CALIFORNIA
HEALTH BENEFITS REVIEW PROGRAM

Analysis of Assembly Bill 264: Pediatric Asthma Self-Management Training and Education Services

A Report to the 2006–2007 California Legislature
March 3, 2006

CHBRP 06-02

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A Report to the 2006–2007 California State Legislature

Analysis of Assembly Bill 264
Pediatric Asthma Self-Management Training and Education Services

March 3, 2006

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PREFACE

This report provides an analysis of the medical, financial, and public health impacts of Assembly Bill 264, a bill that would require health care service plans that cover outpatient prescription drug benefits to also cover pediatric asthma self-management training and education services. In response to a request from the California Assembly Committee on Health on January 3, 2006, the California Health Benefits Review Program (CHBRP) undertook this analysis pursuant to the provisions of Assembly Bill 1996 (2002) as chaptered in Section 127600, et seq., of the California Health and Safety Code.

Wade Aubry, MD, Janet Coffman, PhD, Patricia Franks, BA, and Edward Yelin, PhD, all of the University of California, San Francisco, prepared the medical effectiveness analysis. Michael Cabana, MD, provided technical assistance with the literature review and clinical expertise for the medical effectiveness analysis. Min-Lin Fang, MLIS, of UCSF conducted the literature search. Nicole Bellows, MHSA, Helen Halpin, PhD, Sara McMenamin, PhD, all of the University of California, Berkeley, prepared the public health impact analysis. Meghan Cameron, MPH, Gerald Kominski, PhD, Miriam Laugesen, PhD, Ying-Ying Meng, PhD, and Nadereh Pourat, PhD, of the University of California, Los Angeles, prepared the cost impact analysis. Robert Cosway, FSA, MAAA, and Chris Girod, FSA, MAAA, of Milliman, provided actuarial analysis. Cynthia Robinson, MPP, of CHBRP staff prepared the background section and synthesized individual sections into a single report. Cherie Wilkerson, BA, provided editing services. In addition, a subcommittee of CHBRP's National Advisory Council (see final pages of this report) and a member of the CHBRP Faculty Task Force, Sheldon Greenfield, MD, of the University of California, Irvine, reviewed the analysis for its accuracy, completeness, clarity, and responsiveness to the Legislature's request.

CHBRP gratefully acknowledges all of these contributions but assumes full responsibility for all of the report and its contents. Please direct any questions concerning this report to CHBRP:

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EXECUTIVE SUMMARY

California Health Benefits Review Program Analysis of Assembly Bill 264: Pediatric Asthma Self-Management Training and Education Services

The California Legislature has asked the California Health Benefits Review Program to conduct an evidence-based assessment of the medical, financial, and public health impacts of Assembly Bill 264. AB 264 would amend Section 1367.06 of the California Health and Safety Code.

AB 264 would require a Knox-Keene licensed health care service plan that covers outpatient prescription drug benefits to include coverage for pediatric asthma self-management training and education services.[1] AB 264 would also require that these services to be provided under the supervision of an appropriately licensed or registered health care professional.

AB 264 defines pediatric asthma self-management training and education as those services "prescribed by a participating health care professional legally authorized to prescribe services," including education "necessary to enable an enrollee to properly use the medications and devices prescribed for the treatment of pediatric asthma" and "instruction that will enable pediatric asthmatic patients and their families to gain an understanding of the disease process and the daily management of asthma in order to avoid frequent hospitalizations and complications."

Current law requires that health plans provide "prevention health services." These services, which are to be provided under a physician's supervision, include effective health education.[2]

CHBRP submitted two previous reports to the Legislature on bills related to the topic of pediatric asthma, AB 1549 and AB 2185. Both reports included analyses of coverage for pediatric asthma self-management training and education services. AB 1549 would have required all health plans to provide coverage for over-the-counter and prescription asthma medications as well as pediatric asthma self-management training and education services. AB 1549 did not pass out of the Assembly Committee on Appropriations.

As amended on March 24, 2004, AB 2185 required all health plans to provide coverage for medically necessary equipment and supplies (peak flow meters, nebulizers, and spacers), as well as pediatric asthma self-management training and education services. AB 2185 included the language that education for pediatric asthma was to be consistent with "current professional medical practice." However, AB 2185 was amended subsequently and, as enacted, did not retain the provision requiring coverage for pediatric asthma self-management training and education services.

This analysis updates the medical effectiveness, cost impact, and public health impact analyses of AB 264's proposed mandate for outpatient pediatric self-management training and education

[1] Health care service plans, commonly referred to as health maintenance organizations, are regulated and licensed by the California Department of Managed Care (DMHC), as provided in the Knox-Keene Health Care Services Plan Act of 1975. The Knox-Keene Health Care Services Plan Act is codified in the California Health and Safety Code. Specialized health care service plans would be exempt from AB 264.

[2] California Code of Regulations, Section 1300.67(f)(8).

in light of the new data and evidence accumulated since AB 2185 took effect on January 1, 2005.

I. Medical Effectiveness

- **Asthma Symptoms and Severity.** The asthma self-management training and education programs assessed in these trials had favorable effects on a variety of health outcomes for children with asthma. In particular, the programs have a pattern toward favorable effects on reducing the number of days of asthma symptoms, nights of nocturnal asthma, number of asthma exacerbations, and severity of asthma symptoms. There is also a pattern toward improvement in peak expiratory flow rate.

- **Health Care Use.** The literature suggests that asthma self-management training and education programs have a pattern toward favorable effects in reducing the number of emergency room visits and the number of hospitalizations for asthma, as well as use of beta2-agonists or other "rescue medications" prescribed to treat asthma attacks. However, the evidence of effects of asthma self-management programs on the number of physician visits for children with asthma is ambiguous.

- **Disability Outcomes.** Asthma self-management training and education programs have favorable effects on reducing school absences and increasing participation in other activities. Children who participate in asthma self-management training and education programs have fewer days of restricted activity. There is a pattern toward favorable effects on decreasing the number of days children are absent from school. The evidence of the effects of asthma self-management programs on the number of days caregivers are absent from work to care for a child with asthma is ambiguous.

- **Intermediate Outcomes**. There are patterns toward favorable effects in increasing children's self-efficacy and children's and caregivers' knowledge about asthma. Increases in these intermediate outcomes have been associated with better self-management behaviors which, in turn, lead to better health outcomes.

- **Quality of Life.** Asthma self-management training and education programs have a pattern toward favorable effects on the quality of life for children with asthma and their caregivers.

II. Utilization, Cost, and Coverage Impacts

The cost analysis indicates that all children enrolled in health maintenance organizations (HMOs) in California are covered for asthma self-management training and education services.

- Approximately 503,000 children in California have symptomatic asthma, have prescription drug coverage, and are insured by Knox-Keene licensed health plans obtained through employers, privately-purchased policies, CalPERS, Medi-Cal, or Healthy Families.

- All children subject to this legislation, specified above, are currently covered for asthma self-management and training services. These services include one or more of the following services: individual self-management training and education, individual health education, patient education materials, and group health education.

- The mandate is expected to increase the utilization of pediatric self-management training and education services. This utilization is estimated to increase by approximately 10 percentage points (from 55.6% to 65.6%) for children already covered as a result of increased awareness by providers and patients of the benefit following enactment of the mandate.

- The evidence from the medical effectiveness review suggests that the increased use of self-management training and education services would reduce mean hospitalizations by 21% and mean emergency room visits by 4% for children with symptomatic asthma who receive self-management training and education services as a result of this mandate.

- The mandate is estimated to increase total net expenditures by $5,103,000 or 0.01%. This is equivalent to a total increase of $0.0257 in the premium amounts per member per month (PMPM). The magnitude of increase differs in the group, individual, and public insurance sectors.

- In the private market, costs are estimated to increase by 0.007% for CalPERS, 0.009% for other small and large employers, and 0.007% for the individual market. Costs of Medi-Cal and Healthy Families are expected to increase 0.061% and 0.034%, respectively.

- The overall net expenditure increase of $5,103,000 reflects an estimated gross cost of $5,910,000 for additional self-management training and education, offset by $807,000 in savings associated with reduced emergency room and hospital utilization. Thus, savings in other healthcare costs offset about 14% of the cost of the mandate. The analysis suggests that the mandate will increase the administrative expenses of health plans in proportion to the increases in health care costs.

Table 1. Summary of Coverage, Utilization, and Cost Effects of AB 264

	Before Mandate	After Mandate	Increase/ Decrease	% Change After Mandate
Coverage				
Percent of insured children aged 1-17 with coverage for mandated benefit	100.0%	100.0%	-	0.0%
Number of insured children aged 1-17 in California with coverage for the benefit	5,340,000	5,340,000	-	0.0%
Percent of covered children aged 1-17 in California with symptomatic asthma	9.4%	9.4%	-	0.0%
Number of covered children aged 1-17 in California with symptomatic asthma	503,000	503,000	-	0.0%
Utilization				
Percent of children aged 1-17 with symptomatic asthma receiving education	55.6%	65.6%	10.0%	18%
Number of children aged 1-17 with symptomatic asthma receiving education	279,000	330,000	51,000	18%
Number of emergency room visits per child with symptomatic asthma	0.0400	0.0398	(0.0002)	-0.4%
Number of inpatient admissions per child with symptomatic asthma	0.0110	0.0107	(0.0003)	-2.4%
Expenditures				
Premium expenditures by private employers for group insurance	25,936,592,000	25,938,857,000	2,265,000	0.01%
Premium expenditures for individually purchased insurance	3,041,505,000	3,041,709,000	204,000	0.01%
CalPERS employer expenditures	2,330,367,000	2,330,538,000	171,000	0.01%
Medi-Cal state expenditures	4,334,532,000	4,335,649,000	1,117,000	0.03%
Healthy Families state expenditures	644,314,000	644,707,000	393,000	0.06%
Premium expenditures by employees with group insurance or CalPERS, and by individuals with Healthy Families	8,948,536,000	8,949,334,000	798,000	0.01%
Individual out-of-pocket expenditures (deductibles, copayments, etc)	1,724,145,000	1,724,300,000	155,000	0.01%
Expenditures for non-covered services	--	--	--	N/A
Total annual expenditures	46,959,991,000	46,965,094,000	5,103,000	0.01%

Source: California Health Benefits Review Program, 2006.
Note: The population includes individuals and dependents in California who have private insurance (group and individual) or are enrolled in public plans subject to the Health and Safety Code, including CalPERS, Medi-Cal, or Healthy Families. All population figures include enrollees aged 0–64 years and enrollees 65 years or older covered by employment-based coverage.
Employees and their dependents who receive their coverage from self-insured firms are excluded because these plans are not subject to mandates.
Key: CalPERS = California Public Employees' Retirement System; HMO = health maintenance organization and point of service plans; PPO = preferred provider organization and fee-for-service plans.

III. Public Health Impacts

- In California, approximately 15.8% of insured children aged 1–17 years report having ever been diagnosed with asthma, with 9.4% reporting experiencing asthma symptoms in the past year (i.e., symptomatic asthma). In addition, 60.7% of children with symptomatic asthma report experiencing an asthma attack in the past year and 12.5% report experiencing daily or weekly asthma symptoms. The baseline data suggest that adolescents (ages 12–17) in California with symptomatic asthma missed an average of 1.1 days of school in the last four weeks due to their health condition and 70.6% of children (ages 1–11) with symptomatic asthma reported that they experienced restricted physical activity due to their asthma. In California in 2002, 23 deaths due to asthma were reported among children 1–19 years. More than one-third of children with symptomatic asthma report they take daily medicine for their asthma. In addition, 3.5% of children with symptomatic asthma had an emergency room visit because of their asthma in the past year, and 1.0% were hospitalized because of their disease in the past year.

- It is estimated that as a result of the mandate, there would be a total reduction of approximately 4,500 days of missed school each month due to asthma, or approximately 40,500 fewer days of missed school per year (assuming a nine-month school year); 8,900 fewer children would report that their physical activity is limited due to asthma; 500 fewer children with asthma would visit the emergency department; and 80 fewer children would be hospitalized for asthma-related conditions.

- Males have higher rates of asthma diagnoses compared to females, yet measures of asthma severity such as asthma attacks or emergency room/urgent care visits do not vary significantly by gender and rates of asthma self-management education are similar between the two groups. Similarly, blacks have higher rates of asthma diagnoses compared to whites and Hispanics, yet measures of asthma severity and rates of asthma self-management education do not vary significantly by race. Therefore it does not appear that there are current disparities in asthma severity or in asthma self-management education that would be affected by AB 264. Thus, AB 264 is not expected to affect gender or racial disparities in asthma management.

- Mortality among children with asthma is relatively rare. In California in 2002, 23 deaths due to asthma were reported among children 1–19 years. Reductions in childhood mortality have not been examined as a potential health outcome since mortality is such a rare occurrence among this population. As a result, we are not able to determine whether AB 264 would have any impact on premature death associated with childhood asthma.

- This analysis has found that approximately 40,500 missed school days per year would be averted with the passage of AB 264. As a result, there would likely be productivity gains in California through a decrease in lost workdays of caregivers. The extent to which these productivity gains would be realized, however, is unclear since the evidence regarding caregiver workdays as an outcome in examining the effectiveness of asthma management programs is ambiguous.

INTRODUCTION

Asthma is a chronic inflammatory disease of the airways. It is the most common chronic disease of childhood, affecting an estimated 9 million children (NCHS, 2002). In California, approximately 500,000 children have had asthma symptoms within the past year (CHIS, 2003). Childhood asthma that is poorly managed may result in acute episodes, often requiring emergency department visits and hospitalizations.

Assembly Bill 264 (AB 264) would require a Knox-Keene licensed health care plan that covers outpatient prescription drug benefits to include coverage for pediatric asthma self-management training and education services.[3]

AB 264 defines pediatric asthma self-management training and education as those services "prescribed by a participating health care professional legally authorized to prescribe the services," including, education "necessary to enable an enrollee to properly use the medications and devices prescribed for the treatment of pediatric asthma" and "instruction that will enable pediatric asthmatic patients and their families to gain an understanding of the disease process and the daily management of asthma in order to avoid frequent hospitalizations and complications."

AB 264 also requires that these services be provided "under the supervision of an appropriately licensed or registered health care professional." This provision applies to services provided directly by the health plan as well as services provided under contract with an outside organization.

The population affected by this mandate includes privately insured children (1–17 years) with prescription drug coverage (and their families) who are enrolled in health service plans regulated by the California Department of Managed Care (DMHC).[4] This mandate also affects children (and their families) with prescription drug coverage who are enrolled in health service plans purchased by CalPERS and state-administered programs (e.g., Medi-Cal, Healthy Families).

Currently no other state has an existing mandate specifically requiring health insurers to cover pediatric asthma self-management education and training. State legislative activity in recent years as it pertains to asthma has focused on amending drug-free school laws to permit school children to carry asthma medications to school.

Knox-Keene licensed health plans are required to provide all "basic health care services."[5] DMHC has defined these basic health care services to include preventive health services.[6] Preventive health services include effective health education services, including information

[3] Health care service plans, commonly referred to as health maintenance organizations, are regulated and licensed by the California Department of Managed Care (DMHC), as provided in the Knox-Keene Health Care Services Plan Act of 1975. This statute is codified in the California Health and Safety Code. Specialized health care service plans would be exempt from AB 264. This mandate would not impact health insurance policies regulated under the California Insurance Code under the California Department of Insurance.

[4] Children ages 0–1 year are excluded from the affected population because asthma is commonly not clinically diagnosed for this age group.

[5] Health and Safety Code, Section 1367, subd. (i)

[6] Health and Safety Code, Section 1345(b)(5)

regarding personal health behavior and health care, and recommendations regarding the optimal use of health care services provided by the plan or health care organizations affiliated with the plan. These services are provided "under a physician's supervision."[7]

As of January 2005, health plans are required to provide coverage under their outpatient prescription drug benefits for inhaler spacers, nebulizers, and peak flow meters when medically necessary for the treatment of pediatric asthma. If education is offered, including education to enable an enrollee to properly use medically necessary devices, it must be "consistent with current professional medical practice."[8]

Based on discussions with the author's staff, the intent of this bill is to ensure that self-management and training services are provided to children with asthma and to their families. The author contends that there is a gap in the provision of these services. This bill is intended to close the gap by eliminating any problem with reimbursement for patient education services deemed appropriate by an enrollee's physician.

CHBRP submitted two previous reports to the Legislature on the topic of pediatric asthma. Both reports included analyses of bills that proposed coverage for pediatric asthma self-management education and training, AB 1549 and AB 2185. AB 1549 would have required all health plans regulated and licensed by DMHC to provide coverage for over-the-counter and prescription asthma medications as well as pediatric asthma outpatient self-management training and education services AB 1549 died in the Assembly Committee on Appropriations. AB 2185 required all health plans to provide coverage for medically necessary equipment and supplies (peak flow meters, nebulizers, and spacers) as well as pediatric asthma self-management training and education services. AB 2185 also included language that education for pediatric asthma was to be consistent with "current professional medical practice." The final version of AB 2185 enacted into law did not retain the language requiring coverage for pediatric asthma self-management training and education services.[9]

This analysis updates the medical effectiveness, cost impact, and public health impact analyses of a mandate for outpatient pediatric self-management training and education services in light of new data and evidence accumulated since AB 2185 took effect on January 1, 2005.

[7] California Code of Regulations, Section 1300.67(f) (8).
[8] Health and Safety Code, Section 1367.06. The National Heart, Lung, and Blood Institute's National Asthma Education and Prevention Program Guidelines for the Diagnosis and Management of Asthma are recognized as the standard of care nationally. However, the state does not require local medical practice to be consistent with these national guidelines.
[9] Stats. 2004, Ch. 711

I. MEDICAL EFFECTIVENESS

Successful management of children with asthma depends heavily on the actions of children and their caregivers. In many children, asthma symptoms are caused by environmental factors, some of which can be controlled by their caregivers, such as exposure to tobacco smoke, dust mites, cockroaches, and rodents. Effective treatment of asthma exacerbations (i.e., "asthma attacks") requires that children and parents recognize asthma symptoms and administer medications promptly and effectively. Some children need to take medications on a daily basis or before engaging in exercise to prevent exacerbations. Caregivers play an especially important role in managing children with asthma because children may not be able to manage their asthma without assistance and may not be able to communicate effectively with their health care providers.

