour et al</td>
<td>To develop estimates of smoking attributable mortality, years of potential life lost (YPLL) for adults and infants and productivity losses for adults</td>
<td>Societal</td>
<td>Used the CDC’s Adult and Maternal and Child Health Smoking-Attributable Mortality, Morbidity and Economic Cost (SAMMEC) software to estimate costs</td>
<td>Adult men and women and infants in the US</td>
<td>During 1997–2001, cigarette smoking and exposure to tobacco smoke resulted in approximately 438,000 premature deaths in the United States, 5.5 million YPLL, and $92 billion in productivity losses annually (approximately $61.9 billion for men and $30.5 billion for women).</td>
</tr>
<tr>
<td>Bertera</td>
<td>To estimate the impact of behavioral risk factors on absenteeism and health-care costs</td>
<td>Employer</td>
<td>A cross-sectional design was used to evaluate health risk appraisal and physical-examination data collected from 1984 through 1988. 45,976 employees of Dupont (a large, diversified industrial workforce in the US)</td>
<td></td>
<td>Employees with any of six behavioral risks had significantly higher absenteeism (range = 10% to 32%) compared with those without risks (in particular, smokers had 30% more absenteeism than non-smokers). These differences led to significantly higher illness costs (defined as compensation, health care, and non-health care benefits) for those with risks compared with those without risks. Annual excess illness costs per person at risk were smoking, $960; overweight, $401; excess alcohol, $389; elevated cholesterol, $370; high blood pressure, $343; inadequate seatbelt use, $272; and lack of exercise, $130. Only one factor, lack of exercise, was not significant after adjusting for age, education, pay category, and the six other behavioral risks. The total cost to the company of excess illness was conservatively estimated at $70.8 million annually.</td>
</tr>
<tr>
<td>Centers for Disease Control and Prevention</td>
<td>To provide national estimates of annual smoking-attributable mortality, years of potential life lost (YPLL), smoking-attributable medical expenditures for adults and infants, and productivity costs for adults.</td>
<td>Societal</td>
<td>Used the CDC’s Adult and Maternal and Child Health Smoking-Attributable Mortality, Morbidity and Economic Cost (SAMMEC) software to estimate costs</td>
<td>Adult men and women and infants in the US</td>
<td>During 1995–1999, the average annual mortality-related productivity losses attributable to smoking for adults were $81.9 billion (Table 2). In 1998, smoking-attributable personal health-care medical expenditures were $75.5 billion. For each of the approximately 46.5 million adult smokers in 1999, these costs represent $1,760 in lost productivity and $1,623 in excess medical expenditures. Smoking-attributable neonatal expenditures were $366 million in 1996, or $704 per maternal smoker ($8 per adult smoker). Maternal smoking accounted for 2.3% of total neonatal medical expenditures in 1996. The economic costs of smoking totaled $3,391 per smoker per year.</td>
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<tr>
<td>Authors</td>
<td>Study Question</td>
<td>Perspective</td>
<td>Study type and design</td>
<td>Population and Setting</td>
<td>Results/Comments</td>
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<tr>
<td>DiFranza et al</td>
<td>To estimate the cost-effectiveness of active enforcement of tobacco sales to minors on a national level.</td>
<td>Societal</td>
<td>The intervention included employing minors to attempt tobacco purchases, licensing tobacco vendors, and civil penalties for vendors who illegally sold tobacco products to minors. Analyses were based on enforcement costs of $50, $150, $250, and $350, where marginal expense is lowest at the community level and highest at the federal level.</td>
<td>Setting: USA</td>
<td>Primary outcome measures consisted of four levels of reduction in youth tobacco use ranging from 5% to 50%, with subsequent cost-effectiveness ratios ranging from $44 to $3100 per year of life saved. Inspecting an estimated 543,000 tobacco outlets would cost up to $190 million annually. An enforcement program could save 10 times as many lives as the same amount spent on mammography or screening for colorectal carcinoma. A one-cent per pack cigarette tax could fully fund enforcement.</td>
</tr>
<tr>
<td>Fiore et al</td>
<td>To identify effective, experimentally validated tobacco dependence treatments and practices</td>
<td>Societal</td>
<td>Review of evidence on cost-effectiveness of smoking cessation interventions.</td>
<td>Various</td>
<td>Cost-effectiveness analyses have shown that smoking cessation treatments compare quite favorably with routine medical interventions such as the treatment of hypertension and hypercholesterolemia, and with other preventive interventions such as periodic mammography. In fact, smoking cessation treatment has been referred to as the “gold standard” of preventive interventions. Smoking cessation treatment remains highly cost-effective, even though a single application of any effective treatment for tobacco dependence may produce sustained abstinence in only a minority of smokers.</td>
</tr>
<tr>
<td>Lightwood et al</td>
<td>To estimate excess direct medical costs of low birth weight from maternal smoking and short-term cost savings from smoking cessation programs before or during the first trimester of pregnancy.</td>
<td>Societal</td>
<td>Simulations using data on neonatal costs per live birth. Outcome measures were mean US excess direct medical cost per live birth, total excess direct medical cost, reductions in low birth weight, and savings in medical costs from an annual 1 percentage point drop in smoking prevalence among pregnant women.</td>
<td>Setting: US</td>
<td>Mean average excess direct medical cost per live birth for each pregnant smoker was $511; total cost was $263 million. An annual drop of 1 percentage point in smoking prevalence would prevent 1300 low birth weight live births and save $21 million in direct medical costs in the first year of the program; it would prevent 57,200 low birth weight infants and save $572 million in direct medical costs in 7 years.</td>
</tr>
</tbody>
</table>
| Windsor            | To estimate the projected cost benefit of maternal smoking cessation.             | Societal          | Meta analysis, Cost Benefit Analysis.                                                  | Setting: US, Norway, Canada, and Sweden | • Quitting methods most heavily influence lighter smokers  
• Exposing 800,000 smokers could result in 4% cessation rate  
• Estimated potential savings based on healthier mother and baby: $64 million  
• Cost to benefit ratio is $1:$12  
• Costs only include medical costs during first year of life |
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Intervention</th>
<th>Population &amp; Setting</th>
<th>N</th>
<th>Attrition</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Albrecht et al   | To evaluate the short and long-term effects of smoking cessation strategies tailored to the pregnant adolescent to attain and maintain abstinence. | **Design:** Randomized Controlled Trial (RCT)  
**Intervention:** 3 arms: Teen FreshStart (TFS, a program modeled after the American Cancer Society's educational and motivational FreshStart for adults), Teen FreshStart Plus Buddy (TFS-B, which added the support of a female non-smoking peer), and a control group receiving usual care and education (UC) measured at baseline, 8 weeks post-randomization, and 1-year following study entry. | Pregnant adolescents ages 14 to 19 years | 142 | 31 did not complete 1 year follow up | There were no significant differences among the three treatment groups at baseline in terms of the racial distribution, age, gestational age, age of menses initiation, number in family household, number of family members who smoked, or tobacco use. A significant difference between the UC group and the TFS-B group (p = .010) was seen in smoking behaviors measured 8 weeks following treatment initiation. At 1 year following study entry, however, there were no differences between the groups in smoking behaviors.  
The TFS-B intervention was more effective in attaining short-term smoking cessation in the pregnant adolescent than TFS or UC. Findings suggest that the peer-enhanced programming had a limited effect but could not sustain the participant beyond postpartum (1 year following study entry). Future studies should include relapse prevention to sustain smoking abstinence into the postpartum period. |
| Aveyard et al    | To examine effect of smoking cessation programs on pregnant women's partners    | **Design:** RCT  
**Intervention:** Three arms: (a) standard smoking cessation, (b) midwife trained in smoking cessation, or (c) midwife plus questionnaire giving feedback on stage of change  
Follow up at 30 weeks gestation | Setting:  
- West Midlands, UK  
Inclusion:  
- Pregnant women aged 16 or older | 71  | 18.6% | Partners quitting at 30 wks gestation:  
a) 3.3%  
b) 4.1%  
c) 5.2%  
Partners quitting at 30 wks gestation:  
a) 3.3%  
b) 4.1%  
c) 5.2%  
Probability of quitting did not differ by trial arm  
More studies looking at mobilization of social support of smoking partners should be considered |
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Intervention</th>
<th>Population &amp; Setting</th>
<th>N</th>
<th>Attrition</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campbell et al 2006</td>
<td>To assess effectiveness of two methods of delivering smoking cessation materials</td>
<td>Design:</td>
<td>Setting: New South Wales, Australia</td>
<td>Wave 1 SD: 2,900</td>
<td>Wave 1 SD: 6% ID: 4%</td>
<td>Patient smoking status assessed using cross sectional before and after surveys</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Group randomized trial</td>
<td>● Clinics: All antenatal clinics in New South Wales, Australia</td>
<td>Wave 2 SD: 1,813</td>
<td>Wave 2 SD: 7% ID: 8%</td>
<td>No difference was found between groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intervention</td>
<td>● Women: all women attending clinic over age 16, speaking English and in good health</td>
<td></td>
<td></td>
<td>Within groups no difference was found before and after dissemination of materials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Simple dissemination” clinics received written information and staff training materials</td>
<td>Wave 1 ID: 4,211</td>
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<td>“Intensive dissemination” received written information, offer of staff training visit, sample clinic policy, and support from study facilitators</td>
<td>Wave 2 ID: 2,001</td>
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<td>Coleman et al 2007</td>
<td>To determine whether or not nicotine replacement therapy (NRT) is effective, cost-effective and safe when used for smoking cessation by pregnant women</td>
<td>Design: RCT</td>
<td>Setting: UK</td>
<td>1050</td>
<td>N/A</td>
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<td></td>
<td></td>
<td>Intervention:</td>
<td>Inclusion: pregnant women attending antenatal care between 12-24 weeks pregnant</td>
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<td>Women will receive either nicotine or placebo transdermal patches with behavioral support.</td>
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<td>DiClemente et al 2000</td>
<td>To review the literature regarding the process of smoking cessation in the context of pregnancy and the postpartum periods</td>
<td>Review of epidemiological data, extant reviews of the literature, and current original research reports</td>
<td>Not specified</td>
<td>Not specified</td>
<td>N/A</td>
<td>Understanding obstacles and pathways for pregnancy and postpartum smoking cessation can guide implementation of effective existing programs and development of new ones. Recommendations include promoting cessation before and at the beginning of pregnancy, increasing delivery of treatment early in pregnancy, helping spontaneous and intervention assisted quitters to remain tobacco free postpartum, aiding late pregnancy smokers, and involving the partner of the woman smoker.</td>
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| Donatelle et al 2000 | To determine whether the combination of bolstered social support and financial incentives had an effect in significantly reducing smoking behavior among low income, high risk, pregnant and postpartum women | Design: RCT  
*Intervention:* A theory based “three pronged” approach: positive incentives, “bolstered” social supports, and community participation.  
Participants were followed through two months postpartum (for a maximum of 10 intervention months). | Women enrolled in Oregon’s Women, Infants, and Children (WIC) program, age 15 years or older; self reported smoker (“even a puff in the last seven days”); English speaker/reader; and 28 weeks gestation or less  
Recruitment occurred between June 1996 and June 1997. | 220 | T: 32% at eight months gestation and 36% at two months postpartum.  
C: 51.5% at eight months gestation and 52% at two months postpartum. | Significant differences existed between treatment and control groups in percentages of smokers who were biochemically confirmed as quit at eight months gestation $\chi^2 = 18.4$ ($p < 0.0001$), and also at two months postpartum $\chi^2 = 11.0$ ($p < 0.0009$). |
| Ershoff et al 1989  | To test the effectiveness of a prenatal self-help smoking cessation program that consisted predominately of printed materials received through the mail. | Design: RCT  
*Intervention:* Brief health educator discussion of risks (3-5 minutes); advised of a free smoking cessation class; and pregnancy-specific self-help materials mailed weekly for 7 weeks | Socioeconomically and ethnically diverse group of pregnant women enrolled in a large health maintenance organization (HMO) who reported they were smoking at the time of their first prenatal visit | 242 | 6% of treatment group and 8% of control group | Biochemical confirmation of continuous abstinence achieved prior to the 20th completed week of pregnancy and lasting through delivery revealed 22.2% of the women in the eight-week serialized program quit versus 8.6 per cent of controls with usual care. The adjusted odds ratio was 2.80 (95 per cent CI=1.17, 6.69).  
A low-cost prenatal self-help intervention can significantly affect the public health problem of smoking during pregnancy and its associated risks for maternal and child health. |
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<td>Fang 2004</td>
<td>To review existing research, current strategies, and directions for future research on smoking cessation relapse and relapse prevention in pregnancy and postpartum</td>
<td>A MEDLINE/ PubMed search in 2002 and 2003 for articles containing the key words “smoking,” “pregnancy,” “cessation,” and “cessation relapse prevention” and references of retrieved papers yielded a review of more than 500 articles.</td>
<td>To be included in this review, articles had to address pre- or postnatal relapse prevention or treatment. Articles were also included if they allowed comparisons of women who relapsed versus those who remained smoke free. Of the 146 articles that contained references to postpartum relapse, only 14 specifically described strategies to increase cessation among pregnant women through relapse prevention programs (2 of these 14 articles discussed the same program).</td>
<td>14</td>
<td>N/A</td>
<td>Although there is much information on the rationale and strategies for smoking cessation for pregnant women, fewer studies exist on how to prevent relapse. Maintaining and accelerating progress in cessation during pregnancy and postpartum requires more research that focuses on relapse prevention and cessation. Programs should incorporate stresses particular to postpartum women, should be part of routine health care, and should involve the woman’s social support network, including her partner, to maximize effectiveness. Research is needed that examines how the following optimally influence relapse prevention: stages of change, confidence level, perception of level of ease of quitting, and support systems. Interventions that involve the woman’s partner need further exploration.</td>
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<td>Fiore et al 2000</td>
<td>To identify effective, experimentally validated tobacco dependence treatments and practices</td>
<td>Review</td>
<td>Abstinence data were included only if they were Bio-chemically confirmed, due to reports of high levels of deception regarding smoking status found in pregnant women. Studies that had follow-up time points of less than 5 months were included because of the desire for pre-parturition data. For the meta-analysis, either minimal interventions (&lt;3 minutes) or interventions labeled as “usual care” constituted the reference condition.</td>
<td>7</td>
<td>N/A</td>
<td>A “usual care” intervention with pregnant smokers typically consists of a recommendation to stop smoking, often supplemented by provision of self-help material or referral to a stop-smoking program. Extended or augmented psychosocial interventions typically involve these treatment components as well as more intensive counseling than minimal advice. An augmented smoking cessation intervention is 2.8 times as likely (95% CI: 2.2-3.7%) to result in a pregnant women quitting than usual care.</td>
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| Lawrence et al 2005| To evaluate the effect on quitting smoking at 18 months postpartum of smoking cessation interventions based on the Transtheoretical Model (TTM) delivered in pregnancy compared to current standard care. | Design: Cluster randomized trial  
Intervention: One hundred general practices were randomized into the three trial arms. Midwives in these practices delivered three interventions: A (standard care), B (TTM-based self-help manuals) and C (TTM-based self-help manuals plus sessions with an interactive computer program giving individualized smoking cessation advice). | Population: Pregnant women  
Setting: Antenatal clinics in general practices in the West Midlands, UK. | N=918 | 393 lost  | • Outcomes were self-reported continuous and point prevalence abstinence since pregnancy  
• When combined together, there was a slight and not significant benefit for both TTM arms compared to the control, with an odds ratio of 1.20 (95% CI: 0.29–4.88) for continuous abstinence. For point prevalence abstinence, the OR was 1.15 (CI: 0.66–2.03). Seven of the 54 (13%) women who had quit at the end of pregnancy were still quit 18 months later, and there was no evidence that the TTM-based interventions were superior in preventing relapse.  
• The TTM-based interventions may have shown some evidence of a short-term benefit for quitting in pregnancy but no benefit relative to standard care when followed-up in the longer-term. |
| Lumley et al 2004  | To evaluate the impact of smoking cessation programs implemented during pregnancy | Searched Cochrane Pregnancy and Childbirth register, Cochrane Tobacco register, EMDLINE, EMBASE, PsychLIT, NICAHL, and AUSTHEALTH plus hand searching specific journals | Setting:  
• No setting specified  
Inclusion:  
• Randomized and quasi-randomized of smoking cessation programs implemented during pregnancy | N=64 studies | N/A       | • Significant reduction in smoking in intervention groups (RR 0.94; 95% CI 0.93-0.95)  
• Interventions reduced LBW (RR 0.81; 95% CI 0.7-0.94)  
• Interventions reduced preterm birth (RR 0.84; 95% CI 0.72-0.98)  
• Interventions increased birth weight by 33g (95% CI 11-15 g)  
• No differences found for VLBW, stillbirths, perinatal or neonatal mortality |
<p>| Melvin et al 2000  | To review the evidence base underlying recommended cessation counseling for pregnant women who smoke | Design: Review of literature reviews and meta-analyses | Not specified | 16 studies | N/A       | A brief cessation counseling session of 5–15 minutes, when delivered by a trained provider with the provision of pregnancy specific, self help materials, significantly increases rates of cessation among pregnant smokers. This low intensity intervention achieves a modest but clinically significant effect on cessation rates, with an average risk ratio of 1.7 (95% confidence interval 1.3 to 2.2). There are five components of the recommended method—“ask, advise, assess, assist, and arrange.” |</p>
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<td>Mullen 2004</td>
<td>To review accumulated knowledge about factors that influence restarting smoking and the effectiveness of interventions to decrease it.</td>
<td>Review of the literature</td>
<td>Studies were international, with diverse candidate predictors, intensity and timing of interventions, theory, designs, and measures of quitting and of maintenance postpartum.</td>
<td>Six trials, six multivariate predictor studies, supplemented by qualitative and more focused quantitative studies</td>
<td>N/A</td>
<td>Recommendations: (a) Partner smoking must be addressed in interventions with cessation messages. (b) Intervention studies should include women of lower socioeconomic status and Black women. (c) Program developers and researchers should adopt a consistent standard for cessation. (d) Communication laboratory methods should test ways to increase intrinsic reasons for abstinence and success attributions to stable, internal causes. (e) Staging for postpartum smoking should supplant relapse prevention alone. (f) Among those whose intention it is to maintain nonsmoking postpartum, standard relapse prevention treatment is insufficient to combat environmental cues that also have been suspended for the pregnancy and typical problems of sleeplessness, stress, depression, and weight concern. (g) Interventions ideally should begin in late pregnancy, when postpartum smoking goals can be revised and plans made to manage postpartum issues. (h) Innovative methods for reducing postpartum problems should be tested. (i) Study of incentives for pregnancy cessation should include varying patterns, carryover to early postpartum months, and focus on their impact on long-term change.</td>
</tr>
<tr>
<td>Park et al 2004</td>
<td>To evaluate the impact of partner support on smoking cessation programs</td>
<td>Searched Cochrane Tobacco register, CDC and prevention-Tobacco Information and Prevention Database, Cancer Lit, EMBASE, CINAHL, PsychInfo, ERIC, PsycLit, Dissertation Abstracts, and Healthstar</td>
<td>Setting: • No setting specified Inclusion: • Randomized trials comparing interventions with partner support to identical intervention with no partner support • Follow up of 6 months or more</td>
<td>8 studies</td>
<td>NA</td>
<td>Definition of partner varied between studies • OR for self reported abstinence at 6-9 months: 1.08; 95% CI 0.81-1.44 • 12 month OR: 1.0; 95% CI 0.75-1.34 • Only two studies found increased partner support at follow up</td>
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<td>Rigotti et al 2006</td>
<td>To evaluate the effectiveness of telephone counseling to help pregnant women quit smoking</td>
<td>Design: RCT&lt;br&gt;Intervention: All women received smoking cessation booklet and phone counseling&lt;br&gt;Intervention group received follow up calls and additional materials&lt;br&gt;Participants were followed up immediately post partum and 3 months post partum</td>
<td>Setting: Prenatal care clinics in MA Eligibility: Gestation ≤ 26&lt;br&gt;Aged 18 or older&lt;br&gt;Smoking in last week&lt;br&gt;Commitment or intention to quit not required</td>
<td>I: 220</td>
<td>I: 31%</td>
<td>No significant differences were found among participants receiving additional phone support and standard care</td>
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<td>Stanton et al 2004</td>
<td>To evaluate the impact of smoking cessation targeted at men during wife’s pregnancy</td>
<td>Design: RCT&lt;br&gt;Intervention: Video on effects of smoke on infants, info packet with nicotine patches, audio tape, and stickers, phone intervention with GP Controls sent brochure with contact info for available smoking cessation options</td>
<td>Setting: Men with partners attending public antenatal clinics in metropolitan Australian city&lt;br&gt;Inclusion: Not stated</td>
<td>N=561</td>
<td>I: 23%</td>
<td>Intervention group had significantly higher quit rate than control at 6 months follow up (16.5% vs. 9.3%; OR 0.52; 95% CI 0.31-0.86)&lt;br&gt;The number of smoking men who had to be treated to achieve one stopping smoking (NNT) during their partner’s pregnancy was 13 to 14.&lt;br&gt;Women consented to partners being participants which may have biased population</td>
</tr>
<tr>
<td>Tappin et al 2005</td>
<td>To determine if motivational interviewing helps pregnant smokers quit</td>
<td>Design: RCT&lt;br&gt;Intervention: All received standard health promotion to stop smoking&lt;br&gt;Intervention received standard care plus motivational home interviews</td>
<td>Setting: Antenatal clinic in Glasgow&lt;br&gt;Inclusion: All smokers attending clinic ≤ 24 weeks gestation</td>
<td>I: 351</td>
<td>I: 4%</td>
<td>Similar percentage of people in each group quit smoking (4.8% intervention, 4.6% control)&lt;br&gt;Overall motivational interviews did not have a significant effect on quit rates</td>
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### Tobacco Interventions—Preconception and Prenatal Periods

