

**What Does U.S. National  
Population Survey Data Reveal  
About  
Effectiveness of Nicotine  
Replacement Therapy on Smoking  
Cessation?**

Anne M. Hartman

# What Does U.S. National Population Survey Data Reveal About

## Effectiveness & Impact of Nicotine Replacement Therapy on Smoking Cessation?

### Affiliations

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# Key Issue Explored: NRT Efficacy vs. Effectiveness & Impact

- Continuum from internal validity to external validity
- RCT's of NRT show efficacy
- Real world studies show much lower effectiveness
- The analysis presented here provides survey data from a representative national sample (i.e., real world effectiveness in a free living population)

## Differences Across Studies

- Different settings (clinical, community..)
- Different time pts. -- maximums 5 – 12 mos.
- Different measures of quitting or abstinence-  
point prevalence - continuous abstinence
- Conducted during different periods of time  
(under varying tobacco control policies, taxes..)

# Definition of Terms

**For Next Slide:**

ODDS RATIO (OR) = ratio of odds of quitting for NRT treated (Tx) group to odds of quitting among the placebo group

# Odds Ratios and 7-day Pt Prevalence Abstinence Rates for NRT & Placebo in RCTs

<u>Type of Med</u>	<u>OR: Tx vs. Placebo (95% CI)</u>	<u>5-12 months post “quit-day”</u>	<u>Number of Studies</u>
Patch*	1.9 (1.7-2.2)	17.7% vs. 10.0%	27
OTC Patch	1.8 (1.2-2.8)	11.8% vs. 6.7%	3
Gum 2mg*	1.5 (1.3-1.8)	23.7% vs. 17.1%	13
Lozenge 2& 4mg**	1.5-2.6	17% vs. N/A	4
Nasal spray*	2.7 (1.8-4.1)	30.5% vs. 13.9%	3
Inhaler*	2.5 (1.7-3.6)	22.8% vs. 10.5%	4
Pooled NRT**	1.8 (1.7 to 1.9)	17% vs. 10%	103

\*Fiore et al., 2000; \*\*Cochrane (Silagy et al., 2004)

# Cross-Sectional General Population Studies

## Massachusetts\*:

- No significant change in quitting smoking pre- 1996 (1993) with NRT use vs. post-1996 (1999) NRT use
- Nor between NRT users and non-users in either period
  - ❖ 18.7% successful quitting with NRT vs. 16.7% for non-users— (*pre-1996*)
  - ❖ 31.1% successful quitting with NRT vs. 23.0% for non-users (*post-1996*)

## California\*\* :

- Long-term (6 mos.) length of abstinence for pre-1996 Rx Aid Use but not post-1996 use;
- Short term (< 3 mos.) length of abstinence for both periods seen.

\* Thorndike et al., 2002; \*\*Pierce et al., 2002

# Tobacco Use Supplement to the Current Population Survey (TUS-CPS)

- Key source of U.S. national, state, and sub-state level data on tobacco use & tobacco control policy
- Nationally representative sample
  - 240,000 civilian individuals aged 15+
  - 75% by phone & 25% in person visit
  - 83\* -88% response rate for self + proxy; 63\* -72% for self only

For more info: <http://riskfactor.cancer.gov/studies/tus-cps>



# 2003 Tobacco Use Special Cessation Supplement to the Current Population Survey (TUSCS-CPS)

## Selection Criteria

- 25 years +
- Everyday smoker 12 months prior to survey
- At least one 24hr+ quit attempt in the previous 12 months

# Use of Specific NRT Products\*

(N=8499)

Factor	Sample Size	Percent (%)
Patch Only	1272	14%
Gum Only	385	4.5%
Lozenge Only	49	0.5%
More than one OTC Only	311	3.4%
Nasal Spray Only	5	0.1%
Inhaler Only	55	0.6%
1 OTC + 1 Prescription NRT	29	0.3%
Other combination of NRT	482	5.2%
No Meds	5428	66%

\* LAST quit attempt lasting 24+ hrs. during the past 12 mos.

