UW Center for
Tobacco Research and Intervention
UNIVERSITY OF WISCONSIN
SCHOOL OF MEDICINE AND PUBLIC HEALTH

An Introduction To E-Cigarettes

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September 11, 2021

Conflicts of Interest

- No conflicts to disclose.

Overview

- Context
- E-cigarettes 101
- Public health conundrum
  - Youth uptake
  - Harm reduction

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Smoking in Society

- 14.0% of adult Americans smoke (2019)

The Toll of Cigarettes

- Leading preventable cause of death and disease
  - 1 in 5 deaths
  - 480,000 deaths/year
- Smokers lose an average of 10-20 years of life
- More than 16 million Americans suffer from at least one smoking-related disease
- ~$300 billion in medical care and lost productivity
- ~10% of annual healthcare costs

Smoking in Wisconsin

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What Is an E-Cigarette?

- A device that heats and vaporizes a liquid that contains nicotine designed to mimic the experience of smoking a conventional cigarette
- Many of the products are manufactured overseas (quality control?) while most of the liquids are manufactured in the U.S.
  - More than 250 brands

Disposable

Rechargeable

Vape Pens, Tank Systems, Mods

Pod Mods or Salts

- 1 pod = 1 pack of cigarettes

E-Liquids or "Juice"

- Usually contains:
  - Propylene glycol
  - Glycerin
  - Water
  - Nicotine – 3 mg and 5 mg
  - Flavorings – 10,000+
- Nicotine salts – more nicotine, faster hit

Juul’s Nicotine Rush

E-cigarette Aerosol

- Not harmless
  - Formaldehyde, Acetaldehyde, Toluene, Nitrosamines
  - Cadmium, Nickel, Lead
  - Elevated VOC's: Acrylonitrile, Acrolein, Propylene Oxide, Acrylamide, Crotonaldehyde
  - Particulate Matter
- Combustible cigarettes
  - 7000 chemicals
  - 50+ carcinogens
  - Cyanide, Carbon Monoxide, Arsenic, Benzene, Lead, Ammonia, Cadmium