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<tr>
<td>USDHHS 2001</td>
<td>To review the evidence for effectiveness of smoking prevention and cessation programs among pregnant and postpartum women (Ch. 5)</td>
<td>Review of the literature</td>
<td>Various</td>
<td>Various</td>
<td>NA</td>
<td>Among women, biopsychosocial factors such as pregnancy, fear of weight gain, depression, and the need for social support appear to be associated with smoking maintenance, cessation, or relapse. A higher percentage of women stop smoking during pregnancy, both spontaneously and with assistance, than at other times in their lives. Using pregnancy-specific programs can increase smoking cessation rates, which benefits infant health and is cost-effective. Only about one-third of women who stop smoking during pregnancy are still abstinent one year after the delivery.</td>
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| Van’t Hof et al 2000 | To examine the effectiveness of a provider delivered smoking relapse prevention strategy                                                                                                                   | Design: RCT  
*Intervention:* smoking history obtained at delivery, and transmission of the history to the infant’s pediatric provider | All women delivering babies at six participating Portland, Oregon, metropolitan area hospitals who received an in-hospital screening, reported smoking during the 30 days before the pregnancy and quitting during pregnancy, and were willing to speak with a nurse about having quit smoking. | 287     | I=133, C=144 | Communicating a new mother’s smoking status from the delivery service to the infant’s pediatric provider can be done quickly and effectively, and leads to increased rates of provider delivered smoking relapse prevention advice. However, there was no difference in the relapse rate between women in the intervention (41%) and control (37%) groups. Even when all those lost to follow up were considered to have relapsed, differences between intervention (42%) and control (38%) groups did not vary significantly. |
<p>| Wahlgren et al 1997 | To examine the long-term maintenance of a previously reported behavioral counseling intervention to reduce asthmatic children’s exposure to environmental tobacco smoke (ETS). | Participants were randomized to one of three groups: behavioral counseling to reduce ETS exposure, self-monitoring control, and usual medical care control. Counseling concluded at month 6, and the original trial ended at month 12. Two follow-up interviews occurred at months 20 and 30. | Families of asthmatic children (6 to 17 years), including at least one parent who smoked in the home, recruited from four pediatric allergy clinics. | 91 families | N=67 families | The originally reported analysis of baseline to 12 months was reanalyzed with a more robust restricted maximum likelihood procedure. The 2-year follow-up period was analyzed similarly. Significantly greater change occurred in the counseling group than the control groups and was sustained throughout the 2 years of follow-up. Further exploratory analyses suggested that printed counseling materials given to all participants at month 12 (conclusion of the original study) were associated with decreased exposure in the control groups. Such long-term maintenance of behavior change is highly unusual in the general behavioral science literature, let alone for addictive behaviors. We conclude that ETS exposure can be reduced and that a clinician-delivered treatment may provide substantial benefit. |</p>
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| Walsh et al 1997 | To evaluate the impact of a smoking cessation program implemented at a public antenatal clinic | *Design:* RCT  
*Intervention:* Physician advice regarding risks (2-3 minutes); videotape with information on risks, barriers, and tips for quitting; midwife counseling in one 10-minute session; self-help manual; and follow-up letters | Women attending the antenatal clinic of an urban teaching hospital in Australia. | 252       | At midpoint, 10%, end of pregnancy, 10%, post-partum, 25% | Except for the postpartum self-report, self-report and biochemically validated quit rates in the experimental group were significantly higher than in the control group at all three points, whether point prevalence or consecutive cessation measures were used.  
The experimental program cost more per patient than the control intervention (US$13.95 vs US$1.83). The cost per end-of-pregnancy validated abstainer was US$121.41 in the experimental group, compared with US$37.88 in the control group.  
This study demonstrates that a smoking cessation program conducted by usual care providers in a public antenatal clinic can produce significant increases in sustained quit rates. |
| Windsor et al. 1985 | To evaluate the effectiveness of low-cost, self-help smoking cessation methods for public health clinic populations initiated at the first prenatal visit | *Design:* RCT  
*Intervention:* Pregnancy-specific self-help materials (*Pregnant Woman’s Self-Help Guide To Quit Smoking*) and one 10-minute counseling session with a health educator | Women (less than 7 months pregnant) attending three of five high-volume Public Health Maternity Clinics of the Jefferson County Health Department in the metropolitan area of Birmingham, Alabama | 309       | 15%       | The evidence from this trial indicates that the smoking behavior, (cessation and/or significant reduction) of approximately one of five smokers was changed due to exposure to the methods used.  
Beyond the observed behavior change, the cessation methods applied in this study demonstrated a high degree of feasibility and acceptability among pregnant women and public health maternity clinic staff. |
| Windsor et al 1993 | To evaluate the behavioral impact of smoking cessation health education among pregnant smokers | *Design:* RCT  
*Intervention:* Cessation skills and risk counseling in a 15-minute session by a counselor; education on how to use pregnancy-specific self-help materials; a follow up letter; and social support with a buddy letter, a buddy contract, and a buddy tip sheet | Pregnant smokers who entered prenatal care before 7 months  
*Setting:* the four highest census maternity clinics of the Jefferson County Health Department in Birmingham, Alabama. | 814       | 15%       | The treatment group (E) exhibited a 14.3% quit rate and the control group had an 8.5% quit rate. An historical comparison (HC) group exhibited a 3.0% quit rate. Black E and HC group patients had higher quit rates than white E and HC group patients.  
A cost-benefit analysis found cost-to-benefit ratios of $1:$6.72 (low estimate) and $1:$17.18 (high estimate) and an estimated savings of $247,296 (low estimate) and $699,240 (high estimate). |
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<td>Abdullah et al</td>
<td>To examine whether telephone counseling based on the stages of change component of Transtheoretical model of behavior change together with educational materials could help non-motivated smoking parents of young children to cease.</td>
<td>Participants were randomly allocated into two groups: the intervention group received printed self-help materials and three-session telephone-based smoking cessation counseling delivered by trained counselors; the control group received printed self-help materials only. A structured questionnaire was used for data collection at baseline and at 1, 3 and 6 month follow up.</td>
<td>Hong Kong Special Administrative Region, PR China • Smoking fathers and mothers of Chinese children aged 5 years</td>
<td>952 (I=467 and C=485)</td>
<td>49 lost by end of study</td>
<td>Outcomes: 7 day point prevalence quit rate at 6 months determined by self reports, self-reported 24 hour point prevalence quit rate and self-reported continuous quit rate and bio-chemically validated quit rate at 6 months Results: The 7 day point prevalence quit rate at 6 month follow up was significantly greater in the intervention group (15.3%; 68/444) than the control group (7.4%; 34/459) (P&lt;0.001). The absolute risk reduction was 7.9% (95% confidence interval: 3.78% to 12.01%). The number needed to treat to get one additional smoker to quit was 13 (95% CI: 8–26). The adjusted odds ratio was 2.1 (95% CI: 1.4–3.4) (adjusted for age, number of years smoked, and alcohol dependency). Proactive telephone counseling is an effective aid to promote smoking cessation among parents of young children.</td>
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<td>Emmons et al</td>
<td>To determine whether a motivational intervention for smoking parents of young children will lead to reduced household passive smoke exposure</td>
<td>Design: RCT Intervention: Motivational intervention (MI) group received a 30- to 45-minute MI session with a trained health educator, 4 follow-up calls, feedback from household air nicotine assessments and the participant's CO2 level. Self-help (SH) group received a smoking cessation manual, passive smoke reduction tip sheet, and resource guide in the mail.</td>
<td>Low-income smoking parents/caregivers (N 5 291) who had children who were younger than 3 years and who were recruited through primary care settings</td>
<td>5291</td>
<td>MI: 26 non-responders at 6 months follow up SH: 18 non-responders at 6 months follow up</td>
<td>The 6-month nicotine levels were significantly lower in MI households. Repeated measures analysis of variance across baseline, 3-month, and 6-month time points showed a significant time-by-treatment interaction, whereby nicotine levels for the MI group decreased significantly and nicotine levels for the SH group increased but were not significantly different from baseline.</td>
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| Hovell et al 2002 | To test the efficacy of coaching to reduce environmental tobacco smoke (ETS) exposure among asthmatic Latino children | Design: RCT  
Intervention:  
After asthma management education, families assigned to no additional service or to coaching for ETS exposure reduction (approximately 1.5 hours of asthma management education and 7 coaching sessions (45 mins each) to reduce ETS exposure) | Latino children (ages 3–17 years) with asthma in San Diego, CA | 204 | 16 lost  | Parents in the coached condition reported their children exposed to significantly fewer cigarettes than parents of control children by 4 months (postcoaching). Reported prevalence of exposed children decreased to 52% for the coached families, but only to 69% for controls. By month 4, mean cotinine levels decreased among coached and increased among control children. Cotinine prevalence decreased from 54% to 40% among coached families, while it increased from 43% to 49% among controls. However, cotinine levels decreased among controls to the same level achieved by coached families by the 13-month follow-up. Asthma management education plus coaching can reduce ETS exposure more than expected from education alone, and decreases in the coached condition may be sustained for about a year. The delayed decrease in cotinine among controls is discussed. |
| Hovell et al 2000 | To test the efficacy of behavioral counseling for smoking mothers in reducing young children's exposure to environmental tobacco smoke | Design: RCT  
Intervention:  
Mothers given seven counseling sessions over three months | Ethnically diverse mothers living in low income homes in San Diego County, CA who exposed their children (aged < 4 years) to tobacco smoke in the home. | 108 | 14 lost  | Mothers’ reports of children’s exposure to their smoke in the home declined in the counseled group from 27.30 cigarettes/ week at baseline, to 4.47 at three months, to 3.66 at 12 months and in the controls from 24.56, to 12.08, to 8.38. The differences between the groups by time were significant (P = 0.002). Reported exposure to smoke from all sources showed similar declines, with significant differences between groups by time (P = 0.008). At 12 months, the reported exposure in the counseled group was 41.2% that of controls for mothers' smoke (95% confidence interval 34.2% to 48.3%) and was 45.7% (38.4% to 53.0%) that of controls for all sources of smoke. Children's mean urine cotinine concentrations decreased slightly in the counseled group from 10.93 ng/ml at baseline to 10.47 ng/ml at 12 months but increased in the controls from 9.43 ng/ml to 17.47 ng/ml (differences between groups by time P = 0.008). At 12 months the cotinine concentration in the counseled group was 55.6% (48.2% to 63.0%) that of controls. |
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<tr>
<td>Hovell et al 1994</td>
<td>To test a behavioral medicine program designed to reduce asthmatic children's exposure to environmental tobacco smoke (ETS) in the home</td>
<td>Design: RCT&lt;br&gt;Intervention: Experimental group: a 6-month series of counseling sessions designed to decrease ETS exposure, monitored smoking, exposure, and children's asthma symptoms. Monitoring group: did not receive counseling&lt;br&gt;Usual treatment control group received outcome measures only.</td>
<td>Families with at least one parent who smoked cigarettes and a child (6 to 17 years) with asthma were recruited from four allergy clinics in San Diego</td>
<td>91 families</td>
<td>Not specified</td>
<td>Parents reported the daily number of cigarettes children were exposed to during the week preceding interviews. A nicotine air monitor and construct validity analysis confirmed the validity of exposure reports. Exposure to the parent’s cigarettes in the home decreased for all groups. The experimental group attained a 79 percent decrease in children’s ETS exposure, compared with 42 percent for the monitoring control and 34 percent for the usual treatment control group. Repeated-measures analysis of variance resulted in a significant F(10,350)=1.92, p&lt;0.05) group by time effect. After 12 months, only the experimental/counseling group sustained a decrease in children’s exposure to cigarettes in the home from all smokers (44 percent), while the monitoring control increased 14 percent and the usual treatment group increased exposure 22 percent from pre-intervention.</td>
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<td>Roseby et al 2003</td>
<td>To evaluate interventions aimed at reducing exposure of children to second hand smoke</td>
<td>Searched Tobacco Addiction Group studies, MEDLINE, EMBASE, bibliographies, plus other data bases and specialists</td>
<td>Setting&lt;br&gt;• Community, school, or family setting&lt;br&gt;• Studies addressing parent, family member, child care workers or teachers&lt;br&gt;• All studies including smoking cessation, effect of legislation, smoke free policies, and other health promotion included</td>
<td>18 studies</td>
<td>N/A</td>
<td>3 interventions aimed at population level, 7 studies conducted in well child visits, 8 studies in ill child visit&lt;br&gt;4 studies found statistically significant reduction in parent reported cigarette smoking or household nicotine levels, 3 of these used intensive patient counseling&lt;br&gt;The fourth study involved children in China writing letters to their fathers, not clear how generalizable this is&lt;br&gt;5 studies trended towards significance&lt;br&gt;No clear difference in effect of setting (well child, peripartum, school)&lt;br&gt;Insufficient evidence exists regarding effect on child health indicators</td>
</tr>
<tr>
<td>Wahlgren et al 1997</td>
<td>To examine long-term maintenance of a previously reported behavioral counseling intervention to reduce asthmatic children's exposure to ETS</td>
<td>Design: RCT&lt;br&gt;Intervention: Participants randomized to three groups: behavioral counseling to reduce ETS exposure, self-monitoring control, and usual medical care control.</td>
<td>Families of asthmatic children (6 to 17 years), including at least one parent who smoked in the home, recruited from four pediatric allergy clinics in San Diego.</td>
<td>84 families</td>
<td>20 families lost by end of study</td>
<td>The original analysis (baseline-12 months) was reanalyzed with a more robust restricted maximum likelihood procedure. The 2-year follow-up period was analyzed similarly. Significantly greater change occurred in the counseling group than the control groups and was sustained throughout the 2 years of follow-up. Further analyses suggest that printed counseling materials given to all participants at the conclusion of the original study were associated with decreased exposure in the control groups.</td>
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## Tobacco Interventions—Smoking Among Parents and Other Caregivers

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<th>Study Question</th>
<th>Intervention</th>
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<th>Attrition</th>
<th>Outcomes/Comments</th>
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</table>
| Winickoff et al  | To review impact of parental smoking on child health and pediatrician initiated interventions aimed at parents | NA                                                                            | No inclusion criteria stated  | Not stated | NA        | • 3 clinic based studies showed improved quit rates  
                        |                                                                                 |                                                                                 |                                |        |           | • 3 showed no improvement  
                        |                                                                                 |                                                                                 |                                |        |           | • Pediatrician offices are promising place for parent smoking interventions, but more research needed |
| Winickoff et al  | To evaluate feasibility and impact of parental smoking cessation intervention at child’s hospitalization | Design: Propective cohort  
                        |                                                                                 | Setting: Children’s Hospital in Boston  
                        |                                                                                 | Inclusion: All parents of children admitted with respiratory illness  
                        |                                                                                 | Program Status: Not stated  
                        |                                                                                 | Referral to MA Smoker’s Quitline  
                        |                                                                                 | Follow up with PCP  
                        |                                                                                 | N=71  
                        |                                                                                 | 20%  
                        |                                                                                 | • 5 parents (7%) called free quitline  
                        |                                                                                 | • 35 parents (49%) made quit attempt within last 24 hrs  
                        |                                                                                 | • 15 (21%) parents reported 7-day abstinence at 2 months  
                        |                                                                                 | • No control group so difficult to interpret results  
<pre><code>                    |                                                                                 | • Demonstrates feasibility of implementing intervention at hospitalization |
</code></pre>
<p>| Zhang &amp; Qiu      | To increase knowledge of the health consequences of cigarette smoking, promote healthier attitudes among elementary school students, and motivate fathers who smoke to quit. | In treatment schools: a tobacco-use prevention curriculum, encouragement to implement smoking-control policies to severely limit or restrict smoking, and encouragement of teachers to be non-smoking role models. Students whose fathers smoked monitored, recorded and reported their fathers’ smoking status. | Setting: Schools in the Jiangan district of Hangzhou from May 1989 through January 1990 | 10,395 students in grades 1–7 from 23 primary schools and their fathers. The reference group comprised 9987 students in grades 1–7 from 21 primary schools and their fathers | Not provided | Scores of students in the intervention group were significantly higher than both the reference group follow-up scores and the intervention group baseline scores. Based on the daily recordings maintained by students in the intervention group, 1037 (15.2%) fathers had not smoked cigarettes for 180 or more days. In comparison, based on the interviews of health educators, 800 (11.7%) fathers reported that they maintained cessation. For a later period, the reported smoking rate for fathers in the intervention group decreased from 68.8% to 60.7% (p&lt;0.05) while the reported rate remained approximately the same among fathers in the reference group. Approximately 90% of the fathers in the intervention group who were smokers in May 1989 were reported to have quit smoking for at least 10 days. The 6-month cessation rate for fathers in the intervention group was 11.7% compared with 0.2% in the reference group. |</p>
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| Colby et al 2005  | To evaluate the efficacy of motivational interviewing (MI) encouraging teens to quit smoking | **Design**<br>● RCT  
**Intervention**<br>● Control: Standard care of brief advice (BA)  
● Intervention: MI with 1 wk booster contact  
● Follow up appointments: 1, 3, and 6 months | **Setting:**<br>● Emergency department and adolescent health clinic in the Northeast US  
**Inclusion**<br>● Aged 12-19 and reported smoking in previous 30 days | I: 43  
C: 42 | I: 20%  
C: 20% | Results: 3 month quit rates: no different between groups  
6 month quit rates: MI=23%, n=8; BA=3%, n=1  
● Results support that MI may be effective in medical setting  
● High attrition rates made results difficult to interpret |
| Dalton et al 2003 | To ascertain whether exposure to smoking in movies predicts smoking initiation | **Design:** Prospective  
**Intervention:** Exposure to smoking in movies was estimated for individual respondents on the basis of the number of smoking occurrences viewed in unique samples of 50 movies, which were randomly selected from a larger sample pool of popular contemporary movies. Students were re-contacted 13–26 months later to determine whether they had initiated smoking. | **Setting:**<br>14 schools in Vermont and New Hampshire  
**Inclusion:** Adolescents (aged 10–14 years) who reported in a baseline survey that they had never tried smoking | 3547  
2603 (73% of original sample) | Overall, 10% (n=259) of students initiated smoking during the follow-up period. In the highest quartile of exposure to movie smoking, 17% (107) of students had initiated smoking, compared with only 3% (22) in the lowest quartile. After controlling for baseline characteristics, adolescents in the highest quartile of exposure to movie smoking were 2.71 (95% CI 1.73–4.25) times more likely to initiate smoking compared with those in the lowest quartile. The effect of exposure to movie smoking was stronger in adolescents with non-smoking parents than in those whose parent smoked. In this cohort, 52.2% (30.0–67.3) of smoking initiation can be attributed to exposure to smoking in movies. |
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| Grimshaw & Stanton 2006 | To evaluate the effectiveness of strategies that help young people stop smoking | Searched CENTRAL, Cochrane Tobacco Addiction Group, MEDLINE, EMBSE, PsychINFO, ERIC, CINAHL, and bibliographies | Setting:  
- All levels including individual, organizational, or community  
Inclusion:  
- Randomized controlled trials, cluster-randomized trials, and controlled trials  
- Primary outcome measure was smoking status at 6 months | 15 Studies | NA        | - Pooled results of trials based on transtheoretical (TTM) model achieved moderate long term success  
- TTM pooled OR at 1 yr: 1.7, 95% CI 1.25-2.33  
- TTM pooled OR at 2 yrs: 1.38, 95% CI 0.99-1.92  
- Pharmacological interventions did not result in statistically significant results  
- Cognitive behavior interventions did not achieve statistical success  
- Motivational interviewing achieved statistical success (OR = 2.05, 95% CI 1.10-3.80) but difficult to isolate effects of interview from other study elements |
| Hersey et al 2005    | To evaluate the impact of state anti smoking ads on youth smoking              | Design:  
- Cross sectional observational  
Intervention:  
- Compared rates of smoking between 1999-2002 in states with smoking prevention campaigns  
- Three separate surveys fielded: one before and two after implementation of campaign  
Setting:  
- United States  
- States broken down into three categories of campaigns: established, new, no campaign  
- States with established campaigns: CA, FL, MA  
- States with “new” campaigns: IN, MS, MN, NJ  
Inclusion:  
- Youth aged 12-17  
- Data collected using national sample, over sampling African Americans, Hispanics, and Asians | Wave 1: 3,424  
Wave 2: 12,967  
Wave 3: 10,855 | NA        |          | - Greater declines seen in states with established and new anti smoking campaigns vs. other states (p<0.05)  
- Decline in Smoking 1999-2002 based on program  
  Established: 55% (12.3 to 5.5%)  
  New: 47% (15.0 to 7.9%)  
  No Campaign: 25% (12.5 to 9.4%)  
- Exposure to campaign only assessed by residency in state, not individual level exposure  
- Campaigns usually included school based programming, -factors in addition to media most likely responsible for decline |
| Hyland et al 2005    | To assess the relationship between exposure to state-sponsored anti-smoking ads and smoking cessation | Design:  
- Cross sectional/observational  
Intervention:  
- Compared smoking behavior among those living in states with state sponsored media campaigns and those without.  
Setting:  
- Setting: CA, IA, MA, NM, NJ NY, NC, OR, WA, Ontario  
Inclusion:  
- Lived in same community in 1998 and 2001  
- Resided in one of top 75 media markets  
- Smokers in 1999 | 2,061 | NA        | - Those reporting that anti-tobacco information had increased ‘a lot’ showed significant increase in quit rate (RR1.19, 95% CI 1.03-1.38)  
- States above median exposure to ads had significantly higher quit rates (12.9% vs. 11.0%; P=0.047)  
- Higher exposure leads to increases in quit rates  
- Not able to assess individual exposure  
- Controlled for other anti-tobacco policies (tax increases) but not able to control for other potential confounders |
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<td>Lantz et al 2000</td>
<td>To provide a comprehensive review of interventions and policies aimed at reducing youth cigarette smoking in the US, including strategies that have undergone evaluation and emerging innovations that have not yet been assessed for efficacy</td>
<td>Medline literature searches, books, reports, electronic list servers, and interviews with tobacco control advocates</td>
<td>Various</td>
<td>Number of studies reviewed is not specified</td>
<td>N/A</td>
<td>Interventions and policy approaches were categorized using a typology with seven categories (school based, community interventions, mass media/public education, advertising restrictions, youth access restrictions, tobacco excise taxes, and direct restrictions on smoking). Novel and largely untested interventions were described using nine categories. Youth smoking prevention and control efforts have had mixed results. However, this review suggests a number of prevention strategies that are promising, especially if conducted in a coordinated way to take advantage of potential synergies across interventions. Several types of strategies warrant additional attention and evaluation, including aggressive media campaigns, teen smoking cessation programs, social environment changes, community interventions, and increasing cigarette prices. A significant proportion of the resources obtained from the recent settlement between 46 US states and the tobacco industry should be devoted to expanding, improving and evaluating 'youth-centered' tobacco prevention and control activities.</td>
</tr>
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| Levy et al 2004 | Review of tobacco control policies’ contribution to smoking cessation and initiation | Examined studies evaluating (1) taxes, (2) clean air laws, (3) restrictions on advertising, (4) anti-smoking media campaigns, (5) health warning labels, (6) enforcement of youth access laws, (7) school education programs, and (8, 9)policies to increase utilization of cessation treatments | Inclusion: Not stated | NA  | NA         | *Taxes*  
  • A 10% increase in cigarette price would result in a 3-5% decrease in demand for cigarettes per adult  
  • Youth are more susceptible to the price of cigarettes; higher prices influence progression to established smoker  
  • Among adolescents, a 10% increase in cigarette price would reduce the number of young smokers by 7%  
  *Clean Indoor Air Laws*  
  • States with clean air laws have 10% lower smoker prevalence vs. other states  
  • Worksites with smoking bans can see significant increases in quit rates, ranging from 0-20%  
  • Comprehensive bans on smoking could result in an 11% quit rate  
  *Advertising Restrictions*  
  • Results are mixed—for bans to be effective they must be comprehensive  
  • A comprehensive ban could result in a decrease in smoke prevalence by 4%; a partial ban would result in a 2% decrease  
  *Media Campaigns*  
  • Results are mixed, but when combined with other programs media campaigns can potentially reduce smoking prevalence by 7%  
  *School Education Programs*  
  • Evidence from school programs is mixed; many result positively affect attitudes and lead to only short term change in use  
  *Access to Treatment*  
  • Broad coverage and requirements for physician involvement could lead to a 3.5% reduction in prevalence over 10 years  
  *Telephone Quit Lines*  
  • Absolute difference in quit rates between quit line users and non-users ranges from 3.4-23% |
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<tr>
<td>McDonald et al 2003</td>
<td>To offer program managers, policymakers, and researchers a scientific basis for developing and selecting smoking cessation treatments for adolescents</td>
<td>An evidence review panel systematically rated published and unpublished reports of cessation treatments for youth to make recommendations on theoretical foundations, delivery settings, types of intervention, and provider type.</td>
<td>Various</td>
<td>20 studies</td>
<td>N/A</td>
<td>The 9 studies that reported treatments that increased cessation were based on social cognitive theory. Cognitive-behavioral interventions are a promising approach for helping young smokers quit smoking. Evidence is insufficient to draw other conclusions at this time.</td>
</tr>
</tbody>
</table>
| Muñoz et al 2006    | To evaluate internet based smoking cessation programs in both English and Spanish speaking populations | **Design:** RCT  
**Intervention:**  
1) Guia smoking cessation guide + individually timed educational messages (ITEMs)  
2) Guia + ITEMs + mood management  
Participants followed up at 1, 3, 6, and 12 months  
**Setting:**  
Participants recruited via press releases, search engine links, email messages, announcements on health information sites  
**Inclusion:**  
- 18 years of age  
- Planning to quit smoking in next 3 months  
- Using Internet weekly  
**English intervention:** 280  
**Spanish intervention:** 288 | English: 65%  
Spanish: 39% | 280  
288 | N/A       | Among English speakers, Guia + ITEM alone had higher quit rates at 12 months (17.0 vs. 8.6%, p=0.036)  
- There was no significant difference in quit rates among Spanish speaking participants  
- Study provides evidence that internet interventions are possible  
- Limited support for efficacy of studied intervention  
- No base line measurements reported  
- Very high attrition rates
# Tobacco Interventions—Smoking Among Youth

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<tr>
<td>Murphy-Hoefer et al 2005</td>
<td>To review interventions designed to reduce the prevalence of smoking among college/university students.</td>
<td>Seven databases were searched for relevant articles published in English between 1980 and 2005, and reference lists were examined for additional published studies. The studies were categorized as (1) individual approaches, such as on-campus cessation programs, and (2) institutional approaches, such as smoke-free policies. The studies were categorized by type of institution and geographic location, study design, sample demographics, and outcomes.</td>
<td>Various</td>
<td>14 studies</td>
<td>N/A</td>
<td>Only 5 of the 14 studies identified received a “satisfactory” rating based on evaluation criteria. Most studies were based on convenience samples, and were conducted in 4-year institutions. Seven studies used comparison groups, and three were multi-institutional. Individual approaches included educational group sessions and/or individual counseling that were conducted on campus mostly by healthcare personnel. None used nicotine replacement or other medications for cessation. The quit rates for both smokeless tobacco and cigarette users varied, depending on definitions and duration of follow-up contact. Institutional interventions focused mainly on campus smoking restrictions, smoke-free policies, antitobacco messages, and cigarette pricing. Results indicated that interventions can have a positive influence on student behavior, specifically by reducing tobacco use (i.e., prevalence of cigarette smoking and use of smokeless products, amount smoked) among college students, and increasing acceptability of smoking policies and campus restrictions among both tobacco users and nonusers. While some promising results have been noted, rigorous evaluations of a wider range of programs are needed, along with studies that address cultural and ethnic diversity on campuses.</td>
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</table>
| Ranney et al 2006    | To examine effective interventions at the community and population level to prevent tobacco use and increase demand for effective cessation interventions | Design: Searched MEDLINE, CINAHL, Cochrane libraries and Clinical Trial Register, Psychological Abstracts, and Social Abstracts | Setting: None stated | N=102  | NA        | - Strong evidence exists for increasing price of tobacco products and mass media campaigns concurrent with other interventions  
- Sufficient evidence exists for short term effects of school based programs  
- Insufficient evidence for long term effects of school based programs  
- Strong evidence supporting telephone support increases cessation in adults; insufficient evidence in adolescents  
- Community based pharmacist interventions successful in reducing adult quit rates |
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<tbody>
<tr>
<td>Roddy et al</td>
<td>To evaluate the impact of nicotine replacement therapy on quit rates of low</td>
<td><em>Design</em>: RCT</td>
<td><em>Setting</em>: Youth community center in inner city Nottingham, UK</td>
<td>I: 49</td>
<td>70% of total</td>
<td>Median number of weeks of patch therapy: 1 wk High attrition rates make study result difficult to</td>
</tr>
<tr>
<td>2006</td>
<td>income youth smokers</td>
<td><em>Intervention</em>: All participants offered counseling</td>
<td><em>Inclusion</em>: • Aged 12-20 • Current smoker, non-pregnant</td>
<td>C: 49</td>
<td>remained at</td>
<td>interpret. Authors suggest NRT not effective in this population based on poor compliance.</td>
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<td></td>
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<td>Randomized to placebo or active NRT patches</td>
<td></td>
<td></td>
<td>end of study</td>
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<tr>
<td>Rodgers et al</td>
<td>To determine the effectiveness of a mobile phone text messaging smoking</td>
<td><em>Design</em>: RCT</td>
<td><em>Setting</em>: New Zealand</td>
<td>I: 852</td>
<td>I: 30%</td>
<td>Six week risk of quitting: RR 2.2 (95% CI 1.70-2.70; P &lt; 0.001)</td>
</tr>
<tr>
<td>2005</td>
<td>cessation program</td>
<td><em>Intervention</em>: • Received text messages with smoking cessation advice and one</td>
<td></td>
<td>C: 853</td>
<td>C: 21%</td>
<td>12 week risk of quitting: RR 1.3 (95% CI 1.3-1.84; P &lt; 0.001)</td>
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<td>month free text messaging after quit day—encouraged to contact family</td>
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<td>26 week risk of quitting: RR 1.07 (95% CI 0.91-1.26; P = 0.04)</td>
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<td></td>
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<td>• Matched with quit buddy to provide support</td>
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<td>At 12 and 26 weeks % of quitting in control group increased (18.8% and 23.7% respectively)</td>
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<td></td>
<td></td>
<td>• Followed up at 6, 12, and 26 weeks</td>
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<td>20.8% of those reporting not smoking at 6 weeks failed oral cotinine test</td>
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<td>Approximately 1/3 of each group aged 16-19—may be an effective strategy for youth</td>
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<td>Slater et al</td>
<td>To test the impact of an in-school mediated communication campaign, in</td>
<td><em>Design</em>: RCT</td>
<td></td>
<td>Of 4,216</td>
<td>68.6% provided</td>
<td>• OR = 0.49 for tobacco use in the media + curriculum communities vs. control (p=0.039)</td>
</tr>
<tr>
<td>2006</td>
<td>combination with a participatory, community-based media effort, on marijuana,</td>
<td><em>Intervention</em>: • Schools in media communities randomized to media plus curriculum</td>
<td></td>
<td>students</td>
<td>data at all four</td>
<td>• OR = 0.72 for tobacco use in curriculum communities (p &lt; 0.0050)</td>
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<td></td>
<td>alcohol and tobacco uptake among middle-school students</td>
<td>or media alone</td>
<td></td>
<td>recruited, 66% consented</td>
<td>collection</td>
<td>Notes</td>
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<tr>
<td></td>
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<td>• Schools in non media communities randomized to curriculum or no intervention</td>
<td></td>
<td></td>
<td>points</td>
<td>• Schools assignment not completely random—based on staffing capabilities</td>
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<td></td>
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<td><em>Inclusion</em>: • Communities recruited using National Center for Educational</td>
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<td>• Results may also be biased by active consent procedures</td>
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<td>Statistics</td>
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## Tobacco Interventions—Smoking among Youth

