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Analysis on NYTS 2021: Socio-demographic Factors and Its Effect on Harm Perception of Cigarette and E-Cigarette Smoking

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ABSTRACT

In this modern era of enhancement, basic to secondary human necessities and desires evolve. Smoking cigarettes has been a problem since then and policies and laws are promulgated to address the smoking problem that every nation faces. Background knowledge and personal social demographics may affect their harmful perception of smoking– whether it is an e-cigarette or a traditional cigarette. This research tackles and determines how socio-demographics such as age, gender, and grade level attained can impact the harmful perception of cigarette and e-cigarette consumption. This study further discusses the socio-demographics and its relationship with harm perception on cigarette and e-cigarette smoking. A survey questionnaire from the National Youth Tobacco Survey 2021 was used as a reference and basis to test whether age, gender, and grade level would affect the harm perception on the usage of cigarettes and e-cigarettes and then Multinomial Logistic Regression. Further testing revealed that gender and grade level positively affects the harmful perception of cigarette and e-cigarette smoking, contrary to age which negatively affects said perception.

Keywords: Harm Perception, Electronic Cigarettes, Tobacco Cigarettes, Age, Grade Level, Gender

Introduction

Smoking has been a worldwide problem, not only it is a major problem concerning health, but it also affects our economy. According to the Department of Health in the Philippines, the usage of electronic cigarettes has been rampant especially among youth since policies were implemented and taxes are set higher to prohibit smoking. By then, smoking became more expensive and people started to look for alternatives. Through the years, innovations are made to address little by little the risks and harmful effects of cigarette smoking and the number one emerging alternative is electronic cigarettes.

Electronic cigarettes are products that are powered by batteries. The aerosols that are yielded by a heating liquid are inhaled or smoked by users. (Gorukanti et al., 2016) This technology was made not just to deliver nicotine but also flavors. In addition, propylene glycol, glycerin, and many other constituents are chemicals contained in an e-cigarette. There is a continuous increase in the usage of these electronic cigarettes over the past few years (Cotti et al., 2018). Through the years, the market for these products has increased since these products are relatively inexpensive when compared to traditional cigarette smoking laws have been promulgated that increase the taxes of these products by PHP 45.00 per pack in 2020, and an additional PHP 5.00 annually until it reaches up to PHP 60.00 per pack until 2023. While e-cigarette products are new to the market and laws are yet to be strictly enforced. With that, price sensitivity and disposable income would be a big matter for purchase.

In this level of transitioning in life, this time is when youths get influenced by the society around them (Harrel et al., 2019). To date, it is still a controversial question as to if e-cigarettes serve as a cessation to smoking or just an opportunity to start smoking tobacco and the like. In the UK, experts are receptive to the notion of electronic cigarettes to relieve tobacco smoking. On the other hand, experts in the US are less likely to support it since the substantial population of tobacco cigarette usage is from the younger age group (Shah et al., 2017). However, a well-documented association between smoking and mental health shows an unlikely causal explanation as personal characteristics, social environments, and genetics all together give an impact on the consumer's overall mental and physical health (Plurphanswat, 2017). Is prevalent in adolescent misinformation about e-cigarettes. Considering that e-cigarettes give safer risks than tobacco smoking, have little to few percentages of nicotine, and being able to go with the trend. (Gorukanti et al., 2017). This age group is referred to as "emerging adulthood", reports show that in this age group, their first try at a cigarette was even before the age of 26.

According to Dobson (2004), men and women from lower socioeconomic status or those who are less advantaged are less likely to stop smoking. Smokers tend to have financial distress when compared to non-smokers. (Greenhalgh et al., 2016)

When making purchasing decisions in the tobacco marketplace, an individual's use of conventional or e-cigarettes, or both, can influence their demand for different products (Snider et al., 2017). According to Cotti et al. (2018), both products produce the same feeling because of the nicotine content and it is both inhaled, therefore, making them substitutes.

In a study conducted by Corrigana (2020), smokers with better health, lower body mass index, and acquired higher education were willing to pay more for e-cigarettes. This is likely to be influenced by Eugene Slutsky's Substitution Effect. It is when the consumer substitutes good A for good B as the consumer's financial situation improves or a sudden change in personal satisfaction occurs. It is known that the smoking industry is mostly characterized by a variety of brands, prices, and alternative products.

Huang et al. (2014) stated that a lot various policies to address and mitigate the increasing market and usage of electronic cigarettes are being raised and have been proposed which include minimum age restriction to purchase, youth access to a market of said cigarettes, restrictions and limitations on e-cigarettes promotion and marketing, limited samples as well as the taxes imposed in e-cigarettes– all in the effort to mitigate and address the rapid growth in the market of e-cigarettes. Age is a matter that affects the smoker's perception and possible behavior.

Hartwell et al. (2016) stated that patterns within socio-demographic groups show insufficient data about how electronic cigarettes are more likely significant in their cessation of tobacco smoking, and if the consumption of electronic cigarettes varies among the different socio-demographic units. In accordance, Stallings-Smith et al. (2016) stated that it is important to distinguish the socio-demographics of the consumer to understand the probable subgroups that would need interventions to prevent or in other cases, reduce further development of the obsession. According to Kilic et al. (2014), gender differences as well would affect the consumer's perception and behavior regarding smoking. Certain studies as well supported this claim.

In a study conducted by Goniewiczbn and Zielinska-Danch (2012), male students aged 15-24, on 6th-12th grade level Gaiha (2021), tend to smoke an electronic cigarette after experiencing a cigarette. It also shows that external factors such as parents who also smoke and their respective partners are a factor as to why this age group has the highest risk to use electronic cigarettes. As some of the students tend to believe that electronic cigarettes are a safer alternative than traditional cigarettes. This is supported by a study conducted by Gallus et al., (2014) that even adults believe electronic cigarettes are safer due to the insufficient amount of tobacco on each device. However, 23% of their survey results indicate that electronic cigarettes may be even more harmful than conventional cigarettes.

According to studies made by Krosnick et al. (2006), Rodriguez et al. (2007), and Song et al. (2009), perceptions of harm of cigarette use and the health consequences it may bring are predictors of use.

This research aimed to tackle how the different socio-demographic variables affected the harm perception of consumers and their behavior or smoking decision on e-cigarette and cigarette consumption. It also examined further which of those said socio-demographic factors have a positive or direct relationship with harm perception of smoking and which of those factors have an indirect or inverse relationship with harm perception of smoking. More so, it aimed to identify the reason behind why these factors affected the consumer behavior of respondents. This research further investigated how those given demographics affected the consumer's harmful perception of smoking. This study focused mainly on age, gender, and grade level as dependent variables. By then, it also tackled which of those socio-demographic variables highly affected the harm perception of smoking cigarettes and e-cigarette of consumers the most.

Literature Review

2.1. Age to Harm Perception of Smoking

In a study conducted by Walker et al. (2020) potential evidence has been explored in New Zealand, stating that local governments have implemented strict measures to combat early tobacco addiction. However, the rise of electronic cigarettes being legally sold in 2010 impacted the youth to be sensitive to the product. Hence, contradicts the sole purpose of electronic cigarettes - cessation. In the assessment, daily e-cigarette and tobacco cigarettes were conducted as inhaled at least a day, week, month, and less often than once a month.

Fain (2016) stated that millennials are individuals born in the year 1981 to 1996. Being exposed to constantly progressing technology that is being used for everyday life contributes to how most non-smokers transition to start smoking. Chen et al., (1998) conducted a study with 3,449 participants showing that most smokers aged 21-39 years old with percentage of 55% started smoking at age 14-17, and a low percentage of 14% started at age 20 and older. In the same study, to measure their smoking behaviors, smokers who smoked more than 20 sticks of cigarettes a day, are considered heavy smokers. Choi et al., (2001) defined puffers as smokers who tried cigarettes for a few puffs but did not daily compared to heavy smokers.

