How Widespread Is the Use of E-Cigarettes Among Adults Who Have Never Smoked? A Tale of Three Studies

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Posted Date: 7 March 2025

doi: 10.20944/preprints202503.0493.v1

Keywords: E-cigarettes; Prevalence Non-Smokers

 doi:10.20944/preprints202503.0493.v1

Article

How Widespread Is the Use of E-Cigarettes Among Adults Who Have Never Smoked? A Tale of Three Studies

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Abstract: Background Whilst e-cigarettes have been characterised as a less harmful means of consuming nicotine than combustible cigarettes, concerns have been expressed about the use of these devices by adults who have never smoked (ANS). It is important to quantify the prevalence of e-cigarette use and understand patterns of use among ANS to effectively guide public health policy and regulatory decisions. **Methods** The prevalence and patterns of e-cigarette use among ANS were estimated drawing upon data from three nationally representative surveys in the U.S. including the Population Assessment of Tobacco and Health (n = 29,780), the Tobacco Product Prevalence Study (n = 6,428), and the National Health Interview Survey (27,651). **Results** Between 9 million and 20 million ANS have ever tried e-cigarettes and most ever use is experimental meaning that use is limited to less than 100 times or has never been regular. We estimated that between 2.6 million and 5.2 million ANS are currently (in the past 30 days, 'every day' or 'some days') using e-cigarettes and current use is primarily infrequent (on less than 20 days of the past 30 days or on 'some days'). **Conclusions** E-cigarettes are intended to be used by adults who are currently smoking and as such ANS are an unintended user population. It is important to implement real-time monitoring systems to track e-cigarette use among ANS, so the overall public health impact of these new tobacco and nicotine products can be adequately assessed.

Keywords: E-cigarette prevalence non-smokers

Introduction

With the advent of electronic nicotine delivery systems such as e-cigarettes, the case has been made that these products can make an important contribution towards reducing the harm associated with the use of combustible cigarettes by helping individuals to quit smoking or substantially reduce the number of cigarettes they are smoking. Evidence from a wide range of studies has shown that e-cigarettes can be of assistance in quitting smoking particularly in the case of adults who smoke who are unable or unwilling to quit using other, more established, means of smoking cessation. [1,2] There is now an extensive and growing body of evidence showing that e-cigarettes are both popular amongst adults who smoke, that their use is associated with an increased number of smoking quit attempts, and an increased likelihood that those quit attempts will be successful in enabling the individual to cease smoking. [3–5] Where studies have been undertaken comparing Nicotine Replacement Therapy (NRT) and e-cigarettes, there is clear evidence that e-cigarettes are more effective than NRT in enabling adults to quit smoking. [6]

Alongside the growing body of evidence that e-cigarettes can make an important contribution in assisting adults to quit smoking, concerns have also been raised as a result of the use of these devices by "unintended populations". Where e-cigarettes are being used by adults who formerly smoked (i.e. smoked in the past but not currently smoking), there is a concern that these devices may increase the likelihood of the individual re-acquiring a dependence upon nicotine and, in due course,

 doi:10.20944/preprints202503.0493.v1

resuming smoking. Concerns have also arisen from the use of e-cigarettes by those below the minimum age of sale (<21 years) for tobacco and nicotine products. Research in the United States (U.S.) shows that whilst the use of these devices by middle and high school students has reduced in recent years, nevertheless e-cigarettes remain the most prevalent tobacco and nicotine product currently (in the past 30 days) used by middle and high school students. [7] Alongside concerns arising from the use of e-cigarettes by those who have formerly smoked and those below the minimum age of sale, there is also concern regarding the use of e-cigarettes and other nicotine delivery systems by adults who have never smoked (ANS). The use of these devices by ANS would represent an increase in individuals' exposure to a range of harmful and potentially harmful chemicals. [8]

In this paper, we draw upon data from three national studies in the U.S. to examine the prevalence and patterns of e-cigarette use among ANS.

Methods

The most recent publicly available data from the Population Assessment of Tobacco and Health (PATH) study were collected in 2022-23 (Wave 7). Data collected during the same period for the Tobacco Product Prevalence Study (TPPS) and the National Health Interview Survey (NHIS) were examined to estimate the prevalence and patterns of e-cigarette use among ANS.

Tobacco Product Prevalence Study (TPPS)

TPPS is an annual, online, cross-sectional, household-based survey among adults (21+ years) and those below the minimum age of sale in the U.S. (13 to 20 years). The study is funded by the Centre for Substance Use Research (CSUR). TPPS is designed to assess the prevalence and patterns of use of specific branded tobacco and nicotine products. [9] The study data are collected to support regulatory submissions to the Food and Drug Administration's (FDA) Center for Tobacco Products (CTP) through the Premarket Tobacco Product Application (PMTA) pathway. TPPS participants are recruited from Ipsos-Insight LLC's ("Ipsos") KnowledgePanel, a probability-based, internet research panel in the U.S. designed to be representative of the non-institutionalized U.S. population aged 18 years and older. [10] In 2022 (Wave 2), the TPPS survey was administered to a probability-based sample of 6,428 adults (18+ years). The response rate was 52.0%, and data were collected between June 8 and June 28, 2022. Participants who completed the survey received 1000 points (equivalent to USD $1) credited to their KnowledgePanel account and entered into a sweepstake to win up to USD $500, which is the standard incentive given to KnowledgePanel members for completing a survey.

Population Assessment of Tobacco and Health (PATH)

PATH is a nationally representative, longitudinal cohort study among adults (18+ years) and youth (12 to 17 years) in the U.S. Data are collected via in-person, telephone and web-based interviews. The study is jointly funded by the U.S. National Institutes for Health (NIH) and the FDA. The PATH study examines the use of tobacco and how it affects the health of people in the U.S. and the findings are used to guide the development, implementation, and evaluation of tobacco product regulations in the U.S. In Wave 1, PATH study participants were recruited using a four-stage stratified probability sampling methodology: 1) 156 primary sampling units (PSUs) chosen with each PSU representing a county or group of counties; 2) smaller geographical areas created and selected within each PSU; 3) addresses in the U.S. Postal Service's Delivery Sequence File sampled; and 4) selected individuals within the sampled household addresses selected. [11] The Wave 1 cohort was replenished at Wave 4 and again at Wave 7 with a probability sample of adults who were in the PSUs but not previously selected. In Wave 7 the PATH survey was administered to 30,801 adults. The response rates were 52.4% (Wave 1 cohort), 66.9% (Wave 4 cohort), and 55.1% (Wave 7 adult replenishment sample). Data were collected between January 2022 and April 2023. Participants received USD $50 for taking part in the survey. [12]

