



THE ONTARIO
TOBACCO
RESEARCH
UNIT

UNITÉ
DE RECHERCHE
SUR LE TABAC
DE L'ONTARIO

Generating knowledge for public health



RECIG to Inform Policy Research on E-Cigarettes

CPHA Annual Conference
Toronto, June 16th, 2016

Ontario Tobacco Research Unit (OTRU)
Dalla Lana School of Public Health
University of Toronto

INTRODUCTION

What are e-cigarettes?



E-cigarettes Defined

Battery powered devices that are used to heat and vaporize a solution.

This solution contains:

- Propylene glycol
- Flavourings
- Nicotine (sometimes)

RECIG: RESEARCH ON E-CIGARETTES

**AN ONTARIO MINISTRY OF HEALTH & LONG-
TERM CARE, HEALTH SYSTEM RESEARCH FUND
STUDY**

RECIG INVESTIGATOR TEAM

- Robert Schwartz (PI), OTRU, UoT
- Laurie Zawertailo (PI), CAMH
- Thomas Eissenberg, Virginia Commonwealth University
- Roberta Ferrence, OTRU, UoT
- Shawn O'Connor, OTRU, UoT
- Peter Selby, CAMH
- Melodie Tilson, NSRA

RECIG Research Team

- Emily Di Sante
- Bo Zhang
- Diane Van Abbe
- Jaklyn Andrews
- Muhannad Malas
- Aliya Noormohamed
- Jan vander Tempel
- Ginnie Ng
- Alexa Minichiello

RECIG Knowledge Exchange Advisory Committee

Irmajean Bajnok, RNAO

Claire Harvey, TPH

Jennifer McFarlane, NW TCAN

Michael Perley, OCAT

Rowena Pinto, CCS

Michael Stanbrook, UHN

Andrea Stevens Lavigne, OLA

Melodie Tilson, SHAF

Expert Panel

- Thomas Eissenberg, Virginia Commonwealth University (Chair)
- Linda Bauld, University of Stirling
- Mirjana Djordjevic, National Cancer Institute
- Maciej Goniewicz, Roswell Park Cancer Institute
- Alan Shihadeh, American University of Beirut

Research Questions

1. Determine the prevalence of e-cigarette use, especially among youth
2. Determine the health effects of e-cigarette use
3. Determine the effectiveness of e-cigarettes as a cessation aid
4. Determine the relationship between e-cigarette use and uptake of tobacco smoking

RECIG Studies

- Comprehensive, realist-informed knowledge synthesis
- Analysis of data from existing surveys
- Longitudinal panel of adult smokers and recent smokers (19 years and over)
- Surveys and in-depth interviews with youth and young adults (15-29 years of age)

RECIG Studies (cont'd)

- Social media analysis of e-cigarette message exposure, reach and content
- Randomized clinical trial comparing smoking cessation effectiveness of e-cigarettes and nicotine replacement therapy products
- Biomarker study of e-cigarette users to measure concentrations of nicotine and other chemicals

International, Multidisciplinary Expert Panel



HEALTH EFFECTS

Bottom Line

Evidence of potential health effects is **sufficient** to suggest that anybody **who is not** a current smoker of tobacco cigarettes **should not vape** electronic cigarettes

Health Effects Challenge

No standards for acceptable levels of toxicants
in vapours ingested into the lungs

Nuanced Findings

Range of devices that vary widely in liquids, cartridges, heating mechanisms.