The goal of asthma self-management training and education is to teach children and their caregivers how to accomplish tasks that will enable them to control asthma. The National Heart, Lung, and Blood Institute's (NHLBI) *Guidelines for the Diagnosis and Management of Asthma* recommends that asthma self-management education encompass instruction regarding basic facts about asthma, correct use of medications (e.g., when and how to use an inhaler or nebulizer), self-monitoring skills, and strategies for controlling or avoiding environmental factors that cause asthma symptoms (NHLBI, 1997, pg. 125). The NHLBI guidelines also recommend that "patient education should begin at the time of diagnosis and be integrated into every step of medical care" (NHLBI, 1997, pg. 124).

Studies of the medical effectiveness of asthma self-management training and education interventions were identified through searches of the PubMed, CINAHL, and Cochrane databases, including the Cochrane Database of Systematic Reviews and the Cochrane Central Register of Controlled Trials (CENTRAL). The literature review for this report updates the literature review that CHBRP conducted for AB 1549 and AB 2185, two bills on childhood asthma self-management training and education that were introduced in 2003 and 2004, respectively. Only articles published in 2004 or 2005 were retrieved because the previous CHBRP literature review encompassed all relevant literature published prior to 2004.

A more thorough description of the methods used to conduct the medical effectiveness review and the process used to grade the evidence for each outcome measure may be found in Appendix A: Literature Review Methods. Tables presenting detailed findings for each outcome measure may be found in Appendix B: Summary of Medical Effectiveness Findings on Pediatric Asthma Self-Management Training and Education.

The scope of the literature search included studies of the effects of asthma self-management education and training interventions for children with asthma, written self-management action plans, and monitoring interventions, such as recording symptoms and pulmonary function in a paper or electronic diary. In most trials, the intervention was delivered by a health professional or a lay person trained to provide asthma education. Some trials assessed computer-assisted instructional games and internet-enabled, interactive multimedia asthma education tools. Due to the difficulty of distinguishing between educational and self-management interventions, any trial in which the intervention included an educational or self-management component was reviewed.

The search was limited to abstracts of peer-reviewed studies of children with asthma, defined as subjects aged 0–18 years. Trials that included adults with asthma were excluded unless sub-group analyses were performed for children. Only trials conducted in the United States were included in the review. The review encompassed meta-analyses, systematic reviews, randomized controlled trials, controlled clinical trials, and observational studies. Through the literature search, two recent meta-analyses published in the Cochrane Database of Systematic Reviews were identified (Haby et al., 2001; Wolf et al., 2003). Results from the meta-analyses were given substantial weight in decisions about the effectiveness of pediatric asthma self-management training and education interventions because the authors of meta-analyses pool results from multiple studies and apply rigorous methodological criteria prior to the inclusion of each article in their analyses. All other trials reviewed were published subsequent to the studies assessed by the meta-analyses.

The scope and content of the asthma self-management training and education interventions varied widely across the trials. Due to a lack of sufficient evidence or inadequate program descriptions, the effectiveness of the various components of asthma self-management training or education programs could not be determined, nor was it possible to ascertain whether a specific intervention program was more effective than another. Most studies compared children who received an intervention to children who received their usual care for asthma. These studies were used to make all quantitative estimates. However, some studies compared interventions of varying intensity (e.g., seven home visits vs. one home visit) or modality (e.g., interactive media vs. in-person) and these were included in the qualitative assessment of effects. Table 1 in Appendix B contains descriptions of the intervention and control groups. The trials also varied with respect to the setting in which the intervention was conducted (e.g., outpatient medical office, home, or school) and the manner in which the intervention was delivered (e.g., individual counseling, classes, or interactive computer programs). Some trials focused on specific groups of children with asthma, such as children who had a hospitalization or emergency room visit for asthma or children who live in low-income, inner city areas.

Studies of the medical effectiveness of pediatric asthma self-management training and education assess the effects of self-management training and education on five categories of outcomes:

- health outcomes,
- disability outcomes,
- health services utilization outcomes,
- intermediate outcomes, such as self-efficacy in coping with pediatric asthma and knowledge about managing asthma, and
- quality-of-life outcomes.

Findings

Health outcomes

Days of asthma symptoms

Thirteen studies examined the effects of pediatric asthma self-management training and

education on the number of days children experience asthma symptoms. Nine studies (Bonner et al., 2002; Butz, Pham, et al., 2005; Clark et al., 2004; Evans et al., 1987; Evans et al., 1999; Krishna et al., 2003; Tinkelman and Schwartz, 2004; Velsor-Friedrich et al., 2004, Yoos et al., 2002) found statistically significant reductions in the number of days of asthma symptoms for children participating in an pediatric asthma self-management training and education intervention. Four studies (Fireman et al., 1981; Krieger et al., 2005; Shames et al., 2004; Velsor-Friedrich et al., 2005) found a statistically nonsignificant decrease in days with asthma symptoms for the intervention group compared with the control group. Thus, the evidence suggests that pediatric asthma self-management training and education interventions have a pattern toward favorable effects in reducing the number of days of asthma symptoms that children with asthma experience.

Symptom-free days

Two randomized controlled trials examined the effect of pediatric asthma self-management training and education on the number of symptom-free days children with asthma reported (Brown et al., 2002; Wilson et al., 1996). In both trials, the number of symptom-free days increased in the intervention groups and the changes were statistically significant. Thus, the evidence suggests that self-management training and education have favorable effects in increasing the number of symptom-free days for children with asthma.

Symptom scores

Symptom scores are subjective measurements of how much a patient is bothered by symptoms or how often a patient experiences asthma symptoms. Two trials (Brown et al., 2002; Christiansen et al., 1997) demonstrated a statistically significant effect of pediatric asthma self-management training and education on improving symptom scores for children with asthma. Another trial (Bartholomew et al., 2000) demonstrated an effect that was positive but not statistically significant. Thus, the evidence suggests that self-management training and education have favorable effects on improving symptom scores for children with asthma.

Nocturnal asthma

One meta-analysis (Wolf et al., 2003) found that pediatric asthma self-management training and education was associated with statistically significant decreases in nights of nocturnal asthma. Three studies published subsequent to the meta-analysis reached the same conclusion (Butz, Pham, et al., 2005; Georgiou et al., 2003; Tinkelman and Schwartz, 2004). One randomized controlled trial published subsequent to the meta-analysis found a statistically nonsignificant decrease in nights of nocturnal asthma (Krishna et al., 2003). One study that used a nested design[10] found that children in the intervention group actually had more nights of nocturnal

[10] A nested design is a research design that is appropriate when subjects are grouped into organizational or geographic units. The organizational or geographic units are randomized to either the intervention or the control group. All eligible subjects in the intervention units receive the intervention, and none of the eligible subjects in the control units receive it. Nested designs are often used in studies of educational interventions provided in schools that aim to assess the intervention's effects on individual children. Schools are randomized rather than children to prevent children in the control group from being exposed to the intervention. Nested designs are not used when individual children are assigned to intervention and control groups.

asthma than children in the control group and that the difference was statistically significant (Clark et al., 2004). Overall, however, the preponderance of the evidence suggests that pediatric asthma self-management training and education has a pattern toward favorable effect in reducing the mean number of nights with nocturnal asthma for children.

Asthma severity

Asthma severity is often defined subjectively and is not measured in a standard way. The measures of asthma severity in the trials that were reviewed ranged from characterizations of days of asthma as being mild, moderate, or severe (Butz, Pham, et al., 2005; Homer et al., 2000; Huss et al., 2003; LeBaron et al., 1985; Minai et al., 2004; Whitman et al., 1985); the degree to which a child was bothered by symptoms (Wilson et al., 1996); and functional measures, such as functional status (Bartholomew et al., 2000) and the ability of children with asthma to perform their chores (Perrin et al., 1992). One meta-analysis (Wolf et al., 2003) pooled trials using various definitions and found overall that asthma severity decreased in children who had received pediatric self-management training and education, but the findings were not statistically significant. One study published subsequent to the meta-analysis that was not a randomized trial found statistically significant effects showing reduced severity (Georgiou et al., 2003). Four studies found favorable effects that were favorable but not statistically significant (Bartholomew et al., 2000; Huss et al., 2003; Minai et al., 2004; Yoos et al., 2002). One randomized controlled trial (Homer et al., 2000) found that children in the control group, who received written information about asthma, experienced a greater reduction in asthma severity than children in the intervention group, who played an interactive, educational computer game. Overall, however, the evidence suggests that the effectiveness of pediatric asthma self-management training and education interventions demonstrates a pattern toward favorable effects in reducing asthma severity in children.

Exacerbations

"Exacerbations" are defined as asthma attacks or episodes of asthma. One meta-analysis (Wolf et al., 2003) assessed the effects of pediatric asthma self-management interventions on asthma exacerbations. The meta-analysis found a reduction in the mean number of exacerbations experienced by children with asthma, but the reduction was not statistically significant. Thus, the evidence suggests that the effectiveness of pediatric asthma self-management training and education interventions shows a pattern toward weak or no effect in reducing the mean number of exacerbations for children with symptomatic asthma.

Peak Expiratory Flow Rate

Peak expiratory flow rate (PEFR) measures lung function as the maximum rate of airflow that can be achieved during a sudden forced expiration from a position of full inspiration. One meta-analysis (Wolf et al., 2003) assessed PEFR and found that pediatric asthma self-management training and education improved PEFR by a statistically significant amount. One trial published subsequent to the studies assessed in the meta-analysis also found the effects of pediatric asthma self-management training and education improved PEFR by a statistically significant amount (Guendelman et al., 2002). Two studies published after the meta-analysis found that children in

the intervention group experienced a larger increase in PEFR than children in the control group but that the increase was not statistically significant (Shames et al., 2004; Velsor-Friedrich et al., 2004). One study found a larger increase in PEFR in the control group, but the difference was not statistically significant. Overall, however, the evidence suggests that pediatric asthma self-management training and education interventions show a favorable effect on improving PEFR.

Disability effects

School absences

One meta-analysis (Wolf et al., 2003) found pediatric asthma self-management training and education interventions had a statistically significant effect in reducing school absences. Two studies (Clark et al., 2004; Krishna et al., 2003) published after the meta-analysis also found a statistically significant effect in reducing school absences following the intervention. Two studies found reductions in mean absences that were not statistically significant (Velsor-Friedrich et al., 2004; Velsor-Friedrich et al., 2005). One study with a small sample found that mean absences increased in the intervention group and decreased in the control group (Horner, 2004). Overall, however, the evidence suggests that pediatric asthma self-management training and education has a pattern toward favorable effects on reducing the mean number of days children with asthma are absent from school. Based on an analysis of studies in which children in the control group received usual care for pediatric asthma, the mean number of days absent due to asthma is estimated to decrease by 10%.[11]

Three studies measured the proportion of children with asthma who reported any school absences following self-management training and education. The Georgiou et al. (2003) study demonstrated a statistically significant reduction of 48% in the proportion of children with asthma who missed school in the past six weeks. However, the study design was an uncontrolled, longitudinal survey and thus prone to more biases than a randomized controlled trial. The randomized controlled trials by Guendelman et al. (2002) and Krieger et al. (2005) found a nonsignificant reduction in the proportion of children reporting school absences. Thus, the evidence suggests that self-management training and education shows a pattern toward favorable effects in reducing the proportion of children with asthma who report any school absences. Based on an analysis of studies in which children in the control group received only usual care for asthma, the percent of children absent due to asthma is estimated to decrease by 43%.

Restricted-activity days

Two studies examined the effects of pediatric asthma self-management training and education on the number of days of restricted activity for children with asthma (Krieger et al., 2005; Krishna et al., 2003). Both studies found that children who participated in a pediatric asthma education intervention had fewer days of restricted activity than children in the control group and that the

[11] All quantitative estimates of the effects of asthma self-management training and education were computed by calculating the proportionate effect of the intervention in individual studies that address the outcome of interest and then computing the weighted average proportionate effect across the studies. Studies were weighted by sample size. These estimates are highly sensitive to the results of the individual studies included.

difference was statistically significant. Thus, these findings suggest that pediatric asthma self-management training and education has a favorable effect on reduction in restricted-activity days.

One recent study (Guendelman et al., 2002) reported that the percentage of days with restricted activity decreased more dramatically among children who participated in a pediatric asthma self-management training and education intervention than among children in the control group. That study reported a 25% decrease in the percentage of children with one or more days of restricted activity due to asthma.

Caregiver absences from work

Three studies examined the effects of pediatric asthma self-management training and education on caregivers' absences from work. Two observational studies that did not have control groups found that caregivers of children who participated in a pediatric asthma self-management intervention had fewer absences from work than caregivers of children in the control group (Georgiou et al., 2003; Tinkelman and Schwartz, 2004). One randomized controlled trial found a greater decrease in work absences in the control group than in the intervention group (Krieger et al., 2005). Overall, the results of these studies suggest that the evidence of the effects of pediatric asthma self-management training and education on caregivers' absences from work is ambiguous.

Health services utilization effects

Emergency department utilization

Two meta-analyses assessed the impact of pediatric asthma self-management training and education on emergency department utilization (Haby et al., 2001; Wolf et al., 2003). One meta-analysis concluded that children with asthma who received self-management training and education experienced a statistically significant reduction in the mean number of emergency department visits (Wolf et al., 2003). Four subsequent trials (Greineder et al., 1999; Harish et al., 2001; Kelly et al., 2000; Krishna et al., 2003) also found that pediatric asthma self-management training and education reduced emergency department visits by a statistically significant amount and two recent trials found a non-significant reduction in emergency department visits (Bartholomew et al., 2000; Homer et al., 2000). One recent observational study (Catov et al., 2005) found no difference in mean emergency department visits by children in the intervention and control groups. Overall, the evidence suggests that pediatric asthma self-management training and education interventions show a pattern toward favorable effects in reducing the mean number of asthma-related visits to the emergency department for children with asthma. Based on studies in which children in the control group received usual care for asthma, mean emergency department visits per child with asthma are estimated to decrease by 4%.

One meta-analysis and two studies published subsequent to the studies included in the meta-analysis examined the effects of pediatric asthma self-management training and education on the percentage of children who had one or more emergency department visits for asthma. The meta-

analysis (Haby et al., 2001) reviewed studies of children who previously had an emergency department visit for asthma. The authors found that a lower percentage of children who received asthma self-management interventions were readmitted to the emergency department but that the difference was not statistically significant. Two studies that were not included in the meta-analysis also found nonsignificant reductions in the percentage of children readmitted to the emergency department (Butz, Pham et al. 2005; Guendelman et al., 2002). Thus, the evidence suggests a pattern toward favorable effects in reducing the percentage of children with asthma who visit the emergency department. Based on studies in which children in the control group received only usual care for asthma, the percentage of children with asthma who had at least one emergency department visit for asthma is estimated to decrease by 28%.

Hospitalization

Both meta-analyses assessed the effects of pediatric asthma self-management training and education on hospitalization for asthma (Haby et al., 2001; Wolf et al., 2003). One meta-analysis found a nonsignificant effect in reducing the mean number of hospital admissions for pediatric asthma patients (Wolf et al., 2003). Among the trials published after the articles included in the meta-analysis, two trials (Bartholomew et al., 2000; Greineder et al., 1999) found that the intervention reduced the mean number of hospitalizations for children with asthma by a statistically significant amount. Another study (Kelly et al., 2000), which was not a randomized trial, also found that the intervention reduced the mean number of hospitalizations by a statistically significant amount. One recent observational study found a statistically nonsignificant decrease in mean hospitalizations (Tinkelman and Schwartz, 2004). An observational study (Catov et al., 2005) reported no difference in mean hospitalizations. One randomized controlled trial in which the intervention and control groups received different types of educational interventions found that mean hospitalizations were lower in the control group (Krishna et al., 2003). Overall, however, the preponderance of the evidence suggests a pattern toward favorable effects of pediatric asthma self-management training and education on reducing the mean number of asthma-related hospitalizations for children with asthma. Based on studies in which children in the control group received only their usual care for asthma, the mean number of hospitalizations per child for asthma is estimated to decrease by 21%.

One meta-analysis (Haby et al., 2001) examined the effects of pediatric asthma self-management training and education on the percentage of children hospitalized. The meta-analysis examined the effects of pediatric asthma self-management interventions for children who previously had an emergency department visit. The authors found that the rate of hospitalization was lower among children who participated in an asthma self-management and training intervention but that the difference was not statistically significant. Two studies that were not included in the meta-analysis also found a lower rate of hospitalization among children who received the intervention, but that the difference was not statistically significant (Butz, Pham, et al., 2005; Evans et al., 1999). Overall, the evidence suggests a pattern toward favorable effects of pediatric asthma self-management training and education on the percentage of children hospitalized. Based on studies in which the children in the control group only received usual care for asthma, the percentage of children with asthma who are hospitalized is estimated to decrease by 16%.

Acute and urgent physician visits versus routine visits

Both meta-analyses summarized the effects of pediatric asthma self-management training and education on both routine as well as urgent ambulatory visits to a general practitioner, family physician, pediatrician, or other primary care provider. The meta-analyses found that the interventions resulted in nonsignificant decreases in mean office visits (Wolf et al., 2003) and in the percentage of children who had one or more office visits (Haby et al., 2001).

To develop a clearer picture of the evidence, studies that measured only urgent or unscheduled visits to a primary care provider were examined. Whereas urgent or unscheduled visits suggest that a child is having an exacerbation, scheduled visits enhance asthma management by enabling the primary care provider to assess the child's health and adjust the child's treatment regimen if necessary. Three studies, two randomized controlled trials (Brown et al., 2002; Evans et al., 1987) and one study of a school-based program that used a nested design (Krishna et al., 2003), demonstrated a reduction in the number of urgent or unscheduled visits for children who received pediatric asthma self-management training and education; however, the reductions were not statistically significant. Three studies (Homer et al., 2000; Lukacs et al., 2002; Velsor-Friedrich et al., 2004) that were not randomized controlled trials found that the intervention group had a nonsignificant increase in urgent physician visits. Thus, the evidence regarding the effects of pediatric asthma self-management training and education on the number of urgent or unscheduled physician visits is ambiguous.

Use of medications: short-acting beta2-agonists, and other bronchodilators

Five studies examined the impact of pediatric asthma self-management training and education on use of short-acting beta2-agonists and other bronchodilator medications that are used to relieve acute asthma symptoms. One study that used a nested design (i.e., children in schools) found that a lower percentage of children in the intervention group used "quick relief" medications and that the difference was statistically significant (Velsor-Friedrich et al., 2004). A second study with a nested design found that a lower percentage of children in the intervention group used "quick relief" medications but that the difference was not statistically significant (Velsor-Friedrich et al., 2005). Two randomized controlled trials found that mean days of bronchodilator use decreased in both the intervention and control groups and that there were no statistically significant differences between the groups (Krieger et al., 2005; Shames et al., 2004). Overall, the evidence of the effects of pediatric asthma self-management training and education on use of bronchodilators is ambiguous.

