

Smoke-Free Multi-Unit Housing: Evidence and Evaluation



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Overview



Rationale for Smoke-Free Multiunit Housing



Smoke-Free Multiunit Housing Policy Options



Smoke-Free Multiunit Housing Research and Evaluation

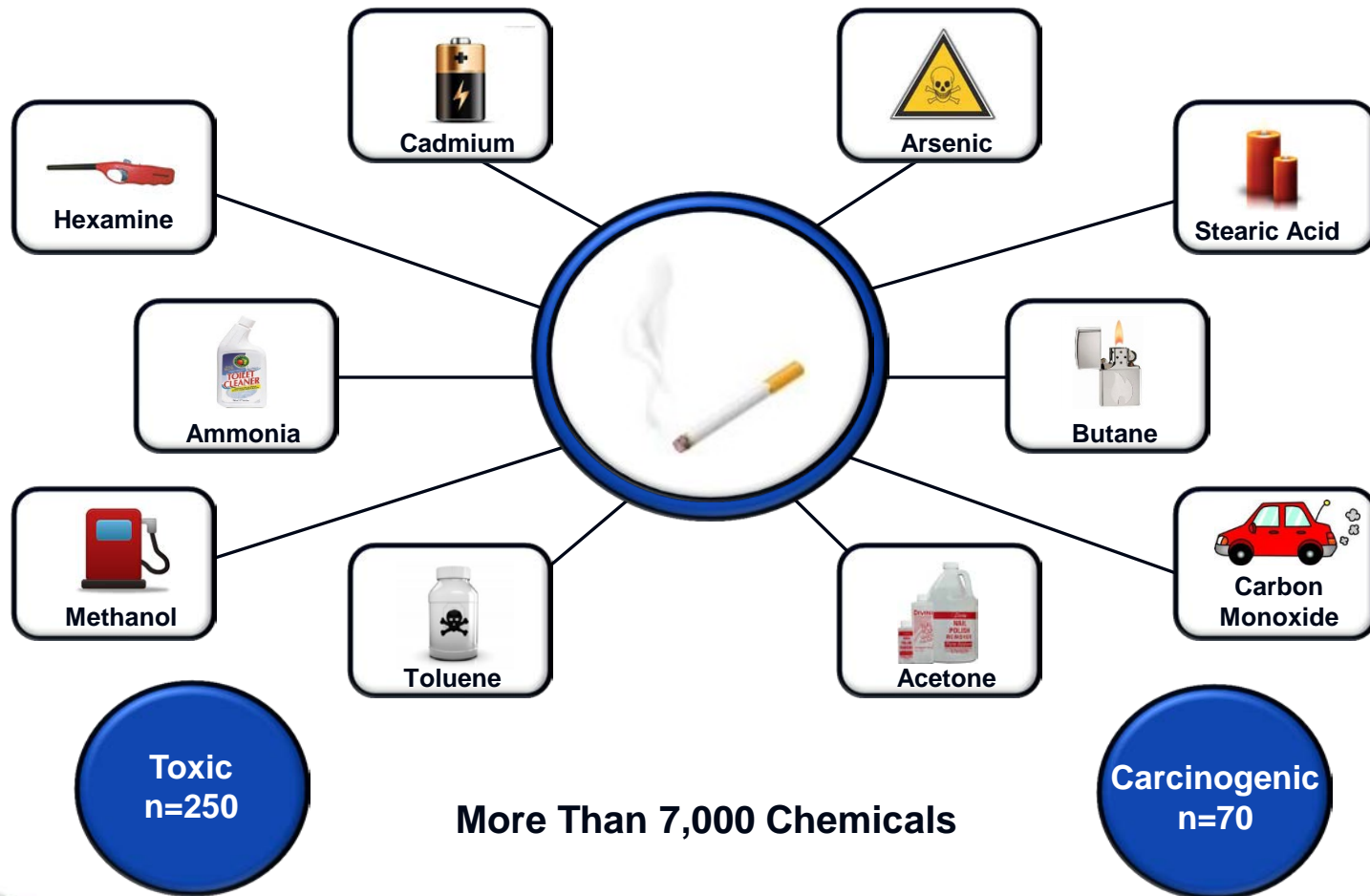


Conclusions



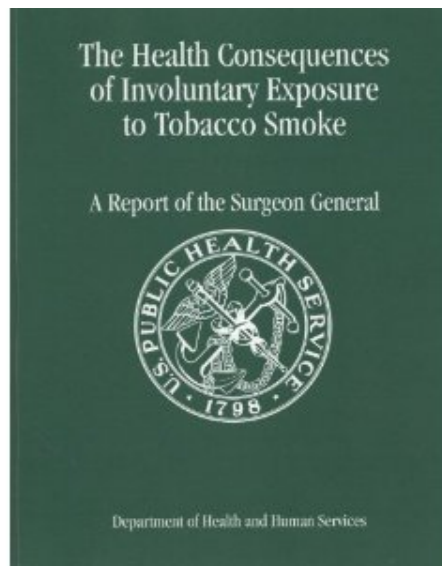
Rationale for Smoke-Free Multiunit Housing

Secondhand Smoke (SHS)



U.S. Surgeon General's Conclusions on SHS

"The scientific evidence now supports the following major conclusions"



Secondhand smoke causes premature death and disease in children and in adults who do not smoke.

The scientific evidence indicates that there is no risk-free level of exposure to secondhand smoke.

Eliminating smoking in indoor spaces fully protects nonsmokers from exposure to secondhand smoke. Separating smokers from nonsmokers, cleaning the air, and ventilating buildings cannot eliminate exposures of nonsmokers to secondhand smoke.

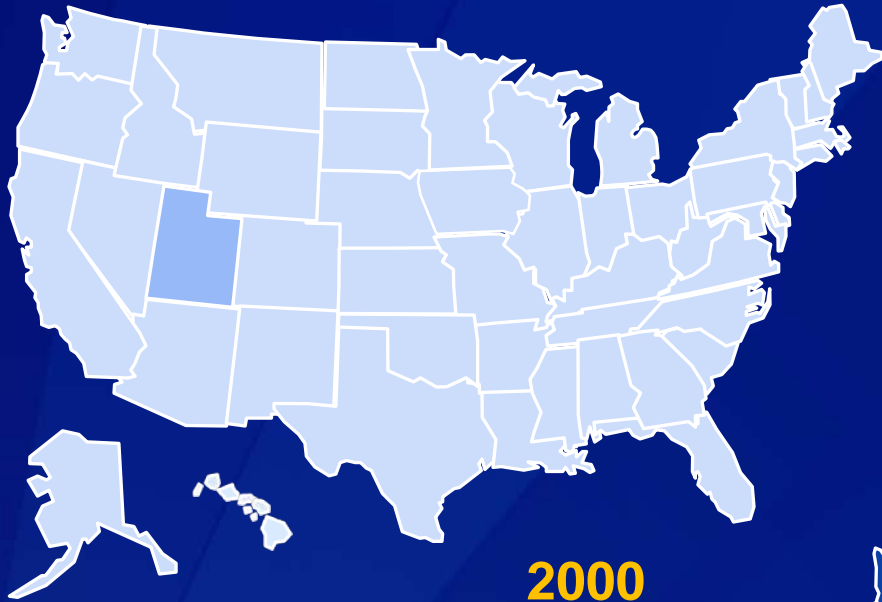
Smoke-free Air Laws Around the World

Get the facts	Request help for your campaign	Speak out for smokefree air
evidence	assistance	action

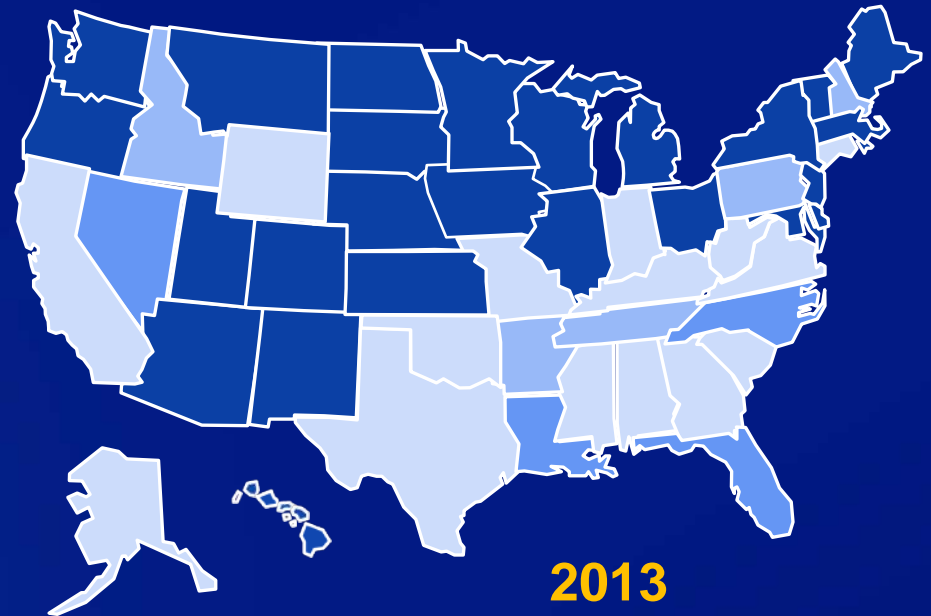


Comprehensive Smoke-Free Laws United States

2000-2013



2000



2013

Source: CDC STATE System



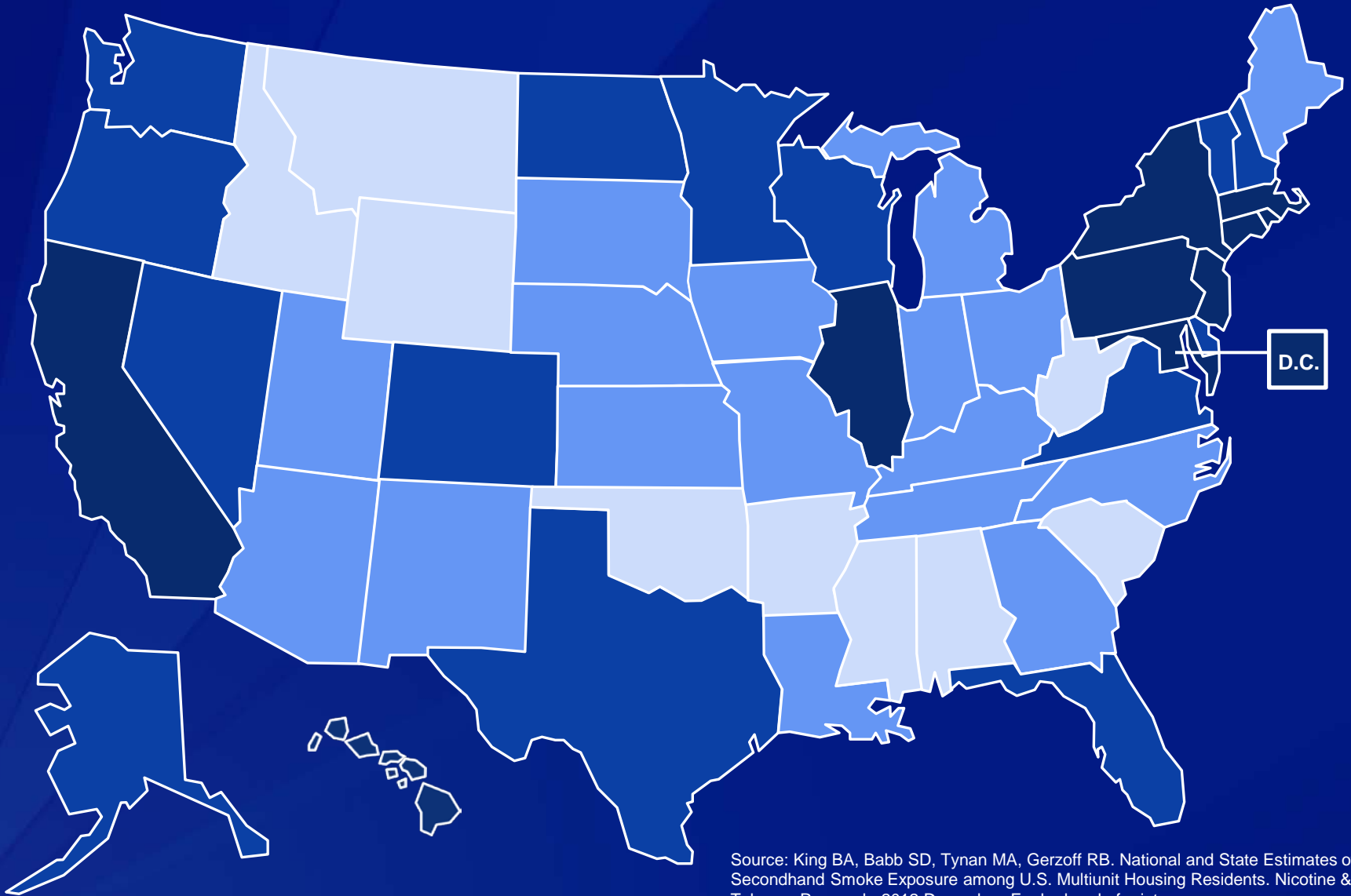
Multiunit Housing (MUH)

“housing structure containing two or more living units separated by dividing walls that extend from ground to roof”



