Not All Dual Tobacco Use Is the Same: Evidence From Tobacco Use Behavior, Biomarkers of Exposure, and Biomarkers of Potential Harm

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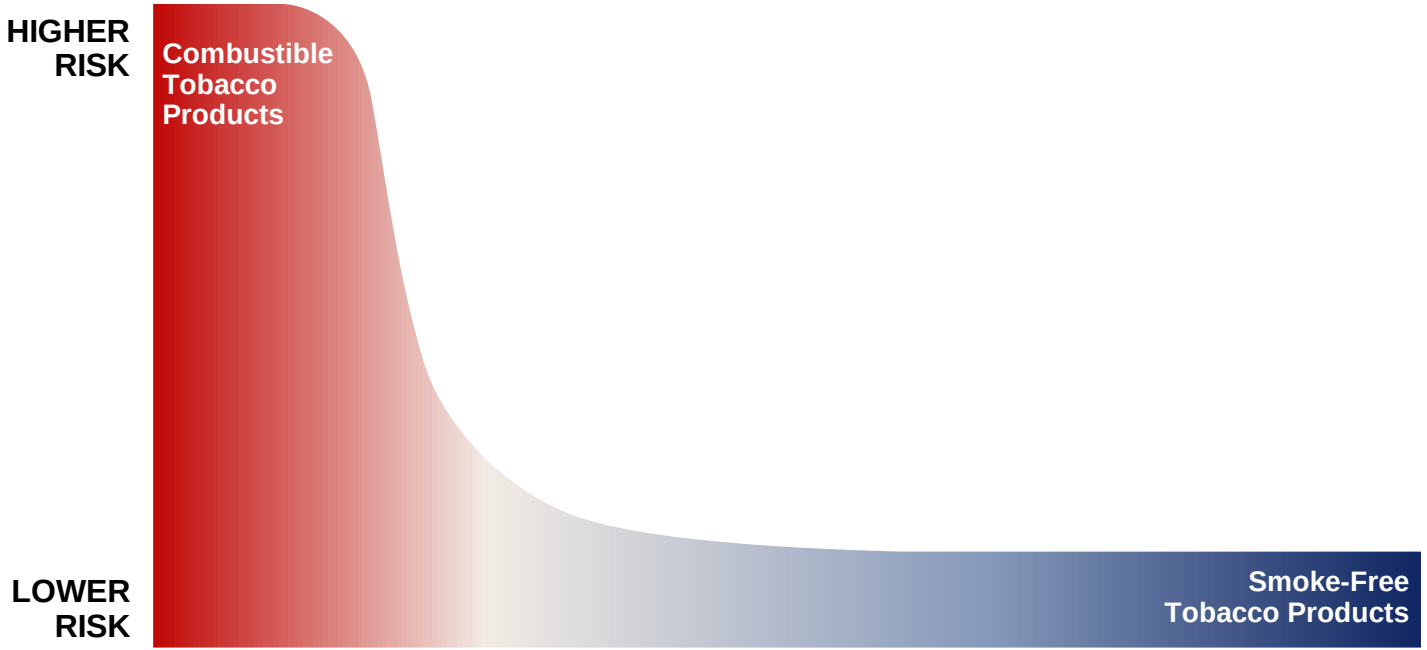
Outline

- Introduction
- Characterization of Adult Dual User Subgroups
  - Differences in Tobacco Use Behaviors
  - Differences in Biomarkers of Exposure
  - Differences in Biomarkers of Potential Harm
- Key Takeaways

Risk Differential – Combustible vs. Smoke-Free Products

Risk Cliff Between Combustible & Smoke-Free Tobacco[1]



[1]Adapted from Nutt, et. al Estimating the Harms of Nicotine-Containing Products Using the MCDA Approach. *Eur. Addict Res* 2014; 20:218-225.

Characterization of Dual Users Varies Across Studies Limiting Comparability

Any use of both products

- Current cigarette and ever e-cigarette use (Christensen 2014, Cheng 2021)
- Everyday or some days use of both (Simonavicius 2017, Goniewicz 2018, Coleman 2019, Chang 2021, Strong 2021)
- Weekly use of both products (Levy 2017)

Daily and non-daily use of both products

- Daily cigarette use and everyday or some days e-cigarette use (Rostron 2019)
- Daily e-cigarette use with cigarette smoking (Biener 2014)
- Daily and non-daily use of both products (Smith 2021)

Frequent and infrequent use of both products

- Light, predominant, and heavy use of both products (Buu 2022)
- Frequent and infrequent use of both products (Lizhnyak 2022)