Use of medications: inhaled corticosteroids

Some children have intermittent asthma that can be managed effectively by limiting exposure to environmental factors that trigger asthma symptoms and by taking bronchodilators when acute symptoms occur. Other children have persistent asthma and need to take medication daily to control their symptoms. Inhaled corticosteroids are among the most frequently used long-term controller medications. One study that sought to improve adherence to recommended asthma treatment regimens found that the percentage of children with a prescription for an inhaled corticosteroid increased among children who participated in the asthma self-management and

education intervention (Bonner et al., 2002). One study reported that children in the intervention group were more likely to use one or more canisters of an inhaled corticosteroid than children in the control group (Lukacs et al., 2002). The authors state that this finding suggests that more children in the intervention group were using an inhaled corticosteroid as a long-term control medication than as a quick-relief medication, which indicates better asthma management practices. Another study found that the daily dose of inhaled corticosteroids increased less rapidly among children in the intervention group than among children in the control group, which suggests asthma was under better control among children in the intervention group than among those in the control group (Krishna et al., 2003). Overall, pediatric asthma self-management training and education has a pattern toward favorable effects on use of inhaled corticosteroids.

Intermediate effects

Self-efficacy

Self-efficacy is defined as "the belief in one's capabilities to organize and execute the sources of action required to manage prospective situations" (Bandura, 1995, pg. 2). The studies reviewed assessed measures of coping scores and health locus of control scales (a metric of how much control people feel they have over their health). One meta-analysis (Wolf et al., 2003) found a statistically significant increase in self-efficacy among children who participated in pediatric asthma self-management training and education interventions. Three studies published after the studies included in the meta-analysis (Bonner et al., 2002; Butz, Pham, et al. 2005; Shegog et al., 2001) also found statistically significant increases in the self-efficacy of children with asthma following self-management training and education. Three studies found increases that were not statistically significant (Bartholomew et al., 2000; Velsor-Friedrich et al., 2004; Velsor-Friedrich et al., 2005). Overall, the evidence shows a favorable effect of pediatric asthma self-management training and education on increasing children's self-efficacy in managing their asthma.

Knowledge: children with asthma

Studies that examine the effects of pediatric asthma self-management training and education interventions on knowledge of asthma used different instruments to measure knowledge. Eight trials found that children with asthma who received self-management training and education experienced statistically significant improvements in their knowledge of asthma and its management (Bonner et al., 2002; Christiansen et al., 1997; Homer et al., 2000; Krishna et al., 2003; LeBaron et al., 1985; Parcel et al., 1980; Rubin et al., 1986; Whitman et al., 1985). Seven studies found a nonsignificant effect on increasing children's knowledge (Bartholomew et al., 2000; Perrin et al., 1992; Persaud et al., 1996; Shames et al., 2004; Shegog et al., 2001;Velsor-Friedrich et al., 2004; Velsor-Friedrich et al., 2005). One trial found a statistically significant increase in asthma knowledge among children in 1st and 2nd grade and a statistically nonsignificant increase among children in 3rd, 4th, and 5th grades (Butz, Pham, et al., 2005). One trial found no effect (Lewis et al., 1984). Overall, however, the findings suggest a favorable effect of pediatric asthma self-management training and education in increasing children's knowledge of their condition.

Knowledge: caregiver

Some pediatric asthma self-management training and education interventions provided education to caregivers. As with children's knowledge of asthma, the studies used different instruments to measure caregivers' knowledge. Six trials measured caregivers' knowledge about asthma. Three studies (Butz, Pham, et al., 2005; Krishna et al., 2003; Shames et al., 2004) found a statistically significant increase in caregiver knowledge. Two studies (Butz, Syron, et al., 2005; Persaud et al., 1996) found a statistically nonsignificant increase. Thus, the evidence suggests a pattern toward favorable effects of pediatric asthma self-management training and education on increasing caregiver knowledge about a child's asthma and its management.

Quality-of-life effects

Quality of life: child

Quality of life concerns physical and emotional well-being, as well as happiness, in aspects of life a person considers important. Studies that analyzed the effects of pediatric asthma self-management training and education on quality of life used several different instruments to measure quality of life. Five studies found that quality of life for children with asthma who participated in the pediatric asthma self-management training and education intervention improved by a statistically significant amount (Evans et al., 1987; Fireman et al., 1981; Georgiou et al., 2003; Perrin et al., 1992; Shames et al., 2004). Two studies found increases in children's quality of life that were not statistically significant (Butz, Pham, et al., 2005; Tinkelman and Schwartz, 2004). Thus, the evidence suggests that self-management training and education has a pattern toward favorable effect on the quality of life of children with asthma.

Quality of life: caregiver

Three trials assessed the impact of pediatric asthma self-management training and education on the quality of life of the caregivers of children with asthma. One trial found a statistically significant increase in quality of life among caregivers of children with asthma who had participated in a self-management training and education intervention (Krieger et al., 2005). One study (Butz, Pham, et al., 2005) found that the relationship between the intervention and caregivers' quality of life was positive but that the relationship was not statistically significant. One trial (Brown et al., 2002) found a statistically significant increase in quality of life for caregivers of younger children (aged 1–3 years) in the intervention group, but no difference for caregivers of older children. Overall, the evidence suggests a pattern toward a favorable effect of pediatric asthma self-management training and education on improving caregiver quality of life.

Conclusions

A review of studies of pediatric asthma self-management training and education programs finds that these programs improve health outcomes, reduce acute and urgent health care utilization outcomes, and improve disability outcomes, intermediate outcomes, and quality of life outcomes for children with asthma.

Health Outcomes: The pediatric asthma self-management training and education programs assessed in these studies had a pattern toward favorable effects on reducing the number of days of asthma symptoms, nights of nocturnal asthma, number of asthma exacerbations, and severity of asthma symptoms. There is also a pattern toward improvement in peak expiratory flow rate, but no evidence of effects on other measures of pulmonary function.

Health Care Utilization Outcomes: The pediatric asthma self-management training and education programs assessed have a pattern toward favorable effects in reducing the number of emergency room visits and the number of hospitalizations for asthma, as well as the use of "rescue medications" prescribed to treat asthma attacks. However the evidence of effects of asthma self-management programs on the number of physician visits for children with asthma is ambiguous.

Disability Outcomes: Children who participate in asthma self-management training and education programs have fewer days of restricted activity. There is a pattern toward favorable effects on the number of days children are absent from school. The evidence of effects of asthma self-management programs on the number of days caregivers are absent from work to care for a child with asthma is ambiguous.

Intermediate Outcomes: Pediatric asthma self-management training and education programs have a pattern toward favorable effects in increasing children's self-efficacy and children's and caregivers' knowledge about asthma.

Quality of Life Outcomes: Pediatric asthma self-management training and education programs have a pattern toward favorable effects on the improving quality of life for children with asthma and their caregivers.

II. UTILIZATION, COST, AND COVERAGE IMPACTS

Present Baseline Cost and Coverage

Current utilization levels and costs of the mandated benefit (Section 3(h))

The mandated services under AB 264 include pediatric asthma self-management training and education services. In estimating the impact of the bill on costs, utilization, and premiums, the services are defined to include child and caregiver self-management training and education on a group or individual basis provided under the supervision of appropriately licensed or registered health care professionals by the plan or contracting provider. Health services utilization associated with poor management of childhood asthma includes emergency department visits and inpatient hospital stays.

For the utilization and cost analysis, children with symptomatic asthma were defined as having had at least one of the following events in the last year: one prescription asthma medication, one asthma-related emergency department visit, one asthma-related hospitalization, one asthma-related outpatient visit, or to have used asthma-related devices and tests. Children under one year of age are excluded from this analysis since diagnosis of asthma is difficult in this age group and thus is rarely made.

Under these criteria, approximately 9.4% of children ages 1-17 years enrolled in Knox-Keene licensed health plans have symptomatic asthma (see Appendix C). This analysis assumes similar costs and rates of utilization for children covered under all insurance categories included due to a lack of specific utilization data for each category.

Using data from the California Health Interview Survey (CHIS) and commercial databases maintained by Milliman, the analysis finds that approximately 503,000 children in California have symptomatic asthma, have prescription drug coverage, and are insured by Knox-Keene licensed health plans obtained through employers, privately-purchased policies, CalPERS, Medi-Cal, or Healthy Families.

Based on data from Milliman, the current utilization rates, costs per service, and per member per month (PMPM) costs for children with symptomatic asthma insured by Knox-Keene health plans are approximately as follows:

- 556 sessions of pediatric asthma self-management training and education per 1,000 members per year (self-management and training, individual and group education, and patient education materials);
- 0.011 inpatient admissions per patient per year;
- 0.4 emergency room visits per patient per year;
- $100 annual cost for education and training (self-management and training, individual and group education, and patient education materials) per patient;
- $4.40 health care cost PMPM for inpatient hospital services.; and
- $2.23 health care cost PMPM for emergency room visits.

Current coverage of the mandated benefit (Section 3(i))

Coverage of pediatric asthma self-management training and education services in Knox-Keene licensed plans in California was determined by a survey of the seven largest health plans in the state and was found to be extensive (Table 2). The six plans who responded represented 93% of those enrolled in commercial Knox-Keene licensed health plans. Approximately 3% of children enrolled in these plans had alternative prescription drug coverage. Due to lack of information on the nature of this alternative coverage, this analysis does not exclude these children from the following cost estimates. Consequently, the cost estimates in this report represent the upper bound. All participating plans cover self-management training and education, primarily during the initial office visit (100%) and most during follow-up visits (80%), individual health education with toll-free automated numbers or advice (100%), and patient education materials (100%). Group health education (50%) is provided least frequently by plans. As discussed in the medical effectiveness review, the effectiveness of the various components of pediatric asthma self-management training or education programs could not be determined alone or in comparison with each other. Consequently, the following analysis is based on the assumption that self-management training and education is covered in some form by Knox-Keene licensed health plans.

Public demand for coverage (Section 3(j))

As a way to determine whether public demand exists for the proposed mandate (based on criteria specified under AB 1996 (2002)), CHBRP is to report on the extent to which collective bargaining entities negotiate for and the extent to which self-insured plans currently have coverage for the benefits specified under the proposed mandate. Currently, the largest public self-insured plans are CalPERS' PERSCare and PERS Choice preferred provider organization (PPO) plans. These plans include coverage for disease management programs for specific conditions, including asthma, diabetes, heart disease and depression. Based on conversations with the largest collective bargaining agents in California, no evidence exists that unions currently include such detailed provisions during the negotiations of their health insurance policies. In order to determine whether any local unions engage in negotiations at such detail, they would need to be surveyed individually.

Impacts of Mandated Coverage

How will changes in coverage related to the mandate affect the benefit of the newly covered service and the per-unit cost? (Section 3(a))

No effect on per-unit cost of the benefit or the service is expected. This is because this legislation does not propose an increase in the number of children who have health insurance coverage, but rather it mandates coverage of services available to children already with coverage as discussed in the next section.

How will utilization change as a result of the mandate? (Section 3(b))

Current rates of coverage for pediatric asthma self-management training and education services in California indicate wide coverage of these types of services by all plans subject to this mandate. However, current data indicate that the utilization rate for these programs by children ages 1-17 years with symptomatic asthma enrolled in Knox-Keene licensed health plans statewide (CHIS, 2001, Table 6) is approximately 55.6% or 279,000 children. The utilization of these programs is estimated to increase by 10 percentage points (i.e. from 55.6% to 65.6%) for an estimated additional 51,000 children receiving asthma self-management education following the mandate. No research, either in the academic literature or in the policy arena, indicated whether the mandated coverage for preventive education services would impact the utilization of these services. Therefore, our estimate of the percentage increase in utilization was determined by the consensus of an expert panel with backgrounds in health services research, preventive care, health education, and asthma management. The rationale of the panel was that pediatric asthma is a health condition with a strong advocacy base and that these advocates could use the media to increase awareness of the importance of asthma self-management training and education and could thus increase demand and utilization on the part of physicians and patients following the enactment of the mandate.

Our previous analysis of AB 2185 (coverage for devices to manage pediatric asthma) assumed a 10 percentage point increase from the baseline. In January 2005, AB 2185 was signed into law and mandated coverage of medical devices with asthma, but struck out language that would have mandated coverage of asthma self-management training and education services. It is likely that the law based on AB 2185 led to a small increase in use of education services related to use of medical devices, however, no data is available on the scope of this effect and the sequential introduction of these bills (one in 2005 and one in 2006) makes it essentially impossible to assess their impacts separately. Due to the lack of available evidence on utilization effects, this estimate from the expert panel represents the best available information. The actual change in utilization of the benefit as a result of the mandate may be higher or lower than a 10 percentage point increase in utilization, thus we include cost impact estimates if utilization were to increase by 5 percentage points (i.e. from 55.6% to 60.6%) or 15 percentage points (i.e. from 55.6% to 70.6%).

It is possible that the increased use of education services would lead to greater use of inhalers and prescription drugs to self-manage the condition. However, many children with asthma are likely to already have the devices but are either not using them or are not using them properly. At the same time, education services are likely to change behavior that would reduce the use of prescription drugs. Thus, our analysis assumed no increase in the utilization of inhalers or prescription drugs as a result of this mandate.

Based on the review of the medical effectiveness of pediatric asthma self-management training and education programs, the evidence suggests that, after the mandate, the mean number of inpatient hospitalizations for children with symptomatic asthma who receive self-management training and education services as a result of this mandate may be reduced by 21% and the mean number of emergency room visits may be reduced by 4%. The effects identified in the literature review, on which the above utilization estimates were made, were observed as part of clinical trials and therefore may not be achieved at the same levels when implemented in a population,

because the trials were conducted under tightly controlled circumstances. Thus, *all estimates of effects of the mandate on health services utilization should be viewed as upper bounds.*

To what extent does the mandate affect administrative and other expenses? (Section 3(c))

The mandate is expected to increase the administrative expenses for health plans but not disproportionately to the increase in health care costs (see the following section). An increase in pediatric asthma treatment and education claims may increase claims administration costs. Plans may have to modify their insurance contracts and member materials and may have to contract with new providers that specialize in asthma education. Health care plans include a component for administration and profit in their premiums, which may be sufficient for covering increased administrative costs (see Appendix C).

Impact of the mandate on total health care costs (Section 3(d))

Total net expenditures (including total premiums and out-of-pocket expenditures) are estimated to increase by approximately $5,103,000 or 0.011%. This is equivalent to $0.0257 in overall premiums PMPM. The impact varies by insurance category from 0.061% ($0.0489 PMPM) for the Healthy Families program, to 0.034% ($0.0384 PMPM) for Medi-Cal, to 0.007% ($0.0172 PMPM) for the individual market, 0.007% ($0.0213 PMPM) for CalPERS, and 0.009% for employment-based insurance ($0.0230 PMPM for large employers and $0.0237 PMPM for small employers) (Table 4). These would be the net effects of the mandate on costs, factoring in both the new costs associated with increased utilization of asthma self-management training and education services as well as the estimated cost savings resulting from reduced asthma-related emergency room visits and hospitalizations. The overall net expenditure increase of $5,103,000 reflects an estimated gross cost of $5,910,000 for additional self-management training and education, offset by $807,000 in savings associated with reduced emergency room and hospital utilization. Thus, savings in other healthcare costs offset about 14% of the cost of the mandate. When estimating this offset, CHBRP assumed the cost reduction would be proportionate to the estimated reductions in emergency room visits and hospital admissions.

The actual change in utilization of the benefit as a result of the mandate may be higher or lower than a 10 percentage point increased utilization assumption, thus we include cost estimates for utilization increases of 5 and 15 percentage points. Given an increase of 5 percentage points in utilization of asthma self-management training and education services, the total expenditures are estimated to increase by $2,551,000 ($0.0132 in overall PMPM). Given an increase of 15 percentage points in use of these services, the total expenditures are estimated to increase by $7,654,000 ($0.0397 in overall PMPM).

Costs or savings for each category of insurer resulting from the benefit mandate (Section 3(e))

Based on the evidence of medical effectiveness, inpatient and emergency department costs are expected to decrease by approximately 21% and 4%, respectively, for the additional increased utilization in self-management training and education services as a result of the enactment of this mandate. The total amount of this savings is estimated at $807,000. Physician visit costs are not

expected to change. However, no impact is expected on rates of coverage as a consequence of AB 246.

Current costs borne by payers (both public and private entities) in the absence of the mandated benefit (Section 3(f))

Pediatric asthma self-management and education services currently provided to children enrolled in Knox-Keene licensed plans in California are covered. After the mandate was enacted, these costs would continue to be borne by the same plans with the same distribution between the private and public markets.

Impact on access and health service availability (Section 3(g))

The mandated benefit would not change access to pediatric asthma self-management and education services for children with asthma who are currently covered. Given the size of the population affected, expected reductions in utilization of inpatient and emergency department services, and a 10 percentage point increase in use of education and training, there is no evidence that the mandate would create price pressures and thus impact the unit cost of asthma self management training and education services. This mandate would also not impact the availability or supply of providers, such as disease management organizations, or health educators.

III. PUBLIC HEALTH IMPACTS

Present Baseline Health Outcomes

In California, 15.8% of insured children aged 1–17 years have ever been diagnosed with asthma (CHIS, 2003).[12] However, more than 40% of these children did not report currently having asthma or experiencing any symptoms in the past year. This means that approximately 9.4% of insured children in California have symptomatic asthma (i.e., asthma for which they experienced symptoms in the past year)[13]. In addition, 60.7% of children with symptomatic asthma report experiencing an asthma attack in the past year, and 2.5% report experiencing daily asthma symptoms, 10.3% report weekly symptoms, and 23.3% report monthly symptoms, whereas almost two-thirds report experiencing symptoms less than every month (CHIS, 2003).

The baseline data suggest that adolescents (ages 12–17 years) in California with symptomatic asthma missed an average of 1.1 days of school in the last four weeks and, of the 40.1% who missed any school, an average of 2.8 days of school were missed (CHIS, 2001). A total of 70.6% of children (ages 1–11) with symptomatic asthma report that they experienced restricted physical activity due to their asthma (CHIS, 2001). Death from asthma is a rare event, but in California in 2002, 23 deaths due to asthma were reported among children 1–19 (CDC, 2006).