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National Health Interview Survey (NHIS)

NHIS is a cross-sectional, face-to-face, in-home survey among adults (18+ years) and youth (12 to 17 years) in the U.S. Follow-up interviews may be conducted by phone. NHIS is conducted by the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC). The main objective of NHIS is to monitor the health of the U.S. population through the analysis of data on a broad range of health topics. To obtain nationally representative samples of participants, the U.S. is split into 1,689 geographic areas which are then split into two groups (urban/rural) based on population density. Within each stratum, clusters of addresses are defined, and a specific number of clusters is systematically selected for the NHIS sample proportional to the number of clusters in the strata. In 2022, the NHIS was administered to 27,651 adults. The response rate was 47.7% and data were collected continuously throughout the year (January to December). Participants do not receive an incentive for completing the interview. [13]

Demographic Characteristics

Demographic characteristics of ANS and who were currently using e-cigarettes were examined, including age (18 to 44 years; 45+ years), sex (male; female), race-ethnicity, socioeconomic status, and education status. Race-ethnicity was grouped to include White, non-Hispanic, Black, non-Hispanic, Hispanic, and 'Other'. Other was defined as "Other non-Hispanic or Other 2+ Races non-Hispanic" (TPPS) and as "Asian non-Hispanic, American Indian and Alaska Native (AIAN) non-Hispanic, AIAN and any other group non-Hispanic, and Other single and multiple races" (NHIS and PATH) because the number of participants in each of these groups was low. In TPPS and PATH socioeconomic status was based on household income, with household income less than USD $50,000 considered to be low income. In NHIS, socioeconomic status was based on the poverty ratio which is the ratio of total income to the appropriate Federal Poverty Level which varies by family size. A poverty ratio of less than one indicates that the person or family is living in poverty, while a ratio of one or greater suggests they are not. The higher the ratio, the greater the income relative to the poverty threshold. [14]

Definitions and Terminology

The criteria used to classify cigarette and e-cigarette use status definitions are shown in Table 1. TPPS asks participants about their use of 'e-cigarettes' defined as "electronic cigarettes or e-cigarettes, such as JUUL, Vuse, blu, and Logic ... you may also know them as e-cigs, vape-pens, e-hookahs, vapes, or mods", whereas PATH uses the term 'electronic nicotine products' defined as "an e-cigarette, pod device, vape pen, tank system, mod e-cigar, e-pipe, e-hookah, or hookah pen", and NHIS uses the term 'e-cigarettes or other electronic vaping product' defined as "JUULs, vape pens, e-cigars, and others".

Table 1. Use Status Definitions.

	TPPS	NHIS	PATH
Cigarette Use			
Never	"Have you ever tried cigarette smoking, even one or two puffs?" = 'No'	"Have you smoked at least 100 cigarettes in your ENTIRE LIFE?" = 'No'	"Have you ever smoked a cigarette, even one or two puffs?" = 'No'
Ever	"Have you ever tried cigarette smoking, even one or two puffs?" = 'Yes'	"Have you smoked at least 100 cigarettes in your ENTIRE LIFE?" = 'Yes'	"Have you ever smoked a cigarette, even one or two puffs?" = 'Yes'

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Current	"In the **past 30 days**, on how many days did you smoke cigarettes?" = 1-30 OR "Do you now smoke cigarettes…" = 'Every day' or 'some days'	"Do you NOW smoke cigarettes every day, some days or not at all?" = 'Every day' or 'Some days'	"In the past 30 days, have you smoked a cigarette, even one or two puffs?" = 'Yes' OR "Do you now smoke cigarettes…?" = 'Every day' or 'Some days'
E-cigarette Use			
Ever	"Have you **ever used** an e-cigarette, even one or two times?" = 'Yes'	"Have you ever used an e-cigarette or other electronic vaping product, even just one time, in your entire life?" = 'Yes'	"Have you ever used an electronic nicotine product, even one or two times" = 'Yes'
Experimental	"How many times have you used an e-cigarette in your **entire life**?" = <100 times	†	"Have you ever used electronic nicotine products fairly regularly?" = 'No'
Established	"How many times have you used an e-cigarette in your **entire life**?" = ≥100 times	†	"Have you ever used electronic nicotine products fairly regularly?" = 'Yes'

	TPPS	NHIS	PATH
Current	"During the **past 30 days**, on how many days did you use an e-cigarette?" = 1-30 OR "Do you now use e-cigarettes…" = 'Every day' or 'Some days'	"Do you NOW use e-cigarettes or other electronic vaping products every day, some days or not at all?" = 'Every day' or 'Some days'	"In the past 30 days, have you used an electronic nicotine product, even one or two times?" = 'Yes' OR "Do you now use electronic nicotine products…?" = 'Every day' or 'Some days'
Infrequent	"During the **past 30 days**, on how many days did you use an e-cigarette?" = 1-19 OR "Do you now use e-cigarettes…" = 'Some days'	"Do you NOW use e-cigarettes or other electronic vaping products every day, some days or not at all?" = 'Some days'	"On how many of the past 30 days have you used an electronic nicotine product?" = '1-19' OR "Do you now use electronic nicotine products…?" = 'Some days'

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Frequent	"During the **past 30 days**, on how many days did you use an e-cigarette?" = 20-30 OR "Do you now use e-cigarettes…" = 'Every day'	"Do you NOW use e-cigarettes or other electronic vaping products every day, some days or not at all?" = 'Every day'	"On how many of the past 30 days have you used an electronic nicotine product?" = '20-30' OR "Do you now use electronic nicotine products…?" = 'Every day'

† Not calculated, question not available.

Survey Measures

Each survey includes a set of questions on the use of cigarettes, and e-cigarettes. In TPPS all participants are asked "Have you ever tried cigarette smoking, even one or two puffs?" (Yes; No). Participants who respond 'Yes' are asked "Do you now smoke cigarettes…" (Every day; Some days; Not at all) and "In the past 30 days, on how many days did you smoke?" (open-ended response, range 0-30). Participants who are aware of e-cigarettes are asked "Have you ever used an e-cigarette, even one or two times?" (Yes, No). Participants who respond 'Yes' are asked "Do you now use e-cigarettes" (Every day; Some days; Not at all) and "During the **past 30 days**, on how many days did you use an e-cigarette?" (open-ended response, range 0-30).

