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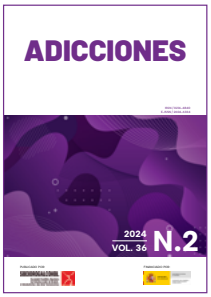

ORIGINAL

Association between e-cigarette and conventional cigarette use among Spanish adolescents

Asociación entre el uso de cigarrillos electrónicos y cigarrillos convencionales en adolescentes españoles

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Abstract

In recent years, studies have highlighted the upward trend in electronic cigarette use among adolescents, as well as the potential of e-cigarette use to lead to subsequent conventional cigarette use. The study's aims were two-fold: 1) to examine the progression from e-cigarette use to conventional cigarette use; and 2) to analyze the differences in the severity of smoking pattern among dual users (i.e., e-cigarette and conventional cigarette use), cigarette-only smokers, and e-cigarette-only users in a Spanish adolescent population. Data were obtained from the ESTUDES, a representative survey of addictive behaviors of Spanish adolescents aged 14-18, which was comprised of 38,010 adolescents (M_{age} = 15.69; *SD* = 1.19; 51.35% females). Results indicate that lifetime e-cigarette use increased the prevalence of subsequent conventional cigarette use by 1.86 times (95% CI 1.74, 1.99), and the prevalence of conventional cigarette use in the last month by 2.38 times (95% CI 2.19, 2.58), independently of whether the e-cigarette contains nicotine or not. Dual users showed a higher percentage of daily smokers, and a greater number of cigarettes per day, a higher use of e-cigarettes with nicotine, and an earlier age of smoking onset. Regarding risk perception, e-cigarette-only users perceived both conventional tobacco and e-cigarettes as less harmful (all *p*-values < .001). These findings document the strength of association between e-cigarette and conventional cigarettes, and underscore the importance of developing legal restrictions and prevention strategies aimed at reducing e-cigarette use, which in turn would reduce tobacco use.

Keywords: e-cigarette, conventional cigarettes, nicotine, adolescents

Resumen

En los últimos años, algunos estudios han destacado la tendencia ascendente en el uso del cigarrillo electrónico entre adolescentes, así como el potencial para el posterior consumo de cigarrillos convencionales. Este estudio tuvo dos objetivos: 1) examinar la progresión del cigarrillo electrónico al cigarrillo convencional; y 2) analizar las diferencias en el patrón de gravedad del tabaquismo entre consumidores duales (i.e., cigarrillos electrónicos y convencionales), fumadores de cigarrillos y consumidores de cigarrillos electrónicos. Los datos se obtuvieron de la encuesta ESTUDES, una encuesta nacional que recoge información de conductas adictivas en adolescentes entre 14 y 18 años, la cual consta de 38 010 personas (M_{edad} = 15,69; *DT* = 1,19; 51,35% mujeres). Los resultados indicaron que haber usado alguna vez un cigarrillo electrónico incrementó la probabilidad de un consumo posterior de cigarrillos 1,86 veces (IC 95% 1,74-1,99), y la probabilidad de consumir tabaco en el último mes 2,38 veces (IC 95% 2,19-2,58), independientemente de si los cigarrillos electrónicos contienen o no nicotina. Los consumidores duales mostraron un mayor porcentaje de fumadores diarios, un mayor número de cigarrillos al día, un mayor uso de cigarrillos electrónicos con nicotina y una edad de inicio más temprana. Con respecto a la percepción de riesgo, los adolescentes que han usado solo cigarrillos electrónicos percibían tanto el tabaco como los cigarrillos electrónicos como menos dañinos (todos los valores *p* < ,001). Estos hallazgos indican la fuerte asociación entre los cigarrillos electrónicos y los convencionales, y subrayan la importancia de desarrollar restricciones legales y estrategias preventivas dirigidas al cigarrillo electrónico, lo que reduciría a su vez el consumo de tabaco.