Amrock et al. (2015) stated that younger age groups, on a personal aspect, view smoking as a less harmful approach. On the other hand, older age groups are more likely to also believe that light to intermittent smoking as well, causes very harmful effects contradicting what the younger age groups tend to believe. Thus, it shows that perceptions of harms caused by light to intermittent smoking vary with the different age groups.

H1: Younger individuals see less harm on smoking

2.2. Gender to Harm Perception of Smoking

According to Chinwong et al. (2018), men are more likely to smoke at around 15-20 times higher than women. Men have a higher smoking behavior compared to women, and they are said to be more likely to smoke daily than females do. On the other hand, developed countries have women who have a higher smoking tendency than females from developing countries. It can be generally said that men's smoking prevalence is usually higher most of the time.

More so, gender differences in consumer behavior toward cigarettes play a big role. (Kilic et al., 2014) According to Chung et al. (2010), more men tend to smoke than women. Multiple studies have shown that socioeconomic status is also associated with smoking behavior (Fernandez et al., 2001; Cho et al., 2008) Though smoking behavior in connection with gender varies in different countries (Cavelaars et al., 2000)

According to Ganz et al. (2018), smoking is higher in gender minorities, those who are members of LGBTQIA+ when compared to non-minority. Harm perceptions of smoking are more prevalent as well in gender minorities. Nayak et al., (2017), showed that there are differences in risk perceptions on e-cigarettes and cigarette usage between members of LGBTQIA+ or gender minorities and heterosexuals. Ganz et al. (2018) stated that sexual and gender identity has a relationship with the prevalence of smoking.

Amrock et al. (2015) stated that females are consistently more likely to view tobacco usage as harmful than males do. Numbers go around 69% of females perceive light smoking as causing lots of harm while only 59.5% of males only do.

H2: Gender indirectly affects the harm perception of smoking.

2.3. Grade level to Harm Perception of Smoking

Long-term effects of electronic cigarettes are yet to be detected compared to the conventional cigarette has been backed up by countless studies and evidence. It has been known to the public by local health authorities that tobacco, nicotine, or any smoke-induced devices are safe as a nicotine replacement addiction (Penzes et al., 2022).

According to the study of S.M. Gaiha, et al (2021) adolescents that were in 6th to 12th grade had access to unreliable sources of information about the relative risks of both conventional and electronic cigarettes. Which perceives them that alternatives such as electronic cigarettes are less harmful and less likely to be addicting. In the same study, prevention programs that most schools establish showed significant changes in behavior in the adolescent group. With a 12%-30% reduction in initiation with non-smokers, it is shown that the effectiveness of refusal information

is highly applicable within this age group. Ambrose et al., (2014) supported the previous related literature stating that the continued misperceptions of harm perception on smoking are an indication of continuous learning in the adolescent group. The adolescent group tends to consider that the risks are easily controlled and believe that they can quit before the effects of this addiction.

In addition, in the study of Kong et al., (2020) adolescents tend to smoke due to the influence of their companions referring to smoking as a stress reliever. Which they also think helps with the boredom they feel. Having easy access to conventional and electronic cigarettes, Noland et al., (2017) supported that public exposure such as retail stores relatively impacts the adolescent group to smoking. Schools with closed spaces also tend to be a place where most of the age group get stimulated.

H3: Education directly affects harm perception of smoking

Synthesis

Socio-demographic factors such as age discussed by Amrock et al. (2015) should have a negative relationship, while the other variable discussed in his study, which is gender, should have a positive relationship with the harm perception of smoking cigarettes and e-cigarettes. While the other mentioned socio-demographics namely grade level should also have a positive relationship with the harmful perception of smoking cigarettes and e-cigarettes of the respondents.

Theoretical Framework

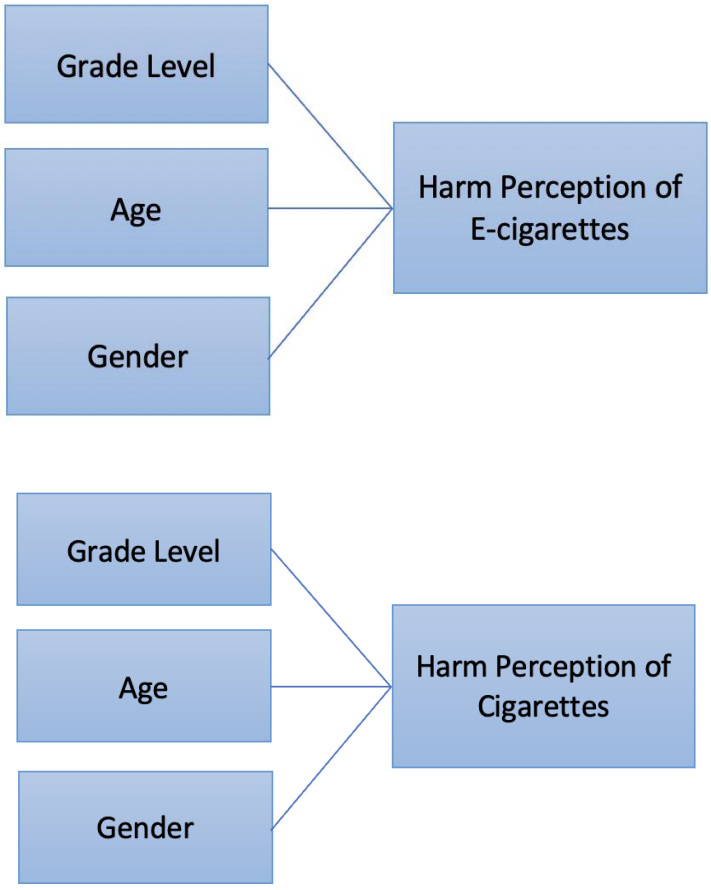
The researchers used the adapted multinomial logistic regression model by Mantey et. al (2021). An extended version of linear logistic regression, Multinomial Logistic Regression (MLR), is used when there are more than two options or levels on a response variable. For each dummy variable, a different logistic regression is predicted by the MLR. By contrasting it with the reference category, each model makes predictions about the impact of predictors on the chances of success in that category using its distinctive set of intercept and regression coefficients. Assumptions are included in multinomial logistic regression, such as the notion that the options for the dependent variable are independent of one another. According to this presumption, selecting or belonging to one group has no bearing on selecting or belonging to another group. Adaptation of the logistic regression formula can be considered to be the MLR if the response variable has more than two potential responses.

$$\ln\left[\frac{P_A}{P_c}\right] = \beta_{0,1} + \beta_{1,1} \cdot X^{(1)} + \beta_{2,1} \cdot X^{(2)} + \cdots + \beta_{m,1} \cdot X^{(m)} = y_1$$

$$\ln\left[\frac{P_B}{P_c}\right] = \beta_{0,2} + \beta_{1,2} \cdot X^{(1)} + \beta_{2,2} \cdot X^{(2)} + \cdots + \beta_{m,1} \cdot X^{(m)} = y_2$$

With levels A, B, and C, it is presumed that Y is a categorical variable in this situation and that m predictos, $X^{(1)}$,$X^{(2)}$, …, $X^{(m)}$; such that $P_A = P\,[Y = A|\,X]$; $P_B = P\,[Y = B|\,X]$ $and\ P_C = P\,[Y = C|\,X]$ (Bhattacharjee et. al, 2022).

Simulacrum



Research Method

The purpose of this study was to identify the factors that most significantly influenced people's perceptions of the risks associated with smoking cigarettes and e-cigarettes, as well as the relationship between socio-demographics and those perceptions.