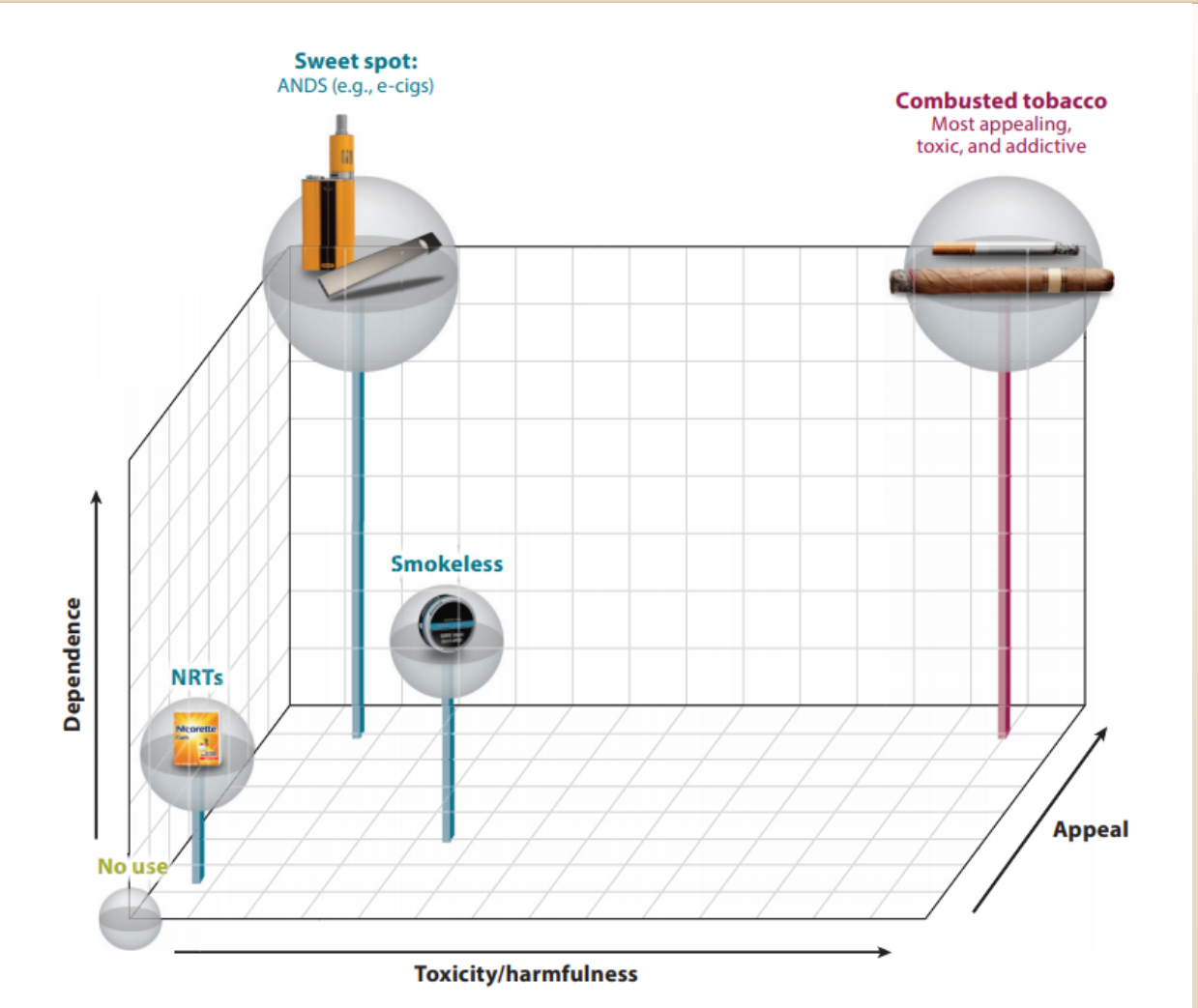
E-cigarette Safety

- Adverse events are typically:
  - Mouth and throat irritation
  - Nausea
  - Headache
  - Dry cough
- More laboratory and pre-clinical than real-world use data
- Some flavors contain chemicals that are known to cause health problems
  - Diactyl, cinnamaldehyde

The Risks – National Academy of Sciences (2017)

- Most e-cigarettes contain and emit numerous potentially toxic substances
  - **Conclusive evidence**
- E-cigarette use results in symptoms of dependence
  - **Substantial evidence**
- Not clear whether e-cigarette use changes short-term adverse health outcomes in several organ systems in smokers who continue to smoke combustible tobacco cigarettes (dual users)
  - **Insufficient evidence**

Continuum of Harm



Abrams et al. (2018). Annual Review of Public Health.