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</table>
| Sowden & Arblaster 2000 | To review effectiveness of mass media campaigns in preventing uptake of smoking by youth | Searched MEDLINE, 28 other electronic databases, plus hand searched key journals and contacted experts | Setting:  
* Not specified  
* Randomized trials, controlled trials, and time series studies  
* Assessed smoking behavior of people under age 25 | N=6 | NA         | * Some evidence exists that mass media campaigns can be effective, but evidence is not strong  
* Two studies concluded that mass media were effective in influencing smoking behavior of young people  
* One successful study found students in communities where TV and radio messages were combined with a school based program had a lower risk of weekly smoking than those in communities receiving only the schools-based component (OR 0.62, 95% CI: 0.49 to 0.78)  
* A Norwegian campaign found the odds ratio for being a smoker in the intervention county compared with being a smoker in the control county was 0.74 (95% CI: 0.64 to 0.86) after adjustment for smoking at baseline and gender  
* Effective campaigns had solid theoretical bases, and used formative research |
<p>| Sussman 2002       | To review research in adolescent and young-adult tobacco use cessation          | Literature review                                                            | Studies focusing on adolescents and youth                                           | 66 tobacco cessation intervention studies as well as 17 prospective studies of adolescent self-initiated tobacco use cessation | Average reach and retention across the intervention studies was 61% and 78%, respectively | A comparison of intervention theories revealed that motivation enhancement (19%) and contingency-based reinforcement (16%) programs showed higher quit-rates than the overall intervention cessation mean. Classroom-based programs showed the highest quit rates (17%). Computer-based (expert system) programs also showed promise (13% quit-rate), as did school-based clinics (12%). These data suggest that use of adolescent tobacco use cessation interventions double quit rates on the average. In the 17 self-initiated quitting survey studies, key predictors of quitting were living in a social milieu that is composed of fewer smokers, less pharmacological or psychological dependence on smoking, anti-tobacco beliefs (e.g., that society should step in to place controls on smoking) and feeling relatively hopeful about life. Key variables relevant to the quitting process may include structuring the context of programming for youth, motivating quit attempts and reducing ambivalence about quitting, and making programming enjoyable as possible. There also is a need to help youth to sustain a quit-attempt. In this regard, one could provide ongoing support during the acute withdrawal period and teach youth social/life skills. |</p>
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<td>Swartz et al 2006</td>
<td>To test the short term efficacy of an internet smoking cessation program</td>
<td><strong>Design:</strong> RCT</td>
<td></td>
<td></td>
<td></td>
<td>• treatment cessation rate: 24.1% (n=21)</td>
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<td></td>
<td><strong>Intervention:</strong></td>
<td>• Randomized to program or wait list</td>
<td></td>
<td>I: 171</td>
<td>I: 49%</td>
<td>• control cessation rate: 8.2% (n=9), p=0.002</td>
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<td></td>
<td>• Intervention consisted of personalized computer based modules mimicking smoking cessation counselor</td>
<td>• Participants followed up at 90 days</td>
<td></td>
<td>C: 180</td>
<td>C: 39%</td>
<td>Intention-to-treat Analysis:</td>
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<td>• At least 18 years old</td>
<td>• currently smoking considering quitting, willing to make quit attempt</td>
<td></td>
<td></td>
<td></td>
<td>• treatment cessation rate: 12.3% (n=21)</td>
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<tr>
<td></td>
<td><strong>Setting:</strong> Subjects recruited from internet and worksite promotions</td>
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<td>• control cessation rate: 5.0% (n=9), p=0.015</td>
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<td></td>
<td><strong>Inclusion:</strong></td>
<td>• After 90 day wait period controls also had access to program</td>
<td></td>
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<td></td>
<td>• Study had high attrition rate</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>• Tobacco use self reported, no biochemical validation</td>
</tr>
</tbody>
</table>

<p>| Task Force on Community Preventive Services 2000 | To conduct systematic reviews on 14 selected interventions and make subsequent recommendations | Multidisciplinary teams developed an approach to organizing, grouping, and selecting the interventions for review, assessed the quality of the body of evidence of effectiveness for interventions and summarizing the strength of this body of evidence, summarized information regarding other evidence, and identified and summarized research gaps. | Interventions were either single-component or multi-component. To be included in the reviews of effectiveness, studies had to meet these criteria: a) they were limited to primary investigations of interventions selected for evaluation; b) they were published in English from January 1980 through May 2000; c) they were conducted in industrialized countries; and d) they compared outcomes in groups of persons exposed to the intervention with outcomes in groups of persons not exposed or less exposed to the intervention (whether the comparison was concurrent or before-after). | 166 studies | N/A       | On the basis of the evidence of effectiveness, the Task Force either strongly recommended or recommended nine of the 14 strategies evaluated including one intervention to reduce exposure to ETS (smoking bans and restrictions), two interventions to reduce tobacco-use initiation (increasing the unit price for tobacco products and multicomponent mass media campaigns), and six interventions to increase cessation (increasing the unit price for tobacco products; multicomponent mass media campaigns; provider reminder systems; a combined provider reminder plus provider education with or without patient education program; multicomponent interventions including telephone support for persons who want to stop using tobacco; and reducing patient out-of-pocket costs for effective cessation therapies). |</p>
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Intervention</th>
<th>Population &amp; Setting</th>
<th>N</th>
<th>Attrition</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Thomas & Perera 2006 | To review behavioral interventions in school to prevent smoking initiation    | Searched Cochrane Central Register of Controlled Trials, Cochrane Tobacco Register, MEDLINE, EMBASE, PsycINFO, ERIC, CINAHL, Health Star, individual authors, and dissertation abstracts | Setting  
  - Schools  
  - Inclusion  
  - Students, classes, schools, or school districts randomized  
  - Children aged 5-12 or 13-18  
  - Measured non-smoking, no biochemical validation required | N=94  
  23 identified as high quality | NA        | Some evidence supporting social influence models, although largest most rigorous study (HSPP) showed no effect  
  - Many researchers question methods and generalizability of HSPP results  
  - Pooled results from social influence studies also showed no effect  
  - Pooled results from "life skills" interventions were positive but non-significant  
  - 3 of 4 Programs using multi-modal approach had positive results, but evaluation less rigorous |
| Werch et al 1996    | To examine the extent to which program comprehensiveness, programmatic outcomes, program integration, and environmental factors are being addressed by college and university drug use prevention programs | Need to fill this in when we get the hardcopy of the article | urban and rural US colleges and universities | 336 schools | N/A | College-based prevention programs employed a range of programmatic goals, prevention communication channels, and prevention strategies within a centralized department for drug use prevention. Most program coordinators reported no perceived change in alcohol, tobacco and other drug use, alcohol/drug-related problems, faculty/staff drug use, and alcohol and drug-related crime resulting from prevention efforts on campus. The level of prevention activity differed across institutional type. |
APPENDIX B: ADDRESSING OBESITY ACROSS THE LIFESPAN

MAGNITUDE: Childhood overweight\textsuperscript{xl} is a significant and growing problem in our society, up sharply in recent decades.\textsuperscript{200} Over the last thirty years, the obesity rate has nearly tripled for preschool children, increasing from five to 14%.\textsuperscript{201} In 2006, an estimated 18% of children ages six to 11 years and 17% of adolescents ages 12-19 years were overweight.\textsuperscript{202} Moreover, the prevalence of overweight among children and youth from certain ethnic minority groups is estimated to be even higher.\textsuperscript{203}

DETERMINANTS: There are multiple identifiable risk factors within children’s physical and social environments that can encourage weight gain among them.\textsuperscript{204} Research points to overeating, lack of physical activity, lack of sleep, time spent watching television or playing video games, consumption of high-calorie liquids (e.g., sodas) and eating away from home as important contributory factors.\textsuperscript{205,206,207,208,209,210,211,212} The term “obesogenic” is frequently used to describe the current environment within which childhood overweight has soared.\textsuperscript{212}

The factors that influence weight status early in life can continue over the long term. As a result, in the absence of effective interventions, overweight persists for many children throughout the lifespan. Preschool children ever overweight have been found to be five times more likely to be overweight at age 12 than preschool children with normal weights,\textsuperscript{213} and obesity persists into adulthood for an estimated 50-80% of overweight children and adolescents.\textsuperscript{214,215,216}

HEALTH CONSEQUENCES: The physical health consequences of childhood overweight include orthopedic complications, metabolic disturbances, type 2 diabetes, disrupted sleep patterns, poor immune function, endocrine problems, impaired mobility, and increased blood pressure and hypertension.\textsuperscript{217,218} The psycho-social consequences associated with childhood overweight include low self-esteem,\textsuperscript{219,220} social alienation,\textsuperscript{221,222} discrimination,\textsuperscript{223,224} lower self-reported quality of life,\textsuperscript{225} and depression.\textsuperscript{226,227} Other studies show that overweight adolescents are as much as 20 times more likely to become overweight as adults,\textsuperscript{228,229} and approximately 70 to 77% of overweight adolescents will remain obese as adults.\textsuperscript{230,231} Furthermore, obesity is associated with increased morbidity and mortality among pregnant women.\textsuperscript{232} Obese women have an increased risk of pregnancy complications (e.g., gestational diabetes and hypertensive disorders) regardless of their health prior to pregnancy,\textsuperscript{233,234,235,236,237,238,239,240} and high maternal body mass index (BMI) is correlated with labor and delivery problems and an increased risk of cesarean delivery.\textsuperscript{241,242,243,244,245} Maternal overweight is also associated with infant birth defects\textsuperscript{246} and macrosomia.\textsuperscript{247}

ECONOMIC CONSEQUENCES: Researchers studying the economic costs of obesity in the United States estimate that direct costs reach $109 billion per year and indirect costs total $75 billion (in 2006 dollars).\textsuperscript{248} A significant portion of these costs is borne by government and businesses; Medicare and Medicaid are estimated to fund approximately 50% of all U.S. obesity-related costs,\textsuperscript{249} and U.S. businesses spent $12.7 billion on obesity in 1994 [$17.3 billion in 2006 dollars] through health insurance, life insurance, disability time, and paid sick leave.\textsuperscript{250}

\textsuperscript{xl} The US Centers for Disease Control and Prevention (2000) uses the term ‘overweight’ to describe children and youth with a body mass index (weight [kg] / height [m\textsuperscript{2}]) at or above the 95\textsuperscript{th} percentile for age and sex based on the reference population of the CDC 2000 growth charts. The CDC designates children “at risk for overweight” if they have a BMI between the 85\textsuperscript{th} and 95\textsuperscript{th} percentiles.
Among overweight pregnant women, the costs of prenatal care are estimated to be five to 16 times higher than for women of healthy weights, increasing with level of obesity.\(^{251}\) In addition, the duration of prenatal and postpartum hospitalization is approximately 4.4 days longer for obese women (whose BMI was >29) than for women with healthy weights.\(^{252}\)

Among children, the economic costs of overweight also are significant. Obesity-related hospital costs for children ages six to 17 increased four-fold between 1979 and 1999, rising from $44 million to $160 million (in 2006 dollars) as the discharges of diabetes nearly doubled.\(^{253}\) One study of children ages five to 18 who presented at an urban primary care clinic showed that the yearly expenditures for children with diagnosed obesity were significantly higher than the expenditures for their healthy-weight counterparts (adjusted mean difference=$172; 95\% CI).\(^{254}\) Even children with overweight and undiagnosed obesity had higher expenditures, which, when extrapolated, suggest that unhealthy weight results in $25,688 of excess spending each year for every 1,000 children ages five to 18 years.\(^{255}\)

**Evidence for Successful Prevention and Treatment:** The overall effectiveness of interventions to prevent or treat overweight in childhood is unclear\(^{256,257,258}\) and few studies target young children in particular.\(^{259}\) To date, evidence of programmatic success among preschoolers is limited to the ‘Hip-Hop to Health Jr’ program, and that was effective only when implemented among a group of African-American children.\(^{260,261}\) The evidence for program effectiveness among elementary school-aged children is mixed and weak as well.

Other reviews of interventions that target childhood overweight concur that the evidence is varied and not well established. For example, a 2005 Cochrane Review concluded that studies to prevent childhood overweight were “heterogeneous in terms of study design, quality, target population, theoretical underpinning, and outcome measures, making it impossible to combine study findings using statistical methods.”\(^{262}\) The Prevention Group of the International Obesity Task Force determined that the evidence base for the effectiveness of prevention efforts targeting children is even harder to determine than for treatment efforts.\(^{263}\) Further, many of the programs that demonstrate an impact can only claim small and short-term improvements in outcomes, the majority of which are limited to activity and nutrition outcomes rather than to improvements in body fat.\(^{264,265}\) Moreover, a 2003 study by Caballero et al\(^{266}\) demonstrates that even longer-term, intensive school-based interventions with multiple components have questionable effectiveness.\(^{270}\) A RCT of intensive home visiting intervention in preventing the early onset of childhood overweight among children between two and five has been undertaken in disadvantaged areas of Sydney, Australia.\(^{271}\)

Because of the limited evidence of program effectiveness to date, researchers question the scientific testing of single or multiple behavioral interventions targeting childhood overweight and suggest that indirect approaches that address economic, educational and/or social problems within society may be more effective.\(^{272,273}\) Similarly, others conclude that the “epidemic of childhood obesity [is] unlikely to be resolved without concerted political action to detoxify the obesogenic environment in which we live.”\(^{274}\) Such an approach will require the active involvement of the medical community, health administrators, teachers, parents, food producers and processors, retailers and caterers, advertisers and the media, recreation and sport planners, urban architects, city planners, politicians and legislators.\(^{275}\)
**Cost Implications of Interventions:** Given the current dearth of literature demonstrating intervention effectiveness, it is not surprising that evidence on the cost implications of interventions that aim to prevent or treat overweight among young children is lacking. One reason for this is that researchers face important challenges in completing cost-effectiveness studies on obesity. These include the need to determine the most relevant measurement outcomes and to develop consensus models of lifetime effects in terms of QALYs \(^\text{xli}\) for each outcome (with consideration paid to differences that may exist by age, sex and race). Also, as noted above, the evidence for any long-term impacts of interventions is still weak in part because this research area has only recently emerged. \(^\text{276}\)

Two relevant studies in the literature demonstrate potential methods for determining obesity-related intervention cost benefits. Wang et al.\(^\text{277}\) conducted a cost-effectiveness study that focused on ‘Planet Health,’ a school-based intervention to improve nutrition and increase physical activity among middle-school aged children. This study concluded that the program helped girls, at a cost of $4305 per QALY, but that there was no effect for boys. Elixhauser et al.\(^\text{278}\) modeled a comprehensive hospital program of preconception diabetes care and concluded that it would reduce maternal and infant hospitalizations (particularly those due to major congenital malformations), resulting in net benefits of $1,720 per enrollee [$2,796 in 2006 dollars].

**Conclusion:** The myriad causes of childhood overweight and its numerous consequences have been well documented. Less well-understood are the most appropriate ways to prevent or treat the problem. Future interventions should carefully document program activities and ensure that evaluations are comprehensive and long-term, with attention paid to the cost implications of interventions. They should target the immediate/direct causes of childhood overweight, taking into account the context within which it occurs. Such research will contribute to our collective understanding of the most appropriate and cost-effective methods to curb the current epidemic of childhood overweight. Without such interventions, the already considerable physical, psycho-social and economic costs to America’s children are likely to continue unabated. One challenge to economic motivations for interventions that address the societal contributors is the inherent difficulty of tracing and measuring the many effects of context interventions that may be useful for changing much more than only childhood obesity.

\(^{\text{xli}}\) A QALY is a quality-adjusted life year and represents a measurement of improved physical or mental health or both, as well as additional years of life. For more information about QALYs see: Gold MR, Siegel JE, Russell LB, Weinstein MC. (1996). *Cost-Effectiveness in Health and Medicine.* New York, NY: Oxford University Press.
### Figure 1. Lifespan Impact of Obesity Interventions

<table>
<thead>
<tr>
<th>Level of Intervention</th>
<th>Preconception/ Pregnancy</th>
<th>Infant/Childhood</th>
<th>Adolescence</th>
<th>Adulthood</th>
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<tbody>
<tr>
<td>Individual</td>
<td>Observational studies i</td>
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</tr>
<tr>
<td>Family</td>
<td>Preschool education iii</td>
<td>Parent education iv</td>
<td></td>
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<tr>
<td>Local/ Community/ Workplace/ School</td>
<td>Teacher curriculum v</td>
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<tr>
<td>National/State</td>
<td>Age period when interventions take place</td>
<td>Age period with continuing positive impacts of intervention</td>
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</tbody>
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1. Eriksson et al. 2001; Nader et al. 2006
2. Field et al. 2005
3. Fitzgibbon et al. 2005
4. Golan et al. 2006
5. Summerbell et al. 2003
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Perspective</th>
<th>Study type &amp; design</th>
<th>Population &amp; Setting</th>
<th>Results/Comments</th>
</tr>
</thead>
</table>
| Colditz G | To assess the economic cost of inactivity and obesity | Societal | Review of Medline for studies reporting cost of obesity, inactivity, or cost of illness | US | Sedentary behavior and lack of physical exercise costs the US 24.3 billion dollars/year in direct healthcare costs (2.4% of US healthcare expenditures) 
| | | | Calculated population attributable risk for diseases related to obesity | | Direct medical costs related to obesity total $70 billion (7% of US healthcare costs) 
| | | | | | Indirect costs associated with obesity total $48 billion |
| Hampl et al | To compare health care utilization and expenditures for healthy-weight patients, overweight patients, and patients with diagnosed and undiagnosed obesity and to examine factors associated with a diagnosis of obesity. | Primary care clinic within an urban hospital setting | Retrospective study using claims data from a large pediatric integrated delivery system in an urban academic children’s hospital. | US Children 5-18 years | Of 8404 patients, 17.8% were overweight and 21.9% were obese. Of the obese children, 42.9% had a diagnosis of obesity. 
| | | | | | Increased laboratory use was found in both children with diagnosed obesity (odds ratio [OR], 5.49; 95% confidence interval [CI], 4.65-6.48) and children with undiagnosed obesity (OR, 2.32; 95% CI, 1.97-2.74), relative to the healthy-weight group. 
| | | | | | Health care expenditures were significantly higher for children with diagnosed obesity (adjusted mean difference, $172; 95% CI, $138-$206) vs the healthy-weight group. 
| | | | | | Factors associated with the diagnosis of obesity were age 10 years and older (OR, 2.7; 95% CI, 2.0-3.4), female sex (OR, 1.5;95%CI, 1.2-1.8), and having Medicaid (OR, 1.6; 95% CI, 1.1-2.3). |
| Finkelstein et al | To review causes and consequences of obesity | NA | Review of published literature (search terms include BMI, obesity, and other economic indicators) | US | Obesity accounts for 5% of health expenditures among business and employer sponsored health plans 
| | | | | | Medicare pays for ~50% of all obesity attributable costs 
| | | | | | Obese individuals more likely to experience absenteeism, costing employers $2.4 billion 
| | | | | | Total (direct and indirect) costs of obesity as high as $139 billion/year |
| Thompson et al | To estimate the cost of obesity to US employers | Payer | Standard methods for risk attribution and for ascertaining cost of illness were used to estimate obesity-attributable expenditures on selected employee benefits | Total US population aged 25-65 years | US businesses spent $12.7 billion on obesity in 1994 
| | | | | | $7.7 billion spent on health insurance, $1.8b on life insurance, $0.8b on disability insurance, and $2.4b on paid sick leave 
| | | | | | Comments: 
| | | | | | Obesity data from 1993, most likely underestimating the current costs 
| | | | | | Many obesity expenditures occur after age 65 
| | | | | | Does not account for expenditures of uninsured |
| Wang et al | To assess the cost effectiveness and cost-benefit of a school based obesity prevention program | Societal | Initial study: RCT CEA/CB Examined cases of adult overweight prevented (medical and lost productivity), QALYs, and cost of program | 10 middle schools in the Boston area over 2 years (310 girls, 331 boys) | For girls, odds ratio of obesity in intervention schools vs. control = 0.47 (p=0.03) 
| | | | | | No differences found among boys 
| | | | | | Medical costs averted: $15,887 
| | | | | | Cost of lost productivity averted: $25,104 
| | | | | | CER: $4,305/QALY 
| | | | | | Results sensitive to discount rate, robust to other parameters |
### Obesity Prevention—Economic Studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Perspective</th>
<th>Study type &amp; design</th>
<th>Population &amp; Setting</th>
<th>Results/Comments</th>
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</thead>
<tbody>
<tr>
<td>Wang &amp; Dietz</td>
<td>To examine the trend of obesity-associated diseases in youths and related economic costs</td>
<td>Hospitals</td>
<td>Used the National Hospital Discharge Survey (1979–1999) to analyze changes in costs among youths (based on discharges with obesity listed as a principal or secondary diagnosis)</td>
<td>US youth ages 6-17 years</td>
<td>• The percent of all discharges that were obesity-associated diseases increased dramatically over a 20 year time period: discharges of diabetes nearly doubled (from 1.43% to 2.36%), obesity and gallbladder diseases tripled (0.36% to 1.07% and 0.18% to 0.59%, respectively), and sleep apnea increased fivefold (0.14% to 0.75%) • 96 percent of discharges with a diagnosis of obesity listed obesity as a secondary diagnosis. • Obesity-associated annual hospital costs increased more than threefold; from $35 million to $127 million</td>
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</table>

### Obesity Prevention—Review Articles

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Methods</th>
<th>Population &amp; Setting</th>
<th>N</th>
<th>Outcomes/Comments</th>
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</thead>
</table>
| Budd and Volpe 2006      | To provide an overview of school-based RCTs intended to prevent increases in BMI | Searched Medline, Cinahl, PsychINFO, and Cochrane using obesity, prevention, child, weight management | Setting: School-based Inclusion:  
RCTs with BMI for age and gender as an outcome  
Published between 1985-2004  
US elementary, middle and high schools  
Published in peer-reviewed journal | 12 studies | • Successful interventions more likely to target older children  
• Use of a multi-component, comprehensive, and detailed nutrition and physical activity curricula for students in higher grades can contribute to program success  
• The positive effects of small and brief RCTs might change if longer follow-up periods occurred  
• 4 successful RCTs used behavior change curriculum (including self-monitoring, goal setting, and cognitive restructuring)  
• 2 programs had significant effects only on girls  
• For older students, classroom instruction and physical education can promote moderate to vigorous physical activity both in and out of school, especially for girls  
• Younger students can benefit from behavior change programs that reduce sedentary behavior |
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Methods</th>
<th>Population &amp; Setting</th>
<th>N</th>
<th>Outcomes/Comments</th>
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</thead>
<tbody>
<tr>
<td>Doak et al 2006</td>
<td>To identify aspects of successful childhood overweight prevention programs</td>
<td>Medline, personal contacts with researchers, Internet web searches, references from published reviews, and additional Medline searches of authors with ongoing intervention studies</td>
<td>Setting: School-based Inclusion:  ● Up to August 2005  ● Children ages 6–19 years  ● anthropometric measurements at baseline and f/u  ● intervention on diet, physical activity or both  ● documentation of monitoring/evaluation</td>
<td>25 studies</td>
<td>17 of the 25 studies were ‘effective’ based on a statistically significant reduction in BMI or skin-folds for the intervention group. Four interventions were effective by BMI as well as skin-fold measures. Of these, two targeted reductions in television viewing. The remaining two studies targeted direct physical activity intervention through the physical education program combined with nutrition education. Of all the interventions reported, one was effective in reducing childhood overweight but was also associated with an increase in underweight prevalence.</td>
</tr>
<tr>
<td>Flodmark et al 2006</td>
<td>To review medical interventions aimed at preventing obesity during childhood and adolescence</td>
<td>Searched PubMed, Cochrane Library, NHSEED, PubMed databases, reference lists of relevant articles, other review articles</td>
<td>Setting: Various Inclusion: 2001 to May 2004 prevention studies with controls, follow-up at least 12 months, description of % overweight subjects, BMI or skinfold thickness as outcomes, general population</td>
<td>39 studies</td>
<td>Fifteen studies reported that prevention had a statistically significant positive effect on obesity, 24 reported neutral results and none reported a negative result (sign test; (P=0.0078)). Adding the studies included in five other systematic reviews yielded, in total, 15 studies with positive, 24 with neutral and none with negative results. Thus, 41% of the studies, including 40% of the children studied, showed a positive effect from prevention.</td>
</tr>
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</table>
| Flynn et al 2006 | To develop best practice recommendations based on finding, selecting and critically appraising programs addressing prevention and treatment of childhood obesity and related risk of chronic diseases | Comprehensive search of 18 library databases (covering medical/academic and grey literature) and the Internet. | Setting: Various Inclusion:  ● 1982-October 2003  ● Indices of overweight as outcomes  ● Risk factors for obesity  ● Chronic disease risk factors/markers associated with obesity  ● Description of attrition  ● Description of participants  ● Process evaluation information | 158 articles (representing 147 programs) | ● Current programs lead to short-term improvements in outcomes relating to obesity and chronic disease prevention with no adverse effects noted.  
● Schools are a critical setting for programming where body composition, chronic disease risk factors and fitness can all be positively impacted.  
● Efforts could be directed towards better integration of chronic disease prevention programs to minimize duplication and optimize resources.  
● Programs require comprehensive evaluation that will ascertain if long-term impact such as sustained normal weight is maintained.  
● Lack of evidence on programs for immigrants, children ages 0–6 years, and males, and programs implemented in community and home settings. |
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<tr>
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</table>
| Harvey et al 2006 | To review studies of provider management of overweight and obese people        | Searched Cochrane MEDLINE, EMBASE, Sigle, Sociofile, dissertation abstracts, Conference Papers Index, Resource Database in Continuing Medical Education, plus hand searching                                                                 | Setting: Health care settings        | 6 studies | • Overall studies were small and of questionable quality  
• Further research needed to determine optimal management of obesity  
• Two reminder systems reported changes in provider behavior, but only one recorded patient outcomes  
• Reminder system reporting patient outcomes resulted in an additional 4.3 lbs and 12.9 lbs lost among women and men in intervention group at 22-24 months  
• Other promising interventions include brief training interventions, shared care, in-patient care, and diettian led training |
| Kumanyika et al 2003 | To summarize Girls Health Enrichment Multi-site Studies (GEMS)                | Review of pilot studies aimed at preventing obesity in African American girls                                                                                                                                                                                    | Setting: After school programs, summer camps in Memphis, Houston, Palo Alto/Oakland, Minneapolis | 4 pilot studies | • No significant changes in BMI or waist circumference seen with any program  
• No significant changes seen in physical activity  
• Girls in Memphis had a significant decrease in consumption of sweetened beverages, but other dietary outcomes were not significant |
| Katz et al 2005  | To review school or work based programs to control overweight and obesity     | • Searched electronic databases  
• Hand search of reference lists, Cochrane reviews, and reports                                                                                                                                                                                                     | Setting: School- or work-based programs  
Inclusion: Interventions related to diet, physical activity, or both  
1966-2001  
Common weight measure used  
Followed for at least 6 months | 10 school based programs  
20 work based programs, 7 used for comparison | School Based  
• Evidence was insufficient to determine if school based programs are successful  
• Interventions that produced modest but positive changes include 1) including nutrition and physical activity components in combination; 2) allotting additional time to physical activity during the school day; 3) including noncompetitive sports (e.g., dance); and 4) reducing sedentary activities, especially television viewing  
Work Based  
• Programs using both diet and exercise were effective in the work place—each component alone was no effective  
• Cost to engage 1% of at risk population <$1 |
<table>
<thead>
<tr>
<th>Authors</th>
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<th>N</th>
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</tr>
</thead>
</table>
| Sharma 2006 | To review population-based interventions for preventing childhood obesity carried out in school settings | Searched CINAHL, ERIC, MEDLINE | Setting: School-based US and UK Inclusion: * 1999-2004 * Kindergarten through high school * Focus on general (not just overweight) children and adolescents | 11 programs | • Most interventions focused on short-term changes right after the intervention  
• Interventions resulted in modest changes in behaviors and mixed results with indicators of obesity  
• TV watching seems to be the most modifiable behavior, followed by physical activity and nutrition behaviors  
• Most programs had multiple components so it was not possible to say which components worked and to what extent  
• Outcome measures such as BMI, triceps skin-fold thickness and waist circumference not measured by all studies included in this review |
| Snethen 2006 | To conduct a meta-analysis of intervention studies designed to reduce overweight/obesity, improve activity, and nutrition | Searched multiple data bases using obesity, children, intervention, weight loss, exercise, nutrition, and dietary | Setting: Various Inclusion: * Studies between 1980-2002 focusing specifically on overweight children (not general population)  
• N ≥ 7  
• Mean age no older than 12  
• Intervention focused on weight loss | 7 studies | Results (reported by outcomes):  
• 4 outcomes had small effect sizes  
• 4 outcomes were medium  
• 7 outcomes from 4 studies had large effect sizes (p = 0.00)  
• Longer interventions tended to have better results  
• Effective programs exist, not clear which programs are most effective  
• No maintenance studies found |
| Stice et al 2006 | 1) To provide a summary of prevention programs for children and adolescents and their effects. 2) To examine participant, intervention, delivery, and design features that are associated with larger intervention effects. | PsycINFO, MEDLINE, Dissertation Abstracts International, CINAHL, tables of content of various journals, reference sections of identified articles, established obesity prevention researchers were contacted and asked for copies of unpublished articles (under review or in press) | Setting: Various Inclusion: 1980-Oct 2005; outcome: proxy measure of body fat; RCTs; active interventions not focused on weight gain prevention; trials with relevant comparison group; trials targeting children and adolescents | 64 programs | • Most interventions do not produce the hypothesized weight gain prevention effects and the overall average intervention effect was small.  
• For most programs that produced significant weight gain prevention effects, the effect sizes are clinically meaningful but are usually confined to pre–post effects.  
• Several prevention programs targeting a variety of health behaviors, such as eating pathology and smoking, produced weight gain prevention effects.  
• Larger weight gain prevention effects were observed for programs targeting children and adolescents (vs. preadolescents), females, and self-presenting samples; programs that were relatively brief; programs solely targeting weight control versus other health behaviors (e.g., hypertension); and programs evaluated in pilot trials. |
## Obesity Prevention—Review Articles

