Economic Evaluation of Home-Based Environmental Interventions Webinar

December 3, 2009
1 – 2:30 pm

Dial: 1-866-689-4723
Access code: 40398934

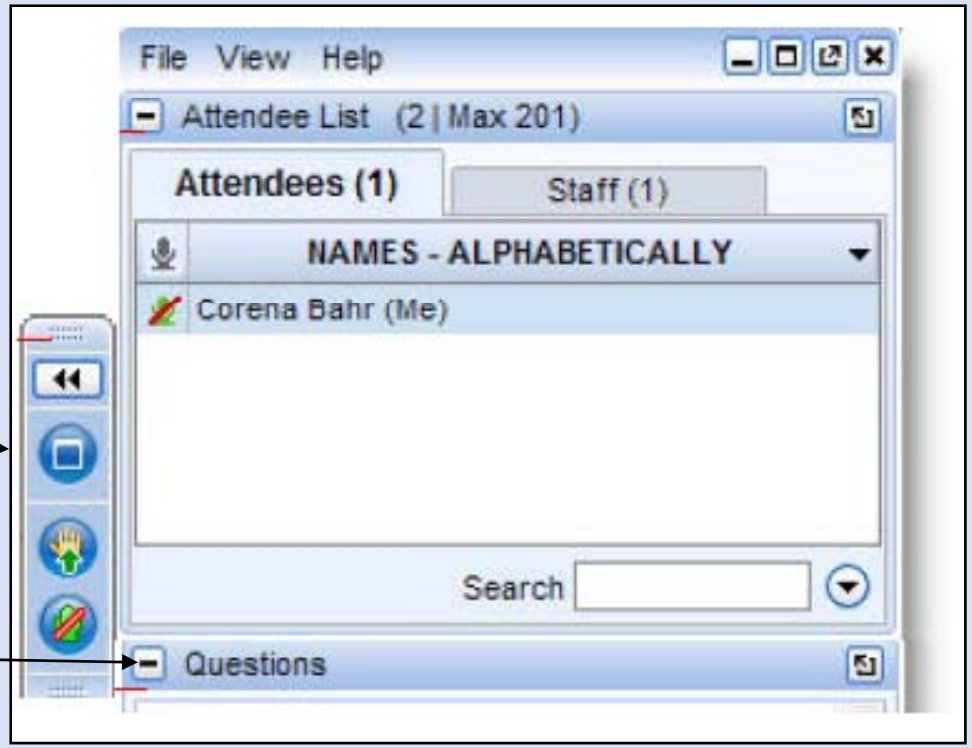
*** Please note you must dial this number by phone in order to hear the audio portion of this Webinar.*

Using the Webinar Technology

Hide Control Toolbar

Maximize Presentation

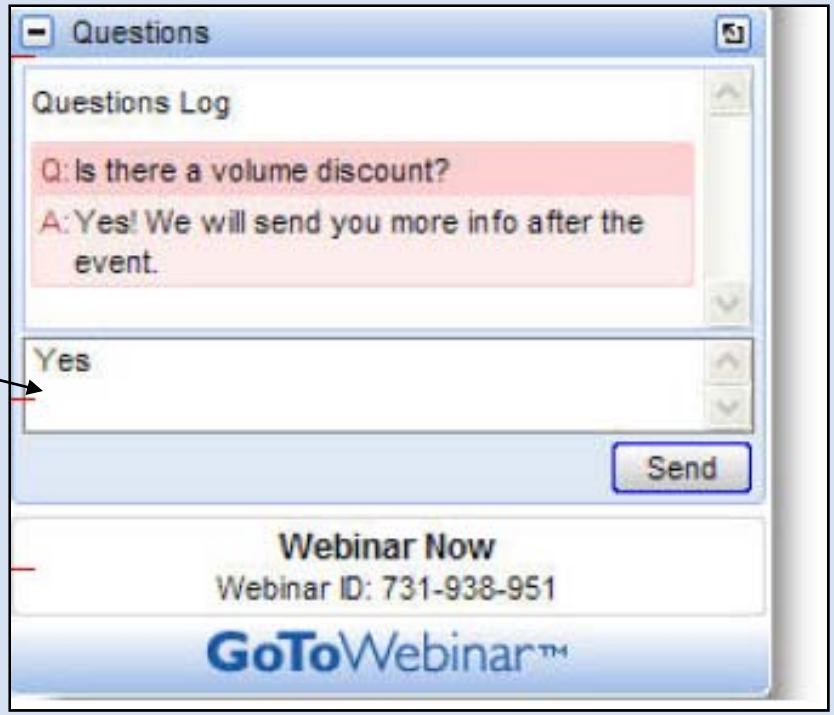
Access Question Feature



Dial: 1-866-689-4723
Access code: 40398934

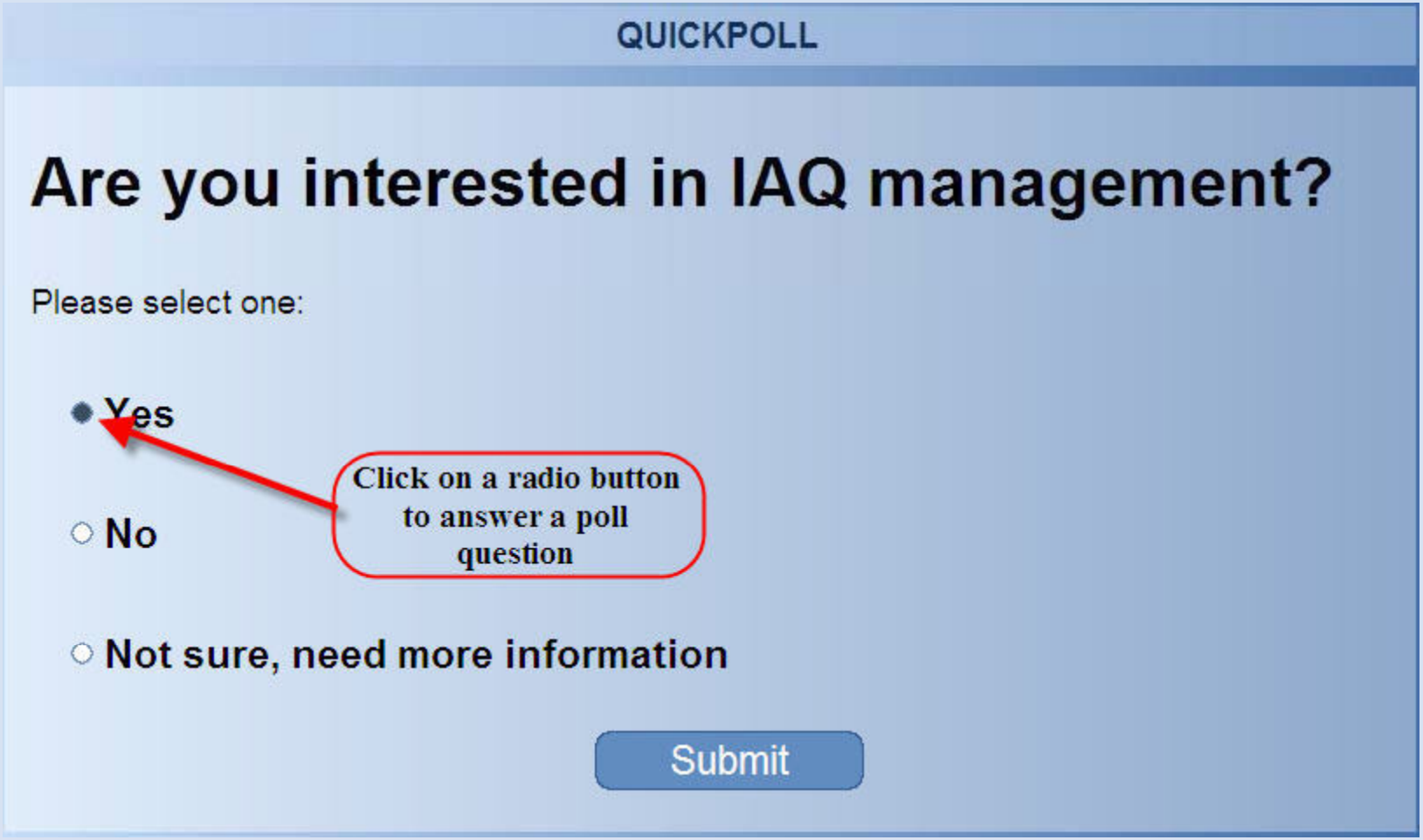
Using the Webinar Technology

Type your question here



Dial: 1-866-689-4723
Access code: 40398934

Using the Webinar Technology



Using the Phone Lines

- As an attendee, your line will be muted to minimize background noise. To access the operator, please dial *1.
- To ask a question, please use the Questions Pane.
- If you need assistance, please contact me using the Questions Pane.