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Novel Approach to Evaluating Adult Dual User Subgroups

- The Population Assessment of Tobacco and Health (PATH) Study
  - Wave 1 Adult Questionnaire Restricted-Use Files and Biomarker Restricted-Use Files (2013-2014)

- Study Groups:
  - Dual User Subgroups
  - Exclusive Daily Cigarette Smokers
  - Exclusive Daily E-Cigarette Users
  - Never Tobacco Users

- Population:
  - Adults aged 18 or older[1]

- Outcomes
  - Demographics and tobacco use patterns
  - Biomarkers of exposure (BOE) and biomarkers of potential harm (BOPH)

		Cigarette Use Behavior	
	Frequency	**≥20 days**	**<20 days**
E-Vapor Use Behavior	**≥20 days**	Frequent Duals	Vapers Who Smoke
	<20 days	Smokers Who Vape	Infrequent Duals

1- The analysis was not restricted to 21+ because, at the time data were collected, the federal minimum legal age to purchase tobacco products was 18.

Key Differences in Demographics and Amount of Cigarette Smoking Among Adult Dual User Subgroups

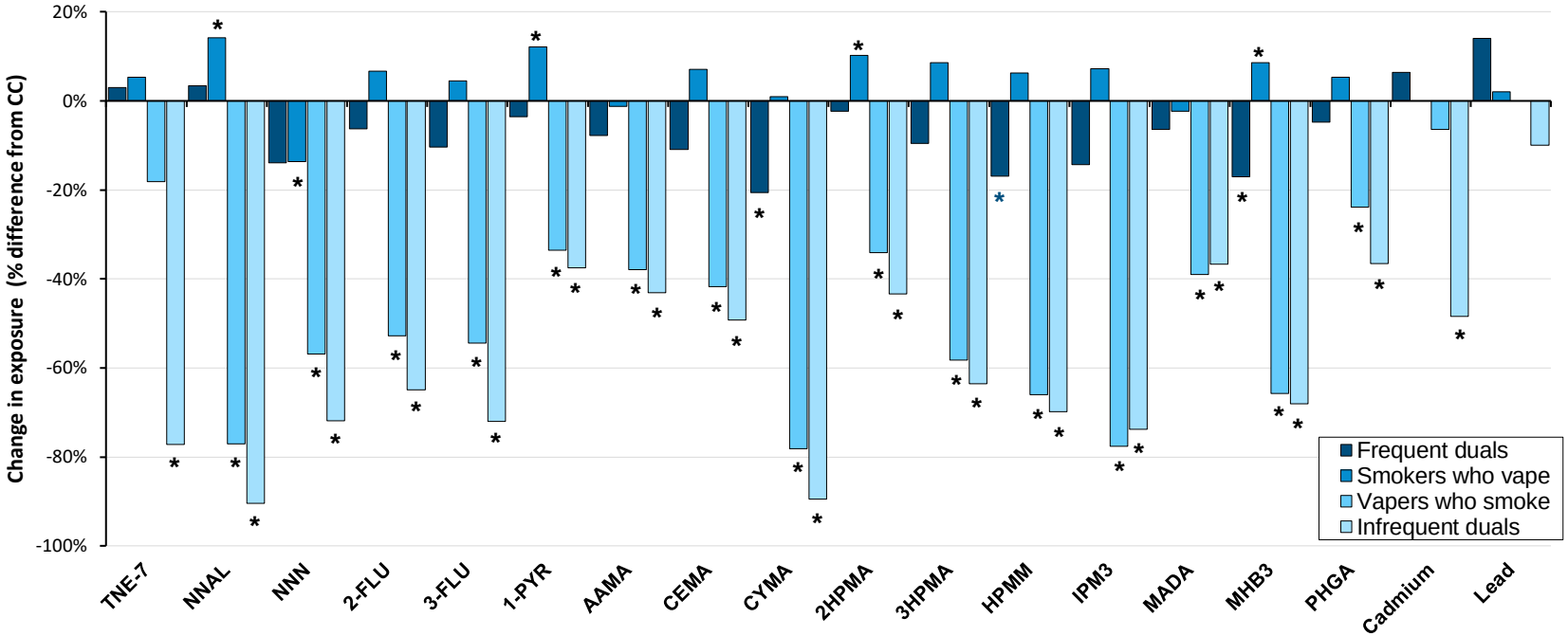
- Greater proportion of females classified as Smokers who vape, Vapers who smoke, and Infrequent dual users.
- Higher proportion of non-Hispanic Whites classified as Frequent duals.
- Higher proportion of Hispanics and younger classified as Infrequent duals
- Vapers who smoke and Infrequent duals smoked fewer cigarettes per day.