Palabras clave: cigarrillo electrónico, cigarrillo convencional, nicotina, adolescentes

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The use of electronic nicotine delivery systems, including electronic cigarettes (e-cigarettes), has increased rapidly in recent years both among adults and adolescents (Cerrai, Potente, Gorini, Gallus & Molinaro, 2020; McNeill, Brose, Calder, Bauld & Robson, 2020; National Drugs Plan [PNSD], 2018; World Health Organization, 2020). This rise in prevalence of e-cigarette is also observed among Spanish adolescents, given that it has increased nearly three-fold in four years, from 17% in 2014 to 48.4% in 2018, surpassing the prevalence of conventional cigarette use (PNSD, 2018).

Previous studies have shown that e-cigarette use is associated with a significant increased risk of initiating conventional cigarette use among non-smoking adolescents and young adults (Baenziger, Ford, Yazidjoglou, Joshy & Banks, 2021; Chan et al., 2020; Chatterjee, Alzghoul, Innabi & Meena, 2018; Khouja, Suddell, Peters, Taylor & Munafò, 2021; Loukas, Marti & Harrell, 2022; Soneji et al., 2017). This finding was consistent when adjusting for several characteristics, including sociodemographic and tobacco-use-related variables (Bold et al., 2018; Hansen, Hanewinkel & Morgenstern, 2020). Results also indicate that adolescents who ever use e-cigarettes have between 2.44 and 10.93 times higher prevalence of future smoking initiation (Baenziger et al., 2021; Chan et al., 2020; Hair et al., 2021; Hansen et al., 2020; Khouja et al., 2021; O'Brien et al., 2021; Owotomo, Stritzel, McCabe, Boyd & Maslowsky, 2020; Soneji et al., 2017; Stanton et al., 2019), and that 30.7% - 44.4% of non-smokers who use e-cigarettes started using tobacco long-term, compared to 8.1% - 10.8% among non-users of e-cigarettes (Chatterjee et al., 2018; Martinelli et al., 2021).

Research supporting the association between e-cigarettes and conventional cigarettes have been based mainly on US population, with the almost absence of studies evaluating this pattern in other countries, including Spanish, where the regulatory context of e-cigarettes differs from other countries (Boletín Oficial del Estado, 2017), also from the European Union (European Union Tobacco Products Directive 2014/40/EU). The analysis of the association between e-cigarettes and conventional cigarettes accros different countries is particularly important because country-specific factors, such as legislation, taxation, social norms and public opinion, may affect this association (Khouja et al., 2021).

We sought to build on prior work by drawing on data from the Survey on Drug Use in Secondary Education (ESTUDES), a large nationally representative study of the Spanish adolescent population. The aims of this study were to: 1) examine the risk of progression to conventional cigarette use among adolescents with lifetime history of e-cigarette use; and 2) analyze the differences in the severity of smoking pattern among dual users (i.e., e-cigarette and cigarette smokers), cigarette-only smokers, and e-cigarette-only users. The indicators of severity of smoking pattern are characteristics (i.e., cigarettes per day, being daily smoker, age of smoking onset, and risk perception) associated with lower probability of intention to quit smoking, and of achieving smoking cessation, as well as, higher likelihood of being a smoker in adulthood (see e.g., Dai, 2021; Greenhalgh, Jenkins Stillman & Ford, 2016; Hamzeh et al., 2020; Hasin et al., 2013).

Method

Participants and procedure

The ESTUDES is based on a representative sample of adolescents aged from 14 to 18 years old in Spain. The survey is anonymous, self-administered and a paper-and-pencil assessment, and its duration was approximately 45-60 minutes. The participants were students enrolled in 3rd and 4th years of secondary education (i.e., 15 and 16 years old), 1st and 2nd years of baccalaureate level (i.e., 17 and 18 years old), or 1st and 2nd years of basic and intermediate vocational training. Details on ESTUDES survey methodology and procedures are available elsewhere (PNSD, 2018).