Dial: 1-866-689-4723
Access code: 40398934

Economic Evaluation of Home-Based Environmental Interventions to Reduce Asthma Morbidity

Tursynbek Nurmagambetov | Sarah Beth Link

Verughese Jacob | Sajal Chattopadhyay | David Hopkins | Deidre Crocker | Gema Dumitru | Stella Kinyota

December 3rd, 2009

Disclaimer

The findings and conclusions in this presentation have not been formally determined by the Task Force on Community Preventive Services or disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any Task Force or agency determination or policy.

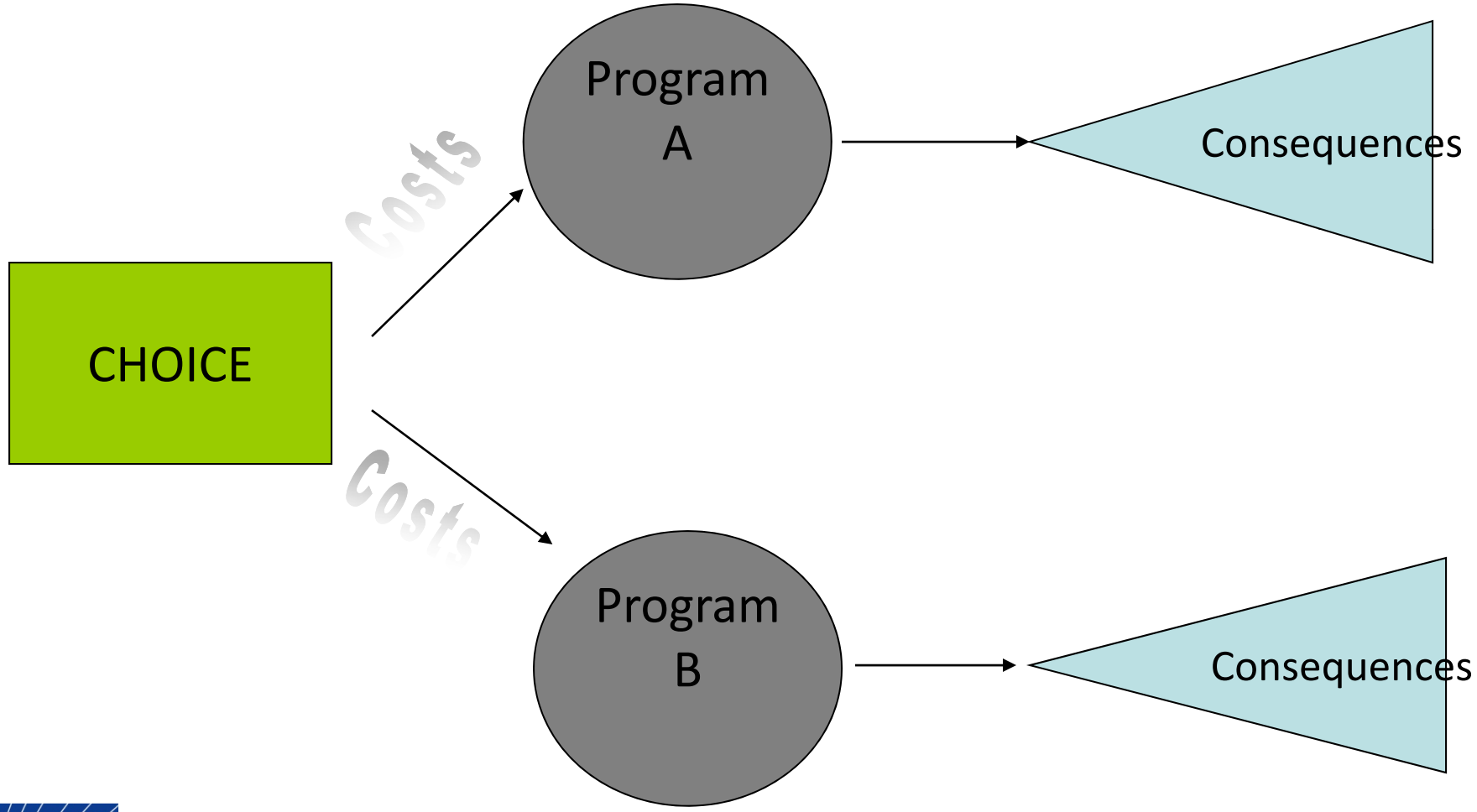
CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

What is economic evaluation?

"Economic evaluation is the comparative analysis of alternative programs in terms of both their costs and consequences" *(Drummond 2005)*

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Economic Evaluation is About Choice



Home-Based Interventions Defined

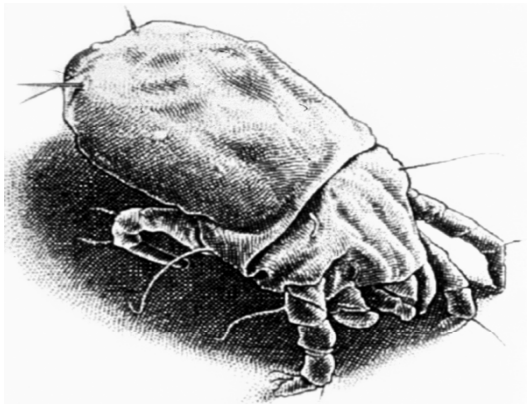
- **Home-based:** at least one home visit conducted by someone with training or experience

- **Multicomponent:** at least one component directed towards the home environment:
    - Environmental Assessment
    - Environmental Remediation
    - Environmental Education

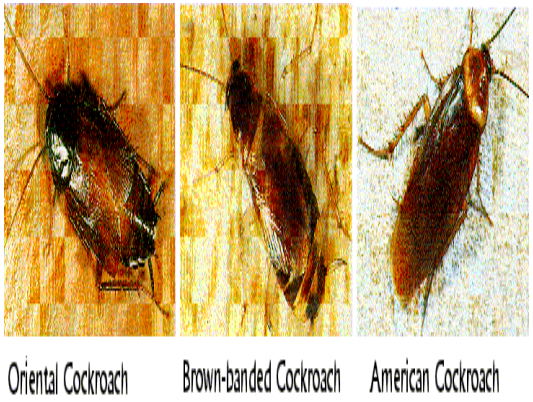
- **Multi-trigger:** environmental component(s) targets two or more potential asthma triggers

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Indoor Asthma Triggers



Dust Mites



Cockroach Allergens

Rodents

Pet Dander

Mold

Cigarette Smoke

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Effectiveness Review: Task Force Finding

The Task Force recommends the use of home-based, multi-trigger, multicomponent interventions with an environmental focus for children and adolescents with asthma on the basis of strong evidence of effectiveness in

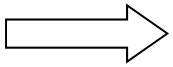
- Reducing the number of symptom days
- Improving quality of life or symptom scores
- Reducing the number of school days missed

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

From the Effectiveness Review to the Economic Review

Home-based interventions are recommended for their **effectiveness** based on:

- Reducing symptom days
- Improving quality of life or symptom scores
- Reducing the number of school days missed



Are these interventions **economically worthwhile**?

