# E-cigarettes and Public Policy: Research Findings and Policy Implications

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Presented at **Hawaii Public Health Association**
**Sullivan Conference Room – UH Cancer Center**

April 9, 2015

# Thanks to:

Kathryn Matayoshi, Hawaii Department of Education, for approval of the research program.

The National Cancer Institute, grant #R01 DA153154 for support of the study.

The parents and participating students for their cooperation.

Desiree Acosta, Zalydmar Cortez, Russel Fisher, Mercedes Harwood-Tappé, Melissa Jasper, Emilee Turner, Corey Anderson, Elizabeth Bain, Josh Balete, Omar Bird, Antonio Brennan, Baryon Hightower Nate Hilts, Olivia Manayan, Todd Nagamine, Heather Nakahara, Dioreme Navasca, Kevin Nhieu, and Scott Zane for their able assistance with data collection.

# Introduction

- Electronic cigarettes (e-cigarettes) introduced to US in 2007. Initially marketed as supplement to tobacco cigarettes for adult smokers.

- E-cigarette use has been increasing rapidly in US and other countries. Currently multibillion-dollar industry. However, possible unintended consequence  is explosive growth in e-cigarette use among adolescents. Use increasing 2x-3x per year.

- Aggressive marketing campaigns for e-cigarettes on prime-time TV, radio, internet, retail outlets.  [See Williams & Knight. Marketing of electronic cigarettes to Hawaii's adolescents. Hawaii Journal of Medicine & Public Health, 2015;74:66-70.]

- Currently some age restrictions on sale in HI; no restrictions on e-cigarette advertising & none expected (Federal level) any time soon.

# Unintended Consequences?

E-cigarettes initially marketed as supplement to tobacco cigarettes for adult smokers.

- Construed by some public health researchers as a “disruptive technology” that might replace tobacco cigarettes (Abrams, JAMA 2013; Cobb & Abrams, NEJM 2014; Fiore et al., NEJM 2014).
- However, possible unintended consequence is an explosive growth in e-cigarette use among adolescents. Use increasing 2x-3x per year.
- From 2010 – 2014, prevalence of e-cigarette use among US high school students has gone from low single digits to 12% - 18% of adolescent population (Arrazola et al., 2014; Hawaii DOH, 2014).

# Currently, national debate going on about e-cigarettes:

- One side: E-cigarettes so attractive to adult smokers that they will facilitate smoking cessation, knock tobacco cigarettes off the market, lead to **demise of combustible tobacco use.** Predicts positive impact on public health.

- Other side: Observing marketing for, use of e-cigarettes in contexts where cigarettes previously banned will lead to **renormalization of smoking.** Predicts null, possibly negative impact on public health.

- Collateral predictions: (A) E-cigarettes promote nicotine dependence, dual use (smoking tobacco cigarettes + using e-cigarettes), hence adult smokers may be more likely to continue smoking (*perpetuation hypothesis*). (B) Look, taste, social popularity of E-cigarettes may attract adolescents to cigarette smoking (*gateway hypothesis*).

# Research is needed to inform this debate with empirical data:

- What is the prevalence of e-cigarette use, dual use (e-cigarettes + cigarettes) among adolescents? Low or high?
- What are the psychosocial characteristics of e-cigarette users (compared with nonusers, smokers)? Normal or distressed?
- How is e-cigarette use related to variables that typically predict cigarette smoking? For example: expectancies about smoking, perceptions of smokers. Same predictors or different predictors?
- And: Are possible confounders lurking in the bushes. Variables that are plausible confounders include gender, parental education, rebelliousness and sensation seeking. Need to determine whether findings are independent of possible confounders.

# Prevalence of E-cigarette Use --National

- What is the prevalence of e-cigarette use, dual use among adolescents? Low or high?