In NHIS, all participants are asked "Have you smoked at least 100 cigarettes in your entire life?" (Yes; No). Participants who respond 'Yes' are asked "Do you now smoke cigarettes every day, some days, or not at all" (Every day; Some days; Not at all). All participants are asked "Have you ever used an e-cigarette or other electronic vaping product, even just one time, in your entire life?" (Yes; No). Participants who respond 'Yes' are asked "Do you now use e-cigarettes or other electronic vaping products every day, some days, or not at all?" (Every day; Some days; Not at all),

In PATH, all participants are asked "Have you ever smoked a cigarette, even one or two puffs?" (Yes; No). Participants who respond 'Yes' are asked "Do you now smoke cigarettes…" (Every day; Some days; Not at all). Participants who respond, 'Some days' are asked "On how many of the past 30 days did you smoke cigarettes?" (open-ended response, range 0-30). Participants who are aware of e-cigarettes are asked "Have you ever used an electronic nicotine product, even one or two times?" (Yes; No). Participants who respond 'Yes' are asked "Have you ever used electronic nicotine products fairly regularly?" (Yes; No), "Do you now use electronic nicotine products…" (Every day; Some days; Not at all) and "In the past 30 days, have you used an electronic nicotine product, even one or two times?" (Yes; No). Images of generic electronic nicotine products are shown to participants for questions: "Have you ever used an electronic nicotine product, even one or two times?" and "In the past 30 days, have you used an electronic nicotine product, even one or two times?"

Statistical Analysis

Demographic and tobacco and nicotine product use characteristics were calculated as percentages with 95% confidence intervals (CIs). The survey package in R was used to account for the complex survey design, including the post-stratification weights for TPPS data and the primary sampling units, sampling stratum, and sampling weights for NHIS data. For PATH data, Wave 7 cross-sectional weights were used. Variance was estimated using the Balanced Repeated Replication method with 100 replicate weights incorporating Fay's 0.3 adjustment. The estimated weighted number of ANS in the U.S. population who had ever used or were currently using e-cigarettes was calculated using the population estimate multiplied by weighted population proportion, rounded down to the nearest 10,000 persons. Population estimates were obtained from the March 2021 supplement of the United States Census Bureau's Current Population Survey. To explore differences between ANS who currently use e-cigarettes and ANS who do not currently use e-cigarettes,

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bivariate analyses were conducted using Pearson's Chi-Squared tests with the Rao and Scott correction to account for complex survey design. Fisher's exact test was applied for variables where expected cell frequencies were small (less than 5). Participants missing PATH Wave 7 cross-sectional weights (n = 1,021) were excluded prior to analysis. No participants were excluded from the TPPS and NHIS datasets prior to analysis. Missing cases due to non-response were excluded on a per analysis basis. Statistical significance was assessed at the $p < 0.05$ level. All statistical analyses were performed using R statistical software (version 4.12.0).

Results

TPPS, NHIS, and PATH participant characteristics for all adults and ANS are shown in Table 2. TPPS, NHIS, and PATH are designed to be nationally representative of the adult (18+) population in the U.S. and as such estimates obtained for age, sex, race-ethnicity, and education status were similar in all three studies. Differences were observed in the socioeconomic status of participants – PATH had a higher proportion of households with an income less than USD $50,000 compared to TPPS among all adults (44.5% vs 29.7%) and ANS (42.7% vs 24.6%). In NHIS, an estimated 33.8% of all participants and 32.3% of ANS were living below the federal poverty level or were low-income households (poverty ratio ≤ 2). NHIS had a higher proportion of ANS compared to TPPS and PATH (66.0% vs 35.8%) but the lowest proportion of adults who were currently smoking (11.3%). The prevalence of e-cigarette use varied across each survey with PATH reporting the highest prevalence of ever (31.9%) and current (9.2%) e-cigarette use, and NHIS reporting the lowest prevalence of ever (19.7%) and current e-cigarette use (5.9%).

The prevalence of ever and current e-cigarette use among ANS is shown in Table 3. Ever use was further defined by 'experimental' use and 'established' use, and current use was further defined by 'infrequent' use and 'frequent' use. (see Table 1) Survey questions to calculate experimental and established use were not available in NHIS. Among ANS, ever use of e-cigarettes was lowest in TPPS (5.5%) and highest in PATH (12.6%). Based on these findings, we estimate that in the U.S. between 8,940,000 and 20,480,000 million ANS have ever used e-cigarettes. In both TPPS and PATH most ever use of e-cigarettes was 'experimental' meaning that most ANS had used e-cigarettes less than 100 times (TPPS) or had never used e-cigarettes 'fairly regularly' (PATH). Current use followed a similar pattern, prevalence was lowest in TPPS (1.6%) and highest in PATH (3.2%). Based on these findings, we estimate that in the U.S. between 2,600,000 and 5,200,000 ANS are currently using e-cigarettes. Current e-cigarette use was primarily 'infrequent' meaning that most ANS were using e-cigarettes 'some days' or on less than 20 of the past 30 days.

Table 2. Participant Characteristics.

	All Adults			ANS[1]		
	TPPS 2022	**NHIS 2022**	**PATH 2022-23**	**TPPS 2022**	**NHIS 2022**	**PATH 2022-23**
	N = 6,428	**N = 27,651**	**N = 29,780**	**N = 2,782**	**N = 17,044**	**N = 11,708**
	W% [95% CI] (N)					
Age						
18 to 44 years	45.7 [44.1-47.4] (4,407)	45.7 [44.8-46.5] (10,030)	45.9 [45.9-45.9] (20,806)	60.9 [58.2-63.4] (2,268)	51.3 [50.3-52.3] (7,091)	57.8 [56.6-59.0] (10,174)
45+ years	54.3 [52.6-55.9] (2,021)	54.3 [53.5-55.2] (17,557)	54.1 [54.1-54.1] (8,972)	39.1 [36.5-41.8] (514)	48.7 [47.7-49.7] (9,906)	42.2 [41.0-43.4] (1,522)
Sex						
Male	48.5 [46.9-50.2]	48.7 [48.0-49.3]	48.5 [48.5-48.5]	46.2 [43.4-48.9]	44.4 [43.5-45.3]	41.6 [40.2-43.1]