Economic summary measures are based on:

- **Program costs**
- **Direct medical costs averted**
- **Productivity loss averted**
- **Symptom free days**

Important factors in the economic review might not be the same ones that support the determination of effectiveness

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

The Economic Review of Home-based Interventions

Methods of Economic Evaluation Analysis

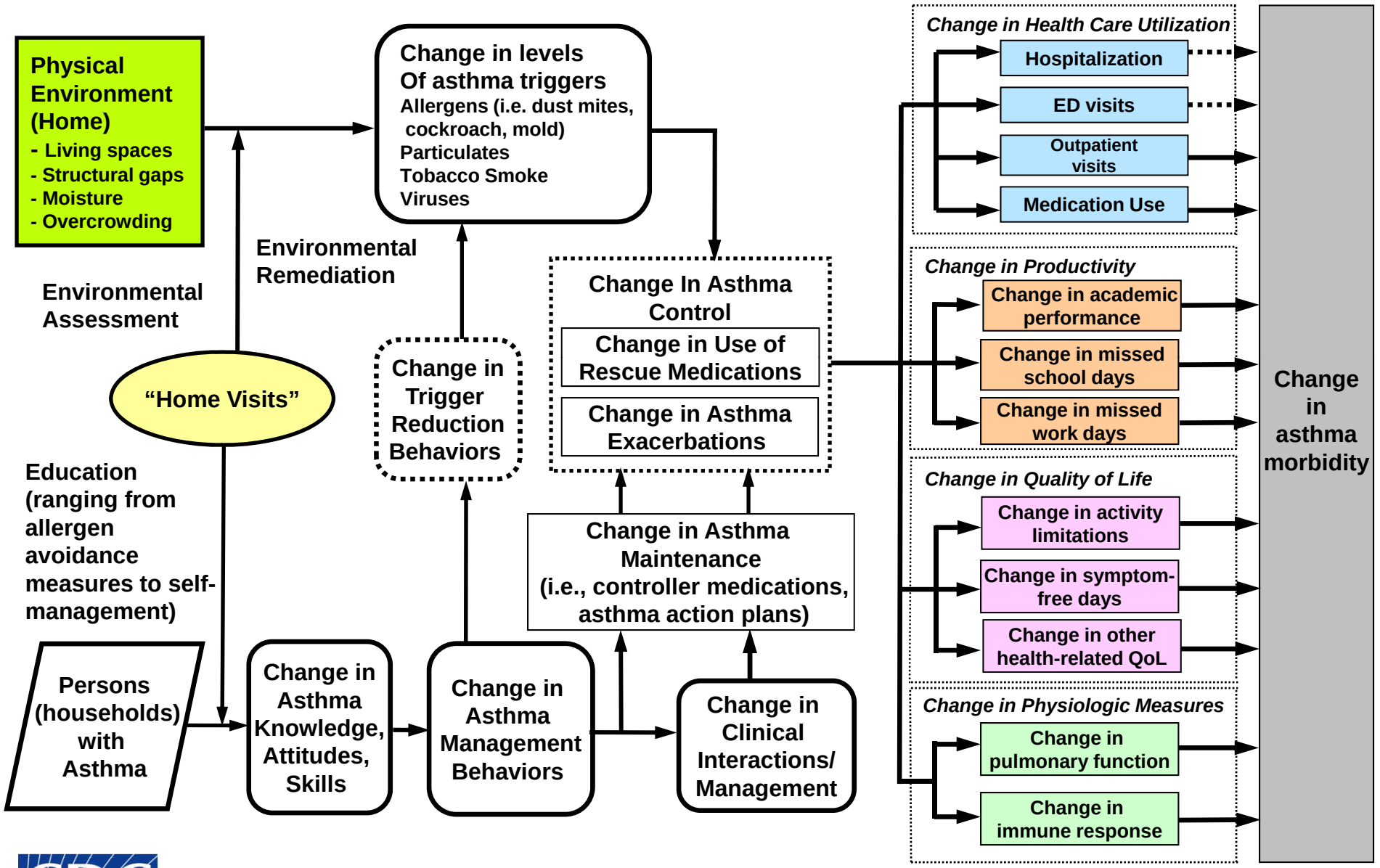
- **Program Cost Analysis (PCA)** identifies the value of all resources used to conduct program (intervention)

- **Cost-Benefit Analysis (CBA)** uses program costs (C) and benefits (B) in monetary terms to estimate Benefit-Costs ratio (B/C) as economic outcome of the program

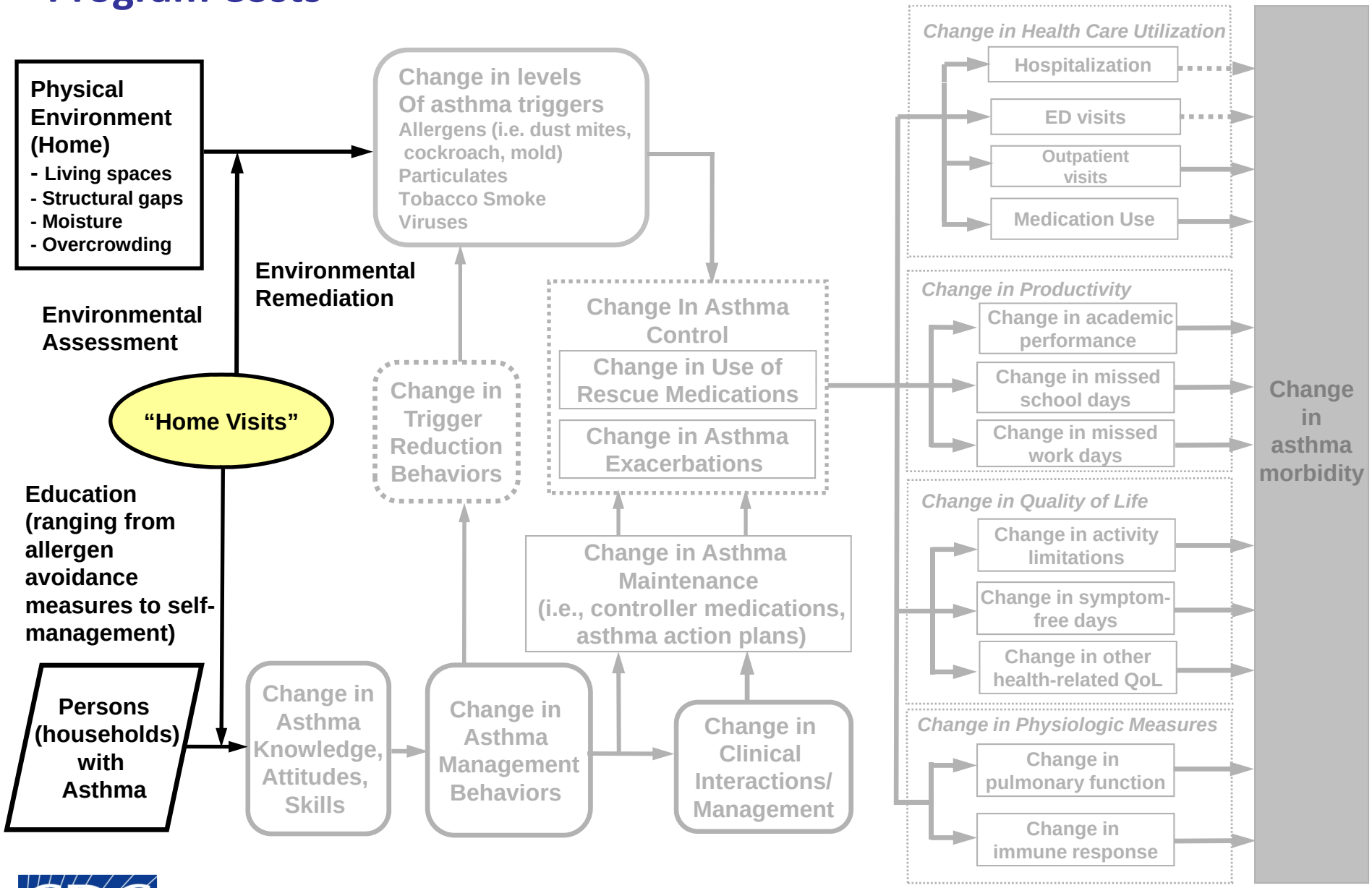
- **Cost-Effectiveness Analysis (CEA)** provides per unit cost of achieving a particular non-monetary health benefit, for example Symptom-Free Day (SFD)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