A cross-sectional analysis was conducted by the researchers using information from the National Youth Tobacco Survey 2021. The Centers for Disease Control and Prevention (CDC) manages the NYTS, a cross-sectional, school-based, self-administered survey provided to American middle and high school students in public or private schools each spring. To create a sample of American students in Grades 6 through 12, or kids aged about 11 to 18, a three-stage cluster sampling approach was utilized. Data were taken from 20,413 students in total. Students whose ages did not fall between 14 and 17 as well as those whose sex and grade level was unknown were eliminated. Additionally, students who failed to respond to questions on their opinions or use of conventional cigarettes or e-cigarettes were omitted. 7,773 students made up the final sample as a result of this.

As previously mentioned above, we would like to use the adapted multinomial logistic regression model by Mantey et. al (2021). In the NYTS, students were asked about their harm perception from both cigarettes and e-cigarettes. There were four possible responses: no harm, a little harm, some harm, and a lot of harm. The baseline or reference category utilized as a comparison was 1 - no harm.

$$\ln\left[\frac{P_A}{P_c}\right] = \beta_{0,1} + \beta_{1,1} \cdot X^{(1)} + \beta_{2,1} \cdot X^{(2)} + \cdots + \beta_{m,1} \cdot X^{(m)} = y_1$$

$$\ln\left[\frac{P_B}{P_c}\right] = \beta_{0,2} + \beta_{1,2} \cdot X^{(1)} + \beta_{2,2} \cdot X^{(2)} + \cdots + \beta_{m,1} \cdot X^{(m)} = y_2$$

4. Results and Discussion

In this study, the relationship between socio-demographic variables (age, gender, and grade level) and harm perception of smoking (cigarette and e-cigarette) were examined. Also, the underlying reasons on why these factors affected the consumer behavior of respondents were identified.

As mentioned in the previous chapter, this research conducted a cross-sectional study and secondary data were collected from the National Youth Tobacco Survey 2021. For the sampling

procedure, a 3-stage cluster sampling was used and generated a total sample of 20,413 students. Furthermore, students with unknown sex, unknown grade level, who did not answer questions regarding harm perceptions of both cigarettes and e-cigarettes were excluded. Students with ages 14-17 were only used in this study and resulted in a final sample of 7,773 students. Harm perception of both cigarettes and e-cigarettes were measured as 1 - No harm, 2 - Little harm, 3 - Some harm, and 4 - A lot of harm.

The researchers used adapted multinomial logistic regression model Mantey et. al (2021). MLR (Multinomial Logistic Regression) was used because there were more than 2 response variables (*1 - No harm, 2 - Little harm, 3 - Some harm, and 4 - A lot of harm*).

$$\ln\left[\frac{P_A}{P_c}\right] = \beta_{0,1} + \beta_{1,1} \cdot X^{(1)} + \beta_{2,1} \cdot X^{(2)} + \cdots + \beta_{m,1} \cdot X^{(m)} = y_1$$

$$\ln\left[\frac{P_B}{P_c}\right] = \beta_{0,2} + \beta_{1,2} \cdot X^{(1)} + \beta_{2,2} \cdot X^{(2)} + \cdots + \beta_{m,1} \cdot X^{(m)} = y_2$$

In this model, the reference or baseline category used was *1 - No Harm*.

4.1. MLR of Socio-demographic Variables and Harm Perception of Cigarette Smoking

Table 1

Model 1: Multinomial Logit, using observations 1-7773
Dependent variable: CHP
Standard errors based on Hessian

	Coefficient	*Std. Error*	*z*	*p-value*	
CHP = 2					
const	2.94214	0.828089	3.553	0.0004	***
Age	−0.540021	0.179641	−3.006	0.0026	***
Gender	0.680815	0.200298	3.399	0.0007	***
GradeLevel	0.360325	0.160072	2.251	0.0244	**
CHP = 3					
const	4.61786	0.770764	5.991	<0.0001	***
Age	−0.620526	0.166312	−3.731	0.0002	***
Gender	0.850452	0.187812	4.528	<0.0001	***
GradeLevel	0.429798	0.148036	2.903	0.0037	***
CHP = 4					
const	4.07040	0.771631	5.275	<0.0001	***
Age	−0.503515	0.166414	−3.026	0.0025	***
Gender	0.885876	0.187971	4.713	<0.0001	***
GradeLevel	0.339061	0.148134	2.289	0.0221	**

Mean dependent var	3.309276		S.D. dependent var	0.705513
Log-likelihood	−7788.198		Akaike criterion	15600.40
Schwarz criterion	15683.90		Hannan-Quinn	15629.02

Number of cases 'correctly predicted' = 3615 (46.5%)
Likelihood ratio test: Chi-square(9) = 50.1424 [0.0000]

All variables were statistically significant for Harm Perception of Cigarette Smoking. In each response variable, age has negative effects. On the other hand, gender and grade level have positive effects. A 95% confidence level was used in the regression and all of the p-values are less than alpha, then we reject the null hypotheses.

4.1.1. Summary Statistics

Table 2

Summary Statistics, using the observations 1 - 7773

Variable	Mean	Median	Minimum	Maximum
Age	7.4134	7.0000	6.0000	9.0000
Gender	1.5038	2.0000	1.0000	2.0000
GradeLevel	4.8132	5.0000	1.0000	8.0000
CHP	3.3093	3.0000	1.0000	4.0000
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Age	1.1183	0.15084	0.11281	-1.3494
Gender	0.50002	0.33250	-0.015181	-1.9998
GradeLevel	1.2464	0.25896	0.080626	-0.90230
CHP	0.70551	0.21319	-0.83077	0.54727
Variable	5% Perc.	95% Perc.	IQ range	Missing obs.
Age	6.0000	9.0000	2.0000	0
Gender	1.0000	2.0000	1.0000	0
GradeLevel	3.0000	7.0000	2.0000	0
CHP	2.0000	4.0000	1.0000	0