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Methods</th>
<th>Population &amp; Setting</th>
<th>N</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Summerbell et al 2005 | Cochrane review to assess effectiveness of programs to prevent obesity in children | Searched Medline, PsychINFO, Embase, Cinahl, and Central databases; non-English language papers were included and experts contacted. | Setting:  
- Various  
Inclusion:  
- 1990-2005  
- RCTs with a minimum duration of 12 weeks  
- Outcomes: weight and height, percent fat content, BMI, ponderal index, skin-fold thickness | 22 studies | - Nearly all studies resulted in positive changes in diet and physical activity, although results regarding BMI were mixed  
- Five of six studies combining dietary education and physical activity showed no effect—one had an effect on girls but not boys  
- Nutrition education alone was not effective  
- Multimedia approach to increasing physical activity effective  
- The studies were heterogeneous in terms of study design, quality, target population, theoretical underpinning, and outcome measures, making it impossible to combine study findings using statistical methods. There was an absence of cost-effectiveness data. |
| Summerbell 2003    | Cochrane review to assess effects of lifestyle interventions to treat childhood obesity | Searched CCTR, MEDLINE, EMBASE, CINAHL, PsychLIT, Science Citation Index, and Social Science Citation Index; contacted experts in child obesity | Setting:  
Not specified  
Inclusion:  
- 1985-July 2001  
- Included studies with lifestyle interventions  
- RCTs with 6 months observation  
- Age < 18 yrs  
- Primary outcome height and weight or weight measurement | 18 studies | - May be some support for programs involving parents, overall not enough evidence to make generalized recommendations  
- Many studies reviewed were small and had high drop out rates  
- Future research should focus on role of families, culturally specific messages |
## Obesity Prevention—Review Articles

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Methods</th>
<th>Population &amp; Setting</th>
<th>N</th>
<th>Outcomes/Comments</th>
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</table>
| Whitlock et al 2005 | To examine the evidence for the benefits and harms of screening and early treatment of overweight among children and adolescents in clinical settings | Cochrane, Medline, PsycINFO, DARE, and CINAHL                             | Setting: Primary care  
Inclusion: 1966-April 2004; studies demonstrating a) direct evidence that screening for overweight leads to improvements, b) the benefits and harms of overweight screening and interventions, c) the validity of screening tests for predicting health outcomes in adulthood, d) the efficacy of behavioral counseling, pharmacotherapeutic, and surgical interventions, and e) studies showing intervention-associated harms. | Based on 7 key questions: 353 articles for questions 1 and 2, 198 articles for questions 4 and 5, 36 articles for questions 3 and 6, 41 articles for question 2, 22 articles for questions 4 and 5, and 4 articles for question 6. | - Interventions to treat overweight adolescents in clinical settings have not been shown to have clinically significant benefits, and they are not widely available.  
- The overall evidence is poor for the direct effects of screening (and intervention) programs and screening harms. The overall evidence is fair/poor for behavioral counseling interventions, because of small, non-comparable, short-term studies with limited generalizability that reported health or intermediate outcomes, such as cardiovascular risk factors, rarely.  
- Trials are particularly inadequate for nonwhite subjects and children 2 to 5 years of age. Fair/poor evidence is available for behavioral counseling intervention harms because of very limited reporting. Fair evidence supports childhood BMI as a risk factor for adult overweight, although data are limited for nonwhite subjects, and data addressing BMI as a risk factor for adult morbidities generally do not control for confounding by adult BMI. Good evidence is available for overweight prevalence based on BMI measures in all groups, except Native American and Asian groups. |
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Intervention</th>
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<th>N</th>
<th>Attrition</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caballero et al 2003</td>
<td>To evaluate the effectiveness of a school-based intervention</td>
<td>Design:</td>
<td>Setting:</td>
<td>I: 879</td>
<td>I: 17%</td>
<td>• No changes in BMI, calories consumed through school lunch, or self efficacy attitudes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• RCT, randomization at school level</td>
<td>• 41 elementary schools in Native American communities of Arizona, New Mexico, and South Dakota</td>
<td>C: 825</td>
<td>C: 17%</td>
<td>• Significant decrease in energy consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intervention:</td>
<td>Inclusion:</td>
<td></td>
<td></td>
<td>• Physical activity improved but motion sensor activity did not</td>
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<tr>
<td></td>
<td></td>
<td>Classroom curriculum, skill building for food services employees, increased physical education, family support</td>
<td>• Schools with ≥ 15 children in 3rd grade, ≥ 90% of 3rd grade students American Indian ethnicity, &gt; 70% retention from 3rd to 5th grades</td>
<td></td>
<td></td>
<td>• Community support was strong</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td>• Significant differences in changing the food service environment to reduce the fat content of school lunches, improving self-reported out-of-school physical activity, and reducing self-reported dietary fat intake among intervention children.</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Comment:</td>
<td></td>
<td></td>
<td><em>Comment:</em> The homogenous American Indian sample might have required a more intense or longer intervention, considering that this population has a high rate of obesity and diabetes.</td>
</tr>
<tr>
<td>Carrel et al 2005</td>
<td>To determine whether a school-based fitness program can improve body composition, cardiovascular fitness level, and insulin sensitivity in overweight children</td>
<td>Design:</td>
<td>Setting:</td>
<td>50</td>
<td>None</td>
<td>• Baseline test results for cardiovascular fitness, body composition, and fasting insulin and glucose levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• RCT</td>
<td>Rural middle school and an academic children's hospital</td>
<td></td>
<td></td>
<td>• Treatment group demonstrated a significantly greater loss of body fat, greater increase in cardiovascular fitness, and greater improvement in fasting insulin level.</td>
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<td></td>
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<td>Intervention:</td>
<td>Inclusion:</td>
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<td></td>
<td>lifestyle-focused, fitness-oriented gym classes (treatment group) or standard gym classes (control group) for 9 months</td>
<td>Overweight children with a BMI above 95th percentile for age</td>
<td></td>
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</tr>
<tr>
<td>Coleman et al 2005</td>
<td>To assess the impact of Child and Adolescent Trial for Cardiovascular Health (CATCH)</td>
<td>Design:</td>
<td>Setting:</td>
<td>I: 723</td>
<td>Overall:</td>
<td>• Girls and boys in control schools had a significant increase in risk of overweight or overweight (both CATCH and control groups increased, but rate of increase was larger in control group)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Quasi-experimental matched controlled design with pretest/post test</td>
<td>• Schools located in the El Paso school district, Texas</td>
<td>C: 473</td>
<td>By 4th grade: 9%</td>
<td>• Percentage of overweight in girls did not vary between intervention and control throughout intervention</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intervention:</td>
<td>Inclusion:</td>
<td></td>
<td>By 5th grade: 27%</td>
<td>• Percentage of overweight increased among boys in both CATCH and control arms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CATCH training for PE teachers, food services staff, and home room teachers, gym equipment purchased</td>
<td>• Third grade children with permission from parents</td>
<td></td>
<td></td>
<td>• Results of physical fitness inconclusive, and no results from cafeteria changes</td>
</tr>
<tr>
<td>Authors</td>
<td>Study Question</td>
<td>Intervention</td>
<td>Population &amp; Setting</td>
<td>N</td>
<td>Attrition</td>
<td>Outcomes/Comments</td>
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| Donnelly et al 1996 | To attenuate obesity and improve physical and metabolic fitness in elementary school children | **Design:** 2 year cohort  
**Intervention:** Enhanced physical activity, grade specific nutrition education, and a lower fat and sodium school lunch program. Controls continued with a regular school lunch and team sports activity program. | **Setting:** Two school districts in rural Nebraska  
**Inclusion:** Cohorts from grades 3 to 5 | 108 | Not indicated in abstract available on the web | Intervention school lunches had significantly less energy (9%), fat (25%), sodium (21%), and more fiber (17%). However, measures of 24-hour energy intake for intervention and control groups showed significant differences for sodium only. Physical activity in the classroom was 6% greater for Int compared to Con (p < 0.05) but physical activity outside of school was approximately 16% less for Int compared to Con (p < 0.05). Body weight and body fat were not different between schools for normal weight or obese children. No differences were found for cholesterol, insulin, and glucose. It appears that compensation in both energy intake and physical activity outside of school may be responsible for the lack of differences between Int and Con. |
| Fitzgibbon et al 2005 | To assess the impact of dietary and physical activity on BMI | **Design:** RCT  
**Intervention:** 20 minutes instruction on healthy eating and 20 minutes of exercise 3x/week, parents received weekly newsletters and homework, controls received general health information. | **Setting:** Head Start programs in the Archdiocese of Chicago  
**Inclusion:** All children and families eligible to participate—program did not target overweight youth | I: 197  
C: 212 | Post intervention: I: 9%, C: 14%  
Year 1: I: 27%, C: 31%  
Year 2: I: 26%, C: 28% |  • Post intervention BMI did not differ between groups  
• At 1 year, the mean increase in BMI between groups was significantly different (0.02 k/m² vs. 0.64 k/m², p=0.002)  
• At 2 year, the mean increase in BMI between groups was significantly different (0.48 k/m² vs. 1.14 k/m², p=0.008)  
• Effects were similar for boys and girls  
• No effect seen on intake of fat, dietary fiber, or exercise  
• Culturally specific program using specially trained early childhood educators, so generalizability questionable |
| Fitzgibbon et al 2006 | To assess the impact of dietary and physical activity on BMI among Latino preschoolers | **Design:** RCT  
**Intervention:** Culturally proficient 14-week (three times weekly) diet/physical activity intervention. Parents completing weekly homework assignments. Controls received general health information. | **Setting:** Twelve predominantly Latino Head Start centers  
**Inclusion:** All children and families at centers | 401 | Year 1: 16%  
Year 2: 17% |  • No significant differences between intervention and control schools in either primary or secondary outcomes at post-intervention, Year 1, or Year 2 follow-ups.  
• When Hip-Hop to Health Jr. was conducted in predominantly black Head Start centers, it was effective in reducing subsequent increases in BMI in preschool children. In contrast, it was not effective in Latino centers (although it was very well received). Future interventions with this population may require further cultural tailoring and a more robust parent intervention |
<table>
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</table>
| Gortmaker et al 1999 | To evaluate the impact of a school-based health behavior intervention (Planet Health) on obesity among boys and girls in grades 6 to 8. | Design: RCT with 5 intervention and 5 control schools. Outcomes were assessed using pre-intervention (fall 1995) and follow-up measures (spring 1997), including prevalence, incidence, and remission of obesity. | Setting: 10 ethnically diverse public schools in 4 Massachusetts communities          | 1560 | 83%        | • The prevalence of obesity among girls in intervention schools was reduced compared with controls, controlling for baseline obesity (odds ratio, 0.47; \( P = .03 \)), with no differences found among boys. There was greater remission of obesity among intervention girls vs control girls (odds ratio, 2.16; \( P = .04 \)).  
• The intervention reduced television hours among both girls and boys, and increased fruit and vegetable consumption and resulted in a smaller increment in total energy intake among girls. Reductions in television viewing predicted obesity change and mediated the intervention effect. Among girls, each hour of reduction in television viewing predicted reduced obesity prevalence (odds ratio, 0.85; \( P = .02 \)). |
<table>
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</table>
| Jamner et al 2004  | To evaluate the effect of an intervention designed to increase physical activity among sedentary adolescent females. | Design: Specific individuals targeted pre-test, post-test                     | Setting: Two public high schools in Orange County, California                                           | I: 36 | I: 25     | C: 22                                                                 | - Significant effect on cardiovascular fitness ($p = .017$), lifestyle activity ($p = .005$), and light ($p = .023$), moderate ($p = .007$), and hard ($p = .006$) activity. All changes were in a direction that favored the intervention. There was no effect of the intervention on psychosocial factors related to exercise.  
- Lean body mass and BMI percentile did not change over time. |
<p>| Pangrazi et al 2003 | To examine the effects of a school-based intervention called PLAY (Promoting Lifestyle Activity for Youth) on physical activity levels and BMI | Design: Tx schools randomized into PLAY, PE, PLAY and PE, and no-treatment No baseline data | Setting: 35 schools in Arizona and new Mexico                                                          | 606   | Not indicated in abstract available on the web | Intervention effective at increasing the physical activity level of children (steps/day), especially girls. No significant differences between groups were found for BMI. |</p>
<table>
<thead>
<tr>
<th>Authors</th>
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</table>
| Robinson 1999    | To assess the effects of reducing television, videotape, and video game use on changes in adiposity, physical activity, and dietary intake | Design: RCT conducted from September 1996 to April 1997  
Intervention: 18-lesson, 6-month classroom curriculum to reduce television, videotape, and video game use. | Setting: Two socio-demographically and scholastically matched public elementary schools in San Jose, Calif.  
Inclusion: 3rd and 4th grade students | 198 | 192       | • Children in intervention group had statistically significant relative decreases in BMI ($P=.002$), triceps skinfold thickness ($P=.002$), waist circumference ($P<.001$), and waist-to-hip ratio ($P<.001$).  
• Relative to controls, intervention group changes were accompanied by statistically significant decreases in children's reported television viewing and meals eaten in front of the television.  
• No statistically significant differences between groups for changes in high-fat food intake, moderate-to-vigorous physical activity, and cardio-respiratory fitness. |
| Sallis et al 1997 | To increase physical activity during physical education classes and outside of school | Design: Schools randomized into treatment or control  
Intervention: Health-related physical education taught by PE specialists or trained classroom teachers | Setting: Seven schools outside San Diego, CA  
Inclusion: Grades 4-5 | 955 | Number not provided; however, no differences seen in attrition between groups. | • Students spent more minutes per week being physically active in specialist-led (40 min) and teacher-led (33 min) PE classes than in control classes.  
• After 2 years, girls in the specialist-led group were superior to girls in the control group on abdominal strength and endurance ($P < .001$) and cardio-respiratory endurance ($P < .001$).  
• No effects on physical activity outside of school. |
| Spiegel 2006     | To evaluate the effectiveness of a multidisciplinary school based intervention | Design:  
• RCT  
• Based on Theory of Reasoned Action  
• All activities incorporated into core curriculum  
• Year long program consisting of 7 modules  
• Both regular and PE teachers involved | Setting:  
 Delaware, Florida, Kansas, North Carolina  
Inclusion: Grades 4-6  
Sampling done at district level, controls selected from same school | 69 classes in 16 schools participated  
I: 534  
C: 479 | I: 13.7%  
C: 16.2% | • 1.5% reduction in intervention children classified as >85% to <95% BMI ($P = 0.01$)  
• No significant shift noticed in control group  
• Both groups reported consuming more fruits/vegetables but still consumed less than recommended  
• Physical activity increased from 59min/wk to 102.5min/wk in intervention group.  
Comment:  
• Method of reporting food intake not very rigorous  
• Teachers applied to participate in program |
### Obesity Interventions—Clinic Based

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<th>Authors</th>
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</table>
| Patrick et al 2006 | To improve adolescent physical activity, to limit their sedentary behaviors and to improve their dietary intake of fruits and vegetables, fiber, or total dietary fat. | Design:  
- **RCT**  
  Intervention: Primary care, office-based, computer-assisted diet and physical activity assessment and stage-based goal setting followed by brief provider counseling and 12 months of monthly mail and telephone counseling; A comparison group received information addressing sun exposure protection | Setting:  
- Primary care with follow-up at home  
  Inclusion:  
- adolescent girls and boys aged 11 to 15 years | 878 | None |  
- Intervention girls and boys significantly reduced sedentary behaviors ($P = .001$);  
- Intervention boys reported more active days per week ($P = .01$)  
- The number of servings of fruits and vegetables for intervention girls approached significance ($P = .07$).  
- No intervention effects were seen for percentage of calories from fat or minutes of physical activity/week.  
- Percentage of adolescents meeting recommended health guidelines was significantly improved for girls for consumption of saturated fat [relative risk, 1.33] and for boys' participation in days/week of physical activity [relative risk, 1.47].  
- No between-group differences were seen in BMI. |

### Obesity Interventions—Family Based Interventions

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</tr>
</thead>
</table>
| Ebbeling et al 2006 | To examine the effect of decreasing sugar-sweetened beverage (SSB) consumption on body weight | Design:  
- **RCT**  
  Intervention: Home deliveries of noncaloric beverages to displace SSBs | Setting:  
- Recruited from pediatric population at Children’s Hospital Boston  
  Inclusion:  
- Adolescents 13-18 years who regularly consumed SSBs | 103 | None |  
- Consumption of SSBs decreased by 82% in the intervention group and did not change in the control group. Change in BMI between tx and cx was not significant overall. However, baseline BMI was a significant effect modifier. Among the subjects in the upper baseline-BMI tertile, BMI change differed significantly between the intervention and control groups. The interaction between weight change and baseline BMI was not attributable to baseline consumption of SSBs.  
- This simple environmental intervention almost completely eliminated SSB consumption in a diverse group of adolescents. The beneficial effect on body weight of reducing SSB consumption increased with increasing baseline body weight. |
## Obesity Interventions—Family Based Interventions

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</thead>
</table>
| Epstein et al  | To test whether alternatives to eating can influence weight control           | Design: • RCT  
Intervention: Families received information about Traffic Light Diet, Food Guide Pyramid, and healthy eating. Also received information about physical activity and praise/reinforcement systems; intervention group received points for engaging in non-food related activities | Setting: • Recruited from newspaper flyers, physicians, and other healthcare providers       | I: 19 | I: 1 (5%)  
C: 22  
C: 5 (22%) | • No significant differences found between groups  
• Both groups had significant declines in which was maintained at 12 and 24 months (p<0.001)  
• Differences consistent with both intention to treat and measured BMI  
• Episodes of eating also significantly decreased over time (p<0.001)  
• Possible that no difference seen between groups due to implementation problems |
| Golan et al    | To compare the effects of targeting parents alone vs. parents and children in obesity treatment | Design: • RCT  
Intervention: 1 hr support and education session weekly for 10 wks, biweekly for 4 wks, monthly for 2 months  
Monthly 40-50 minute interventions per family  
Emphasized health eating, exercise, and parenting skills  | Setting: Israel  
Inclusion: • Children 6-11 yrs  
Children >85th percentile BMI  
No other wt loss program participation | 32 families  
4: parent only  
1: parent child | 80% of parent only group had full attendance vs. 55% in parent child group  
Parent only group overweight change was -9.5% vs. -2.4% in parent/child group  
Difference between groups sig. for change in BMI (P=0.024) and change in % overweight (P=0.02)  
Both groups reported a reduction in obesogenic habits (22% in parent vs. 15% in parent/child), but difference between groups significant (P<0.05)  
More permissive parents found fewer changes in child’s BMI  
Large difference in attendance at sessions may signify baseline difference in groups, and may explain variation in program effectiveness |
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</table>
| Datar et al   | Examine effect of physical education time on BMI change                          | Design: Observational longitudinal cohort intervention: No intervention made—observational study | Setting: National sample of kindergarten students Inclusion: Data from Early Childhood Longitudinal Study | N 19,028 | 5,177 missing from waves 2 and 4 | Observational study  
|               |                                                                                |                                                                                                 |                                                                                        |        | 10,211 had all measurements at all waves                                                                                   | PE instruction had strong negative effect on BMI in girls, but no significant impact on boys |
| Danielzik et al | To evaluate the effects of preventive school measures on long term obesity    | Design: Cross sectional population based surveys Intervention: Six hour school based intervention | Setting: Kiel, Germany Inclusion: All first graders entering school between 1996 and 2001 (T0), and all fourth graders entering school between 2000 and 2005 (T1) | T0: 257 | T1: 257               | Interim study—data not available on all school children  
|               |                                                                                |                                                                                                 |                                                                                        | NA     |                       | 4 year incidence of overweight reduced in intervention group (36.5 vs. 41.7%)  
|               |                                                                                |                                                                                                 |                                                                                        |        |                       | Children participating in family program had slower increase in fat mass compared to both intervention and non-intervention group (10% vs. 27% and 32% respectively) |
| Edwards et al | Assess acceptability and impact of family based behavioral treatment (FBBT) for childhood obesity | Design: Pre-post test evaluation of four consecutive groups Intervention: Advice for whole family on lifestyle changes, weight control plan for child, and strategies | Setting: Clinic in the UK Inclusion: Referred from general practitioners, school nurses, or pediatricians  
|               |                                                                                |                                                                                                 |                                                                                        | N=33   | 12 wks: 19%  
|               |                                                                                |                                                                                                 |                                                                                        |        | 3 mo: 40%               | Primary follow up only 12 wks  
|               |                                                                                |                                                                                                 |                                                                                        |        |                       | No control group—just pre/post test design  
|               |                                                                                |                                                                                                 |                                                                                        |        |                       | Significant reduction seen for %BMI and total BMI (p<0.001)  
|               |                                                                                |                                                                                                 |                                                                                        |        |                       | Self concept score (Piers-Harris) and depression (CDI) went up (p<0.001), although this was not related to change in BMI  
|               |                                                                                |                                                                                                 |                                                                                        |        |                       | Children and families chose to participate—were referred by nurses and clinicians  
<p>|               |                                                                                |                                                                                                 |                                                                                        |        |                       | Large scale feasibility questionable due to cost |
| Goldfield     | Assess impact of open loop feedback plus reinforcement vs. open loop feedback on physical activity, body composition |                                                                                                 |                                                                                        | Only 8 wks in duration                                                                 |        |                       |                                                                                                                                       |</p>
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</thead>
<tbody>
<tr>
<td>Jurg et al 2006</td>
<td>To assess a school-based intervention that focuses on the use of theory, environmental changes and parental influences</td>
<td>Design: quasi-experimental pre-test/post-test</td>
<td>Setting: Grades 4, 5 and 6 of four intervention schools and two control schools in Amsterdam</td>
<td>510 children</td>
<td></td>
<td>Full text not on web Measures not appropriate</td>
</tr>
<tr>
<td>Saelens et al 2002</td>
<td>To evaluate the effect of behavioral weight control initiated in a primary care setting</td>
<td>Design: RCT Intervention: Behavioral skills development using computer assessment, physician consult, and telephone reinforcement Parents of intervention group also sent information Controls received physician non-tailored counseling on healthy eating and activity and no follow up</td>
<td>Setting: Pediatric primary clinics in Southern California Inclusion: Ages between 12-16 20%-100% above median BMI for sex and age</td>
<td>I: 23 C: 21</td>
<td>I: 12% C: 9%</td>
<td>Treatment program only 4 months Significantly more control subjects increased their BMI z scores compared to intervention (p&lt;0.03) More intervention adolescents decreased BMI z score at post treatment (40.0% vs. 10.5%, p&lt;0.04) Overall BMI did not produce an overall average loss of weight among participants</td>
</tr>
<tr>
<td>Taylor 2005</td>
<td>Assess education and exercise-based in family centered environment</td>
<td>8 wk group intervention</td>
<td>Recruited from pediatricians, school nurses, newspapers, PSAs Age: 8-15 BMI: &gt; 85th percentile Other: stable vitals, adequate coordination</td>
<td></td>
<td></td>
<td>Study not long enough in duration</td>
</tr>
<tr>
<td>Authors</td>
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| Zahner et al 2006 | To increase overall PA and to improve fitness and health in 6- to 13-year-old children | Design: RCT  
Intervention:  
- two additional physical education classes per week given by trained physical education teachers adding up to a total of five physical activity classes per week  
- short physical activity breaks (2-5 min each) during academic lessons  
- physical activity home work  
- adaptation of recreational areas around the school | Setting: Two provinces in Switzerland  
Inclusion: | I: 298  
C: 204 |           | Excluded because results are not yet available |
**APPENDIX C: UNINTENTIONAL INJURY PREVENTION AND INTERVENTION**

**Magnitude of the Problem:** Injuries are the leading cause of death, disabilities, and health care utilization for children and teenagers between the ages of one and nineteen in the United States. In 2004, nearly 16,000 children died of unintentional injuries and an estimated 240,000 children under 15 years old were hospitalized due to injuries. Each year between 1995 and 2004, among children under eighteen, there were an estimated nine million emergency department visits made as a result of unintentional injury.