  CDC national sample, HS students (Arrazola et al., MMWR 2014):
  - Ever used e-cigs 12% Current use of e-cigs (past 30 days) 5%
  - Ever used cigarettes 35% Current use cigarettes 13%

  - Connecticut sample, HS students (Krishnan-Sarin et al., Nicotine & Tobacco Research [NTR] 2014):
  - Ever used e-cigs 25% Current use e-cigs 12%
  - Ever used cigarettes 20% Current use cigarettes 9%

  - Monitoring the Future, nat'l sample (Johnston et al., ISR 2015) :
  - 12th graders: Current use e-cigs 17% Current use cigarettes 14%
  - 10th graders: Current use e-cigs 16% Current use cigarettes 7%

  - Minnesota HS students, grades 9-12 (Minn. Health Dept. 2014):
    - Current use e-cigs 13% Current use cigarettes 11%

# Prevalence of E-cigarette Use -- Hawaii

- What is the prevalence of e-cigarette use in Hawaii?

DOH Tobacco Survey, HS students (St. John et al., Dec. 2014):

- Ever used e-cigs **2011** 5% Ever used e-cigs **2013** 18%

Wills, Knight, Williams, Pagano, & Sargent (Pediatrics 2015).
School-based survey, Oahu 9th-10th grade students, 2013-2014:

Ever used e-cigs 29% Currently use e-cigs 18%

<u>Cross-classification:</u>
E-cigarette only 17%
Cigarette only 3%
Dual user 12%
Nonuser 68%

- What are the psychosocial characteristics of e-cigarette users (compared with nonusers, smokers)? Normal or distressed?

**Table 4.** Mean (*SE*) for variables by usage groups, with *F* for Anova and *P*s for three contrasts from multinomial regression

| | Usage group | | | | | Contrast (*P*) | | |
|---|---|---|---|---|---|---|---|---|
| Variable | 1.Non user | 2. E-cigs only | 3. Cigs only | 4.Dual use | *F* | 1 vs 2 | 2 vs 3 | 2 vs 4 |
| SOCIAL-COGNITIVE PROTECTIVE FACTORS | | | | | | | | |
| Parental support | 25.9(.20) | 23.3(.40) | 20.0(.97) | 21.8(.48) | 36.5 | .001 | .01 | .03 |
| Parental monitoring | 21.2(.10) | 20.0(.20) | 18.7(.50) | 19.0(.24) | 33.0 | .001 | .04 | .01 |
| Academic involvement | 18.3(.11) | 16.6(.22) | 15.5(.53) | 15.5(.26) | 46.7 | .001 | .ns | .002 |
| Grades past year | 4.3(.02) | 3.9(.05) | 3.8(.11) | 3.5(.06) | 65.1 | .001 | .ns | .001 |
| Behavioral self-control | 65.4(.32) | 61.2(.65) | 57.9(1.58) | 57.0(.77) | 43.2 | .001 | .ns | .001 |
| Emotional self-control | 44.3(.28) | 40.4(.57) | 35.9(1.42) | 38.9(.68) | 33.9 | .001 | .ns | .ns |
| Social competence | 9.4(.08) | 9.7(.16) | 8.7(.39) | 9.7(.19) | 2.5# | .ns | .ns | .ns |
| SOCIAL-COGNITIVE RISK FACTORS | | | | | | | | |
| Smoker prototype | 8.9(.10) | 9.4(.20) | 10.1(.50) | 10.5(.24) | 13.3 | .02 | .ns | .01 |
| Smoking expectancies | 8.8(.16) | 10.1(.31) | 13.3(.79) | 14.3(.38) | 68.6 | .001 | .002 | .001 |
| Behavioral dysreg. | 38.9(.27) | 43.6(.54) | 42.6(1.33) | 45.7(.64) | 45.3 | .001 | .ns | .02 |
| Emotional dysreg. | 21.7(.22) | 24.7(.45) | 27.4(1.11) | 26.7(.54) | 37.0 | .001 | .03 | .01 |
| Peer smoking | 0.8(.04) | 1.5(.08) | 1.9(.19) | 2.8(.09) | 135.6 | .001 | .ns | .001 |
| E-cigarettes healthier | 1.6(.01) | 1.8(.03) | 1.7(.06) | 1.8(.03) | 30.3 | .001 | .ns | .ns |
| PROBLEM-BEHAVIOR RISK FACTORS | | | | | | | | |
| Parent-adol. conflict | 7.6(.09) | 8.7(.18) | 9.4(.46) | 9.5(.22) | 29.2 | .001 | .ns | .02 |
| Sensation seeking | 13.4(.12) | 15.8(.24) | 16.8(.58) | 17.8(.29) | 89.6 | .001 | .ns | .001 |
| Rebelliousness | 6.3(.09) | 8.4(.18) | 9.5(.46) | 10.9(.22) | 152.7 | .001 | .ns | .001 |
| COLLATERAL SUBSTANCE USE | | | | | | | | |
| Alcohol use | 0.5(.03) | 1.5(.06) | 1.9(.14) | 2.5(.07) | 296.4 | .001 | .ns | .001 |
| Marijuana use | 0.1(.03) | 0.6(.05) | 1.1(.13) | 2.6(.06) | 474.4 | .001 | .ns | .001 |
| Heavy drinking | 0.1(.02) | 0.3(.03) | 0.4(.08) | 0.9(.04) | 138.2 | .001 | .ns | .001 |