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	(2,970)	(12,598)	(14,085)	(1,137)	(7,009)	(5,167)
Female	51.5 [49.8-53.1] (3,458)	51.3 [50.7-52.0] (15,050)	51.5 [51.5-51.5] (15,695)	53.8 [51.1-56.6] (1,645)	55.6 [54.7-56.5] (10,032)	58.4 [56.9-59.8] (6,541)
Race-Ethnicity						
White, non-Hispanic	62.7 [61.1-64.3] (3,802)	62.1 [60.5-63.6] (18,242)	61.1 [61.1-61.1] (15,661)	56.4 [53.7-59.1] (1,623)	56.7 [55.0-58.5] (10,367)	52.7 [51.1-54.2] (5,135)
Black, non-Hispanic	11.9 [10.9-13.0] (703)	11.9 [11.0-12.8] (3,112)	11.3 [11.3-11.3] (4,769)	14.4 [12.6-16.4] (402)	12.5 [11.6-13.5] (1,997)	14.0 [13.3-14.8] (2,185)
Hispanic	16.8 [15.6-18.1] (1,518)	17.2 [15.9-18.5] (3,943)	17.0 [17.0-17.0] (6,831)	17.8 [15.8-19.9] (549)	20.3 [18.7-21.8] (2,911)	19.9 [18.9-20.8] (3,269)
Other[2]	8.6 [7.7-9.6] (405)	8.8 [8.1-9.6] (2,354)	10.6 [10.6-10.6] (2,519)	11.4 [9.7-13.2] (208)	10.4 [9.5-11.4] (1,769)	13.4 [12.5-14.3] (1,119)

	All Adults			**ANS[1]**		
	TPPS 2022	**NHIS 2022**	**PATH 2022-23**	**TPPS 2022**	**NHIS 2022**	**PATH 2022-23**
	N = 6,428	**N = 27,651**	**N = 29,780**	**N = 2,782**	**N = 17,044**	**N = 11,708**
			W% [95% CI] (N)			
Household Income						
Less than $50,000	29.7 [28.2-31.2] (2,363)	†	44.5 [43.6-45.4] (14,495)	24.6 [22.3-27.0] (1,078)	†	42.7 [40.9-44.5] (5,484)
$50,000 to $99,999	29.5 [28.0-31.1] (1,789)	†	26.8 [25.9-27.7] (7,092)	30.5 [28.1-33.1] (873)	†	27.3 [25.9-28.8] (2,745)
$100,000 or more	40.8 [39.1-42.4] (2,276)	†	28.7 [27.9-29.6] (6,449)	44.9 [42.2-47.6] (876)	†	29.9 [28.2-31.7] (2,615)
Poverty Ratio						
≤1	†	17.8 [17.1-18.5] (4,831)	†	†	16.7 [15.9-17.5] (2,711)	†
> 1 ≤ 2	†	16.0 [15.4-16.5] (4,266)	†	†	15.6 [14.9-16.3] (2,515)	†
> 2 ≤ 3	†	13.2 [12.7-13.7] (3,720)	†	†	12.9 [12.3-13.5] (2,270)	†
> 3 ≤ 4	†	31.9 [30.9-32.9] (8,894)	†	†	34.4 [33.2-35.6] (6,053)	†
> 4 ≤ 5	†	11.2 [10.7-11.7] (3,087)	†	†	11.4 [10.8-12.0] (1,950)	†
> 5	†	9.9 [9.4-10.5]	†	†	9.0 [8.3-9.7] (1,545)	†

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(2,853)

	All Adults			ANS[1]		
	TPPS 2022	NHIS 2022	PATH 2022-23	TPPS 2022	NHIS 2022	PATH 2022-23
	N = 6,428	N = 27,651	N = 29,780	N = 2,782	N = 17,044	N = 11,708
	W% [95% CI] (N)					
Educational Status						
Less than high school	9.2 [8.3-10.2] (364)	10.8 [10.2-11.4] (2,369)	9.3 [9.0-9.6] (2,974)	9.1 [7.6-10.8] (161)	9.6 [9.0-10.3] (1,259)	9.6 [9.0-10.1] (971)
High school graduate or GED	28.3 [26.8-29.9] (1,815)	27.2 [26.4-28.0] (6,983)	28.0 [27.7-28.3] (8,741)	22.3 [20.1-24.7] (775)	24.9 [24.0-25.8] (3,824)	29.9 [29.0-30.7] (3,537)
Some college or associate's degree	27.1 [25.7-28.7] (1,994)	29.4 [28.7-30.2] (7,738)	29.7 [29.7-29.7] (10,307)	25.9 [23.6-28.4] (902)	28.1 [27.2-29.0] (4,397)	29.5 [28.8-30.1] (4,250)
Bachelor's degree or advanced degree	35.3 [33.7-36.9] (2,305)	32.6 [31.6-33.5] (10,412)	33.0 [32.9-33.0] (7,641)	42.6 [40.0-45.4] (944)	37.4 [36.2-38.5] (7,480)	31.1 [30.3-31.8] (2,919)
Cigarette Use						
Never[1]	35.8 [34.2-37.4] (2,782)	66.0 [65.2-66.8] (17,044)	35.8 [34.5-37.1] (11,708)	100.0 (2,782)	100.0 (17,044)	100.0 (11,708)
Ever[3]	64.2 [62.6-65.8] (3,646)	34.0 [33.2-34.8] (9,897)	64.2 [62.9-65.5] (18,038)	†	†	†
Current[4]	16.8 [15.6-18.1] (1,356)	11.3 [10.8-11.8] (3,144)	15.8 [15.3-16.3] (6,459)	†	†	†
E-cigarette Use						
Ever[5]	22.8 [21.4-24.2] (1,847)	19.7 [18.9-20.4] (4,616)	31.9 [31.0-32.8] (14,797)	5.5 [4.4-6.9] (386)	11.1 [10.4-11.8] (1,502)	12.6 [11.6-13.5] (3,053)
Current[6]	7.4 [6.5-8.3] (887)	5.9 [5.5-6.3] (1,274)	9.2 [8.8-9.5] (4,843)	1.6 [1.0-2.4] (138)	2.9 [2.5-3.3] (336)	3.2 [2.9-3.5] (895)

Note: ANS = Adults who have never smoked; W% = Weighted Percentage; CI = Confidence Interval; N = Unweighted number of participants; Variables may not total to N because of missing data; † Not available [1] Never smoked is defined as: never smoked a cigarette, not even one or two puffs (TPPS and PATH); smoked less than 100 cigarettes in lifetime (NHIS) [2] Other is defined as: "Other non-Hispanic or Other 2+ Races non-Hispanic" (TPPS); "Asian non-Hispanic, American Indian and Alaska Native (AIAN) non-Hispanic, AIAN and any other group non-Hispanic, and Other single and multiple races" (PATH and NHIS) [3] Ever cigarette use is defined as: smoked a cigarette at least one time in lifetime, even one or two puffs (TPPS and PATH); smoked 100 or more cigarettes in lifetime (NHIS) [4] Current cigarette use is defined as: now smokes cigarettes every day or some days, or smoked in the past 30 days (TPPS and PATH); now smokes cigarettes every day or some days (NHIS) [5] Ever e-cigarette use is defined as: used an e-cigarette even one or two times (TPPS); used an e-cigarette or other electronic vaping product even just one time in lifetime (NHIS); used an electronic nicotine product even one or two times (PATH) [6] Current e-cigarette use is defined as: now uses e-cigarette every day or some

 doi:10.20944/preprints202503.0493.v1

days, or in the past 30 days (TPPS); now uses e-cigarettes or other electronic vaping products every day or some days (NHIS); now uses electronic nicotine products every day or some days, or in the past 30 days (PATH).