Many potential effects not yet studied

Some e-cigarettes can deliver as much nicotine in 10 puffs as a regular cigarette

For youth, nicotine can affect brain development

Effects of frequent long-term exposure not known



Constituents: In e-liquids and vapor

- Carbonyls, tobacco specific nitrosamines (TSNAs), and impurities were frequently detected in e-liquids at low levels
- Low levels of carbonyls, VOCs, TSNAs, metals, impurities, and particulate matter have been found in e-cigarette vapor

Passive Exposure

- E-cigarette use may result in low levels of passive exposure to nicotine, organic compounds, metals, and particulate matter
- Particulate matter high in indoor vaping by a large number of people
- Lower than cigarettes, but not zero

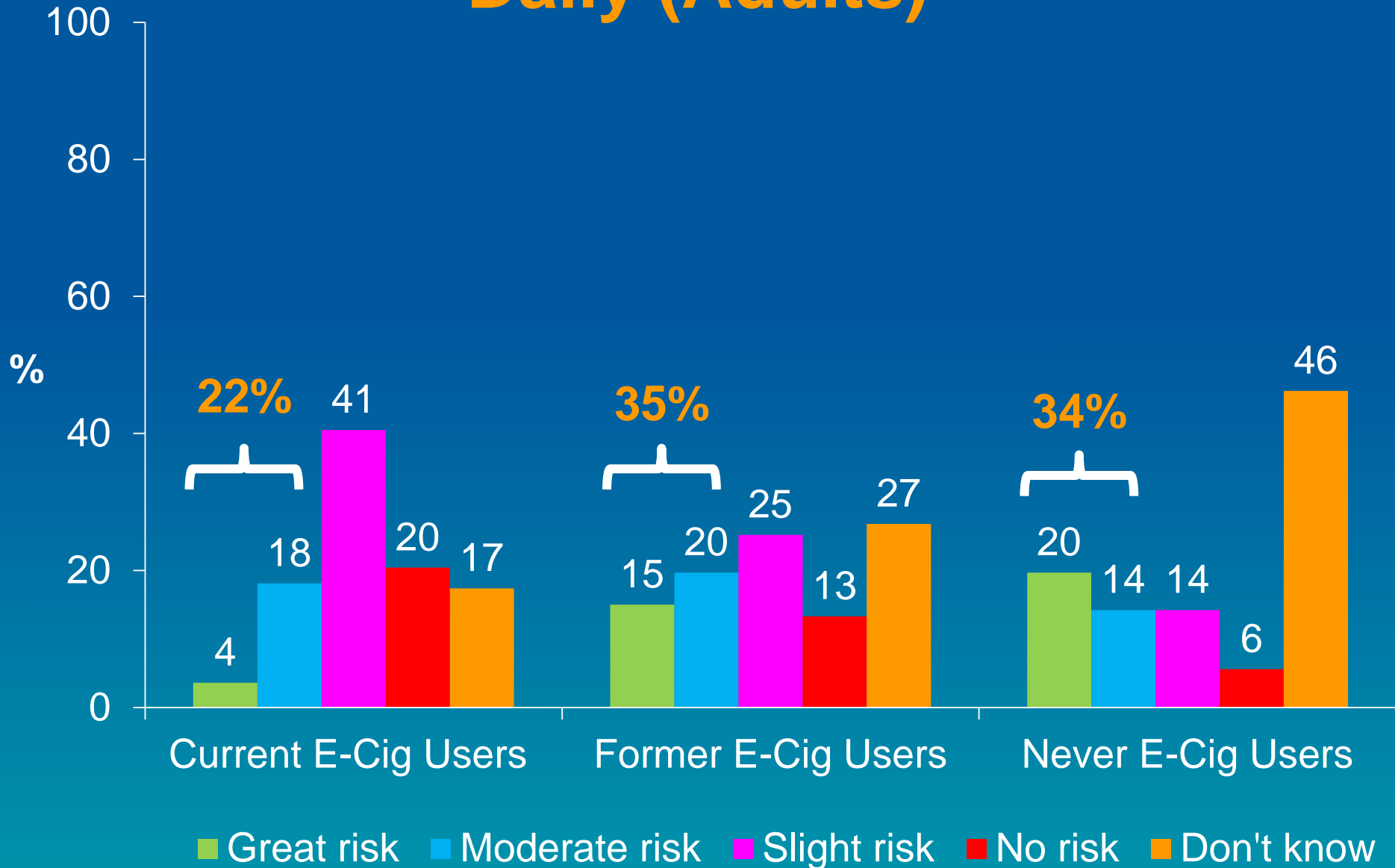
Cytotoxicity: From e-liquids and vapor

- Exposure to e-liquids and vapors result in varying levels of cytotoxicity
- E-cigarette vapor may be less cytotoxic compared to cigarette smoke
- Nicotine content and flavorings added to e-liquids may contribute to the negative effects on cell viability
- Increasing battery output voltage may also contribute to increased cytotoxicity

Health Effect: Respiratory Effects

- Some **respiratory** effects were reported, but there was a large variability in results
- *Vardavas et al* (2012) reported a 16% decrease in FENO after using e-cigarettes for 5 minutes ($p=0.005$)
 - **Significant increase in overall peripheral airway resistance ($p=0.024$)**
