Changes in E-Vapor Harm Perception and Related Transition Behaviors among US Adults Who Smoke: Longitudinal Analysis of Population Assessment of Tobacco and Health (PATH) Study Waves 1 to 6 Data

Abstract

Despite the overwhelming scientific evidence that e-vapor products (EVPs) are less harmful than cigarettes, many adults in the U.S. who smoke (AS) perceive EVPs as being equally or more harmful than cigarettes and these misperceptions are increasing over time. We analyzed PATH Wave 1 to Wave 6 (2013-2021) data to determine changes in e-vapor harm perception among AS over time and associated behavioral transitions. The proportion of AS that perceived EVPs to be the same or more harmful than smoking cigarettes increased greatly from Wave 1 [45.6% (95%CI 44.4-46.7%)] to Wave 6 [87.7% (95%CI 86.5-88.8%)]. Similar trends were observed when we further segmented AS and adults who use EVPs (AV) based on their tobacco use status (i.e., never, current or former use of cigarettes and/or EVPs). The AS subgroups with the correct harm perception of EVPs (i.e., EVPs being less harmful than cigarettes) were more likely to transition to exclusive EVP use or dual use. Similarly, AV subgroups with the correct harm perception were more likely to transition to or remain using EVPs exclusively. For example, adults who both vape and smoke with the correct perception transitioned to exclusive EVP use at a rate of 6.1% (Wave 1 to 2, 95%CI 4.7-7.9%) to 22.5% (Wave 5 to 6, 95%CI 18.2-27.5%) compared to those with misperceptions who transitioned at a rate of 2.9% (Wave 1 to 2, 95%CI 1.7-4.7%) to 11.9% (Wave 5 to 6, 95%CI 9.5-14.8%). In conclusion, accurate and timely messages are needed to correct misperceptions of EVPs relative to cigarettes and help facilitate AS transition away from cigarette smoking.

Introduction

Many authoritative bodies have concluded adults who smoke cigarettes can reduce their harm by completely switching to e-vapor products [1-4]. Research has demonstrated that adults who smoke cigarettes (AS) are more likely to adopt or switch completely to e-vapor products if they perceive e-vapor to be less harmful than cigarette smoking [5-7]. However, the misperception of e-vapor being about the same or more harmful than cigarettes has been growing over time [8]. In our analysis, we examine the changes in e-vapor harm perception among AS and adults who use EVPs (AV) and how it relates to switching behaviors using the most recent Population Assessment of Tobacco and Health (PATH) study data.

Methods

The PATH is an ongoing nationally representative longitudinal cohort study cosponsored by FDA and NIH. We utilized PATH Wave 1 (with data collection from Sep 2013 to Dec 2014) to Wave 6 (March 2021 to November 2021) data to conduct the following cross-sectional and longitudinal analysis.

Selected References

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- 8.Malt L, Verron T, Cahours X, Guo M, Weaver S, Walele T, O'Connell G. Perception of the relative harm of electronic cigarettes compared to cigarettes amongst US adults from 2013 to 2016: analysis of the Population Assessment of Tobacco and Health (PATH) study data. Harm Reduction Journal. 2020 Sep 18;17(1):65.

Conclusion

- Vast majority of AS have perceived EVPs as equally or more harmful than cigarette smoking, and the misperception has been growing over time.
- □ AS or DU with the correct relative harm perception were MORE likely to transition to exclusive EVPs use.
- □ AV or DU with the correct relative harm perception were LESS likely to transition to exclusive cigarette smoking.
- To facilitate the transition of adults who smoke cigarettes away from cigarette smoking, it is crucial to provide accurate and timely messages that effectively address and correct differential harm misperceptions regarding e-vapor products in comparison to cigarettes.

Methods Cont'd

- Cross-sectional Analysis: We examined the changes in e-vapor harm perception relative to cigarette smoking over time. Weighted proportions of EVPs relative harm perception were reported among overall AS (defined as adults who currently smoke every day or some days and having smoked 100 or more cigarettes), AV (defined as adults who currently use EVPs every day or some days) and by AS and AV subgroups, as defined below

- AS (EV NVR): AS who have never used EVPs
- AS (EV FMR): AS who reported having formerly used EVPs and not currently using EVPs
- AV (CS NVR): AV who have never smoked cigarettes
- AV (CS FMR): AV who reported having smoked 100 or more cigarettes and not currently smoking cigarettes
- DU: Adults who reported currently smoking cigarettes and using EVPs

- Longitudinal Analysis: Generalized estimating equation (GEE) models were fitted to study the associations between relative harm perception and switching behaviors including

- AS (EV FMR) switching to exclusive EVP use
- DU switching to exclusive EVP use or cigarette smoking
- AV (CS FMR) switching to exclusive cigarette smoking

Results

The proportion of AS who perceived e-cigarettes or other electronic nicotine products to be less harmful than cigarettes has reduced from 54.4% in Wave 1 to 12.3% in Wave 6.