The total sample was comprised of 38,010 adolescents (M_{age} = 15.69; *SD* = 1.188; 51.35% females). A total of 52.90% of participants were enrolled in secondary education, 35.51% in baccalaureate and the remaining 11.58% in vocational training. The sample was taken from 917 educational centers (68.44% public schools), and 1,769 classrooms, representative of the entire national territory.

Measures

Information relative to participants was collected retrospectively. Specifically, adolescents completed the survey that included sociodemographic measures on age, sex and academic year. Additionally, they were asked about the pattern of use of both conventional cigarettes and e-cigarettes. Specifically, students were asked about their lifetime, last month and daily use of conventional cigarette, as well as the age of smoking onset and the number of cigarettes smoked per day. Regarding e-cigarette use, participants were asked about the use in their lifetime, the age of e-cigarette use onset, and if the e-cigarette cartridges contain or not nicotine.

Also, risk perception of smoking 20 cigarettes per day, and of using e-cigarette sometimes was collected. Responses were coded in two categories, "few or no problems" and "quite a few or several problems".

Data analysis

In order to examine the relationship between e-cigarette use (both with and without nicotine) and tobacco use, several binary regression models were conducted. Prevalence ratio (PR) and its confidence intervals at 95% were calculated following prior recommendations (Espelt, Bosque-Prous & Marí-Dell'Olmo, 2019). The analyses were

adjusted by participants' sociodemographic characteristics, specifically sex and age.

Differences in the severity of smoking pattern among dual users (i.e., both e-cigarette and conventional cigarette smokers), conventional cigarettes-only smokers, and e-cigarette-only users were analyzed using ANOVA for continuous variables (i.e., cigarettes per day and age of smoking onset) and chi-square in categorical variable (i.e., daily smokers, type of e-cigarette cartridges, and risk perception). Effect size was calculated using Cohen's *d*, phi coefficient, and Cramer's V, as appropriate.

All analyses were conducted using the statistical package SPSS for Windows (version 24, SPSS, Inc., Chicago, IL, USA), with 95% of confidence interval.

Results

Risk of progression from e-cigarette use to conventional cigarette use

A total of 45.79% (n = 4,533) of dual users (i.e., those who used both e-cigarettes and conventional cigarettes in their lifetime) smoked conventional cigarettes firstly and subsequently e-cigarettes, 19.70% (n = 1,950) used e-cigarettes before and cigarettes later, and the remaining 34.50% (n = 3,415) started at the same age in both.

Results indicated that 25.08% (n = 1,950) of lifetime e-cigarette users progressed to conventional cigarette use, compared to 17.47% (n = 3,616) of non-e-cigarette users that later smoked. E-cigarette use increased 1.48 times the prevalence of subsequent lifetime conventional cigarette use, as well as 2.21 times the prevalence of last month conventional cigarette use (see Table 1).

Considering only those adolescents who initially used e-cigarettes, the 18.80% (n = 1,356) used e-cigarettes with nicotine, and 81.19% (n = 5,826) without nicotine. Using e-cigarettes with nicotine increased 2.64 times the prevalence of being a lifetime cigarette smoker (4.54 times subsequent last month cigarette use), whereas using e-cigarettes without nicotine increased 1.22 times the prevalence of later smoking (1.73 times subsequent last month cigarette use) (see Table 1).

Differences in the severity of smoking pattern among dual users, cigarette-only smokers, and e-cigarette-only users

Participants who have ever smoked both e-cigarettes and conventional cigarettes are mostly daily smokers, smoke a greater number of cigarettes per day, mostly use e-cigarettes with nicotine, and initiated smoking –either e-cigarette or conventional cigarette– almost a year earlier. Regarding with risk perception, e-cigarettes-only users perceived both tobacco and e-cigarette as less harmful, compared to cigarette-only smokers and dual users (see Table 2).