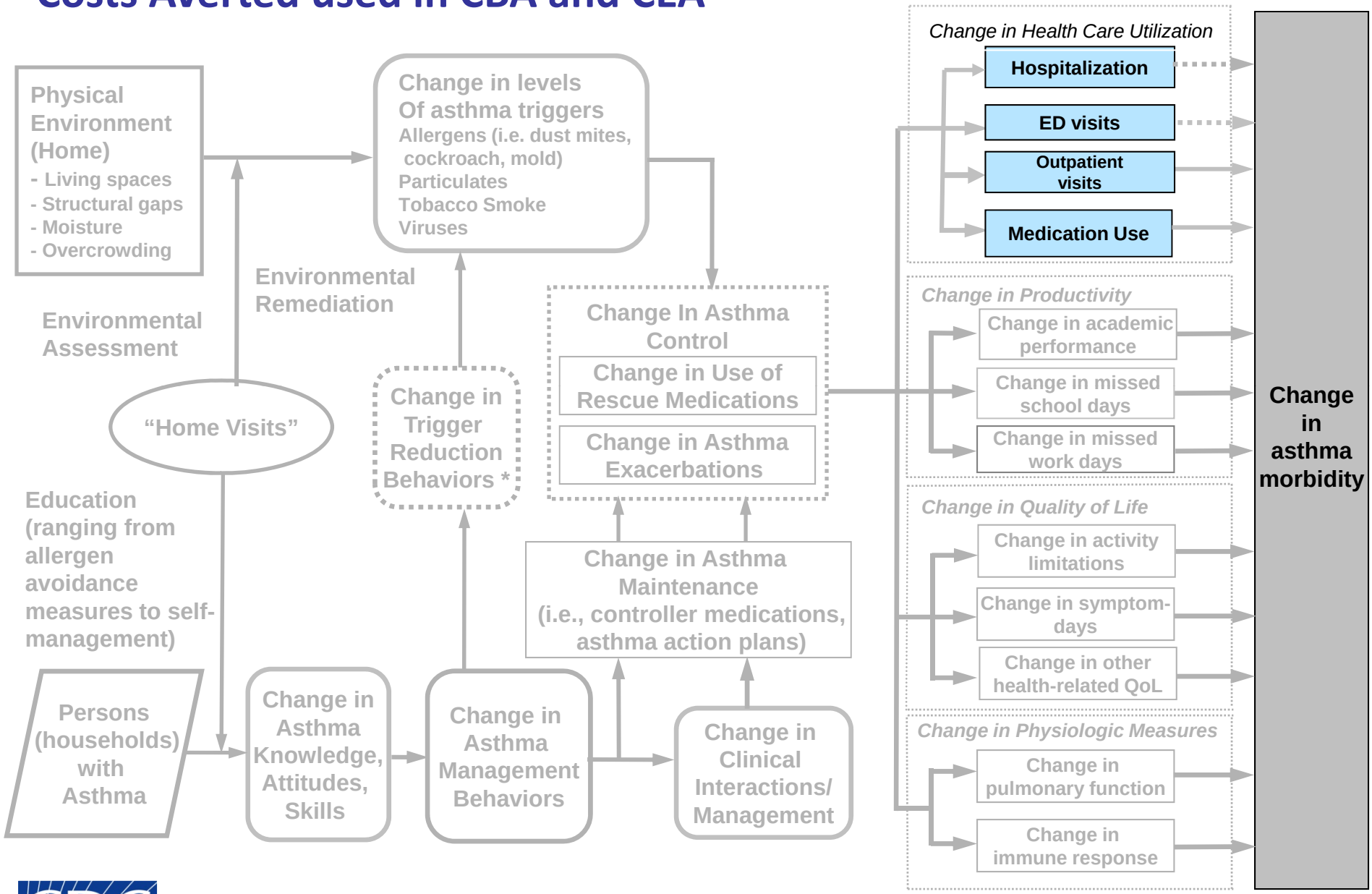
Economic Considerations within the Analytic Framework