4.1.2. Collinearity

```
Variance Inflation Factors
Minimum possible value = 1.0
Values > 10.0 may indicate a collinearity problem

      Age    4.905
   Gender    1.009
 GradeLevel    4.908

VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient
between variable j and the other independent variables

Belsley-Kuh-Welsch collinearity diagnostics:

  variance proportions
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lambda	cond	const	Age	Gender	GradeLev~	const	Age	Gender
7.030	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.485	1.252	0.000	0.000	0.001	0.000	0.000	0.000	0.000
0.167	6.497	0.000	0.000	0.000	0.000	0.000	0.000	0.012
0.117	7.766	0.001	0.000	0.013	0.000	0.001	0.000	0.003
0.110	8.009	0.000	0.001	0.083	0.005	0.000	0.000	0.004
0.048	12.059	0.000	0.000	0.000	0.000	0.005	0.000	0.004
0.031	14.943	0.037	0.000	0.026	0.025	0.001	0.000	0.001
0.005	36.311	0.000	0.000	0.000	0.000	0.014	0.020	0.000
0.003	45.204	0.098	0.145	0.003	0.117	0.003	0.004	0.000
0.003	52.532	0.000	0.003	0.662	0.027	0.000	0.004	0.740
0.001	91.437	0.219	0.001	0.190	0.159	0.247	0.001	0.212
0.000	272.048	0.645	0.850	0.022	0.667	0.729	0.970	0.025

lambda	cond	GradeLev~	const	Age	Gender	GradeLev~
7.030	1.000	0.000	0.000	0.000	0.000	0.000
4.485	1.252	0.000	0.000	0.000	0.000	0.000
0.167	6.497	0.001	0.000	0.000	0.012	0.001
0.117	7.766	0.001	0.001	0.000	0.003	0.001
0.110	8.009	0.000	0.000	0.000	0.004	0.000
0.048	12.059	0.004	0.005	0.000	0.004	0.004
0.031	14.943	0.001	0.001	0.000	0.001	0.001
0.005	36.311	0.017	0.014	0.020	0.000	0.017
0.003	45.204	0.003	0.003	0.005	0.000	0.004
0.003	52.532	0.030	0.000	0.004	0.739	0.030
0.001	91.437	0.181	0.247	0.001	0.212	0.181
0.000	272.048	0.763	0.728	0.969	0.025	0.762

lambda = eigenvalues of inverse covariance matrix (smallest is 9.4987e-05)
cond = condition index
note: variance proportions columns sum to 1.0

According to BKW, cond >= 30 indicates "strong" near linear dependence,
and cond between 10 and 30 "moderately strong". Parameter estimates whose
variance is mostly associated with problematic cond values may themselves
be considered problematic.

Count of condition indices >= 30: 5
Variance proportions >= 0.5 associated with cond >= 30:

const	Age	Gender	GradeLev~	const	Age	Gender	GradeLev~	const	Age	Gender	GradeLev~
0.962	0.999	0.877	0.970	0.993	1.000	0.977	0.994	0.993	1.000	0.976	0.994

Count of condition indices >= 10: 7
Variance proportions >= 0.5 associated with cond >= 10:

const	Age	Gender	GradeLev~	const	Age	Gender	GradeLev~	const	Age	Gender	GradeLev~
0.999	0.999	0.903	0.995	0.999	1.000	0.981	0.998	0.999	1.000	0.981	0.998

All of the values in age, gender, and grade level are less than 10 indicating that there is no collinearity problem in these variables.

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4.2. MLR of Socio-demographic Variables and Harm Perception of E-cigarette Smoking

Table 3

Model 2: Multinomial Logit, using observations 1-7773
Dependent variable: EHP
Standard errors based on Hessian

	Coefficient	*Std. Error*	*z*	*p-value*	
EHP = 2					
const	2.78064	0.633436	4.390	<0.0001	***
Age	−0.506951	0.138821	−3.652	0.0003	***
Gender	0.296677	0.150417	1.972	0.0486	**
GradeLevel	0.493886	0.124008	3.983	<0.0001	***
EHP = 3					
const	3.09027	0.606668	5.094	<0.0001	***
Age	−0.526047	0.132640	−3.966	<0.0001	***
Gender	0.666375	0.144071	4.625	<0.0001	***
GradeLevel	0.536507	0.118456	4.529	<0.0001	***
EHP = 4					
const	2.89835	0.610045	4.751	<0.0001	***
Age	−0.492369	0.133381	−3.691	0.0002	***
Gender	0.718086	0.144789	4.960	<0.0001	***
GradeLevel	0.474308	0.119100	3.982	<0.0001	***

Mean dependent var	3.135469	S.D. dependent var	0.799056
Log-likelihood	−8795.572	Akaike criterion	17615.14
Schwarz criterion	17698.64	Hannan-Quinn	17643.77

Number of cases 'correctly predicted' = 3355 (43.2%)
Likelihood ratio test: Chi-square(9) = 89.8448 [0.0000]

For harm perception of e-cigarette smoking, all variables were statistically significant. Each response variable is negatively affected by age. On the contrary, grade level and gender have positive effects. All of the p-values in the regression are less than alpha, a 95% confidence level was used, and we reject the null hypotheses.

4.2.1. Summary Statistics

Table 4

Summary Statistics, using the observations 1 - 7773

Variable	Mean	Median	Minimum	Maximum
Age	7.4134	7.0000	6.0000	9.0000

Gender	1.5038	2.0000	1.0000	2.0000
GradeLevel	4.8132	5.0000	1.0000	8.0000
EHP	3.1355	3.0000	1.0000	4.0000
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Age	1.1183	0.15084	0.11281	-1.3494
Gender	0.50002	0.33250	-0.015181	-1.9998
GradeLevel	1.2464	0.25896	0.080626	-0.90230
EHP	0.79906	0.25484	-0.59447	-0.29129
Variable	5% Perc.	95% Perc.	IQ range	Missing obs.
Age	6.0000	9.0000	2.0000	0
Gender	1.0000	2.0000	1.0000	0
GradeLevel	3.0000	7.0000	2.0000	0
EHP	2.0000	4.0000	1.0000	0

4.2.2. Collinearity

Variance Inflation Factors
Minimum possible value = 1.0
Values > 10.0 may indicate a collinearity problem

Age	4.905
Gender	1.009
GradeLevel	4.908

VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient
between variable j and the other independent variables

Belsley-Kuh-Welsch collinearity diagnostics:

variance proportions

lambda	cond	const	Age	Gender	GradeLev~	const	Age	Gender
6.504	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.960	1.145	0.000	0.000	0.001	0.000	0.000	0.000	0.000
0.168	6.227	0.001	0.000	0.006	0.001	0.001	0.000	0.004
0.153	6.527	0.000	0.000	0.001	0.000	0.000	0.000	0.025
0.123	7.273	0.000	0.000	0.075	0.003	0.000	0.000	0.004
0.044	12.133	0.000	0.000	0.000	0.000	0.010	0.000	0.007
0.035	13.638	0.028	0.000	0.021	0.019	0.002	0.000	0.001
0.005	36.389	0.000	0.001	0.000	0.001	0.025	0.037	0.001
0.004	40.298	0.000	0.005	0.673	0.024	0.000	0.004	0.723
0.004	41.258	0.074	0.107	0.005	0.091	0.005	0.008	0.000
0.001	70.840	0.223	0.001	0.195	0.161	0.237	0.001	0.208
0.000	214.788	0.673	0.885	0.024	0.700	0.720	0.950	0.025

lambda	cond	GradeLev~	const	Age	Gender	GradeLev~
6.504	1.000	0.000	0.000	0.000	0.000	0.000
4.960	1.145	0.000	0.000	0.000	0.000	0.000
0.168	6.227	0.001	0.001	0.000	0.005	0.001
0.153	6.527	0.001	0.000	0.000	0.020	0.001
0.123	7.273	0.000	0.000	0.000	0.010	0.000
0.044	12.133	0.006	0.009	0.000	0.007	0.006
0.035	13.638	0.001	0.004	0.000	0.003	0.003
0.005	36.389	0.030	0.023	0.034	0.001	0.028
0.004	40.298	0.030	0.000	0.004	0.721	0.030
0.004	41.258	0.005	0.010	0.015	0.000	0.011
0.001	70.840	0.174	0.236	0.001	0.207	0.173
0.000	214.788	0.751	0.716	0.945	0.025	0.747

lambda = eigenvalues of inverse covariance matrix (smallest is 0.000140975)

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  cond   = condition index
  note: variance proportions columns sum to 1.0

According to BKW, cond >= 30 indicates "strong" near linear dependence,
and cond between 10 and 30 "moderately strong". Parameter estimates whose
variance is mostly associated with problematic cond values may themselves
be considered problematic.

Count of condition indices >= 30: 5
Variance proportions >= 0.5 associated with cond >= 30:

    const     Age    Gender GradeLev~    const     Age    Gender GradeLev~    const     Age    Gender GradeLev~
    0.970   0.999    0.897   0.977    0.987   0.999    0.958   0.990    0.986   0.999    0.954   0.989

Count of condition indices >= 10: 7
Variance proportions >= 0.5 associated with cond >= 10:

    const     Age    Gender GradeLev~    const     Age    Gender GradeLev~    const     Age    Gender GradeLev~
    0.999   0.999    0.918   0.996    0.999   0.999    0.967   0.998    0.999   0.999    0.964   0.998
```

Age, gender, and grade level all have values that are less than 10, indicating that there is no collinearity issue with these variables.

4.3. Discussion

Harm perception of cigarette and e-cigarette smoking is affected and led by various factors. Said factors are age, gender, and grade level but factors are not limited to those only. Factors that are present might affect harm perception positively or negatively.

As mentioned in MRL, all these variables (age, gender, grade level) are significant in the harm perception of cigarette smoking. Both gender and grade level affects the perception of users on the harm of cigarette smoking for certain reasons positively while on the other hand, age affects it negatively.