- How is e-cigarette use related to variables that typically predict cigarette smoking? For example: expectancies about smoking, perceptions of smokers.

Bunnell et al. (NTR 2015). School-based survey, nat'l representative samples of 6th-12th grade students, 2011-2013. Analysis for NONSMOKERS:

Intention to smoke higher among e-cig users (44%) than never users (22%)

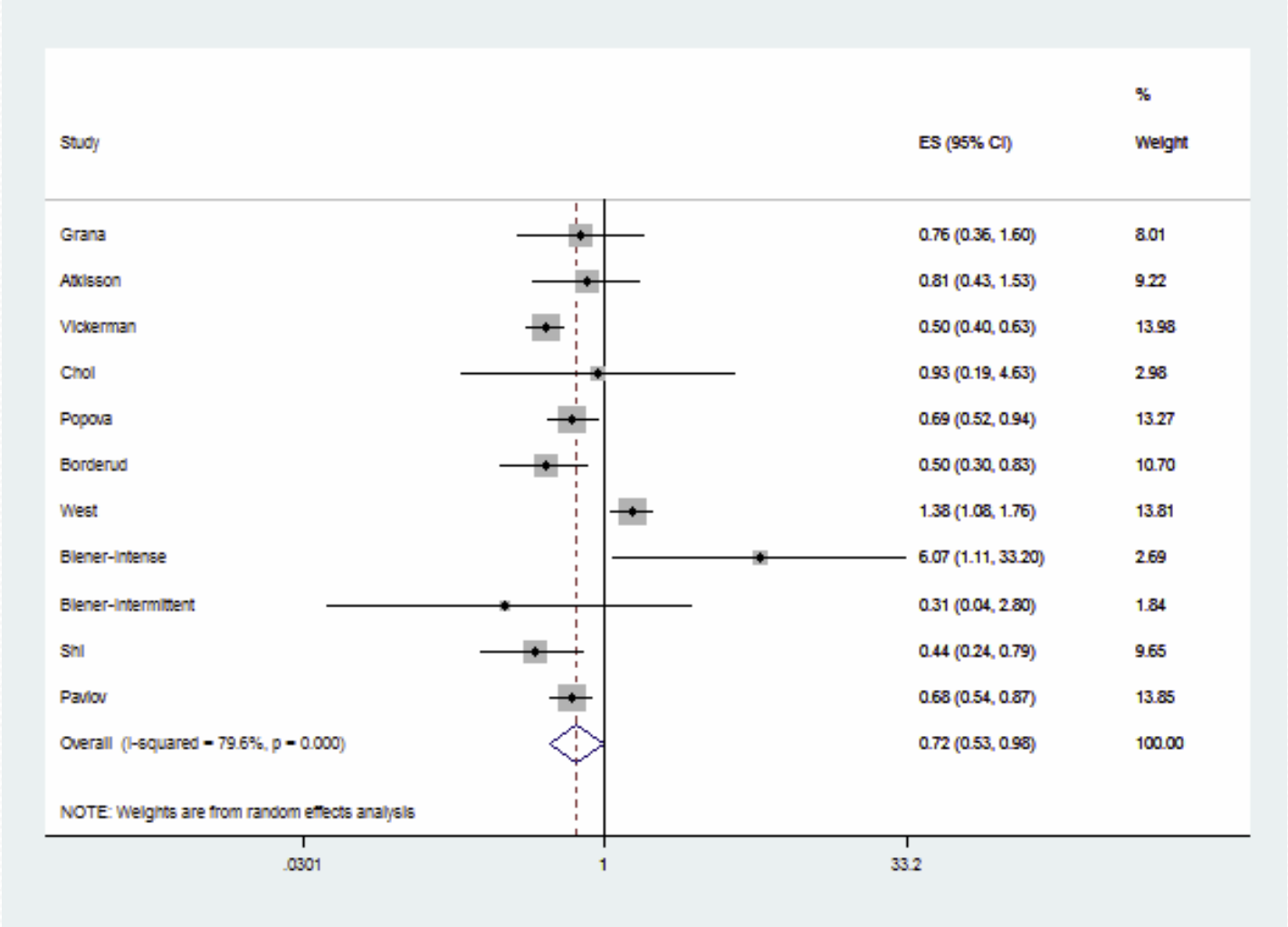
Coleman et al. (NTR 2015). RDD telephone survey, nat'l representative sample young adults, 2012-2013. Analysis for NONSMOKERS:

Intention to smoke higher for e-cig users (46%) than never users (14%)

King et al. (NTR 2015). Laboratory study, young adult daily smokers. Method: exposure to confederate drinking bottled water, then smoking either combustible cigarette or e-cigarette.

Seeing e-cigarette use increased P's desire to smoke tobacco cigarette.

- How is e-cigarette use related to smoking cessation, general populations of smokers? Grana et al., *Circulation* 2014;129:1972-1986. Corrected odds ratio = 0.62 (95% CI = .51 - .76)



- **Health Effects?** General agreement that in absolute terms, using an e-cigarette is not as harmful as smoking a tobacco cigarette. **BUT**:

Evidence limited, but some concern about respiratory effects, high serum cotinine levels in e-cig users. [Callahan-Lyon, P. Electronic cigarettes: Human health effects. *Tobacco Control* 2014;23:ii36-ii40.]

Some suggestions of short-term health effects but literature inconsistent, with methodological problems + conflicts of interest. [Pisinger C, Dossing M. A systematic review of health effects of electronic cigarettes. *Preventive Medicine* 2014; 69:248-260.]

Concern about effects of nicotine on adolescent brain during a particularly sensitive developmental period. [England, LJ. Nicotine and the developing brain. *American Journal of Preventive Medicine* 2015.]

Nicotine not currently listed by IARC as carcinogen but developing evidence for role of nicotine as tumor promoter. [Grando, SA. Connections of nicotine to cancer. *Nature Reviews Cancer* 2014;14:419-429.]

# Summary of Evidence

E-cigarette awareness and use are prevalent among adolescents. Particularly high rate of e-cig use in Hawaii. Common perception that e-cigarettes are healthier than tobacco cigarettes.

E-cigarette users differ on a range of psychosocial variables. Elevated on risk status above nonusers but e-cig only users are lower on risk status compared with dual users, who have relatively high risk status.

Findings significant with statistical control for a number of  covariates.

Several results are consistent with proposition that e-cigarettes may increase interest in smoking, recruit lower-risk adolescents to smoking.

Evidence on health effects minimal but concern about information on websites sponsored by e-cigarette companies. [Bellum J. “How Big Vaping is misinforming the public about e-cigarettes.” Vox Media, March 28, 2015.] http://www.vox.com/2015/3/28/8301923/e-cigarette-information

# Issues in Policy Debate

Current debate ongoing between harm-reduction advocates and public health researchers concerned about possible negative effects of e-cigarettes. [Chapman S. E-cigarettes: The best and the worst case scenarios for public health. BMJ 2014;349:g5512.]

If e-cigarettes help current smokers to quit, then their use should be **encouraged** (through low or non-taxation, minimal access restrictions).