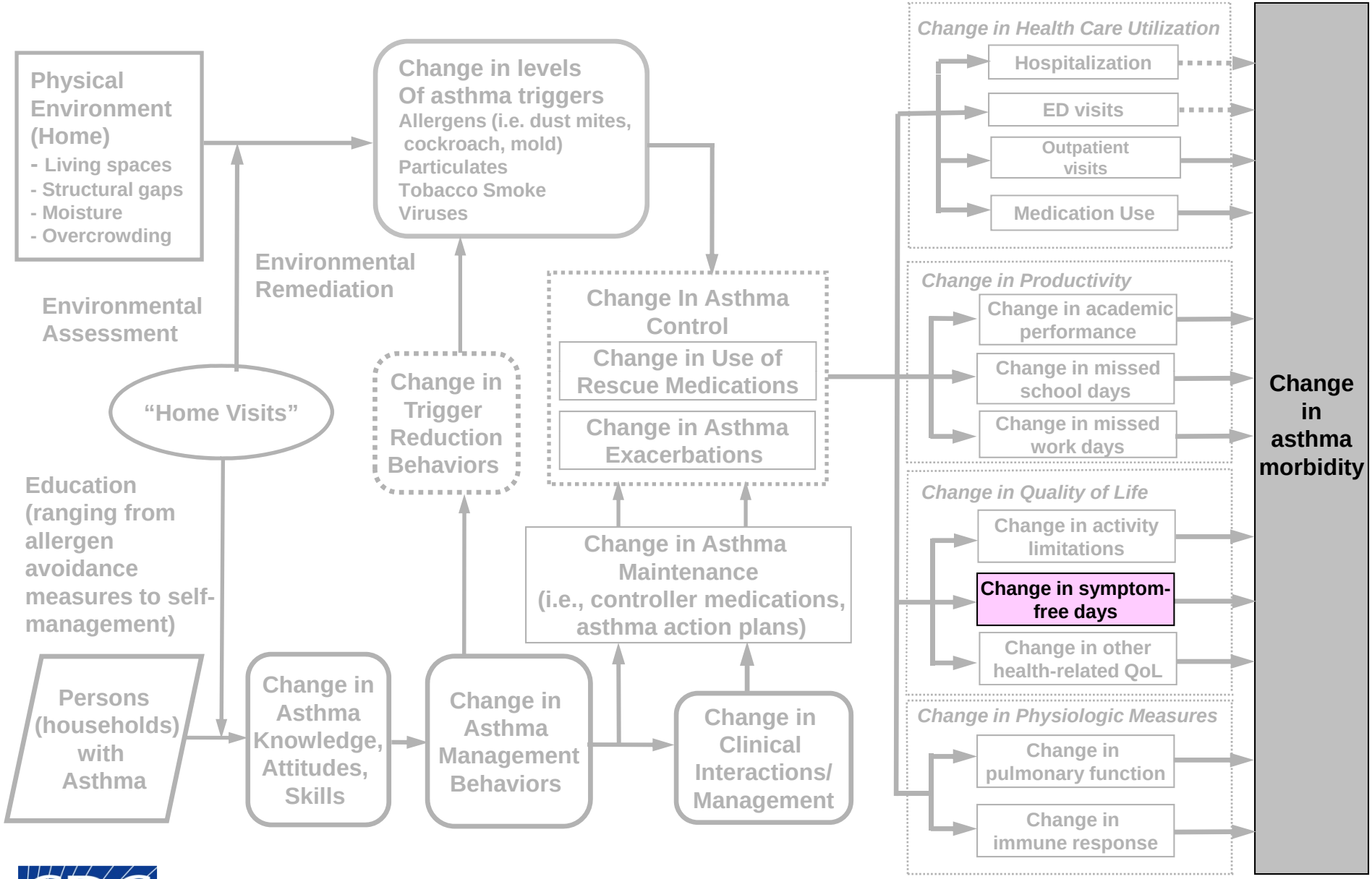
Program Costs



Costs Averted used in CBA and CEA



Effectiveness Measure Used in CEA

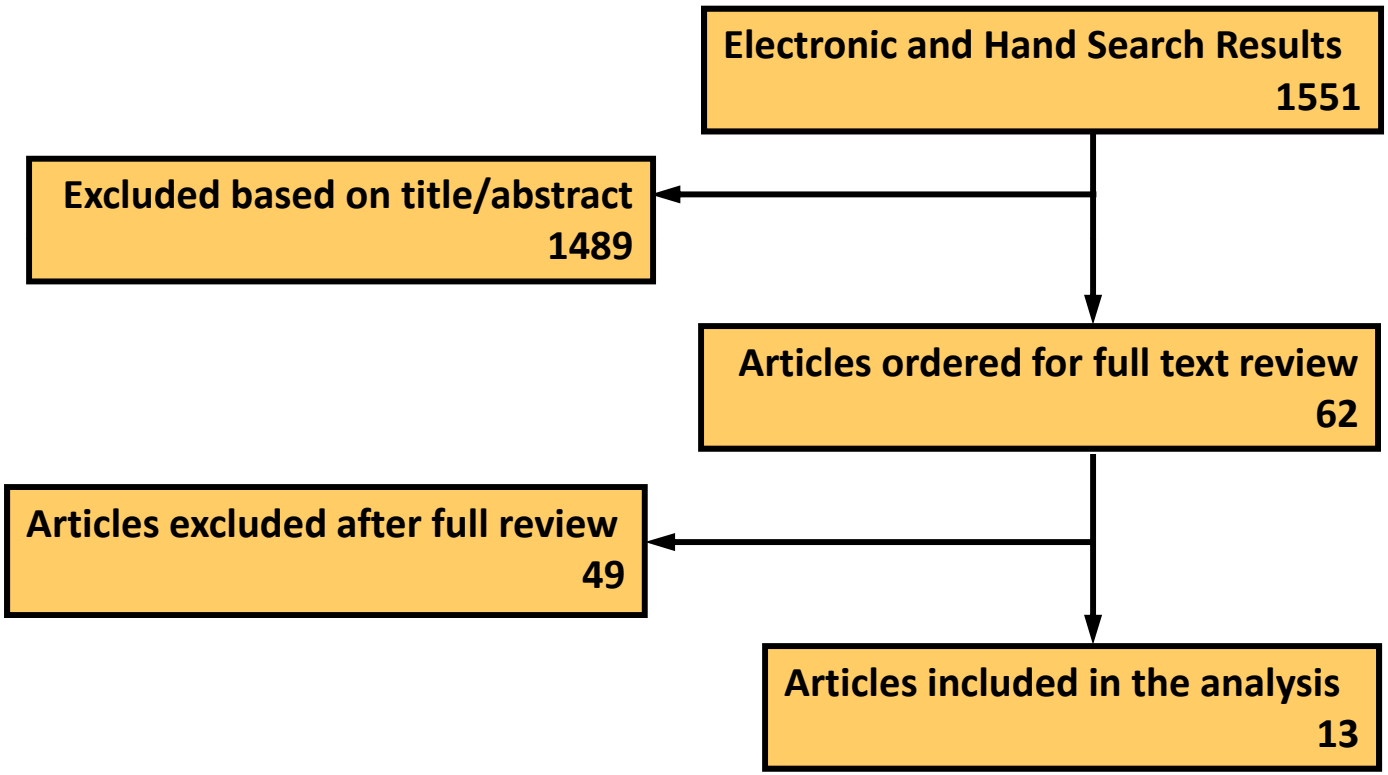


Economic Review: Research Questions

1. What are the ranges of program cost, cost-benefit, and cost-effectiveness estimates?
2. What are important factors or drivers that influence the economic outcomes?
3. What are the significant gaps in the economic information reported in these studies?

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Economic Evaluation Search Results (1950–June 2008)



CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Key Elements of Economic Evaluation Studies

- **Program cost** (reported in all studies)
- **Costs averted** (or saved) as a result of a program:
  - Direct cost:
    - Hospitalizations
    - ED visits
    - Outpatient office visits (scheduled and unscheduled)
    - Asthma medication use
  - Indirect cost:
    - School days missed
    - Work days missed
- **Symptom-free days** (SFD)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Key Elements of Economic Evaluation Studies (cont'd)

All costs were adjusted to 2007 US dollars using:

- Medical Consumer Price Index (MCPI)
- Consumer Price Index Urban (CPI-U)
- Purchasing Power Parities (PPP) from the World Bank for international currencies

These adjustments allow to compare costs from different countries and from different years

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Types of Economic Evaluation Analysis Used in the Review

There were three types of economic evaluation analysis in this review:

- Program Cost Analysis (PCA): 12 (all studies)
- Cost-Benefit Analysis (CBA): 3 studies
- Cost-Effectiveness Analysis (CEA): 3 studies

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Types of Economic Evaluation Analyses

Study	Program Cost	Direct Medical Costs Averted	Productivity Loss Averted	Type of Analysis
Barton, 2007	●			**Program Cost Analysis only (PCA) (N=6)**
Sommerville, 2000	●			
Kercsmar, 2006	●			
Eggleston, 2005	●			
Primomo, 2006	●			
Lin, 2005	●			
Oatman, 2007	●	●		**Cost-Benefit Analysis (CBA) (N=3)**
Jowers, 2000	●	●	●	
Shelledy, 2005	●	●		
Krieger, 2005	●	●		**Cost-Effectiveness Analysis (CEA) (N=3)**
Kattan, 2005	●	●		
Sullivan, 2002	●	●		

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Completeness of Program Cost Information

We classified all studies in 3 category depending on how detailed information on program cost was provided in the study:

- **Satisfactory (S)** – provided the list of program cost components and the cost of each component
- **Partially complete (P)** – provided the list of program components but not the cost of the components
- **Limited (L)** – provided no break-down of program cost component

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Completeness of Program Cost Information

Study	Completeness of Program Cost Information
Barton, 2007	Limited (L)
Sommerville, 2000	Limited (L)
Kercsmar, 2006	Limited (L)
Eggleston, 2005	Partially Complete (P)
Primomo, 2006	Satisfactory (S)
Lin, 2005	Limited (L)
Oatman, 2007	Satisfactory (S)
Jowers, 2000	Limited (L)
Shelledy, 2005	Partially Complete (P)
Krieger, 2005	Partially Complete (P)
Kattan, 2005	Satisfactory (S)
Sullivan, 2002	Satisfactory (S)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Major Drivers of Program Cost

- Environmental remediation intensity
- Education focus
- Type of home visitor and
- Number of home visits

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Environmental Remediation Intensity

Minor

Environmental assessment

Pillow and mattress covers

Moderate

Pest management

HEPA filters, vacuums

Vent filters

Major

New form of ventilation/heating

Re-roofing

Wiring

Insulation

Removal of water damaged materials

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Education Focus

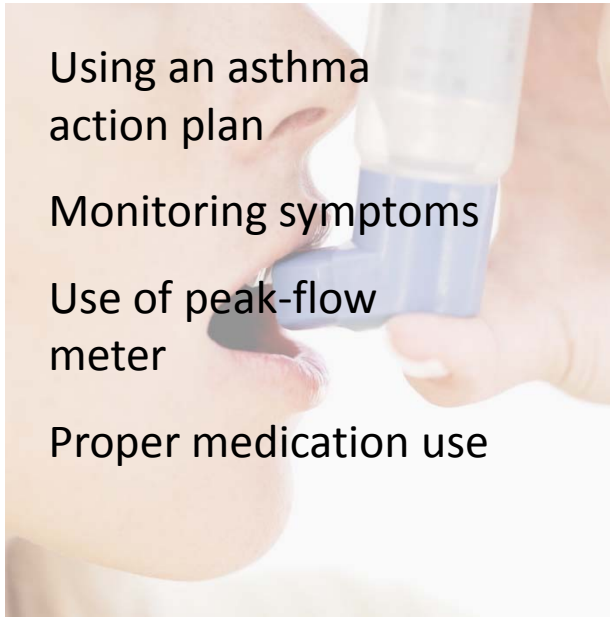
Environmental Education

Reducing or removing triggers from the home

Reducing exposure to triggers

Cleaning instruction

Self-Management



Using an asthma action plan

Monitoring symptoms

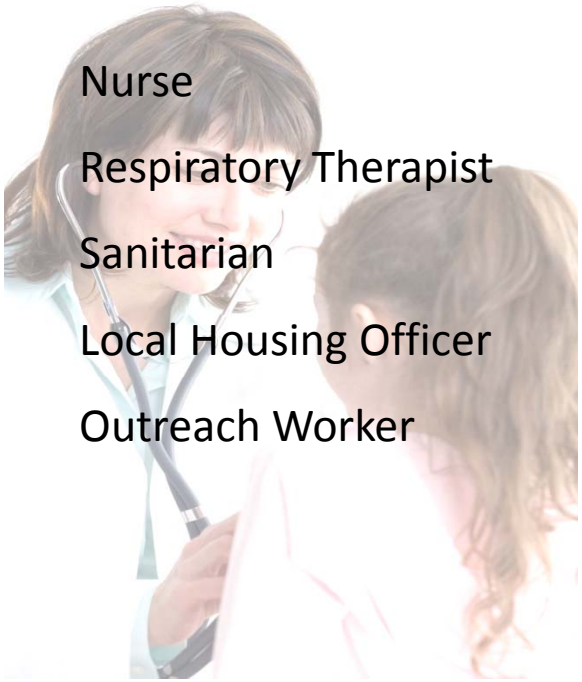
Use of peak-flow meter

Proper medication use

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Home Visitation

Type of Home Visitor	Number of home visits
Nurse	1
Respiratory Therapist	2
Sanitarian	…
Local Housing Officer	9
Outreach Worker	



Presenting Economic Findings

- We present separately summaries on PCA, CBA and CEA studies

- For each type of analysis PCA, CBA and CEA we will present:
  - Information on the study and program
  - Completeness of cost information
  - Drivers of program cost
  - Full economic summary measure