**Duplex, Double/Multi-Family Home, Apartment,
Condominium, Townhouse**

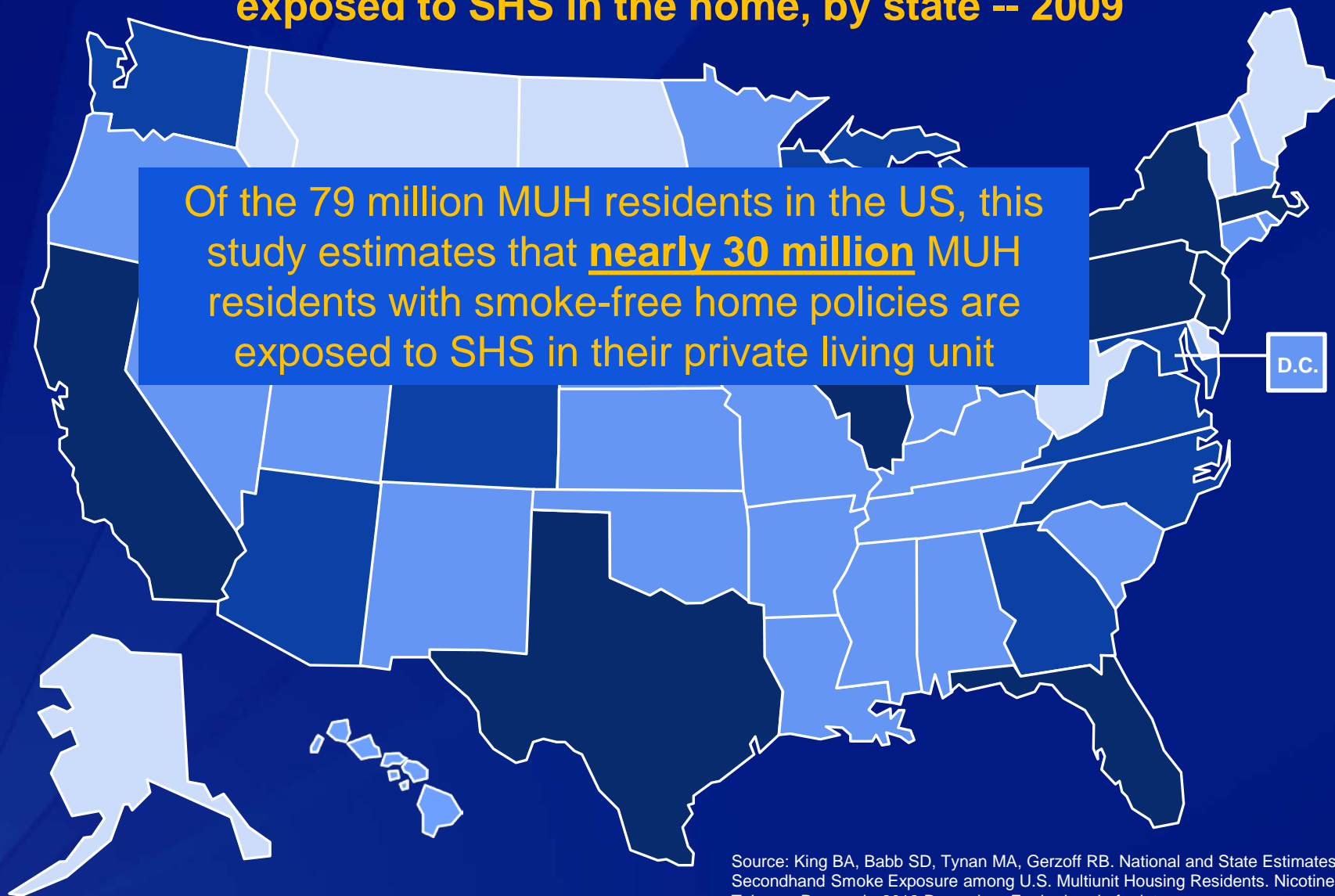
Percent of multiunit housing residents, by state -- 2009



Source: King BA, Babb SD, Tynan MA, Gerzoff RB. National and State Estimates of Secondhand Smoke Exposure among U.S. Multiunit Housing Residents. *Nicotine & Tobacco Research*. 2012 December. Epub ahead of print.

Estimated number of U.S. multiunit residents with smoke-free homes exposed to SHS in the home, by state -- 2009

Of the 79 million MUH residents in the US, this study estimates that nearly 30 million MUH residents with smoke-free home policies are exposed to SHS in their private living unit



Source: King BA, Babb SD, Tynan MA, Gerzoff RB. National and State Estimates of Secondhand Smoke Exposure among U.S. Multiunit Housing Residents. *Nicotine & Tobacco Research*. 2012 December. Epub ahead of print.

29,000 – 99,999 100,000 – 499,999 500,000 – 999,999 ≥ 1,000,000

Subsidized Housing in the United States

All Programs (February 2011 – May 2012)

2.9 Million Units



46.4%



39.1%



23.5%

Public Housing Only (February 2011 – May 2012)

1.0 Million Units



40.4%



34.8%



30.3%



Smoke-Free Multiunit Housing Policy Options

Avenues for MUH Policy Implementation



U.S. Subsidized

~ 7 million persons (9%)

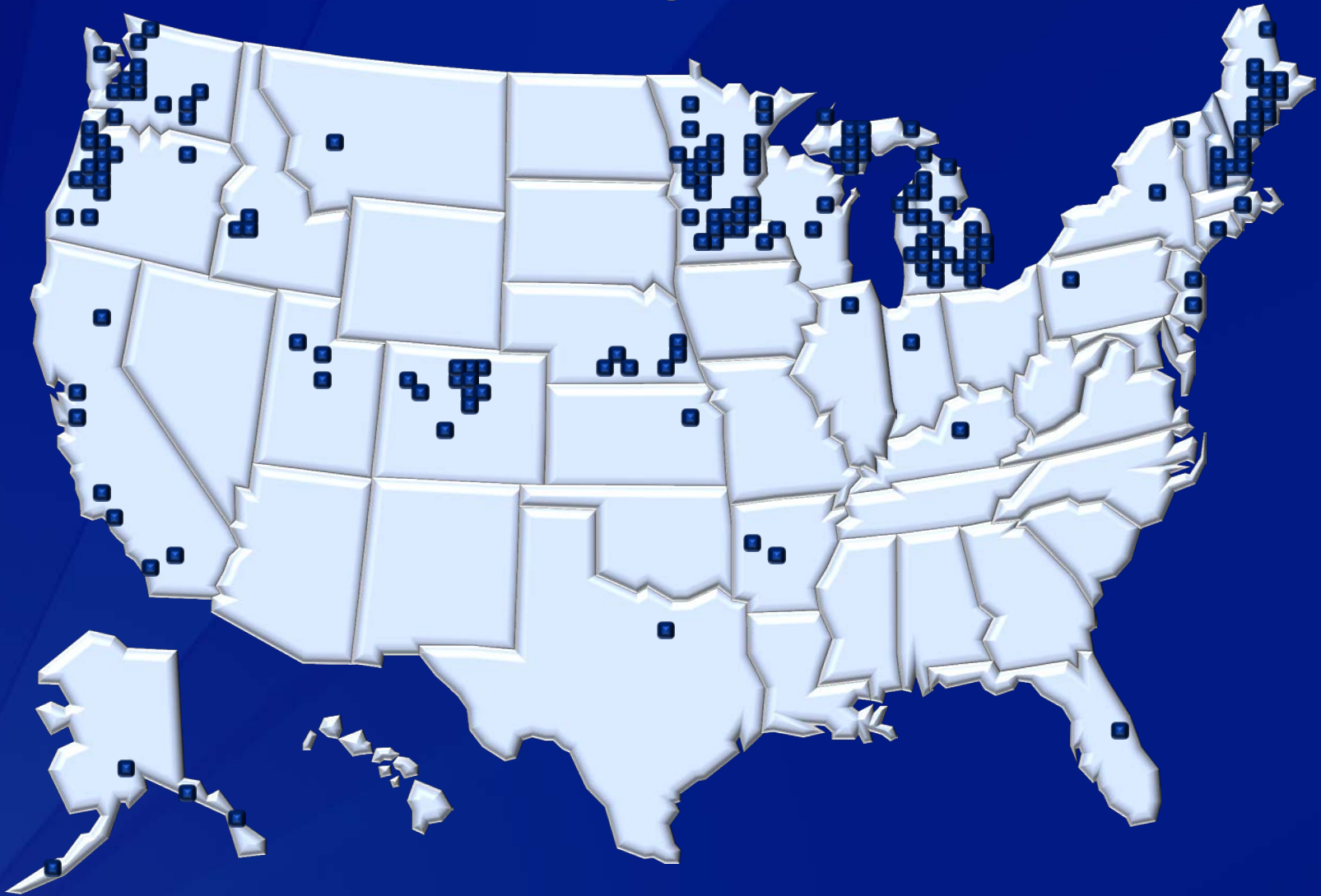
U.S. Market Rate

~ 72 million persons (91%)

U.S. Localities with Smoke-Free Market Rate MUH Laws (In Effect as of April 2013)

<u>Locality</u>	<u>Year</u>
Alameda, California	2013
Belmont, California	2009
Compton, California	2013
Pasadena, California	2013
Richmond, California	2011
Santa Clara County, California	2012
Sebastopol, California	2011
Sonoma County, California	2013
Union City, California	2012

Smoke-Free Public Housing — U.S., September 2010



Update: As of January 2011, at least 230 local housing authorities had adopted smoke-free policies and this is increasing at a rate of about 3 per month.

 Smoke-Free Housing Policy

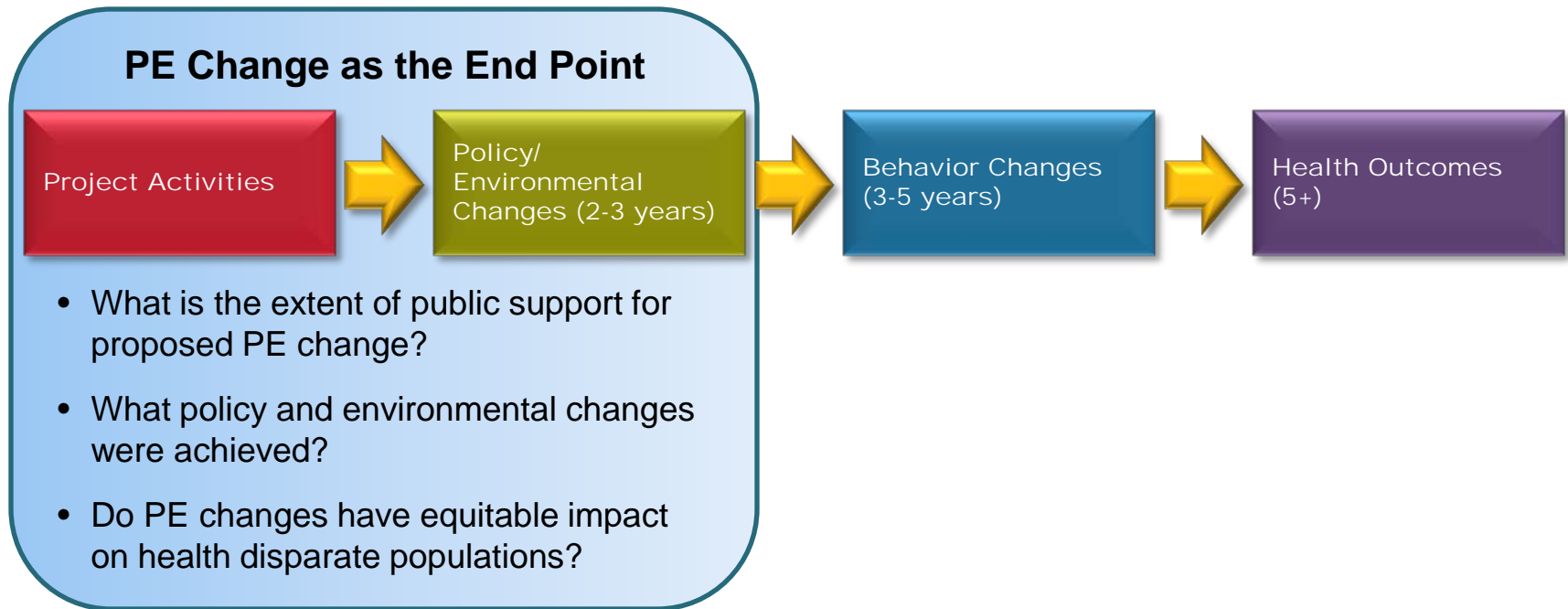
 No Smoke-Free Housing Policy

Source: Smoke-Free Environments Law Project

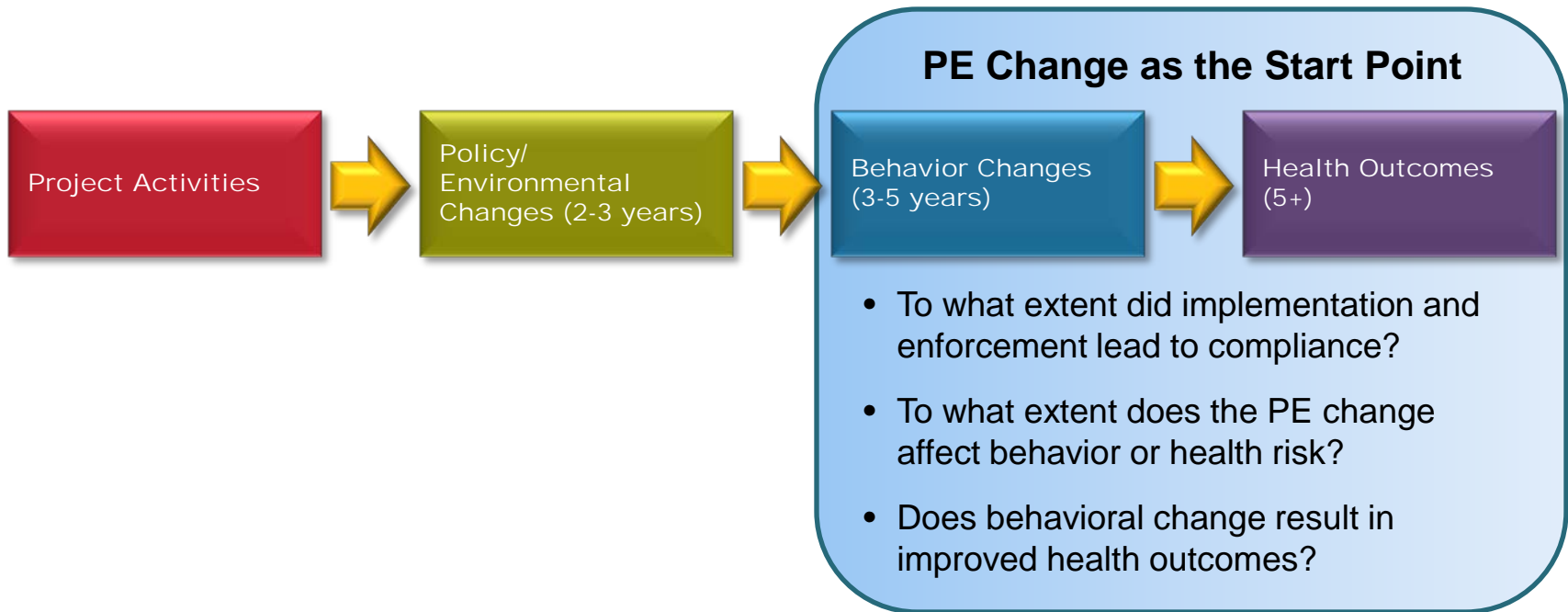
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Smoke-Free Multiunit Housing Research and Evaluation