- *Flouris et al* (2013) found no significant differences in FENO after active e-cigarette use ($p>0.001$)
 - **Neither brief active e-cigarette use nor 1h passive e-cigarette exposure significantly affected the lung function ($p>0.001$)**

Perceived Risks of Using E-Cigarettes Daily (Adults)



Problem Perception

- What are the real health effects as opposed to the perceived health effects?
- Vaping into the lungs perceived per se as problematic?
 - General public
 - Tobacco control community
- Are sufficient numbers of people that matter sufficiently concerned?



Reframing the Problem



ECIG Health
Effects

Tobacco
Cigarettes

What if e-cigarettes are both a problem and a solution?



ECIGs health effects are problem

ECIGs as cessation aid are solution

EFFECTIVENESS AS A CESSATION AID

ARE E-CIGARETTES EFFECTIVE CESSATION AIDS?



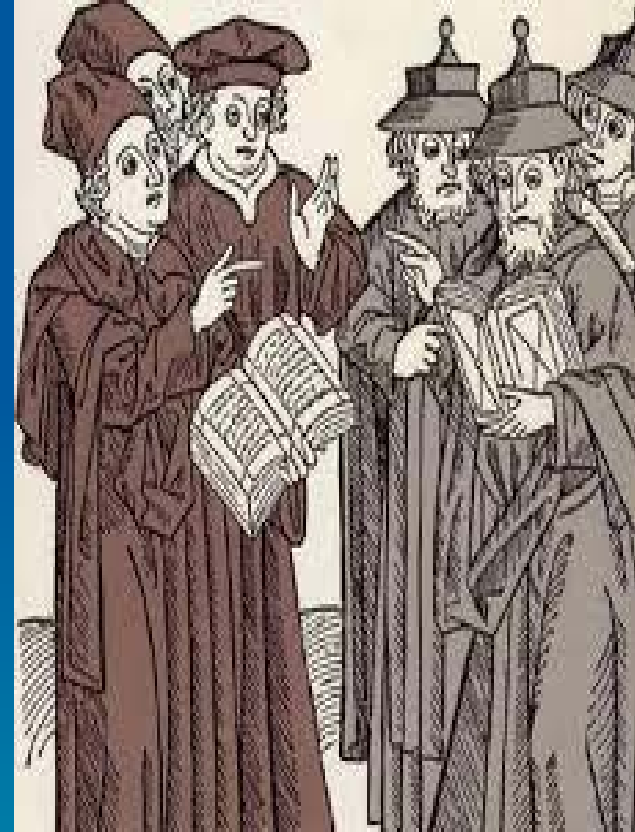
Conclusively:
The evidence to date is inconclusive!

E-Cigarettes for Cessation: State of Knowledge

Respected scholars diverge in drawing conclusions from same studies

Most agree: insufficient high quality studies

Emerging evidence suggests that the answer is nuanced



Misinformation and Interpretation

**Reporting from Royal College of Physicians
Report: “Nicotine without smoke: tobacco
harm reduction”**

What the Press Release said

e-cigarettes are likely to be beneficial to UK public health. Smokers can therefore be reassured and encouraged to use them, and the public can be reassured that e-cigarettes are much safer than smoking.