Historical trends show that the occurrence of injuries can be reduced. Between 1985 and 2000, the incidence rate of injuries decreased from 2,259 to 1,740 per 10,000 for children between the ages of zero and four, and from 2,699 to 1,925 per 10,000 for those ages five to fourteen. This reduced occurrence rate coincides with a decreased death rate due to injuries: from 1979 to 1998, unintentional injury deaths declined by 52%, 51% and 45% among children ages one to four, five to nine, and ten to fourteen, respectively.

**Determinants and Risk Factors:** Research has shown that environmental hazards and poor quality of housing are associated with injuries. Other risk factors include poverty, poor parenting, being a single parent, alcohol and substance abuse, and neglect.

**Health Consequences:** In 1996, unintentional injuries (primarily brain, spinal cord, burn, and limb injuries) left an estimated 150,000 children and adolescents permanently disabled. Unintentional injuries account for two thirds of all injury-related deaths of children in the United States.

**Economic Consequences:** Studies assessing the cost burdens of child injuries generally take a societal perspective to estimate both immediate and longer-term costs, including costs for victims, families, government, insurers, and taxpayers. Those costs are comprised of direct or resource costs (such as medical costs) and indirect or productivity costs (such as future wage loss due to disability).

Miller estimates that approximately 15% of total medical spending went to injury-related care, and as much as $14 billion [$18 billion in 2006 dollars] in lifetime medical spending and $66 billion [$85 billion in 2006 dollars] in present and future work losses resulted from unintentional childhood injuries occurring in 1996. Two studies estimated the monetary burdens resulting from a range of injuries and concluded that the combination of fatal and nonfatal injuries among children aged zero to four had resulted in $4 billion [$4.7 billion in 2006 dollars] in medical costs and $12 billion [$14 billion in 2006 dollars] in productivity losses. In 1996, 22.2 million children, about three in every ten, suffered unintentional injuries serious enough to require medical treatment or cause at least half a day of restricted activity. Resource and productivity cost due to these injuries was estimated to average $3,600 per victim [$4,626 in 2006 dollars].

The leading causes of both resource and productivity costs of unintentional injuries to children aged zero to four resulted from falls, $7 billion [$9 billion in 2006 dollars]; struck by/against objects, $2.5 billion [$3.2 billion in 2006 dollars]; motor vehicle traffic, $1.5 billion [$1.9 billion in 2006 dollars]; burn/anoxia $1 billion [$1.3 billion in 2006 dollars]; and cut/pierce $0.7 billion [$0.9 billion in 2006 dollars]. As for specific injuries among children, the total lifetime cost of
injuries to pedestrians and pedal-cyclists caused by collisions with motor vehicles was estimated to be $1.1 billion [$1.4 billion in 2006 dollars] and $45 million [$58 million in 2006 dollars], respectively, for children aged zero to four. National costs associated with bicycle handlebar-related abdominal and pelvic organ injuries among children nineteen or younger were $9.6 million [$12 million in 1996 dollars] in total hospital charges, $10 million [$13 million in 2006 dollars] in lifetime medical costs, $11.5 million [15 million in 2006 dollars] in lifetime productivity losses, and $504 million [$648 million in 2006 dollars] in lifetime monetized quality-adjusted life-years.

**INTERVENTIONS TO REDUCE OCCURRENCE:** Many studies have found evidence of preventive interventions that can effectively reduce the incidence of injuries.

**Gun safety:**
Several studies found no significant difference between intervention and control groups for interventions targeting children’s manner of playing with guns or parents’ gun ownership. However, studies reported mixed evidence of effects on storage behaviors: two studies found that, among those parents who owned guns, there was a significant intervention effect on safety behaviors such as purchasing trigger locks and using locked storage, while Sidman et al. found that a community education campaign had no effect on purchasing a lock-box.

**Road safety:**
*Pedestrians/road safety:* Burke found that a stencil in the shape of a school bus applied to the pavement at a bus stop reduced children’s risky behaviors. An Australian study found increased road safety activities, as well as a significant reduction in the volume of traffic on local access roads over the trial period of a community intervention, when both road safety interventions and development of traffic calming features were implemented.

*Passenger safety:* Interventions aimed at improving passenger safety for children include promoting rear seating and the use of child car seats, booster seats, and lap and shoulder belts. A six-month program that provided bilingual education materials for a low-income Hispanic community and distributed rewards to those families whose children were rear seated in cars significantly increased child rear seating from 33% to 49% in the intervention city. A multifaceted community campaign including education, car seat training, and discount coupons for booster seats increased booster-seat use to 26% in the intervention communities, significantly higher than the control communities. A child safety-seat loaner program targeting Hispanic preschoolers found that the use of restraints among those who attended health centers increased significantly, compared to other groups.

*Bicycle helmets:* Wu reported that distributing free helmets significantly increased reported helmet use in the experimental group compared to both the control group (nearly 16 times higher) and the second intervention group, who received only vouchers. A multifaceted bicycle helmet promotion program targeting low income children, which comprised classroom instruction, educating parents, obtaining and fitting helmet for each child to use, and conducting bicycle rodeos for children to practice safe riding skills, found that helmet use in the intervention group more than doubled, from 43% to 89%, significantly higher than the increase in the control group. A four-year program targeting elementary school children in Quebec, including
persuasive communication and activities to facilitate helmet acquisition, was found to significantly increase the use of helmets for groups exposed to the program from 1.3% to 33%.

**Home safety:**

*General home injury:* Two interventions\(^{309,310}\) delivered at the community level included injury prevention campaigns and home visits by trained local collaborators. Together, these studies found significant improvement in behavioral change, such as adoption of safety devices or practices, than they did in incidence of injuries. Among seven studies that only measured behavioral changes, six\(^{311,312,313,314,315,316}\) found significant improvement in the intervention group for at least one safety measure, compared to the control group. Five out of six studies that reported significant improvement assessed programs that provided discounted or free safety devices as part of the home visiting intervention. On the other hand, only two\(^{317,318}\) out of four studies reported significant reduction in injury or injury-related doctor visits, and the remaining two studies\(^ {319,320}\) did not find significant differences in injury incidence between intervention and control groups.

*Smoke alarms:* Three studies reviewed interventions that distributed smoke alarms or detectors to assigned households. Two studies\(^ {321,322}\) reported a significant reduction in the rate of injuries or hospitalizations associated with residential fires in the intervention communities.

*Baby walkers:* Kendrick\(^ {323}\) found that postpartum home visits not only significantly reduced the ownership of baby walkers, a seat in a frame on wheels for infants between three and 12 months that has been found unsafe to infants, but also successfully discouraged parents who owned baby walkers from using them.

*Lawnmowers:* An intervention\(^ {324}\) aimed at reducing child injuries from lawnmowers reported that an intervention in which parents watched a 20-minute education video produced significant increases in four out of six safety practices.

**Community safety:**

*Playground:* A New Zealand study\(^ {325}\) reported that a health promotion program consisting of providing information about hazards, an engineer’s report, regular contact between the school and program facilitators, and assistance in obtaining funding, was associated with a 52% reduction in height/surface hazards.

*Shopping carts:* Harrell\(^ {326}\) found no intervention effects of using two warning signs on improving adult supervision or reducing risky child activities in grocery carts.

**Safe Communities Model:** The WHO Safe Community model is a community-based, all-age, all-injury prevention program, relying on input from local politicians, civil servants, representatives of non-governmental organizations, and public health workers to identify problems and implement actions.\(^ {327,328}\) In New Zealand, this program was found to significantly reduce injury-related hospitalizations (p<0.05) for children aged zero to fourteen in the intervention communities; in Sweden, the risk of child (aged zero to six) injury in the intervention community decreased significantly more than it did in the control.\(^ {329}\)
**ECONOMIC STUDIES:** Eight studies concluded that the interventions reviewed were cost-effective, including three smoke alarm distribution programs, three car seat use programs, one on bicycle helmet use, and one based on home visits. One additional review study found that more than half of the 84 preventive interventions included in the study yielded net societal cost savings. However, a U.K. study concluded a RCT of a smoke alarm give-away program was unlikely to represent a cost-effective use of resources, in part because too few alarms were installed and maintained.

**CONCLUSION:** In sum, a majority of studies found that preventive interventions effectively improved parents’ and children’s knowledge and safety behaviors and increased the use of safety devices. Fewer studies investigated changes in the injury rate *per se* as outcomes, but some of the studies that did so found positive changes. Most economic studies found that the reviewed interventions were cost-effective. It is worthy to note that some extremely high positive returns might be an overestimation, in part because those cost-outcome studies only considered the cost of safety devices, but not the cost to facilitate the adoption of such devices, which would include the costs of promotion as well as the cost of fees for administration, operation, personnel, and so forth. Nevertheless, including these additional costs is unlikely to change the conclusion that most interventions studied were found cost-effective.
### Figure 1. Lifespan Impact of Injury Prevention Efforts

<table>
<thead>
<tr>
<th>LEVEL OF INTERVENTION</th>
<th>Preconception/ Pregnancy</th>
<th>Infant/Childhood</th>
<th>Adolescence</th>
<th>Adulthood</th>
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<tbody>
<tr>
<td>Individual</td>
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<td>Gun safety education</td>
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<td>Prenatal home visitation</td>
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<td>Education against the use of baby walkers</td>
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<td>Local/ Community/ Workplace/ School</td>
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<td>Community education combined with incentives distribution for road safety</td>
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<td>National/State</td>
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<td>Changes in baby walker safety standards</td>
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<td>Child passenger safety laws</td>
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</tbody>
</table>

**Notes:**
- Age period when interventions take place
- Age period with continuing positive impacts of intervention

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1 Hardy 2002
3 Kitzman 1997
4 Kendrick et al 2005
5 Greenberg-Seth et al. 2004
6 Rodgers & Leland 2005
7 Segui-Gomez et al. 2001

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### Table 1. Studies on Injury Prevention

#### INDIVIDUAL-LEVEL INTERVENTIONS: GUN SAFETY

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Intervention</th>
<th>Population &amp; Setting</th>
<th>N</th>
<th>Attrition</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Hardy 2002    | Assess effectiveness of skills-based firearm safety program                    | **Design:** Randomized controlled trial  
**Intervention:**  
- Intervention group received four lessons delivered by trained undergraduate students on gun safety aimed at changing behavior when guns are encountered  
- Follow up period not clearly stated—appears to be directly after intervention  
- Control group received intervention 1 wk after evaluation  
**Setting:** Three day care centers in urban southeastern US  
**Inclusion:**  
- Children attending day care whose parent’s consented | I: 34  
C: 36 | none | • The intervention had no effect on likelihood children would play with guns or alert adults when guns found during play  
• Among children who played with guns, there was no difference in gun related behavior such as play shooting or displays of aggressive behavior  
• Children reporting that their parents owned a gun were more likely to play with guns (P=0.001) and significantly more gun-related (shooting) behavior (P=0.017) |

#### FAMILY-LEVEL INTERVENTIONS: GUN SAFETY

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<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
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<th>Population &amp; Setting</th>
<th>N</th>
<th>Attrition</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Carbone et al 2005 | Evaluate the effectiveness of gun safety counseling by pediatricians  
| Design:  
- Controlled pre-test, post-test  
**Intervention:**  
- Physicians trained in Steps to Prevent Firearm Injury (STOP 2) program  
- Families receiving intervention counseled by physician, given brochures and gun lock  
- Families followed up with one month after the intervention  
**Setting:**  
- Pediatric clinic within a community Health Center in Tucson, AZ  
**Inclusion:**  
- All families with children younger than 18, attending clinic who reported owning guns | I= 73 families  
C= 78 | 16% | • The intervention had no effect on gun ownership  
• Among families reporting no locks at baseline, no significant effect seen on increasing lock use  
• Overall gun safety (defined as any change in locked storage of gun, improved type of gun storage, or storing gun unloaded) practice increased among intervention group (RR 2.29; 95% CI 1.52-3.44; P<0.001)  
• Frequency of locked storage increased in intervention group (RR 5.2; 95% CI 1.59-17.32; P<0.003)  
• Control group more likely to have proper gun storage at baseline |
## Family-level interventions: Gun Safety

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
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</tr>
</thead>
</table>
| Grossman et al.  | Determine effectiveness of gun safety counseling in well child visits | **Design:**  
- Randomized controlled trial, unit of randomization was provider  
- Physicians trained by academic detailers, given reading materials, bibliography, and audio tape to assist in counseling  
- Parents received only one counseling session  
- Follow up with parents occurred 3 months after office visit  | **Setting:**  
- Primary care clinics at Group Health Cooperative in Washington State  
- Providers—those seeing at least 5 patients <18 years of age per month  
- Families—had a scheduled well child visit for child aged 2 months - 18 years  | Providers:  
I: 28  
C: 28  
Families:  
I: 618  
C: 677 | Providers: None  
Families: 23% | No statistical difference between control and intervention groups in acquisition of firearms, removal of guns, or acquisition of safe storage boxes |

## Family-level interventions: Road Safety

### Bicycle helmet use

<table>
<thead>
<tr>
<th>Authors</th>
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<th>Attrition</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Wu et al. 2005   | To evaluate the effectiveness of 3 competing pediatric emergency department (ED) interventions aiming to increase sport helmet use in a state without helmet legislation. | **Design:**  
RCT  
**Intervention:**  
I1: received free helmet  
I2: received a voucher for helmet  
C: received counseling  | **Setting:**  
pediatric emergency department (ED)  
**Inclusion:**  
English-speaking children aged 5-16  | I1: 78  
I2: 65  
C: 57 | At follow-up  
I1: 77  
I2: 62  
C: 53 | Directly receiving a free helmet in the ED significantly increased reported helmet use relative to the control group; the odds that a parent reported helmet use were nearly 16 times higher (P < 0.01), and the odds that a child reported helmet use were nearly 10 times higher (P < 0.01). |
<table>
<thead>
<tr>
<th>Authors</th>
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</thead>
</table>
| Clamp 1998   | To assess effectiveness of general practitioner advice about child safety, and provision of low cost safety equipment to low income families, on use of safety equipment and safe practices at home. | Design: Randomized, unblinded, controlled trial  
**Intervention:**  
- General practitioner safety advice  
- Access to safety equipment at low cost.  
- Control families received usual care. | Setting: A general practice in Nottingham.  
Inclusion: 169 families with children aged up to 5 registered with the practice | I: 83  
C: 82 | None |  
- After intervention, intervention group used more safety equipments:  
  fireguards (relative risk 1.89, 95% CI 1.18 to 2.94), smoke alarms (1.14, 1.04 to 1.25), socket covers (1.27, 1.10 to 1.48), locks on cupboards for storing cleaning materials (1.38, 1.02 to 1.88), and door slam devices (3.60, 2.17 to 5.97).  
- Also, significantly more families in intervention group showed very safe practice in storage of sharp objects (1.98, 1.38 to 2.83), storage of medicines (1.15, 1.03 to 1.28), window safety (1.30, 1.06 to 1.58), fireplace safety (1.84, 1.34 to 2.54), socket safety (1.77, 1.37 to 2.28), smoke alarm safety (1.11, 1.01 to 1.22), and door slam safety (7.00, 3.15 to 15.6). |
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<th>Authors</th>
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</thead>
</table>
| Gielen et al. 2002  | To present the results of an intervention trial to enhance parents’ home-safety practices through pediatric safety counseling, home visits, and an on-site children’s safety center | *Design:* RCT                                                                                   | *Setting:* A hospital-based pediatric resident continuity clinic in inner city         |       |                   | - The prevalence of safety practices ranged from 11% of parents who stored poisons safely to 82% who had a working smoke alarm.  
- No significant differences in safety practices were found between study groups.  
- Families who visited the children’s safety center compared with those who did not had a significantly greater number of safety practices (34% vs 17% had > or 3). |
|                     |                                                                               | *Intervention:*  
- I1: Parents in the enhanced-intervention group received the standard services plus a home-safety visit by a community health worker.  
- I2: Parents in the standard-intervention group received safety counseling and referral to the children’s safety center from their pediatrician. | *Inclusion:* First- and second-year pediatric residents and their patient-parent with children no older than 6 months | I1: 94 | I2: 93            | 12-month follow up:  
I1: 62  
I2: 60                                                                                          |
| Johnston et al 2000 | Evaluate pilot program adding family injury prevention to low income pre-school in Washington state | *Design:* Quasi experimental Programs partitioned into two groups based on size, geographic location, and staff | *Setting:* Two counties in Washington state  
*Inclusion:* Families of children aged 4 or 5 years enrolled in Head Start or Washington State preschool program | I: N = 258 | C: N = 160        | - Intervention families were more likely to have obtained first working smoke detector (RR 3.3; 95% CI 1.3-8.6) or to have added a smoke detector (RR 2.0; 95% CI 1.2-3.1)  
- Because families were given smoke detectors by case workers, does not show evidence of change in parent behavior |
|                     |                                                                               | *Intervention:*  
- Group 1: standard care plus written materials  
- Group 2: in addition to standard care, case workers added safety counsel, tested safety devices, and given safety supplies |                                                                       | I: 18% | C: 7%              |                                                                  |
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<th>Authors</th>
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</thead>
</table>
| Johnston et al 2006| Evaluate healthy steps (HS) program on child development, parenting practices, and parental well-being | **Design:** Concurrent comparison at clinic level with nested randomized trial in intervention arm  
**Intervention:**  
- Usual care (UC)  
- Standard HS (HS): Postnatal home counseling on child development, telephone support, and developmental assessment  
- HS plus 3 prenatal visits (HSP) | **Setting:** Large integrated delivery system in the Pacific Northwest  
**Inclusion:**  
- Less than 22 wks gestation  
- Younger than 45 yrs | UC = 136  
HS = 152  
HSP + prenatal = 151 | UC: 23%  
HS: 23%  
HSP: 19% |  
- Families followed up at 3 months  
- Intervention families more likely to use stair gates (RR 1.19; 95% CI 1.15-1.23) and have access to poison control centers (RR 1.06; 95% CI 1.03-1.12) but less likely to have safety latches (RR 0.88; 95% CI 0.83-0.93)  
- Other safety measures included non-home outcomes  
- Non-participants significantly different than participants (less maternal education, lower family income) |
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<th>Outcomes/Comments</th>
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</table>
| Kendrick et al. 1999 | To assess the effectiveness of safety advice, provision of low cost safety equipment, and first aid training on frequency and severity of unintentional injuries in children at home. | Design: Cluster randomized controlled trial.  
Intervention:  
- A package of safety advice at child health surveillance consultations at 6-9, 12-15, and 18-24 months  
- provision of low cost safety equipment to families on means tested state benefits; home safety checks  
- first aid training by health visitors.  
Setting: 36 general practices in Nottingham.  
Inclusion: All children aged 3-12 months registered with participating practices. | I: 1,124  
C: 1,028 | 25-month:  
I: 1,020 (7%)  
C: 960 (6%) | - No significant difference was found in frequency of at least one medically attended injury (odds ratio 0.97, 95% CI: 0.72 to 1.30), at least one attendance at an accident and emergency department for injury (1.02, 0.76 to 1.37), at least one primary care attendance for injury (0.75, 0.48 to 1.17), or at least one hospital admission for injury (0.69, 0.42 to 1.12).  
- No significant difference in the secondary outcome measures was found between the intervention and control groups. |
| King et al 2001  | Examine effectiveness of home visit program to improve home safety and decrease frequency of injury to children | Design: Randomized controlled trial  
Intervention:  
All groups received home inspection  
Non-intervention arm receive general safety pamphlet  
Intervention arm received information package, coupons, and specific instructions  
Participants contacted by phone 4-8 months after | Setting: Multicenter trial in 5 hospitals in 4 Canadian urban centers  
Eligibility: 1,172 Children aged <8 initially enrolled in an injury case-control study | I: 601  
C: 571 | 1-year  
I: 482 (20%)  
C: 469 (18%) | - Overall intervention did not significantly impact injury prevention behaviors  
- Intervention group more likely to have hot water <54°C (OR 1.31; 95% CI 1.14-1.50; P=0.001)  
- Rate ratio of injury requiring doctor visit: 0.75; 95% CI 0.58-0.96  
- All injury data self reported |
<table>
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<th>Authors</th>
<th>Study Question</th>
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<th>Outcomes/Comments</th>
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<tbody>
<tr>
<td>King et al. 2005</td>
<td>To review the long-term (36-month) effects of the previous study</td>
<td>home visit</td>
<td></td>
<td>36-month</td>
<td>I: 403</td>
<td>C: 371</td>
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<td>I: 33%</td>
<td>C: 35%</td>
<td>Participants in the intervention group (63%) reported that home visits changed their knowledge, beliefs, or practices around the prevention of home injuries compared with those in the non-intervention group (43%; p&lt; 0.001).</td>
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<td>the rate of injury visits to the doctor was 0.74 (95% CI 0.63 to 0.87)</td>
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<td>However, the effectiveness of the intervention appears to be diminishing with time (rate ratio for the 12–36 month study interval = 0.80; 95% CI 0.64 to 1.00).</td>
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<tr>
<td>Kitzman et al. 1997</td>
<td>Review the effectiveness of home-visitation services as a way of improving maternal and child outcomes</td>
<td>Design: RCT</td>
<td>Setting: Public system of obstetric care in Memphis</td>
<td>I: 228</td>
<td>C: 615</td>
<td>In the first 2 years of children’s lives, intervention group encountered fewer injuries or ingestions (0.43 vs. 0.55; p=0.05; fewer hospitalization due to injury or ingestion (0.03 vs. 0.16, p&lt;0.01)</td>
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<td>Intervention: Free transportation for scheduled prenatal care</td>
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<td>Inclusion: Women at less than 29 weeks’ gestation</td>
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<td>No previous live births</td>
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<td>&gt;=2 following SES risks: unmarried, &lt;12 years of education, unemployed</td>
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<td>Control group received free transportation and screening</td>
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<td>Control group received free transportation and screening</td>
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<td>Mayer et al. 1998</td>
<td>To evaluate a 20-minute video intervention to increase parents’ safety awareness and preventive actions to avoid child injuries from lawnmower</td>
<td>Design: RCT</td>
<td>Setting: An outpatient orthopedic clinic at Cardinal Glennon Children’s Hospital in St. Louis, Missouri.</td>
<td>I: 30</td>
<td>I: 25%</td>
<td>Differences favoring the intervention group were found for four of six behavior outcomes. For example, the proportion reporting never allowing children near operating mowers increased from half to two-thirds with no change among comparison group parents.</td>
</tr>
<tr>
<td>Posner et al 2004</td>
<td>Assess effectiveness of emergency department (ED) based home safety intervention</td>
<td>Design: Randomized controlled trial</td>
<td>Setting: Urban pediatric ED Inclusion: All caregivers of children up to 5 years of age</td>
<td>I: N= 49</td>
<td>I: 29%</td>
<td>Intervention group had higher overall safety score (73% vs. 66.8%, P&lt;0.002) Intervention group had higher scores for cut/piercing safety (P&lt;0.001) and burn safety (P&lt;0.03) but no difference found for falls, water safety, aspiration prevention, or fire prevention Most of safety improvement from kit distribution All safety improvements are self reported</td>
</tr>
<tr>
<td>Authors</td>
<td>Study Question</td>
<td>Intervention</td>
<td>Population &amp; Setting</td>
<td>N</td>
<td>Attrition</td>
<td>Outcomes/Comments</td>
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</tbody>
</table>
| Sznajder et al 2003 | Test effectiveness of free preventive devices and counseling for injury prevention | **Design:** RCT  
**Intervention:**  
- Standard intervention of counseling, two pamphlets on domestic injury, emergency call numbers  
- Standard intervention plus a safety kit containing home safety items  
- Both groups followed up at 6-8 weeks after first visit | **Setting:** Hauts-de-Seine near Paris  
**Inclusion:**  
- Usual criteria for social services | I: N=50  
C: N=50 | I: 2%  
C: 0% | - Participants not random—families selected by Mother and Child Protection Services  
- Only assesses behavior, not injury outcome  
- Groups receiving kits had significantly more safety improvements related to falls, fire, poisoning, and suffocation (P<0.02) but specific activities not reported  
- Where specific unsafe behaviors were observed, group receiving kits had overall higher increase in reduction of these behaviors (64.4% vs. 41.2%, P<0.02)  
- Behaviors not related to the kits also improved |
### FAMILY-LEVEL INTERVENTIONS: BABY WALKERS

<table>
<thead>
<tr>
<th>Authors</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Kendrick et al</td>
<td>Evaluate the effectiveness of educating pregnant women to reduce baby walker possession and use</td>
<td><strong>Design:</strong>&lt;br&gt;- Cluster randomized controlled trial <strong>Intervention:</strong>&lt;br&gt;- Control group received standard advice on baby walkers&lt;br&gt;- Intervention group received advice at recruitment and home visits at 10 days and 3-4 months post partum</td>
<td>Setting: Practices in Nottingham and Newark and Sherwood primary care trust, UK Pregnant women at least 28 wks gestation</td>
<td>I: N=525&lt;br&gt;C: N=631</td>
<td>I: 11%&lt;br&gt;C: 14%</td>
<td>• Participants followed up when infant aged 3-4 months&lt;br&gt;• OR owning baby walker: 0.63 (95% CI 0.43-0.93, P=0.02)&lt;br&gt;• OR using baby walker: 0.26 (95% CI 0.08-0.84, P=0.03)&lt;br&gt;• Participants not blinded to study group&lt;br&gt;• Walker use is self reported</td>
</tr>
</tbody>
</table>

### COMMUNITY-BASED INTERVENTIONS: GUN SAFETY

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<tr>
<th>Authors</th>
<th>Study Question</th>
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<th>Attrition</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sidman et al</td>
<td>Evaluation of a broad public education campaign to promote safe hand gun storage</td>
<td><strong>Design:</strong>&lt;br&gt;- Quasi-experimental <strong>Intervention:</strong>&lt;br&gt;- Campaign included media campaign, PSA's, fact sheets, discount coupons for lock boxes, and a hotline&lt;br&gt;- Baseline data collected in 1996, program implemented in 1997-2001, follow up data collected in 2001</td>
<td>Setting: King County, Washington <strong>Inclusion:</strong>&lt;br&gt;- Families with at least 1 child &lt; 18 and owned a gun&lt;br&gt;- 9 control counties identified west of the Mississippi—selected based on population</td>
<td>Intervention: Baseline: N = 151 Follow up: N = 217&lt;br&gt;Control: Baseline: N=151 Follow up: N =128</td>
<td>NA</td>
<td>• No significant difference found between intervention and control group&lt;br&gt;• Both control and intervention groups had increases in guns stored in lock boxes (12.5% for intervention, 11.4% for control)</td>
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## Community-based Interventions: Road Safety