Framing the Logic Model: Policy or Environmental Change as the End Point

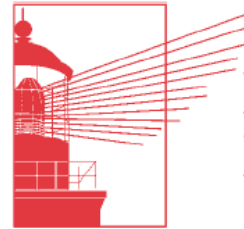


Framing the Logic Model: Policy or Environmental Change as the Start Point



Introduction to Program Evaluation for Comprehensive Tobacco Control Programs

- ▶ Create a logic model to guide your evaluation efforts



Introduction to Program Evaluation

for
Comprehensive Tobacco
Control Programs

November 2001

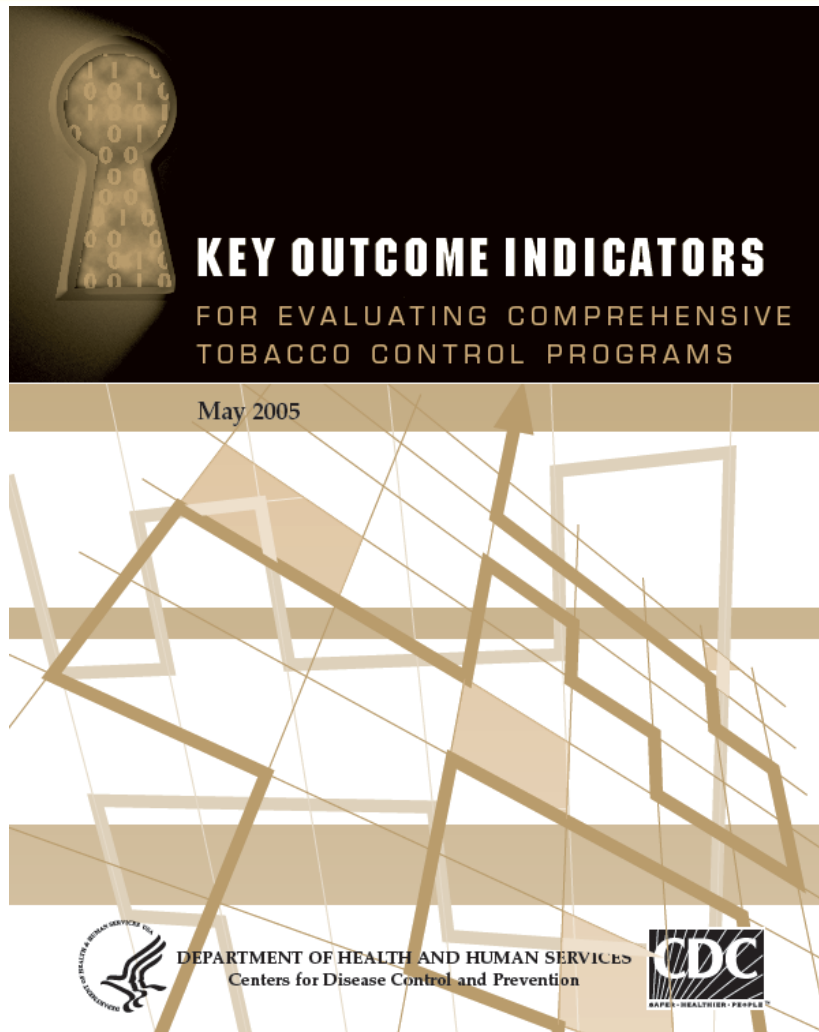


DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention



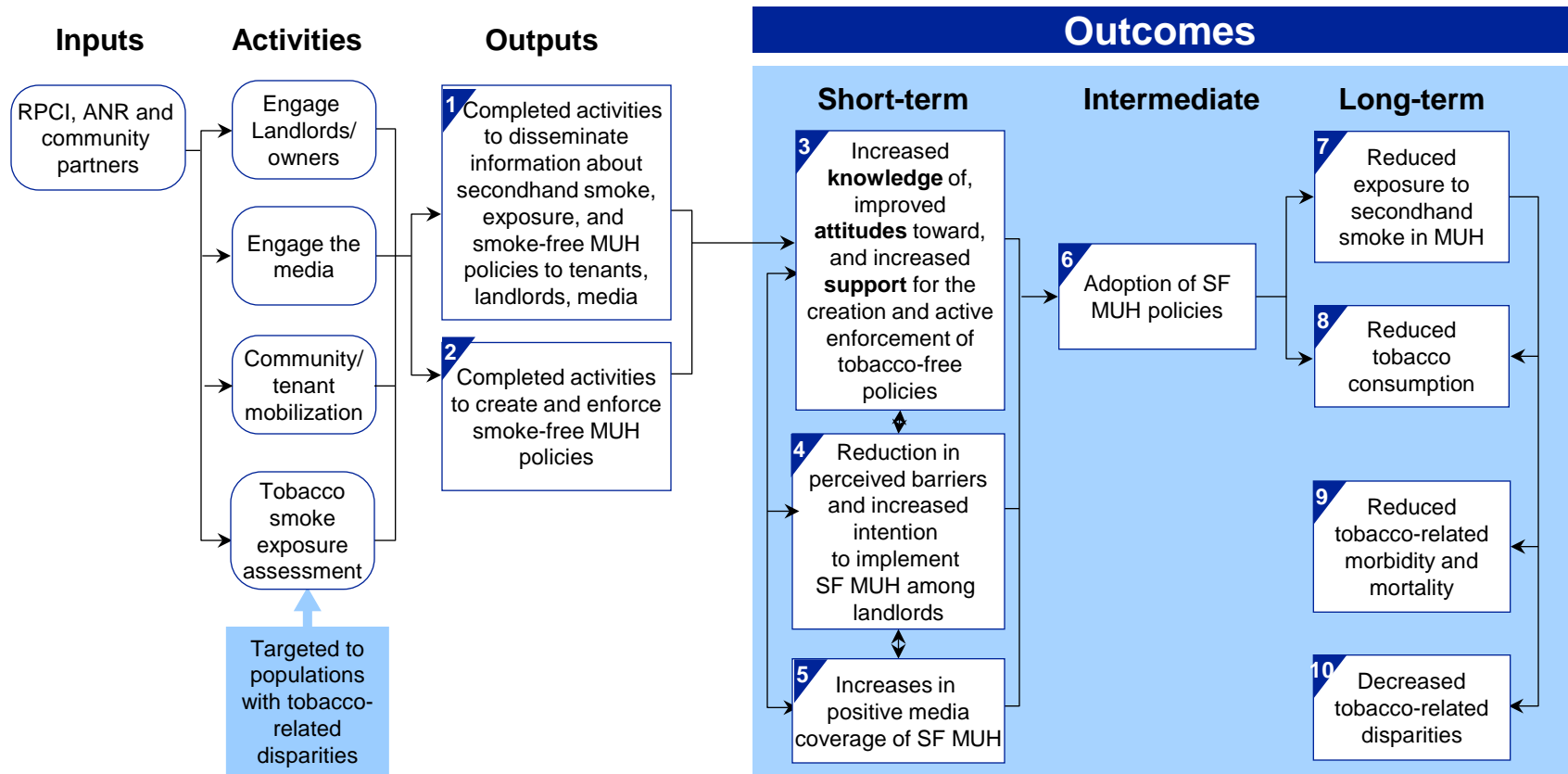
Key Outcome Indicators

For Evaluating Comprehensive Tobacco Control Programs

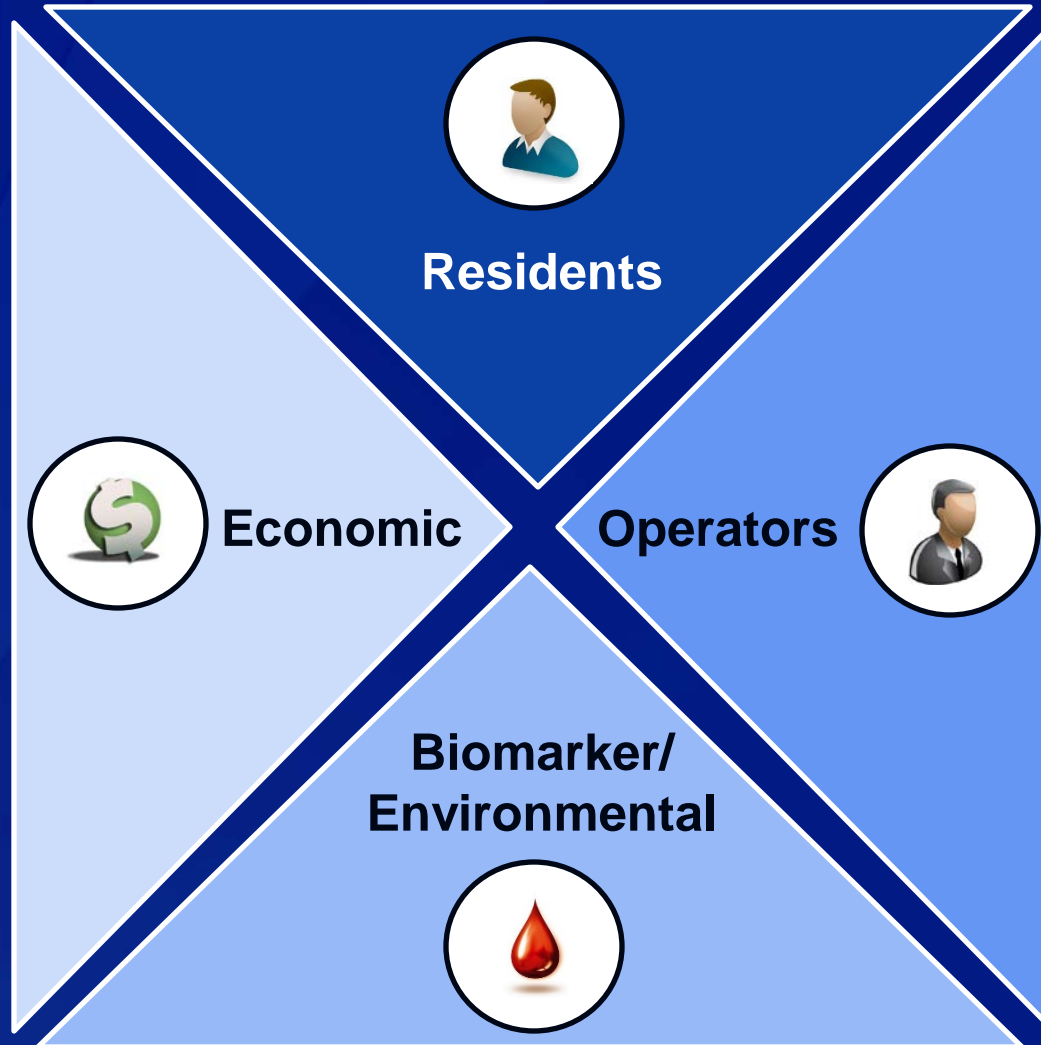


- ▶ There are many resources and examples available to help

Eliminating Nonsmokers' Exposure to Secondhand Smoke in Multi-unit Housing



Types of Smoke-Free MUH Research



Data Sources for Smoke-free Multi-Unit Housing Evaluation

▶ Surveys

- Population level
- Tenants
- Landlords
- New data collection or existing data sources

▶ Environmental testing for tobacco smoke contamination

- Air quality monitoring
- Nicotine in air or on surfaces

▶ Biomarkers

- Cotinine exposure

▶ Health Outcomes

- Short-term



Surveys: Tenants

- ▶ **Identify population of interest: based on the intervention you are evaluating**
 - All MUH residents?
 - Subsidized housing residents?
 - Specific buildings?
- ▶ **Survey method**
 - Mail
 - Telephone
 - Web
 - In-person
 - Existing survey or new data collection



Surveys: Tenants

- ▶ **What to ask?**
- ▶ **There are several previous MUH tenant surveys that can be used as models to develop your own questionnaires**
- ▶ **We also have a short survey of recommended questions that you can use that will address the key evaluation domains and provide consistency across studies**