Discussion

This is the first study examining the relationship between e-cigarette use and conventional cigarette use among a nationally representative sample of Spanish adolescents. The main outcomes underline that the use of e-cigarettes increased by 48% the prevalence of progression to lifetime conventional cigarette use, and by 121% the prevalence of progression to last month conventional cigarette use, independently of whether the e-cigarette contains nicotine or not. Further, dual users (i.e., e-cigarettes and conventional cigarettes) were mostly daily smokers, smoke a greater number of cigarettes per day, use mostly e-cigarettes with nicotine, and initiate smoking –either e-cigarettes or conventional cigarettes– almost a year earlier. Conversely, e-cigarette-only users showed a lower risk perception from tobacco and e-cigarettes.

These findings are in agreement with previous research (see e.g., Baenziger et al., 2021; Chadi, Hadland & Harris, 2019; Chan et al., 2020; Epstein et al., 2021; Hair et al., 2021; Hansen et al., 2020; Khouja et al., 2021; Owotomo et al., 2020; Soneji et al., 2017; Stanton et al., 2019; Walley, Wilson, Winickoff & Groner, 2019), which evidences that e-cigarette use significantly increases the probability of progression to conventional cigarette use among non-smokers. Several complementary reasons from the biochemical, behavioral and environmental aspects may contribute to explain this progression. Regular e-cigarette use with nicotine content leads to a nicotine

Table 1
Relationship between e-cigarette and subsequent conventional cigarette use adjusted by participants' sex and age

	Subsequent lifetime cigarette use	Subsequent last month cigarette use
E-cigarette use[a]	1,950 (7,774)	1,216 (8,230)
No e-cigarette use[a]	3,616 (20,689)	1,615 (20,497)
	RP = 1.48 (IC 95% 1.41, 1.55)	*RP* = 2.21 (IC 95% 2.06, 2.37)
E-cigarette with nicotine[a]	735 (1,356)	522 (1,443)
No e-cigarette use[a]	3,616 (20,689)	1,615 (20,497)
	RP = 2.64 (IC 95% 2.50, 2.79)	*RP* = 4.54 (IC 95% 4.20, 4.91)
E-cigarette without nicotine[a]	1,124 (5,826)	646 (6,114)
No e-cigarette use[a]	3,616 (20,689)	1,615 (20,497)
	RP = 1.22 (IC 95% 1.15, 1.29)	*RP* = 1.73 (IC 95% 1.59, 1.88)

Note. [a]frequency (total); PR = prevalence ratio; CI = confidence interval.

Table 2
Differences between dual users, cigarette-only users, and e-cigarettes-only users

	Dual users[b] (*n* = 11,226)	Cigarette-only users (*n* = 3,616)	E-cigarettes-only users (*n* = 5,824)	*p*-value	Effect size
Daily smokers	2,738 (24.38%)	416 (11.50%)	-	< .001	.31
Age of smoking onsetac	13.77 (1.61)	14.69 (1.48)	14.45 (1.34)	< .001	.51
Cigarettes per daya	5.96 (5.14)	4.97 (4.65)	-	< .001	.01
Type of e-cigarette cartridge (with nicotine)	4,315 (38.43%)	-	621 (10.66%)	< .001	.31
Risk perception of e-cigarette use (several health problems)	1,143 (10.18%)	497 (13.74%)	467 (8.02%)	< .001	.09
Risk perception of cigarette use (several health problems)	9,315 (82.98%)	3,116 (86.17%)	4,748 (81.52%)	< .001	.05

Note. [a]Mean (standard deviation). [b]Dual users refers to those participants who ever use e-cigarettes and conventional cigarettes. cSmoking refers to either e-cigarette use or conventional cigarette use.

dependence (Case et al., 2018; Hammond et al., 2021), and smokers switch to tobacco in order to obtain nicotine more immediately (Grana, Benowitz & Glantz, 2014; O'Connell et al., 2019). The fact that even e-cigarettes without nicotine increased subsequent cigarette use can be explained because both share the same mimetic, that is, hand-to-mouth movements, puffing and exhaling smoke (Caponnetto et al., 2013, 2017; Park et al., 2020).