Results gathered from the study show that age significantly and negatively affects harm perception of smoking. This coincides with the reason that older people tend to get addicted to it and disregards the harmful effects of smoking. Considering as well that they are legally allowed to purchase anytime and most adults have the financial capability to purchase. As well the fact that they got older smoking and they haven't experienced complications, their harm perception tends to be lower which is the opposite for younger people.

Gender would also significantly and positively affect the harmful perception of smoking. Men are more likely to conceive smoking as less harmful while women see smoking as more harmful. Based on the data that the researchers utilized, gender differences that include brain activity, body response, and capabilities to smoking are factors that may affect the harmful perception of people.

With the data that the researchers gathered, using MLR shows that grade level or education attainments have a positive relationship with harm perception. The grade levels of 9th to 11th show that within this grade level understand the approximate harm of both cigarette and electronic smoking. The different level of gathering information from lectures, reports, published journals, and articles, within this grade level shows a significant factor as to why these grade levels know that there is a rough perception of the harm of cigarette and electronic smoking. The same data shows that the group of the subject shows a significant impact of getting influenced to use either electronic or tobacco cigarettes.

Comparing the relationships between said socio-demographic variables and the harm perception of smoking cigarettes and e-cigarettes show that they have the same result, regardless of whether it is on smoking cigarettes or smoking e-cigarettes.

Conclusion

5.1. Summary

Oftentimes, personal socio-demographic variables are not looked upon as factors that may affect the harmful perception of people on smoking cigarettes and electronic cigarettes.

The focal point of this research was to discuss and examine the effects of various socio-demographic factors on consumers' harm perception and their potential use of cigarettes and electronic cigarettes. Additionally, it looked at which of the aforementioned socio-demographic factors directly affected smokers' perceptions of the risks that are associated with and can be acquired with smoking and which of those factors have an indirect relationship. The data was gathered from the National Youth Tobacco Survey (NYTS) 2021, which is available and acquired from The Centers for Disease Control and Prevention (CDC), and conducted a cross-sectional study. Multinomial Logistic Regression (MLR) was used to test the hypotheses. For both harm perception of cigarette and e-cigarette smoking, results disclosed that age has an indirect relationship while gender and grade level has a direct relationship with harm perception of cigarette smoking and e-cigarette smoking provided by various personal factors that root said socio-demographics. After thorough analysis, it shows that younger people tend to see smoking as more harmful than older ones, women perceive smoking as more dangerous than men do, and lastly, students in their ninth to eleventh grade see the harm perception of smoking the most. Adjustments and promulgations of new and existing laws and policies could be made and legislators and the health sector would benefit from this study.

5.2. Conclusions

This analysis discovered that older adults have the propensity to become addicted to it and ignore the negative effects of smoking using NYTS 2021, a cross-sectional data set. Women tend to view smoking as more detrimental than men do. Men tend to think of smoking as less dangerous. The ninth through eleventh-grade levels demonstrate that students in these grade levels comprehend the general harm caused by both cigarette and electronic smoking. The harm perception of smoking cigarettes and using e-cigarettes have the same effect, according to comparisons of the connections between the aforementioned socio-demographic factors and the two behaviors.

5.3. Policy Implications

Based on the results of this research, consumers aged 14-15 years old tend to get influenced and start smoking either or both tobacco or electronic cigarettes. Moreover, the examined socio-demographics namely age, gender, and grade level are usually not given attention as factors affecting the harmful perception of the given products. With the results that can be acquired from this study, policies could be revised and improved to address these as well. With the current laws and policies the country implemented on the distribution of tobacco-yielding products, the government should make amendments to the current laws that would limit the distribution of both tobacco products and electronic cigarettes beyond the ending age of a minor which is 18 years old. The current laws that prohibit the distribution of tobacco and electronic cigarettes seem to be inefficient considering with the data used, students aged 14-15 are at risk of being exposed to these products. With the same data, it has shown that there are still many consumers that are aware of the harmful perception these products could give, especially if started at a young age. There must be justifications within schools, households, and even communities about the risks and potential risks of electronic cigarettes and tobacco cigarettes. Extensive studies are yet to be presented about the long-term effects of electronic cigarettes considering that the rise of these products has been very recent, and considered to be a good alternative to tobacco smoking and to as a cessation.

References

[1] Alechnowicz, K. (2004). The Philippine tobacco industry: “the strongest tobacco lobby in Asia.” *Tobacco Control*, *13*(suppl_2), ii71–ii78. https://doi.org/10.1136/tc.2004.009324

[2] Allcott, H., & Rafkin, C. (2020). Optimal Regulation of E-Cigarettes: Theory and Evidence. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3592146

[3] Ambrose, B. K., Rostron, B. L., Johnson, S. E., Portnoy, D. B., Apelberg, B. J., Kaufman, A. R., & Choiniere, C. J. (2014). Perceptions of the Relative Harm of Cigarettes and E-cigarettes Among U.S. Youth. *American Journal of Preventive Medicine*, *47*(2), S53–S60. https://doi.org/10.1016/j.amepre.2014.04.016

[4] Audrain-McGovern, J., Strasser, A. A., & Wileyto, E. P. (2016). The impact of flavoring on the rewarding and reinforcing value of e-cigarettes with nicotine among young adult smokers. *Drug and Alcohol Dependence*, *166*, 263–267. https://doi.org/10.1016/j.drugalcdep.2016.06.030

[5] Barnett, T. E., Soule, E. K., Forrest, J. R., Porter, L., & Tomar, S. L. (2015). Adolescent Electronic Cigarette Use. *American Journal of Preventive Medicine*, *49*(2), 199–206. https://doi.org/10.1016/j.amepre.2015.02.013

[6] Barrington-Trimis, J. L., Braymiller, J. L., Unger, J. B., McConnell, R., Stokes, A., Leventhal, A. M., Sargent, J. D., Samet, J. M., & Goodwin, R. D. (2020). Trends in the Age of Cigarette Smoking Initiation Among Young Adults in the US From 2002 to 2018. *JAMA Network Open*, *3*(10), e2019022. https://doi.org/10.1001/jamanetworkopen.2020.19022

[7] Bellew, B., Antonio, M., Limpin, M., Alzona, L., Trinidad, F., Dorotheo, U., Yapchiongco, R., Garcia, R., Anden, A., & Alday, J. (2013). Addressing the tobacco epidemic in the Philippines: progress since ratification of the WHO FCTC [Review article]. *Public Health Action*, *3*(2), 103–108. https://doi.org/10.5588/pha.13.0006

[8] Bhattacharjee, P., Dey, V., Mandal, U., & Paul, S. (2022). Quantitative risk assessment of submersible pump components using Interval number-based Multinomial Logistic Regression(MLR) model. *Reliability Engineering &Amp; System Safety*, *226*, 108703. https://doi.org/10.1016/j.ress.2022.108703

[9] Cantrell, J., Huang, J., Greenberg, M. S., Xiao, H., Hair, E. C., & Vallone, D. (2019). Impact of e-cigarette and cigarette prices on youth and young adult e-cigarette and cigarette behaviour: evidence from a national longitudinal cohort. *Tobacco Control*, tobaccocontrol-2018. https://doi.org/10.1136/tobaccocontrol-2018-054764

[10] Chen, C. M., Chang, K. L., & Lin, L. (2013). Re-examining the price sensitivity of demand for cigarettes with quantile regression. *Addictive Behaviors*, *38*(12), 2801–2804. https://doi.org/10.1016/j.addbeh.2013.07.003

[11] Chiang, C. Y., & Chang, H. Y. (2016). A population study on the time trend of cigarette smoking, cessation, and exposure to secondhand smoking from 2001 to 2013 in Taiwan. *Population Health Metrics*, *14*(1). https://doi.org/10.1186/s12963-016-0109-x