Multi-Unit Housing

Survey

Recommended Questions





Surveys: Tenants

Research Domains for Tenants of Multi-Unit Housing

- ▶ **Exposure to SHS**
- ▶ **Policy environment**
 - Smoke-free home or building policy
- ▶ **Knowledge of health effects from SHS**
- ▶ **Attitudes and support for smoke-free policies**
- ▶ **Smoking behavior**
 - Change in smoking among smokers
 - Avoidance of SHS among non-smokers
- ▶ **Health outcomes**
- ▶ **Demographics: essential to address disparities**



Multunit housing residents' experiences and attitudes toward smoke-free policies (King, 2010)

▶ MUH Tenants in New York State

- Respondents from the New York State Adult Tobacco Use Survey (2007 to 2009) who identified as MUH residents (n=5,936)
- Survey included questions about smoking status, personal home smoking policies, SHS incursions, and support for smoke-free building policies

▶ Results

- 73% reported personal smoke-free home policy; of whom 46% indicated experiencing a SHS incursion in their home
- The majority (56%) indicated support for smoke-free building policy implementation (27% of smokers vs. 62% of non-smokers)

Table 3. Sociodemographic predictors of New York MUH residents^a who report that secondhand smoke entered their personal living space from somewhere else in or around their building within the past 12 months

Characteristic	<i>n</i> (%)	OR (95% CI) ^b	Characteristic	<i>n</i> (%)	OR (95% CI) ^b	<i>con't.</i>
Gender			Children <18 years old in household			
Female	2,248 (43.7)	1.00	No	2,198 (38.7)	1.00	
Male	1,078 (40.2)	0.89 (0.77–1.04)	Yes	1,122 (50.1)	1.22 (1.02–1.46)	
Age (years)			Missing data	6 (33.3)	0.75 (0.13–4.21)	
18–34	666 (52.4)	1.00	Type of MUH			
35–54	1,172 (45.9)	0.80 (0.66–0.98)	Apartment building	2,078 (46.7)	1.00	
55–64	634 (41.5)	0.73 (0.58–0.93)	Duplex	243 (33.7)	0.57 (0.43–0.77)	
65+	817 (30.7)	0.46 (0.36–0.59)	Double/multifamily home	630 (36.3)	0.69 (0.57–0.84)	
Missing data	37 (37.8)	0.58 (0.29–1.18)	Condominium	259 (32.4)	0.63 (0.47–0.83)	
Ethnicity			Town house	116 (42.2)	0.93 (0.63–1.39)	
Non-Hispanic White	1,803 (38.3)	1.00	Smoking status			
Non-Hispanic Black	765 (43.3)	1.00 (0.83–1.22)	Nonsmoker	3,075 (43.2)	1.00	
Hispanic	544 (55.7)	1.54 (1.23–1.92)	Smoker	251 (35.1)	0.63 (0.47–0.84)	
Other	214 (42.5)	0.97 (0.72–1.31)	Time (survey quarter) ^c	3,326	0.88 (0.85–0.91)	
Education (years)						
<12	395 (48.1)	1.00				
12	848 (38.9)	0.81 (0.63–1.05)				
13–15	820 (41.8)	0.85 (0.65–1.10)				
16+	1,242 (43.9)	0.95 (0.73–1.23)				
Missing data	21 (33.3)	0.59 (0.23–1.54)				
New York State region						
New York State excluding New York City	1,186 (37.3)	1.00				
New York City	2,140 (45.5)	1.06 (0.90–1.26)				

Note. Statistically significant OR noted in bold. MUH = multiunit housing; OR = odds ratio.

^aAmong those with a personal smoke-free home policy.

^bAdjusted for all covariates in table.

^cTime entered into model as a continuous variable.

Table 4. Sociodemographic predictors of New York MUH residents who favor the implementation of a smoke-free building policy

Characteristic	n (%)	OR (95% CI) ^a	Characteristic	n (%)	OR (95% CI) ^a (con't.)
Gender			Children <18 years old in household		
Female	3,863 (54.4)	1.00	No	4,203 (50.1)	1.00
Male	2,023 (48.5)	0.88 (0.78–0.98)	Yes	1,676 (57.9)	1.25 (1.09–1.44)
Age (years)			Missing data	7 (71.4)	2.03 (0.38–10.9)
18–34	1,078 (55.2)	1.00	Type of MUH		
35–54	2,054 (50.9)	0.96 (0.82–1.13)	Apartment building	3,640 (53.4)	1.00
55–64	1,146 (48.6)	0.91 (0.75–1.10)	Duplex	446 (55.6)	1.18 (0.95–1.47)
65+	1,555 (54.9)	1.04 (0.86–1.25)	Double/multifamily home	1,166 (50.3)	0.91 (0.78–1.05)
Missing data	53 (58.5)	1.13 (0.63–2.03)	Condominium	431 (50.3)	0.90 (0.73–1.12)
Ethnicity			Town house	203 (42.4)	0.60 (0.44–0.81)
Non-Hispanic White	3,367 (46.4)	1.00	Smoking status		
Non-Hispanic Black	1,345 (56.7)	1.61 (1.38–1.86)	Nonsmoker	4,768 (59.5)	1.00
Hispanic	824 (66.7)	2.44 (2.02–2.95)	Smoker	1,118 (22.1)	0.17 (0.14–0.19)
Other	350 (58.9)	1.63 (1.28–2.07)	Time (survey quarter) ^b	5,886	1.03 (1.00–1.05)
Education (years)					
<12	730 (58.6)	1.00			
12	1,579 (54.8)	0.91 (0.75–1.11)			
13–15	1,466 (49.7)	0.73 (0.60–0.89)			
16+	2,080 (50.2)	0.71 (0.58–0.87)			
Missing data	31 (51.6)	0.54 (0.26–1.15)			
New York State region					
New York State excluding New York City	2,285 (49.8)	1.00			
New York City	3,601 (54.0)	0.80 (0.70–0.90)			

Note. Statistically significant OR noted in bold. MUH = multiunit housing; OR = odds ratio.

^aAdjusted for all covariates in table.

^bTime entered into model as a continuous variable.



Implementation of a Smoke-free Policy in Subsidized Multiunit Housing: Effects on Smoking Cessation and Secondhand Smoke Exposure (Pizacani 2012)

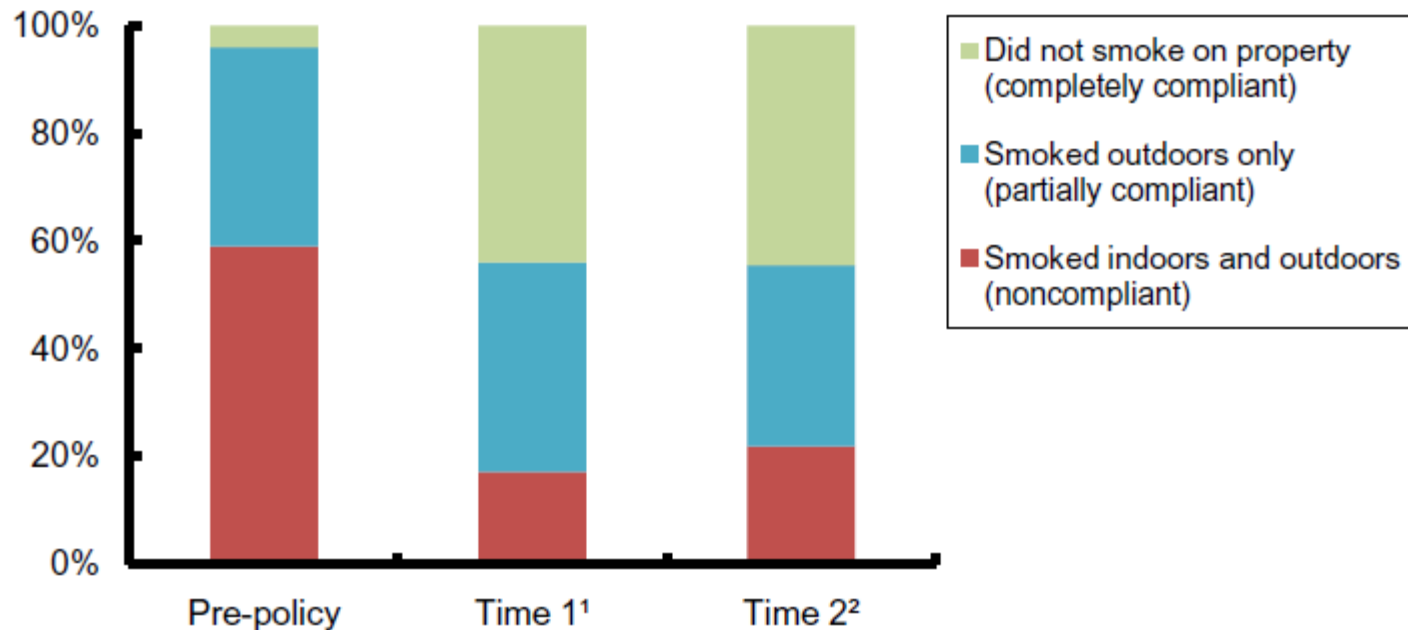
▶ Tenants in low-income subsidized housing

- Self-administered paper-based (mailed) questionnaire
- Assessed cessation-related behavior, policy knowledge and compliance, and SHS exposure
- Retrospective and subject to recall bias and social desirability bias

▶ Smoke-free policy resulted in:

- Increased quitting among smokers
- Reduced cigarette consumption among smokers
- Self-reported indoor smoking decreased from 59% to 17%
- A reduction from 41% to 17% in number of nonsmokers reporting frequent SHS exposure indoors.

Figure 1. Compliance with policy among tenants who smoke ($n = 73$), by location and time.

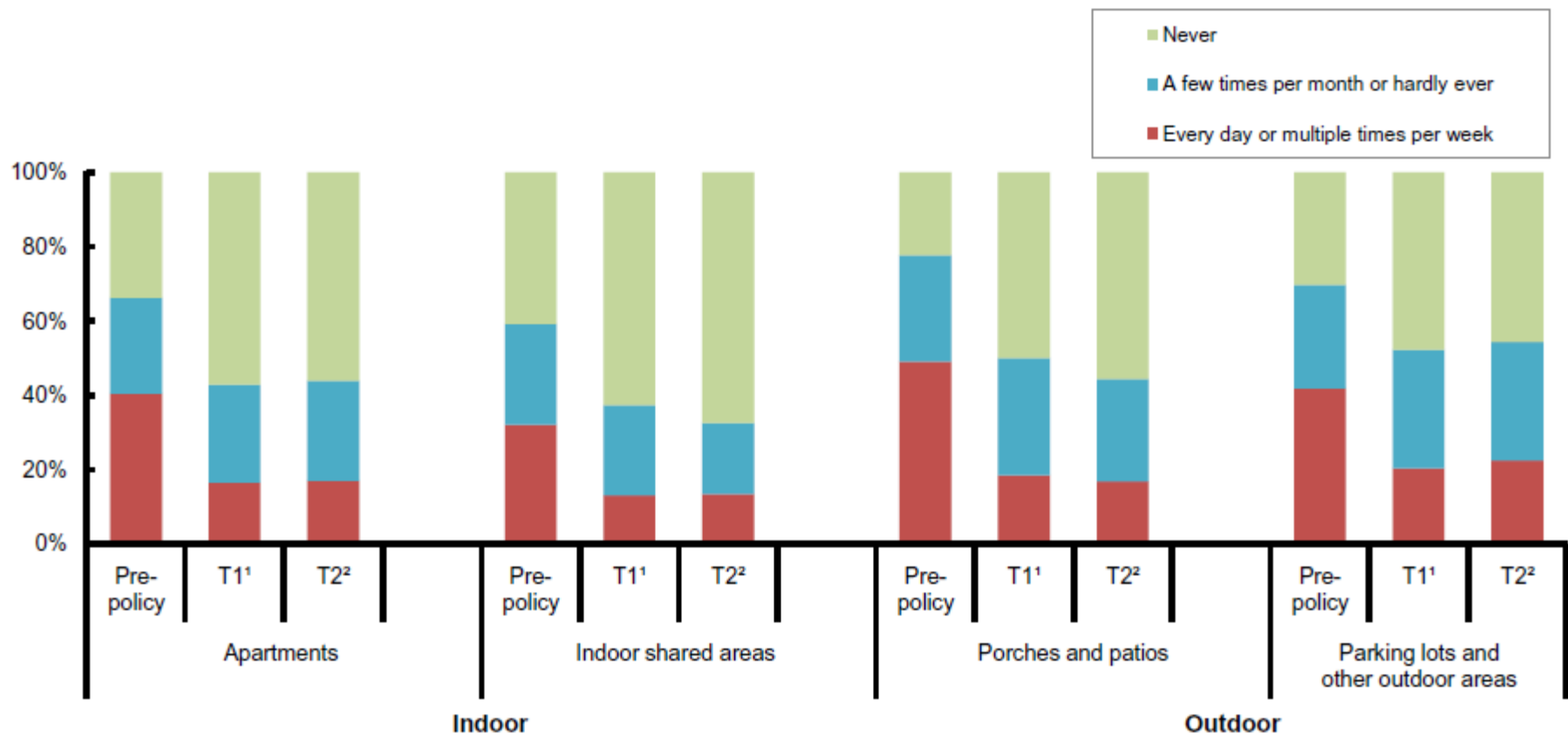


¹ Time one survey was conducted 5 months post policy implementation

² Time two survey was conducted one year later (17 months post policy implementation)

Note: $p < .001$ for all comparisons between pre-policy period and Time 1; no significant differences between Time 1 and Time 2

Figure 2. Secondhand smoke exposure among nonsmoking tenants (n = 320), by location and time.