E-cigarette Conundrum

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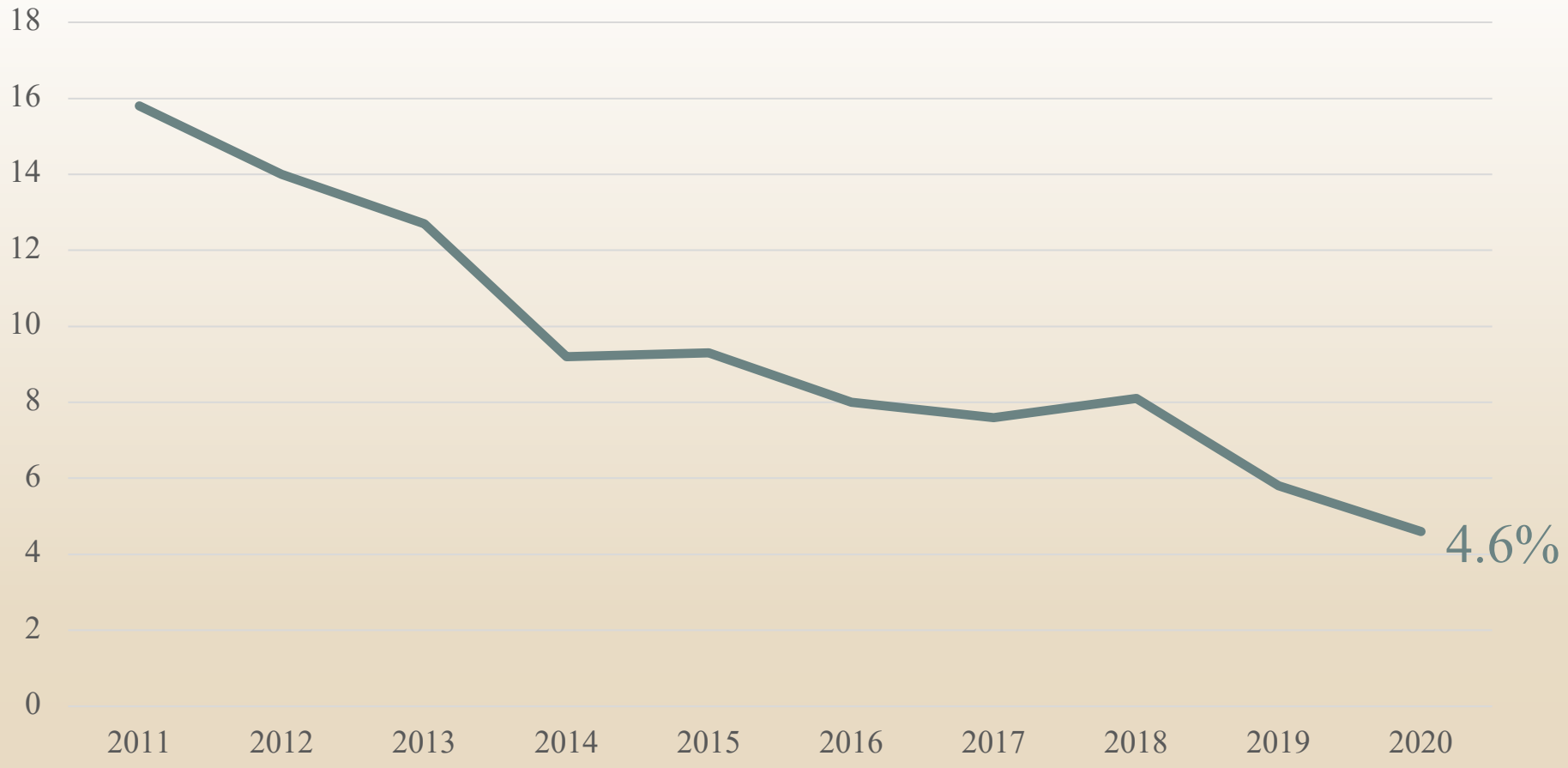
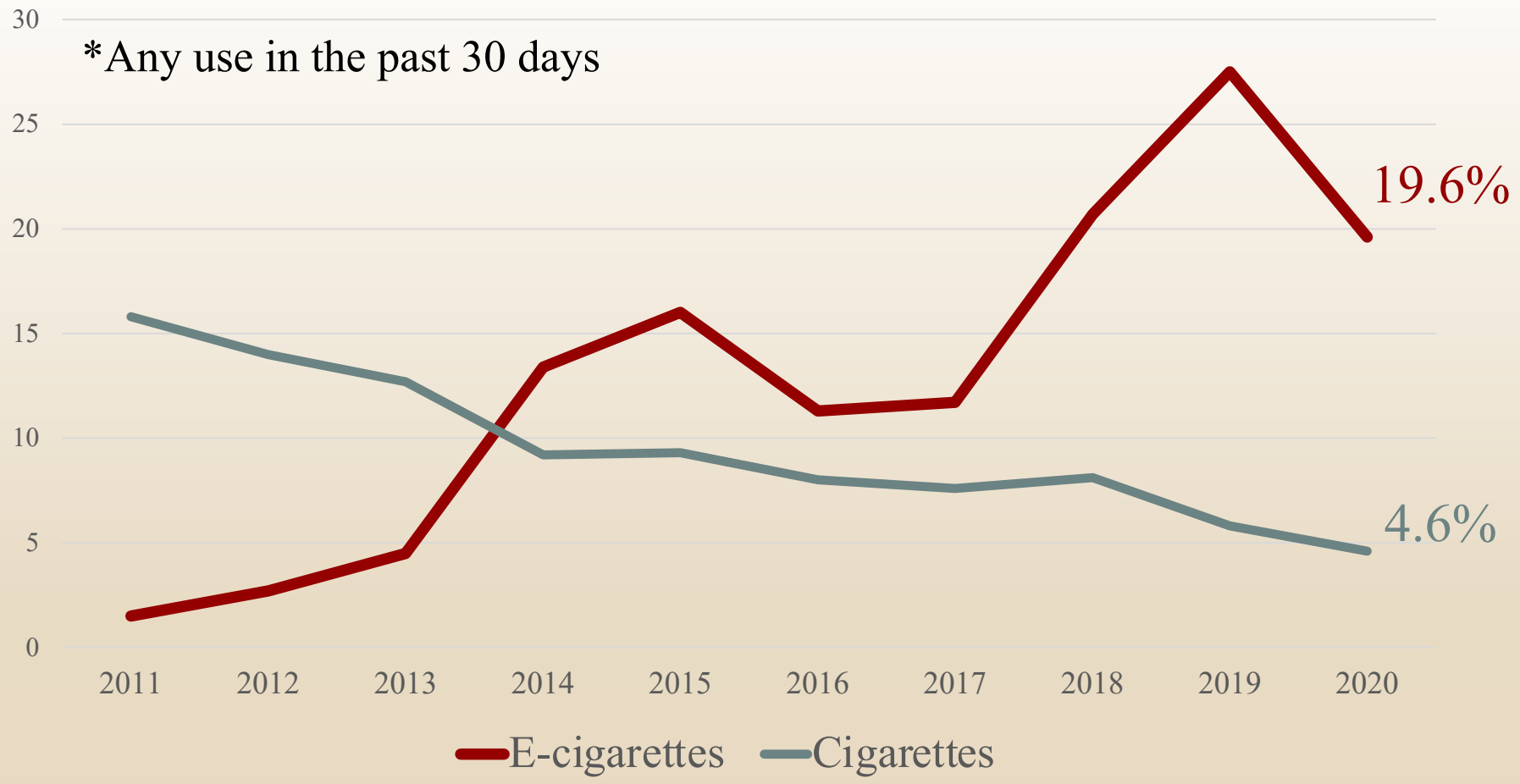
High School Use - Cigarettes



