Using computer simulation to reduce secondhand smoke exposure in children of low-Income families (Pilot Study)

Neil E Klepeis, Ph.D.
Education, Training, and Research, Inc.
Scotts Valley, CA 95066
neilk@etr.org

Presenter Disclosures

Neil E. Klepeis

(1) The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

"No relationships to disclose"

Significance of In-Vehicle Secondhand Smoke Exposure

- Low income persons least likely to have smoking bans in cars and homes
- 30 – 50% of US family automobiles are sites of children's exposure
- Children particularly sensitive to exposure Acute Health Effects
  - Respiratory Problems
  - Eye Irritation
  - Asthma Attacks

Effective Interventions for Reducing or Eliminating Children's Exposure to Secondhand Smoke

- Interventions Focused on Smoking Cessation Alone NOT ALWAYS Effective
- Including Rapid Feedback on Exposure Likely to be More Effective
- Focus on Child's Exposure and Communication to Family Members
- Cotinine Feedback is Delayed & Expensive
- Counseling is Time Intensive and Expensive
- Better Way?

Summary of Presentation

Science-Based Intervention with Real-Time Exposure Feedback

- SCIENCE. The Car Setting
- MESSAGING (TRANSLATION). Develop Messaging and Real-Time Exposure Feedback Mechanism
- INTERVENTION. Intervention Design, Virtual Environment, Graphics, Animation, Sound
- EVALUATION. Pilot Study of Intervention in Stockton, CA and Lexington, KY

The Science

Vehicle Air Exchange Rates

- 85 Air Changes
- Five Vehicles
- Tracer Gas Releases

- Five Driving Speeds
- Window Positions
- Ventilation Settings

Secondhand Smoke Particles in Cars with Real Smokers

- 3 Rented Vehicles
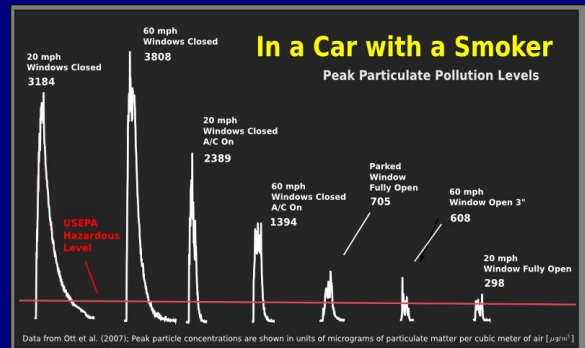- 2 Smokers
- 14 Cigarettes
- Particle/CO monitoring

- Five Speeds
- Window Positions
- Ventilation Settings

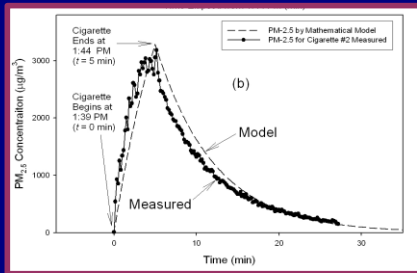## Real-Time Particle Monitoring Data
Ott et. 2007

In a Car with a Smoker
Peak Particulate Pollution Levels

20 mph Windows Closed 3184
60 mph Windows Closed 3808
20 mph Windows Closed A/C On 2389
USEPA Hazardous Level
60 mph Windows Closed A/C On 1394
Parked Window Fully Open 705
60 mph Window Open 3" 608
20 mph Window Fully Open 298

Data from Ott et al. (2007); Peak particle concentrations are shown in units of micrograms of particulate matter per cubic meter of air [μg/m³]
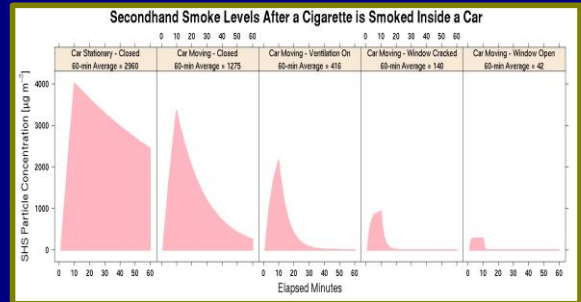

Mass Balance Model Fits In-Vehicle Particle Data

Levels are well predicted using a mathematical mass balance model.