# Definition of Terms

## For Next Set of Slides:

HAZARD RATIO (HR) – rate of relapse among the NRT users divided by the rate of relapse among the non-users

E.g., an HR of 0.90 means the relapse rate for the NRT group is lower than that of the non-NRT group —thus the NRT group remains abstinent longer

# Cox Proportional Hazards Regression

## Length of Abstinence\* for NRT Use

(N = 8200)

Factor	Hazard Ratio (Relapse)	95% CI	p-value ( <i>T</i> -test, $\beta=0$ )	3+ Months Still Abstinent %	6+ Months Still Abstinent %	9+ Months Still Abstinent %
Any One NRT	0.90	0.82 - 0.97	0.008	28	16	14
More than One NRT	1.08	0.97 - 1.21	0.163	21	12	12
No NRT	1.00	.	.	25	17	16

\* On Last Quit Attempt

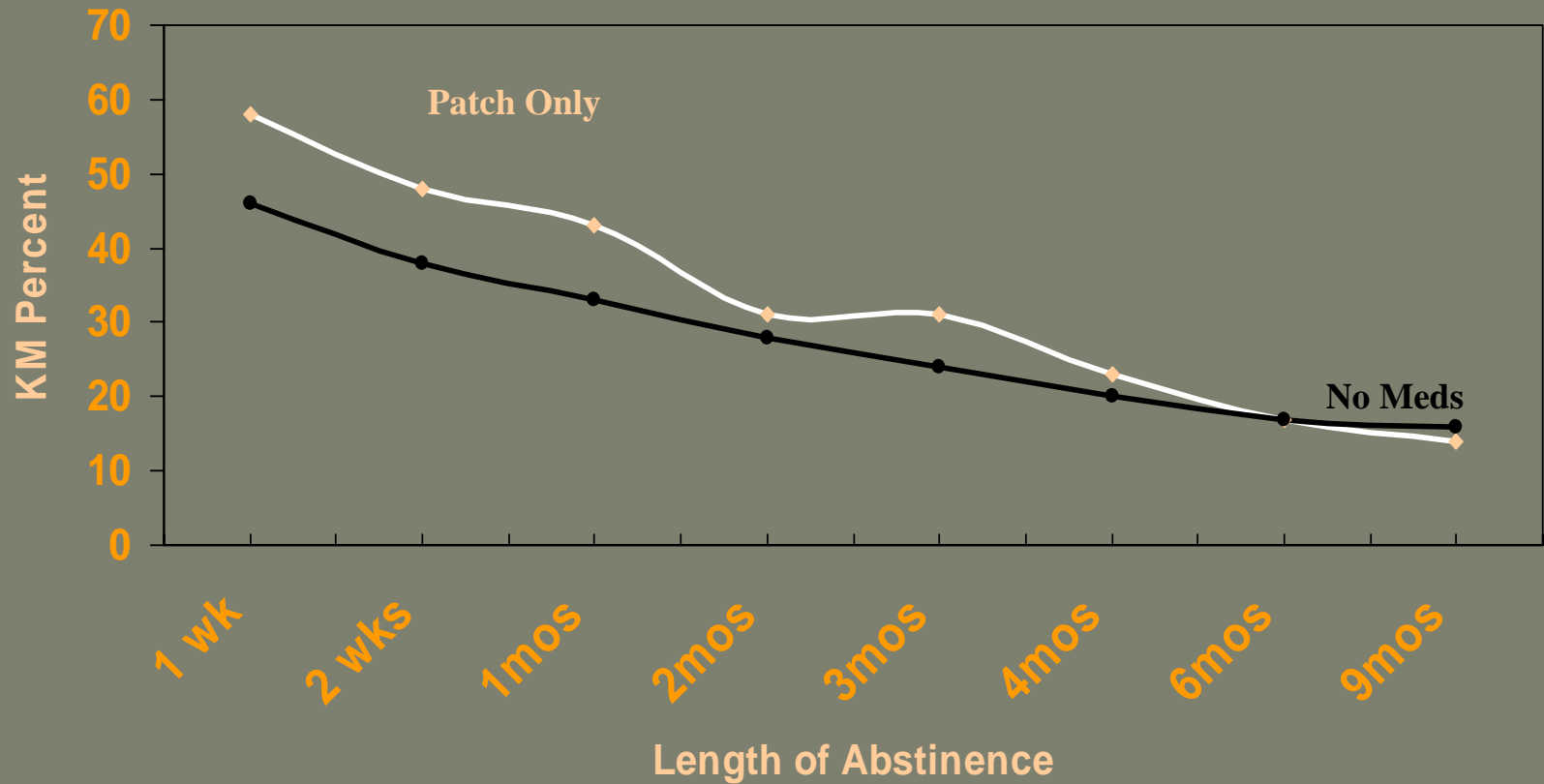
# Cox Proportional Hazards Regression

## Length of Abstinence for NRT

N = (8200)