Table 3. Prevalence of ever and current e-cigarette use among adults who have never smoked.

	Never Smoked[1]					
	TPPS		NHIS		PATH	
	N = 2,782		N = 17,044		N = 11,708	
	W% [95% CI] (N)	EWNP [95% CI]	W% [95% CI] (N)	EWNP [95% CI]	W% [95% CI] (N)	EWNP [95% CI]
Ever[2]	5.5 [4.4-6.9] (386)	8,940,000 [7,150,000-11,220,000]	11.1 [10.4-11.8] (1,502)	9,550,000 [8,950,000-10,160,000]	12.6 [11.6-13.5] (3,053)	20,480,000 [18,860,000-21,950,000]
Experimental[3]	4.5 [3.5-5.8] (320)	7,310,000 [5,690,000-9,430,000]	†	†	5.0 [4.6-5.4] (1,294)	8,130,000 [7,480,000-8,780,000]
Established[4]	1.0 [0.6-1.7] (66)	1,620,000 [970,000-2,760,000]	†	†	3.0 [2.7-3.3] (831)	4,870,000 [4,390,000-5,360,000]
Current[5]	1.6 [1.0-2.4] (138)	2,600,000 [1,620,000-3,900,000]	2.9 [2.5-3.3] (336)	2,490,000 [2,150,000-2,840,000]	3.2 [2.9-3.5] (895)	5,200,000 [4,710,000-5,690,000]
Infrequent[6]	1.0 [0.6-1.7] (90)	1,620,000 [970,000-2,760,000]	1.7 [1.4-1.9] (195)	1,460,000 [1,200,000-1,630,000]	1.8 [1.6-2.0] (525)	2,920,000 [2,600,000-3,250,000]
Frequent[7]	0.5 [0.2-1.1] (48)	810,000 [320,000-1,780,000]	1.3 [1.0-1.5] (141)	1,110,000 [860,000-1,290,000]	0.9 [0.8-1.1] (259)	1,460,000 [1,300,000-1,780,000]

Note: W% = Weighted Percentage; CI = Confidence Interval; N is unweighted; EWNP = Estimated Weighted Number of Persons; Variables may not total to N because of missing data; † Not available [1] Never smoked is defined as: never smoked a cigarette, not even one or two puffs (TPPS and PATH); smoked less than 100 cigarettes in lifetime (NHIS) [2] Ever e-cigarette use is defined as: used an e-cigarette even one or two times (TPPS); used an e-cigarette or other electronic vaping product even just one time in lifetime (NHIS); used an electronic nicotine product even one or two times (PATH) [3] Experimental is defined as: used e-cigarettes less than 100 times in lifetime (TPPS); never used electronic nicotine products fairly regularly (PATH) [4] Established is defined as: used e-cigarettes 100 or more times in lifetime (TPPS); used electronic nicotine products fairly regularly (PATH) [5] Current e-cigarette use is defined as: now uses e-cigarettes every day or some days, or in the past 30 days (TPPS); now uses e-cigarettes or other electronic vaping products every day or some days (NHIS); now uses electronic nicotine products every day or some days, or in the past 30 days (PATH) [6] Infrequent is defined as: now uses e-cigarettes some days or on between 1 and 19 days of the past 30 days (TPPS); now uses electronic nicotine products some days or on between 1 and 19 days in the past 30 days (PATH); now uses e-cigarettes or other electronic vaping product some days (NHIS) [7] Frequent is defined as: now uses e-cigarettes every day or on 20 or more of the past 30 days (TPPS); now uses electronic nicotine products every day or on 20 or more of the past 30 days (PATH); now uses e-cigarettes or other electronic vaping product every day (NHIS).

Tables 4 to 6 report the demographic characteristics of ANS who are currently using e-cigarettes and ANS who are not currently using e-cigarettes.

Table 4. Demographic characteristics associated with current e-cigarette use among adults who have never smoked, TPPS Wave 2 (2022).

	Never Smoked[1]

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	N = 2,782	
	Current E-cigarette Use[2] N = 138	Non-Current E-cigarette Use[3] N = 2,644
	W% [95% CI]	
Age*		
18 to 44 years	95.6 [87.5-99.0]	60.3 [57.6-63.0]
45+ years	4.4 [1.0-12.5]	39.7 [37.0-42.4]
Sex		
Male	45.4 [32.6-58.8]	46.2 [43.4-48.9]
Female	54.6 [41.2-67.4]	53.8 [51.1-56.6]
Race-Ethnicity		
White, non-Hispanic	70.3 [57.1-81.3]	56.2 [53.5-59.0]
Black or African American, non-Hispanic	5.8 [1.7-14.6]	14.6 [12.7-16.6]
Hispanic	18.0 [9.5-29.9]	17.8 [15.7-20.0]
Other	5.9 [1.7-14.7]	11.5 [9.8-13.3]
Income*		
Less than $50,000	18.5 [9.8-30.4]	24.7 [22.4-27.1]
$50,000 to $99,999	45.6 [32.7-59.0]	30.3 [27.8-32.9]
$100,000 or more	35.9 [24.0-49.3]	45.0 [42.3-47.8]
Education Status*		
Less than high school	14.7 [7.1-26.0]	9.0 [7.5-10.7]
High school graduate or GED	30.2 [19.1-43.4]	22.2 [20.0-24.6]
Some college or associate's degree	36.5 [24.5-50.0]	25.7 [23.4-28.2]
Bachelor's degree or advanced	18.6 [9.9-30.6]	43.0 [40.3-45.8]

W% = Weighted percentage; CI = Confidence Interval; N = Unweighted number of participants * Statistical significance (p-value < 0.05) based on the Pearson's Chi-squared test (or Fisher's Exact Test for smaller sample sizes), indicating a significant association for the characteristic of adults who have never smoked and are currently using e-cigarettes compared adults who have never smoked and are not currently using e-cigarettes [1] Never smoked is defined as: never tried a cigarette, not even one or two puffs [2] Current e-cigarette use is defined as: now uses e-cigarettes every day or some days, or on at least one of the past 30 days [3] Non-current e-cigarette use is defined as: now uses e-cigarettes 'not at all', or not used e-cigarettes in the past 30 days, or never used e-cigarettes.