In terms of medication usage, of those children with symptomatic asthma, more than one-third report they take daily medicine for their asthma (CHIS, 2003). In addition, 3.5% of children with symptomatic asthma had an emergency room visit because of their asthma in the past year, and 1.0% were hospitalized because of their disease in the past year (See Table 1). Finally, 55.6% of adolescents with symptomatic asthma report having ever received any information from their doctor on how to avoid the things that make their asthma worse (CHIS, 2001).

Impact of the Proposed Mandate on Public Health

<u>Impact on Community Health (Section 1A)</u>

It is estimated that in California there are 503,000 children (ages 1–17 years) with symptomatic asthma in health insurance plans affected by this mandate (enrolled in Knox-Keene licensed plans that include prescription drug coverage offered through employers, privately-purchased policies, CalPERS, Medi-Cal, or Healthy Families). Although nearly all children in California with symptomatic asthma currently have coverage for self-management training and education, a 10 percentage-point increase (i.e., from 55.6% to 65.6%) in the utilization of self-management training and education is estimated after the enactment of the mandate. (See *Section II: Utilization, Cost and Coverage Impacts* for justification of this assumption) This would result in approximately 51,000 more children with symptomatic asthma receiving self-management education and training post-mandate. The remainder of this section discusses the potential impact of the proposed mandate on selected health outcomes based on the findings of the medical

[12] The data used in this section from the 2003 CHIS is restricted to children ages 1–17 years with the following health insurance types: privately purchased, employer-based, Medi-Cal, and Healthy Families.
[13] Using CHIS 2003 data, a prevalence rate of symptomatic asthma was calculated to be 9.5%. This figure was adjusted to 9.4% using methods described in *Appendix C.*

effectiveness literature presented in Section I. A summary of the findings is presented in Table 5. The estimated impact of AB 264 is discussed below.

The four specific outcomes for which quantitative estimates of the public health impacts of the mandate were made were school absences (mean number of days missed), restricted-activity days (percentage of children reporting), emergency department visits (percentage of children reporting), and hospitalizations (percentage of children reporting).

School absences

Nearly 40% of adolescents (12–17 years) with symptomatic asthma missed school in the past month due to illness, with a reported 1.1 days of school missed per month per asthmatic child (CHIS, 2001). Assuming similar rates of missed school days among the 5–11-year-old population, this translates into over 450,000 total days of school missed among the children with symptomatic asthma affected by this mandate. The evidence suggests that pediatric asthma self-management training and education leads, on average, to a 10% reduction in the number of school days missed by children with asthma. Based on this evidence, the analysis suggests that for the 10% of children with asthma who would newly use the self-management training and education after the mandate, approximately 4,500 fewer days of school would be missed each month due to asthma, or approximately 40,500 fewer days of missed school per year, assuming a 9-month school year. If the utilization after the mandate were to increase by 5 percentage points, the reduction in days of school missed per month ranges would be approximately 2,300. If the utilization after the mandate were to increase by 15 percentage points, then the reduction in missed school days per month would be as high as 6,800.

Restricted-activity days

70.6% of children (ages 1-11) with symptomatic asthma report that their physical activity is limited to some extent because of their asthma (CHIS, 2001): 41.4% report that their physical activity is rarely limited due to asthma, 22.1% report that their physical activity is sometimes limited due to asthma, and 7.1% report that their physical activity is limited either most of the time or always due to asthma. Assuming similar rates of restricted-activity days among adolescents (12-17), this would translate into more than 350,000 children affected by this mandate reporting limited physical activity. The evidence suggests that pediatric asthma self-management training and education leads to a 25% reduction in the percentage of children reporting that their physical activity is limited due to asthma. Based on the evidence, the analysis suggests that for the 10% of children with asthma who would newly use the self-management training and education after the mandate, approximately 8,900 fewer children would report that their physical activity is limited due to asthma. This estimate ranges from 4,400, assuming a 5 percentage point increase in utilization, to 13,300 assuming a 15 percentage point increase in utilization.

Emergency department visits

Approximately 3.5% of children with asthma visit the emergency department each year. This translates into a total of approximately 17,600 children with asthma-related emergency room visits per year in the population affected by this mandate. The evidence suggests that pediatric asthma self-management training and education leads, on average, to a decrease of 28% in the proportion of patients reporting an emergency department visit. Based on this evidence, the analysis suggests that there would be approximately 500 fewer emergency department visits for children with asthma. This estimate ranges from 250, assuming a 5 percentage point increase in utilization, to 750 assuming a 15 percentage point increase in utilization.

Hospitalizations

An estimated 1.0% of children with asthma are hospitalized in California each year for asthma-related conditions. This translates into 5,000 children affected by this mandate who are hospitalized annually. The evidence suggests that pediatric asthma self-management training and education leads, on average, to a 16% reduction in the percentage of children with asthma-related hospitalizations. Based on this evidence, there would be approximately 80 fewer children hospitalized for asthma-related conditions. This estimate ranges from 40, assuming a 5 percentage point increase in utilization, to 120 assuming a 15 percentage point increase in utilization.

For all of the public health outcomes, the effects identified in the literature review, which were observed as part of trials, may not be achieved at the same levels when implemented in a population because the trials were conducted in tightly controlled circumstances that do not necessarily represent how care is provided in the real world. In addition, there could be variations from insurer to insurer that could affect actual health outcomes.. If fewer additional covered children newly receive services as a result of the mandate, or if the actual interventions are less effective than what was observed in clinical trials, the public health benefits of this mandate would be less.

Other significant public health effects

A review of the literature on the effectiveness of pediatric asthma self-management training and education identified other outcomes for which such training and education is effective. However, quantitative estimates of the impact on children in California with symptomatic asthma could not be made for these other outcomes due to the lack of baseline data. These outcomes include an overall reduction in asthma severity for children, fewer days of asthma symptoms, more symptom-free days, reduced nocturnal asthma, and improvement in lung function as measured by PEFR. In addition, literature on the impact of pediatric self- management training and education suggests that children and, in some cases, their caregivers, report an increase in their quality of life and increased knowledge about asthma and its management. Finally, evidence suggests that children who have had asthma self-management training and education perceive they are more capable of organizing and executing the actions that are required to manage their asthma.

Impact on Community Health Where Gender and Racial Disparities Exist (Section 1B)

A literature review was conducted to determine whether there are gender or racial disparities associated with the prevalence and outcomes for pediatric asthma documented in the peer-reviewed literature. Additionally the 2003 CHIS data were examined for gender and racial differences in asthma prevalence and related health outcomes.

Table 6 reports the 2003 CHIS data by gender. According to the CHIS data, there are significant gender differences in asthma prevalence, with 18% of males aged 1 to 17 years reported to have ever been diagnosed with asthma, compared with 13% of females in the same age group. A review of the literature shows that during early childhood, asthma is more prevalent in males; however, during adolescence, asthma prevalence equalizes between the genders, and in adulthood, females have higher rates of asthma (Bjornson and Mitchell, 2000). Among children with asthma in California, CHIS data did not show a significant gender difference in whether children had an asthma attack or asthma-related emergency room or urgent care visit in the past year. Additionally, male and female children were provided education on how to avoid making their asthma worse at approximately the same rates (CHIS, 2001; CHIS, 2003).

Table 7 shows the racial differences in childhood asthma prevalence in California based on the 2003 CHIS data. Black children have the highest rates of diagnosed asthma, with 24% reporting having ever been diagnosed with asthma, followed by Whites at 16% and Hispanics at 14%. In addition, Black children had higher rates of symptomatic asthma (18%) compared to White (10%) or Hispanic (8%) children. Although it was not a statistically significant difference, Black children also reported the highest rates of asthma episodes/attacks and emergency room/urgent care visits in the past year.

A substantial amount of research has documented racial and ethnic disparities with regards to childhood asthma. Nationally, non-Hispanic black children have a substantially higher prevalence of asthma and a higher number of asthma attacks (NCHS, 2005; Smith et al., 2005). The prevalence gap between white and black children widened progressively from 1980 to the mid-1990s (Akinbami and Schoendorf, 2002). Black children with asthma have also been found to have more severe asthma as evidenced by greater physical limitations, asthma related hospitalization rates, emergency room visits, and mortality rates (Akinbami and Shoendorf, 2002; Boudreaux et al., 2003; Lozano et al., 1995; Smith et al., 2005).

Although some research has found that Hispanic children have the same or lower asthma prevalence compared with white children (Akinbami and Shoendorf, 2002; Lieu et al., 2002; NCHS, 2005), other research has explored the heterogeneous Hispanic population residing in the United States and finds that certain subpopulations, such as Puerto Ricans, have significantly higher rates of asthma whereas Mexicans appear to have lower than average rates (Lara et al. 2006). In Los Angeles County, Hispanics were more likely than non-Hispanic whites to report physical activity limitations and a need for urgent care associated with asthma (Simon et al., 2003).

One concern regarding racial disparities is whether minority children have sufficient access to

preventive care for asthma. Researchers found that after controlling for numerous risk factors, black and Hispanic children with asthma received fewer preventive medications compared with white children (Lieu et al., 2002; Ortega et al., 2002). In addition, compared with white children, minority children were less likely to receive high-quality preventive care for asthma (Finkelstein et al., 1995). For Hispanic children in particular, language barriers can contribute to poor asthma management (Chan et al, 2005). Despite these differences, there was no significant difference in the rates in which education on how to avoid making asthma worse was provided across different racial groups.

Males have higher rates of asthma diagnoses compared to females, yet measures of asthma severity such as asthma attacks or emergency room/urgent care visits do not vary significantly by gender and rates of asthma self-management education are similar between the two groups. Similarly, blacks have higher rates of asthma diagnoses compared to whites and Hispanics, yet measures of asthma severity and rates of asthma self-management education do not vary significantly by race. Therefore it does not appear that there are current disparities in asthma severity or in asthma self-management education that would be affected by AB 264. Thus, AB 264 is not expected to affect gender or racial disparities in asthma management.

Reduction of Premature Death and the Economic Loss Associated with Disease (Section 1C)

A literature review was conducted to determine the extent to which childhood asthma results in premature death and economic loss to California and whether AB 264 might have an impact on these outcomes.

Mortality among children with asthma is relatively rare. In 2002, the National Center for Health Statistics report that there were 0.3 deaths due to asthma per 100,000 children. In California in 2002, 23 deaths due to asthma were reported among children 1–19 years and 458 deaths were reported among the entire population, including adults (CDC, 2006). The Medical Effectiveness section of this report summarizes how pediatric asthma management programs have been found to improve health outcomes. However, reductions in childhood mortality are not examined as a potential health outcome since mortality is such a rare occurrence among this population. As a result, we are not able to determine whether AB 264 would have any impact on premature death associated with childhood asthma.

The economic loss associated with childhood asthma consists of the direct costs discussed in the Utilization, Cost, and Coverage Impacts section and the indirect costs related to a reduction in productivity. For childhood asthma, the productivity losses are due primarily to lost workdays for caregivers of children with asthma. A few studies have examined caregiver productivity losses due to childhood asthma. Two studies have calculated the indirect costs of asthma in the United States due to caregiver time associated with missed school among children ages 5 to 17 years (Smith et al., 1997; Weiss et al., 2000). The calculated annual cost (in 1994 dollars) of caregiver productivity losses due to childhood asthma was $194.5 million in one study and $956.7 million ($191.4 per child with asthma) in the other. The difference in these estimates are due to the use of different data sources for estimating the number of missed school days and substantially different estimates in valuation of caregiver time (Smith et al., 1997; Weiss et al.,

2000).

This analysis has found over 40,000 missed school days per year would be averted with the passage of AB 264. As a result, there could be productivity gains in California through a decrease in lost workdays of caregivers. The extent that these productivity gains would be realized, however, is unclear since there is ambiguous evidence regarding caregiver workdays as an outcome in examining the effectiveness of pediatric asthma management programs (Georgiou et al., 2003; Kreiger et al., 2005; Tinkelman and Schwartz, 2004).

TABLES

Table 2. Current Coverage of Pediatric Asthma Self-Management Training and Education

Type of Education or Training	Percent Covered
Education materials to patient or guardian	
Paper form	100%
Electronic form	100%
Individual health education	
Toll-free automated number	100%
Toll-free advice	100%
Computer-based health management	83%
Group health education classes to patient or guardian	50%
Self-management training and education	
Initial office visit	100%
Follow-up office visit	83%
Follow-up with other provider	83%
Home-based visit, provider	33%
School-based visit, provider	0%

Source: CHBRP Questionnaire to Health Plan on Current Coverage for AB 264.

Table 3. Baseline (Pre-Mandate) Per Member Per Month Premium and Expenditures, California, Calendar Year 2006, by Insurance Plan Type

	Large Group		Small Group		Individual		CalPERS	Medi-Cal		Healthy Families	
	HMO	PPO	HMO	PPO	HMO	PPO	HMO	HMO 65 yrs and Over	HMO Under 65 yrs	HMO	Total Annual
Population currently covered	8,237,000	—	2,593,000	—	984,000	—	782,000	339,000	2,423,000	714,000	16,072,000
Average portion of premium paid by employer	$202.76	$292.75	$189.45	$235.81	$0.00	$0.00	$248.33	$265.00	$112.00	$75.20	$33,245,805,000
Average portion of premium paid by employee	$62.47	$77.87	$74.62	$49.58	$257.58	$137.75	$43.82	$0.00	$0.00	$4.80	$11,990,041,000
Total Premium	**$265.23**	**$370.62**	**$264.07**	**$285.39**	**$257.58**	**$137.75**	**$292.16**	**$265.00**	**$112.00**	**$80.00**	**$45,235,846,000**
Covered benefits paid by member (deductibles, copays, etc.)	$9.39	$50.08	$15.90	$42.40	$15.68	$32.14	$10.35	$0.00	$0.00	$2.18	$1,724,145,000
Benefits not covered	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0
Total Expenditures	**$274.62**	**$420.70**	**$279.97**	**$327.79**	**$273.26**	**$169.89**	**$302.51**	**$265.00**	**$112.00**	**$82.18**	**$46,959,990,000**

Source: California Health Benefits Review Program, 2006.
Note: The population includes individuals and dependents in California who have private insurance (group and individual) or are enrolled in public plans subject to the Health and Safety Code, including CalPERS, Medi-Cal, or Healthy Families.
All population figures include enrollees aged 0–64 years and enrollees 65 years or older covered by employment-based coverage.
Employees and their dependents who receive their coverage from self-insured firms are excluded because these plans are not subject to mandates.
Key: CalPERS = California Public Employees' Retirement System; HMO = health maintenance organization and point of service plans; PPO = preferred provider organization and fee-for-service plans.

Table 4. Post-Mandate Impacts on Per Member Per Month and Total Expenditures, California, Calendar Year 2006, by Insurance Plan Type

	Large Group		Small Group		Individual		CalPers	Medi-Cal		Healthy Families		
	HMO	**PPO**	**HMO**	**PPO**	**HMO**	**PPO**	**HMO**	**HMO 65 yrs and Over**	**HMO Under 65 yrs**	**HMO**	**Total Monthly (PMPM)**	**Total Annual**
Population currently covered	8,237,000	—	2,593,000	—	984,000	—	782,000	339,000	2,423,000	714,000	16,072,000	16,072,000
Average portion of premium paid by Employer	$0.0176	$0.0000	$0.0170	$0.0000	$0.0000	$0.0000	$0.0181	$0.0000	$0.0384	$0.0460	$0.0205	$3,946,000
Average portion of premium paid by employee	$0.0054	$0.0000	$0.0067	$0.0000	$0.0172	$0.0000	$0.0032	$0.0000	$0.0000	$0.0029	$0.0052	$1,002,000
Total Premium	**$0.0230**	**$0.0000**	**$0.0237**	**$0.0000**	**$0.0172**	**$0.0000**	**$0.0213**	**$0.0000**	**$0.0384**	**$0.0489**	**$0.0257**	**$4,948,000**
Covered benefits paid by member (deductibles, copays, etc.)	$0.0008	$0.0000	$0.0014	$0.0000	$0.0010	$0.0000	$0.0008	$0.0000	$0.0000	$0.0013	$0.0008	$156,000
Benefits not covered	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000
Total Expenditures	**$0.0238**	**$0.0000**	**$0.0251**	**$0.0000**	**$0.0183**	**$0.0000**	**$0.0221**	**$0.0000**	**$0.0384**	**$0.0502**	**$0.0265**	**$5,103,000**
Percentage Impact of Mandate												
Insured premiums	0.009%	0.000%	0.009%	0.000%	0.007%	0.000%	0.007%	0.000%	0.034%	0.061%	0.011%	0.011%
Total expenditures	0.009%	0.000%	0.009%	0.000%	0.007%	0.000%	0.007%	0.000%	0.034%	0.061%	0.011%	0.011%

Source: California Health Benefits Review Program, 2006.
Note: The population includes individuals and dependents in California who have private insurance (group and individual) or are enrolled in public plans subject to the Health and Safety Code, including CalPERS, Medi-Cal, or Healthy Families.
All population figures include enrollees aged 0–64 years and enrollees 65 years or older covered by employment-based coverage.
Employees and their dependents that receive their coverage from self-insured firms are excluded because these plans are not subject to mandates.
Key: CalPERS = California Public Employees' Retirement System; HMO = health maintenance organization and point of service plans; PPO = preferred provider organization and fee-for-service plans.

Table 5. Health Outcomes Related to Asthma Management in Children (ages 1–17 Years) in Health Maintenance Organizations and Point-of-Service Plans, California, Estimates for Calendar Year 2006

Public Health Measure	Baseline Rates	Change Based on Effectiveness Review*	Change as a Result of AB 264
School absences	1.1 mean days/month	–10%	–4,500 days/month
Restricted activity days	70.6% of children	–25%	–8,900 children
Emergency room visits	3.5% children	–28%	–500 children
Hospitalizations	1.0% of children	–16%	–80 children hospitalized

Sources: California Health Benefits Review Program, 2006. School absences and restricted activity are from direct analysis of 2001 CHIS data; emergency room visits and hospitalizations are based on estimates provided by Milliman.
Note: The number of children to whom AB 264 applies is 503,000. This represents the number of children with symptomatic asthma (i.e., experienced asthma symptoms in the last year) in health plans subject to the mandate.
*It is estimated that 10% of children with asthma who are presently covered will newly use the benefit following the mandate (i.e., 50,300 ages 1–17 years or 40,800 school-aged 5–17 years).