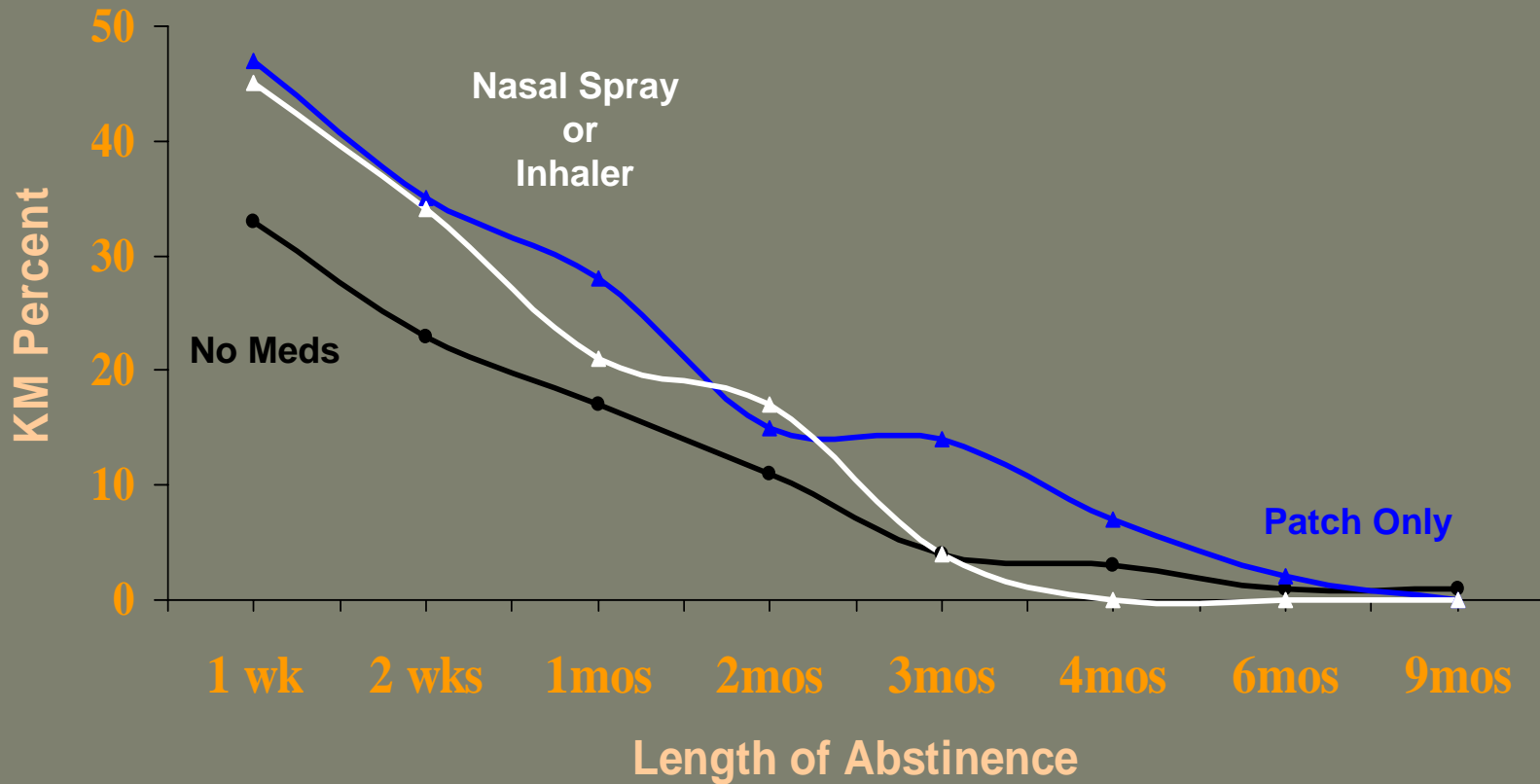
Factor	Hazard Ratio (Relapse)	95% CI	p-value ( <i>T</i> -test, $\beta=0$ )	3+ Months Still Abstinent %	6+ Months Still Abstinent %	9+ Months Still Abstinent %
Patch Only	0.84	0.77 – 0.92	<0.001	31	17	14
Gum Only or Lozenge Only	0.98	0.84 – 1.15	0.838	23	16	14
Nasal Spray Only or Inhaler Only	0.73	0.50 – 1.05	0.090	23	20	20
Bupropion and Any 1 NRT	0.99	0.82 – 1.20	0.948	20	14	12
Other combination of NRT	1.07	0.97 – 1.19	0.186	21	12	12
No Meds	1.00	.	.	24	17	16