Simulation of Levels in a Car

Flexible Educational Tool

Real-Time Demonstration of Secondhand Smoke in Cars for the Press

Press Event Promoting CA's new "No Smoking in Cars with Minors" Law – January 2008

- Volunteer Smoker
- Sidepak Monitors
- Stationary and Moving
- Windows Open/Closed

Air Quality Index


U.S. Environmental Protection Agency Air Quality Index

Level of Health Concern	Numerical Value	Corresponding Particle Level	
Very Hazardous	> 500	> 500	μg/m³
Hazardous	301 – 500	250 - 500	μg/m³
Very Unhealthy	201 – 300	150 – 250	μg/m³
Unhealthy	151 – 200	65 – 150	μg/m³
Unhealthy for Sensitive Groups	101 – 150	40 – 65	μg/m³
Moderate	51 – 100	15 – 40	μg/m³
Good	0 – 50	0 – 15	μg/m³

Dramatic Rise in PM-2.5 Levels Within Seconds

1-s Particle Concentrations Exceeded EPA's "HAZARDOUS" Limit by 20 or 30 Times Before ½ of a Cigarette was Consumed

Los Angeles California

00:00:02   00:00:12
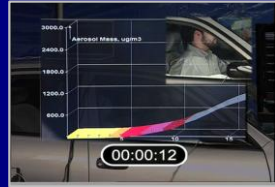
Surface Contamination in Cars

"*Cars with strong secondhand smoke odor showed nicotine surface contamination levels 30 times higher than cars free of the unpleasant odor.*"

- Georg Matt, SDSU

Matt, G.E., Quintana, P.J.E., Hovell, Chatfield, D., Ma, D.S., Romero, R., Uribe, A. (in press). Residual Tobacco Smoke Pollution in Used Cars for Sale: Air, Dust, and Surfaces. Nicotine and Tobacco Research.

Matt, G.E., Romero, R., Ma, D.S., Quintana, P.J.E., Hovell, M.F., Salem, S., Aguilar, M., Boland, J., Cullimore, J., Crane, M., Junker, J., Tassinario, P., Timmermann, V., Wong, K., & Chatfield, D. (in press). Tobacco use and asking prices of used cars: prevalence, costs, and new opportunities for changing smoking behavior. Tobacco Induced Diseases, 4:2 (31 Jul 2008).

Three Key Health Messages for Secondhand Smoke in Cars

- **RISES RAPIDLY**. Secondhand smoke rises rapidly to extremely high, unhealthy levels in a car
- **STAYS INSIDE**. Even with windows open, smoke can be trapped inside the car for a long period
- **REMAINS AFTER SMOKING**. Smoke residue sticks to seats long after smoking has stopped

---

A Secondhand Smoke Mother-Child Virtual Experience

- **Mother – Child**
- **Real-Time Particulate Levels Meter**
- **Controls:**
  - ***Cigarette**
  - ***Speed**
  - ***Window**
  - ***AC**
  - ***Recirculate**
- **"Helper" Character**
- **Multilingual**

Smoker's Point of View

Reach for Cigarette   **Light Up**

Smoking – Smoke Levels Rise

Rising Levels Cause Acute Health Effects in Virtual Child

Coughing

Rubbing Eyes

Health Effects for Extreme Levels

Instruct Smoker-Mother to Work Towards Protecting Their Child

Pilot Study in Stockton, CA and Lexington, KY – Low Income Pop.

- Feasibility
- Usability
- Acceptability
- Messaging
- Learning
- Retention
- Behaviour

- Kiosks- Waiting Rooms
- Pre/Post Testing
- Case/Control Groups
- Focus Groups
- 2-week Follow-up
- Interviews
- Participant Opinions
- Practitioner Opinions
- Clinic Staff Opinions

Participant Types, n=151 eligible

Location/Sample	Knowledge (Ineligible)	Intervention (Case)	Control	Follow Ups
Stockton – in-clinic use	123	44	45	9
Stockon + Lodi + San Leandro – out-of-clinic use	-	16	11	7
Lexington – in-clinic use	-	21	14	3
TOTALS	123	81	70	19

