

Inequalities in Smoking and E-Cigarette Use in Young Adults With Mental Ill-Health, 20 years After Ireland's Smoking Ban

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ABSTRACT

Background: Ireland's Smoking Ban reduced health inequalities known to be associated with smoking but some groups may not have benefited. Mental ill-health and smoking are known to be associated with health inequalities. Whether similar patterns exist for e-cigarette use is less clear, as few data exist.

Objectives: To examine: (1) self-reported doctor-diagnosed mental ill-health in Irish 20-year-olds; (2) smoking, e-cigarette, and dual use in those with and without mental ill-health; and (3) protective and risk factors for smoking and e-cigarette use in these groups.

Methods: We use cross-sectional data from 20 year-olds in Wave 4 of *Growing Up in Ireland* Child Cohort. They were asked to self-report mental ill-health which had been diagnosed by a clinician, and their smoking and e-cigarette use. All analyses were performed using SPSS v27.

Results: 19.4% (n = 1008) of the total sample (n = 4729) reported a mental ill-health diagnosis. Comparing those with and without, those with mental ill-health had significantly higher prevalence of current smoking (47%, n = 419 vs 36%, n = 1361; OR 1.57, CI: 1.36, 1.82), e-cigarette use (17%, n = 152 vs 13%, n = 485; OR 1.40, CI: 1.15, 1.70), and dual use (12%, n = 109 vs 9%, n = 328; OR 1.46, CI: 1.16, 1.84). Risk factors for smoking and e-cigarette use were, earlier smoking initiation, peers or primary caregivers who smoked, being in paid employment, one-parent family background, and social media use. Being female was protective. Most risk factors were significantly higher in young adults with mental ill-health but, after adjusting for these variables, respondents with mental ill-health still have significantly higher adjusted higher odds of smoking (aOR 1.28, CI: 1.05, 1.56).

Conclusions: Inequalities in smoking and e-cigarette use in young adults with mental ill-health are evident 20 years after Ireland's National Smoking Ban. Despite extensive Tobacco Control interventions in the past 20 years, there is still need in Ireland for new targeted interventions to reduce health inequalities for left-behind young smokers with mental ill-health.

KEYWORDS: smoking, e-cigarettes, smoking ban, mental ill-health, young adults, Ireland, smoking initiation

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Introduction

A comprehensive suite of tobacco control interventions in Ireland has led to sizeable reductions in smoking in Ireland.^{1,2} Nonetheless, 20 years after the introduction of the most radical intervention – the 2004 national ban on smoking in workplaces³ – population smoking prevalence remains relatively high at 18%^{4,5} and has shown signs of stagnancy.^{4,6,7} Limited explanations have been offered for this, including the introduction of e-cigarettes^{8,9} to the Irish market around 2013 leading to a re-normalisation of smoking and, in particular, an increase in smoking among some teenagers.⁸ There has been some documentation of heterogeneity in the smoking population^{10–12} but some large vulnerable groups have not been studied and have remained somewhat invisible in terms of tobacco control research and cessation interventions^{10,11,13,14} and also,

therefore, not specifically targeted. This lack of consideration is even more pronounced as regards the relationship between smoking and e-cigarette use. People with mental health conditions are one such group known to be particularly vulnerable to smoking. In this paper, we examine data on young adults with mental health conditions and consider whether protective and risk factors for smoking and e-cigarette differ and need separate education and intervention.

The global burden of mental ill-health is “enormous, underappreciated, and largely unmet” with annually, about 30% of the population worldwide affected by a mental disorder; depression and substance abuse being among the most prevalent conditions.¹⁵ Of all groups with disabilities, higher prevalence of tobacco use is particularly well-established internationally in those who suffer mental ill-health.^{16–18} There are no precise population figures for



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prevalence rates of smoking¹⁹ or e-cigarette use in Ireland in individuals with mental ill-health. It is therefore not possible to estimate if Ireland's Smoking Ban helped to reduce smoking or associated inequalities in this population. However, it seems unlikely as Section 47¹ of the Public Health (Tobacco) Act, 2002 as amended by Section 16 of the Public Health (Tobacco) (Amendment) Act, 2004 specifically prohibited the smoking of a tobacco product in workplaces but exempted certain classes of places or premises including psychiatric hospitals.²⁰ This exemption, it has been suggested²¹ may have made matters worse in terms of health and other inequalities suffered by people with mental ill-health.