### Pedestrian/Road Safety

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<th>Attrition</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Burke et al. 1996| To evaluate the effectiveness of a stencil in the shape of a school bus applied to the pavement at a bus stop in improving safe behaviors | Design: Randomly controlled trial  
Intervention: Children were instructed to remain within a safe area during boarding that was demarcated by a pavement stencil  
Inclusion: | Setting: 9 bus stops in Farmington, CT  
Inclusion: | I: 5 stops; 145 observations  
C: 4 stops; 174 observations | N/A | - Children in the control group were twice as likely to show unsafe behavior while waiting (OR=2.1). |
| Stevenson et al. 1999 | To assess the effectiveness of community/environmental interventions undertaken as part of the Child Pedestrian Injury Prevention Project (CPIPP). | Design: A quasi-experimental community intervention trial over 3 years  
Intervention: Three communities were assigned to either:  
- A community/environmental road safety intervention and a school based road/pedestrian safety education program (intervention group 1)  
- a school based road/pedestrian safety education program only (intervention group 2)  
- Or to no road safety intervention (comparison group).  
Inclusion: | Setting: Three communities (local government areas) in the Perth metropolitan area, Western Australia.  
Inclusion: | I1: 1 community  
I2: 1 community  
C: 1 community | N/A | - Greater road safety activity was observed in intervention group 1 compared with the other groups.  
- A significant reduction in the volume of traffic on local access roads was also observed over the period of the trial in intervention group 1, but not in the remaining groups. |
## Community-based Interventions: Road Safety

### Bicycle Helmet

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</thead>
</table>
| Britt et al. 1998| To evaluate the effectiveness of a multifaceted bicycle helmet promotion program for low income children | **Design:** Treatment and control sites are **not** randomly selected.  **Intervention:**  
- Provide classroom instruction to children  
- Educate parents  
- Obtain and fit helmets for each child  
- Conduct bicycle rodeos that allowed the children to practice safe riding skills and to see other children wearing helmets  
- Require children wear helmets while riding on school grounds  | **Setting:** Preschool Head Start programs in Washington State  
**Inclusion:**  
- Eligible families in either program must have incomes at or below the federal poverty level  
- Children must be 3 or 4 years old and their siblings up to 14  | I: 14 sites; 543 children  
C: 4 sites; 200 children  | I: 30%  
C: 10%  | • Helmet use in the intervention group more than doubled, from 43% to 89%, while use in the control group increased from 42% to 60% (p<0.05 for intervention group changes vs control group changes).  
• Intervention own helmet: RR=1.53 (1.34 to 1.79)  
• Intervention always wear helmet: RR= 1.58 (1.25 to 1.99) |
| Farley et al. 1996 | To assess the effectiveness of a 4-year program of bicycle helmet promotion that targeted elementary school children in one region of Quebec | **Design:** Quasi-experimental.  **Intervention:**  
- Persuasive communication and community organization  
- Combining standard educational activities and activities to facilitate helmet acquisition and use (e.g., offering coupons).  | **Setting:** 25 municipalities in Monterege region  
**Inclusion:**  
Children 5-12 residing in those municipalities  | I: 6,087  
C: 2,025  | N/A  | • Helmet use increased from 1.3% to 33% in 1993 in the intervention communities.  
• OR of use of helmet for group exposure to program vs. not was 1.78 (99% CI 1.10 2.89) |
<table>
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</table>
| Ebel et al. 2003 | To evaluate the effectiveness of a multifaceted community booster seat campaign in increasing observed booster seat use among child | Design: Prospective, nonrandomized, controlled community intervention trial. Intervention:  
• The campaign targeted both parents and children.  
• Broad-based community education program  
• Discount booster seat coupons  
• Car seat training programs | Setting: The campaign was initiated in 4 communities (250,000) in the greater Seattle, Wash, area between January 2000 and March 2001. Eight communities in Portland, Ore, and Spokane, Wash, served as control sites.  
Inclusion: Children aged 4-8 years and weighing 18-36 kg [40-80 lb] | I: 4 communities  
C: 8 communities | N/A | • Before the campaign began, 13.3% of eligible children in the intervention communities and 17.3% in the control communities were using booster seats, adjusting for child age, driver seat belt use, and sex of driver.  
• 15 months after the start of the campaign, adjusted booster seat use had increased to 26.1% in the intervention communities and 20.2% in the control communities ($P=0.008$ for the difference in time trends between intervention and control communities). |
| Greenberg-Seth et al. 2004 | To evaluate short-term effect of a community-based effort to promote child rear seating in a low-income Hispanic community | Design: Quasi-experiment  
Intervention: "Kids in the Back"  
• Community education  
• Incentive programs over 6 months: gave gifts to reward those who put kids in the back; and gave information on risks to those who didn’t | Setting: Holyoke, MA, a low-income community with a substantial proportion of Hispanics  
Inclusion: Child passengers younger than 12 years | I: 1 community  
C: 2 cities | N/A | • Post-intervention, the percentage of motor vehicles with all children rear-seated significantly increased from 33% to 49% ($p<0.0001$), which was significantly different from the increase in the control cities ($p<0.0001$). |
| Istre et al. 2002 | To evaluate a program to increase child restraint use among Hispanics | Design: NRCT  
Intervention:  
• establishing a child safety seat loaner program  
• educating parents in small classes  
• identifying mothers as authority figures to help communicate the message  
• addressing the issue of fatalism or destiny  
• Using videos that graphically showed what happens to a child held on an adult’s lap in a car | Setting: Three adjacent zip codes (75208, 75211, and 75212) in the west sector of Dallas; other parts of Dallas served as comparison  
Inclusion: Children <5 | I: 3 zip code areas (7,413 observations)  
C: the rest of Dallas (4,137 observations) | N/A | • Child restraint use among preschool-aged Hispanic children increased significantly in all 3 settings between 1997 and 2000 ($P<0.0001$)  
• Observed driver seat belt use also increased significantly in each of the 3 settings ($P<0.001$), whereas little change in driver seat belt use for other parts of Dallas (not significant). |
## Community-Based Interventions: General Home Safety

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| Petridou et al 1997 | To assess effectiveness (follow-up 255 days) of a health education injury prevention programme focusing on home injuries among the young (<=18 years old) and elderly (>=65 years old) | **Design:** Community controlled trial  
**Intervention:**  
- There was an injury prevention campaign at Naxos involving virtually all opinion leaders and implemented through lectures, workshops and publicity in the local media.  
- The main intervention focused on 172 households on the island of Naxos and was done by trained local collaborators who visited each household weekly  
**Setting:** on the Greek islands of Naxos (intervention) and Spetses (control)  
**Inclusion:** Residents on both islands | I: 172 households  
C: 177 households | N/A | • Naxos (intervention) had statistically significant improvements with respect to 11 of the 28 examined variables, whereas on the island of Spetses (control), such improvement was only noted for one variable.  
• Home accident incident rate per 105 person-days among 0-18 was 87 in the intervention and 110 in the compare group, which are not significantly different, one-side p-value=.09.  
• For total home accidents happened to targeted 0-18 years old in intervention group, RR=0.79, 90% CI (0.60, 1.06) |
| Ytterstad et al. 1998 | To describe the long term effectiveness of a community based program targeting prevention of burns in young children | **Design:** Quasiexperimental  
**Intervention:**  
- the purchase and installation of cooker safeguards (guard rail around the edge of the stove)  
- Lowering tap water thermostat settings to 55°C in homes, kindergartens, and public buildings.  
**Setting:** The Norwegian city of Harstad (main intervention), six surrounding municipalities (intervention diffusion), and Trondheim (reference).  
**Inclusion:** Children 0-5 | I1: population 23,000  
I2: population 14,000  
C: population 134,000 | N/A | • The mean burn injury rate decreased by 51.5% after the implementation of the intervention in Harstad (p < 0.05) and by 40.1% in the six municipalities (not significant).  
• Rates in the reference city, Trondheim, increased 18.1% (not significant). |
## Community-Based Interventions: General Home Safety

### Smoke Alarm/Detector

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</thead>
<tbody>
<tr>
<td>Mallonee 2000</td>
<td>Assess impact of smoke detector distribution program</td>
<td><strong>Design:</strong></td>
<td>Setting: Oklahoma City&lt;br&gt;Eligibility: Residents of targeted neighborhood&lt;br&gt;Neighborhood chosen based on high rate residential fires</td>
<td>NA</td>
<td>NA</td>
<td>• 10,100 smoke alarms distributed&lt;br&gt;• 80% of houses in need and 25% of total homes received alarm&lt;br&gt;• At 48 months 46% of alarms installed and functioning&lt;br&gt;• Injury rate associated with residential fires decreased by 81% in targeted area and 7% in non-targeted area&lt;br&gt;• Injury rate per 100 fires decreased 76% in targeted group and 12% in non-targeted areas&lt;br&gt;• Estimated that 60 injuries and deaths prevented during six year follow up</td>
</tr>
<tr>
<td>Ginnelly et al. 2005</td>
<td>To determine whether a smoke alarm give-away program is effective and cost-effective in reducing the risk of fire-related deaths &amp; injuries</td>
<td><strong>Design:</strong> cluster RCT&lt;br&gt;<strong>Intervention:</strong> &quot;Let's Get Alarmed&quot;: Smoke alarms, batteries and fire safety brochures were distributed to intervention groups</td>
<td>Setting: 40 wards in inner London Boroughs of Camden and Islington&lt;br&gt;Inclusion: Households above average material deprivation</td>
<td>I: 73,399 households&lt;br&gt;C: comparable size</td>
<td>N/A</td>
<td>• The mean cost for a household in a give-away ward, including the cost of the program, was £12.76, compared to £10.74 for the control ward.&lt;br&gt;• The total mean number of deaths and injuries was greater in the intervention wards than the control wards, 6.45 and 5.17.&lt;br&gt;• When an injury/death avoided is valued at £1000, a smoke alarm give-away has a probability of being cost effective of 0.15.</td>
</tr>
<tr>
<td>Peleg et al. 2005</td>
<td>To map Israeli child burn prevention programs and to measure their success from the rate of burn-related hospitalizations.</td>
<td><strong>Design:</strong> Community comparison; historical comparison&lt;br&gt;<strong>Intervention:</strong> 13 interventions were identified in the intervention communities</td>
<td>Setting: Israeli communities&lt;br&gt;Inclusion: Only Jewish communities were compared in the evaluation</td>
<td>I: 13 communities&lt;br&gt;C: 35 communities</td>
<td>N/A</td>
<td>• From 1998 to 2000, a 25% reduction in the burn-related hospitalization rate of children 0-4, from 1.39/1000 to 1.05/1000 infants and toddlers (p = 0.03) was realized in intervention communities.&lt;br&gt;• No change was observed in the non-intervention group, where the rate at the two measurements remained stable at 1.26/1000 infants and toddlers.</td>
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<tr>
<td>Authors</td>
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| Roseveare et al. 1999 | to evaluate the relative effectiveness of two methods of reducing playground hazards in schools. | Design: Randomly controlled trial  
Intervention:  
- The intervention group received a health promotion programme consisting of information about the hazards, an engineer's report, regular contact and encouragement to act on the report, and assistance in obtaining funding.  
- The control group only received information about hazards in their playground. | Setting: Twenty four schools in Wellington, New Zealand  
Inclusion: The 12 schools that made up the intervention group were randomly sampled from the 60 primary schools in Wellington City | I: 12 schools  
C: 12 schools | none | • A key result was the 52% reduction in height/surface hazards achieved in the intervention schools, compared with an 8% reduction in the controls  
• By the second follow up, nine of the 12 intervention schools had eliminated at least one height/surface hazard compared with only three control schools. |
### Community-based Interventions: General Community Safety

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</tr>
</thead>
</table>
- Implementation of WHO safe community model | Setting: Waitakere, New Zealand population 155,000; Control community: 147,000 | I: 1 community  
C: 1 Community | N/A       | • For children 0-14, community showed a decrease in injury hospitalization rates in the intervention/post-intervention period |
| Harrell 2003            | To evaluate the effectiveness of two warning signs on adult supervision and child risky activities in grocery carts | *Design:* Quasi-experimental *Interventions:*  
- One supermarket had signs to prompt adults not to allow children to stand in the cart seat or basket  
- The other supermarket had signs to inform parents of the risk of injury to a child in carts | Setting: Two supermarkets in similar size in Canada  
*Inclusion:* Children 1-6 | I1: 100  
I2: 100 | N/A       | • No effect was found                                                                                                                                                     |
- Local mass media provide regular information about injury prevention.  
- Trained nurses provide information to parents  
- Indoor environments at schools and sports facilities were evaluated | Setting: Intervention (Motala municipality) and control (Mjolby municipality) areas, both in Ostergotland county, Sweden.  
*Inclusion:* | I: 1 community  
C: 1 Community | N/A       | • The total relative risk of child injury in the intervention community decreased more (odds ratio 0.74; 95% confidence interval (CI) 0.68 to 0.81) than in a control community exposed only to national level injury prevention programs (0.93; 95% CI 0.82 to 1.05).  
• The risk of severe or fatal (AIS 3-6) injuries remained constant. |
<table>
<thead>
<tr>
<th>Authors</th>
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<th>Perspective</th>
<th>Study type and design</th>
<th>Population and Setting</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Cook et al. 1999 | To develop reliable US estimates of the medical costs of treating gunshot injuries | Medical cost| Cost burden           | National acute-care and follow-up treatment costs and payment sources for gunshot injuries | ● Mean medical cost per injury was about 17,000  
● The 134,445 gunshot injuries in 1994 produced $2.3 billion (95% CI, $2.1-2.5 billion) in lifetime medical costs (1994 dollars)                                                                 |
| Corso et al. 2006| To measure national incidence, medical costs, and productivity losses of medically treated injuries | Societal    | Cost burden of all injuries | All injuries in 2000                                                                   | ● Injury in 2000 resulted in lifetime costs of $406 billion; $80 billion for medical treatment and $326 billion for lost productivity.  
● Males had a 20% higher rate of injury than females.  
● Injuries resulting from falls or being struck by/against an object accounted for more than 44% of injuries.                                                                 |
| DiGuiseppi et al. 1999 | To reduce fires and fire related injuries by increasing the prevalence of functioning smoke alarms in high risk households. | Cost of the program | Setting: 40 wards in inner London Boroughs of Camden and Islington  
Inclusion: Households above average material deprivation | Design: cluster RCT  
Intervention: “Let's Get Alarmed”: Smoke alarms, batteries and fire safety brochures were distributed to intervention groups | ● In total distributed 20,050 free smoke alarms.  
● The giveaway programme cost £145 087, of which more than 60% was for personnel costs (table 2). The one year reminder postcards cost £12 736, most of which paid for data entry.  
● Actual installation remains unknown: “Given our target population, we speculate that a substantial proportion of the alarms may not be fully installed.” |
| Ginnelly et al. 2005 | Evaluate cost effectiveness of mass smoke alarm distribution | Societal    | Cost effectiveness     | Residents of under privileged wards of inner London Boroughs                          | ● 20,050 alarms distributed among 73,399 intervention households  
● Injuries and deaths more common from fires in intervention households (6.45 vs. 5.17 over 24 months)  
● Costs for the give away program were also higher than control wards  
● No lost productivity costs accounted for                                                                 |
| Haddix et al 2001 | Evaluate cost effectiveness of target smoke alarm distribution | Societal    | Cost effectiveness     | Oklahoma City residents living in targeted high risk neighborhood                     | ● Program was cost saving from both societal and health care system perspective  
● Total discounted cost of intervention was $531,000 over 5 years  
● Estimated medical costs prevented over 5 years: $1.5 million  
● Estimated productivity costs averted: $14 million  
● Medical costs do not include emergency room, rehabilitation, or out of pocket expenses                                                                 |
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</tr>
</thead>
</table>
| Kedikoglou et al. 2005 | To present an infant car-restraint loan scheme and evaluate its cost-effectiveness | Intervention: Car-restraints were lent for a six-month period to eligible prospective parents for a modest fee. | Cost effectiveness | 188 families who attended the sycho-prophylactic delivery classes at the University Maternity Hospital “Alexandra” in Athens | • 92% of the participants reported proper use of the device and 82% had already purchased the second-stage car restraint.  
• The cost-effectiveness ratio varies between J 418.00 and J 3,225.00 per life-year saved, depending on whether the modest administrative fee is considered. |
| Kopjar et al. 2000  | Estimate cost-effectiveness of helmet use based on an estimated risk reduction | Societal     | Cost effectiveness    | Included all cases of head injuries reported through the registration system from 1990 through 1996 in U.S. | • The risk of head injury was highest among children aged 5 to 16. the greatest reduction in absolute risk of head injury, 1.0 to 1.4% over 5 years estimated helmet lifetime, occurred among children who started using a helmet between 3 and 13  
• Estimates indicate it would cost U.S. $2,200 in bicycle helmet expenses to prevent any one upper head injury between 3-13  
• In contrast, it would cost $10,000-25,000 to avoid an adult injury |
| Kim et al. 1997    | To determine whether asking for a $5.00 donation for bicycle helmets, compared with distribution free of charge, would affect helmet use among children | Willingness-to-pay | Cost effectiveness    | Six public health clinic sites (506 eligible children) in King County, Washington       | • 82% of children whose parents were asked for a copayment and 77% of children who received free helmets were reported to wear their helmets every time they rode their bicycles (p=0.20).  
• The adjusted odds ratio for the association between copayment compared with free helmets and helmet use was 1.66 (95% confidence interval 0.94 to 2.92). |
| King et al 2001 Canadian 1999 | Examine effectiveness of home visit program to improve home safety and decrease frequency of injury to children | Design: Randomized controlled trial  
Intervention:  
• All groups received home inspection  
• Non-intervention arm receive general safety pamphlet  
• Intervention arm received information package, coupons, and specific instructions | Setting: Multicenter trial in 5 hospitals in 4 Canadian urban centers  
Eligibility: Children aged <8 initially enrolled in an injury case-control study | I: N=601  
C: N=571 | • See above for clinical outcomes  
• Incremental cost per participant: $48.11  
• Cost per injury prevented: $372 |
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<tbody>
<tr>
<td>Levitt &amp; Doyle</td>
<td>test the relative effectiveness of child safety seats, lap-and-shoulder seat belts, and lap belts in preventing injuries among motor vehicle passengers aged 2-6.</td>
<td>Societal</td>
<td>Cost effectiveness; 3 data sets: • the General Estimates Survey (GES), a nationally representative sample of approximately 50,000 crashes each year for sixteen years; • New Jersey Department of Transportation (NJDOT) data covering all crashes in that state between 2001 and 2004; • A Wisconsin data set that includes the universe of crashes with police reports in that state from 1994 to 2002, and links these crashes to hospital discharge records.</td>
<td>US children aged 2-6.</td>
<td>• No apparent difference in the two most serious injury categories for children in child safety seats versus lap-and-shoulder belts. • Child safety seats provide a statistically significant 25% reduction in the least serious injury category. • Lap belts are somewhat less effective than the two other types of restraints, but far superior to riding unrestrained.</td>
</tr>
<tr>
<td>Miller et al.</td>
<td>To analyze the societal return on investment in booster seats and in laws requiring their use in the United States.</td>
<td>Societal</td>
<td>Cost-Outcome Analysis</td>
<td>Booster Seats for Auto Occupants Aged 4 to 7 Years</td>
<td>• A booster seat costs $30 plus $167 for maintenance and time spent on installation and use. • This investment saves $1854 per seat, a return on investment of 9.4 to 1. • Even lower bound estimates in sensitivity analysis indicated that society would benefit from the use of booster seats. Seat laws offer a return of 8.6 to 1.</td>
</tr>
<tr>
<td>Miller et al.</td>
<td>To estimate the costs of pedestrian and bicycle crash injuries in the US</td>
<td>Societal</td>
<td>Cost-Outcome Analysis</td>
<td></td>
<td>• Costs of pedestrian and bicyclists injuries in 2000 are total $40 billion over the lifetimes • Youth aged 5-14 face greater annual risks</td>
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</table>
## Injury Economic Studies

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<th>Authors</th>
<th>Study Question</th>
<th>Perspective</th>
<th>Study type and design</th>
<th>Population and Setting</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
Total: $81,400  
Productivity: $66,500  
Medical Costs: $13,800  
Other Resources: $1,100  
Per victim costs by injury  
Burn/Anoxia: $4,500  
Caught between objects: $1,900  
Drowning/Submersion: $21,000  
Fall: $4,200  
Firearm: $17,000  
- Suffocating/Choking: $11,000  
- Cost estimates are incidence-based and based on multiple national data sources  
- Productivity costs undervalue lives of women and minorities as they are paid less than white males  
- Some data (cost of coroners) date back 10-20 years |
| Miller & Levy 2000       | To review cost-outcome analyses in injury prevention and control and estimate associated benefit-cost ratios and cost per quality-adjusted life-year. | Societal    | Cost-outcome analysis | Medline and Internet search, bibliographic review, and federal agency contacts identified published and unpublished studies from 1987 to 1998 for the U.S. | - More than half of the 84 injury prevention measures reviewed yielded net societal cost savings  
- 12 measures had costs that exceeded benefits  
- Of 33 road safety measures analyzed, 19 yielded net cost savings  
- Of 34 violence prevention approaches studied, 19 yielded net cost savings, whereas 8 had costs that exceeded benefits. |
| Miller et al 1997        | Discuss methodology of cost outcomes related to injury, cost effective analysis of smoke detectors | Societal    | Benefit cost analysis | All US homes                                                                           | - Estimated cost savings for each detector are $210-$636  
- Benefit/cost ratio: 5.5-15.5 per detector  
- Costs include medical, other tangible costs, quality of life gains, but not property damage savings  
- Parental time caring for children not included |
<p>| Miller &amp; Cohen 1997      | To estimate the costs of US gunshot and cut/stab wounds by intent               | Societal    | Cost estimation       | Gunshot and cut/stab wounds                                                              | - In 1992, gunshot wounds cost an estimated US $126 billion, cut/stab wounds cost another $51 billion dollars. |</p>
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Perspective</th>
<th>Study type and design</th>
<th>Population and Setting</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Roberts et al. 1998 | Estimate costs of injuries based on prevalence of incidence | Societal    | Cost estimation        | U.S. 0-15              | • Road accident cost  
• Home accident cost  
• Hidden cost of injury                                                                                                                                                                                        |
| Winston et al. 2001 | Provide national estimates of incidence and costs of handle-bar related child injuries | Societal    | Cost estimation        | U.S. <20               | • An estimated 1,147 subjects in the US had serous non-motor-involved bicycle-related abdominal or pelvic organ injury leading to hospitalization in 1997  
• An estimated $9.6 million in total hospital charges  
• 10 million in lifetime medical costs  
• $11.5 million in life productivity losses  
• $503.9 million in lifetime monetized quality-adjusted life-years |
APPENDIX D: MENTAL HEALTH DISORDER INTERVENTIONS

MAGNITUDE: While the majority of young children are emotionally and psychologically healthy, a substantial minority of these infants, toddlers and preschoolers manifest some form of problematic behavior. A 1999 Surgeon General’s report estimates that about 20% of children have mental disorders that cause at least mild functional impairments. For children between the ages of one and six years, these often take the form of externalizing behaviors, or acting out (ranging 3.4%-6.6%). In other cases, even very young children can manifest withdrawal, depression or anxiety—often referred to as internalizing behaviors (ranging 3.0%-6.6%). Within this age group, oppositional defiant disorder (ODD)/conduct disorder (CD) and attention-deficit hyperactivity disorder (ADHD) are the most frequently-reported specific emotional and behavioral problems.

DETERMINANTS AND RISK FACTORS: The etiology of early childhood mental health problems is multi-factorial, with important contributions made by dispositional, environmental, and genetic factors. A systematic review reveals that the incidence of early childhood behavior problems is higher for young children living in poverty than for the general population. It is also well established that maternal depression increases the risk for child behavioral and emotional problems. Insecure attachment to caregivers and harsh, inconsistent discipline have also been implicated.

HEALTH CONSEQUENCES: Despite the prevalent misperception that emotional and behavioral problems among preschoolers are “normal” and will be eventually “outgrown,” extensive research shows that early disruptive and aggressive behavior tends to persist and develop into chronic and more severe forms of anti-social behavior. Additionally, behavior problems in one domain may spill over into others, and serious externalizing problems in early childhood may lead to internalizing problems in young adulthood by lowering academic competence.

ECONOMIC CONSEQUENCES: Behavior problems have negative effects on other outcomes, such as educational attainment, unemployment, and violent crimes committed. Moreover, the high prevalence and enduring consequences of mental health problems in children have considerable financial implications for society, families, and individuals, both immediately and in the longer term. Sturm et al. estimate that the cost of treating children ages one to five nationwide approached $698 million dollars ($864 million in 2006 dollar value). From a family perspective, Busch and Barry, using a U.S. national data set, demonstrated that caring for a child with mental health care needs affects family financial well-being, far more than caring for a child with other special health care needs. From a societal perspective, a U.K. study assessed the cost consequences across six domains (foster and residential care in childhood, provision of special educational, state benefits received in adulthood, breakdown of relationships, health, and crime) and estimated that children ten years of age with persistent antisocial behavior would cost society £70,019 [$134,406 in 2006 U.S. dollars] by the time they were 28 years old—ten times as much as those without such behavior problems.
**Evidence for Prevention and Treatment:** A wide range of early intervention strategies with different targets and a variety of theoretical underpinnings have been developed and tested over the past decade. We included only randomized controlled trials (RCT) in this review.

**Parent-focused:**

The majority (34 of 59) of the studies summarized in this review used a parent-focused training approach, in which parents learn from a psychologist or educator about effective behavior management skills. A number of forms of behavioral parent training programs, based on social learning models (e.g., Patterson, 1982) have been developed. They typically focus on teaching parents how to increase positive interactions with their children while reducing coercive and inconsistent parenting practices. Six studies evaluated the application of different forms of Triple P (the Positive Parenting Program), a multi-level system of intervention for parents of young children. Together, they found that this program had significant short-term effects on reducing child behavior problems, as well as improving parenting style. In general, more intensive interventions were superior to less intensive ones.

Another popular parent-training model involves videotape vignettes developed by Webster-Stratton and colleagues. “The Incredible Years” provides training on a sequence of topics including parent–child play, praise, incentives, limit-setting, problem-solving and discipline. Five of six RCTs found that behavior problems among children receiving the intervention were significantly reduced compared to those in the control groups. A study of a videotape training program found that, at the 3-month follow-up, children in the intervention group had a significantly greater reduction in problem behavior than those in the control group.

Studies also found that parent-training programs yielded no effect on child behavior when delivered by non-specialist nurses rather than therapists. Neither parent counseling nor advising programs work effectively this way. Another set of programs focus on improving the quality of the relationship between parents and their children. One, Parent-Child-Interaction Therapy (PCIT), a 14-week therapy developed by Eyberg and colleagues, focuses on improving child–parent relationships and providing parents with skills to manage disruptive behavior. Two studies reported that both immediate and continued improvement in disruptive behaviors resulted from PCIT. Relationship-focused interventions also include Infant/toddler-parent psychotherapies. Based on attachment theory, these programs are designed to improve the quality of early relationships between parents and young children, and often are used to help improve attachment security among offspring of depressed mothers. Eleven of the twelve studies, reported that such interventions improved infant/toddler-parent interaction and/or the children’s security or behaviors, as well as maternal depressive symptoms. Muntz et al. has suggested that video-recording parent-child interactions may be more cost-effective than the standard parent-training programs. Dozier et al. ’s study targeted foster children, and parents in the intervention group reported positive but not significant improvement in their children’s behavior problems.