The second finding was that adolescents who ever used both e-cigarettes and conventional cigarettes showed greater severity of smoking pattern than adolescents who only used conventional cigarettes or e-cigarettes. These outcomes are aligned with previous research, which consistently shows that dual users have a more prevalent daily use (Conner et al., 2019), smoke more cigarettes per day (Wang et al., 2018), use mostly e-cigarette with nicotine cartridges (Dai, 2021), and engage earlier in smoking behavior (Conner et al., 2021). This smoking pattern could be explained by several reasons. Dual users tend to greater nicotine dependence (Shiffman & Sembower, 2020), and e-cigarette use provides less nicotine compared to conventional cigarettes (Grana et al., 2014), resulting in more daily smokers and in a greater number of cigarettes per day. Finally, as with other substances, earlier drug use is a strong predictor of more severe use (Pilatti, Read & Pautassi, 2017), as our results show.

Taken together, these results suggest a strength of association between e-cigarettes and conventional cigarettes. One potential policy implication is that legal changes and preventive strategies that target e-cigarette use may be effective in reducing conventional tobacco use among adolescents. Our findings, therefore, highlight the need to enact regulation policies that reduce the availability of e-cigarettes in Spain, such as the prohibition of flavors in refillable cartridges, the equalization of taxes on all tobacco products, the prohibition of consumption in enclosed or semi-enclosed public places, and the regulation of the advertising, promotion and sponsorship. Our findings also underscore the importance of developing prevention and treatment strategies directed at curtailing e-cigarette use in this population.

Our study is not exempt of limitations common to most large-scale surveys. First, although studies of retrospective nature are appropriate for this type of analysis, a prospective study would be more robust to confirm the current findings. Second, we focused on adolescents who started using e-cigarettes before using conventional cigarettes or vice versa, so it may not be possible to generalize our results to those who start using conventional cigarettes and e-cigarettes at the same age. Third, the type of e-cigarette used by adolescents (e.g., heated tobacco products), as well as the frequency of vaping was not specified. Finally, those adolescents who were not schooled were not included in the survey, thus, these findings cannot be extrapolated to all Spanish adolescents aged 14-18.

Despite these limitations, our study extends previous findings by documenting for the first time in a representative sample of Spanish adolescents, that e-cigarette use is related to an increased risk of subsequent conventional cigarette use, regardless of whether cartridges contain nicotine or not. Also, dual users showed greater severity of smoking pattern, evidenced by a higher number of daily smokers, cigarettes per day, a greater use of e-cigarettes with nicotine, and lower age of smoking onset. There is a need to consider the health benefits of changes in e-cigarette regulation that reduce access to these devices, and the development of prevention and intervention efforts targeted at adolescent e-cigarette users.

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Contributors

GAD: conceptualization, formal analysis, methodology, writing-original draft. RSV: conceptualization, writing original draft. AGP: conceptualization, formal analysis, methodology. SW: editing, writing-review, supervision. JRFH: writing-review, supervision.

Conflict of interests

None declared.

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References

Baenziger, O. N., Ford, L., Yazidjoglou, A., Joshy, G. & Banks, E. (2021). E-cigarette use and combustible tobacco cigarette smoking uptake among non-smokers, including relapse in former smokers: Umbrella review, systematic review and meta-analysis. *BMJ Open*, *11*, 1–11. doi:10.1136/bmjopen-2020-045603.

Bold, K. W., Kong, G., Camenga, D. R., Simon, P., Cavallo, D. A., Morean, M. E. & Krishnan-Sarin, S. (2018). Trajectories of e-cigarette and conventional cigarette use among youth. *Pediatrics*, *141*. doi:10.1542/peds.2017-1832.