¹ Time one survey was conducted 5 months post policy implementation

² Time two survey was conducted one year later (17 months post policy implementation)

Note: $p < .001$ for all comparisons between pre-policy period and Time 1; no significant differences between Time 1 and Time 2



Preferences and practices among renters regarding smoking restrictions in apartment buildings (Henrikus, 2003)

▶ Survey of MUH Tenants living in Golden Valley, MN

- Survey mailed to individual renters in the seven largest apartment complexes (n=511 mailed, n=301 completed)
- Assessed: smoking status, building and individual unit smoking policies, policy enforcement difficulty, methods to avoid ETS, smoking policy preference, and health beliefs

▶ Results:

- 7.1% reported their building was smoke-free; 56% reported partial smoke-free policies (shared areas), 29% reported no rules
- 60% reported not allowing smoking in individual units
- 64% would either strongly or somewhat prefer a smoke-free building policy (79% of non-smokers vs. 18% of smokers, $p < 0.01$)
 - Preference was significantly higher among higher educated respondents and those with “none or few” smoking friends

Predictors of preference for a smoke-free building

Table 3 Predictors of preference for a smoke-free building

Characteristic	n	% preferring smoke-free	χ^2	p Value
Sex				
Male	167	65.3		
Female	130	63.1	0.153	NS
Age (years)				
18-29	104	62.5		
30-49	113	60.2		
50+	78	74.4	4.421	NS
College degree				
Yes	158	71.5		
No	140	55.7	8.057	0.005
Smoking status: cigarettes				
Non-smoker	217	79.0		
Smoker	71	18.3	86.672	0.001
Roommate smoking status				
No roommate smokes	253	67.6		
Roommate smokes	44	43.2	9.688	0.002
Proportion of friends who are smokers				
None or few	201	78.1		
More than a few	97	35.0	52.708	0.001

Results of multivariate analyses of predictors of major outcome variables: odds ratios

Table 4 Results of multivariate analyses of predictors of major outcome variables: odds ratios

Predictor	Prefer smoke-free building	Allows smoking in apartment	Enforcement seen as difficult	ETS seen as unhealthy
Greater age	0.993	1.028**	1.016	0.981*
Male sex	1.041	1.181	0.751	0.962
College degree	1.504	0.722	0.661	0.718
Current smoker	0.094**	5.843**	4.672**	0.156**
Friends smoke	0.300**	1.887*	1.978	0.546
Smoker in household	0.648	4.286**	2.237*	1.916

*p<0.05; **p<0.0005.

ETS, environmental tobacco smoke.



'Neighbour smoke' – exposure to secondhand smoke in multiunit dwellings in Denmark in 2010: a cross-sectional study (Koster 2012)

▶ Cross-sectional study of 2,188 Danish MUH residents

- Sample obtained using internet panel with >100,000 panelists available; Quotas of Danish population filled according to gender, age, region, and education
- 40-item questionnaire assessed tobacco-related behaviors and SHS exposures

▶ Results:

- 22% of MUH residents reported being exposed to “neighbor smoke”
- Among residents who never allowed smoking in their home, 28% reported SHS exposures
- There was an increased preference for smoke-free building living among younger respondents, those with children in the home, and those who reported being exposed to neighbor smoke

Table 2. Distribution of 2183 respondents living in multiunit dwellings on reported neighbour smoke exposure (%) in Denmark, 2010.

	Adjusted OR (95% CI) for reported exposure to neighbour smoke	Percentage reported exposure to neighbour smoke		
		Ever	Never	Don't know
Total (n=2183)		22.1	64.5	13.4
Age (years)	p=0.167			
15–19	1.7 (1.0 to 2.9)	18.4	70.7	10.9
20–29	1.2 (0.8 to 1.8)	23.9	60.0	16.2
30–39	1.5 (1.0 to 2.1)	29.0	60.1	10.9
40–49	1.6 (1.0 to 2.5)	21.4	62.1	16.5
50–59	1.1 (0.7 to 1.7)	16.8	65.8	17.4
60–99	1.0 (reference)	18.0	71.9	10.0
Smoking (own)	p<0.001			
Current	0.4 (0.3 to 0.6)	6.5	70.6	22.9
Former	1.1 (0.9 to 1.5)	27.8	63.0	9.2
Never	1.0 (reference)	25.7	62.2	12.1
Smoking inside home	p<0.001			
Ever	0.5 (0.4 to 0.6)	5.4	66.0	28.6
Never	1.0 (reference)	28.2	63.1	8.7
Children in home	p=0.005			
Yes	1.0 (reference)	27.0	64.2	8.8
No	0.7 (0.5 to 0.9)	20.9	64.6	14.5
Region	p=0.001			
Capital	1.9 (1.3 to 2.7)	27.5	58.0	14.5
Northern Jutland	1.1 (0.6 to 1.9)	18.0	76.0	6.0
Middle Jutland	1.3 (0.8 to 1.9)	19.5	69.3	11.2
Southern Denmark	1.0 (reference)	14.4	70.4	15.2
Zealand	1.2 (0.8 to 2.0)	17.2	69.3	13.5
Type of residence	p<0.001			
Apartment	4.5 (3.3 to 6.1)	28.8	54.2	17.0
Two- to four-family house	0.4 (0.2 to 0.9)	5.0	89.4	5.6
Dormitory room	2.3 (0.9 to 5.6)	20.0	65.7	14.3
Non-detached town house	1.0 (reference)	11.0	82.1	6.9

p Values are from tests for variation between factor levels. The model included gender, age, region, education, smoking, smoking inside home, children in home and type of residence.

Koster B, Brink A, Clemmensen IH. 'Neighbour smoke' – exposure to secondhand smoke in multiunit dwellings in Denmark in 2010: a cross-sectional study. *Tobacco Control*, 2012: doi:

10.1136/tobaccocontrol-2011-050393.

Table 3. Distribution of 1429 respondents living in apartment buildings (including dormitory rooms) on preferred rules in building (%) in Denmark, 2010

	Adjusted OR (95% CI) for preference for building with smoking ban	Prefer building with indoor smoking ban (%)	Prefer building without indoor smoking ban (%)	Don't know (%)
Total (n=1429)		41.1	44.8	14.1
Age (years)	p<0.001			
15–19	3.9 (1.9 to 8.1)	62.3	27.1	10.6
20–29	2.6 (1.6 to 4.2)	54.8	31.9	13.3
30–39	1.5 (0.9 to 2.3)	45.1	42.1	12.7
40–49	0.9 (0.5 to 1.6)	32.3	53.2	14.6
50–59	0.9 (0.5 to 1.6)	25.1	59.6	15.3
60–99	1.0 (reference)	28.6	54.4	17.0
Smoking (own)	p<0.001			
Current	0.1 (0.1 to 0.2)	15.7	73.6	10.7
Former	0.5 (0.3 to 0.7)	39.7	44.5	15.9
Never	1.0 (reference)	61.6	23.0	15.4
Smoking inside home	p<0.001			
Ever	0.2 (0.2 to 0.3)	18.1	68.1	13.8
Never	1.0 (reference)	60.0	25.7	14.3
Children in home	p=0.061			
Yes	1.0 (reference)	44.1	37.3	18.6
No	0.8 (0.6 to 1.0)	40.5	46.2	13.2
Neighbour smoke	p<0.001			
Exposed	1.8 (1.3 to 2.5)	58.0	36.5	13.2
Not exposed	1.0 (reference)	28.9	49.6	13.9

p Values are from tests for variation between factor levels. The model included gender, age, education, own smoking, smoking inside home, children, region, type of residence and exposure to neighbour smoke.



Surveys: Owners/Operators

- ▶ **Need new data collection**
- ▶ **Can be challenging to identify and contact respondents**
- ▶ **Heterogeneous in terms of number and types of buildings owned/operated**
- ▶ **Previous example surveys are available**

Erie & Niagara County Survey of Apartment Owners and Managers





Surveys: Owners/Operators Research Domains

- ▶ **Smoking policies**
- ▶ **Attitudes and support for smoke-free policies**
- ▶ **Barriers to smoke-free policy adoption**
- ▶ **Economics**
 - Occupancy rates
 - Rent
 - Maintenance and other costs of smoking versus non-smoking units
- ▶ **Knowledge of health effects**
- ▶ **Demographics**



Prevalence and predictors of smoke-free policy implementation and support among owners and managers of multiunit housing (King, 2010)

- ▶ **Telephone-based survey of MUH operators in Erie and Niagara Counties, NY with mail follow-up of non-responder**
 - Survey sampling service used to identify subjects
 - Occupational Safety and Health Administration's Standard Industrial Classification (SIC) system: SIC code 6513 – 'operators of apartment buildings' (n=241 in Erie and Niagara Counties)
 - 127 completes (telephone: n=115; mail: n=12)
- ▶ **Questionnaire: preferences/practices related to smoke-free building policies, perceived barriers and motivators of implementation, interest in policy implementation, and building characteristics**



Prevalence and predictors of smoke-free policy implementation and support among owners and managers of multiunit housing (King, 2010)

- ▶ **9% of respondents reported owning or managing only smoke-free buildings; additional 2% reported having a smoke-free building policy in at least one of their buildings.**
 - High interest (75%) in smoke-free policy implementation among operators without current policies
- ▶ **Major barriers and motivators to policy implementation**
 - Primary concerns: higher vacancy rates and decreased potential tenant market size
 - Motivators: Known high demand for smoke-free living; reduction in insurance rates and reduction in tenant turnover

Table 1. Predictors of smoke-free policy interest among owners and managers of multiunit housing in which smoking is currently permitted, binary logistic regression, n=110

Predictor	<i>n</i>	Percent	<i>OR</i>	95% <i>CI</i>
Total units owned/managed				
2-49	22	81.8	1.00	
50-99	20	70.0	0.47	0.10-2.27
100-149	25	64.0	0.36	0.07-1.78
150+	43	79.1	0.80	0.19-3.41
Average building size				
2-4 units	24	79.2	1.00	
5-9 units	28	75.0	0.78	0.18-3.36
10+ units	58	72.4	0.62	0.16-2.36
Average building age, years				
≤10	9	66.7	1.00	
11-20	13	76.9	1.42	0.17-11.9
21-30	20	95.0	5.07	0.36-72.1
>30	68	69.1	0.84	0.15-4.87
Building construction				
All masonry	70	72.9	1.00	
All wood-frame	32	75.0	0.92	0.30-2.84
Other	8	87.5	1.51	0.15-15.3
HUD subsidy status				
No HUD units	50	62.0	1.00	
HUD units	60	85.0	3.12	1.14-8.52
Participant smoking status				
Nonsmoker	95	76.8	1.00	
Smoker	15	60.0	0.47	0.13-1.68

Note. Statistically significant OR noted in bold. *OR* = odds ratio, HUD = U.S. Department of Housing and Urban Development. Adjusted for all covariates listed in table.

Table 2. Perceived barriers and motivators of smoke-free policy implementation among owners and managers of multiunit housing in which smoking is currently permitted

Perceived barriers and motivators (<i>n</i> = 110)	Percent
<i>Primary concern about policy implementation^a</i>	
Higher vacancy rate	27
Decrease in market size of potential tenants	21
Federal, state, or local legality of policy	18
Increased staff time for enforcement	7
Increased legal costs associated with enforcement	6
Higher turnover rate	5
<i>Any^b motivators for policy implementation</i>	
Studies show high demand for smoke-free units	85
Knew it would reduce fire and insurance rates	85
Knew it would reduce tenant turnover rate	83
Tenants requested that policy be implemented	73
Could charge higher rent for smoke-free units	71
Offered free advertising for smoke-free units	48

^aEight percent of respondents reported “no concern” and 8% reported “don’t know.”

^bRespondents were asked to check all that apply.



Intervention to promote smoke-free policies among multiunit housing operators (King, 2011)

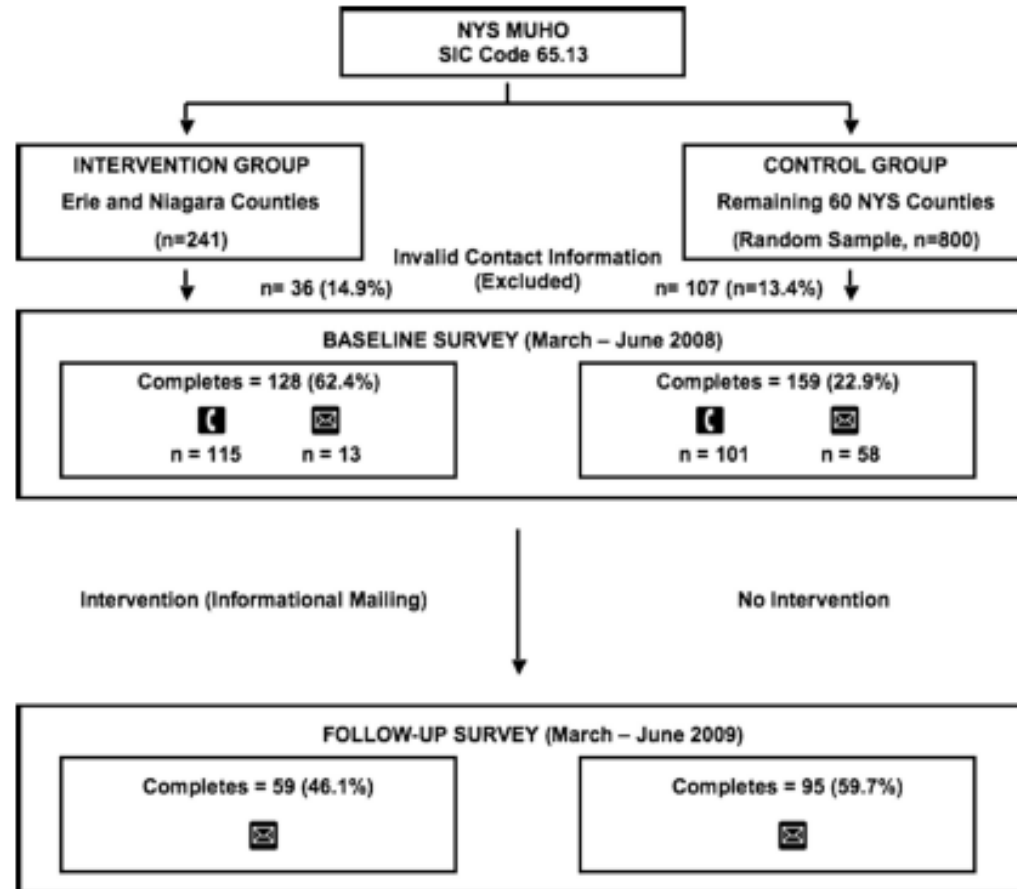
▶ All respondent identified by OSHA SIC Code 6513

- Telephone/Mail-based questionnaires at baseline
- Mail based follow-up (1 year later)

▶ Intervention materials:

- Informational packet; summary of baseline findings, FAQs (legality, benefits of smoke-free policies), and a report on smoke-free MUH in UNITS magazine

FIGURE ● Flowchart of Participant Recruitment



Abbreviations: MUHO, Multiunit housing operator; NYS, New York State; SIC, standard industrial classification.