# Kaplan-Meier Curve for Length of Abstinence Patch Only vs. No Meds



# Kaplan Meier Curve for Length of Abstinence

Nasal Spray Only or Inhaler Only vs. Patch vs. No  
Meds (*Only Relapsed Smokers*)

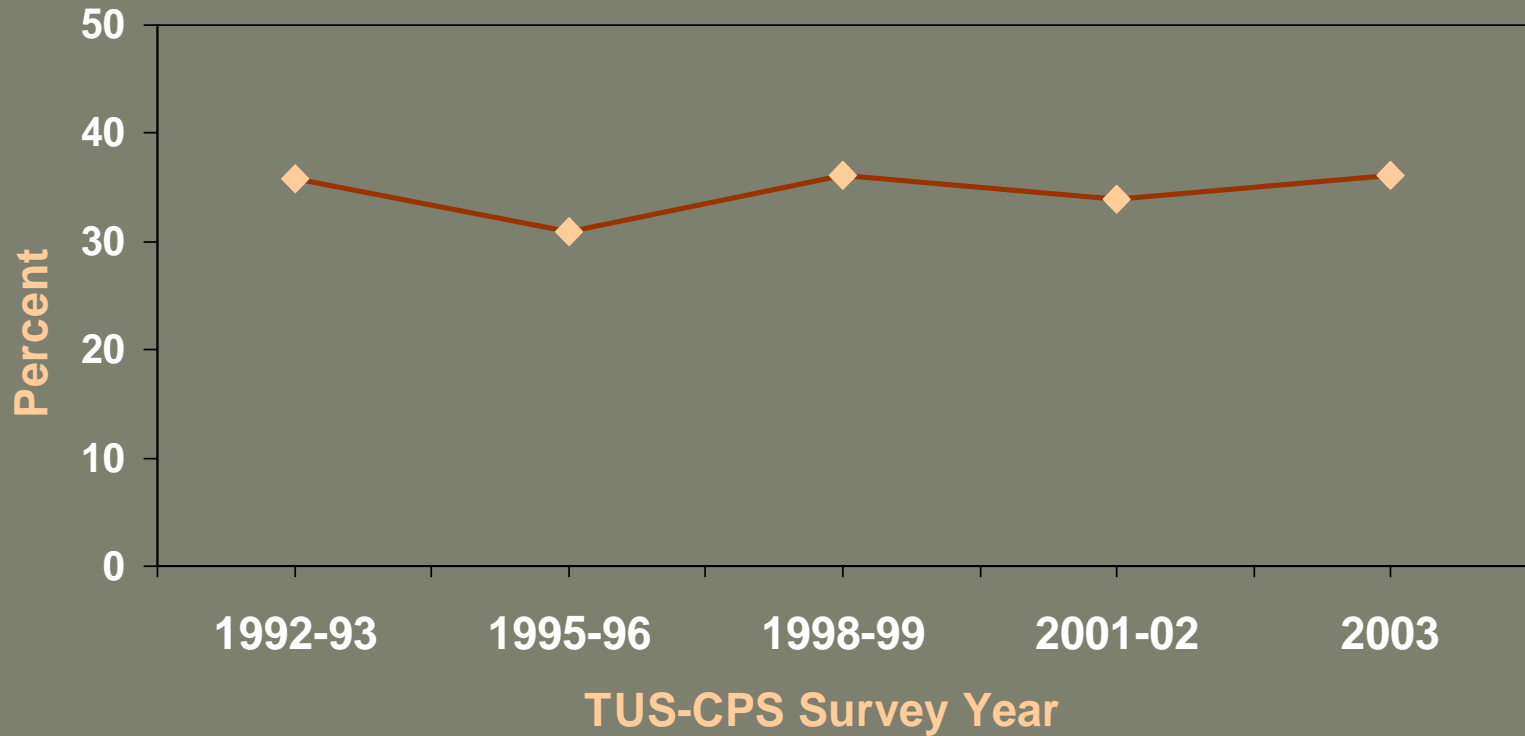


# Cox Proportional Hazards Regression Length of Abstinence for Pharmaceutical Aids (*Only Relapsed Smokers*) (N=6650)

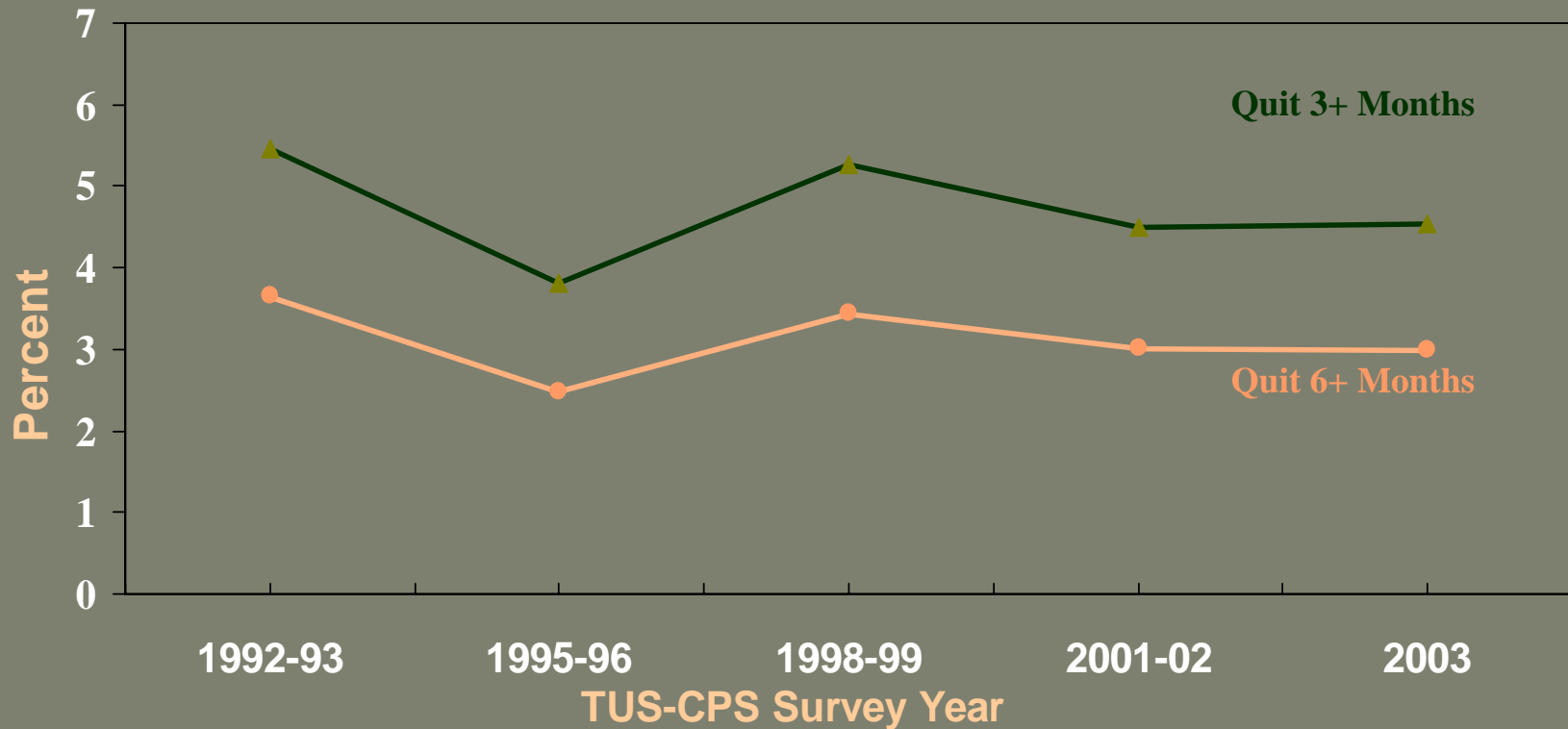
Factor	Hazard Ratio ( <i>Relapse</i> )	95% CI	p-value ( <i>T-test, <math>\beta=0</math></i> )	3+ Months Still Abstinent %	6+ Months Still Abstinent %	9+ Months Still Abstinent %
Patch Only	0.71	0.65 – 0.77	<10 <sup>-5</sup>	14	2	0
Gum Only or Lozenge Only	0.98	0.86 – 1.10	0.682	7	1	1
Nasal Spray Only or Inhaler Only	0.71	0.52 – 0.98	0.040	4	0	0
Bupropion and Any 1 NRT	0.80	0.70 – 0.92	0.003	5	1	1
Other combination of NRT	0.80	0.71 – 0.90	<0.001	9	2	2
No Meds	1.00	.	.	8	1	1