Table 5. Demographic characteristics associated with current e-cigarette use among adults who have never smoked, NHIS 2022.

	Never Smoked[1] N = 17,044	
	Current E-cigarette Use[2] (N = 336)	Non-Current E-cigarette Use[3] (N = 16,708)
	Weighted Percentage [95% CI]	
Age *		
18 to 44 years	93.6 [91.1-96.0]	50.0 [49.0-51.0]
45+ years	6.4 [4.0-8.9]	50.0 [49.0-51.0]
Sex *		
Male	51.0 [44.7-57.4]	44.2 [43.3-45.1]
Female	49.0 [42.6-55.3]	55.8 [54.9-56.7]
Race/Ethnicity		

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White, non-Hispanic	63.8 [57.5-70.0]	56.5 [54.7-58.3]
Black/African American, non-Hispanic	12.7 [8.8-16.6]	12.5 [11.5-13.5]
Hispanic	15.0 [10.9-19.1]	20.4 [18.9-22.0]
Other	8.6 [4.9-12.3]	10.5 [9.6-11.4]
Poverty Ratio *		
Less than 1	19.4 [14.6-24.2]	16.6 [15.8-17.4]
1-2	20.0 [14.5-25.5]	15.5 [14.8-16.1]
2-3	12.0 [8.0-16.0]	12.9 [12.3-13.6]
3-4	25.4 [19.9-30.8]	34.7 [33.5-35.9]
4-5	11.9 [8.1-15.8]	11.3 [10.7-11.9]
More than 5	11.2 [7.4-15.0]	9.0 [8.3-9.7]
Educational Status *		
Less than high school	8.3 [4.3-12.3]	9.7 [9.0-10.3]
GED diploma/ High school graduate	33.0 [27.2-38.8]	24.7 [23.7-25.6]
Some college or associate's degree	39.0 [32.8-45.1]	27.8 [26.9-28.7]
Bachelor's degree or advance degree	19.7 [15.6-23.8]	37.9 [36.7-39.1]

W% = Weighted percentage; CI = Confidence Interval; N = Unweighted number of participants * Statistical significance (p-value < 0.05) based on the Pearson's Chi-squared test (or Fisher's Exact Test for smaller sample sizes), indicating a significant association for the characteristic of adults who have never smoked and are currently using e-cigarettes compared adults who have never smoked and are not currently using e-cigarettes [1] Never smoked is defined as: smoked less than 100 cigarettes in lifetime [2] Current e-cigarette use is defined as: now uses e-cigarettes or other electronic vaping products every day or some days [3] Non-current e-cigarette use is defined as: now uses e-cigarettes or other electronic vaping products 'not at all', or never used e-cigarettes or other electronic vaping products.

Table 6. Demographic characteristics associated with current e-cigarette use among adults who have never smoked, PATH Wave 7 (2022-23).

	Never Smoked[1] N = 11,703	
	Current E-cigarette Use[2] N = 895	**Non-Current E-cigarette Use[3] N = 10,808**
	W% [95% CI]	
Age*		
18 to 44 years	95.7 [92.2-99.2]	56.5 [55.3-57.8]
45+ years	4.3 [0.8-7.8]	43.5 [42.2-44.7]
Sex*		
Male	46.8 [42.7-50.9]	41.5 [40.0-43.0]
Female	53.2 [49.1-57.3]	58.5 [57.0-60.0]
Race-Ethnicity*		
White, non-Hispanic	45.8 [41.7-49.9]	52.9 [51.3-54.5]
Black, non-Hispanic	16.4 [13.0-19.8]	14.0 [13.1-14.8]
Hispanic	23.9 [20.8-27.0]	19.8 [18.8-20.7]
Other	13.9 [10.4-17.4]	13.4 [12.4-14.4]
Household Income*		
Less than $50,000	55.5 [51.0-60.1]	42.3 [40.5-44.2]
$50,000 to $99,999	22.1 [18.1-26.0]	27.5 [26.0-29.0]
$100,000 or more	22.4 [18.6-26.2]	30.2 [28.4-32.0]
Educational Status*		

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Less than high school	6.6 [5.2-8.0]	8.8 [8.0-9.7]
High school graduate or GED	30.4 [26.7-34.0]	24.5 [23.1-25.9]
Some college or associate's degree	47.6 [43.6-51.7]	29.4 [28.2-30.6]
Bachelor's degree or advanced degree	15.4 [11.8-19.0]	37.2 [35.9-38.5]

W% = Weighted percentage; CI = Confidence Interval; N = Unweighted number of participants * Statistical significance (p-value < 0.05) based on the Pearson's Chi-squared test (or Fisher's Exact Test for smaller sample sizes), indicating a significant association for the characteristic of adults who have never smoked and are currently using e-cigarettes compared adults who have never smoked and are not currently using e-cigarettes [1] Never smoked is defined as: never smoked a cigarette, not even one or two puffs [2] Current e-cigarette use is defined as: now uses e-cigarettes every day or some days, or on at least one of the past 30 days [3] Non-current e-cigarette use is defined as: now uses e-cigarettes 'not at all', or not used e-cigarettes in the past 30 days, or never used e-cigarettes.

Tobacco Product Prevalence Study

ANS who are currently using e-cigarettes were primarily aged 18 to 44 years (95.6%), female (54.6%), White, non-Hispanic (70.3%), household income between USD $50,000 and $99,000 (45.6%), and some college or an associate's degree (36.5%). Among ANS, statistically significant differences were observed for age, household income, and education status between participants currently and not currently using e-cigarettes. (Table 4)

National Health Interview Survey

ANS who are currently using e-cigarettes were primarily aged 18 to 44 years (93.6%), male (51.0%), White, non-Hispanic (63.8%), living at or below the federal poverty level i.e. poverty ratio ≤ 2 (39.4%), and some college or associate's degree (39.0%). Among ANS, statistically significant differences were observed for age, sex, poverty ratio, and education status between participants currently and not currently using e-cigarettes (Table 5)

Population Assessment of Tobacco and Health

ANS who are currently using e-cigarettes were primarily aged 18 to 44 years (95.7%), female (53.2%), White, non-Hispanic (45.8%), household income less than USD $50,000 (55.5%), and some college or an associate's degree (47.6%). Among ANS, statistically significant differences were observed for age, sex, race-ethnicity, household income, and education status between participants currently and not currently using e-cigarettes. (Table 6)

Discussion

In this paper we report the prevalence and patterns of e-cigarette use among ANS in the U.S. drawing upon data from three national surveys, TPPS, NHIS, and PATH. All three surveys are designed to be nationally representative of the adult population in the U.S. therefore participants were similar in terms of their age, sex, race-ethnicity, and education status. However, participants differed according to socioeconomic status - PATH included a higher proportion of low-income participants compared to TPPS and NHIS. TPPS data are weighted to match the U.S. Census Bureau's population benchmarks, which suggests that PATH has a higher proportion of participants with a low socioeconomic status than one would expect to see in the adult population in the U.S.