Intervention to promote smoke-free policies among multiunit housing operators (King, 2011)

- ▶ **Exposure to the intervention did not significantly increase the adoption of a smoke-free building policy**
 - Between baseline and follow-up: 6.8% of MUH operators in intervention and 6.3% in the controls reported policy implementation
- ▶ **Interest in implementing a smoke-free building policy did significantly increase in the intervention group**
- ▶ **Concerns about adopting a smoke-free policy also decreased significantly in the intervention group between baseline and follow-up**



Secondhand smoke in apartment buildings: Renter and owner or manager perspectives (Hewett, 2007)

▶ Survey of both MUH tenants and MUH operators in Minnesota, 2001

- Renter sample drawn from commercially available list (n=405), oversampled for minorities, younger individuals, households with children, and smaller buildings
 - Surveyed winter, 2001 by mail with phone follow-up (lottery-type incentive chance to win \$1,000)
- Owners/managers – convenience sample drawn from members of the Minnesota Multi Housing Association (n=26), members of the National Association of Housing and Redevelopment Officials (n=12), and known operators of smoke-free housing (n=11)
 - Surveyed early in 2001 by telephone (\$100 incentive given)

▶ Questionnaire:

- Operator – experiences, perceptions, information needs regarding ETS transfer in apartment buildings and designation of smoke-free buildings
- Renter – quantified the extent/severity of perceived SHS problems and assessed the marketability of smoke-free housing



Secondhand smoke in apartment buildings: Renter and owner or manager perspectives (Hewett, 2007)

▶ MUH Operator results:

- About a third of operators identified tobacco smoke as the most common source of objectionable air odor
 - But majority report it does not require a significant amount of staff time to resolve tenant complaints, and it rarely or never a factor for potential or existing tenants to occupy their properties
- 20 of the 49 operators had designated one or more smoke-free buildings
 - 19 out of 20 were very likely to continue offering them
- Among operators without smoke-free policies, there was little interest in implementing such policies
 - Major concerns included increased vacancy/decreased market sizes, potential legal issues, and costs of enforcing the policy



Secondhand smoke in apartment buildings: Renter and owner or manager perspectives (Hewett, 2007)

▶ MUH Tenant Results:

- 59% of renters did not allow smoking in their apartment
- 48% of all renters reported that tobacco smoke odors entered their current apartment from somewhere else
 - More frequently reported among households with children and those living below the HHS poverty level
- There was a discrepancy between the tenant- and operator-reported prevalence of living in a smoke-free building
 - 14% of renters reported so, but after contacting building operators, only an estimated 2% actually lived in smoke-free buildings
- Nearly half of all renters would be extremely or very interested in living in a smoke-free building

Figure 1. Responses to the question, “Which [of your concerns about designating one or more buildings smoke-free] do you see as the most important?” among decision-makers who have not designated any buildings smoke-free.

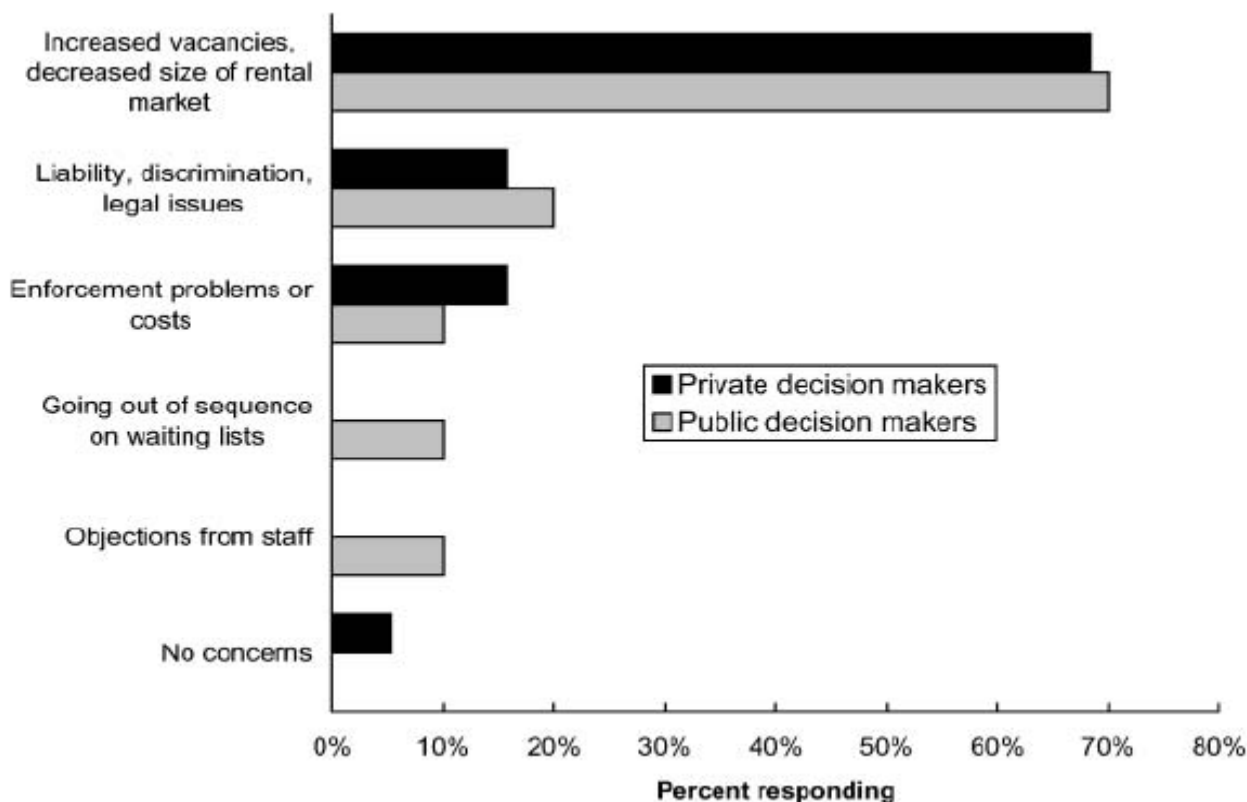


Figure 1. Responses to the question, “Which [of your concerns about designating one or more buildings smoke-free] do you see as most important?” among decision-makers who have not designated any buildings smoke-free. Because a few respondents refused to select only one of their concerns as the most important, totals add to 105% (private) and 120% (public).



Exposure Assessment: Air Monitoring

What determines SHS exposure in MUH?

- ▶ **Driving Force, Stack Effect: Hot Air Rises**
- ▶ **Driving Force, Wind Effect: Air Currents Across Building**
- ▶ **Many Cracks and Crevices in MUH: Fixtures, Outlets, Baseboards, Sprinklers, Plumbing**
- ▶ **Significant Air Flow Between Units: As much as 30 to 50% of air comes from other apartments**
- ▶ **Tiny SHS Particles Travel in Cracks**

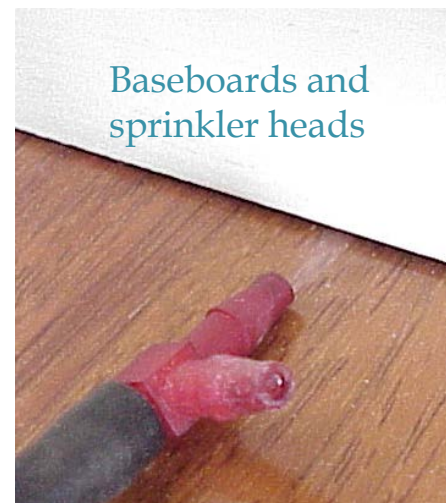
What if you open a window?

- ▶ **Smoker on a lower floor in winter – will probably increase SHS transfer problem to upstairs neighbor**

How Does The Air Get In and Through and Out?

- ▶ Anyway it can!
- ▶ Gaps in walls, floors, mechanical chases
- ▶ Some are accessible and others too diffuse or inaccessible for sealing

Most openings are small and diffuse



How Does The Air Get In and Through and Out?

Some openings are BIG!

Why do our clothes smell like smoke?





Exposure Assessment: Air Monitoring

- ▶ **Particle monitoring (PM_{2.5})**
- ▶ **Nicotine Monitoring**
 - In air
 - On surfaces
- ▶ **These have been extremely useful in educating on and evaluating smoke-free policies in other environments (e.g. workplaces)**

Measuring Exposure to Tobacco Smoke Pollution

- Cigarettes, cigars and pipes are major emitters of respirable suspended particles less than 2.5 microns ($PM_{2.5}$) in diameter that are easily inhaled deep into the lungs
- **TSI SidePak AM510 Personal Aerosol Monitor (weight: ~1 lb)**
- This device is a real-time laser photometer with a built-in sampling pump that measures airborne particle mass-concentration