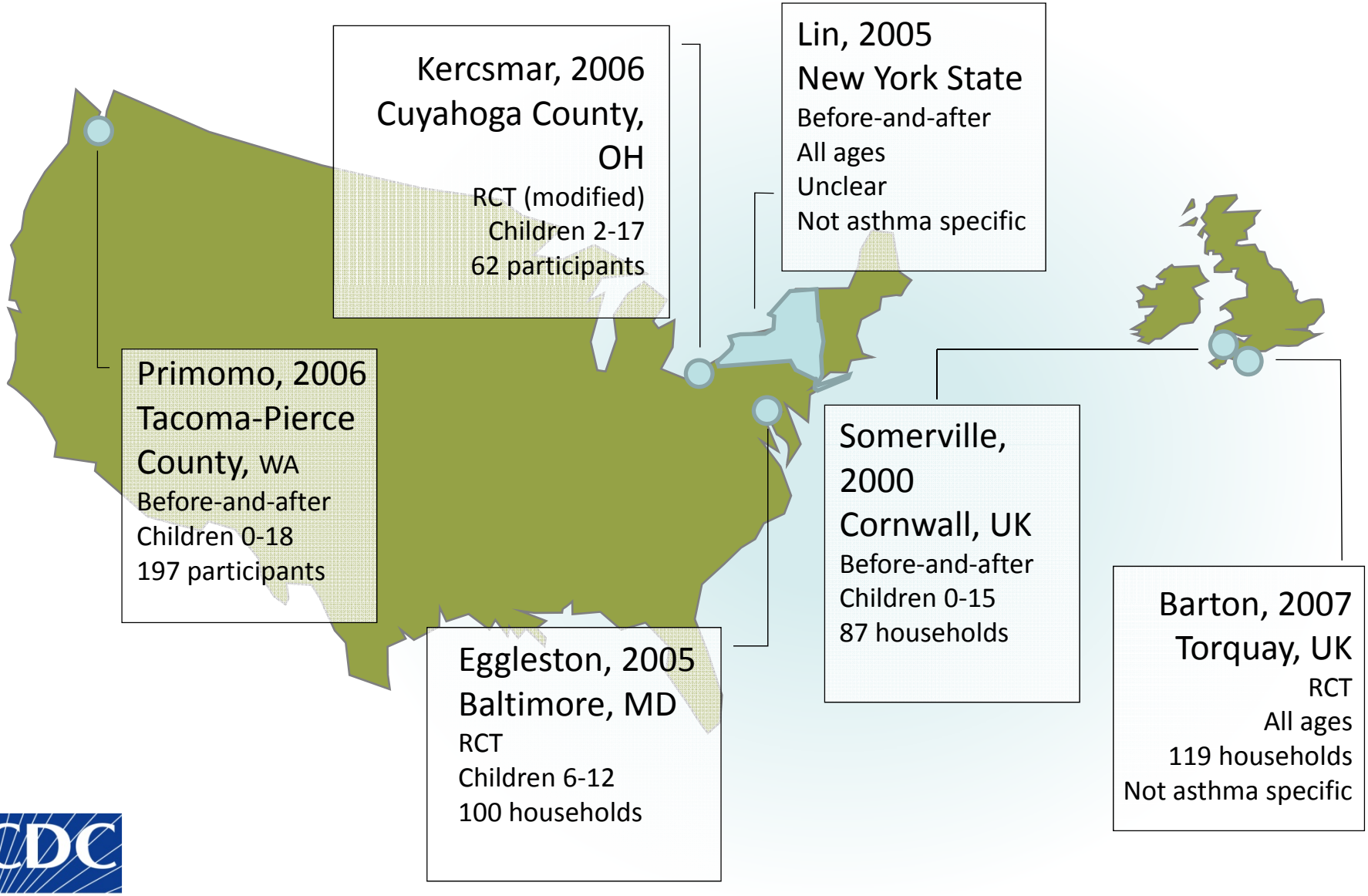
CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Program Cost Analysis (PCA)

- Identifies the value of all resources used to conduct intervention (program)
- Program cost is a good measure of economic value of the program when sufficient information is not available to conduct CBA or CEA
- PCA was performed for all studies, and in 6 studies it was the only type of economic evaluation analysis

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Program Cost Analysis: Information on Studies



Program Cost Analysis: Completeness

	List of Cost Components	Costs Included	Potential Costs Not Included	Cost by Component	Quality of Cost Information
Barton, 2007	--	•building supplies •labor		--	Limited (L)
Sommerville, 2000	--	•building supplies •labor		--	Limited (L)
Kercsmar, 2006	--	•remediation costs	• lab costs • clinic visits • Labor	--	Limited (L)
Eggleston, 2005	✓	• mattress and pillow encasings • room HEPA cleaner • pest control visits • educator visits	• lab costs • clinic visits • follow up evaluations	--	Partially Complete (P)
Primomo, 2006	✓	•staffing •supplies •travel •overhead		✓	Satisfactory (S)
Lin, 2005	--	• remediation supplies • labor • overhead		--	Only total program cost available (L)

Program Cost Analysis: Drivers and Results

Study	Home Visitor	Home Visits	Environmental Intensity	Education Focus		Program Cost per Participant ($2007)
				Environ.	Self-Mgmt	
Barton, 2007	Nurse	1	major			$14,858 (L)
Sommerville, 2000	Local Housing Officer	2	major			$6,424 (L)
Kercsmar, 2006	Sanitarian	5	major		✓	$3,796 (L)
Eggleston, 2005	Env. Educator, Exterminator	3	moderate	✓		$554 (P)
Primomo, 2006	Outreach Worker	2	minor	✓	✓	$231 (S)
Lin, 2005	Outreach Worker	2 to 3	moderate	✓	✓	Only total program cost is available (L)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

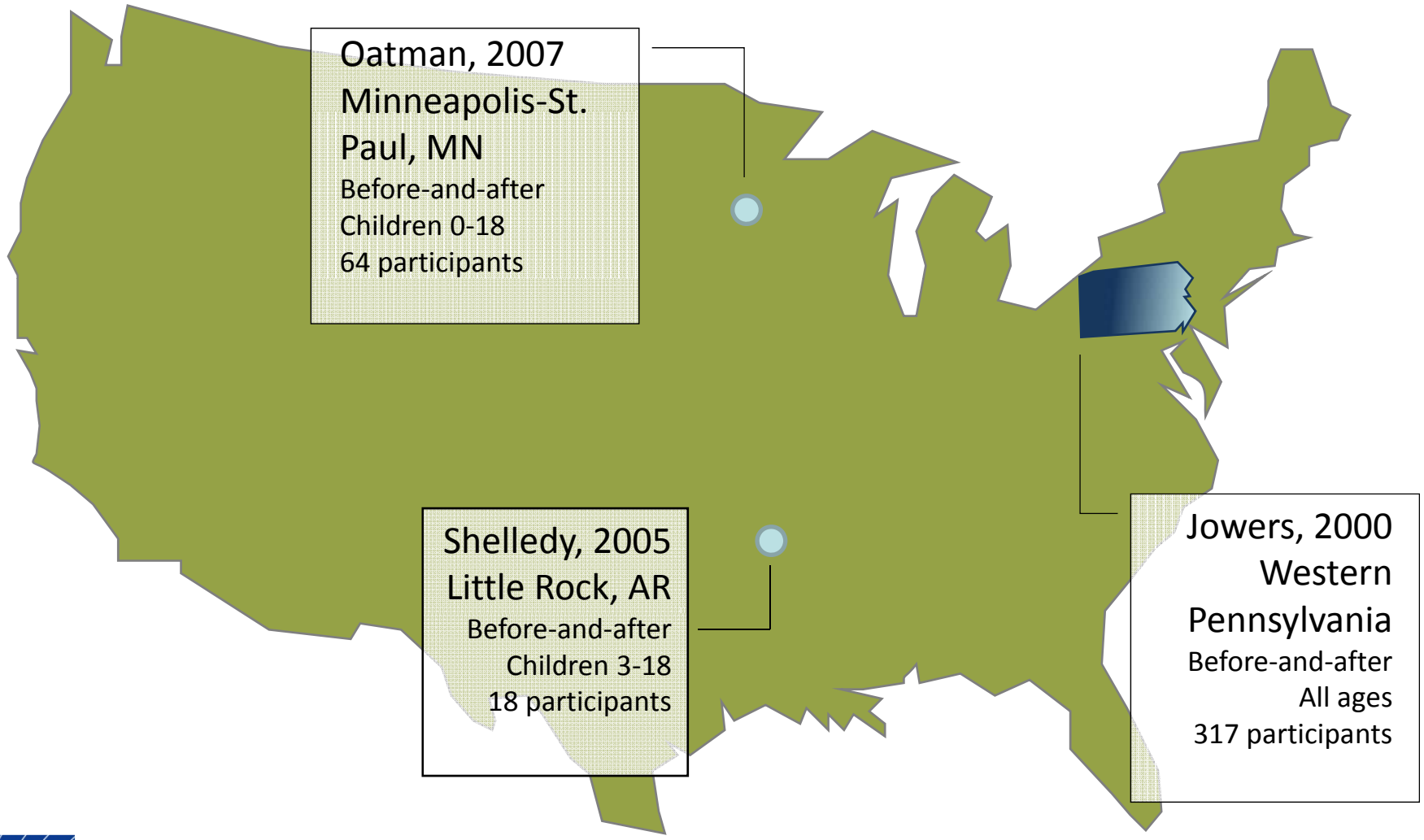
Cost-Benefit Analysis (CBA)