# Any Cigarette Smoking Cessation Activity of the US Household Population 25 Years and older Age-Adjusted Percentage Estimates



# Reported Cigarette Smoking Cessation of the US Household Population 25 Years and older Age-Adjusted Percentage Estimates



# Conclusions

- NRT efficacy studies yield higher rates of success at 6 mos. than effectiveness studies (*ours & previous studies*)
- Surveillance data tends to show weaker effects or no effect for NRT especially for long term abstinence of 6 mos.+; some shorter term effects are seen for 2-4 mos. (*ours & previous studies*)
  - Patch use quit rate for 3 mos. is 31% vs. no medicinal aid use rate of 24%, while (*our study*)
  - For 6 mos. rates are 17% and 16% respectively (*our study*)
- Patch use effect (0.84) is most consistently statistically significant --stronger for relapsed smokers (0.71) (*our study*)
  - 14% vs. 8% for 3 mos.
  - 2% vs. 1% for 6 mos.
- Rx NRT use effects are statistically significant ONLY among relapsed smokers (*our study*)

# Limitations & Advantages of Surveillance Studies

- **LIMITATIONS**
  - Self selection to use of NRT
  - Factors not measured are uncontrolled
  - Possibly residual confounding despite adjusting for some factors in a model
  - Some retrospective recall error
- **ADVANTAGES**
  - Large nationally representative general population
  - Free-living population makes own choices culminating from self and external factors
  - Helps understand existing population statistics, i.e., existing successful quitting rates (U.S. little change in small, 3-6 % per yr. quitting rates)
  - Helps identify differences between “real world” and randomized studies & can suggest interventions for bringing the two closer together

# Future Research & Practice to Consider

- Understand self selection of use of NRT
- Pattern of use of NRT- “real world” usage not ideal
- Provide realistic messages and expectations to smokers-
  - necessity for repetition & skill building
  - define “effective,” most will not succeed in any given attempt, only about 5% more succeed with NRT (10%) over no NRT (5%) success leaves 90% who will fail over 6 mos.
- More effective tailoring of existing & new products to result in greater quitting success
- Increased use of tailored products

# Future Research & Practice to Consider *(continued)*

- Convince smokers that tobacco addiction should follow a medical model -- e.g., cholesterol control
  - First try simple behavioral changes such as altering diet-- similar to self help “quitting smoking on one’s own”
  - If not successful then seek medical aid
- Finally, need different types of studies to evaluate impact in the “real world” not just randomized studies nor just cohort/cross-sectional ones—  
***Totality of evidence***

# Overview:

- RCT's efficacy
- Public health settings randomizing participants
- Community studies
- Surveillance –cohort & cross-sectional population studies

# Definitions of Terms

- Point prevalence abstinence: past 7-days only (most inclusive of quitters)
- Continuous abstinence: all days since quit day (most conservative/fewest quitters)
- Prolonged abstinence: all days since quit day with a “grace” period, usu 2 weeks; (in between)

Continuous and Prolonged abstinence measures produce similar absolute quit rates and ORs, but are NOT equivalent to Point Prevalence unless it is REPEATED Point Prevalence

**Point Prev > Rep Pt Prev ~ Prolonged ~ Continuous**

Keeley, Hughes, & Carpenter, NTR, 2001



# Definitions of Terms

- Survival or “relapse” curve (Kaplan-Meier) – percent of sample still abstinent at each successive date
- Odds Ratio (OR): odds of quitting in one group vs. another; e.g. OTC NRT vs placebo; OTC NRT vs. Rx

# Odds Ratios and 7-day Pt Prevalence Abstinence Rates for Pharmacotherapy & Placebo in RCTs

<u>Type of Med</u>	<u>OR: Tx vs. Placebo (95% CI)</u>	<u>5-12 months post “quit-day”</u>	<u>Number of Studies</u>
Patch*	1.9 (1.7-2.2)	17.7% vs. 10.0%	27
OTC Patch	1.8 (1.2-2.8)	11.8% vs. 6.7%	3
Gum 2mg*	1.5 (1.3-1.8)	23.7% vs. 17.1%	13
Lozenge 2& 4mg**	1.52-2.64	N/A	
Nasal spray*	2.7 (1.8-4.1)	30.5% vs. 13.9%	3
Inhaler*	2.5 (1.7-3.6)	22.8% vs. 10.5%	4
Bupropion*	2.1 (1.5-3.0)	30.5% vs. 17.5%	2
Pooled NRT**	1.77 (1.66 to 1.88)	N/A	103