What the Report Summary Says

- E-cigarettes appear to be effective when used by smokers as an aid to quitting smoking.
- E-cigarettes are not currently made to medicines standards and are probably more hazardous than NRT.
- It is important to promote the use of e-cigarettes, NRT and other non-tobacco nicotine products as widely as possible as a substitute for smoking in the UK.

What the Report itself says (p. 85)

- Experience with NRT suggests that e-cigarette use is likely to increase the proportion of smokers making a quit attempt, but appropriate evidence on this effect is not yet available.
- Observational population-level evidence indicates more likely to make an attempt to stop smoking but it is not yet clear whether they are more likely to succeed 119,120

Nuanced Cessation Aid Findings

Some smokers using certain kinds of e-cigarettes in certain ways may quit smoking

Some smokers may become dual users which may or may not lead to cessation

By far, most smokers who try, do not become vapers and do not quit

When do they work for cessation?

Some studies (including our own) suggest:

- Daily vaping
- Nicotine e-cigarettes
- Vaping in order to quit smoking

Knowledge Synthesis

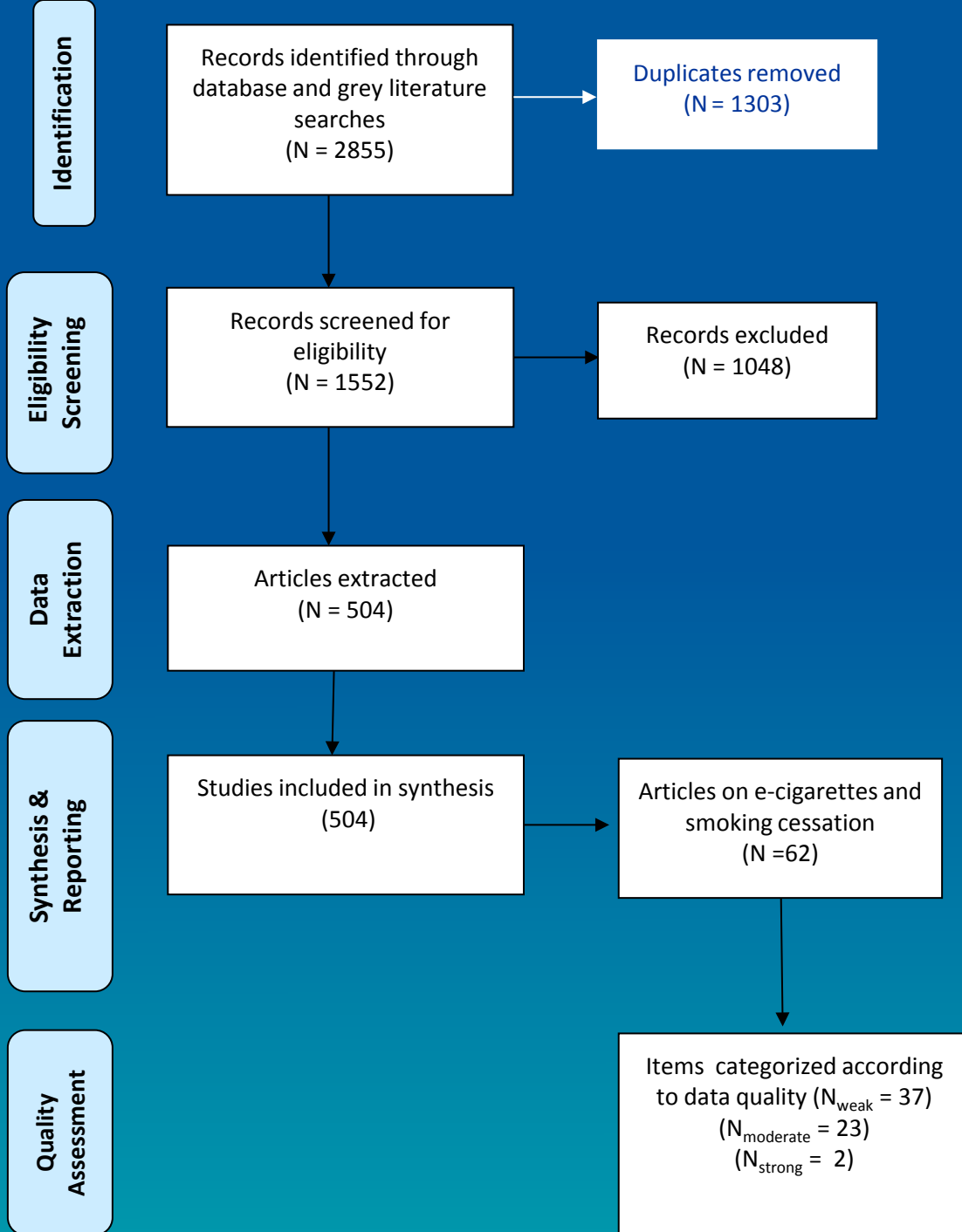
Search Strategy

- Original data of all types including cross-sectional surveys
- Peer-reviewed literature sources
 - PubMed, Medline, PsycINFO, CINAHL, ERIC, ROVER, Scopus, ISI Web of Science, Cochrane Library, and the OTRU library catalogue
- Grey literature sources
 - Grey Matters, OAlster, Open Grey, the NYAM website, the Legacy Library, BIOSIS Previews, Conference Papers Index, ISI Proceedings, Dissertation Abstracts International, CIHI, and Grey Net International.
- Exclusion by 2 reviewers (blind to each other)

Knowledge Synthesis (2)

Quality Assessment

- Developed a quality assessment form that accommodated the methodological heterogeneity of the literature; informed by:
 - QualSys tool (2004) and Cochrane handbook criteria.
 - 16 indicators including design, sample representativeness, instrument validity/reliability, statistical analysis, reflexivity, and risk of bias.
 - Summary score values: weak (0.00 – 0.49), moderate (0.50 – 0.74), or strong (0.75 – 1.00).
- Conflict of Interest was assessed separately.



GRADE

Grading of Recommendations Assessment, Development and Evaluation (GRADE) to assess the overall quality of evidence per outcome



Results

Overview of Included Articles on Smoking Cessation (N=62)

Primary Outcomes, N=45; Secondary Outcomes, N=19

	Quality Assessment			
Study Type	Strong (S)	Moderate (M)	Weak (W)	Total
RCT	0	5	5	10
Experimental	1	7	8	16
Longitudinal	0	5	13	18
Cross Sectional	1	6	12	19

Primary outcomes: abstinence and reduction

Secondary outcomes: cravings and withdrawal symptoms

GRADE RESULTS

- The state of the evidence about the effectiveness of e-cigarettes as a smoking cessation aid is currently assessed as *very low to low*, due primarily to methodological weaknesses of current studies
- Evidence of a positive association between e-cigarette use and smoking reduction is slightly better but also weak as indicated by a GRADE assessment of *low to moderate*

Secondary Outcomes: Cravings and Withdrawal Symptoms

- 9 out of 10 moderate or strong studies demonstrated positive results.
- Overall quality of evidence was rated as low using the GRADE approach.

Conclusions

- Evidence for the effectiveness of e-cigarettes as a cessation aid is inconclusive.
 - Too much uncontrolled variation.
 - Many important variables are not accounted for.
 - External validity issues.
- However, the direction of the effect seems to be positive in the majority of moderate and strong studies.
- Newer-generation devices can be more useful.