Boletin Oficial del Estado (2017). *Real Decreto 579/2017, por el que se regulan determinados aspectos relativos a la fabricación, presentación y comercialización de los productos del tabaco y los productos relacionados.* https://www.boe.es/boe/dias/2017/06/10/pdfs/BOE-A-2017-6585.pdf.

Caponnetto, P., Maglia, M., Cannella, M. C., Inguscio, L., Buonocore, M., Scoglio, C.,… Vinci, V. (2017). Impact of different e-cigarette generation and models on cognitive performances, craving and gesture: A randomized cross-over trial (CogEcig). *Frontiers in Psychology*, *8*, 127. doi:10.3389/fpsyg.2017.00127.

Caponnetto, P., Russo, C., Bruno, C. M., Alamo, A., Amaradio, M. D. & Polosa, R. (2013). Electronic cigarette: A possible substitute for cigarette dependence. *Monaldi Archives for Chest Disease - Pulmonary Series*, *79*, 12–19. doi:10.4081/monaldi.2013.104.

Case, K. R., Mantey, D. S., Creamer, M. L. R., Harrell, M. B., Kelder, S. H. & Perry, C. L. (2018). E-cigarette-specific symptoms of nicotine dependence among Texas adolescents. *Addictive Behaviors*, *84*, 57–61. doi:10.1016/j.addbeh.2018.03.032.

Cerrai, S., Potente, R., Gorini, G., Gallus, S. & Molinaro, S. (2020). What is the face of new nicotine users? 2012–2018 e-cigarettes and tobacco use among young students in Italy. *International Journal of Drug Policy*, *86*, 102941. doi:10.1016/j.drugpo.2020.102941.

Chadi, N., Hadland, S. E. & Harris, S. K. (2019). Understanding the implications of the "vaping epidemic" among adolescents and young adults: A call for action. *Substance Abuse*, *40*, 7–10. doi:10.1080/08897077.2019.1580241.

Chan, G. C. K., Stjepanović, D., Lim, C., Sun, T., Shanmuga Anandan, A., Connor, J. P.,… Leung, J. (2020). Gateway or common liability? A systematic review and meta-analysis of studies of adolescent e-cigarette use and future smoking initiation. *Addiction*, *116*, 743–756. doi:10.1111/add.15246.

Chatterjee, K., Alzghoul, B., Innabi, A. & Meena, N. (2018). Is vaping a gateway to smoking: A review of the longitudinal studies. *International Journal of Adolescent Medicine and Health*, *30*. doi:10.1515/ijamh-2016-0033.

Conner, M., Grogan, S., Simms-Ellis, R., Cowap, L., Armitage, C. J., West, R.,… Siddiqi, K. (2021). Association between age at first reported e-cigarette use and subsequent regular e-cigarette, ever cigarette and regular cigarette use. *Addiction, 116,* 1839-1847.doi:10.1111/add.15386.

Conner, M., Grogan, S., Simms-Ellis, R., Scholtens, K., Sykes-Muskett, B., Cowap, L.,… Siddiqi, K. (2019). Patterns and predictors of e-cigarette, cigarette and dual use uptake in UK adolescents: Evidence from a 24-month prospective study. *Addiction*, *114*, 2048–2055. doi:10.1111/add.14723.

Dai, H. (2021). Prevalence and factors associated with youth vaping cessation intention and quit attempts. *Pediatrics, 148*, e2021050164. doi:10.1542/peds.2021-05016.

Epstein, M., Bailey, J. A., Kosterman, R., Rhew, I. C., Furlong, M., Oesterle, S. & McCabe, S. E. (2021). E-cigarette use is associated with subsequent cigarette use among young adult non-smokers, over and above a range of antecedent risk factors: A propensity score analysis. *Addiction*, *116*, 1224–1232. doi:10.1111/add.15317.