Participants also differed according to their cigarette and e-cigarette use history. TPPS and PATH included the same proportion of ANS (35.8%) compared to 66.0% in NHIS. This can be explained by the difference in the definition of 'never smoked' in NHIS (never smoked 100 or more cigarettes) compared to TPPS and PATH (never smoked, not even one or two puffs of a cigarette).

 doi:10.20944/preprints202503.0493.v1

The <100 cigarettes in lifetime measure will capture adults who have recently smoked or are currently smoking therefore may not be a suitable measure of 'never smoked'. [15] Use of e-cigarettes varied across all three studies. Ever use ranged from 19.7% (NHIS) to 31.9% (PATH). The definition of 'ever use' was consistent across all three studies (used even one or two times) however each study differed in the terminology used to describe e-cigarettes – 'E-cigarette' (TPPS), 'E-cigarette or other electronic vaping product' (NHIS), and 'Electronic nicotine product' (PATH). In addition, PATH participants were shown a generic image of 'electronic nicotine products' when answering questions about their use and included products other than e-cigarettes such as e-cigars and e-pipes which may account for the higher prevalence of ever use observed. Current use of e-cigarettes also varied across all three studies ranging from 5.9% (NHIS) to 9.2% (PATH). The definition of 'current use' was consistent in TPPS and PATH (every day or some days or in the past 30 days) but differed in NHIS (every day or some days). Standardized terminology and definitions of tobacco and nicotine product use would facilitate comparison between studies. [16] While participants in all three studies were recruited using probability-based sampling methodologies, the procedure for collecting data (online vs face-to-face vs telephone) may also account for some of the difference observed in the prevalence of e-cigarette use between the three studies.

Among ANS, the prevalence of ever use of e-cigarettes varied, with use lowest in TPPS (5.5%) and highest in PATH (12.6%). Current use of e-cigarettes ranged from 1.6% (TPPS) to 3.2% (PATH) which suggests that between 2.6 million and 5.2 million ANS are currently using e-cigarettes. The higher prevalence of current e-cigarette among ANS in the PATH study may be associated with the higher proportion of individuals from low-income households compared to TPPS and the use of generic images in questioning about the use of e-cigarettes. [17, 18] The variability in the prevalence of current e-cigarette use across the studies makes it difficult to quantify the extent of current e-cigarette use among ANS however, findings from all three studies were consistent suggesting that ever use is predominantly experimental and current use is predominantly infrequent. Data from the United Kingdom (U.K.) suggest that e-cigarette use among adults who have never smoked is predominantly daily however, direct comparison with our findings is limited as the U.K. data included those who may have smoked for up to one year. [19]

In all three studies, significant differences were observed in the demographic characteristics of ANS who were using e-cigarettes compared to ANS who were not currently using e-cigarettes. ANS who were currently using e-cigarettes were more likely to be younger (18 to 44 years) and female (TPPS and PATH). These findings are consistent with research from the U.K. which found that adults (18+ years) who had never regularly smoked (i.e. never smoked for a year or more) and were currently using e-cigarettes and were more likely to be younger, female, and consuming higher levels of alcohol. [19] Further research is warranted to understand what additional characteristics may be associated with the use of e-cigarettes among ANS including the use of other tobacco and nicotine products, recreational drugs, and previous medical history which have been associated with higher prevalence of e-cigarette use among the adult population. [20]

In determining the overall public health impact of the growth in e-cigarette use there is a clear need to weigh the potential benefit of these devices as a means of quitting smoking and the potential harm that can arise where these devices are being used by individuals with no prior smoking history. In the latter case, harm arises from the fact that whilst e-cigarettes are widely recognized to be less harmful than combustible cigarettes, they are not harmless - individuals using these devices are typically exposed to a range of harmful and potentially harmful chemicals including nicotine. [8] Similarly, whilst the population percentage of adults who smoke and who are using these devices is greater than the population percentage of adults who have never smoked and who are using these devices, nevertheless, the size of these two populations is very different with those who have never smoked (i.e. not smoked even one cigarette) being a much larger proportion of the overall population than adults who smoke. As a result, in assessing the overall net public health impact of e-cigarettes it is not a simple case of comparing the population prevalence of e-cigarette use amongst adults who smoke and amongst those with no smoking history. In forming a judgement about the overall public

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health impact of these devices, there is a need to weigh the relative value given to the number of cases of successful smoking cessation associated with the use of these devices with the value to be given to those instances where individuals with no prior smoking history are being exposed to a range of harmful and potentially harmful chemicals as a result of their use of these devices.

The public health implications of the growth in e-cigarette use on the part of those who have never previously smoked depend to a large extent on the question as to what these adults might have done in the absence of vaping products being available. In the case of those who would have initiated smoking in the absence of vaping, it may be said that their use of e-cigarettes could have lowered the level of toxicants that they would otherwise have been exposed to had they initiated combustible cigarette use. However, in the case of those who would not have initiated smoking, the conclusion must be that these individuals will have increased their exposure to a range of harmful and potentially harmful chemicals because of their e-cigarette use.

Within the U.S., the judgement as to whether e-cigarettes are making a positive or negative contribution to public health, in effect assessing the impact of the use of these devices both in terms of their intended population (e.g. adults who smoke) and their use by any unintended populations groups (e.g. those below the minimum age of sale, adults who have never smoked) is part of the PMTA process. In a PMTA submission to the FDA's CTP manufacturers are required to submit scientific evidence that can allow the regulator to form a view as to whether the candidate tobacco or nicotine product can be judged "appropriate for the protection of the public health" (APPH). [21] Those products that are judged to meet the APPH standard can then be legally marketed within the U.S. The scientific evidence submitted includes data on the extent to which adults who smoke are using the candidate product to quit smoking and significantly reduce (≥50%) the number of cigarettes smoked per day alongside evidence as to the extent to which the device is being used by any unintended population groups. In coming to a judgement as to whether a marketing authorisation for an e-cigarette device or product should be granted, the FDA are clearly assessing whether the benefit of the candidate product in assisting adults in quitting smoking or reducing the number of cigarettes they are smoking is greater than the population harm of the product where it is being used by (or likely to be used by) unintended population groups.