\*Fiore et al., 2000; \*\*Cochrane (Silagy et al., 2004)

# RCT Abstinence Rates for Pharmacotherapy & Placebo

(from Clinical Practice Guidelines\*)

<u>Type of Med</u>	<u>OTC vs. Rx</u>	<u>OR</u>	<u>Quit 6-12 mos.</u>
Patch	OTC	1.9	17.7%
Gum 2mg	OTC	1.5	23.7%
Lozenge 2& 4mg	OTC	1.5-2.6**	N/A
Nasal spray	Rx	2.7	30.5%
Inhaler	Rx	2.5	22.8%
Bupropion	Rx	2.1	30.5%
Placebo	NA	1.0	10 - 17.3%

\*Fiore et al., 2000; 6,000 papers reviewed

\*\*Cochrane (Silagy et al., 2004)

# Studies in Public Health Settings

- **Inhaler\* & Patch\*\* studies**
  - Pts randomized to inhaler /patch with physician or without physician (OTC)
  - 1 yr quit rate for inhaler 3.1% vs .77%; patch 4.0% vs. 4.7% ns
- **Meta- analyses\*\*\* of 7 Over-the-Counter (OTC) trials (mostly trials of randomized participants) of either OTC NRT vs. Placebo, or OTC NRT vs. Prescription NRT**
  - 6 mos. Quit rate was 7% for OTC NRT & for Prescription NRT
  - 6. mos. Quit rate was 3.7% for average of 3 placebo trials
  - 6 mos. Quit rate was 3% from 1992 study for “self quitting”
  - **THUS A 6-MOS. QUIT RATE for NRT from these Effectiveness studies is ONLY about--- 3-4% DIFFERENCE --- from PLACEBO OR SELF QUITTING; WHILE NRT Efficacy studies previously mentioned show about-- 8-13% DIFFERENCE --from PLACEBO**

# OTC Efficacy Meta-analysis

Abstinence: Repeated Pt Prevalance, Prolonged, or Continuous

<u>Type of Med</u>	<u>OR: Tx vs. Placebo (95% CI)</u>	<u>2.5-6 months post "quit-day"</u>	<u>Number of Studies</u>
OTC Patch	2.5 (1.8-3.6)	9.6% vs. 4.3%	4

<u>Type of Med</u>	<u>OR: OTC vs. Rx (95% CI)</u>	<u>6-12 months post "quit-day"</u>	<u>Number of Studies</u>
OTC Patch	1.4 (.6-3.3)	8.9% vs. 8.0%	4

Hughes, Shiffman, et al., Tobacco Control; 2003

# Community Settings

Free NRT voucher giveaway  
(gum/patch in NY)<sup>\*</sup>, <sup>\*\*</sup>

- 22%<sup>\*</sup> at 4-6 mos. & 21-33%<sup>\*\*</sup> at 4 mos. were abstinent (7-day abstinence) compared to 12% earlier group not given free NRT voucher

# Surveillance Studies

- Cohort study – COMMIT 11 paired communities across U.S. surveyed in 1993 and 2001
  - Rx Patch/Gum (pre-1996) 6 mos.+ quit rate vs. OTC Patch/Gum (post-1996) rate
    - Patch: 15.3% vs. 15.5%
    - Gum : 9.7% vs. 17.6%
- Cross-sectional general population studies in MA\* & CA\*\*
  - MA: No significant change in quitting smoking pre- 1996 (1993) with NRT use vs. post-1996 (1999) NRT use -or - between NRT users and non-users in either period
    - 8.1% pre-1996 vs 11.1% post 1996 successful quitting (past year quitters who at the time of the survey were not smoking)
    - 18.7% successful quitting with NRT use vs. 16.7% success for non-users-- pre-1996
    - 31.1% successful quitting with NRT use vs. 23.0% success for non-users –post-1996
  - CA: Long-term (6 mos.) length of abstinence for pre-1996 Rx Aid Use but not post-1996 use; Short term (< 3 mos.) length of abstinence for both periods seen.