**Parent support** programs do not necessarily provide direct training sessions to parents of at-risk children, but provide parents with supportive consultation about their children’s well-being. Despite the positive effect of the Healthy Steps consultant on parenting practices and care utilization, there was a significant increase in parents’ reports of their children’s aggressive behavior and sleeping issues compared to control mothers, due to the program increasing the
mothers’ awareness of such problems. One of the barriers to implementing interventions with young children is parental motivation. Two studies found that enhancing parents’ awareness of children’s competencies and parenting practices can be useful in improving both parental involvement and child behavior problems.

Child-focused:
McLaughlin et al. examined the long-term influences of the Carolina Abecedarian project, a comprehensive early education program for at risk preschoolers, in which they received full-time, high-quality educational intervention in a childcare setting from infancy through age five. Individuals who received child-care treatments reported fewer depressive symptoms, on average, at age 21, than those in the control group (26% vs. 37%).

Family-focused:
Berlin et al. and Blair et al. found significant effectiveness in the Infant Health and Development Program (IHDP) on behavior problems of low-birth weight premature infants. Nine studies (reporting on seven interventions) targeted various risk factors, and provided both parent- and child-focused family-level training programs in group settings. In particular, Webster-Stratton and Hammond found that those in the parent and child-training group demonstrated significant improvements in problem-solving and conflict management skills, compared to those in the parent-training-only group. They also showed more positive parent and child interactions than those who received child-training alone. All of these improvements were sustained at the one-year follow-up. It appears that child- and parent-training each made a unique contribution to the improvement of children’s outcomes.

Teacher-focused:
Five programs involving school teachers that primarily focused on preschool children were identified, and another seven studies (six interventions) targeted school-age children. Across these studies, intervention group children improved significantly more than comparison group children in their teacher-rated (but not always in parent-rated) social skills, as well as in internalizing and externalizing problems. Webster-Stratton and colleagues compared different strategies and argued that it was difficult to demonstrate statistically significant additive effects of teacher training. Programs that targeted school-aged children all reported some significant improvement in at least one study outcome, such as social competence and conduct problems.

System-level:
A RCT was implemented to assess the impact of welfare reform as an example of the effects of national-level policy change on children’s behavior. New Hope, an employment-based program for adults living in poverty, which provided strong work support through extensive child-care assistance and health care subsidies, had a positive affect on teacher-reported, but not parent-reported, child behavior problems.

Cost implications of interventions: Although the number of economic evaluations has grown in many fields, they are still scarce in the area of child mental health prevention and intervention. Scott and colleagues examined the outcome of a 13-to-16 week long Webster-Stratton basic videotape program administered to parents of children three-to-eight years old, who were
referred with antisocial behavior. They found that the program cost of groups was £571 [$1,096 in 2006 U.S. dollars] per child and the effect size on the primary outcome measure was 1.06, giving a cost of £540 [$1,037 in 2006 U.S. dollars] per standard deviation improvement in antisocial behavior. They concluded that this parenting group intervention was more cost-effective than routine clinic treatment, but this number is difficult to interpret in the absence of studies of other interventions reporting results in similar units. Muntz et al. 440 suggested that treatments using videotaped recording of parent-child interactions may be more cost-effective than standard parent-training programs. Jensen et al. 441 conducted the only study to date on cost-effectiveness of major ADHD treatments; they reported that, for 14 months of treatment, medical management costed $1,180 [$1,381 in 2006 dollars] per group, intensive behavior treatment costed $6,988 [$8,181], combined medical management and behavior treatment costed $7,827 [$9,163], and routine community care costed $1,071 [$1,254]. Combining the effectiveness of each treatment, they concluded that medical management treatment, although not as effective as combined medical management and behavior treatment, was likely to be more cost effective in routine treatment for children with ADHD, especially for those without comorbid disorders. Finally, McAuley et al. 442 examined outcomes of a U.K. program called Home-Start, which offers volunteer support to families under stress where there is at least one child under five years old. On average, families supported by Home-Start costed £3,058 [$5,954 in 2006 U.S. dollars] more than comparison group families. When considering volunteer time, the average cost of intervention was £8,831 [$17,194 in 2006 U.S. dollars] higher than for the comparison group. After considering the effectiveness, they concluded that Home-Start did not appear to be a cost-effective alternative to standard health visitor-based services.

**CONCLUSION:** This review finds that the literature on parent training are extensive, and most programs aimed at directly improving parenting skills yield positive results; however, these improvements in children’s behavior do not necessarily generalize to settings outside the home. In general, interventions that focus on multiple risk factors are more effective. Most studies explicitly target young children’s externalizing behavior problems, especially ODD/CD or ADHD, with fewer studies intentionally targeting internalizing behavior problems.
Figure 1. Lifespan Impact of Interventions for Mental Health Disorders

<table>
<thead>
<tr>
<th>LEVEL OF INTERVENTION</th>
<th>Preconception/ Pregnancy</th>
<th>Infant/Childhood</th>
<th>Adolescence</th>
<th>Adulthood</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual</strong></td>
<td></td>
<td>Child-focused training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td></td>
<td>Parent-focused programs</td>
<td>Child-focused training; Parent-focused training programs</td>
<td></td>
</tr>
<tr>
<td>Local/ Community/ Workplace/ School</td>
<td>Parent- and child-focused programs; Collaborative problem solving</td>
<td>School-based: Fast Track</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National/State</td>
<td></td>
<td>New Hope</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Age period when interventions take place**
- **Age period with continuing positive impacts of intervention**

1. Abecedarian project
2. Healthy Steps, Early Head Start
3. Incredible Years’ Dinosaur Curriculum
4. Triple P
7. Conduct Problems Prevention Research Group 2004
8. Huston AC et al. 2005
Table 1. Studies on Prevention and Intervention for Mental Health Disorders

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Intervention</th>
<th>Population &amp; Setting</th>
<th>N/Attrition</th>
<th>Measures</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Bor et al. 2002 | To review the Effects of the Triple P-Positive Parenting Program on Preschool Children with Co-Occurring Disruptive Behavior or ADHD | Design: RCT  
Intervention: Tripe P  
- enhanced BFI (EBFI)  
- standard BFI (SBFI)  
- waitlist (WL) | Setting:  
Inclusion: 87 preschoolers with co-occurring disruptive behavior and attentional/hyperactive difficulties. | I1: 26  
I2: 29  
C:32  
28% | • ECBI  
• PDR | • At postintervention both BFI programs were associated with significantly lower levels of parent-reported child behavior problems (p<0.05), lower levels of dysfunctional parenting, and greater parental competence than the WL condition  
• The gains achieved at postintervention were maintained at 1-year follow-up.  
• The enhanced program was not shown to be superior to the standard program using any of the outcome measures at either postintervention or follow-up. |
| Bradley et al. 2003 | To review a four-session psycho-educational group for parents of preschoolers with behavior problems, delivered in community agencies. | Design: RCT  
Intervention: Brief Psychoeducational Parenting Program: 3 weekly group sessions and a 1-month booster, focusing on being to support effective discipline | Setting: community agencies in metropolitan Toronto  
Inclusion: Parents of 3-4 children | I: 89  
C: 109  
1 year follow up: 25% | • PS  
• PBQ  
• PCQ  
• BSI | • At 3 months, the parents who received the intervention reported significantly greater improvement in parenting practices and a significantly greater reduction in child problem behavior than the control group.  
• At 1-year follow up, changes in parenting behavior appeared to be sustained over a 1-year follow-up, although these follow-up results may not be representative of the sample as a whole. |
| Cicchetti et al. | To review a program promoting secure attachment in the offspring of depressed moms | Design: RCT  
Intervention: Mothers and toddlers participated joint therapy sessions | Setting:  
Inclusion: Toddlers with mothers with or without depression history | I: 27  
C1: 36  
C: 45 | • BDI  
• DIS-III-R  
• AQS | • To promote secure attachment |
| Cohen et al. 1999 | To contrast the effectiveness of an infant-led with an alternate form of parent-infant psychotherapy | Design: RCT  
Intervention:  
- Watch, Wait, and Wonder (WWW)  
- Or, mother-infant psychotherapy (PPT). | Setting: Hincks-Dellcrest Centre for Children’s Mental Health  
Inclusion: 10- to 30-month-old infants and their mothers who were referred to the center | I1: 34  
I2: 33 | • CBCL  
• YSR | • Infants in the WWW group were significantly more likely than infants in the PPT group to move towards either a secure or organized attachment relationship ( p < .03)  
• Before treatment began mothers and infants in both groups exhibited greater reciprocity in play and less conflict |
| Connell et al. 1997 | To evaluate the effectiveness of a self-directed family program on oppositional behaviors in rural and remote areas | Design: RCT  
Intervention:  
- Parents were required to read a workbook each week for 10 weeks  
- Weekly telephone contact | Setting: home  
Inclusion: Families reside in rural area in Australia, children aged 2-6 without development delays | I: 12  
C: 11 | • ECBI  
• PSOC  
• PS  
• DASS  
• PDRC | • There was a significantly lower level of disruptive child behavior in the treatment group than the control group at post-treatment, p=.0005  
• A significant reduction in ECBI intensity scores for the treatment, but not significant for the control, p=.0005 |
<table>
<thead>
<tr>
<th><strong>INDIVIDUAL-LEVEL INTERVENTIONS: PARENT-FOCUSED</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dozier et al. 2006</strong></td>
<td>To present preliminary data testing the effectiveness of an intervention delivered to foster children</td>
</tr>
<tr>
<td>Design: RCT</td>
<td>Setting: Foster care</td>
</tr>
<tr>
<td>Intervention: Attachment and Biobehavioral Catch-up:</td>
<td>Infants and toddlers in foster care</td>
</tr>
<tr>
<td>* The foster parents received in-home training for 10 weekly sessions.</td>
<td></td>
</tr>
<tr>
<td>* Control intervention group received an educational program: Developmental Education for Families</td>
<td></td>
</tr>
<tr>
<td>* Comparison group: non-foster children</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>PDR</strong></td>
</tr>
<tr>
<td></td>
<td>A main effect for Intervention Group emerged, <em>p</em> &lt; .002.</td>
</tr>
<tr>
<td></td>
<td>Post hoc analyses revealed differences between the control intervention group and the other two groups (<em>p</em> &lt; .001), but not between the experimental intervention group and the typically developing group (<em>p</em> &gt; .20)</td>
</tr>
<tr>
<td></td>
<td>The Intervention group main effect on behavior was not significant, nor were differences significant when considering only the toddler group, <em>p</em> &gt; .10</td>
</tr>
<tr>
<td><strong>Funderburk et al. 1998</strong></td>
<td>To review the maintenance of treatment effects of parent-child interaction therapy</td>
</tr>
<tr>
<td>Design:</td>
<td>Setting: Foster care</td>
</tr>
<tr>
<td>Intervention: 14-session parent-child interaction programs</td>
<td>Inclusion: Children 2-7; had behavior problem;</td>
</tr>
<tr>
<td></td>
<td><strong>SESBI</strong></td>
</tr>
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<td></td>
<td>Conners index</td>
</tr>
<tr>
<td></td>
<td>Walker-McConnell Scale of Social Competence and school adjustment</td>
</tr>
<tr>
<td></td>
<td>At the 12-month follow up, treatment children maintained post-treatment improvements in conduct problems</td>
</tr>
<tr>
<td></td>
<td>At the 18-month follow up, children were found declined on most measures into the range of pre-treatment levels</td>
</tr>
<tr>
<td><strong>Gardner et al. 2006</strong></td>
<td>To test effectiveness of a parenting intervention, for reducing conduct problems in clinically-referred children.</td>
</tr>
<tr>
<td>Design: RCT</td>
<td>Setting: 9 sites across one county in UK</td>
</tr>
<tr>
<td>Intervention: Webster-Stratton Incredible Years video-based 14-week group program</td>
<td>Inclusion: children referred for conduct problems, aged 2-9, primarily low-income families</td>
</tr>
<tr>
<td></td>
<td><strong>ECBI</strong></td>
</tr>
<tr>
<td></td>
<td>Parenting Scale</td>
</tr>
<tr>
<td></td>
<td>BDI (parents)</td>
</tr>
<tr>
<td></td>
<td>Post-treatment improvements were found in child problem behavior, by parent-report (effect size (ES) .48, <em>p</em> = .05) and direct observation (ES .78, <em>p</em> = .02)</td>
</tr>
<tr>
<td></td>
<td>child independent play (ES .77, <em>p</em> = .003)</td>
</tr>
<tr>
<td></td>
<td>observed negative (ES .74, <em>p</em> = .003) and positive (ES .38, <em>p</em> = .04)</td>
</tr>
<tr>
<td></td>
<td>parenting; parent-reported confidence (ES .40, <em>p</em> = .03) and skill (ES .65, <em>p</em> = .01),</td>
</tr>
<tr>
<td><strong>Gardner et al. 2003</strong></td>
<td>To determine whether early psychosocial intervention with LBW-Term infants improved cognition and behavior</td>
</tr>
<tr>
<td>Design: RCT</td>
<td>Setting: Kingston, Jamaica</td>
</tr>
<tr>
<td>Intervention: weekly home visits by paraprofessionals for the first 8 weeks of life</td>
<td>Inclusion: LBW-Term infants (weight &lt;2500 g).</td>
</tr>
<tr>
<td></td>
<td><strong>LBW-T</strong> intervened infants had higher scores than LBW-T control infants on the cover test (<em>P</em> &lt; .05) and were more cooperative (<em>P</em> &lt; .01) and happy (<em>P</em> &lt; .05).</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Study</th>
<th>Objective</th>
<th>Design</th>
<th>Intervention</th>
<th>Setting</th>
<th>Inclusion</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gianni et al. 2006</td>
<td>To evaluate the effects of an early post-discharge developmental mother—child intervention program on neurodevelopmental outcome at 36 months in VLBW infants.</td>
<td>RCT</td>
<td>Mother-child pairs attend group meetings with psychologist and a psychometrician</td>
<td>Outpatients’ department</td>
<td>Infants with bwt &lt; 1250g, being singleton, infant fed preterm formula, without abnormal MRI</td>
<td>I: 18 C: 18 Griffiths Mental Development Scale • compared to controls, children in intervention group exhibited higher scores in personal—social subscales ([mean (S.D.)]=101.4 (9.3) vs. 92.9 (12.1), P =0.02)</td>
</tr>
<tr>
<td>Hart et al. 1998</td>
<td>To assess the effectiveness of a short-term intervention for improving interaction behaviors of newborns with their depressed mothers</td>
<td>RCT</td>
<td>Mothers were trained to use Assessment of the Behavior of her Infant (MABI) independently and periodically at home.</td>
<td>home</td>
<td>Depressed mothers</td>
<td>I: 14 C: 13 CES-D (mothers) • At 1 month, infants in the experimental group were performing more optimally than infants in the control group on Social Interaction, F(l, 25) = 5.76, p &lt; .05</td>
</tr>
<tr>
<td>Horowitz et al. 2001</td>
<td>To test the efficacy of an interactive coaching intervention to promote responsiveness between depressed mothers and their infants</td>
<td>RCT</td>
<td>Interaction coaching for at-risk parents and their infants (ICAP)</td>
<td>Hospital in Boston</td>
<td>Postpartum women</td>
<td>I: 60 C: 57 Mother: EPDS BDI Interaction DMC • A significant difference in responsiveness was found between the treatment and control groups (p=.006). • The treatment group had a significantly higher DMC mean score than did the control group at Time 2 (t=3.15, df=116, p=.002) and at Time 3 (t=2.22, df=115, p=.029).</td>
</tr>
<tr>
<td>Hutchings et al. 2002</td>
<td>To compare a standard program to an intensive program</td>
<td>CT</td>
<td>• Intensive program had home visit of average 25 hours</td>
<td>home</td>
<td>New referrals to mental health service, children aged 2-10, with ECBI in the top half of the clinical range</td>
<td>I1: 22 I2: 19 CBCL BDI Parenting scale • Child behavior improved significantly in both groups</td>
</tr>
</tbody>
</table>
## Individual-Level Interventions: Parent-Focused

<table>
<thead>
<tr>
<th>Study Authors</th>
<th>Description</th>
<th>Design</th>
<th>Intervention</th>
<th>Setting</th>
<th>Inclusion</th>
<th>Outcome Measures</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johnson et al. 2005</td>
<td>To test the effectiveness of a home based developmental education intervention in improving outcome at 5 years for very preterm infants.</td>
<td>RCT</td>
<td>developmental education program (Portage) or social support intervention or standard care.</td>
<td>home</td>
<td>babies born &lt;33 weeks gestational age</td>
<td>I1: 97, I2: 90, C: 97, 5-year I1: 63, I2: 61, C: 63</td>
<td>CBCL</td>
</tr>
<tr>
<td>Johnson et al. 2006</td>
<td>To test Healthy Steps impacts on child’s behavior</td>
<td>RCT</td>
<td>Healthy Steps (HS) or PrePare (PP) + HS</td>
<td>At providers’ and home</td>
<td>Pregnant women &lt; 22 weeks' gestation at study enrollment, &lt; 45 years, English speaking, and planning to use a study clinic for pediatric care.</td>
<td>I1: 117, I2: 122, C: 104, 22%</td>
<td>CBCL</td>
</tr>
<tr>
<td>Leung et al. 2003</td>
<td>To evaluate the effectiveness of Triple P in Hong Kong</td>
<td>RCT</td>
<td>Triple P</td>
<td>At home</td>
<td>Children aged 3-7, with behavioral problems but no disability</td>
<td>I: 33, C: 36</td>
<td>ECBI, PDR, SDQ, PS, PSOC, PPC, RQI</td>
</tr>
<tr>
<td>Lieberman et al. 2005</td>
<td>To compare the efficacy of child-parent psychotherapy (CPP) and case management plus treatment</td>
<td>RCT</td>
<td>Child-parent psychotherapy (CPP): weekly parent-child sessions for 1 year or, community referral for individual treatment</td>
<td>Community?</td>
<td>Children aged 3-5 of divorced mothers</td>
<td>I1: 36, I2: 29, I1: 14%, I2: 12%</td>
<td>CBCL</td>
</tr>
<tr>
<td>Lieberman et al. 2006</td>
<td>To assess the effect of the CPP 6-month after termination of the program</td>
<td></td>
<td></td>
<td></td>
<td>6-month: I1: 6% (27), I2: 14% (23)</td>
<td>CBCL, SCL-90 Symptoms Checklist, Revised.</td>
<td>Follow-up analyses revealed that only the CPP group evidenced significant reductions (TC: 126 = 3.92, p G .001 and ITT: t41 = 4.07, p G .001).</td>
</tr>
<tr>
<td>Study</td>
<td>Intervention Focus</td>
<td>Design</td>
<td>Setting</td>
<td>Inclusion</td>
<td>Intervention Details</td>
<td>Setting Details</td>
<td>Outcome measures</td>
</tr>
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<tr>
<td>Linares et al. 2006</td>
<td>Parent-focused</td>
<td>RCT</td>
<td>At agency</td>
<td>Foster children aged 3-10 without disabilities, from NYC</td>
<td>Pairs intervention: 12-week parenting course (Incredible Years); co-parenting component</td>
<td>Foster children aged 3-10 without disabilities, from NYC</td>
<td>CBCL, PPI, ECBI</td>
</tr>
<tr>
<td>Minkovitz et al. 2003</td>
<td>Classroom-based</td>
<td>RCT</td>
<td>Pediatric care</td>
<td>Newborns up to 3 were enrolled at birth or first office visit, who were not adopted or in foster care, or too ill to visit doctor’s office</td>
<td>Healthy Steps: incorporating developmental specialists and enhanced developmental services into pediatric care</td>
<td>Newborns up to 3 were enrolled at birth or first office visit, who were not adopted or in foster care, or too ill to visit doctor’s office</td>
<td>CBCL</td>
</tr>
<tr>
<td>Morawska &amp; Sanders 2006</td>
<td>Self-administered</td>
<td>RCT</td>
<td>Home</td>
<td>Toddler between the ages of 18 and 36 months and that the family lived within the Brisbane metropolitan area, Australia</td>
<td>Triple P</td>
<td>Toddler between the ages of 18 and 36 months and that the family lived within the Brisbane metropolitan area, Australia</td>
<td>ECBI, PS</td>
</tr>
<tr>
<td>Muntz et al. 2004</td>
<td>Intensive practice</td>
<td>RCT</td>
<td>Home</td>
<td>Children aged 2-10, who were referred to mental health service because of severe behavior problems</td>
<td>Intensive parent behavioral training</td>
<td>Children aged 2-10, who were referred to mental health service because of severe behavior problems</td>
<td>ECBL, CBCL</td>
</tr>
<tr>
<td>Study</td>
<td>Interventions</td>
<td>Design</td>
<td>Setting</td>
<td>Inclusion</td>
<td>Immediate effect</td>
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<tr>
<td>Nixon et al. 2003</td>
<td>To compare standard and abbreviated treatments for oppositional defiant preschoolers</td>
<td>RCT</td>
<td>Health and community center</td>
<td>Children aged 3-5 exhibiting behavioral difficulties</td>
<td>Mothers in both the STD and ABB conditions reported less oppositional and conduct problem behavior (ECBI, ODD symptoms) than mothers in the WL condition. Mothers in the STD condition also reported less severe behavior problems around the home (HSQ-M) compared with WL mothers, but ABB mothers did not.</td>
<td></td>
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</tr>
<tr>
<td>Patterson et al. 2002</td>
<td>To assess the effectiveness of a parenting program, delivered by health visitors in primary care, in improving the mental health of children and their parents</td>
<td>RCT</td>
<td>Health centers and community centers</td>
<td>Parents of children aged 2–8 years who scored in the upper 50% on a behaviour inventory</td>
<td>the 21 intervention group children whose initial scores fell in the clinical range decreased by 26.1 points from preintervention to six month follow up (p &lt; 0.001); those of the 39 children initially scoring in the normal range decreased by 9.2 points (p = 0.002) over this period. The 25 control group children with initial scores in the clinical range decreased by only 9.3 points (p = 0.001); those in the normal range (n = 31) decreased by 5.9 points (not significant).</td>
<td></td>
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</tr>
<tr>
<td>Sanders et al. 2000</td>
<td>To compare three variants of Triple P with comparison group</td>
<td>RCT</td>
<td>Community center</td>
<td>Families with 3-year-old who are at risk of behavior problems</td>
<td>Overall children in EBFI showed greater reliable improvement than children in other groups. By 1-year follow-up, children in all 3 treatment groups achieved clinically reliable change in observed disruptive behavior.</td>
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</table>
### Individual-Level Interventions: Parent-Focused

<table>
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<tr>
<th>Study</th>
<th>Interventions</th>
<th>Design</th>
<th>Setting</th>
<th>Inclusion</th>
<th>Follow-Up</th>
<th>Outcome Measures</th>
<th>Findings</th>
</tr>
</thead>
</table>
| Scott et al. 2001 | To evaluate a behaviorally based group parenting program for antisocial behaviors in children | **Design:** Controlled trial  
**Intervention:** Webster-Stratton basic videotape program administered to parents of six to eight children over 13-16 weeks. | **Setting:** 4 local child and adolescent mental health services  
**Inclusion:** 141 children aged 3-8 years referred with antisocial behavior |  
I: 90  
C: 51  
Follow-up: I: 73  
C: 37 |  
- SDQ  
- CBCL | • Children in the intervention group showed a large reduction in antisocial behavior; those in the waiting list group did not change (effect size between groups 1.06 SD (95% confidence interval 0.71 to 1.41), P < 0.001). |
| Shaw et al. 2006 | To test the effectiveness of the Family Check-Up in sustaining maternal involvement and preventing the exacerbation of child conduct problems | **Design:** RCT  
**Intervention:** Family-Based Interventions  
- Family Check-Up (FCU) is a brief three-session intervention  
- “get-to-know-you” (GTKY) feedback sessions, average number of sessions=3.26 | **Setting:**  
**Inclusion:** Mothers with at-risk toddler-age boys were recruited from the WIC program |  
I: 60  
C: 60  
2-year follow up: I: 46  
C: 46 |  
- BDI  
- CBCL  
- HOME | • At the 2-year follow up, intervention group (change in mean= 2.44, SD= 3.11) showed a significant decrease in CBCL Destructive scores, compared with those in the control group (change in mean= 0.75, SD = 3.20), F(1, 108) =7.81, p < .01. |
| Sonuga-Barke et al. 2001 | To evaluate two different parent-based therapies for preschool attention-deficit/hyperactivity disorder (ADHD) | **Design:** RCT  
**Intervention:** a structured 8-week program involving 8 1-hour weekly visits by one of two specially trained health visitor therapists.  
- I1: Parent training: received coaching in child management techniques.  
- I2: parent counseling and support group: received nondirective support and counseling  
- or, waiting-list control group | **Setting:**  
**Inclusion:** Three-year-old children displaying a preschool equivalent of ADHD |  
I1: 30  
I2: 28  
C: 20 |  
- PACS  
- GHQ  
- PSOC | ADHD symptoms were reduced (F2, 74 = 11.64; p < .0001) and mothers’ sense of well-being was increased by PT relative to both other groups (F2,74 = 10.32;p < .005).  
53% of children in the PT group displayed clinically significant improvement (□ 2 = 4.08; p = .048). |
| Sonuga-Barke et al. 2004 | To assess the effectiveness of the same PT program when delivered as part of routine primary care by non-specialist nurses. | **Design:** RCT  
**Intervention:** PT consisted of a structured eight-week program involving eight, one-hour weekly visits. All sessions were carried out on a one-to-one basis with mothers and their AD/HD children in their homes. | **Setting:** home  
**Inclusion:** 3-year-old children with AD/HD |  
I: 59  
C: 30 |  
- PACS  
- WWP  
- CBCL  
- GHQ  
- PSOC | There was no significant improvement in AD/HD symptoms in both groups  
While PT is an effective intervention for preschool AD/HD when delivered in specialized settings, these benefits do not appear to generalize when program are delivered as part of routine primary care by non-specialist nurses. |
<table>
<thead>
<tr>
<th><strong>INDIVIDUAL-LEVEL INTERVENTIONS: PARENT-FOCUSED</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Stewart-Brown et al. 2004</strong></td>
<td>To test the effectiveness at one year of the Webster Stratton Parents and Children Series group parenting program in a population sample of parents.</td>
</tr>
<tr>
<td><strong>Design:</strong> RCT</td>
<td><strong>Setting:</strong> Local center</td>
</tr>
<tr>
<td><strong>Intervention:</strong> The Incredible Years</td>
<td>Parents groups</td>
</tr>
<tr>
<td>• Webster-Stratton’s 10 week parenting program led by trained and supervised health visitors.</td>
<td><strong>Inclusion:</strong> parents of children aged 2–8 years in who scored in the upper 50% on a validated behavior inventory,</td>
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<tr>
<td><strong>I:</strong> 60</td>
<td>• ECBI</td>
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<tr>
<td><strong>C:</strong> 56</td>
<td>• SDQ</td>
</tr>
<tr>
<td></td>
<td>• PSI</td>
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<td></td>
<td>• GHQ</td>
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<td>• RSE</td>
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<td>• At 12 months significant change (p, 0.05) in a positive direction was observed for intervention group children on the intensity scale of the ECBI, and the total, conduct, and hyperactivity scales of the SDQ.</td>
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<td></td>
<td>• Significant change in a positive direction was also observed for intervention group parents on all scales of the GHQ, with the exception of the anxiety subscale; on all scales of the PSI, with the exception of parent-child interaction subscale; and on the RSE scale.</td>
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<td></td>
<td>• At 12 months there were no significant differences between the control and intervention group as regards any of the scales measuring children’s emotional and behavioral adjustment.</td>
</tr>
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</table>

| **Van Zeijl et al. 2006** | To evaluate a home-based video-feedback intervention to promote positive parenting and sensitive discipline (VIPP-SD) |
| **Design:** RCT | **Setting:** home |
| **Intervention:** Discussing actual parent–child interactions in six 1.5-hr sessions with individual families at home. | **Inclusion:** 1- to 3-year-old children’s relatively high scores on externalizing behavior. |
| **I:** 120 | • CBCL |
| **C:** 117 | • after receiving the intervention, mothers in the intervention group had more favorable attitudes toward sensitivity, F(1, 235) = 18.88, p < .01 (partial _2 = .07), and toward sensitive discipline, F(1, 235) = 4.49, p = .05 (partial _2 = .02), than control group mothers at the posttest |
|  | • In families with more marital discord and in families with more daily hassles, the intervention resulted in a decrease of overactive problem behaviors in the children. |