[12] Chinwong, D., Mookmanee, N., Chongpornchai, J., & Chinwong, S. (2018). A Comparison of Gender Differences in Smoking Behaviors, Intention to Quit, and Nicotine Dependence among Thai University Students. *Journal of Addiction*, *2018*, 1–8. https://doi.org/10.1155/2018/8081670

[13] Choi, W. S., Gilpin, E. A., Farkas, A. J., & Pierce, J. P. (2001). Determining the probability of future smoking among adolescents. *Addiction*, *96*(2), 313–323. https://doi.org/10.1046/j.1360-0443.2001.96231315.x

[14] Chung, W., Lim, S., & Lee, S. (2010). Factors influencing gender differences in smoking and their separate contributions: Evidence from South Korea. *Social Science &Amp; Medicine*, *70*(12), 1966–1973. https://doi.org/10.1016/j.socscimed.2010.02.025

[15] Corrigan, J. R., O'Connor, R. J., & Rousu, M. C. (2020). Which smokers adopt e-cigarettes and at what price? An experimental estimation of price elasticity of demand and factors correlated with e-cigarette adoption. *Addictive Behaviors*, *105*, 106324. https://doi.org/10.1016/j.addbeh.2020.106324

[16] Cotti, C. D., Courtemanche, C., Maclean, C., Nesson, E., Pesko, M., & Tefft, N. (2021). The Effects of E-Cigarette Taxes on E-Cigarette Prices and Tobacco Product Sales: Evidence from Retail Panel Data. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3856776

[17] Cotti, C., Nesson, E., & Tefft, N. (2018). The relationship between cigarettes and electronic cigarettes: Evidence from household panel data. *Journal of Health Economics*, *61*, 205–219. https://doi.org/10.1016/j.jhealeco.2018.08.001

[18] Crespi, F., Liberati, P., Paradiso, M., Scialà, A., & Tedeschi, S. (2021). Smokers are different: The impact of price increases on smoking reduction and downtrading. *Economic Modelling*, *97*, 326–334. https://doi.org/10.1016/j.econmod.2020.04.004

[19] Dave, D., Feng, B., & Pesko, M. F. (2019). The effects of e-cigarette minimum legal sale age laws on youth substance use. *Health Economics*, *28*(3), 419–436. https://doi.org/10.1002/hec.3854

[20] Dobson, R. (2004). Poor more likely to smoke and less likely to quit. *BMJ*, *328*(7445), 914.6. https://doi.org/10.1136/bmj.328.7445.914-e

[21] Ekpu, V. U., & Brown, A. K. (2015). The Economic Impact of Smoking and of Reducing Smoking Prevalence: Review of Evidence. *Tobacco Use Insights*, *8*, TUI.S15628. https://doi.org/10.4137/tui.s15628

[22] Franz, G. (2008). Price effects on the smoking behaviour of adult age groups. *Public Health*, *122*(12), 1343–1348. https://doi.org/10.1016/j.puhe.2008.05.019
Friedman, A. S., & Horn, S. J. L. (2018). Socioeconomic Disparities in Electronic Cigarette Use and Transitions from Smoking. *Nicotine & Tobacco Research*, *21*(10), 1363–1370. https://doi.org/10.1093/ntr/nty120

[23] Friedman, A. S. (2015). How does electronic cigarette access affect adolescent smoking? *Journal of Health Economics*, *44*, 300–308. https://doi.org/10.1016/j.jhealeco.2015.10.003

[24] Friedson, A., & Rees, D. I. (2020). Cigarette Taxes and Smoking in the Long Run. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3602428

[25] Gaiha, S. M., Duemler, A., Silverwood, L., Razo, A., Halpern-Felsher, B., & Walley, S. C. (2021). School-based e-cigarette education in Alabama: Impact on knowledge of e-cigarettes, perceptions and intent to try. *Addictive Behaviors*, *112*, 106519. https://doi.org/10.1016/j.addbeh.2020.106519

[26] Ganz, O., Johnson, A. L., Cohn, A. M., Rath, J., Horn, K., Vallone, D., & Villanti, A. C. (2018). Tobacco harm perceptions and use among sexual and gender minorities: findings from a national sample of young adults in the United States. *Addictive Behaviors*, *81*, 104–108. https://doi.org/10.1016/j.addbeh.2018.01.032

[27] Goel, R. K. (2014). Economic stress and cigarette smoking: Evidence from the United States. *Economic Modelling*, *40*, 284–289. https://doi.org/10.1016/j.econmod.2014.04.009

[28] Goldenson, N. I., Leventhal, A. M., Stone, M. D., McConnell, R. S., & Barrington-Trimis, J. L. (2017). Associations of Electronic Cigarette Nicotine Concentration With Subsequent Cigarette Smoking and Vaping Levels in Adolescents. *JAMA Pediatrics*, *171*(12), 1192. https://doi.org/10.1001/jamapediatrics.2017.3209

[29] Goniewicz, M. L., & Zielinska-Danch, W. (2012). Electronic Cigarette Use Among Teenagers and Young Adults in Poland. *Pediatrics*, *130*(4), e879–e885. https://doi.org/10.1542/peds.2011-3448

[30] Gorukanti, A., Delucchi, K., Ling, P., Fisher-Travis, R., & Halpern-Felsher, B. (2017). Adolescents' attitudes towards e-cigarette ingredients, safety, addictive properties, social norms, and regulation. *Preventive Medicine*, *94*, 65–71. https://doi.org/10.1016/j.ypmed.2016.10.019

[31] Harrell, P. T., Brandon, T. H., England, K. J., Barnett, T. E., Brockenberry, L. O., Simmons, V. N., & Quinn, G. P. (2019). Vaping Expectancies: A Qualitative Study among Young Adult Nonusers, Smokers, Vapers, and Dual Users. *Substance Abuse: Research and Treatment*, *13*, 117822181986621. https://doi.org/10.1177/1178221819866210

[32] Hartwell, G., Thomas, S., Egan, M., Gilmore, A., & Petticrew, M. (2016). E-cigarettes and equity: a systematic review of differences in awareness and use between sociodemographic groups. *Tobacco Control*, *26*(e2), e85–e91. https://doi.org/10.1136/tobaccocontrol-2016-053222

[33] Heckman, B. W., Fong, G. T., Borland, R., Hitchman, S., O'Connor, R. J., Bickel, W. K., Stein, J. S., Yong, H., Nahhas, G. J., Pope, D. A., Shang, C., Cheng, K., Levy, D. T., & Cummings, K. M. (2019). The impact of vaping and regulatory environment on cigarette demand: behavioral economic perspective across four countries. *Addiction*, *114*(S1), 123–133. https://doi.org/10.1111/add.14538

[34] Heckman, J. J. (1976). The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models. Annals of Economic and Social Measurement, 5(4), 475–492.

[35] Huang, J., Tauras, J., & Chaloupka, F. J. (2014). The impact of price and tobacco control policies on the demand for electronic nicotine delivery systems. *Tobacco Control*, *23*(suppl 3), iii41–iii47. https://doi.org/10.1136/tobaccocontrol-2013-051515

[36] Huijie Li, Yunping Zhou, Suyun Li, Qiang Wang, Lulu Pan, Xiaorong Yang, Nan Zhang, Fan Jiang, Mingkui Han, & Chongqi Jia. (2015). The Relationship between Nicotine Dependence and Age among Current Smokers. *Iranian Journal of Public Health*, *44*(4), 495–500.