Table 6: Asthma Prevalence and Related Information by Gender in Children 1–17 Years with Health Insurance Coverage, California, 2003

Variable	All (95% Confidence Interval)	Males (95% Confidence Interval)	Females (95% Confidence Interval)
Ever diagnosed with asthma	15.8% (14.8–16.8)	18.2% (16.7–19.6)	13.3% (12.0–14.6)
Had asthma episode/attack in past 12 months*	37.2% (34.0–40.5)	37.5% (33.2–41.7)	36.9% (31.9–41.9)
Emergency room/urgent care visit for asthma in past 12 months**	21.6% (18.1–25.0)	24.0% (19.3–28.7)	18.3% (13.5–23.1)
Physician ever provided information on how to avoid asthma getting worse***	55.6% (50.1–61.1)	55.7% (48.0–63.4)	55.4% (47.7–63.1)

Source: California Health Interview Survey, 2003. Respondents 1–17 years with health insurance coverage (employer-sponsored, privately purchased, CHIP, and Medicaid), n = 8.2 million.
*Asked of respondents who have been told by a doctor that they have asthma (n = 1,300,000).
**Asked of respondents who have been diagnosed with asthma and who report they still have asthma and/or report that they had an episode/attack within the past 12 months (n = 851,000).
***Sample limited to those who reported experiencing asthma symptoms in the past 12 months (only asked of adolescents aged 12–17 years) (n = 320,000).

Table 7: Asthma Prevalence and Related Information by Race in Children 1–17 Years with Health Insurance Coverage, California, 2003

Variable	All (95% Confidence Interval)	White (95% Confidence Interval)	Black (95% Confidence Interval)	Hispanic
Ever diagnosed with asthma	15.8% (14.8–16.8)	15.9% (14.6–17.2)	24.2% (19.5–28.9)	14.0% (12.3 – 15.7)
Had asthma episode/attack in past 12 months*	37.2% (34.0–40.5)	37.9% (33.6–42.1)	44.7% (33.6–55.8)	32.1% (26.0 – 38.2)
Emergency room/urgent care visit for asthma in past 12 months**	21.6% (18.1–25.0)	18.8% (14.3–23.3)	33.3% (21.8–44.8)	24.7% (17.4 – 32.0)
Physician ever provided information on how to avoid asthma getting worse***	55.6% (50.1–61.1)	54.5% (47.8–61.2)	50.9% (31.0–70.9)	62.6% (51.0 – 74.1)

Source: California Health Interview Survey, 2003. Respondents 1–17 years with health insurance coverage (employer-sponsored, privately purchased, CHIP, and Medicaid), n = 8.2 million.
*Asked of respondents who have been told by a doctor that they have asthma (n = 1,300,000).
**Asked of respondents who have been diagnosed with asthma and who report they still have asthma and/or report that they had an episode/attack within the past 12 months (n = 851,000).
***Sample limited to those who reported experiencing asthma symptoms in the past 12 months (only asked of adolescents aged 12–17 years) (n = 320,000).

APPENDICES

Appendix A: Literature Review Methods

Assembly Bill 264 (AB 264) would require that all health care service plans regulated and licensed by the California Department of Managed Care (DMHC), as provided in the Knox-Keene Health Care Services Plan Act of 1975, that cover outpatient prescription drug benefits include coverage for pediatric asthma self-management training and education necessary to enable an enrollee to properly use the medications and devices prescribed for the treatment of pediatric asthma.

AB 264 defines pediatric asthma self-management training and education as those services "prescribed by a participating health care professional legally authorized to prescribe the services," including, but not limited to "instruction that will enable pediatric asthmatic patients and their families to gain an understanding of the disease process and the daily management of asthma in order to avoid frequent hospitalizations and complications."

AB 264 also requires that these services be provided "under the supervision of an appropriately licensed or registered health care professional." This provision applies to services provided directly by the health plan as well as services provided under contract with an outside organization.

Appendix A describes the methods used in the literature review for AB 264: Pediatric Asthma Self-Management Training and Education. The literature review for AB 264 updates literature reviews that CHBRP conducted for AB 1549 introduced in 2003 and AB 2185 introduced in 2004, two bills with provisions on childhood asthma self-management training and education. Only articles published in 2004 and 2005 after these reviews were completed were retrieved because the previous CHBRP literature reviews encompassed all relevant literature published earlier.

This literature review included meta-analyses, systematic reviews, randomized controlled trials, controlled clinical trials, and observational studies. The PubMed, CINAHL, and Cochrane databases, including the Cochrane Database of Systematic Reviews and the Cochrane Central Register of Controlled Trials (CENTRAL), were searched.

The scope of the literature search included effects of self-management education interventions and written asthma action plans on health, disability, utilization, quality of life, and intermediate outcomes for children with asthma. The search was limited to abstracts published in English and to studies of children, defined as subjects aged 0–18 years. Trials that included adults with asthma were excluded unless sub-group analyses were performed for children. Only individual trials conducted in the United States were included in the review because "usual care" for asthma may vary across nations and because utilization of types of health care services, such as emergency room visits, may vary across nations with differing types of health care systems. Due to the difficulty of distinguishing between educational and self-management interventions, any trial in which the intervention included an educational or self-management component was reviewed.

At least two reviewers screened the title and abstract of each citation returned by the literature search to determine eligibility for inclusion. Full text articles were obtained and reviewers reapplied the initial eligibility criteria.

Sixty-three articles were obtained and reviewed in this update review for AB 264. Forty-nine articles were not included in the analysis of AB 264 for the following reasons: no abstract was available; published only in abstract form (e.g., abstract of a conference presentation); unsystematic summary of the literature; inadequate program description (i.e., no data analysis reported); conducted outside the United States; subjects were not children; intervention not targeted toward children and caregivers (e.g., targeted toward physicians); intervention not delivered by health care personnel; did not address asthma self-management training and education (e.g., addressed prevention of asthma, prevalence of asthma, risk factors associated with asthma, use of asthma medications); or addressed asthma self-management training and education, but did not address medical effectiveness (e.g., addressed cost, barriers to implementation).

Due to a lack of sufficient evidence, the effectiveness of the various components of self-management training or education programs could not be determined, nor was it possible to ascertain whether a specific intervention program was better than another. Accordingly, the conclusions drawn with respect to interventions affecting each outcome measure do not concern *components* of interventions, only *entire* interventions.

Through the literature search, two recent meta-analyses published in the Cochrane Database of Systematic Reviews were identified. One meta-analysis, entitled "Educational Interventions for Asthma in Children" included 32 trials published between 1980 and 1998. The second meta-analysis, entitled, "Interventions for Educating Children who have Attended the Emergency Room for Asthma," included eight trials published between 1985 and 1999, in which the subjects were children who had had an emergency room visit for asthma. Meta-analysis can be defined as "quantitative statistical analysis that is applied to separate but similar experiments of different and usually independent researchers and that involves pooling the data and using the pooled data to test the effectiveness of the results" (Merriam-Webster). Results from the meta-analyses were given substantial weight in decisions about the effectiveness of asthma self-management training and education interventions because the authors of the meta-analyses applied rigorous methodological criteria prior to the inclusion of each article in their analyses.

Of the individual trials analyzed, the results of randomized controlled trials were given more weight than nonrandomized trials. In nonrandomized trials, intervention and control groups are often not equivalent prior to the intervention, which can bias the trial's results. This is less likely to occur in randomized controlled trials because randomization should ensure that the intervention and control groups are equivalent prior to the intervention and, thus, increase the likelihood that differences in outcomes for the intervention and control groups are due to exposure to the intervention and not to other differences between the groups.

Trials fell into three broad groupings. The first involved before and after comparisons of intervention and control groups, reporting four sets of measures. The second grouping provided

"after" measures for intervention and control groups, implicitly assuming that the "before" values were the same because randomization process was adequate. A third group consisted of a few studies that reported before and after measures for an intervention group without a control group.

The asthma self-management training and education interventions varied widely across the studies. In some cases the intervention focused on the use of medical devices used to dispense asthma medications, such as metered-dose inhalers (e.g., Minai et al., 2004) or nebulizers (e.g., Butz, Syron, et al., 2005). In other cases the intervention, emphasized mitigation of exposure to household environmental risk factors for asthma symptoms such as dust mites, cockroaches, and rodents (e.g., Krieger et al., 2005). In still other cases, the intervention provided children and their caregivers with education about multiple topics relevant to asthma self-management (e.g., Butz, Pham, et al., 2005; Clark et al., 2004; Evans et al, 1999, Horner, 2004; Shames et al., 2004)

The control groups also varied across the studies. In most cases, the control group received "usual care" for asthma, which means that they did not receive any asthma self-management training or education above and beyond what they might otherwise receive from their primary care practitioner or other asthma care provider. "Usual care" may vary across children enrolled in a study, but the studies do not provide sufficient information for us to determine the magnitude of variation. In other cases, the control group received a less intensive or less comprehensive intervention (e.g., Butz, Syron, et al., 2005; Greineder et al., 1999; Huss et al., 2003; Krieger et al. 2005; Krishna et al. 2003; Kubly and McClellan, 1984; Lewis et al., 1984) or a different intervention (Homer et al., 2000; Yoos et al., 2002). Studies in which the control group received some sort of intervention were excluded from our quantitative estimates of the effects of asthma self-management training and education.

The trials were conducted in a variety of settings. Among individual trials, 10 trials were carried out in schools, a setting in which health plans typically do not cover services. Twenty-one trials were conducted in primary care or specialty outpatient clinics. In nine trails, the intervention consisted of visits to children's homes to provide education to children and/or their parents. Ten trials involved one or more telephone calls with children's parents. In one trial, children used a device that connected to the Internet through their home telephones. One trial conducted classes for parents in libraries (as well as classes in schools for children). Articles describing four trials did not indicate the setting in which the trial took place. The number of settings exceeds the number of trials because many trials delivered the intervention in more than one setting (e.g., outpatient clinic and home).

The asthma self-management training and education interventions were delivered by a variety of providers. In some cases, the provider was not a licensed or registered health professional and the article did not provide sufficient information to determine whether the provider was supervised by a licensed or registered health professional. Among individual trials, nurses were the most common providers, furnishing interventions in 23 trials. Other licensed health professionals who delivered interventions included physicians (four trials), nurse practitioners (three trials), and respiratory therapists (three trials). In two trials, the intervention was provided by a health educator. Five trials involved providers with training and/or experience in mental health or social services. In two trials, the intervention was delivered by an educator, either a

teacher or a research assistant with a master's degree in education. Eight trials involved interactive, educational computer games that children were expected to play on their own. In four of the computer game trials, the child also received education from a licensed health professional or unlicensed asthma educator, and in four cases the child learned about asthma self-management solely through the game. In five cases, the articles did not provide sufficient information to ascertain who provided the intervention. The total number of provider types exceeds the number of trials because in some trials the intervention was delivered by more than one type of provider (e.g., physicians and nurses).

To "grade" the evidence for all outcome measures, the CHBRP effectiveness team uses a system[14] with the following categories:

1. Favorable (statistically significant effect): Findings are uniformly favorable, and many or all are statistically significant.
2. Pattern[15] toward favorable (but not statistically significant): Findings are generally favorable, but there may be none that are statistically significant.
3. Ambiguous/mixed evidence: Some findings are significantly favorable, and some findings with sufficient statistical power show no effect.
4. Pattern toward no effect/weak evidence: Studies generally find no effect, but this may be due to a lack of statistical power.
5. No effect: There is statistical evidence of no clinical effect in the literature with sufficient statistical power to make this assessment.
6. Unfavorable: No findings show a statistically significant benefit, and some show significant harms.
7. Insufficient evidence to make a "call": There are very few relevant findings, so that it is difficult to discern a pattern.

The search terms used to locate studies relevant to the AB 264 were as follows:

Medical Subject Headings (MeSH) for searching PubMed and Cochrane:

Asthma
Asthma/economics/education/therapy
Cost–benefit analysis
Counseling
Health care costs
Health education
Outcome assessment (health care)
Outcome of education
Patient education
Program evaluation

[14] The foregoing system was adapted from the system used by the U.S. Preventive Services Task Force, available at http:www.ahcpr.gov/clinic/3rduspstf/ratings.htm. The medical effectiveness team also considered guidelines from the Centers for Medicare & Medicaid Services (available at htttp://www.cms.hhs.gov//FAC?02-MCAC.asp.#and guidelines from the Blue Cross and Blue Shield Association (available at http://www.bcbs.com/tec/teccriteria.html).
[15] In this report, the word "trend" may be used synonymously with "pattern."

Quality of life
School health services
Self care

Publication types:

Meta-analysis
Randomized controlled trial
Clinical trial
Practice guidelines
Multicenter study

Keywords:

Below is a list of keywords used in the search to retrieve recently published articles that have not been indexed with MeSH terms.

asthma, asthma (education or educational) intervention*, asthma (educational or education) plan, asthma (education or educational) program*, asthma (education or educational), child, children, childhood, clinical trial*, cost*, cost effective*, (counsel*), health education, home-based, nurse*, meta-analysis, multicenter study, outcome*, patient education , pediatric asthma, practitioner-based, program evaluation, quality of life, randomized controlled trial*, school-based

All PubMed searches were limited to a specific age group using the Age Group Limit option: All Child (0-18 years).
* truncation

CINAHL

Below is a list of CINAHL subject headings and keywords used to search CINAHL.

Subject Headings:

Adolescence
Asthma
Asthma/economics/education/therapy
Explode Child [1]
Clinical trials
Costs and cost analysis
Health care costs
Health education
Outcomes of education
Outcomes (health care)
Outcome assessment

Patient education
Program evaluation
School health education
School health education/evaluation
Systematic reviews

Keywords:

asthma (education or educational) intervention*, asthma (educational or education) plan, asthma (education or educational) program*, asthma (education or educational), Meta-analysis, randomized controlled trial* , Explode Child[1]

*truncation
Explode Child[1] All narrower index terms underneath of Child were automatically searched.

APPENDIX B

Summary of Medical Effectiveness Findings on Pediatric Asthma Self-Management Training and Education

Appendix B presents detailed information on medical effectiveness findings on pediatric asthma self-management training and education in two tables.

Table B-1 is a summary of the published studies on pediatric asthma self-management training and education reviewed for AB 264 and of earlier studies reviewed for AB 1549 and AB 2185. The table includes study citations and descriptions of the types of trials, intervention and control groups, populations studied, and locations in which studies were conducted.

Table B-2 is a summary of the evidence of medical effectiveness of asthma self-management training and education interventions by outcome, including the citation, the results, and the categorization of results.

These tables include the 13 studies obtained from the current literature review as well as 32 studies assessed in CHBRP's previous reports on childhood asthma self-management training and education.

Full bibliographic information can be found in the list of references at the end of this report.

Table B-1. Summary of Published Studies on Pediatric Asthma Self-Management Education and Training

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Haby et al., 2001	**Meta-analysis of 8 randomized controlled trials and controlled clinical trials**	**Interventions included interactive communication of information about asthma, self-monitoring of symptoms, and/or written asthma action plans vs. usual care (7 trials) or low-intensity education (1 trial)**	**Children aged 0-18 years with an emergency room visit for asthma**	**United States, New Zealand, United Kingdom**
Wolf et al., 2003	Meta-analysis of 32 randomized controlled trials and controlled clinical trials	Interventions included group education, individual education, and/or asthma self-management strategies	Children aged 2-18 years	United States, Australia, Canada, Germany, Israel, Italy, Netherlands, New Zealand, Sweden, United Kingdom
Alexander et al., 1988*	Randomized controlled trial	Education, management, vs. usual care	No consistent source for asthma management other than emergency room (primarily low-income)	Memphis
Bartholomew et al., 2000	Randomized controlled trial	Computer-assisted instructional game (self-management education) vs. usual care	Total sample, 6.8% health maintenance organization, 6.8% Medicare, 48.3% Medicaid, 6.8% self-pay, 31.4% none	Inner-city Texas
Bonner et al., 2002	Randomized controlled trial	Education and management (diary, peak flow meter) vs. usual care	Almost 85% of families received Medicaid or had no insurance, urban families	New York

Notes: Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).

*Study included in Wolf et al. (2003) meta-analysis.

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Brown et al., 2002	Randomized controlled trial	Education vs. usual care	More than 80% received Medicaid (84% in intervention group)	Metro Atlanta
Butz, Pham, et al., 2005	**Nested design**	**A school-based educational intervention that consisted of 2 two-hour sessions for children and 1 one-hour session for caregivers vs. written materials about asthma**	**Children diagnosed with asthma; recruited from rural elementary schools; aged 6-12 years; children from multiple racial/ethnic groups**	**Rural areas in Maryland**
Butz, Syron, et al., 2005	**Randomized controlled trial**	**Six home visits focused on educating caregivers on identification and treatment of asthma symptoms, especially use of nebulizers, vs. three home visits that address use of a peak flow meter and asthma action plans**	**Children diagnosed with asthma who used a nebulizer to administer at least one asthma medication; recruited from university-affiliated primary care practices, specialty pediatric practices and pediatric emergency rooms; aged 2-8 years; lived in inner-city areas; 89% were African-American**	**Baltimore**

Notes: Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).
*Study included in Wolf et al. (2003) meta-analysis.

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Catov et al., 2005	**Observational study – untreated comparison group with pre/post test and one group pre/post test analyses**	**Home visits by a respiratory therapist vs. usual care**	**Persons who had one or more hospitalizations or three or more emergency room visits with a primary diagnosis of asthma; recruited enrollees in a managed care plan; 59% of subjects were children – subgroup analyses for children only are reported; all enrolled in Medicaid; included African-American and European-American children**	**Western Pennsylvania – rural and urban areas**
Christiansen et al., 1997*	Observational study - untreated comparison group with pre/post test	Education, management vs. usual care	Inner-city	San Diego
Clark et al., 2004	**Nested design**	**Comprehensive, school-based educational intervention for children and caregivers vs. usual care (control group received the intervention after the trial was completed)**	**Children whose caregivers reported a diagnosis of asthma and active asthma symptoms or use of asthma medication, or no diagnosis but reported 3 or more of 7 asthma symptoms in the previous year or either of two exercise-related asthma symptoms; recruited from schools in urban areas with high asthma prevalence; grades 2-5; 54% lived in families with incomes of less than $15,000; 98% were African-American**	**Detroit**

45 **Notes:** Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).
*Study included in Wolf et al. (2003) meta-analysis.