Figure 1. Changes in EVP Harm Perception among AS (PATH Wave 1 to Wave 6)

(a) Proportions who Reported "Less harmful", "About the same", and "More harmful"





Based on cross-sectional analysis of PATH data Wave 1 (Sep 2013 – Dec 2014) to Wave 6 (Mar 2021 – Nov 2021).

Responses based on Wave 1 and Wave 2 question: "Is using e-cigarettes less harmful, about the same, or more harmful than smoking cigarettes?". In Wave 3 to Wave 6, the question was changed to: "Is using e-cigarettes or other electronic nicotine products less harmful, about the same, or more harmful than smoking cigarettes?". AS sample size in each wave: Wave 1 n=10473, Wave 2 n=9323, Wave 3 n=8811, Wave 4 n=9653, Wave 5 n=7959, Wave 6 n=5531.

(b) Proportions with Responses of "About the same" and "More Harmful"

significantly across all AS and AV subgroups.



Figure 2. Changes in EVP Harm Perception by AS and AV Subgroups (PATH Wave 1 to Wave 6) "Is using e-cigarettes or other electronic nicotine products less harmful, about the same, or more harmful than smoking cigarettes?"

Based on cross-sectional analysis of PATH data Wave 1 (Sep 2013 – Dec 2014) to Wave 6 (Mar 2021 – Nov 2021)

Our longitudinal analysis using GEE models shows - AS (EV FMR) and DU were MORE likely to switch to exclusive EVP use at follow up if they were in more recent wave, in younger age group, with higher income level, smoking cigarettes some days, and perceiving EVPs as less harmful than cigarette smoking. - AV (CS FMR) were LESS likely to switch to exclusive cigarette smoking at follow up if they were in older age group, at mid-income level, using EVPs every day, and perceiving EVPs as less harmful than cigarette smoking.

using EVPs every day, and perceiving EVPs as less harmful than cigarette smoking.