[37] Islam, T., Meade, N., Carson, R. T., Louviere, J. J., & Wang, J. (2022). The usefulness of socio-demographic variables in predicting purchase decisions: Evidence from machine learning

procedures. *Journal of Business Research*, *151*, 324–338. https://doi.org/10.1016/j.jbusres.2022.07.004

[38] Jahnel, T., Ferguson, S. G., Partos, T., & Brose, L. S. (2020). Socioeconomic differences in the motivation to stop using e-cigarettes and attempts to do so. *Addictive Behaviors Reports*, *11*, 100247. https://doi.org/10.1016/j.abrep.2020.100247

[39] Jiajian Chen, & Millar Wj. (1998). Age of smoking initiation: implications for quitting. *Health Reports*, *9*(4), 39-48(Fre). https://pubmed.ncbi.nlm.nih.gov/9836879/

[40] Jin, H. J., & Cho, S. M. (2021). Effects of cigarette price increase on fresh food expenditures of low-income South Korean households that spend relatively more on cigarettes. *Health Policy*, *125*(1), 75–82. https://doi.org/10.1016/j.healthpol.2020.08.004

[41] Johnson, M. W., Johnson, P. S., Rass, O., & Pacek, L. R. (2017). Behavioral economic substitutability of e-cigarettes, tobacco cigarettes, and nicotine gum. *Journal of Psychopharmacology*, *31*(7), 851–860. https://doi.org/10.1177/0269881117711921

[42] Jun, J., & Kim, J. K. (2020). Do state regulations on e-cigarettes have impacts on the e-cigarette prevalence? *Tobacco Control*, *30*(2), 221–226. https://doi.org/10.1136/tobaccocontrol-2019-055287

[43] Kalkhoran, S., & Glantz, S. A. (2016). E-cigarettes and smoking cessation in real-world and clinical settings: a systematic review and meta-analysis. *The Lancet Respiratory Medicine*, *4*(2), 116–128. https://doi.org/10.1016/s2213-2600(15)00521-4

[44] Kalkhoran, S. M., Levy, D. E., & Rigotti, N. A. (2022). Smoking and E-Cigarette Use Among U.S. Adults During the COVID-19 Pandemic. *American Journal of Preventive Medicine*, *62*(3), 341–349. https://doi.org/10.1016/j.amepre.2021.08.018

[45] Kilic, D., & Ozturk, S. (2014). Gender differences in cigarette consumption in Turkey: Evidence from the Global Adult Tobacco Survey. *Health Policy*, *114*(2–3), 207–214. https://doi.org/10.1016/j.healthpol.2013.05.019

[46] Kong, G., Bold, K. W., Cavallo, D. A., Davis, D. R., Jackson, A., & Krishnan-Sarin, S. (2021). Informing the development of adolescent e-cigarette cessation interventions: A qualitative study. *Addictive Behaviors*, *114*, 106720. https://doi.org/10.1016/j.addbeh.2020.106720

[47] Leinsalu, M., Kaposvári, C., & Kunst, A. E. (2011). Is income or employment a stronger predictor of smoking than education in economically less developed countries? A cross-sectional study in Hungary. *BMC Public Health*, *11*(1). https://doi.org/10.1186/1471-2458-11-97

[48] Lippert, A. M. (2015). Do Adolescent Smokers Use E-Cigarettes to Help Them Quit? The Sociodemographic Correlates and Cessation Motivations of U.S. Adolescent E-Cigarette Use. *American Journal of Health Promotion*, *29*(6), 374–379. https://doi.org/10.4278/ajhp.131120-quan-595

[49] Li, W., Vargas-Rivera, M., Eissenberg, T. E., Shihadeh, A., Talih, S., & Maziak, W. (2022). Effect of menthol/mint-flavored pods on young JUUL E-cigarette users' subjective experience, puffing behavior, and nicotine exposure: A pilot study. *Drug and Alcohol Dependence*, *237*, 109516. https://doi.org/10.1016/j.drugalcdep.2022.109516

[50] Loomis, B. R., Rogers, T., King, B. A., Dench, D. L., Gammon, D. G., Fulmer, E. B., & Agaku, I. T. (2016). National and State-Specific Sales and Prices for Electronic Cigarettes—U.S., 2012–2013. *American Journal of Preventive Medicine*, *50*(1), 18–29. https://doi.org/10.1016/j.amepre.2015.05.003

[51] Madden, D. (2008). Sample selection versus two-part models revisited: The case of female smoking and drinking. *Journal of Health Economics*, *27*(2), 300–307. https://doi.org/10.1016/j.jhealeco.2007.07.001

[52] Mantey, D. S., Chido-Amajuoyi, O. G., Omega-Njemnobi, O., & Montgomery, L. (2021). Cigarette smoking frequency, quantity, dependence, and quit intentions during adolescence: Comparison of menthol and non-menthol smokers (National Youth Tobacco Survey 2017–2020). *Addictive Behaviors*, *121*, 106986. https://doi.org/10.1016/j.addbeh.2021.106986

[53] Martín Álvarez, J., Golpe, A., Iglesias, J., & Ingelmo, R. (2020). Price and income elasticities of demand for cigarette consumption: what is the association of price and economic activity with cigarette consumption in Spain from 1957 to 2016? *Public Health*, *185*, 275–282. https://doi.org/10.1016/j.puhe.2020.05.059

[54] Martire, K. A., Clare, P., Courtney, R. J., Bonevski, B., Boland, V., Borland, R., Doran, C. M., Farrell, M., Hall, W., Iredale, J. M., Siahpush, M., & Mattick, R. P. (2017). Smoking and finances: baseline characteristics of low income daily smokers in the FISCALS cohort. *International Journal for Equity in Health*, *16*(1). https://doi.org/10.1186/s12939-017-0643-6

[55] Marynak, K. L., Gammon, D. G., King, B. A., Loomis, B. R., Fulmer, E. B., Wang, T. W., & Rogers, T. (2017). National and State Trends in Sales of Cigarettes and E-Cigarettes, U.S., 2011–2015. *American Journal of Preventive Medicine*, *53*(1), 96–101. https://doi.org/10.1016/j.amepre.2017.01.016

[56] Mathur Gaiha, S., Halpern-Felsher, B., Feld, A. L., Gaber, J., Rogers, T., & Henriksen, L. (2021). JUUL and other e-cigarettes: Socio-demographic factors associated with use and susceptibility in California. *Preventive Medicine Reports*, *23*, 101457. https://doi.org/10.1016/j.pmedr.2021.101457

[57] Meernik, C., Baker, H. M., Kowitt, S. D., Ranney, L. M., & Goldstein, A. O. (2019). Impact of non-menthol flavours in e-cigarettes on perceptions and use: an updated systematic review. *BMJ Open*, *9*(10), e031598. https://doi.org/10.1136/bmjopen-2019-031598

[58] Merz, W., Magraner, J., Gunge, D., Advani, I., Crotty Alexander, L. E., & Oren, E. (2022). Electronic cigarette use and perceptions during COVID-19. *Respiratory Medicine*, *200*, 106925. https://doi.org/10.1016/j.rmed.2022.106925

[59] Noland, M., Rayens, M. K., Wiggins, A. T., Huntington-Moskos, L., Rayens, E. A., Howard, T., & Hahn, E. J. (2017a). Current Use of E-Cigarettes and Conventional Cigarettes Among US High School Students in Urban and Rural Locations: 2014 National Youth Tobacco Survey. *American Journal of Health Promotion*, *32*(5), 1239–1247. https://doi.org/10.1177/0890117117719621

[60] Orleans, C. T. (2007). Increasing the Demand for and Use of Effective Smoking-Cessation Treatments. *American Journal of Preventive Medicine*, *33*(6), S340–S348. https://doi.org/10.1016/j.amepre.2007.09.003

[61] Park, S. H., Duncan, D. T., Shahawy, O. E., Lee, L., Shearston, J. A., Tamura, K., Sherman, S. E., & Weitzman, M. (2017). Characteristics of Adults Who Switched From Cigarette Smoking to E-cigarettes. *American Journal of Preventive Medicine*, *53*(5), 652–660. https://doi.org/10.1016/j.amepre.2017.06.033