To date, millions of e-cigarette products have been assessed by FDA, with over 99% of these having been deemed to not meet the APPH standard. FDA have issued marketing granted orders to only a small number of e-cigarette devices and e-cigarette flavors that they have judged to be APPH. [22] In coming to those judgements, FDA has not specified what value or weighting they have given to the evidence of any actual or potential benefit and the evidence of any actual or potential harm with each device assessed. As a result, it remains unclear what level of population benefit would outweigh the level of population harm for a product to be deemed APPH.

Complex as it clearly is to weigh the benefits and harms of e-cigarettes with regard to the use of these devices by adults who smoker as an aid to quitting smoking and the use of these products by those who have never smoked, the judgement as to the overall public health impact of e-cigarettes is even more complex when it comes to determining their possible role with regard to smoking prevention. The use of e-cigarettes by ANS can be seen as a clear case of an increase in the individual's exposure to a range of harmful and potentially harmful chemicals and can, in those terms, be seen as harm. However, it is entirely possible that at least a proportion of those ANS who are using e-cigarettes might have started to smoke in the absence of those devices being available. In this sense, and to an unknown degree, e-cigarette use by ANS might indicate a possible smoking prevention effect associated with the use of these devices. The difficulty here is one of determining what value to place on a hypothesised smoking prevention effect associated with the avoidance of a more harmful event (smoking initiation) by the adoption of a behaviour that itself carries some level of harm (vaping initiation) in a situation where one cannot know for sure if the more harmful event would have been adopted.

The challenge in determining whether a proportion of ANS who are using e-cigarettes might have used combustible cigarettes, in the absence of e-cigarettes being available, is even more acute

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when it comes to assessing the public health impact of the use of these devices by those below the minimum age of sale. From one perspective the use of e-cigarettes on the part of tobacco-naïve individuals below the minimum age of sale may be seen as the clearest example of the harm associated with these devices. However, in a situation where at least a proportion of those below the minimum age of sale might, in other circumstances, have initiated smoking, the characterisation of e-cigarette use in this unintended population group as a clear harm would seem to be at best premature and at worst a failure to recognise the potential benefit of the initiation of a more harmful behaviour (smoking) being averted by the initiation of a less harmful behaviour (e-cigarettes) at an age when smoking initiation typically occurs. Forming a view as to the net public health impact of the use of e-cigarettes by adults who are smoking, adults who have never smoked, and those below the minimum age of sale is clearly a complex task with the relative newness of the technology of non-combustion-based tobacco and nicotine products further adding to the challenge faced by regulators.

Whilst there is a clear need for longitudinal research assessing the public health impact of the use of these technologies with regard to different population groups (adults who smoke, adults who have never smoked, adults who formerly smoked, those below the legal age of sale), the rapidity with which these products are being developed means that regulatory decisions are having to be made in the absence of anything constituting full data. The challenge facing regulatory bodies then is one of determining which products (e-cigarettes and other new tobacco products) can be judged APPH in the absence of the data required to fully make that assessment.

Whilst it may be said that the precautionary principle would suggest that none of these devices should be authorised for marketing until the assessment of their long-term overall impact on public health has been undertaken, however such extreme regulatory action would result in the removal from the market of a range of products that are likely to be assisting many thousands of adults in quitting smoking. The fact that smoking persists in the U.S. and elsewhere in the face of the clear understanding of the serious harm that smoking can cause places enormous value on the contribution of any technology that can assist individual efforts at smoking cessation. Within a context in which products are being rapidly developed that may be assisting many adults who smoker in quitting smoking, but with those self-same products appealing to some unintended user groups, and where there is a deficiency in the available data, there is a need to stimulate both public and professional debate as to how best to regulate these products weighing what is known and what is unknown about the actual and potential benefit and their actual and potential harm.

Strengths and Limitations

To our knowledge, this study is the first to quantify the prevalence of current e-cigarette use among ANS in the U.S. Our findings should be considered in the context of several limitations. PATH and NHIS include adults aged 18 to 20 years along with adults aged 21+ years. In the U.S. the minimum legal age of sale is 21 years which means the data used in this analysis includes a mix of two unintended user populations – ANS in addition to those below the minimum age of sale. It is not possible to remove adults <21 years from PATH data as age is a categorical variable rather than a continuous variable. It is possible to remove these adults from TPPS and NHIS however, this age cohort of adults were included to support the comparison between the three studies. The definition of "e-cigarette" varied across studies so a direct comparison between estimates of use is limited. The method of data collection varied across all three studies including online, face-to-face, and telephone. As the smoking and e-cigarette use behaviours were self-reported the mode of data collection may have influenced how willing participants were to report their cigarette and e-cigarette use (social desirability bias). Self-reported data is also subject to recall bias however, the main outcomes of interest in this study assessed no prior smoking history and recent e-cigarette use which may help participants be more precise in recalling past behaviour. The NHIS definition of 'never smoked' captures some participants with prior smoking history and therefore over-estimates the size of the true non-smoking population. We created a group 'Other' for race-ethnicities that had low number of subjects in these groups and our findings may not detect important associations between e-

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cigarette use among ANS in these minority race-ethnicity populations. Finally, our analysis compared TPPS and NHIS survey data with the most recent publicly available PATH data (Wave 7, January 2022 – April 2023) and as such the extent of current e-cigarette use among ANS may not accurately reflect present levels of e-cigarette use in this population group. Real-time data on the prevalence of e-cigarette use in this population would help guide regulatory decisions and public health policy. [23]

Conclusion

Among ANS in the U.S., between 2.6 million and 5.2 million are currently using e-cigarettes. Current e-cigarette use was predominantly infrequent suggesting between 810,000 and 1,430,000 ANS are using e-cigarettes daily or on 20 or more of the past 30 days. ANS is an unintended user population group, so it is important to continue to monitor prevalence and patterns of e-cigarette use in this group. The challenge here is one of determining the impact of the use of these devices where they are being used by adults who smoke to assist their smoking cessation efforts and where they are being used by those who have never smoked as a form of smoking prevention or nicotine uptake. The public health importance of further reducing the level of smoking within the U.S. and elsewhere underlines the need to establish the impact of e-cigarettes in the short, medium, and long-term and to ensure that regulatory decisions are made in a transparent way based on the best available scientific evidence and supported by widespread public and scientific debate.

Funding: This manuscript was prepared without external financial support

Conflict of Interest: The authors report no conflict of interest in the preparation of this manuscript

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