Espelt, A., Bosque-Prous, M. & Marí-Dell'Olmo, M. (2019). Considerations on the use of odds ratio versus prevalence or proportion ratio. *Adicciones, 31*, 257-259. doi:10.20882/adicciones.1416.

European Union Tobacco Products Directive 2014/40/EU. *European Parliament and Council, on the approximation of*

the laws, regulations and administrative provisions of the Member States concerning the manufacture, presentation and sale of tobacco and related products and repealing Directive 2001/37/EC. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0040.

Grana, R., Benowitz, N. & Glantz, S. A. (2014). E-cigarettes: A scientific review. *Circulation, 129*, 1927-86. doi:10.1161/CIRCULATIONAHA.114.007667.

Greenhalgh, E. M., Jenkins S., Stillman, S. & Ford, C. (2016). *Factors that predict success or failure in quit attempts*. In Greenhalgh, EM, Scollo, MM and Winstanley, MH (Ed.). Tobacco in Australia: Facts and issues. Cancer Council Victoria.

Hair, E. C., Kreslake, J. M., Mowery, P., Pitzer, L., Schillo, B. & Vallone, D. M. (2021). A longitudinal analysis of e-cigarette use and cigar, little cigar or cigarillo initiation among youth and youth adults: 2017-2019. *Drug and Alcohol Dependence, 226,* 108821. doi:10.1016/j.drugalcdep.2021.108821.

Hammond, D., Reid, J. L., Burkhalter, R., O'Connor, R. J., Goniewicz, M. L., Wackowski, O. A.,… Hitchman, S. C. (2021). Trends in e-cigarette brands, devices and the nicotine profile of products used by youth in England, Canada and the USA: 2017–2019. *Tobacco Control, 32,* 19-29. doi:10.1136/tobaccocontrol-2020-056371.

Hamzeh, B., Farnia, V., Moradinazar, M., Pasdar, Y., Shakiba, E., Najafi, F. & Alikhani, M. (2020). Pattern of cigarette smoking: Intensity, cessation, and age of beginning: Evidence from a cohort study in West of Iran. *Substance abuse treatment, prevention, and policy, 15*, 1-9. doi:10.1186/s13011-020-00324-z.

Hansen, J., Hanewinkel, R. & Morgenstern, M. (2020). Electronic cigarette advertising and teen smoking initiation. *Addictive Behaviors*, *103*, 106243. doi:10.1016/j.addbeh.2019.106243.

Hasin, D. S., O'Brien, C. P., Auriacombe, M., Borges, G., Bucholz, K., Budney, A.,… Grant, B. F. (2013). DSM-5 criteria for substance use disorders: Recommendations and rationale. *The American journal of psychiatry, 170*, 834–851. doi:10.1176/appi.ajp.2013.12060782.

Khouja, J. N., Suddell, S. F., Peters, S. E., Taylor, A. E. & Munafò, M. R. (2021). Is e-cigarette use in non-smoking young adults associated with later smoking? A systematic review and meta-analysis. *Tobacco Control*, *30*, 8–15. doi:10.1136/tobaccocontrol-2019-055433.

Loukas, A., Marti, C. N. & Harrell, M. B. (2022). Electronic nicotine delivery systems use predicts transitions in cigarette smoking among young adults. *Drug and Alcohol Dependence, 231*, 109251. doi:10.1016/j.drugalcdep.2021.109251.

Martinelli, T. F., Candel, M., de Vries, H., Talhout, R., Knapen, V., Croes, E.,… Nagelhout, G. E. (2021). Exploring the gateway hypothesis of e-cigarettes and tobacco a prospective replication study among adolescents in the Netherlands and Flanders. *Tobacco Control*, 1–9. doi:10.1136/tobaccocontrol-2021-056528.

McNeill, A., Brose, L., Calder, R., Bauld, L. & Robson, D. (2020). *Vaping in England: An evidence update including mental health and pregnancy, March 2020. London: Public Health England.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/869401/Vaping_in_England_evidence_update_March_2020.pdf.