\* Thorndike et al., 2002; \*\*Pierce et al., 2002

# TUSCS-CPS

## Demographics

N=8499

- **Gender**
  - Male (52%)
  - Female (48%)
- **Age**
  - 25-44 (56%)
  - 45-64 (37%)
  - 65+ (7%)
- **Education**
  - <12<sup>th</sup> (16%)
  - HS grad (38%)
  - Some/College Grad (46%)
- **Race/Ethnicity**
  - White-NH (77%)
  - Black-NH (11%)
  - Hispanic (7%)
  - Other (5%)
- **Geographic Region**
  - Northwest ( 20%)
  - Midwest (27%)
  - South (35%)
  - West (18%)



# TUSCS-CPS

## Use of Pharmaceutical & Behavioral Aids

- 53 % used no aid
- 30% used NRT
- 29% used over-the-counter method (OTC)
- 14% combined NRT with behavioral treatment
- 5% combined NRT with Bupropion

# Use of Specific NRT Products and Bupropion\* (N=8499)

Factor	Sample Size	Percent (%)
Patch Only	1272	14.0%
Gum Only	385	4.5%
Lozenge Only	49	0.5%
More than one OTC Only	311	3.4%
Nasal Spray Only	5	0.1%
Inhaler Only	55	0.6%
1 OTC + 1 Prescription NRT	29	0.3%
Bupropion Only	483	5.4%
Bupropion + Any 1 NRT	324	3.4%
Other combination of NRT and/or Bupropion	158	1.8%
No Meds	5428	65.9%

\* LAST quit attempt lasting 24+ hrs. during the past 12 mos.

# Cox Proportional Hazards Regression

## Length of Abstinence\* for NRT, Bupropion (N = 8200)

Factor	Hazard Ratio (Relapse)	95% CI	p-value ( <i>T</i> -test, $\beta=0$ )	3+ Months Still Abstinent %	6+ Months Still Abstinent %	9+ Months Still Abstinent %
Any One NRT	0.90	0.82 - 0.97	0.008	28	16	14
More than One NRT	1.08	0.97 - 1.21	0.163	21	12	12
No NRT	1.00	1.00 - 1.00	.	25	17	16
Bupropion	0.98	0.90 - 1.08	0.729			
No Bupropion	1.00	1.00 - 1.00	.			

\* On Last Quit Attempt

# Cox Proportional Hazards Regression

## Length of Abstinence for Pharmaceutical Aids N =( 8200)

Factor	Hazard Ratio (Relapse)	95% CI	p-value ( <i>T</i> -test, $\beta=0$ )	3+ Months Still Abstinent %	6+ Months Still Abstinent %	9+ Months Still Abstinent %
Patch Only	0.84	0.77 – 0.92	0.000	31	17	14
Gum Only or Lozenge Only	0.98	0.84 – 1.15	0.838	23	16	14
Nasal Spray Only or Inhaler Only	0.73	0.50 – 1.05	0.090	23	-	-
Bupropion Only	0.93	0.83 – 1.04	0.186	27	18	14
Bupropion and Any 1 NRT	0.99	0.82 – 1.20	0.948	20	14	12
Other combination of NRT and/or Bupropion	1.07	0.97 – 1.19	0.186	21	12	10
No Meds	1.00	.	.	24	17	16

# Cox Proportional Hazards Regression Length of Abstinence for Pharmaceutical Aids (*Only Relapsed Smokes*) (N=6650)

Factor	Hazard Ratio ( <i>Relapse</i> )	95% CI	p-value ( <i>T-test, <math>\beta=0</math></i> )	3+ Months Still Abstinent %	6+ Months Still Abstinent %	9+ Months Still Abstinent %
Patch Only	0.71	0.64 – 0.77	0.000	14	2	0
Gum Only or Lozenge Only	0.98	0.86 – 1.10	0.682	7	1	0
Nasal Spray Only or Inhaler Only	0.71	0.52 – 0.98	0.040	4	0	0
Bupropion Only	0.83	0.74 – 0.93	0.001	10	2	0
Bupropion and Any 1 NRT	0.80	0.70 – 0.92	0.003	5	1	1
Other combination of NRT and/or Bupropion	0.80	0.71 – 0.90	0.000	9	2	2
No Meds	1.00	.	.	8	1	1

# Kaplan Meier Curve for Length of Abstinence

Bupropion vs. Bupropion + Any 1 NRT vs. No Meds  
(Only Relapsed Smokers)