<p>| <strong>Velderman et al. 2006</strong> | To evaluate an intervention aimed at breaking potential intergenerational cycle of insecure attachment |
| <strong>Design:</strong> RCT | <strong>Setting:</strong> Home |
| <strong>Intervention:</strong> Four home visits when the infants were between 7 and 10 months old. | <strong>Inclusion:</strong> Insecure mothers with first-born 4-month-old children, and with 8-14 years education |
| • I1: VIPP video-feedback and brochures | <strong>I1:</strong> 28 |
| • I2: VIPP-R additional discussions of mothers’ childhood attachment experience | <strong>I2:</strong> 26 |
| <strong>C:</strong> 27 | • AAI |
|  | • IBQ |
|  | • SSP |
|  | • Outcome is mother-infant interaction |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Study Purpose</th>
<th>Design</th>
<th>Intervention</th>
<th>Setting</th>
<th>N</th>
<th>Scores</th>
</tr>
</thead>
</table>
| Verduyn et al. 2003 | To evaluate the effect of group cognitive behavioral therapy (CBT) on child behavior problems and maternal depression in a group of women with young children. | RCT             | I1: CBT for depression and parenting skills enhancement, received 16 group sessions.  
I2: mothers’ support group attended mother and toddler groups run by a health visitor together with an experienced clinical psychologist. | - CBCL  
- ECBL                                                                 | I1: 47  
I2: 44  
C: 28  
70% | - There were significant differences in the primary outcome of child behavior pretest to post-test (P<0.001), pre-test to 6-month follow-up (P=0.006) and to 12- month follow-up (P=0.006) on CBCL total scores for the CBT group but not for the two control groups.  
- The CBT group also displayed an improvement in ECBI problem scores from pre-test to 6-month follow-up (P<0.01) and to 12-month follow-up (P=0.007), whereas the two control groups did not. |
| Zubrick et al. 2005 | To evaluate the effectiveness of a universally delivered group behavioral family intervention (BFI) in preventing behavior problems in children. | Quasi-experimental longitudinal | Triple-P  
- Parenting groups: 2-hr/week, 4 weeks  
- Telephone support sessions  
- Reading materials & video | Community health services  
Inclusion: Preschool aged children and their parents recruited from the Eastern Metropolitan Health Region of Western Australia | I: 804  
C: 806 | - The immediate effect: parent-reported child behavior decreased in adjusted mean ECBI by an estimated 22.4 points (95% CI=20.38, 24.48), this improvement was .83 of a standard deviation, which corresponds to a large effect size.  
- At 12- and 24-month, post-intervention, this improvement attenuated but was still statistically significant with decreases in the adjusted mean ECBI score of 11.3 (95% CI=9.1, 13.5) and 12.9 (95% CI=10.4, 15.4), respectively, corresponding to a medium effects. |
### INDIVIDUAL-LEVEL INTERVENTIONS: CHILD-FOCUSED

<table>
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<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Intervention</th>
<th>Population &amp; Setting</th>
<th>N/Attrition</th>
<th>Measures</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| McLaughlin et al. 2007 | To evaluate effects of early childhood interventions on young adult depressive symptoms | Design: RCT  
Intervention: Abecedarian study  
- Full-day, year-round, center-based, free, educational child care from infancy through 5.  
Setting: Center-based  
Inclusion: Infants at high risk for poor cognitive/academic outcomes due to environmental factors such as poverty. | I: 57  
C: 54  
age-21 follow-up: 104 out of 111 participated | - BSI  
- HOME | - 37% of the individuals in the control group rated themselves as having depressive symptoms, in contrast to 26% of those who were in the treatment group |

### FAMILY-LEVEL INTERVENTIONS

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<tr>
<th>Authors</th>
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<th>Measures</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| Barkley et al. 2000 | To examine the effectiveness of a multi-method psycho-educational intervention for preschool children with disruptive behavior | Design: RCT  
Intervention: Four groups:  
- no treatment (42)  
- parent training only (39)  
- full-day treatment classroom only (37)  
- combination of parent training with the classroom treatment (40)  
Setting: Worcester Public Schools  
Inclusion: 158 children at kindergarten having high levels of aggressive, hyperactive, impulsive, and inattentive behavior. | C=42  
I1=39  
I2=37  
I3=40 | - CBCL  
- HSQ  
- Normative Adaptive Behavior Checklist  
- PSI  
- SSQ  
- SSRS  
- Woodcock Johnson Psychoeducational Test Battery  
- CPT | - No significant effects were found on any of the clinic lab tests.  
- Two subscales focusing on attention problems and aggression were statistically significant.  
- The children receiving the special classroom intervention had significantly higher levels of social skills and significantly fewer behavioral problems than did those children not receiving this intervention.  
- Parent training produced no significant treatment effects, probably owing largely to poor attendance. |
| Berlin et al. 1998 | To examine the effectiveness of early intervention | Design: Longitudinal randomized trial  
Intervention: Infant Health and Development Program (IHDP):  
- Home visiting  
- Extrafamilial education from 12 months for 20h per week  
- Parent groups  
Setting: 8 medical institutions, between January 7, 1985 and October 9, 1985  
Inclusion: Low-birth-weight premature infants | I: 377  
C: 608 | - BCL  
- CBCL  
- HOME  
- ICQ | - At 24 and 36 months, intervention children's mothers reported fewer behavior problems than mothers of follow-up children, measured by BCL and CBCL. |
<table>
<thead>
<tr>
<th>Authors</th>
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</tr>
</thead>
</table>
| Blair et al. 2003 | To examine maternal control strategy and child compliance as a function of early intervention | Design: RCT  
Intervention: Combined Incredible Years with additional components, including  
- home visit  
- Parenting groups  
- Child groups  
- Parent and child group activities | Setting: Home and clinic  
Inclusion: Children age 2.5-5 with older relatives with criminal record or with CD or ODD | I: 16  
C: 14  
0% | DSM-III-R  
DPICS                                                    | Among children in the intervention group, consistent maternal guidance was related to lower externalizing and to lower internalizing. |
| Brotman et al. 2003 | To review a pilot study testing a prevention program promoting families at risk | Design: RCT  
Intervention:  
- 22 weekly 90-min concurrent groups for parents and preschoolers  
- an additional 30 min of guided parent-preschooler interactions at the end of each group  
- 10 biweekly home visits, and 5 booster sessions  
- Program elements for siblings | Setting:  
Inclusion: all families in the trial with at least one older sibling (5–17 years old) living in the family | I: 26  
C: 21 | NYPRS  
NYTRS  
CPRS–R  
CTRS–R      | Children in intervention group showed decreases in externalizing behaviors over time, whereas control group showed increases; the effect ($\eta^2=1.41$) is considered large. |
| Brotman et al. 2005 | To examine the potential beneficial effects of a family-based preventive intervention on the older siblings of targeted preschoolers at risk for conduct problems | Design: RCT  
Intervention: Incredible Years Series  
- Parenting groups  
- Child groups  
- Home visits | Setting:  
Inclusion: Families who had siblings under 5. | I: 50  
C: 49  
25% | PPI  
Observation (OPPUS) | In all domains with significant interactions, there were intervention effects for adolescent siblings but not for school-age siblings. |
| Brotman et al. 2005 | To investigate the immediate impact of an 8-month center- and home-based prevention program for preschoolers at high risk for conduct problems | Design: RCT  
Intervention: Incredible Years Series  
- Parenting groups  
- Child groups  
- Home visits | Setting: Center- and home-based  
Inclusion: Families were identified over a 5-year period from family court records of youths in Manhattan and the Bronx, NY, who had siblings under 5. | I: 50  
C: 49  
25% | PPI  
Observation (OPPUS) | The intervention yielded significant effects on negative parenting, parental stimulation for learning, and child social competence with peers. |
<table>
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</tr>
</thead>
</table>
| Feinfield & Baker 2004   | To evaluate the efficacy of a manualized multimodal treatment program for young children | Design: RCT  
Intervention:  
- Parent and child together groups  
- Parent groups  
- Individual meetings  
- Child groups | Setting:  
Inclusion: Families of children with externalizing behavior problems, between 4 and 8, not developmentally delayed | I: 24  
C: 23 | CBCL  
ECBI  
HSQ  
SSQ  
TRF | Treatment parents reported significant reductions in child behavior problems, improved parenting practice  
Five months following the treatment, teachers reported significant improvements in child behaviors |
| Greene et al. 2004       | To examine the effectiveness of a cognitive-behavioral model of intervention of collaborative problem solving (CPS) | Design: RCT  
Intervention:  
- I1: Collaborative problem solving (CPS): 7-16 sessions where therapists identified cognitive-behavioral therapy as their primary therapeutic orientation  
- I2: parent training (PT): 10-week behavior management program | Setting:  
Inclusion: Affectively dysregulated children with Oppositional-defiant disorder (ODD) between 4 and 12, IQ > 80 | I1: 28  
I2: 19 | GAF score  
PCRI  
PSI  
ODD Rating Scale  
Clinical Global Impression | On the PCRI, the CPS condition produced significant improvement on both the Limit Setting subscale (Z= 3.52, p < .01) and the Communication subscale (Z= 2.27, p <.05)  
At 4-month follow-up, 80% of children in the CPS condition evidenced an excellent response to treatment, vs. 44% of those in the PT condition |
| Webster-Stratton & Hammond 1997 | To examine different strategies | Design: RCT  
Intervention:  
- parent-training,  
- child-training,  
- Parent- and child-training, a waiting-list control group | Setting:  
Inclusion: children aged 4 to 8 with early-onset conduct problem | CT: 27  
PT: 26  
CT+PT: 22  
Comp: 22 | ECBI  
DSM-III | All treatment children showed significant improvements in problem solving as well as conflict management skills  
Favored the CT condition over the PT condition.  
At home, PT and CT + PT parents and children had significantly more positive interactions, compared with CT parents and children.  
One-year follow-up: all the significant changes noted immediately post treatment had been maintained over time  
CT + PT condition produced the most significant improvements in child behavior at 1-year follow-up. |
<table>
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</table>
| Conduct Problems Prevention Research Group 2004 | To examine the effects of the Fast Track program on children with early-onset conduct problems, from 1st grade through high school. | Design: RCT  
Intervention: Fast Track (1-grade):  
- Parent groups with home visiting  
- Academic tutoring  
- Social-skill training.  
- A universal intervention was delivered to everyone in the school | Setting: Classrooms in primary schools  
Inclusion: high-risk children screened from kindergarten | I: 445  
C: 446  
I: 10%  
C: N/A | • CPPRG  
• PDR | • Interventions have significant effects: OR=0.66, 0.61, 0.70 for three outcomes respectively (social cognition and social competence problems, peer deviance, and home and community problems)  
• Probability of having problems in the intervention group are 6 to 7 percentage points less than the control group for the three domains with significant effects (.16 vs .23; .12 vs .18; .22 vs .29). |
| Han et al. 2005                              | To evaluate effects of a classroom-based social skills program for pre-kindergarten children | Design: RCT  
Intervention: RECAP (Reaching Educators, Children, & Parents program:  
- class program  
- site-based teacher training  
- group parents training | Setting: School  
Inclusion: aged 4–5 years in the 12 participating pre-kindergarten classrooms | I: 83  
C: 66  
10% | • CBCL  
• SSRS  
• C-TRF | • Significant treatment effects were found for teacher but not parent reports  
• Treatment group children improved significantly more than comparison group children in their teacher-rated social skills and internalizing and externalizing problems. |
<table>
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</tr>
</thead>
</table>
| Harrington et al. 2007 | To test the hypothesis that a community based intervention by secondary child and adolescent mental health services would be significantly more effective and less costly than a hospital based intervention | Design: RCT  
Intervention: Parental education groups.  
- Each service used their routine interventions for behavioral disorder for the age group being studied.  
Setting: Community vs. hospital  
Inclusion: Parents of 3 to 10 year old children with behavioral disorder who had been referred to mental health services | I1: 72  
I2: 69  
One-year 18% | | ECBI  
BDI |  
- No significant differences between the community and hospital based groups on any of the outcome measures, or on costs. |
| Hutchings et al. 2002 | To compare a standard program to an intensive program                                                                                                                                                       | Design: CT  
Intervention:  
- Intensive program had home visit of average 25 hours  
- Standard program had home visit of average 7 hours  
Setting: home  
Inclusion: New referrals to mental health service, children aged 2-10, with ECBI in the top half of the clinical range | I1: 22  
I2: 19 | | CBCL  
BDI  
Parenting scale |  
- Child behavior improved significantly in both groups |
| King et al. 1998 | To evaluate the efficacy of a 4-week cognitive behavior treatment program for children who refuse to go to school program for children who refuse to go to school program for children who refuse to go to school program for children who refuse to go to school | Design: RCT  
Intervention:  
- A 4-week program including  
  - Individual child cognitive-behavior therapy  
  - Parent/teacher training  
Inclusion: Children aged 5-15, who met criteria for school refusal | I: 17  
C: 17 | | Fear thermometer  
R-CMAS  
CDI  
CBCL  
GAF |  
- Significant differences in self-reported were found post-treatment between the two groups:  
  - Fear thermometer: p<.01  
  - Fear survey schedule for children II: p<.05  
  - R-CMAS: p<.01  
  - CDI: p<.05  
  - SEQSS: p<.01  
- No significant between-group differences in externalizing problems reported by parents |
<table>
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<th>Measures</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
</table>
| McGoey et al. 2005 | To investigate a comprehensive multi-component intervention on children at-risk for ADHD | Design: RCT  
Intervention:  
- Early intervention:  
  - School-based consultation  
  - Parent training (12 weeks); 9 monthly booster sessions  
  - If necessary, pharmacological treatment  
  - Or, community treatment control | Setting:  
Home and school  
Inclusion:  
Children aged 3-5, at-risk for ADHD | I1: 30  
I2: 27 | • PKBS  
• Observation | • Teacher reports on the PKBS showed great improvements in both groups  
• Both parent and teachers' reports found greater improvement in the community treatment control group |
| Nafpaktitis & Perlmutter 1998 | To investigate school-based early mental health intervention on at risk children | Design: RCT  
Intervention:  
- 4 to 12 30-minute individual play sessions | Setting:  
School  
Inclusion:  
At risk children aged 5-10, enrolled in two rural elementary schools in central CA | I: 20  
C: 20 | • T-CRS | • The group difference was significant F(7,28)=2.95, p<.05 |
| Owens et al. 2005 | To assess the effectiveness of YESS program on children with ADHD | Design: RCT  
Intervention:  
Youth Experiencing Success in School (YESS)  
- Behavioral parenting sessions  
- Teacher consultation  
- Coordination of care  
- Individual child sessions with clinicians | Setting:  
Elementary schools in rural Ohio  
Inclusion:  
Children (1-6 grade) showing ADHD symptoms | I: 30  
C: 12 | • DBD  
• IRS  
• CBCL | • Based on parent-rated symptoms, treatment group, compared to the waitlist, had significant improvement in oppositional and defiant behaviors, peers relations, and aggression  
• Based on teacher-rated symptoms, treatment group has significant improvement in inattention, teacher relations, academics, self-esteem, overall IRS score, attention, and DSM ADD. |
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Intervention</th>
<th>Population &amp; Setting</th>
<th>N</th>
<th>Measures</th>
<th>Outcomes/Comments</th>
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</thead>
</table>
| Waschbusch et al. 2005 | To evaluate 3 distinct but overlapping approaches to delivering a behavioral school-based intervention on children disruptive behaviors | **Design:** RCT  
**Intervention:**  
- SW: focused on factors in the child's school, consisting of both universal and targeted services  
- TS: used a targeted service focused on factors in school  
- TH: used a targeted service focused on both school and home factors | **Setting:** School & home  
**Inclusion:** Students from elementary schools aged from 5 to 12 | SW: 26  
TS: 27  
TH: 24  
C: 29 | • DSM-IV  
• CIRS  
• STR | • Results showed that the behavior of disruptive children in all schools improved during the course of the year, with some evidence that interventions provided complementary effects |
| Webster-Stratton 1998 | Two types of parenting programs with Head Start mothers were compared | **Design:** RCT  
**Intervention:**  
- I1: Experiment group (Incredible Years)  
  - Weekly parent group meetings (8-16 parents for 2 hr, once a week).  
  - Groups viewed videotapes of modeled parenting skills  
  - The group leaders led a focused group discussion of the parent-child interactions  
  - Teacher training workshops  
- I2: regular Head Start curriculum | **Setting:** Head Start centers  
**Inclusion:** Children in the Head Start program who are at risk for developing problems | I1: 296  
I2: 130 | • CES-D  
• CBCL  
• ECBI  
• DPICS-R  
• CII | • Short-term: The intervention children significantly \( p < .01 \) increased in positive behaviors at both home and schools from pre- to post-assessment, whereas the control children remained unchanged.  
• Long-term (12-18 months), pattern of change across the three time points in the mothers' perceptions of child adjustment was not significantly different for the intervention and control groups. |
<table>
<thead>
<tr>
<th>Community-Based Interventions</th>
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</thead>
<tbody>
<tr>
<td><strong>Authors</strong></td>
</tr>
</tbody>
</table>
| Webster-Stratton et al. 2001 | Two types of parenting programs with Head Start mothers were compared | Design: RCT  
**Intervention:** I1: Experiment group (Incredible Years)  
- 12-Week parent group meetings (8-16 parents for 2 hr, once a week),  
- Groups viewed videotapes of modeled parenting skills  
- the group leaders led a focused group discussion of the parent-child interactions  
- 6 monthly 1-day teacher training workshops  
I2: regular Head Start curriculum  
**Setting:** Head Start centers  
**Inclusion:** Children in the Head Start program who are at risk for developing problems | I1: 191  
I2: 81 | ● CES-D  
● CBCL  
● ECBI  
● DPICS-R  
● CII | ● Short-term: Analyses of the children of intervention attenders compared with the control children revealed significant intervention effects at home, $F(1, 171) = 4.47, p < .05$, and at school $F(1, 32) = 4.63, p < .04$.  
● Long-term (1 year), 80% of the experimental children were below our "at-risk" cutoff (fewer than nine problems per 30 min) for conduct problems at home |
| Webster-Stratton et al. 2004 | To compare four different intervention strategies | Design: RCT  
**Intervention:** PT (parent training)  
PT+TT (PT+ Teacher training)  
CT (child training)  
CT+TT PT+CT+TT  
**Setting:** Inclusion: Families with 4-8 old children with ODD | PT: 31  
PT+TT: 24  
CT: 30  
CT+TT: 23  
PT+CT+TT: 25  
C: 26 | ● ECBI  
● DPICS-R  
● CII | ● Following the 6-month intervention, all treatments resulted in significantly fewer conduct problems with mothers, teachers, and peers compared to controls. |
| MTA Cooperative Group 1999 | To compare long-term effects of 4 treatment strategies on ADHD of school-aged children | Design RCT  
**Intervention:**  
- Medication  
- Behavioral treatment  
- Combined medication and  
**Setting:** Community/school-based  
**Inclusion:** Children aged 7 to 9.9 years with ADHD combined type | M: 144  
B: 144  
CT: 145  
CC: 146 | ● DSM-IV  
● DISC | ● Children in the combined treatment and medication management showed significantly greater improvement than those given intensive behavior treatment and community care. |
### Community-Based Interventions

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<th>Outcomes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jensen et al. 2005</td>
<td>To compare cost-effectiveness of the four ADHD treatments</td>
<td>behavioral treatment</td>
<td>Community care</td>
<td></td>
<td></td>
<td>• Medical management treatment, although not as effective as combined medical management and behavioral treatment, is likely to be more cost-effective in routine treatment for children with ADHD, particularly those without comorbid disorders.</td>
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</tbody>
</table>

### System-Level

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<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Intervention</th>
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<th>N/Attrition</th>
<th>Measures</th>
<th>Outcomes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huston et al. 2005</td>
<td>To review the long-term impacts of New Hope on children’s outcomes</td>
<td>Design: RCT&lt;br&gt;Intervention: New Hope: provided three financial benefits&lt;br&gt;</td>
<td>Setting: Community&lt;br&gt;Inclusion: Families had one or more children between the ages of 13 months and 10 years 11 months</td>
<td>I: 23% C: 27%</td>
<td>• Positive Behavior Scale&lt;br&gt;• Problem Behavior Scale from the SSRS&lt;br&gt;• Lone-liness and Social Dissatisfaction Questionnaire</td>
<td>• Parents of children in New Hope families rated them higher on positive social behavior than did parents of control children, but there were no program effects on parent ratings of problem behaviors&lt;br&gt;• Teachers rated New Hope boys significantly higher on positive social behavior than they did control boys. They rated New Hope girls significantly higher than controls on internalizing problems</td>
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JHU • WCHPC
## Economic Studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Question</th>
<th>Perspective</th>
<th>Study type and design</th>
<th>Population and Setting</th>
<th>Outcomes/Comments</th>
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</thead>
<tbody>
<tr>
<td>Currie &amp; Stabile, 2004</td>
<td>To estimate effects of ADHD</td>
<td>Societal</td>
<td>Using data from</td>
<td>Children with ADHD in US and Canada</td>
<td>• ADHD symptoms increase the probability of future grade repetition and special education and reduce future reading and mathematics test scores.</td>
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<td>• Canadian National Longitudinal Survey of Children and Youth</td>
<td></td>
<td>• A score at the 90th percentile of the distribution of a hyperactivity score based on symptoms increases the probability of grade repetition by 6 percent in Canada, and by 7 percent in the U.S.</td>
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<td></td>
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<td>• American National Longitudinal Survey of Youth.</td>
<td></td>
<td>• Income has little effect on the probability of treatment</td>
</tr>
<tr>
<td>Dretzke et al., 2005</td>
<td>Effectiveness and cost-effectiveness of parent training/education program for the treatment of child conduct disorder</td>
<td>Cost-effectiveness</td>
<td>Cost-effectiveness</td>
<td>Child with conduct disorder</td>
<td>• No significant difference in either effectiveness or costs between the community and hospital based group parental education programs.</td>
</tr>
<tr>
<td>Jensen et al., 2005</td>
<td>The only study on cost-effectiveness of major ADHD treatments</td>
<td>Cost-effectiveness</td>
<td>Using NIMH’s Multimodal Treatment Study of Children with ADHD (MTA study)</td>
<td>Children with ADHD</td>
<td>• They reported during 14 months of treatment, medical management cost $1,180 (in 2000 dollars) per group, intensive behavior treatment cost 6,988, combined medical management and behavior treatment cost $7,827, and routine community care cost $1,071.</td>
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<td>• Combining with effectiveness of each treatment, they concluded medical management treatment, although not as effective as combined medical management and behavior treatment, was likely to be more cost effective in routine treatment for children with ADHD, especially those without comorbid disorders.</td>
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<td>McCauley et al., 2004</td>
<td>To evaluate the effectiveness of Home-Start support:</td>
<td>Cost-effectiveness</td>
<td>U.K. program called Home-Start</td>
<td>Children from disadvantaged background</td>
<td>• On average, families supported by Home-Start cost £3,058 more than comparison group families.</td>
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<td>• When considering volunteers time, the average cost of intervention was £8,831 higher than comparison group.</td>
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<td>• After considering the effectiveness, they concluded Home-Start did not appear to be a cost-effective alternative to standard health visitor-based services.</td>
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<tr>
<td>Muntz et al., 2001</td>
<td>To compare a standard and an intensive parent-child interaction training program</td>
<td>Cost-effectiveness</td>
<td>Six-month RCT</td>
<td>Child with severe behavior problems</td>
<td>• The study suggested that the treatment using videotaped recording of parent-child interactions may be more cost-effective than the standard parent-training programs.</td>
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<tr>
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</table>
| Romeo et al. 2006  | To identify the costs incurred by children with antisocial behaviors in UK     | Cost of care      | Using the Client Service Receipt Inventory for Childhood   | Child (3-8) referred to mental health services              | • Mean annual total cost was £5,960, ranging 48-19,940  
• The greatest cost burden of £4,637 was borne by the family                                                                                           |
| Scott et al., 2001 | Estimate effects of treating antisocial behaviors                               | Societal          | Costs applied to data of 10 year old children from the inner London longitudinal study selectively followed up to adulthood | Child with conduct disorders                               | • Cost was £571 per child  
• Cost-effectiveness: £540 per standard deviation improvement in antisocial behaviors  
• Cost-benefit: children with conduct disorder would cost public services around £75,000.                                                 |
| Thompson et al. 1996 | investigated the costs and outcomes of a reduced version of the Common Sense Parenting program, with approximately 30 hours of staff time to serve 10 families | Cost-effectiveness | Three-month follow-up control-trial comparison             | 90 families who were referred to Common Sense Parenting     | • Cost about $70 (in 1996 prices) per family.  
• They found parents who completed this program reported more improvement in externalizing, but not in internalizing, child problems than untreated controls, and the treatment effects were maintained at 3-month follow-up. |
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Among young people.


Lantz PM, Jacobson PD, Warner KE, W


The MTA Cooperative Group. A 14-Month Randomized Clinical Trial of Treatment Strategies for Attention-Deficit/Hyperactivity Disorder. *Arch Gen Psychiatry*. 1999; 56:1073-1086


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