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Clark et al., 1986*	Randomized controlled trial	Education, management vs. usual care	Low-income urban children	New York City
Evans et al., 1999	**Randomized controlled trial**	**Group and individual education and telephone calls for caregivers plus group education for children vs. usual care**	**Children diagnosed with asthma who used at least 2 asthma medications, had at least one asthma hospitalization, or had at least one unscheduled physician visit during the six months prior to recruitment, or who had respiratory symptoms for two days or nights during the two weeks prior to recruitment; aged 5-11 years; lived in inner-city census tracts where at least 20% of the population was below 100% of poverty; African-American and Hispanic children and children from other racial/ethnic groups**	**Baltimore, Chicago, Cleveland, Detroit, New York, St. Louis, Washington, DC**
Evans et al., 1987*	Nested design	School-based education, management vs. usual care	Low-income (71% received Medicaid or other public assistance)	New York City
Fireman et al., 1981*	Controlled clinical trial - sequential assignment	Education, management vs. usual care	Selected from pediatric allergist's office and Allergy Clinic of Children's Hospital	Pittsburgh, PA
Georgiou et al., 2003	Nested design	Education and management (w/peak flow meter) vs. (no control)	Pediatric asthmatic members and caregivers of United Healthcare (national health care organization)	Multiple states within the United States

Notes: Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).
*Study included in Wolf et al. (2003) meta-analysis.

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Greineder et al., 1999	Randomized controlled trial	In-person education for children and family members, written asthma action plan, and follow-up telephone calls vs. in-person education and written asthma action plan	Selected from urban health centers of Harvard Pilgrim Health Care (health maintenance organization)	New England
Guendelman et al., 2002	Randomized controlled trial	Education and management w/Health Buddy vs. asthma diary	Intervention 92% public, 8% private. Control group 93% public, 6% private	Oakland, CA
Harish et al., 2001	Randomized controlled trial	Asthma clinic (w/education, action plan) vs. usual care	Low-income, inner-city population	New York (Bronx)
Homer et al., 2000	Randomized controlled trial	Educational computer game (designed to teach management) vs. written educational materials	Adolescents 13.3% of total sample had private insurance	Boston
Horner, 2004	**Nested design**	**School-based group education program vs. usual care**	**Children diagnosed with asthma; grades 3-5; 46% were from poor or working-class families; African-American, Mexican-American, and European-American children**	**United States – article does not mention a specific state or city**
Huss et al., 2003	Randomized controlled trial	Education and computer-based instructional asthma game and written educational materials vs. written educational materials	Inner-city children	Baltimore

Notes: Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).
*Study included in Wolf et al. (2003) meta-analysis.

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Kelly et al., 2000	Controlled clinical trial – alternating assignment	Education in clinic and management (w/written action plan) vs. usual care	All children were covered by Medicaid	Norfolk, VA
Krieger et al., 2005	**Randomized controlled trial**	**Seven visits from a community health worker plus full resources (e.g., bedding encasements, low-emission vacuums, rodent traps, allergy tests) vs. one visit and limited resources (i.e., only bedding encasements)**	**Households containing at least one child whose caregiver reported persistent asthma symptoms, and whose medical record indicated a diagnosis of asthma or who had at least one emergency room or hospital visit for asthma; recruited from clinics, hospitals, emergency rooms, and referrals from agencies and community residents; aged 4-12 years; all enrolled in Medicaid and/or lived in households with incomes below 200% of poverty; caregivers spoke English, Spanish, or Vietnamese**	**Seattle**
Krishna et al., 2003	Randomized controlled trial	Internet-enabled, interactive, multimedia asthma education program, in-person education, written educational materials, and written asthma action plan vs. in-person education, written educational materials, and written asthma action plan	Participants were children who visited a pediatric pulmonary clinic	Missouri

Notes: Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).
*Study included in Wolf et al. (2003) meta-analysis.

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Kubly and McClellan, 1984*	Randomized controlled trial	Factual information about asthma, self-care skills, and breathing exercises vs. factual information about asthma	Mostly Anglo American, median family income $20,000- $30,000	Southwestern United States
LeBaron et al., 1985*	Randomized controlled trial	Education vs. usual care	Patients at private pediatric allergy practices; low-to-middle-income or higher	San Antonio, TX
Lewis et al., 1984*	Randomized controlled trial	Five, one-hour, interactive asthma education classes provided to groups of 5 to 7 children and their parents_vs. three, 1.5-hour asthma education lectures provided to groups of 12 to 25 persons.	Patients of the Southern California Permanente Medical Group	Los Angeles
Lukacs et al., 2002	Observational study - untreated comparison group with pre/post test	Education, management (written action plan) vs. usual care	Kaiser Permanente members.	Colorado
Minai et al., 2004	**Observational study – one group pre/post design**	**Education re proper use of metered dose inhalers (no control group – pre/post study)**	**Children referred to a pediatric asthma education clinic at an inner-city hospital; older than age 4; African-American, Hispanic, and European-American children**	**Cleveland**
Parcel et al., 1980*	Observational study – untreated comparison group	School-based education vs. usual care	Mostly African American, low-middle to lower socioeconomic status	Galveston, TX

Notes: Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).
*Study included in Wolf et al. (2003) meta-analysis.

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Perrin et al., 1992	Randomized controlled trial	Education and stress management program vs. usual care	Predominantly white, middle-to-upper-class	Boston
Persaud et al., 1996*	Randomized controlled trial	Education, management vs. usual care	69% Medicaid -	Galveston, TX
Rubin et al., 1986*	Randomized controlled trial	Educational asthma computer game vs. brief verbal instructions	Children were patients at Yale-New Haven Hospital, Hospital of St. Raphael, Yale Health Plan (university-based health maintenance organization), Community Health Care Plan (private health maintenance organization), or private pediatrician's office	New Haven, CT
Shames et al., 2004	**Randomized controlled trial**	**Multi-component asthma education intervention that included a video game vs. usual care**	**Children diagnosed with moderate-to-severe asthma whose parents reported significant asthma symptoms and had at least one hospitalization or two acute care or emergency room visits for asthma during the previous year; aged 5-12 years; lived in low-income urban areas; over 70% enrolled in Medi-Cal; African-American, Hispanic children, and children from other racial/ethnic groups**	**San Francisco and San Jose, California**
Shegog et al., 2001	Randomized controlled trial	Computer-assisted instruction game designed to teach self-management vs. conventional education	Recruited from clinics and schools in a large urban area	Texas
Shields et al., 1990*	Randomized controlled trial	Education vs. usual care	Drawn from urban health maintenance organization	Chicago

Notes: Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).

*Study included in Wolf et al. (2003) meta-analysis.

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Tinkelman and Schwartz, 2004	**Observational study – one group pre/post design**	**School-based asthma education program plus an interactive web site (no control group – pre/post study)**	**Children diagnosed with asthma; aged 5-15 years; enrolled in urban elementary or middle schools; most from low-income families; most children are Latino**	**Denver, Colorado and Carrollton, Texas (in Dallas metropolitan area)**
Velsor-Friedrich et al., 2005	**Nested design**	**Participation in Open Airways, a school-based intervention, and five follow up visits with a nurse practitioner vs. no intervention**	**Children diagnosed with asthma; recruited from schools; aged 8-13 years; resided in inner city neighborhoods**	**Large city in the midwestern United States**
Velsor-Friedrich et al., 2004	**Nested design**	**Participation in Open Airways, a school-based intervention vs. no intervention**	**Children diagnosed with asthma; recruited from schools; aged 8-13 years; resided in inner city neighborhoods**	**Large city in the midwestern United States**
Whitman et al., 1985*	Two designs: Randomized controlled trial for school age children and observational study with one group pre/post design for preschool children	Education, management vs. usual care	School-aged, preschool (no control); referred by private physicians	Utah
Wilson et al., 1996*	Randomized controlled trial	Education, management vs. usual care	Mothers were relatively well-educated (52% graduated from college), 10.7% minority	St. Paul, MN

Notes: Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).

*Study included in Wolf et al. (2003) meta-analysis.

Citation	Type of Trial	Intervention vs. Control Group	Population Studied	Location
Yoos et al., 2002	Randomized controlled trial	Education about asthma plus one of three interventions for monitoring asthma symptoms: (1) subjective symptom monitoring, (2) peak expiratory flow rate (PEFR) monitoring when symptomatic, (3) PEFR monitoring twice daily and when symptomatic	Recruited from diverse primary care settings	New York

Notes: Studies in bold were published after the literature review for CHBRP's earlier reports on asthma self-management education and training (i.e., studies published in 2004 or 2005).
*Study included in Wolf et al. (2003) meta-analysis.

Table B-2. Summary of Evidence of Medical Effectiveness of Pediatric Asthma Self-Management Training and Education Interventions by Outcome

School absences (% patients)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Wolf et al., 2003 (meta-analysis,n = 1 trial)	OR 0.78 [0.36, 1.66]	NS, fav
Georgiou et al., 2003 (pre/post, n = 401 children)	36%→23% (missed 1 or more days in past month)	Sig, fav
Guendelman et al.,2002 (RCT, n = 134 children) §	%/6 weeks: Int pre 52%→ post 44%, control pre 15%→post 22%	NS, fav
Krieger et al., 2005 (RCT, n = 214 children) ±	**% with one or more sick days/2 weeks—int pre 31.1→post 12.2, control pre 28.4→post 20.3; Probability of having a sick day in 2 weeks: OR 0.46 [-1.70, 0.16]**	**NS, fav**

School absences (mean days)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Wolf et al., 2003 (meta-analysis, n = 16 trials)	SMD –0.14 [–0.23, –0.04]	Sig, fav
Christiansen et al., 1997* (nested design, n = 52 children, 4 schools)	Mean int post 2.39, control post 2.98	NS, fav
Clark et al., 2004 (nested design, n = 835 children, 14 schools) ±	**Sick days/3 months: 34% lower in the intervention group than in control group; Sick days/12 months: 8% lower in the intervention group**	**Sig, fav**
Evans et al., 1987* (nested design – n = 239 children, 12 schools)±	Absences/year: int pre 21.3→post 19.4, control pre 20.8→post 19.7	NS, fav
Fireman et al., 1981*	Mean int post 0.5, control post 4.6	Sig, fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
(CCT, n = 26 children)		
Horner, 2004 (nested design – n = 44 children, # schools not reported)±	**Sick days/12 months—Int pre 3.98→post 4.09, control pre 4.35→post 3.78**	**NS, not fav**
Krishna et al., 2003 (RCT – n = 228 children)**±§**	Int pre 7.9→post 1.4, control pre 6.4→post 5.4	Sig, fav
Perrin et al., 1992* (RCT, n = 56 children)±	No/month—int pre 0.73→post 0.24, control pre 0.14→post 0.22	NS, fav
Persaud et al., 1996* (RCT, n = 36 children)	Int post 6.4, control post 7.6	NS, fav
Rubin et al., 1986* (RCT, n = 54 children)**±§**	Int pre 13.0→post 14.1, control pre 17.0→post 18.6	NS, fav
Velsor-Friedrich et al., 2005 (nested design, n = 52 children, 8 schools)±	**Sick days/12 months—Int pre 13.5→post 9.03, control pre 15.5→post 14.4**	**NS, fav**
Velsor-Friedrich et al., 2004 (nested design, n = 102 children, 8 schools)±	**Sick days/12 months—Int pre 13.5→post 9.03, control pre 15.5→post 14.4**	**NS, fav**
Wilson et al. 1996* (RCT, n = 76 children)	Sick days in 1 month—int pre 1.0→post 0.8, control pre 0.7→post 1.4	NS, fav

School absences (total days across all patients)— favorable

Trial	Results	Categorization (Significance, Direction)
Tinkelman and Schwartz, 2004 (pre/post, n = 41 children)	**Sick days/6 months—pre 85→post 28; 67.1% decrease**	**Sig, fav**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Restricted activity (# of days)—favorable

Trial	Results	Categorization (Significance, Direction)
Krieger et al., 2005 (RCT, n = 214 children) ±	**Days with activity limitations/2 weeks—int pre 5.6→post 1.5, control pre 4.3→post 1.7**	**Sig, fav**

Restricted activity (% patients)—favorable

Trial	Results	Categorization (Significance, Direction)
Guendelman et al., 2002 (RCT, n = 134 children) §	Int pre 66.7%→post 32.3%, control pre 72.1%→post 46.7%	Sig, fav
Krishna et al., 2003 (RCT, n = 228 children)	Int pre 46.2%→post 6.7%, control pre 35.3%→post 13.5%	Sig, fav

Emergency department visits (mean)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Haby et al., 2001 (meta-analysis, n = 8 trials)	**3 trials whose results could not be combined—difference between int and control groups -0.64 to -5.5 ED visits**	**NS, fav**
Wolf et al., 2003 (meta-analysis, n = 12 trials)	SMD –0.21 [–0.33, –0.09]	Sig, fav
Alexander et al., 1988* (RCT, n = 21 children)	Int pre 2.6→post 0.6, control pre 2.5→post 2.4	Sig, fav
Bartholomew et al., 2000 (RCT, n = 133 children) ±§	Int pre 2.0→post 1.3, control pre 1.9→post 1.2; effect size 0.03	NS, fav
Catov et al., 2005 (pre/post with comparison group, n = 224 children)	**Mean visits/year: no difference between intervention and control groups**	**NS, not fav.**
Christiansen et al., 1997* (nested design, n = 52 children, 4 schools)	Mean per subject year: Int post 0.304, control post 0.197	NS, not fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
Clark et al., 1986* (RCT, n = 310 children)	Int pre 2.36→post 1.72, control pre 2.64→post 2.49	NS, fav
Fireman et al., 1981* (CCT, n = 26 children)	Int post 0.08, control post 1.00	NS, fav

Greineder et al., 1999 (RCT, n = 57 children)	Int pre 1.55→post 0.41, control pre 1.57→post 0.96	Sig, fav
Harish et al., 2001 (RCT, n = 129 children)	Mean number of ED visits per patient/month: Int post 0.101, control post 0.326	Sig, fav
Homer et al., 2000 (RCT, n = 137 children)±	Mean/year: Int pre 2.14→post 0.86, control pre 2.24→post 0.73	NS, fav
Kelly et al., 2000 (CCT, n = 78)	Mean/year: Intervention pre 3.6→post 1.7, control pre 3.5→post 2.3. Control RR 1.4 [1.02, 1.9]	Sig, fav
Krishna et al., 2003 (RCT, n = 228 children)±	Int pre 2.0→post 0.1, control pre 1.2→post 0.6	Sig, fav
Lewis et al., 1984* (RCT, n = 76 children)	Int pre 3.68→post 2.30, control pre 3.04→post 3.71	Sig, fav
Shields et al., 1990* (RCT, n = 253 children)	Int post 0.54, control post 0.38	NS, not fav

Emergency department visits (total days across all patients)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Tinkelman and Schwartz, 2004 (pre/post, n = 41 children)	**ED visits/6 months: Int pre 5→post 0 (p = 0.063)**	**NS, fav**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Emergency department visits (% patients)— pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Haby et al., 2001 (meta-analysis, n = 8 trials)	**4 trials whose results were combined: 0.87 [0.37, 2.08]**	**NS, fav**
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**% with one or more ED visits/6 months: Int pre 17%→post 13.4%, control pre 17.9%→post 18%**	**NS, fav**
Guendelman et al., 2002 (RCT, n = 134 children)§	%/6 weeks: Int pre 27%→post 10%, control pre 28%→post 18%	NS, fav
Harish et al., 2001 (RCT, n = 129 children)	%/12 months: Int post 53.3%, control post 66.7%	NS, fav
Lukacs et al., 2002 (pre/post with comparison group, n = 298 children in 4 primary care offices)	%/18 months: Int post 26%, control post 22%; RR = 0.86 [0.49, 1.40]	NS, fav
Persaud et al., 1996* (RCT, n = 36 children)	%/20 weeks: Int post 22%, control post 50%	Sig, fav

Hospitalizations (mean)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Haby et al., 2001 (meta-analysis, n = 8 trials)	**2 trials whose results could not be combined: difference between intervention and control groups -0.04 to 0.56 hospital admissions**	**NS**
Wolf et al., 2003 –(meta-analysis, n = 8 trials)	SMD –0.08 [–0.21, 0.05]	NS, fav
Bartholomew et al., 2000 (RCT, n = 133 children) ±§	Mean/year: Int pre 0.7→post 0.4, control pre 0.6→post 0.5; effect size = –0.14	Sig, fav
Catov et al., 2005 (pre/post with comparison group, n = 224 children)	**No difference between intervention and control groups**	**NS, not fav**
Christiansen et al., 1997* (nested design, n = 52 children, 4 schools)	Mean per subject-year: Int post 0.027, control post 0.254	NS, fav

Notes:
Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).
*Studies included in Wolf et al.'s (2003) meta-analysis.
±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.
§Study in which the intervention included an educational computer game or an interactive, internet-based device.
Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
Clark et al., 1986* (RCT, n = 310 children) ±	Int pre 0.13→post 0.11, control pre 0.25→post 0.21	NS, fav
Fireman et al., 1981* (CCT, n = 26 children)	Int post 0, control post 0.31	NS, fav
Greineder et al., 1999 (RCT, n = 57 children)	Int pre 0.86→post 0.14, control pre 1.00→post 0.57	Sig, fav
Harish et al., 2001 (RCT, n = 129 children)	Int post 0.37, control post 0.42	NS, fav
Kelly et al., 2000 (CCT, n = 78 children)	Int pre 0.6→post 0.2, control pre 0.53→post 0.48; control RR 2.4 [1.04, 5.4]	Sig, fav
Krishna et al., 2003 (RCT, n = 228 children)±§	Int pre 0.1→post 0.1, control pre 0.6→post 0.1	Sig, not fav
Lewis et al.,1984* (RCT, n = 76 children)	Child/year: Int post 0.27, control post 0.60	NS, fav

Hospitalizations (total admissions across all patients)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Tinkelman and Schwartz, 2004 (pre/post, n = 41 children)	**Hospitalizations/6 months: Int pre 2→post 0 (p = 0.063)**	**NS, fav**