Table 1. Association between Harm Perception and Switc

$AS (EV FMR) \rightarrow EVP Only$ 0.7 (0.4,1.3)	$DU \rightarrow EVP Only$ 0.7 (0.4.1.2)	$AV (CS FMR) \rightarrow CS Only$	$DU \rightarrow CS Only$
0.7 (0.4,1.3)	07(0412)		
	0.7 (0.7, 1.2)	1.1 (0.5,2.5)	1.4 (0.8,2.5)
0.5 (0.3,0.8)**	0.8 (0.4,1.4)	1.1 (0.4,2.8)	1.4 (0.8,2.5)
1.6 (1.0,2.6)	2.0 (1.1,3.5)*	0.9 (0.4,2.0)	0.7 (0.4,1.2)
2.1 (1.2,3.6)*	2.9 (1.6,5.2)***	0.6 (0.2,1.6)	0.4 (0.2,0.8)**
0.9 (0.7,1.3)	1.2 (0.8,1.6)	0.7 (0.4,1.4)	0.8 (0.6,1.1)
0.6 (0.4,0.9)*	0.5 (0.4,0.8)**	0.6 (0.3,1.3)	2.6 (1.6,4.1)***
0.2 (0.1,0.4)***	0.5 (0.3,0.8)**	0.3 (0.2,0.7)**	3.3 (1.9,5.8)***
1.5 (0.9,2.6)	1.8 (1.1,3.0)*	0.6 (0.2,1.6)	0.8 (0.5,1.3)
1.7 (0.9,3.5)	1.0 (0.4,2.3)	0.7 (0.2,2.9)	1.3 (0.5,3.1)
1.1 (0.6,2.0)	1.4 (0.7,2.9)	1.6 (0.4,5.9)	0.6 (0.3,1.2)
1.2 (0.8,1.7)	1.2 (0.8,1.8)	0.5 (0.3,1.0)*	0.7 (0.5,1.1)
2.1 (1.2,3.8)*	2.0 (1.0,3.8)*	0.6 (0.2,1.5)	0.4 (0.2,0.8)**
1.2 (0.8,1.7)	1.6 (1.1,2.2)*	0.9 (0.5,1.6)	0.6 (0.4,0.8)**
1.5 (0.8,2.6)	1.6 (0.9,2.8)	1.2 (0.4,3.4)	0.4 (0.2,0.7)**
0.6 (0.4,0.9)**	0.2 (0.1,0.3)***	Not Applicable	Not Applicable
Not Applicable	Not Applicable	0.3 (0.2,0.6)***	0.1 (0.1,0.2)***
1.8 (1.3,2.5)***	2.8 (1.9,4.1)***	0.4 (0.2,0.8)*	0.4 (0.3,0.6)***
Wave 6 (Mar 2021 – Nov 2021). wave. As the incidence of AS (EV NVF nly: n = 2,224; AV (CS FMR) → CS On	R) \rightarrow EVP Only and AV (CS I ly: n=872; DU \rightarrow CS Only: n	NVR) \rightarrow CS Only is very low, the GEE n =2139.	nodels estimates were
	0.5 (0.3,0.8)** 1.6 (1.0,2.6) 2.1 (1.2,3.6)* 0.9 (0.7,1.3) 0.6 (0.4,0.9)* 0.2 (0.1,0.4)*** 1.5 (0.9,2.6) 1.7 (0.9,3.5) 1.1 (0.6,2.0) 1.2 (0.8,1.7) 2.1 (1.2,3.8)* 1.2 (0.8,1.7) 1.5 (0.8,2.6) 0.6 (0.4,0.9)** Not Applicable 1.8 (1.3,2.5)*** Wave 6 (Mar 2021 – Nov 2021). wave. As the incidence of AS (EV NVF hly: n = 2,224; AV (CS FMR) → CS On	0.5 (0.3,0.8)**0.8 (0.4,1.4)1.6 (1.0,2.6)2.0 (1.1,3.5)*2.1 (1.2,3.6)*2.9 (1.6,5.2)***0.9 (0.7,1.3)1.2 (0.8,1.6)0.6 (0.4,0.9)*0.5 (0.4,0.8)**0.2 (0.1,0.4)***0.5 (0.3,0.8)**1.5 (0.9,2.6)1.8 (1.1,3.0)*1.7 (0.9,3.5)1.0 (0.4,2.3)1.1 (0.6,2.0)1.4 (0.7,2.9)1.2 (0.8,1.7)1.2 (0.8,1.8)2.1 (1.2,3.8)*2.0 (1.0,3.8)*1.2 (0.8,1.7)1.6 (1.1,2.2)*1.5 (0.8,2.6)1.6 (0.9,2.8)0.6 (0.4,0.9)**0.2 (0.1,0.3)***Not ApplicableNot Applicable1.8 (1.3,2.5)***2.8 (1.9,4.1)***Wave 6 (Mar 2021 − Nov 2021).→ EVP Only and AV (CS Iwave. As the incidence of AS (EV NVR) → EVP Only and AV (CS Inly: n = 2,224; AV (CS FMR) → CS Only: n=872; DU → CS Only: n	0.5 (0.3,0.8)**0.8 (0.4,1.4)1.1 (0.4,2.8)1.6 (1.0,2.6)2.0 (1.1,3.5)*0.9 (0.4,2.0)2.1 (1.2,3.6)*2.9 (1.6,5.2)***0.6 (0.2,1.6)0.9 (0.7,1.3)1.2 (0.8,1.6)0.7 (0.4,1.4)0.6 (0.4,0.9)*0.5 (0.4,0.8)**0.6 (0.3,1.3)0.2 (0.1,0.4)***0.5 (0.3,0.8)**0.3 (0.2,0.7)**1.5 (0.9,2.6)1.8 (1.1,3.0)*0.6 (0.2,1.6)1.7 (0.9,3.5)1.0 (0.4,2.3)0.7 (0.2,2.9)1.1 (0.6,2.0)1.4 (0.7,2.9)1.6 (0.4,5.9)1.2 (0.8,1.7)1.2 (0.8,1.8)0.5 (0.3,1.0)*2.1 (1.2,3.8)*2.0 (1.0,3.8)*0.9 (0.5,1.6)1.5 (0.8,2.6)1.6 (0.9,2.8)1.2 (0.4,3.4)0.6 (0.4,0.9)**0.2 (0.1,0.3)***Not ApplicableNot ApplicableNot Applicable0.3 (0.2,0.6)***1.8 (1.3,2.5)***2.8 (1.9,4.1)***0.4 (0.2,0.8)*



The proportions of adults who perceived e-cigarettes or other electronic nicotine products to be less harmful than cigarette smoking have reduced

- DU were LESS likely to switch to exclusive cigarette smoking if they were in more recent wave, in younger age group, with higher income/education level,

ching	based	on C	GEE	Model:	Odds	Ratio	with	95%	CI
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