Participant Characteristics, n =151

| Racial Categories	Females	Males	Total
American-Indian/Alaska Native	0	0	0
Asian	3	3	6
Native Hawaiian or Other Pacific Islander	0	0	0
Black or African American	39	11	50
White/Latino	64	20	84
Other	6	5	11

Feasibility, Usability, Acceptability

- Nearly Universal Positive Response to the Simulation
- Placing Kiosks in WIC Waiting Areas is Feasible; People did not feel uncomfortable using them
- Patients Found them Easy to Use Before or After Their Appointments for 15-20 minutes
- Kiosks in Waiting Areas are a Good Way to Reach Low Income Groups that May not Have Access to Internet or Computers
- All Groups Found Interface Intuitive and Compelling
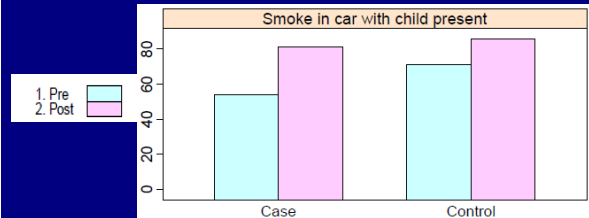- Messaging and Interactive Controls Need to be Very Clear

Pre-Post Test Questions
Percent Who "Strongly Agree"
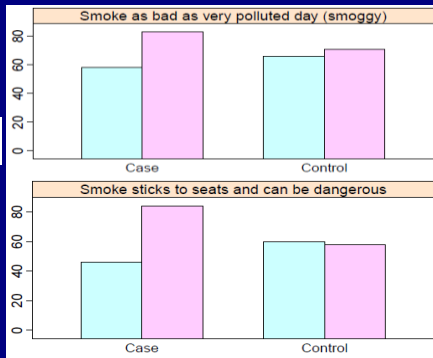
Pre-Post Test Question
How often do you smoke with your child (PRE) or would you smoke with your child in the car (POST)?

Patient Interviews 1, Emotional Reactions to Baby's Condition

"Oh no, I can't do that"

"The poor baby's getting sick,"

"That looks just like [my child], and I'm making her sick."

Patient Interviews 2, Learning, Retention, and Behaviour

- Some people thought about program "constantly"
- Seeing the child in the backseat experiencing distress significantly affected them and they often remembered that particular aspect of the program
- One participant: The dangers of second-hand smoke has become "part of her world".

Patient Interviews 3, Learning, Retention, and Behaviour, cont.

- *One participant: "The program … told me that smoke stays on the seats in the car. I didn't know any of that… that even with the windows down, the child is still very much affected with the smoke… every time I'm in the car. Also, every time I see someone smoking in their car. I think about the little girl choking. It's always in my head I think about how I used to do that and think that smoking but rolling down my windows was okay. I learned that it is not… "*

Patient Interviews 4, Learning, Retention, and Behaviour, cont.

- *Another participant: "It made me feel that I was wrong in my habits. I instantly wanted to make a change... I even told some of my family members and friends to go look at it. Especially those with children and who also smoke in the car. Now everyone doesn't smoke in the car period. After I participated, I stopped smoking."*

Successes

- Feasible and Popular for use in waiting rooms

- Connection and identification with virtual characters: strong emotional response of some users

- No negative impressions from users and clinic staff (but some misc suggestions for improvement)

- Received positively by smokers

- Some responses showed strong commitment to change behaviour

- Lays groundwork for larger, longer-term studies and tighter integration with providers

Challenges

- Difficulty getting participants to return for followup and interviews

- Difficult to get participants to use the program on the internet, i.e., outside of the clinic

- Not able to study long term effects on behavior

- Small differences in case and control in initial impact on learning, likely due to novelty of the kiosk in general

- In California: Significant prior knowledge of secondhand smoke hazards limited ability to see quantitative differences in learning and knowledge

Next Steps / Studies

- Work more closely with care providers, integrate into routine care

- Look at impact over long term w/ months of follow up sessions and evaluation

- Include smoking cessation counselling as part of intervention

- Involve whole families: husband, boyfriend, grandparents, siblings, friends

- Simulation improvements: More character interaction, wider selection of characters, smoking in home, different points of view (child,parent,grandparent)

Acknowledgments