Hospitalizations (% patients)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Haby et al., 2001 (meta-analysis, n = 8 trials)	**5 trials whose results were combined: RR 0.74 [0.38, 1.46]**	**NS, fav**
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**% hospitalized/6 months: Int pre 5.4%→post 3.6%, control pre 7.9%→post 5.6%**	**NS, fav**
Evans et al., 1999 (RCT, n = 1,033 children)	**%/1 year: Int post 14.8%, control post 18.9% difference between int and control groups:**	**NS, fav**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
	-4.19 [-8.75, 0.36]	
Guendelman et al., 2002 (RCT, n = 134 children)§	%/6 weeks: Int pre 14%→post 7%, control pre 13%→post 7%	NS, fav
Harish et al., 2001 (RCT, n = 129 children)	%/1 year: Int post 26%, control post 26%	NS, not fav
Lukacs et al., 2002 (pre/post with comparison group, n = 298 children, 4 primary care offices	%/18 months: Int post 10%, control post 4%; RR 1.37 [0.48, 3.71]	NS, not fav

Physician visits (mean)—mixed evidence

Trial	Results	Categorization (Significance, Direction)
Urgent/unscheduled visits		
Brown et al., 2002 (RCT, n = 95 children)	Visits for acute asthma exacerbations: Int pre 5.04→post 2.71, control pre 4.52→post 2.80	NS, fav
Evans et al., 1987* (nested design, n = 239 children, 12 schools) ±	Episodes requiring a visit to a physician: Int pre 4.3→post 3.6, control pre 3.8→post 3.3	NS, fav
Homer et al., 2000 (RCT, n = 137 children)±§	Mean acute office visits: Int pre 0.91→post 0.93, control pre 0.96→post 0.77	NS, not fav

Notes:
Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).
*Studies included in Wolf et al.'s (2003) meta-analysis.
±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.
§Study in which the intervention included an educational computer game or an interactive, internet-based device.
Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
Krishna et al., 2003 (RCT, n = 228 children)±§	Urgent visits to physician: Int pre 6.6→post 0.8, control pre 6.4→post 1.3	NS, fav
Lukacs et al., 2002 (pre/post with comparison group, n = 298 children, 4 primary care offices)	1 or more acute outpatient visits; RR 1.16 [0.70, 1.84]	NS, not fav—acute asthma outpatient visit (w/nebulized beta-agonist treatment given)
Velsor-Friedrich et al., 2004 (nested design, n = 102 children, 8 schools) ±	**Visits/2 weeks: Int post 0.07, control post 0.00**	**NS, not fav**
Not distinguished as to type of visit		
Wolf et al., 2003 (meta-analysis, n = 6 trials)	SMD –0.15 [–0.31, 0.01]	NS, not fav
Shields et al., 1990* (RCT, n = 253 children)	Mean office visits—Int post 1.63, control post 1.86	NS, fav

Unscheduled physician visits (total days across all patients)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Tinkelman and Schwartz, 2004 (pre/post, n = 41 children)	**Visits/6 months: Int pre 35→post 14**	**Sig, fav**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

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±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Physician visits (% patients)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Urgent/Unscheduled Visits		
Haby et al., 2001 (meta-analysis, n = 8 trials)	**5 trials: RR 0.74 [0.49, 1.12]**	**NS, fav**
Velsor-Friedrich et al., 2005 (nested design, n = 52 children, 8 schools)	**% with one or more visits/year: int post 14%, control post 20%**	**NS, fav**

Urgent care use: emergency department or unscheduled physician visit (mean)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Evans et al., 1999 (RCT, n = 1033 children)±	**Mean visits/year: int post 2.64, control post 2.85; Difference between intervention and control groups: -0.21 [-0.62, 0.20]**	**NS, fav**
Rubin et al., 1986* (RCT, n = 54 children)±§	Mean visits/year: int pre 5.6→2.8, control pre 5.2→4.5	
Shames et al., 2004 (RCT, n = 119 children)§	**Mean visits/2 months: int pre 3.0→post 0.06, control pre 4.0→post 1.3; difference between intervention and control groups: -0.48 [-1.12, 0.11]**	**NS, fav**

Urgent care use: emergency department, hospital, or unscheduled clinic visit (mean)--favorable

Trial	Results	Categorization
Krieger et al., 2005 (RCT, n = 214 children)±	**Mean visits/2 months: int pre 23.4%→post 8.4%, control pre 20.2%→post 16.4%; Probability of having an urgent care visit in 2 months: OR 0.38 [0.16, 0.89]**	**Sig, fav**

Notes:

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±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Medications: inhaled corticosteroids --favorable

Trial	Results	Categorization
Bonner et al., 2002 (RCT, n = 119 children) ±	Prescribed inhaled corticosteroids: Int pre 54%→post 70%, control pre 44%→post 38%.	Corticosteroids-Sig, fav
Krishna et al., 2003 (RCT, n = 228 children)±§	Daily dose of inhaled corticosteroids: Int pre 353.09→post 433.51 µg, control pre 350.53→post 753.88	Sig, fav
Lukacs et al., 2002 (pre/post with comparison group, n = 298 children, 4 primary care offices)	% receiving more than 1 dispensing of an inhaled corticosteroid/18 months: Int post 53%, control post 41%; RR 1.41 [1.08, 1.72]	Sig, fav

Medications: cromolyn--favorable

Trial	Results	Categorization (Significance, Direction)
Bonner et al., 2002 (RCT, n = 119 children) ±	Prescribed cromolyn: Int pre 26%→post 24%, control pre 36%→post 36%	NS, fav

Medications: beta2-agonists or other rescue medications—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Krieger et al., 2005 (RCT, n = 214 children)±	**Days used beta2-agonists/2 weeks: Int pre 7.5→post 4.0, control pre 6.9→post 4.0; Difference between intervention and control groups: -0.23 [-1.88, 1.42]**	**NS, fav**
Shames et al., 2004 (RCT, n = 119 children)§	**Days used bronchiodilator/1 year. follow-up: Int pre 47→post 32, control pre 52→post 42; Difference between intervention and control groups: -7.7 [-21.2, 5.9]**	**NS fav**
Tinkelman and Schwartz, 2004 (pre/post, n = 41	**# oral steroid bursts/6 months: Int pre 15→post 7; 53.3%**	**NS, fav.**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

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±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

children)		
Velsor-Friedrich et al., 2005 (nested design, n = 52 children, 8 schools)	**% ever used/2 weeks: Int post 39%, control post 46%**	**NS, fav**

Medications: type not specified—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**% taking "daily controller medicine": Int pre 57.5%→post 52.7%, control pre 60.4%→post 62.9%**	**Sig, fav**
Krieger et al., 2005 (RCT, n = 119 children)±	**Days used "controller medications"/2 weeks: Int pre 5.9→post 3.5, control pre 4.4→post 3.6; Difference between intervention and control groups: -1.03 [-2.79, 0.73]**	**NS, fav**
Tinkelman and Schwartz, 2004 (pre/post, n = 41 children)	**# of patients using long-term controller medications: Int pre 20→post 26, a 30% increase**	**NS, not fav**
Velsor-Friedrich et al., 2004 (nested design, n = 102 children, 8 schools)±	**Days used medication/2 weeks: Int post 0.83, control post 1.00**	**NS, fav**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

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±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

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Peak expiratory flow rate (PEFR)z—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Wolf et al., 2003 (meta-analysis, n = 3 trials)	SMD 0.53 [0.19, 0.86]	Sig, fav
Christiansen et al., 1997* (nested design, n = 52 children, 4 schools)	Int pre 261.04→post 331.37, control pre 272→post 313.53	NS, fav
Guendelman et al., 2002 (RCT, n = 134 children)§	Peak expiratory flow in yellow or red zone – OR –0.43	Sig, fav
Shames et al., 2004 (RCT – n = 119 children)§	**Mean PEF rate: Int pre 209.4→post 276.4, control pre 217.5→post 294.5; Difference between intervention and control groups: -6.3 [-40.8, 28.2]**	**NS, fav**
Velsor-Friedrich et al., 2005 (nested design, n = 52 children, 8 schools)	**% increase in peak flow at 12-month follow-up: Int post 26.21%, control post 27.80%**	**NS, not fav**
Velsor-Friedrich et al., 2004 (nested design, n = 102 children, 8 schools)±	**Mean change in PEF rate: Int 7.5%, control 2.9%**	**Sig, fav**

Notes:
Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).
*Studies included in Wolf et al.'s (2003) meta-analysis.
±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.
§Study in which the intervention included an educational computer game or an interactive, internet-based device.
Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Days of asthma symptoms—strong pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Bonner et al., 2002 (RCT, n = 119 children)±	Frequency of wheezing, sleep disturbance, and confinement to home (sum of measures on 3 1-3 point scales – 1 = <1 time; 2 = 1-2 times; 3 = >2 times): Int pre 6.72→post 5.46, control 6.30→post 6.72	Sig, fav
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**Intervention group had significantly fewer symptoms of shortness of breath**	**Sig, fav**
Clark et al., 2004 (nested design, n = **835 children, 14 schools)±**	**Days symptoms/12 months: 17% fewer in the intervention group than in the control group**	**Sig, fav**
Evans et al., 1999 (RCT, n = 1,033 children)±	**Days symptoms/2 weeks: Int pre 5.1→post 3.51, control pre 5.1→post 4.06; Difference between intervention and control groups: -0.55 [-0.92, -0.18]**	**Sig, fav**
Evans et al., 1987* (nested design, n = 239 children, 12 schools)±	Days symptoms/12 months: Int pre 31.9→post 18.1, control pre 28.3→post 30.3	Sig, fav
Fireman et al., 1981* (CCT, n = 26 children)	Average # of wheezing days/patient/month: Int post 3.1, control post 4.6	NS, fav
Krieger et al., 2005 (RCT, n = 214 children)±	**Days symptoms/12 months: Int pre 8.0→post 3.2, control pre 7.8→post 3.9; Difference between treatment and control groups: -1.24 [-2.9, 0.4]**	**NS, fav**
Krishna et al., 2003 (RCT, n = 228 children)±§	Days symptoms/2 months: Int pre 104.5→post 23.9, control pre 97.8→post 48.2	Sig, fav
Shames et al., 2004 (RCT, n = 119 children)§	**% days with symptoms: Int pre 55→post 31, control pre 59→post 40; Difference between intervention and control groups: -1.9 [-14.4, 10.7]**	**NS, fav**
Tinkelman and Schwartz, 2004 (pre/post, n = 41 children)	**Frequency with which child has asthma symptoms [1 = < 2 times/week, 4 = continual]; Int pre 1.5→post 0.43**	**Sig, fav**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

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§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
Velsor-Friedrich et al., 2005 (nested design, n = 52 children, 8 schools)	**% At least 1 day of symptoms/12 months: Int post 50%, control post 54%**	**NS, fav**
Velsor-Friedrich et al., 2004 (nested design, n = 102 children, 8 schools)±	**Days symptoms/2 weeks: Int post 1.26, control post 1.49**	**Sig, fav**
Yoos et al., 2002 (RCT, n = 168 children)	Mean # days/week of symptoms, baseline and in 3 months: 1) monitor symptoms - pre 2.83→post 2.87 2) peak flow monitoring when symptomatic - pre 2.87→post 2.00 3) daily peak flow monitoring - pre 3.19→post 2.68	Sig, fav for group 2 (PEFR vs. symptoms); NS, fav for group 3 (daily PEFR regardless of symptoms

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

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Nights of nocturnal asthma—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Wolf et al., 2003 (meta-analysis, n = 3 trials)	SMD –0.34 [–0.62, –0.05]	Sig, fav
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**Int group reported significantly fewer nights waking with wheezing, shortness of breath, chest tightness/discomfort**	**Sig, fav**
Clark et al., 2004 (nested design, n = 835 children, 14 schools) ±	**Nights symptoms/12 months: the intervention group had 40% more nights with symptoms than the control group**	**Sig, not fav**
Georgiou et al., 2003 (pre/post, n = 401 children)	Symptoms improved 5.8 points (scale 0-100)	Sig, fav
Krishna et al., 2003 (RCT, n = 228 children)**±§**	Nights of sleep disturbance: Inte pre 64.7→post 15.2, control pre 62.0→post 17.1	NS, fav
Tinkelman and Schwartz, 2004 (pre/post, n = 41 children)	**Frequency with which child has nocturnal asthma [1 = < 2 times/week, 4 = continual]; Int pre 1.07→post 0.14**	**Sig, fav**
Wilson, 1996* (RCT, n = 76 children)	Parental nights of sleep interruption/week: Int pre 0.6→post 1.3, control pre 0.8→post 2.6	Sig, not fav

Exacerbations (mean)—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Wolf et al., 2003 (meta-analysis, n = 5 trials)	SMD –0.21 [–0.43, 0.01]	NS, fav
Evans et al., 1987* (nested design, n = 239 children, 12 schools)±	Average annual # episodes: Int pre 10.6→post 9.0, control pre 10.1→post 11.8 Average duration of episodes (days): Int pre 2.77→post 1.87, control pre 2.85→post 2.40	Sig, fav; Sig, fav
Fireman et al., 1981* (CCT,,- n = 26 children)	Average # of attacks/patient/month: Int post 1.5, control post 6.0	Sig, fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

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§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
LeBaron et al., 1985* (RCT, n = 31 children)	Frequency of attacks (0 = constant, 10 = none): Int pre 9.13→post 8.87, control pre 8.31→post 8.75	NS, not fav
Whitman et al., 1985* (RCT for school-aged children & pre/post for preschool children, n = 59 children)±	Preschool children: Int pre 10.10→post 5.14. School-aged children: Int pre 11.05→post 6.26, control pre 7.84→post 4.47	Pre-school—Sig, fav School-age—NS, fav

Asthma severity—pattern toward favorable

Trial	Result	Categorization (Significance, Direction)
Wolf et al., 2003 (Meta-analysis, n = 4 trials)	SMD –0.15 [–0.43, 0.12]	NS, fav
Bartholomew et al., 2000 (RCT, n = 133 children)±§	Functional status: Int pre 138.0→post 139.6, control pre 136.5→post 137.3; effect size = 0.16	NS, fav
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**Change in severity score, scale 1-4 (1 = mild intermittend, 4 = severe persistent): Int -0.40, control 0.01**	**Sig, fav**
Georgiou et al., 2003 (pre/post, n = 401 children)	% with mild symptoms: Int pre 66.9%–post 75.3% moderate asthma	Sig, fav
Harish et al., 2001 (RCT, n = 129 children)	Severe asthma: Int pre 26.5%→post 35.0%, control pre 19.8%→post 16.18%	Sig, not fav
Homer et al., 2000 (RCT, n = 137 children)±§	Severity based on National Institutes of Health criteria, 0 = mild, 2 = severe: Int pre 1.11→post 0.94, control pre 1.05→post 0.78 (-18% vs. -35%)	NS, not fav
Huss et al., 2003 (RCT, n = 101 children)	Patients w/moderate or severe asthma: Int pre 46%→post 34%, control pre 38%→post 20%	NS, fav
LeBaron et al., 1985* (RCT, n = 31 children)	Asthma severity (0 = severe, 10 = none): Int pre 8.6→post 8.87, control pre 6.81→post 8.81	NS, fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

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Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Result	Categorization (Significance, Direction)
Minai et al., 2004 (pre/post, n = 45 children)	**Severity based on clinical criteria (1 = mild, 4 = severe persistent): Int pre 2.6→post 2.3**	**NS, fav**
Perrin et al., 1992 (RCT, n = 56 children)±	Functional measures: Daily chores (#/week): Int pre 15.3→post 19.5, control pre 17.2→post 17.6 Time playing with friends (hours/week): Int pre 8.1→post 11.1, control pre 10.2→post 11.5 After-school activities (#/week): Int pre 3.4→post 4.5, control pre 5.7→post 4.7	Chores: Sig, fav; Other measures: NS, fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

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§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Whitman et al., 1985* (RCT for school-aged children & pre/post for preschool children, n = 59 children)±	Preschool children (int): Days of no asthma: pre 69.37→post 69.62 Days of mild asthma: pre 18.67→post 17.62 Days of moderate asthma: pre 5.52→post 5.10 Days of severe asthma: pre 1.76→post 0.81 School-aged children: Days of no asthma: Int pre 68.26→post 70.56, control pre 63.74→post 72.21 Days of mild asthma: Int pre 16.53→post 13.59, control pre 13.74→post 12.95 Days of moderate asthma: Int pre 7.21→post 6.00, control pre 9.05→post 7.79 Days of severe asthma: Int pre 0.79→post 1.84, control pre 1.26→post 0.63	Preschool kids: No asthma—NS, fav; Mild asthma—NS, fav; Moderate asthma—NS, fav; Severe asthma—Sig, fav School-aged children: No asthma—NS, fav;Mild asthma—NS, fav; Moderate asthma—NS, fav; Severe asthma—NS, not fav
Wilson et al., 1996* (RCT, n = 76 children)	Degree to which child was bothered by symptoms/1 month: Int pre 2.7→post 2.3, control pre 2.6→post 2.3	NS, fav
Yoos et al., 2002 (RCT, n = 168 children)	Mean scores: 1) monitoring symptoms - pre 1.7→post 1.56 2) peak flow monitoring when symptomatic - pre 1.85→post 1.49 3) daily peak flow monitoring - pre 1.76→post 1.50	NS, fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

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Symptom-free days—favorable

Trial	Results	Categorization (Significance, Direction)
Brown et al., 2002 (RCT, n = 95 children)	Int pre 42→post 101, control pre 33→post 91	Sig, fav for younger children, not for older children
Wilson et al., 1996* (RCT,n = 76 children)	In 2 weeks: Int pre 8.5→post 10.2, control pre 11.9→post 9.3 For 1 month: Int pre 20.2→post 22.2, control pre 24.6→post 20.8	Sig, fav; Sig, fav

Symptom scores—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Bartholomew et al., 2000 (RCT, n = 133 children)	Usherwood Symptom Questionnaire: Int pre 60.4→post 65.8, control pre 60.3→post 64.9. Effect size 0.10	NS, fav
Christiansen et al., 1997* (nested design, n = 52 children, 4 schools)	Mean of sum of scores on 5 items – Scale 0-3 (3 = most severe): Int post 2.87, control post 4.36	Sig, fav
Georgiou et al., 2003 (pre/post, n = 401 children)	Symptoms improved 2.4 points	Sig, fav

Quality of life—child—strong pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Brown, 2002 (RCT, n = 95 children)	Pediatric Quality of Life Questionnaire (Scale: 1 = not bothered, 7 = extremely bothered): Int pre 2.50→post 1.63, control pre 2.47→post 1.74. Effect size 13%-15%	Sig, fav for younger, no treatment effect for older children