[62] Perelman, J., Alves, J., Pfoertner, T. K., Moor, I., Federico, B., Kuipers, M. A. G., Richter, M., Rimpela, A., Kunst, A. E., & Lorant, V. (2017). The association between personal income and smoking among adolescents: a study in six European cities. *Addiction*, *112*(12), 2248–2256. https://doi.org/10.1111/add.13930

[63] Pesko, M., Courtemanche, C., & Maclean, C. (2020). The Effects of Traditional Cigarette and E-Cigarette Tax Rates on Adult Tobacco Product Use. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3844276

[64] Pisinger, C., & Døssing, M. (2014). A systematic review of health effects of electronic cigarettes. *Preventive Medicine*, *69*, 248–260. https://doi.org/10.1016/j.ypmed.2014.10.009

[65] Plurphanswat, N., Kaestner, R., & Rodu, B. (2017). The Effect of Smoking on Mental Health. *American Journal of Health Behavior*, *41*(4), 471–483. https://doi.org/10.5993/ajhb.41.4.12

[66] Pokhrel, P., Fagan, P., Little, M. A., Kawamoto, C. T., & Herzog, T. A. (2013). Smokers Who Try E-Cigarettes to Quit Smoking: Findings From a Multiethnic Study in Hawaii. *American Journal of Public Health*, *103*(9), e57–e62. https://doi.org/10.2105/ajph.2013.301453

[67] Rapp, J. L., Alpert, N., Wilson, K. M., Flores, R. M., & Taioli, E. (2021). Changes in E-Cigarette Perceptions Over Time: A National Youth Tobacco Survey Analysis. *American Journal of Preventive Medicine*, *61*(2), 174–181. https://doi.org/10.1016/j.amepre.2021.03.006

[68] Ronchetti, J., & Terriau, A. (2021). Help me quit smoking but don't make me sick! The controversial effects of electronic cigarettes on tobacco smokers. *Social Science & Medicine*, *274*, 113770. https://doi.org/10.1016/j.socscimed.2021.113770

[69] Rousu, M. C., Marette, S., Thrasher, J. F., & Lusk, J. L. (2014). The economic value to smokers of graphic warning labels on cigarettes: Evidence from combining market and experimental auction data. *Journal of Economic Behavior & Organization*, *108*, 123–134. https://doi.org/10.1016/j.jebo.2014.09.003

[70] Sanders-Jackson, A., Schleicher, N. C., Fortmann, S. P., & Henriksen, L. (2015). Effect of warning statements in e-cigarette advertisements: an experiment with young adults in the United States. *Addiction*, *110*(12), 2015–2024. https://doi.org/10.1111/add.12838

[71] Sapru, S., Vardhan, M., Li, Q., Guo, Y., Li, X., & Saxena, D. (2020). E-cigarettes use in the United States: reasons for use, perceptions, and effects on health. *BMC Public Health*, *20*(1). https://doi.org/10.1186/s12889-020-09572-x

[72] Schneider, S., & Diehl, K. (2015). Vaping as a Catalyst for Smoking? An Initial Model on the Initiation of Electronic Cigarette Use and the Transition to Tobacco Smoking Among Adolescents. *Nicotine & Tobacco Research*, *18*(5), 647–653. https://doi.org/10.1093/ntr/ntv193

[73] Shah, A., Pharm, M., & Pharm, B. (2017). E-cigarettes and Smoking Cessation: Economic Impact on Current Smokers with Chronic Obstructive Pulmonary Disease. https://scholarscompass.vcu.edu/cgi/viewcontent.cgi?article=6086&context=etd

[74] Siahpush, M., Borland, R., & Scollo, M. (2003, March 01). Smoking and financial stress. Retrieved May 19, 2022, from https://tobaccocontrol.bmj.com/content/12/1/60

[75] Smethells, J. R., Harris, A. C., Burroughs, D., Hursh, S. R., & LeSage, M. G. (2018). Substitutability of nicotine alone and an electronic cigarette liquid using a concurrent choice assay in rats: A behavioral economic analysis. *Drug and Alcohol Dependence*, *185*, 58–66. https://doi.org/10.1016/j.drugalcdep.2017.12.008

[76] Smith, T. T., Sved, A. F., Hatsukami, D. K., & Donny, E. C. (2014). Nicotine reduction as an increase in the unit price of cigarettes: A behavioral economics approach. *Preventive Medicine*, *68*, 23–28. https://doi.org/10.1016/j.ypmed.2014.07.005

[77] Smith, T. T., Wahlquist, A. E., Heckman, B. W., Cummings, K. M., & Carpenter, M. J. (2018). Impact of E-cigarette Sampling on Cigarette Dependence and Reinforcement Value. *Nicotine & Tobacco Research*, *22*(2), 297–301. https://doi.org/10.1093/ntr/nty258

[78] Snider, S. E., Cummings, K. M., & Bickel, W. K. (2017). Behavioral economic substitution between conventional cigarettes and e-cigarettes differs as a function of the frequency of e-cigarette use. *Drug and Alcohol Dependence*, *177*, 14–22. https://doi.org/10.1016/j.drugalcdep.2017.03.017

[79] Stallings-Smith, S., & Ballantyne, T. (2019). Ever Use of E-Cigarettes Among Adults in the United States: A Cross-Sectional Study of Sociodemographic Factors. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, *56*, 004695801986447. https://doi.org/10.1177/0046958019864479

[80] Tamayo, R. L. (2021). Factors associated with the intention to continue using tobacco among adolescents: A secondary analysis of the 2015 Global Youth Tobacco Survey in the Philippines. *Population Medicine*, *3*(November), 1–6. https://doi.org/10.18332/popmed/143526

[81] Tokle, R., Brunborg, G. S., & Vedøy, T. F. (2021). Adolescents' Use of Nicotine-Free and Nicotine E-Cigarettes: A Longitudinal Study of Vaping Transitions and Vaper Characteristics. *Nicotine & Tobacco Research*, *24*(3), 400–407. https://doi.org/10.1093/ntr/ntab192

[82] Varona-Perez, P., Bridges, S., Lorenzo-Vazquez, E., Suarez-Medina, R., Venero-Fernandez, S. J., Langley, T., Britton, J., & Fogarty, A. (2019). What is the association between price and economic activity with cigarette consumption in Cuba from 1980 to 2014? *Public Health*, *173*, 126–129. https://doi.org/10.1016/j.puhe.2019.05.014

[83] Walker, N., Parag, V., Wong, S. F., Youdan, B., Broughton, B., Bullen, C., & Beaglehole, R. (2020). Use of e-cigarettes and smoked tobacco in youth aged 14–15 years in New Zealand: findings from repeated cross-sectional studies (2014–19). *The Lancet Public Health*, *5*(4), e204–e212. https://doi.org/10.1016/s2468-2667(19)30241-5

[84] Wipfli, H., Bhuiyan, M. R., Qin, X., Gainullina, Y., Palaganas, E., Jimba, M., Saito, J., Ernstrom, K., Raman, R., & Withers, M. (2020). Tobacco use and E-cigarette regulation: Perspectives of University Students in the Asia-Pacific. *Addictive Behaviors*, *107*, 106420. https://doi.org/10.1016/j.addbeh.2020.106420

[85] Wong, L. P., Mohamad Shakir, S. M., Alias, H., Aghamohammadi, N., & Hoe, V. C. (2016). Reasons for Using Electronic Cigarettes and Intentions to Quit Among Electronic Cigarette Users in Malaysia. *Journal of Community Health*, *41*(6), 1101–1109. https://doi.org/10.1007/s10900-016-0196-4

[86] Yao, T., Sung, H. Y., Huang, J., Chu, L., St. Helen, G., & Max, W. (2020). The impact of e-cigarette and cigarette prices on e-cigarette and cigarette sales in California. *Preventive Medicine Reports*, *20*, 101244. https://doi.org/10.1016/j.pmedr.2020.101244