National Drugs Plan (PNSD) (2018). *Encuesta sobre el uso de drogas en enseñanzas secundarias en España (ESTUDES) 1994-2018/2019.* https://pnsd.sanidad.gob.es/profesionales/sistemasInformacion/sistemaInformacion/pdf/ESTUDES_2020_Informe.pdf.

O'Brien, D., Long, J., Quigley, J., Lee, C., McCarthy, A. & Kavanagh, P. (2021). Association between electronic cigarette use and tobacco cigarette smoking initiation in adolescents: A systematic review and meta-analysis. *BMC Public Health*, *21*, 954. doi:10.1186/s12889-021-10935-1.

O'Connell, G., Pritchard, J. D., Prue, C., Thompson, J., Verron, T., Graff, D. & Walele, T. (2019). A randomised, open-label, cross-over clinical study to evaluate the pharmacokinetic profiles of cigarettes and e-cigarettes with nicotine salt formulations in US adult smokers. *Internal and Emergency Medicine*, *14*, 853–861. doi:10.1007/s11739-019-02025-3.

Owotomo, O., Stritzel, H., McCabe, S. E., Boyd, C. J. & Maslowsky, J. (2020). Smoking intention and progression from e-cigarettes use to cigarette smoking. *Pediatrics*, *146*, e2020002881. doi:10.1542/peds.2020-002881.

Park, E., Livingston, J. A., Wang, W., Kwon, M., Eiden, R. D. & Chang, Y. P. (2020). Adolescent E-cigarette use trajectories and subsequent alcohol and marijuana use. *Addictive Behaviors*, *103*. doi:10.1016/j.addbeh.2019.106213.

Pilatti, A., Read, J. P. & Pautassi, R. M. (2017). ELSA 2016 cohort: Alcohol, tobacco, and marijuana use and their association with age of drug use onset, risk perception, and social norms in Argentinean college freshmen. *Frontiers in Psychology*, *8*, 1452. doi:10.3389/fpsyg.2017.01452.

Shiffman, S. & Sembower, M. A. (2020). Dependence on e-cigarettes and cigarettes in a cross-sectional study of US adults. *Addiction*, *115*, 1924–1931. doi:10.1111/add.15060.

Soneji, S., Barrington-Trimis, J. L., Wills, T. A., Leventhal, A. M., Unger, J. B., Gibson, L. A.,… Sargent, J. D. (2017). Association between initial use of e-cigarettes and subsequent cigarette smoking among adolescents and young adults a systematic review and meta-analysis. *JAMA Pediatrics*, *171*, 788–797. doi:10.1001/jamapediatrics.2017.1488.

Stanton, C. A., Bansal-Travers, M., Johnson, A. L., Sharma, E., Katz, L., Ambrose, B. K.,… Pearson, J. L. (2019). Longitudinal e-cigarettes and cigarette use among US

youth in the PATH study (2013-2015). *Journal of the National Cancer Institute*, *111*, 1088–1096. doi:10.1093/jnci/djz006.

Walley, S. C., Wilson, K. M., Winickoff, J. P. & Groner, J. (2019). A public health crisis: Electronic cigarettes, vape, and JUUL. *Pediatrics*, *143*, e20182741. doi:10.1542/peds.2018-2741.

Wang, J. B., Olgin, J. E., Nah, G., Vittinghoff, E., Cataldo, J. K., Pletcher, M. J. & Marcus, G. M. (2018). Cigarette and e-cigarette dual use and risk of cardiopulmonary symptoms in the Health eHeart Study. *PLoS ONE*, *13*. doi:10.1371/journal.pone.0198681.

World Health Organization (2020). *Summary results of the global youth tobacco survey in selected countries of the WHO European Region*. https://apps.who.int/iris/bitstream/handle/10665/336752/WHO-EURO-2020-1513-41263-56157-eng.pdf?sequence=1&isAllowed.