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**Scale 1-7 (1 = maximum impairment, 7 = no impairment): Int pre 5.10→post 5.50, control pre 4.47→post 4.81**	**NS, fav**
Evans et al., 1987* (nested design, n = 239 children, 12 schools)±	Positive feelings about asthma (% change): Int 6%, control –4%	Sig, fav
Fireman et al., 1981* (CCT, n = 26 children)	Illness anxiety: Int pre 8.4→post 7.4, control pre 9.1→post 9.2	Sig, fav
Georgiou et al., 2003 (pre/post, n = 401 children)	Reduction in functional limitations, life interruptions, and impact on family activity: graph provided, no data available	Sig, fav
Perrin et al., 1992 (RCT, n = 56 children)	Child Behavior Checklist: Total problems score: Int pre 60.8→post 54.4, control pre 57.7→post 55.0	Sig, fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Shames et al., 2004 (RCT, n = 119 children)§	**Child Health Survey for Asthma: Physical Domain - Int pre 53.5→post 79.9, control pre 49.3→post 69.9; difference between intervention and control groups: 7.67 [1.61, 13.72];** **Child Emotional Health Domain - Int pre 63.7→post 81.9, control pre 64.3→post 74.2; difference between intervention and control groups: 6.01 [-2.05, 14.07];** **Child Social Activity Domain - Int pre 58.3→post 80.3, control pre 63.4→post 74.6; difference between intervention and control groups: 7.25 [-0.02, 14.52];** **Family Social Activity Domain - Int pre 67.6→post 87.3, control pre 69.7→post 86.5; difference between intervention and control groups: 3.43 [-2.61, 9.46]**	**Sig, fav – physical activity and child social activity;** **NS, fav – child emotional health, and family social activity**
Tinkelman and Schwartz, 2004 (pre/post, n = 41 children)	**Mean overall score (1 = very poor, 7 = very good): Int pre 6.1→post 6.49**	**NS, fav**

Quality of life—caregiver—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Brown et al., 2002 (RCT, n = 95 children)	Juniper's Pediatric Asthma Caregiver's Quality of Life Questionnaire - Scale 1-5, (1 = not at all, 5 = every day or very much): Int pre 1.77→post 1.35, control pre 1.83→post 1.50.	Sig, fav for younger children; NS for older children
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**Pediatric Caregiver Quality of Life Questionnaire - Scale 1-7 (1 = none of the time, 7 = all of the time): Int pre 6.22→post 6.49, control pre 6.27→post 6.38**	**NS, fav**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Krieger et al., 2005 (RCT, n = 214 children)	**Higher score = better quality of life: Int pre 4.0→post 5.6, control pre 4.4→post 5.4; Difference between intervention and control groups: 0.58 [0.18,0.99]**	**Sig, fav**

Self-efficacy—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Wolf et al., 2003 – (meta-analysis, n = 6 trials)	SMD 0.36 [0.15, 0.57]	Sig, fav
Bartholomew et al., 2000 (RCT, n = 133 children)±§	Int pre 74.3post 75.3, control pre 72.0→post→ 73.6; effect size = 0.06	NS, fav
Bonner et al., 2002 (RCT, n = 119 children)±	9 items – Scale 1-7 (higher score = more confidence):Int pre 33.22→post 46.70, control 31.18→34.08	Sig, fav
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**Child Asthma Self-Efficacy Measure, 9 items with scale 0-3 (0 = none of the time, 3 = all of the time): Int pre 18.40→post 21.02, control pre 20.43→post 20.32**	**Sig, fav**
Evans et al., 1987* (nested design, n = 239 children, 12 schools)±	Self-efficacy index (% change): Int 3%, control 0%	Sig, fav
Kubly and McClellan, 1984* (RCT, n = 28 children)	Children's Health Locus of Control—F = 4.29 Self-Care Activity Questionnaire for Asthmatic Children—F = 1.60	Sig, fav NS, fav
LeBaron et al., 1985* (RCT, n = 31 children)	Overall control of asthma (0 = very poor, 10 = excellent): Int pre 6.23→post 6.93, control pre 6.50→post 6.91	NS, fav
Parcel et al., 1980* (post with comparison group, n = 104 children)	Children's Health Locus of Control Scale (maximum score = 40): Int pre 29.0→post 30.2, control pre 27.1→ post 27.5	Sig, fav
Persaud et al., 1996* (RCT, n = 36 children)	Children's Health Locus of Control Scale – change in score: Int post 2.2, control post 0.8	NS, fav
Rubin et al., 1986* (RCT, n = 54 children)±§	Children's Health Locus of Control Scale (maximum score = 40): Int pre 32.2→post 33.5,	NS, fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
	control pre 32.3→post 31.4	
Shegog et al., 2001 (RCT, n = 71 children)±§	Int pre 53.4→post 56.5, control pre 51.6→post 51.5; F (analysis of variance) = 4.45	Sig, fav
Velsor-Friedrich et al., 2005 (nested design, n = 52 children, 8 schools)	**Scale 1-5 (1 = I cannot do this, 5 = I can do this): Int post 4.09, control post 3.82**	**NS, fav**
Velsor-Friedrich et al., 2004 (nested design, n = 102 children, 8 schools)	**Scale 1-5 (1 = I cannot do this, 5 = I can do this): Int post 4.25, control post 4.15**	**NS, fav**
Whitman et al., 1985* (RCT for school-aged children & pre/post for preschool children, n = 59 children)±	Maximum score = 16: Int pre 0.89→post 15.00, control pre 0.59→post 1.74	Sig, fav

Knowledge—child—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Bartholomew et al., 2000 (RCT, n = 133 children)±§	Int pre 13.7→post 16.4, control pre 14.0→post 15.8; effect size = 0.17	NS, fav
Bonner et al., 2002 (RCT, n = 119 children)±	Int pre 2.86→post 5.38, control pre 2.84→post 3.18	Sig, fav
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**Maximum possible score = 25: Grades 1-2 - Int post 12.45, control post 10.75; Grades 3-5 - Int post 10.41, control post 9.93**	**Sig, fav—grades 1-2; NS, fav—grades 3-5**
Christiansen et al., 1997* (nested design, n = 52 children, 4 schools)	17 true/false questions (1 = correct answer): Int pre 9.9→post 13.7, control pre 11.3→post 10.9	Sig, fav
Homer et al., 2000 (RCT, n = 137 children)±§	% correct responses: Intervention pre 60→post 77, control pre 57→post 63	Sig, fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
Krishna et al., 2003 (RCT, n = 228 children)**±§**	Int: Children aged 7-17 years pre 43.11→post 53.12, control aged 7-17 years pre 43.44→post 47.51	Sig, fav
LeBaron et al., 1985* (RCT, n = 31 children)	Patient knowledge of cromolyn: Int pre 9.00→post 11.93, control pre 9.00→post 10.63	Sig, fav
Lewis et al., 1984* (RCT, n = 76 children)	% correct: Int pre 66%→post 61%, control pre 74%→post 71%	NS, no effect
Parcel et al., 1980* (post with comparison group, n = 104 children)	Grades K-2: Int pre 13.07→post 14.62, control pre 11.58→post 12.19. Grades 3-5: Int pre 14.19→post 15.96, control pre 13.95→post 14.10	Sig, fav. Sig, fav
Persaud et al., 1996* (RCT, n = 36 children)	Change in score on a 20-item instrument: Int 1.8, control 1.9	NS, fav
Perrin et al., 1992 (RCT, n = 56 children)±	Int pre 11.76→post 13.76	NS, fav
Rubin et al., 1986* (RCT, n = 54 children)**±§**	Parcel Knowledge of Asthma Questionnaire - % responses correct: Int pre 76.1%→post 90.5%, control pre 78.4%→post 80.4%	Sig, fav
Shames et al., 2004 (RCT, n = 119 children)§	**Survey with maximum of 23 points: Int pre 17.4→post 20.5, control pre 17.1→post 18.9; difference between intervention and control groups: 0.44 [-0.70, 1.58]**	**NS, fav**
Shegog 2001 (RCT, n = 71 children) ±§	Int pre 18.6→post 21.1, control pre 15.7→post 17.8; F for int pre and post = 37.87	NS, fav
Velsor-Friedrich et al., 2005 (nested design, n = 52 children, 8 schools)	**Int post 14.28, control post 11.88**	**NS, fav**
Velsor-Friedrich et al., 2004 (nested design, n = 102 children, 8 schools) ±	**Maximum possible score = 25: Int post 14.05, control post 13.35**	**NS, fav**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Whitman, 1985* (RCT for school-aged children & pre/post for preschool children – n = 59 children) ±	Int pre 5.63→post 8.47, control pre 5.68→post 6.42	Sig, fav

Knowledge—caregiver—pattern toward favorable

Trial	Results	Categorization (Significance, Direction)
Butz, Pham, et al., 2005 (nested design, n = 201 children, 7 counties)	**Maximum possible score = 20: Int post 17.51, control post 16.34**	**Sig fav**
Butz, Syron, et al., 2005 (RCT, n = 210 children)	**% likely to give correct answer to question about appropriateness of giving child asthma medication for cough symptoms: Int post 83.9%, control post 74.7%. Both groups more likely to give correct answers to four other asthma knowledge questions. Neither group improved on one question 98.2% answered correctly at baseline.**	**NS, fav**
Homer et al., 2000 (RCT, n = 137 children)±§	% responses correct: Int post 81%, control post 78%	NS, fav
Krishna et al., 2003 (RCT, n = 228 children)±§	Intervention caregivers for children aged 0-6 years: pre 47.94→post 55.68. Caregivers for children 7-17: pre 49.95→post 55.38. Control caregivers for children 0-6: pre 48.41→post 52.30. For caregivers for children 7-17: pre 49.57→post 51.70	Sig, fav
Persaud et al., 1996* (RCT, n = 36 children)	Change in scores on 55-item questionnaire: Intervention 1.9, control 2.6	NS, fav

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

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Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Trial	Results	Categorization (Significance, Direction)
Rubin et al., 1986* (RCT, n = 54 children)±§	Parcel Knowledge of Asthma Questionnaire - % responses correct: Int pre 81.7%→post 87.3%, control pre 80.4%→post 84.9%	NS, fav
Shames et al., 2004 (RCT, n = 119 children)§	**Survey with maximum of 25 points: Int pre 14.6→post 18.7, control pre 14.9→post 15.9; difference between intervention and control groups: 1.74 [0.58, 2.90]**	**Sig, fav**

Notes:

Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).

*Studies included in Wolf et al.'s (2003) meta-analysis.

±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.

§Study in which the intervention included an educational computer game or an interactive, internet-based device.

Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

Work absence—caregiver—mixed evidence

Trial	Results	Categorization (Significance, Direction)
Georgiou et al., 2003 (pre/post, n = 401 children)	% missed 1 or more days of work/1 month: Int pre 17.1%→post 9.6% # days/12 months: Int pre 3.8→post 1.8	Sig, fav Sig, fav
Krieger et al, 2005 (RCT, n = 214 children)±	**%/2 weeks: Int pre 13.1%→post 11.2%, control pre 21.0%→post 13.0%; Difference between intervention and control groups: 0.07 [-0.91,1.05]**	**NS, not fav**
Tinkelman and Schwartz, 2004 (pre/post, n = 41 children)	**# days/6 months: Int pre 11→post 0**	**NS, fav**

Notes:
Studies in bold were published subsequent to the studies assessed in CHBRP's prior reports on asthma self-management training and education for children (i.e., studies published in 2004 or 2005).
*Studies included in Wolf et al.'s (2003) meta-analysis.
±Studies in which the intervention was delivered by an unlicensed person or for which the article did not contain sufficient information to determine whether the person who delivered the intervention was a licensed or registered health professional or was supervised by one.
§Study in which the intervention included an educational computer game or an interactive, internet-based device.
Abbreviations used in the tables are as follows: CCT = controlled clinical trial; ED = emergency department; in t= intervention; OR = odds ratio; RCT = randomized controlled trial; RR = relative risk; SMD = standardized mean differences.

APPENDIX C

Cost Impact Analysis: Caveats and Assumptions

This appendix describes caveats and assumptions used in conducting the cost impact analysis. For additional information on the cost model and underlying methodology, please refer to the CHBRP Web site, http://www.chbrp.org/analysis_methodology/cost_impact_analysis.php.

The cost analysis in this report was prepared by Milliman, Inc., and University of California, Los Angeles, (UCLA) with the assistance of CHBRP staff. Per the provisions of AB 1996 (California Health and Safety Code, Section 127660, et seq.), the analysis includes input and data from an independent actuarial firm, Milliman. In preparing cost estimates, Milliman and UCLA relied on a variety of external data sources. The *Milliman Health Cost Guidelines* (HCG) were used to augment the specific data gathered for this mandate. The HCGs are updated annually and are widely used in the health insurance industry to estimate the impact of plan changes on health care costs. Although this data was reviewed for reasonableness, it was used without independent audit.

General Caveats and Assumptions
The expected costs in this report are not predictions of future costs. Instead, they are estimates of the costs that would result if a certain set of assumptions were exactly realized. Actual costs will differ from these estimates for a wide variety of reasons, including:

- Prevalence of mandated benefits before and after the mandate different from our assumptions;
- Utilization of mandated services before and after the mandate different from our assumptions;
- Random fluctuations in the utilization and cost of health care services.

Additional assumptions that underlie the cost estimates presented here are:

- Cost impacts are only shown for people with insurance;
- The projections do not include people covered under self-insurance employer plans because those employee benefit plans are not subject to state-mandated minimum benefit requirements;
- Employers and employees will share proportionately (on a percentage basis) in premium rate increases resulting from the mandate. In other words, the distribution of premium paid by the subscriber (or employee) and the employer will be unaffected by the mandate.

There are other variables that may affect costs, but which Milliman did not consider in the cost projections presented in this report. Such variables include, but are not limited to:

- Population shifts by type of health insurance coverage. If a mandate increases health insurance costs, then some employer groups or individuals may elect to drop their coverage. Employers may also switch to self-funding to avoid having to comply with the mandate.

- Changes in benefit plans. To help offset the premium increase resulting from a mandate, enrollees or insured may elect to increase their overall plan deductibles or copayments. Such changes would have a direct impact on the distribution of costs between the health plan and the insured person, and may also result in utilization reductions (i.e., high levels of patient cost sharing result in lower utilization of health care services). Milliman did not include the effects of such potential benefit changes in its analysis.
- Adverse selection. Theoretically, individuals or employer groups who had previously foregone insurance may now elect to enroll in an insurance plan postmandate because they perceive that it is to their economic benefit to do so.
- Health plans may react to the mandate by tightening their medical management of the mandated benefit. This would tend to dampen our cost estimates. The dampening would be more pronounced on the plan types that previously had the least effective medical management (i.e., FFS and PPO plans).
- Variation in existing utilization and costs, and in the impact of the mandate, by geographic area and delivery system models: Even within the plan types we modeled (HMO, PPO, POS, and FFS), there are variations in utilization and costs within California. One source of difference is geographic. Utilization differs within California due to differences in the health status of the local commercial population, provider practice patterns, and the level of managed care available in each community. The average cost per service would also vary due to different underlying cost levels experienced by providers throughout California and the market dynamic in negotiations between health plans and providers.
- Both the baseline costs prior to the mandate and the estimated cost impact of the mandate could vary within the state due to geographic and delivery system differences. For purposes of this analysis, however, we have estimated the impact on a statewide level.

Mandate-Specific Caveats and Assumptions

- An estimated 9.5% of children 1–17 years are insured by employment-based, privately purchased, Medi-Cal, and Healthy Families plans based on CHIS 2003. The exclusion of children in self-insured benefit plans and health insurance policies regulated by the California Department of Insurance leads to an estimated 9.4% of children with pediatric asthma in plans who are subject to this mandate. Based on expert opinion, children under one years of age are excluded from this analysis since diagnosis of asthma is difficult in this age group and thus is rarely made.

- The unit costs for the pediatric self-management training and education services was estimated as $100 per enrollee per year based on CHBRP inquiries from various providers of these services.

- The baseline of utilization rate of asthma self-management and education services was obtained from the 2001 CHIS Survey. Data were only available for children 12-17 and with symptomatic asthma. An estimated 55.6% responded “yes” to the following question: “Did your doctor ever give you information on how to avoid the things that make your asthma worse?” The same rate was assigned children under 12 years.

- The increase in the utilization of self-management training and education was estimated to be 10 percentage points (from 55.6% to 66.6%). This percentage increase in utilization was determined in consultation with experts; the actual change in utilization of the benefit as a result of the mandate may be higher or lower than this assumption. Because the actual utilization may vary, estimates that correspond with a low threshold (a 5 percentage point utilization increase) and a high threshold (a 15 percentage point utilization increase) were also presented throughout this report.

- The reduction in total expenditures per asthma patient as a result of the legislation is based on a 4% reduction in the mean number of emergency department visits and a 21% reduction in inpatient hospitalizations for asthma patients that begin to receive self-management training and education services as a result of this mandate.

APPENDIX D

Information Submitted by Outside Parties for Consideration for CHBRP Analysis

CHBRP policy includes analysis of information submitted by outside parties, and places an open call to all parties who want to submit information during the first two weeks of the CHBRP review.

No information was submitted for this analysis.

For information on the processes for submitting information to CHBRP for review and consideration please visit: http://www.chbrp.org/recent_requests/index.php

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A group of faculty and staff undertakes most of the analysis that informs reports by the California Health Benefits Review Program (CHBRP). The CHBRP **Faculty Task Force** comprises rotating representatives from six University of California (UC) campuses and three private universities in California. In addition to these representatives, there are other ongoing contributors to CHBRP from UC. This larger group provides advice to the CHBRP staff on the overall administration of the program and conducts much of the analysis. The CHBRP **staff** coordinates the efforts of the Faculty Task Force, works with Task Force members in preparing parts of the analysis, and coordinates all external communications, including those with the California Legislature. The level of involvement of members of CHBRP's Faculty Task Force and staff varies on each report, with individual participants more closely involved in the preparation of some reports and less involved in others.

As required by CHBRP's authorizing legislation, UC contracts with a certified actuary, Milliman, to assist in assessing the financial impact of each benefit mandate bill. Milliman also helped with the initial development of CHBRP's methods for assessing that impact.

The **National Advisory Council** provides expert reviews of draft analyses and offers general guidance on the program to CHBRP staff and the Faculty Task Force. CHBRP is grateful for the valuable assistance and thoughtful critiques provided by the members of the National Advisory Council. However, the Council does not necessarily approve or disapprove of or endorse this report. CHBRP assumes full responsibility for the report and the accuracy of its contents.

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