- CBA measures all benefits (B) and all costs (C) in monetary terms
- Ideally, CBA includes all direct and indirect costs and benefits over sufficiently long time
- Present value of all future costs and benefits is used

Benefit-Cost Ratio = sum of costs averted/program costs

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Cost-Benefit Analysis: Information on Studies



CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Cost-Benefit Analysis: Completeness of Program Costs

Study	List of Cost Components	Costs Included	Potential Costs Not Included	Cost by Component	Quality of Cost Information
Oatman, 2007	✓	• remediation products and delivery • home assessment	• follow up home visits and phone calls	✓	Satisfactory (S)
Jowers, 2000	--	• physician and patient education • nurse home visits	• 6 months of follow up costs	--	Limited (L)
Shelledy, 2005	✓	• cost per respiratory therapist visit	--	--	Partially Complete (P)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Cost-Benefit Analysis: Drivers of Program Cost

Study	Home Visitor	Home Visits	Environmental Intensity	Education Focus		Program Cost per Participant ($2007)
				Environ.	Self-Mgmt	
Oatman, 2007	Asthma Educator, Respiratory Therapist	3	moderate	✓	✓	$497 (S)
Jowers, 2000	Nurse	2	minor		✓	$377 (L)
Shelledy, 2005	Respiratory Therapist	8	minor	✓	✓	$721 (P)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Cost-Benefit Analysis: Results

Study	(1) Program Cost per participant ($2007)	(2) Direct Medical Costs Averted ($2007)	(3) Prod. Loss Averted ($2007)	Benefit-Cost Ratio [(2)+(3)]/(1) ($2007)
Oatman, 2007	$497 (S)	$2,637	--	5.3
Jowers, 2000	$377 (L)	$2,181	$772	7.8
Shelledy, 2005	$721 (P)	$10,093	--	14.0

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Cost-Effectiveness Analysis (CEA)

- CEA provides per unit cost of achieving a particular non-monetary health benefit
- Specifically for CE studies in this review the final economic outcome can be expressed as Incremental Cost-Effectiveness Ratio (ICER):

ICER = (Program cost – Costs Averted)/ Change in SFD

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Effectiveness Measure Used in CEA Studies

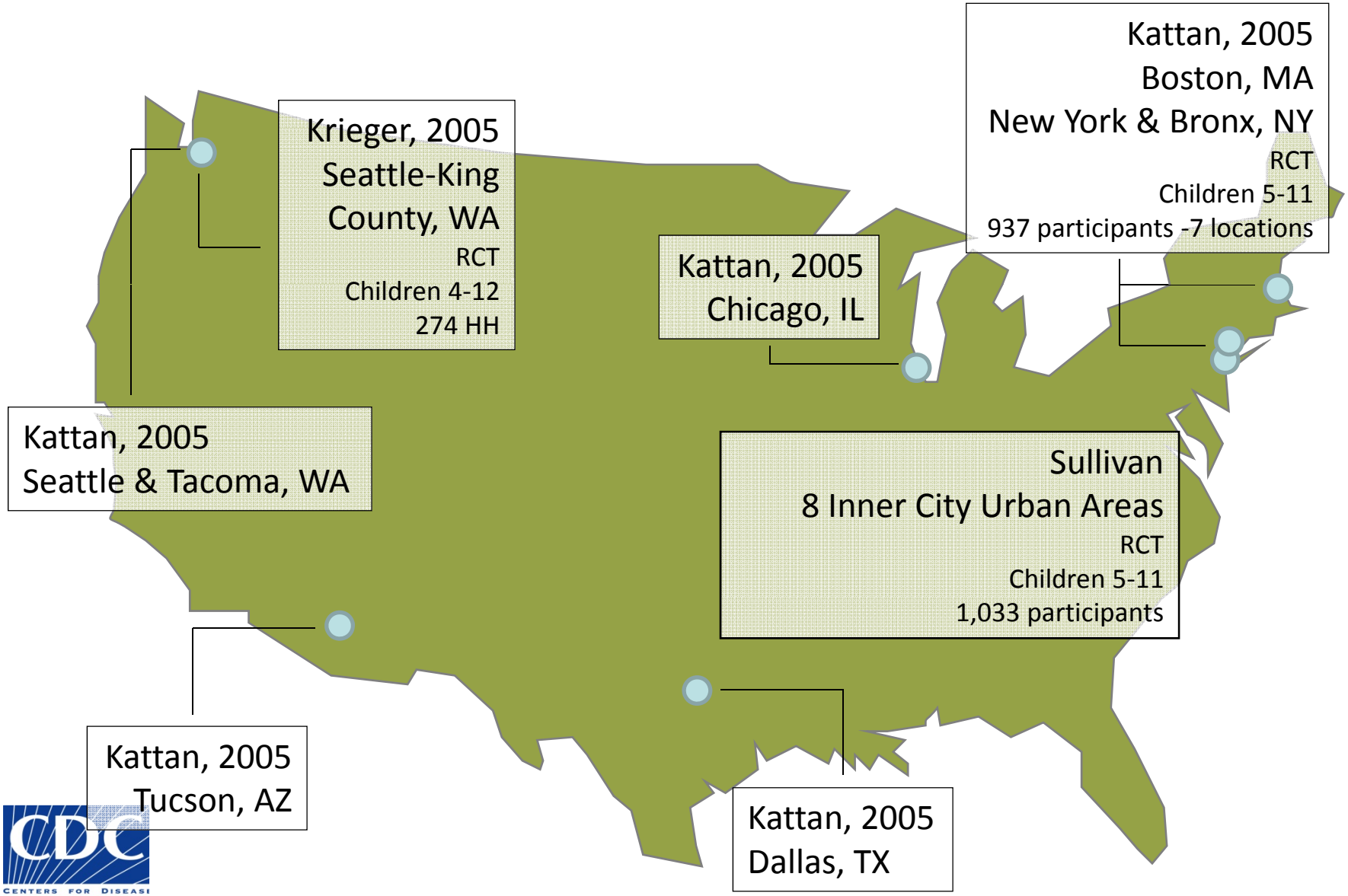
Symptom Free Days (SFDs)

- Good proxy for health state measure*
- Reflects quality of life of individuals with asthma
- Sensitive to asthma interventions
- Universal for all people with asthma regardless of age and employment status

*As recommended by the U.S. Panel on Cost-Effectiveness in Health and Medicine

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Cost-Effectiveness Analysis: Information on Studies



Cost-Effectiveness Analysis: Completeness of Program Cost

Study	List of Cost Components	Costs Included	Costs Not Included	Cost by Component	Quality of Cost Information
Krieger, 2005	✓	• salary fringe benefits • supplies • rent • travel • office expenses • indirect charges	• low intensity program costs	--	Partially Complete (P)
Kattan, 2005	✓	• skin test • remediation products • salary • travel • pest management	--	✓	Satisfactory (S)
Sullivan, 2002	✓	• personnel and training • extermination visits • skin tests • medical equipment • remediation products • other	--	✓	Satisfactory (S)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Cost-Effectiveness Analysis: Drivers of Program Cost

Study	Home Visitor	Home Visits	Environmental Intensity	Education Focus		Program Cost per Participant ($2007)
				Environ.	Self-Mgmt	
Krieger, 2005	Community Health Worker	5 to 9	moderate	✓		$1,316 (P)
Kattan, 2005	Environmental Counselor (high school graduates)	5 to 7	moderate	✓		$1,720 (S)
Sullivan, 2002	Exterminator	0 or 2	minor	✓	✓	$458 (S)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Cost-Effectiveness Analysis: Results

Study	(1) Program cost per participant ($2007)	(2) Direct Medical Costs Averted ($2007)	(3) Change in SFDs	ICER [(1)-(2)]/(3) ($2007)
Krieger, 2005	$1,316 (P)	$147	20.8 (1 year)	$57 per SFD*
Kattan, 2005	$1,720 (S)	$555	37.8 (2 years)	$31 per SFD
Sullivan, 2002	$458 (S)	$147	26.6 (2 years)	$12 per SFD