Particle Size

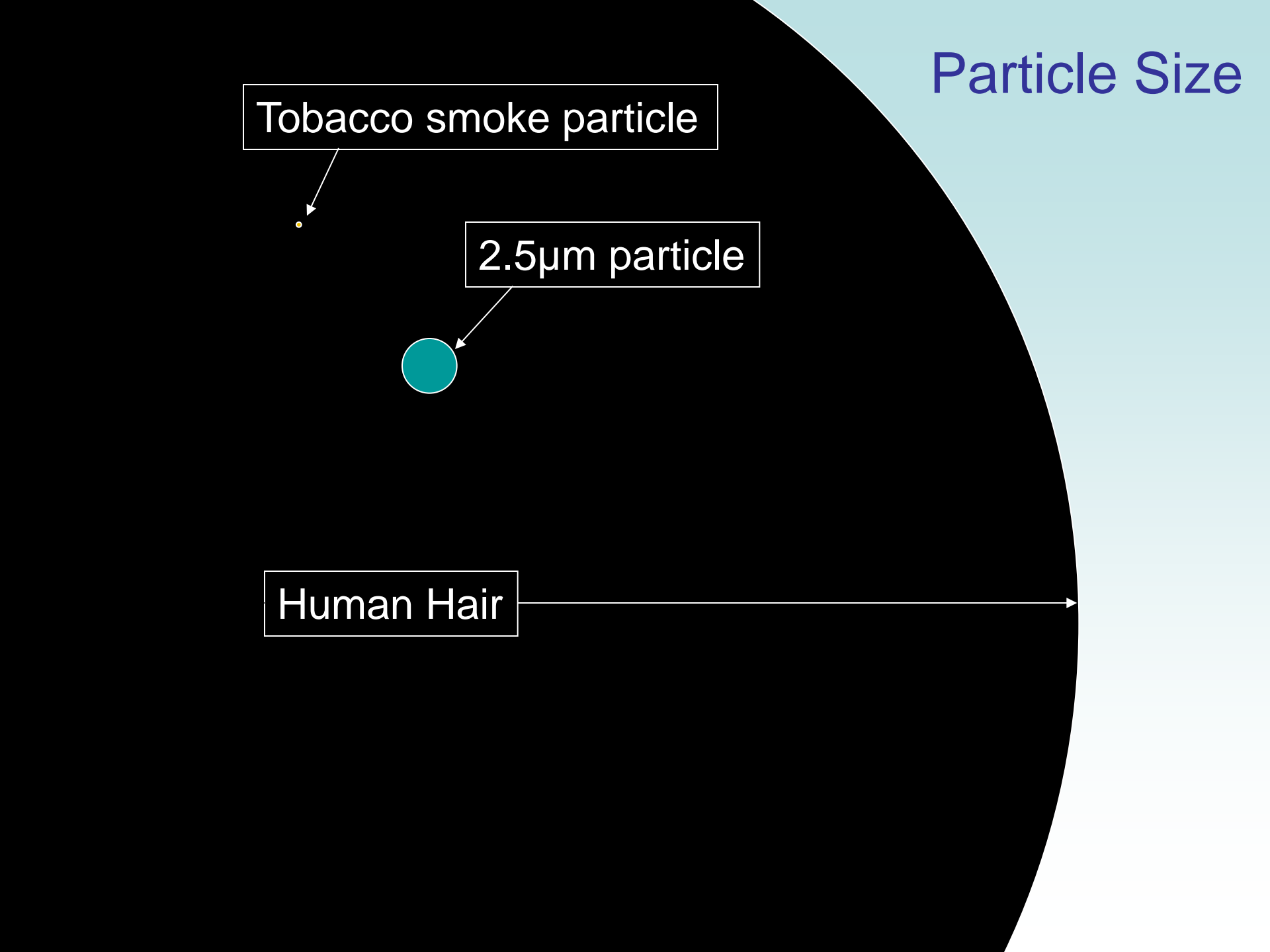
Tobacco smoke particle



2.5 μ m particle



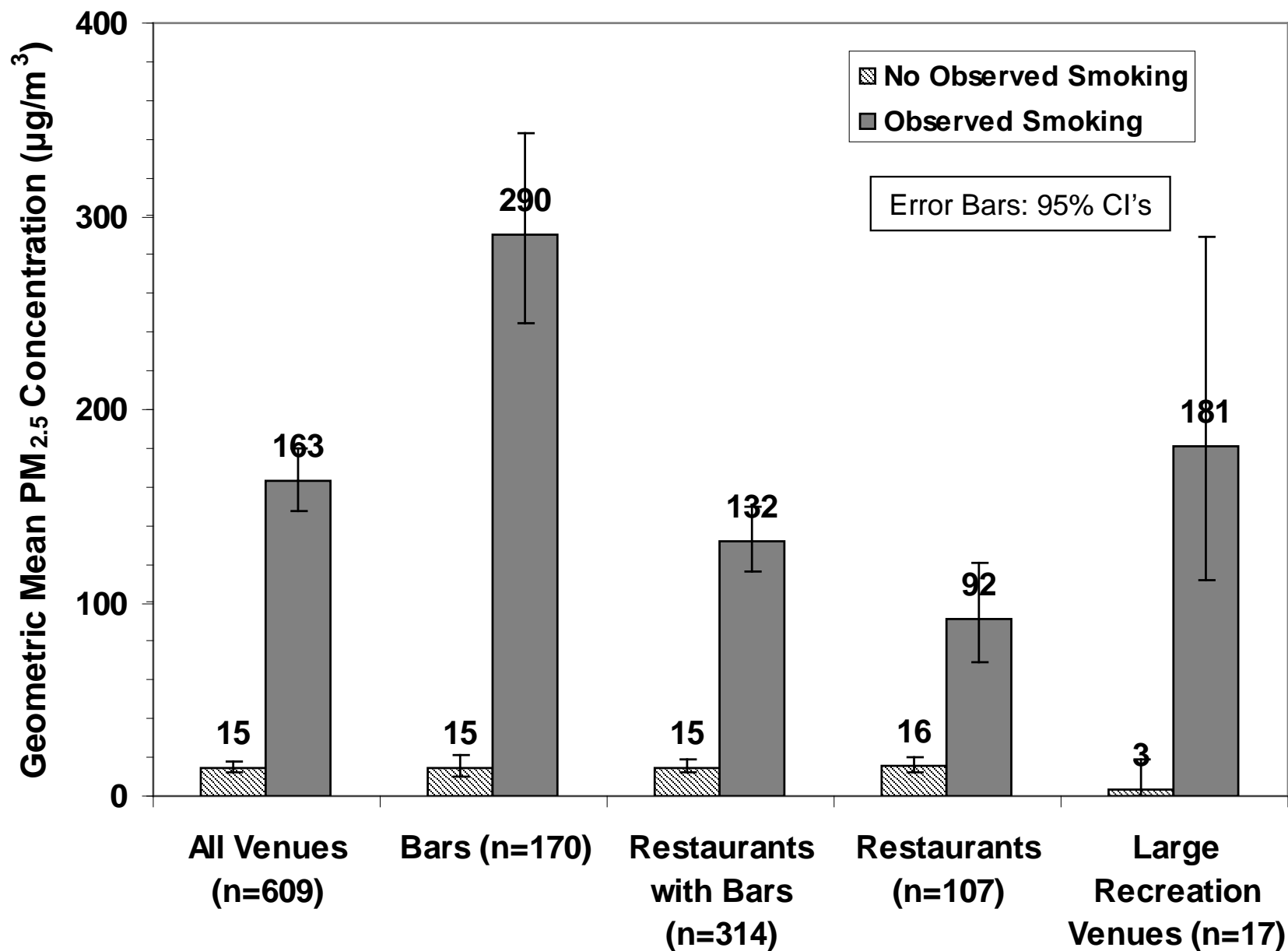
Human Hair



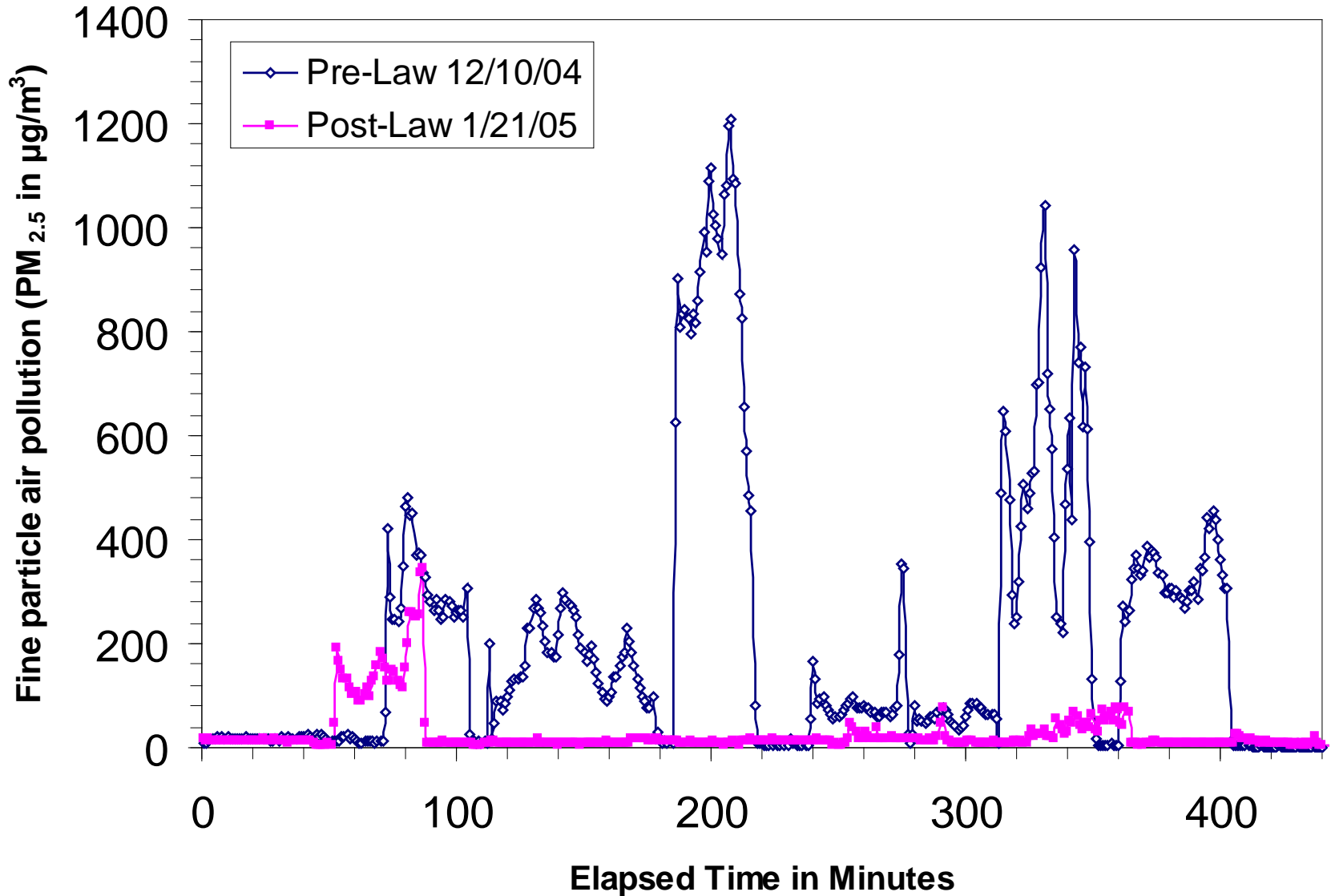
U.S. Environmental Protection Agency Air Quality Index

Air Quality	Air Quality Index	PM _{2.5} (μg/m ³)	Health Advisory
Good	0-50	≤15	None.
Moderate	51-100	16-40	Unusually sensitive people should consider reducing prolonged or heavy exertion.
Unhealthy for Sensitive Groups	101-150	41-65	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
Unhealthy	151-200	66-150	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
Very Unhealthy	201-300	151-250	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
Hazardous	≥301	≥251	People with heart or lung disease, older adults, and children should remain indoors and keep activity levels low. Everyone else should avoid all physical activity outdoors.









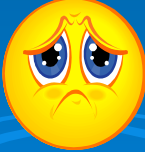


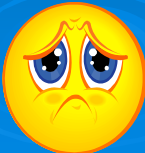
Mean PM_{2.5} Concentrations by Observed Smoking Status and Type of Venue



Particle levels in Bloomington Indiana Bars and Restaurants Before and After Clean Indoor Air Law



Measuring Tobacco Smoke Pollution

Microenvironment	Quality of Scientific Exposure Data	Usefulness for Evaluation
Indoor Public Places (e.g. worksites, restaurants, bars, casinos)		
Homes (with active smoking)		
Cars		
Outdoors	 	
Multi-unit Housing	 	



Secondhand smoke transfer and reductions by air sealing and ventilation in multiunit buildings: PFT and nicotine verification (Bohac 2011)

▶ Two approaches to characterize the transfer of SHS between apartment units

- Guarded-zone pressurization tests and passive PFT (perflurocarbon tracers) methods
- Measurements taken before and after any air-sealing or ventilation treatments completed

▶ Pre-treatment results confirmed significant airflow between units in apartment buildings

- However, careful implementation of the best air-sealing procedures and ventilation improvements (retroactively) only moderately reduced inter-unit air flow between smoking and non-smoking units
 - Eliminating air leakage between units is not a practical means of solving SHS transmission in existing MUH buildings



Secondhand Smoke Transfer in Multiunit Housing (King 2010)

► Monitoring in 11 MUH buildings in Buffalo, NY

- 14 smoke-free units; 16 smoke-permitted units
- Concurrent PM_{2.5} measurements in smoke-free and smoke-permitted units within each building (TSI SidePak AM510 Personal Aerosol Monitor)
- Respondents completed a brief questionnaire, instructed to keep a daily activity log detailing activities that could affect air quality guidelines (smoking, cooking, window/door placement)

► Results of Monitoring – SHS transfer

- Evidence of SHS transfer from smoke-permitted to smoke-free units detected in 2 of 14 smoke-free units; 6 of 8 hallways.
- Ventilation, time of day, and proximity between units were important factors determining SHS transfer
 - Median PM_{2.5} levels were greatest between 4 PM and Midnight

Figure 1. Median PM_{2.5} levels in smoke-permitted units, hallways, smoke-free units, and outdoor patios by time of day.

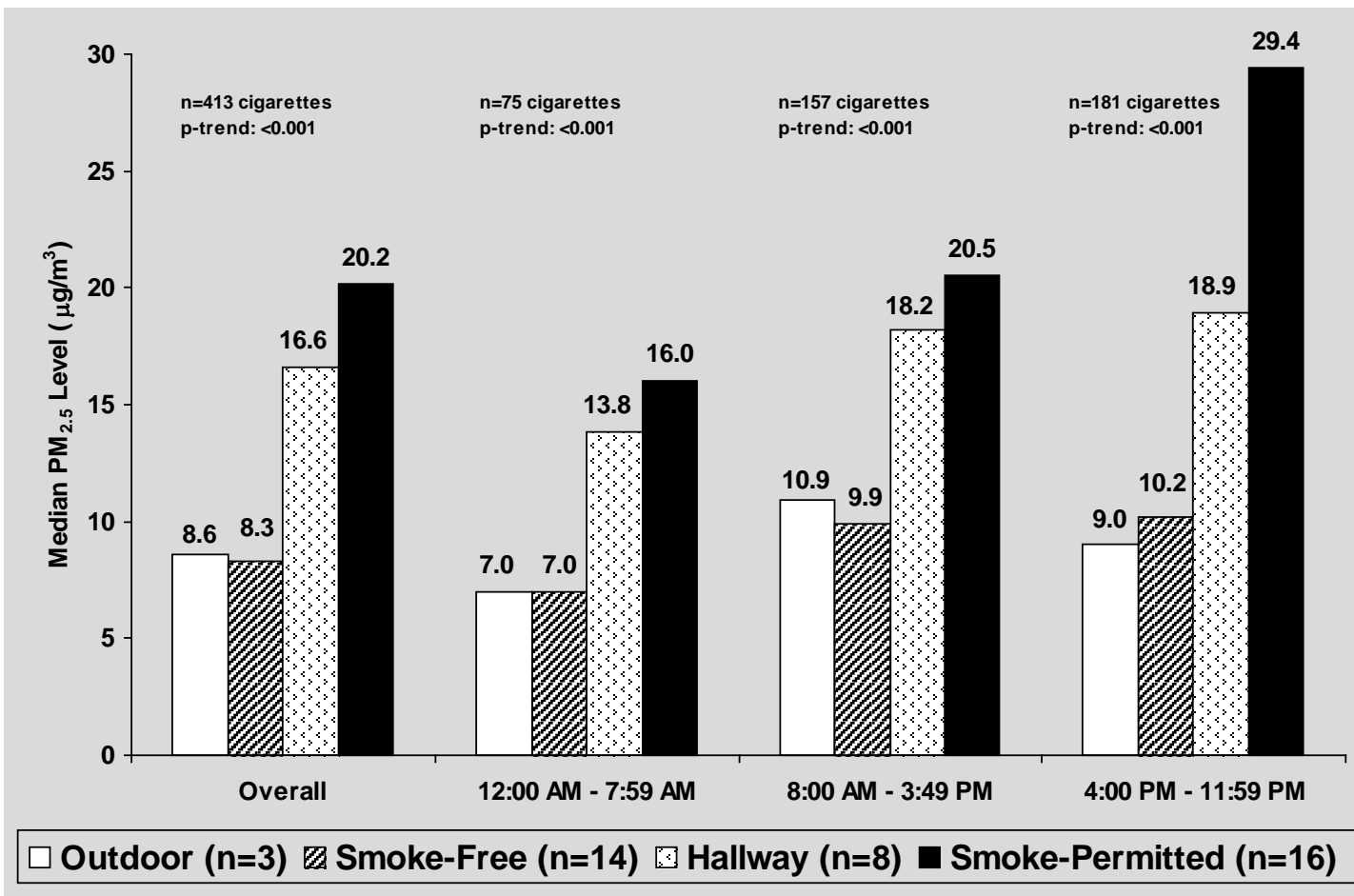


Figure 2. (b) Illustration of real-time changes in PM_{2.5} levels in a multiunit residential building (Building 1). No air monitoring was conducted in unlabeled units.