Characteristics	Exclusive daily cigarette smokers (n=2442)	Dual cigarette & e-vapor users (n=970)				Exclusive daily e-vapor users (n=169)
		Frequent duals (n=169)	Smokers who vape (n=678)	Vapers who smoke (n=57)	Infrequent duals (n=66)	
Sex						
Male	47.6	43.0	36.6	37.9	34.5	43.1
Female	52.4	57.0	63.4	62.1	65.5	56.9
Age (mean)	46.0	46.2	43.5	43.1	38.5	43.9
Race/ethnicity						
NH-White	70.5	87.7	78.4	79.2	57.8	84.1
NH-Other	19.1	8.2	10.9	13.4	6.9	11.2
Hispanic	10.4	4.1	10.7	7.3	35.3	4.7
CPD (mean)	15.8	15.0	15.7	8.4	4.8	-

NH – Non-Hispanic

Substantially Lower BOEs in Some Adult Dual User Subgroups

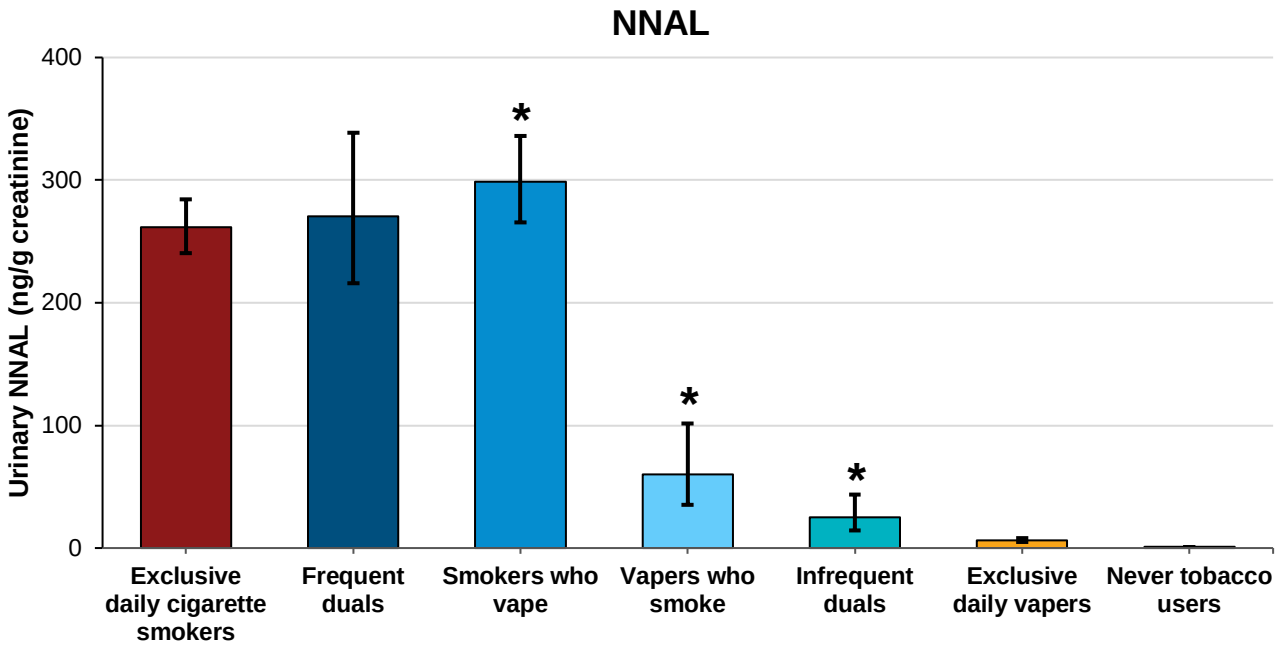
Biomarkers of Exposure Among Dual User Subgroups Relative to Exclusive Daily Cigarette Smokers