*Computed by reviewers

Summary & Conclusions

CDC
CENTERS FOR DISEASE
CONTROL AND PREVENTION

Ranges of Economic Outcomes

Benefit-Cost Ratio: 5.3 - 14.0

Incremental Cost-Effectiveness Ratio: $12 - $57 per SFD

Program Cost: $231 - $14,858

By Quality of Cost Information		
Limited (N=5): $377 - $14,858	Partially Complete (N=3): $554-$1,316	Satisfactory (N=4): $231-$1,720
By Location		
U.K. (N=2): $6424 - $14,858	U.S. (N=10): $231 - $3,796	
By Type of Analysis		
CA (N=6): $231-$14,858	CBA (N=3): $377-$721	CEA (N=3): $458-$1,720

All monetary values are in $2007

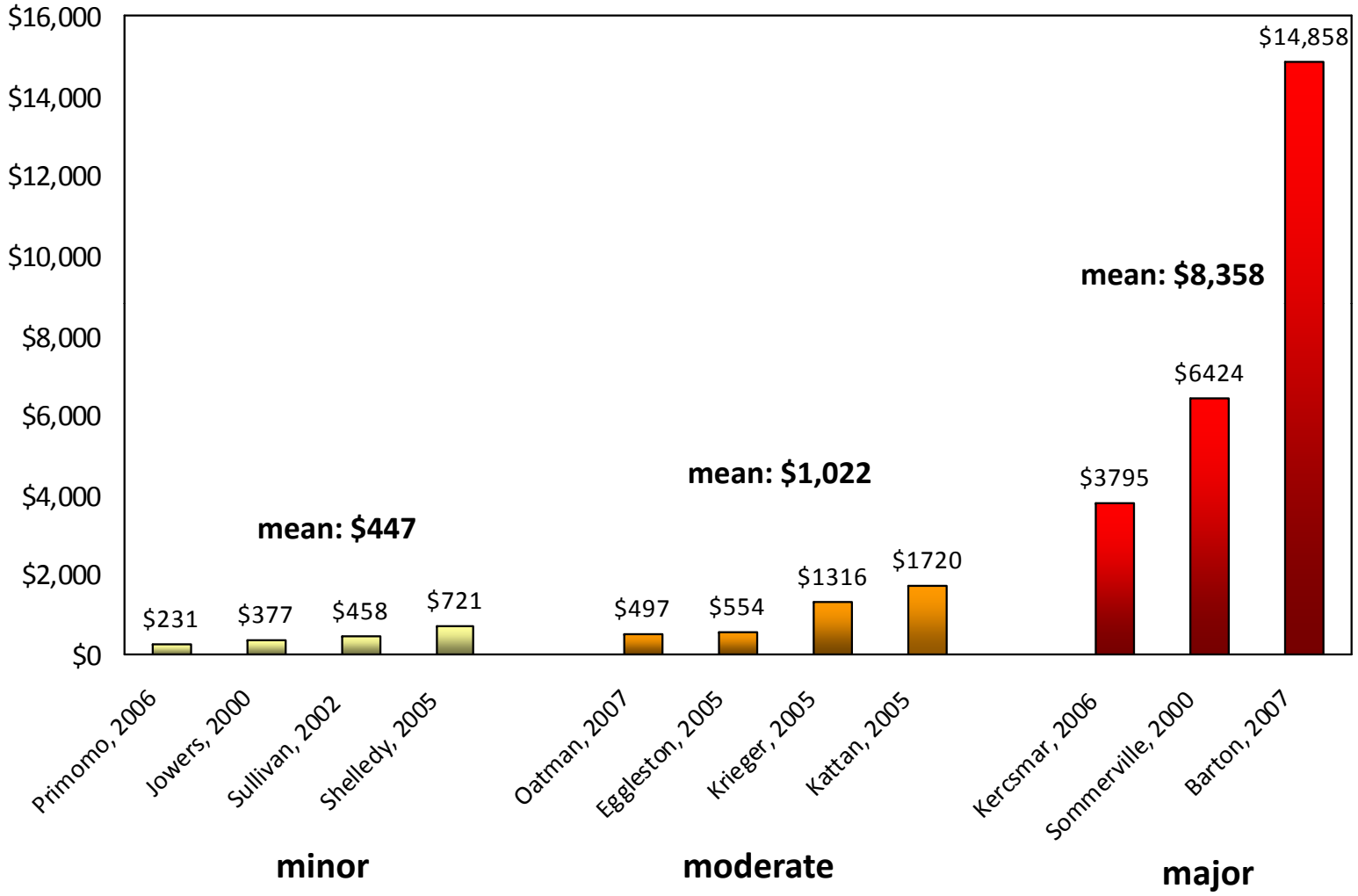
CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Summary of Drivers of Program Costs

Study	Home Visitor	Home Visits	Remediation Intensity	Education Focus		Program Cost per Participant ($2007)
				Environ.	Self-Mgmt	
Barton, 2007	Nurse	1	major			$14,858 (L)
Sommerville, 2000	Local Housing Officer	2	major			$6,424 (L)
Kercsmar, 2006	Sanitarian	5	major	✓	✓	$3,796 (L)
Eggleston, 2005	Env. Educator, Exterminator	3	moderate	✓	✓	$554 (P)
Primomo, 2006	Outreach Worker	2	minor	✓	✓	$231 (S)
Lin, 2005	Outreach Worker	2 to 3	moderate	✓	✓	Only total program cost is available (L)
Oatman, 2007	Asthma Educator, Respiratory Therapist	3	moderate	✓	✓	$497 (S)
Jowers, 2000	Nurse	2	minor		✓	$377 (L)
Shelledy, 2005	Respiratory Therapist	8	minor	✓	✓	$721 (P)
Krieger, 2005	Community Health Worker	5 to 9	moderate	✓		$1,316 (P)
Kattan, 2005	Environmental Counselor (high school graduates)	5 to 7	moderate	✓		$1,720 (S)
Sullivan, 2002	Exterminator	0 or 2	minor	✓	✓	$458 (S)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Program Cost by Environmental Remediation Intensity



CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Gaps in Economic Evaluation of the Interventions

- Economic effect of each program component
- Economic burden of asthma attributable to the home environment
- Optimal investment for interventions to have desired effectiveness results
- Increasing (and diminishing) returns to investment
- Economic evaluation studies with longer follow-up periods

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Applicability

- Most of the studies were conducted in urban areas with a diverse population
- Most of the studies that we reviewed target children and adolescents
- Many of the studies focused on children with moderate to severe asthma
- Participants in the studies ranged from 18 to 1,033, suggesting interventions can be carried out on a wide scale
- Two CEA studies were multi-site interventions across the US; therefore, study findings can be generalized

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Limitations

- The studies reviewed are heterogeneous in terms of:
  - components of costs and benefits included
  - nature and intensity of the interventions
  - number of participants and
  - severity of asthma within the study population
- Many of the papers did not include relevant costs averted, such as productivity loss averted; therefore, these studies can potentially provide more favorable economic outcomes
- Interventions may provide more benefits if time horizon is longer

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Summary of Key Findings

- Studies with satisfactory program cost information report the range of program costs from $231 to $1,720 per participant
- Cost-Benefit studies show net positive returns on investment with a benefit-cost ratio ranging from 5.3 to 14.0
- Cost-Effectiveness studies demonstrate that costs per SFD range from $12 to $57, and could be lower if all direct and indirect cost were included

Based on this evidence, the economic benefits from these interventions have the potential to match or even exceed the cost of intervention

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

The Task Force

Finds that the combination of minor to moderate environmental remediation with an educational component provides good value for the money invested based:

- on improvement in symptom free days,
- savings from averted costs of asthma care, and
- improvement in productivity

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Acknowledgements

Jill Ferdinands, PhD……. NCIRD

Elizabeth Herman, MD……NCEH

Maureen Wilce, MS……..NCEH

Paul Garbe, DVM, MPH……..NCEH

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Contact Information

- Tursynbek Nurmagambetov
  - ten7@cdc.gov
  - 770-488-0790

- Gema Dumitru
  - ggd7@cdc.gov
  - 770-488-0796

- APRHB at CDC
  - 770-488-3700 (main line)
  - 770-488-1540 (fax)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Thank You!

Thank you for joining us!

- Please provide your feedback using the Question and Answer pane
- An archive of this Webinar will be posted to: www.AsthmaCommunityNetwork.org
- Continue the discussion! Visit the forums: www.AsthmaCommunityNetwork.org/Forums