E-cigarettes and smoking cessation on Twitter: a social media analysis

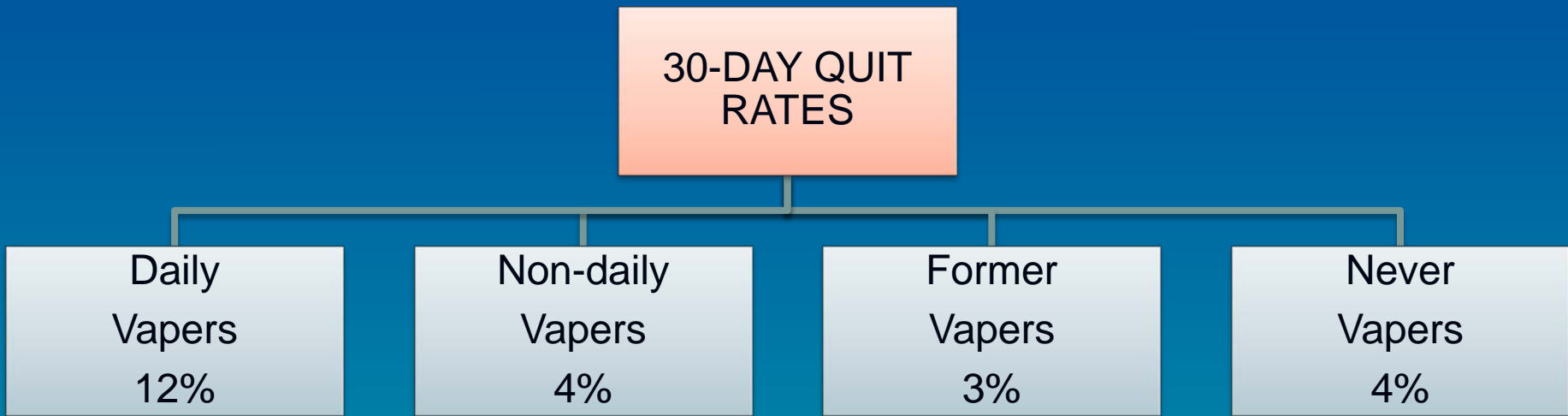
- A full year's worth of Twitter data through *Sysomos HeartBeat*, which allowed us to capture a purposive sample of tweets from users with the widest and farthest reach.
- We identified 120,803 tweets by 80,809 users about e-cigarettes and smoking cessation, estimated to have been seen 316 million times by other Twitter users.
- Attitudes about e-cigarettes as smoking cessation aids were favorable across user types (industry, press, public figures, fake accounts, and personal users), except for public health professionals, who lacked consensus and contributed negligibly to the conversation.

Ontario Adult Longitudinal

The vast majority of smokers who tried quitting with e-cigarettes, vaped only a few times and did not quit smoking

Ontario Adult-Longitudinal

Intention to Treat (ITT) Analysis



Adult-Longitudinal Discussion

CAUTION

12% quit rate among daily vapers represents only 9 out of 37 baseline smokers.

Of these 9:

- 2 continued to smoke cigars

- 2 continued to use smokeless

- 1 continued to use waterpipe

Should e-cigarettes be promoted as a cessation aid?

YES

- Less harm than tobacco
- Could work for some as well or better than alternatives
- Potentially huge reach

NO

- Could aid tobacco maintenance
- Continues nicotine dependence
- Unknown long-term health effects
- Normalizes vaping & smoking
- Can't have huge reach without encouraging uptake by non-smokers

Anti-precautionary principle?



If ECIGs are **less harmful** than cigarettes and
if ECIGs help **some people quit** smoking cigarettes
...but we don't know for sure who, when, how...
why not err on side of anti-precaution and promote
use among smokers?