B

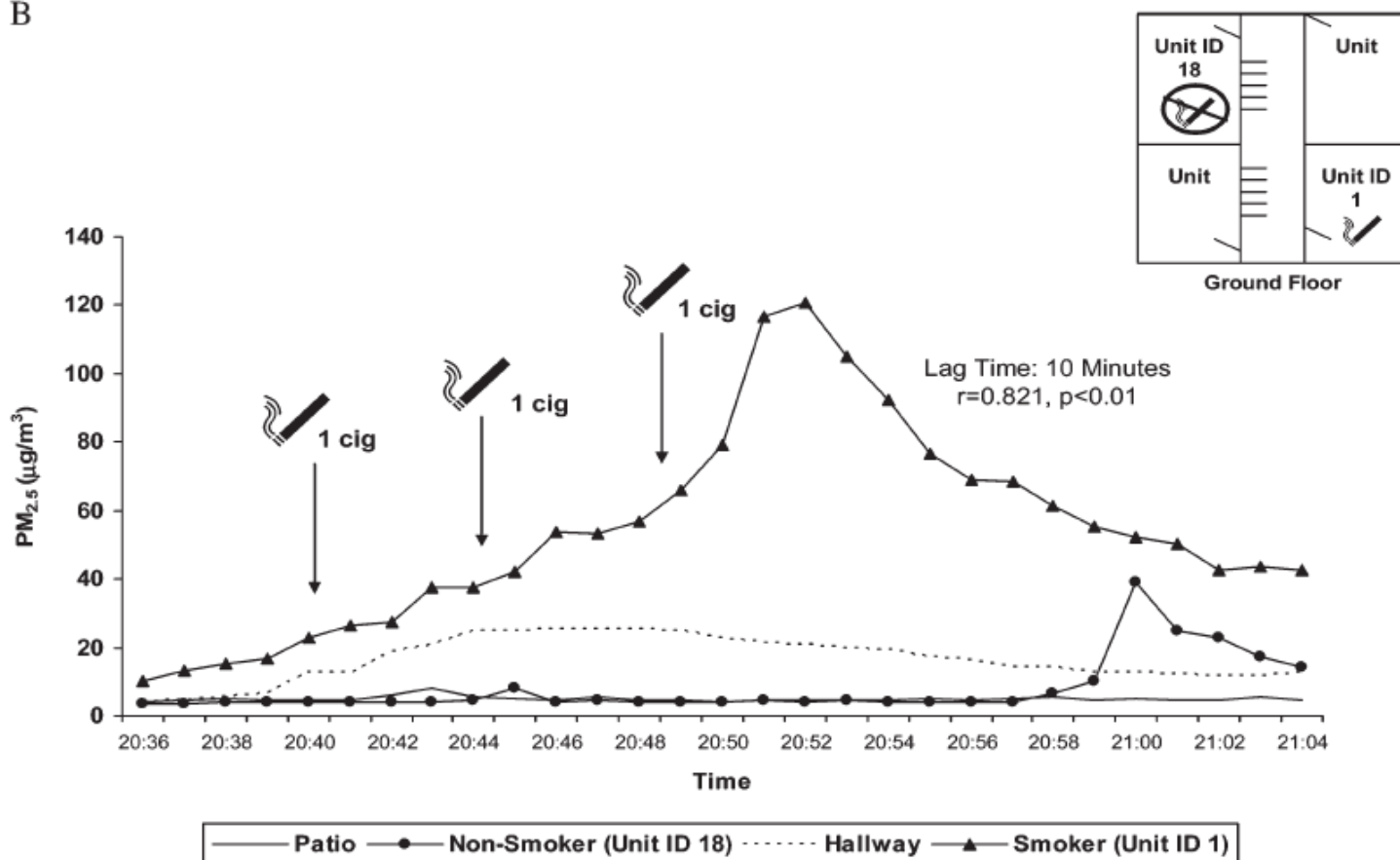


Figure 2. (b) Illustration of real-time changes in PM_{2.5} levels in a multiunit residential building (Building 1). No air monitoring was conducted in unlabeled units. Note: The front door of the smoke-permitted unit was opened during the timeframe presented. No other instances of appliance use, pyrolysis, or ventilation were reported during this timeframe. No air monitoring was conducted in unlabeled units.



Indoor air concentrations of nicotine in low-income, multi-unit housing: associations with smoking behaviours and housing characteristics (Kraev, 2009)

- ▶ **Tenants in 49 low-income, MUH residences in the Greater Boston Area**
 - Passive monitors assessed airborne nicotine levels
 - Questionnaire (interview): residential history, household smoking behaviors, and physical housing characteristics
 - Visual inspection for signs of tobacco use
- ▶ **48% of residences had no smokers living in home**
 - However, 94% of the 49 residences had detectable levels of nicotine present
 - Nicotine was detected in 89% of non-smoking home (17 of 19), and 95% of smoking homes (21 of 22)
 - Nicotine measurements increased with the number of smokers present in the home (including visitor smokers)



Exposure Assessment: Air Monitoring Conclusions for MUH

- ▶ **Air is shared throughout MUH, it transfers between apartments and common areas**
- ▶ **Tobacco smoke pollution transfer does occur and has been documented**
- ▶ **However, exposure assessment is much more complicated than one-room indoor settings**
 - There are a much larger number of variables that effect exposures
 - The dynamic and complex physical characteristics of TSP have a large impact on exposure measurements



Exposure Assessment: Air Monitoring

- ▶ **You need expert support!**
- ▶ **Significant equipment and/or laboratory costs**
- ▶ **In may not provide any more reliable data than a simple survey**



Exposure Assessment: Biomarkers

- ▶ **Cotinine most commonly used**
- ▶ **Can be measured in blood, urine, saliva, hair, toenails**
- ▶ **Urine is most commonly used**
 - Relatively easy to collect
 - Well characterized
 - Very sensitive
- ▶ **Analytical method used, and hence sensitivity, is CRUCIAL!**



Exposure Assessment: Cotinine

- ▶ **“dip sticks” or urine test strips (e.g. Nicalert, Tobacalert)**
 - Cheap
 - Instant results
 - Only provide crude semi-quantitative result
 - NOT sensitive enough for this application



Exposure Assessment: Cotinine

▶ Immunoassay of saliva or urine cotinine

- Does not require specialized laboratory extractions and analyses (compared to GC/LC/MS), but you still need a lab and some expertise
- Moderate price
- Sensitive and MAY be able to measure change in SHS exposure in MUH



Exposure Assessment: Cotinine

- ▶ **LC/MS/MS or isotope dilution-high-performance liquid chromatography/atmospheric pressure chemical ionization tandem mass spectrometry**
 - Gold standard, most sensitive (detectable limit around 0.015 ng/ml)
 - Used in NHANES (National Health and Nutrition Examination Survey)
 - Expensive and only a few labs will do it
 - Unfortunately, this is probably the sensitivity required to document changes in SHS exposure among non-smokers in MUH



Tobacco-Smoke Exposure in Children Who Live in Multiunit Housing (Wilson 2011)

▶ Data from NHANES (2001-2006)

- Serum cotinine levels measured in children using isotope dilution-high-performance liquid chromatography/atmospheric pressure chemical ionization tandem mass spectrometry
- Tobacco-smoke exposure defined as cotinine level ≥ 0.015 ng/mL.
- Analysis restricted to children ≤ 18 years old who lived in a home where no one smoked. Respondent housing categorized as: detached/mobile home, apartment or attached house
- No additional smoking-status information was available

▶ 73% of children were exposed tobacco-smoke

- 85% of children living in apartments had cotinine levels indicative of recent tobacco smoke exposure, compared to 80% of children in attached houses and 70% of children in detached houses

▶ Mean cotinine levels were statistically significantly higher among children living in apartments (0.075 ng/mL) compared to those living in attached (0.053 ng/mL) and detached (0.031 ng/mL) houses

Figure 2: Percentage of children unexposed by housing type and cotinine level

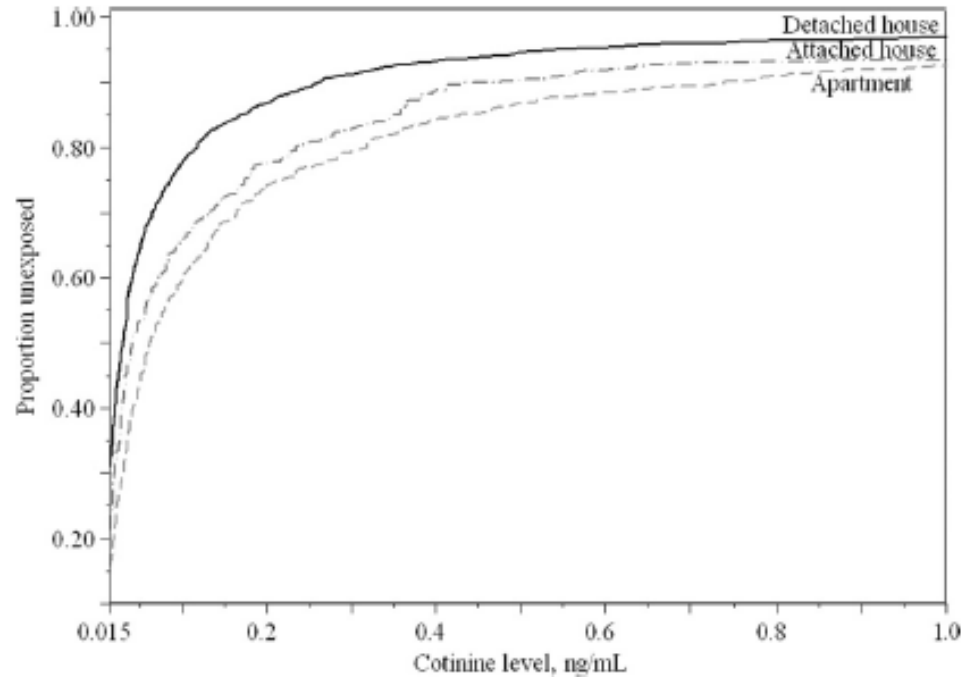


FIGURE 2

Percentage of children unexposed by housing type and cotinine level. The y-axis shows the proportion of children who are unexposed at different cotinine levels, which are displayed on the x-axis. The 3 lines represent each of the different housing types: detached house, attached house, and apartment (dashed line).



Economic Studies

Past-Year Smoking-Related Costs for Multiunit Housing Properties, by Smoking Policy: California, 2008-2009

Weighted
Average Cost



Completely Smoke-Free

\$ 1,623



Partially Smoke-Free

\$ 8,659



Never Smoke-Free

\$ 2,703



Economic Studies

Estimated Annual Cost-Savings Associated with Prohibiting Smoking in U.S. Subsidized Housing, by Cost Type.

Cost Type	All Subsdized Housing	Public Housing Only
	Cost Savings	Cost Savings
SHS-Related Health Care	\$341 million	\$101 million
Renovation of Units Where Smoking is Permitted	\$108 million	\$ 32 million
Smoking-Attributable Fires	\$ 72 million	\$ 21 million
TOTAL	\$521 million	\$154 million

Evaluating Smoke-free MUH Initiatives

Recommendations

▶ Focus on surveys

- Cost-effective
- Wide range of outcomes that can be assessed
- You probably already have some expertise to implement this
- Extensive body of literature to rely on

▶ Air quality monitoring and biomarkers studies are not a sure thing

- You must have expert support in exposure assessment
- Can get expensive quickly
- Limited successful previous work in MUH
- Better suited for smaller scale targeted evaluation, at least for now

Summary

- **No risk-free level of SHS exposure exists**
 - **MUH residents are particularly susceptible to SHS, which can infiltrate smoke-free living units from smoke-permitted living units and shared areas**
-
- **The only way to fully protect nonsmokers from secondhand smoke is to completely eliminate smoking in indoor spaces**
 - **Smoke-free policies have been successfully implemented in both public and market rate MUH**
-
- **There is an increasing body of scientific literature on the issue of smoke-free MUH**
 - **Further research is needed to evaluate the impact of smoke-free MUH policies on several key indicators, including SHS exposure, tobacco use, disparities, economic impact and health effects**

Question/Answer Period

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