Abbreviations: TNE-7: Total Nicotine Equivalents -7; NNAL: 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; NNN: N'-Nitrosonornicotine; 2-FLU: 2-hydroxyfluorene; 3-FLU: 3-hydroxyfluorene; 1-PYR: 1-hydroxypyrene; AAMA: N-Acetyl-S-(2-carbamoylethyl)-L-cysteine; CEMA: N-Acetyl-S-(2-carboxyethyl)-L-cysteine; CYMA: N-Acetyl-S-(2-cyanoethyl)-L-cysteine; 2HPMA: N-Acetyl-S-(2-hydroxypropyl)-L-cysteine; 3HPMA: N-Acetyl-S-(3-hydroxypropyl)-L-cysteine; HPMM: N-Acetyl-S-(3-hydroxypropyl-1-methyl)-L-cysteine; IPM3: N-Acetyl-S-(4-hydroxy-2-methyl-2-buten-1-yl)-L-cysteine; MADA - Mandelic acid; MHB3: N-Acetyl-S-(4-hydroxy-2-buten-1-yl)-L-cysteine; PHGA - Phenylglyoxylic acid
Note: * - denotes statistically significant difference ($p<0.05$) when compared to exclusive cigarette smokers.

Evaluation of the Impact of Dual Use Should Consider Different Subgroups

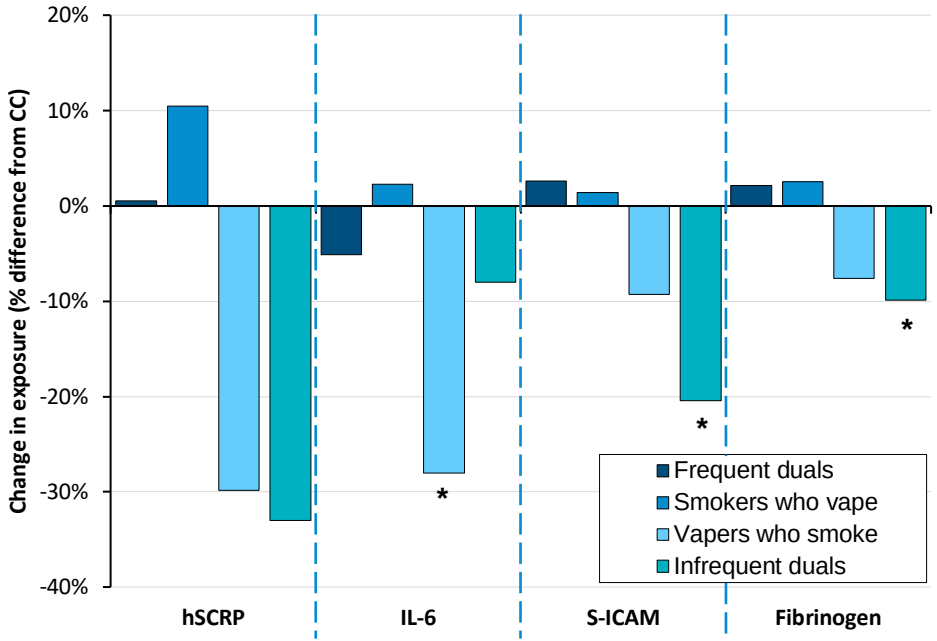
Exposure to NNK Among Exclusive Daily Cigarette Smokers, Dual User Subgroups, Exclusive Daily E-cigarette Users, and Never Tobacco Users.



Abbreviation: NNAL: 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol.
Note: * - denotes statistically significant difference ($p<0.05$) when compared to exclusive cigarette smokers.

Favorable Changes in BOPHs Among Some Adult Dual User Subgroups

Biomarkers of Potential Harm Among Dual User Subgroups Relative to Exclusive Daily Cigarette Smokers



Abbreviations:: hSCRP – High-sensitivity C-reactive protein; IL-6 – Interleukin 6; S-ICAM – Soluble intercellular adhesion molecule-1.
Note: * - denotes statistically significant difference ($p<0.05$) when compared to exclusive cigarette smokers.

Evaluation of the Impact of Dual Use Should Consider Different Subgroups

Adult Dual User Subgroup	Biomarkers of Exposure	Biomarkers of Potential Harm
Frequent Duals	Some Higher	No Change
Smokers Who Vape	Some Higher	Some Higher
Vapers Who Smoke	Substantially Lower	Favorable Changes
Infrequent Duals	Substantially Lower	Favorable Changes

Key Takeaways

- Adult Dual Users are Better Characterized as Subgroups Based on Frequency of Product Use.
- Differences in Demographics and Tobacco Use Patterns Exist Among Adult Dual User Subgroups.
- Differences in BOEs and BOPHs Are Driven by Frequency of Cigarette Smoking.
- We Conclude That Dual Users Should Not Be Treated as a Homogeneous Population. Lower Levels of BOEs and BOPHs in Some Dual User Subgroups Suggest Harm Reduction Potential.

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Thank You

Please contact us if you have any questions.

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