E-CIGARETTE USE IN ONTARIO

E-cigarette Use (Past Year)

Group	Population	%
Age 18+	1,113,000	10.9
Age 18-24	417,200	33.2

E-cigarette Use, Past Year (Adults)

Group	Population	%
Current smoker	595,900	42.6
Former smoker	129,700	4.5
Never smoker	387,500	6.6



Past-Month Vaping

3.4% of 18+

14.7% of current
smokers

E-cigarette Use, Past Year (Students)

Group	%
Grade 7-8	4.9
Grade 9-12	23.4
Grade 7-12	18.7
Male	21.6
Female	15.6
Smoked cigarettes past year	66.5
Not smoked cigarettes past year	10.6

**SELECT PATTERNS OF USE:
FINDINGS FROM A PANEL OF
ADULT SMOKERS**

Among all ever users of e-cigarettes

For majority: <10 vape sessions on the day they last used e-cigarettes



Each vape session usually lasting 1-5 minutes (81%)

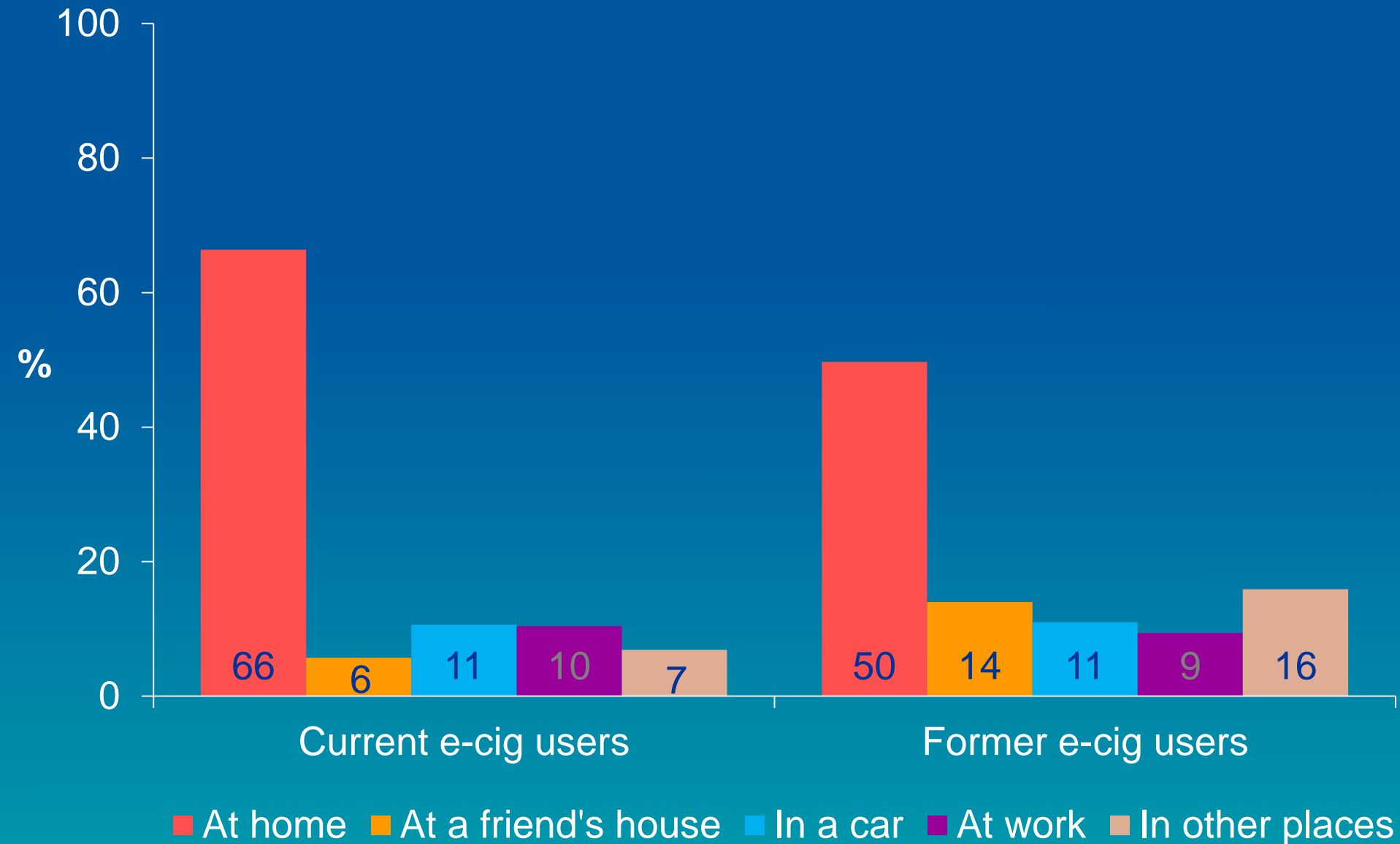


<10 puffs on each vape session on average (84%)



<50 puffs per day (80% smoking (79%) and curiosity (59%)) (Table 3).

Where Last E-Cigarette Was Used



Source of the Last E-Cigarette

Source	Current Users	Former Users
Vape shop or lounge	54%	13%*
Convenience store or small grocery store	15%	30%*
On the internet	11%	11%
Gas station	4%	7%*
Pharmacy	1%	5%*
Supermarket	0.2%	2%*
Other (e.g., from friends, free samples)	14%	32%*

Research Policy Timelines

Research

- 2010 – ECIG Issue Identified
- Fall 2013 Targeted Research Call
- Fall 2014 Research Begins
- Winter 2016 Results