Issue: Evidence that e-cigs help cessation not currently supportive.

Need for Cuba Gooding test ("Show me the money!")

Independent of above, if e-cigarettes increase likelihood of smoking in adolescence, then their use should be **restricted** (though taxation, age-of-sale restrictions, public smoking policies).

Issue: Evidence for gateway effects still indirect.

Need for "smoking gun" study clearly demonstrating transition effect.

Whether to place *restrictions on advertising* for e-cigarettes remains controversial. Adv. restrictions adopted in 2014 by European Union countries but rejected by FDA in their deeming regulations.

Issue: FDA needs strong evidence on health effects, but still mixed.

# What is Needed Now?

More research on smoking cessation. Do e-cigarettes really help smokers quit?

- Need fair, well-designed studies that follow groups of smokers over time with good characterization of their risk status, motivation.
- Need objective determination of outcomes (e.g., cotinine analysis).

More research on adolescents to test gateway hypothesis. Does use of e-cigarettes in early adolescence (11-12 years) lead to ↑ likelihood of smoking at later ages (14-15 years)?

- Need to include psychosocial controls as e-cig users may differ.
- Need to have longitudinal studies, determine transitions over time.
- Need focused study of dual users: Where, when, why.

Investigative reporting into backgrounds of supposedly grass roots organizations and nonpartisan policy groups. Historical strategy of tobacco companies to promote smoking through front organizations.

(Economic analysis currently being circulated to state legislatures.)

STATE BUDGET SOLUTIONS

# POLICY ANALYSIS

MARCH 31, 2015

## E-Cigarettes Poised to Save Medicaid Billions

*J. Scott Moody, Chief Executive Officer and Chief Economist*

Electronic cigarettes (e-cigs) have only been around since 2006, yet their potential to dramatically reduce the damaging health impacts of traditional cigarettes has garnered significant attention and credibility. Numerous scientific studies show that e-cigs not only reduce the harm from smoking, but can also be a part of the successful path to smoking cessation.

The term "e-cig" is misleading because there is no tobacco in an e-cig, unlike a traditional, combustible cigarette. The e-cig uses a battery-powered vaporizer to deliver nicotine via a propylene-glycol solution—which is why "smoking" an e-cig is called "vaping." The vapor is inhaled like a smoke from a cigarette, but does not contain the carcinogens found in tobacco smoke.

Unlike traditional nicotine replacement therapy (NRT), such as gum or patches, e-cigs mimic the physical routine of smoking a cigarette. As such, e-cigs fulfill both the chemical need for nicotine and physical stimuli of smoking. This powerful combination has led to the increasing demand for e-cigs—8.2% use among nondaily smokers and 6.2% use among daily smokers in 2011.[1]

The game-changing potential for dramatic harm reduction by current smokers using e-cigs will flow directly into lower healthcare costs dealing with the morbidity and mortality stemming from smoking combustible cigarettes. These benefits will particularly impact the Medicaid system where the prevalence of cigarette smoking is twice that of the general public (51% versus 21%, respectively).

Based on the findings of a rigorous and comprehensive study on the impact of cigarette smoking on Medicaid spending, the potential savings of e-cig adoption, and the resulting tobacco smoking cessation and harm reduction, could have been up to $48 billion in Fiscal Year (FY) 2012.[2] This savings is 87% higher than all state cigarette tax collections and tobacco settlement collections ($24.4 billion) collected in that same year.

Unfortunately, the tantalizing benefits stemming from e-cigs may not come to fruition if artificial barriers slow their adoption among current smokers. These threats range from the Food and Drug Administration regulating e-cigs as a pharmaceutical to states extending their cigarette tax to e-cigs. To be sure, e-cigs are still a new product and should be closely monitored for long-term health effects. However, given the long-term fiscal challenges facing Medicaid, the prospect of large e-cigs cost savings is worth a non-interventionist approach until hard evidence proves otherwise.

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Suspicion that State Budget Solutions supported by Philip Morris.
Economic analysis distorts conclusions from scientific papers cited.

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