Source: National Youth Tobacco Survey
American Lung Association

High School Use – Cigarettes and E-cigarettes



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Flavors and Youth

- Flavors play a major role in youth initiation and use
  - 81.5% of e-cigarette users use the product "because they come in flavors I like"
- 66% of teens think e-cigarettes are just vaping flavor
- 80% of WI high school students would *not* use unflavored products
  - 95% of middle school students
- FDA banned flavors in disposable pods (Juul)

Nicotine Effects on the Developing Brain

- Rewire the brain to:
  - Increase risk of impulsivity and mood disorders
  - Impact learning and memory
  - Impact reward functioning
  - Become dependent
- Increase risk of becoming a combustible cigarette smoker
  - Meta-analysis in JAMA Pediatrics (2017)
  - Recent paper questions this finding (Selya, et al., 2019)
    - Kids who went on to smoke may have started smoking without e-cigarettes

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E-cigarettes and Smoking Cessation

- Moderate evidence from observational studies more frequent use of e-cigarettes is associated with increased likelihood of cessation
- Dual use is a common use pattern
  - More than half e-cigarette users also smoke
- Cannot study e-cigarettes as a cessation medication/device in the U.S.
  - UK Health Service prescribes them for cessation

E-cigarettes and Smoking Cessation

- New Zealand trial
  - Nicotine patches + e-cigarette with nicotine: 7%
  - Nicotine patches + placebo e-cigarette: 4%
  - Nicotine patches: 2%
- UK National Health Service trial
  - E-cigarette starter pack: 18.0%
    - 80% of abstainers continued to use e-cigarettes
  - 3 months of chosen NRT: 9.9%
    - 9% of abstainers continued to use NRT

E-cigarettes As A Cessation Aid

Relative Risk for Abstinence in Nicotine E-Cigarettes vs NRT and / or Counselling - Similar follow-ups

Study	Duration in Weeks	Nicotine EC N	NRT/Support N	Relative Risk REML, Random, 95% CI	Weights in %	Relative Risk [95% CI]
Subgroup 1 - NRT and Support						
Hajek et al 2019	26	155/438	112/446		78.7	1.41 [1.15, 1.73]
Lee et al 2018	8	3/20	0/10		0.4	3.67 [0.21, 64.80]
Bullen et al 2013	12	38/289	27/295		15.1	1.44 [0.90, 2.29]
RE Model for Subgroup 1						1.42 [1.18, 1.71]

Grabovac et al. (2021). Effectiveness of Electronic Cigarettes in Smoking Cessation: A Systematic Review and Meta-analysis. *Nicotine & Tobacco Research.*

Cochrane 2020 Conclusions

- E-cigarettes may help more people to stop smoking for six months or longer than using NRTs or nicotine free e-cigarettes.
- E-cigarettes may increase quit rates compared to no support, or behavioral support alone.
- The overall incidence of serious adverse effects related to e-cigarettes is low.
- There is not yet enough evidence to support claims that e-cigarettes are effective tools for quitting smoking.
  - The effects are particularly unclear when it comes to newer types of e-cigarettes that have better nicotine delivery, and the effect of e-cigarettes when combined with an NRT.

Conclusions

- Smoking represents a significant public health concern
  - The leading preventable cause of death and disease
- E-cigarettes are an innovative technology to deliver nicotine
- E-cigarettes are not safe, but they appear to be less harmful than combustible cigarettes
- E-cigarettes have the potential to be a public health benefit (i.e., a harm reduction strategy) and a public health threat (i.e., increase youth addiction)

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