Policy

- 20XX Internal Gov't policy work
- Summer 2014 Ontario Election
- Fall 2014 Bill 45 Introduced
- Summer 2015 Bill 45 adopted
- Winter 2016 Implemented



Policy Options

Policy Option	Status
Regulate to decrease safety and health risks	
Regulate to assure nicotine delivery	
Ban all or most flavours	
Restrict to adults	X
Regulate promotion	X
Restrict to current smokers	
Ban vaping in public places	X
Restrict sales to licenses vape shops	
Complete ban on sale / use	

Take Home Messages



- Non-smokers should not vape
- Low levels of toxicants with unknown long-term health effects
- Vaping is likely far less harmful than smoking
- Some smokers using certain kinds of e-cigarettes in certain ways may quit smoking
- Until now, not panacea for helping smokers quit

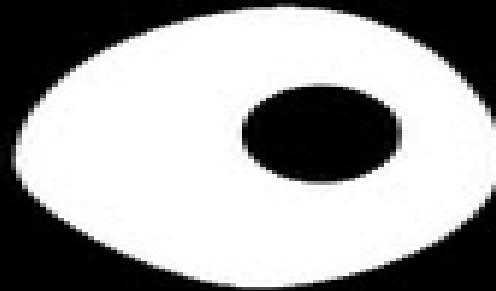
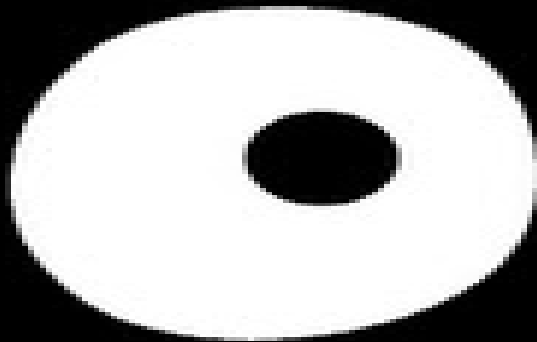
What next?

Regulatory policy could do more to:

1. Prevent non-smokers (primarily youth) from initiating
2. Make e-cigarettes less harmful for smokers
3. Make e-cigarettes more effective cessation aids

What should policymakers do?

If health effects are perceived as problem; apply precautionary principle and protect non-smokers, especially youth from initiating



If cessation possibilities are perceived as solution to cigarette smoking; apply anti-precaution and promote regulated use for smokers only