While public health campaigns in many countries have led to greatly reduced smoking prevalence,¹⁶ including in Ireland,²² the benefits of these campaigns seem to have largely bypassed people with mental ill-health²³ who smoke at significantly higher rates than the general population,²⁴ perhaps as much as twice as high.^{18,25} Purdy and colleagues¹⁸ report that, in Northern Ireland, smoking was three times more common among people with probable clinical depression than among people without. Conversely, a consistent finding in international studies of the adult population is that individuals with healthier behaviour patterns are more likely to report positive mental health,²⁶ a finding confirmed in Ireland as regards several healthy behaviour clusters including former smokers.²⁷

Although studies of tobacco use in those with mental ill-health often do not differentiate across age groups (e.g. 16) we have shown previously that older adults in Ireland with mental health difficulties are more likely to smoke than those without such difficulties and they also experience higher rates of smoking-related disease.¹⁰ There is also evidence of higher smoking prevalence among young people with mental ill-health^{16,17,19}

For example, Mayfield Arnold et al.²⁸ found that, at ages 12-14 years, the probability of depressive symptoms was four times greater among adolescents who currently smoked compared to those who were not current smokers,²⁹ but also that mental ill-health was mediated through socio-demographic inequalities including race, gender, income, and health. Purdy and colleagues,¹⁸ reporting on the complexity of the well-established relationship between smoking and mental health, point to evidence indicating that mental health increases the risk of becoming a person who smokes as well as confirming that smoking is injurious to mental health. The nature of the link between smoking and depressive symptoms among adolescents is contested (e.g.,¹⁹) but is likely bi-directional.^{28,30,31}

Worsening youth mental health has been an increasing public health concern together with concerns about youth substance use. Associations between mental health problems and increased tobacco use are well-established but few studies have examined whether similar patterns exist for e-cigarette use. Mental health comorbidities of e-cigarette use generally parallel those of combustible cigarette use, with a few exceptions. Becker et al.,³² in a review of 40 recent studies, found a variety of mental health comorbidities with adolescent and young adult e-cigarette use, particularly strong for adolescents. Because of their relative recency,

however, data about e-cigarette use in specific young adult populations such as those with mental ill-health remain scarce.

One reason for this is that although adverse mental health is associated with greater substance use, including smoking and e-cigarette use, surveys of people with mental health conditions often do not collect data on smoking and e-cigarette use. For example, the *MyWorld Survey 2*³³ carried out by Jigsaw Ireland found very high rates of mental ill-health among 12-25 year olds in Ireland and collected data on multiple substance use but did not include cigarettes or e-cigarettes. Equally, surveys on substance use such as ESPAD (European Schools Survey Project on Alcohol and other Drugs) which collects extensive data on smoking and e-cigarette use in 15-16-year-olds, do not collect data on mental health conditions.

Thus, little is known about the use of tobacco products in adolescents and young adults with mental ill-health, despite being a population known to be vulnerable to health, educational, and economic inequalities. Furthermore, these young adults are in the 20-34 year-olds who have the highest smoking prevalence of any age group.^{4,34} For example, we found that in Ireland three-quarters of 20-year-olds reported that they had ever-smoked, more than 1 in 8 had tried to stop smoking but were unable to and the ages between 17 and 19 were vulnerable ones for smoking initiation, perhaps indicative of young adults leaving school, starting higher education and jobs, and moving away from home, as well as the end of statutory age restrictions.³⁵

For this study, a considerable benefit of the longitudinal GUI is that it has extensive datasets on children, adolescents and young adults with disabilities including questions on study participants' mental health as well as substantial data on smoking and e-cigarette use. In this study, we use data from GUI about young adults with mental ill-health and tobacco use together with variables (all from Wave 4) known to be associated with tobacco and e-cigarette use (age, gender, activity levels, employment status, age started smoking and social media use, familial variables - family income (quintiles), household type (one-parent, two-parent), and caregiver smoking, as well as peer smoking at age 17 years (Wave 3) to examine nicotine use in this vulnerable population.

In using *Growing Up in Ireland* data, we address previously unanswered questions about important aspects of smoking and e-cigarette use in young people with mental ill-health in an Irish context 20 years after the Smoking Ban, including whether e-cigarette use differs from cigarette smoking. If implications of combustible and electronic cigarette use among young adults with mental ill-health differ, this population is likely to require tailored and targeted smoking and e-cigarette prevention and treatment strategies which may be enhanced by addressing mental health.³² This study aims to provide the evidence base for such interventions.

Methods

Data source

The data we use are from the Child Cohort (Cohort '98) of the Growing up in Ireland National Longitudinal Study of

Children (GUI). This nationally representative cohort study of children living in the Republic of Ireland commenced in 2008 when the children were aged 9 years (Wave 1). For Wave 1, a two-stage clustered sampling method was used to recruit 8568 children from the national primary school system born between November 1997 and October 1998 and their caregivers. These children and their caregivers were then surveyed every four years approximately. We use data ($n = 4729$) from Wave 4 collected in 2019 when the participants were aged 20 years, and who had been present at Wave 1 when the participants were aged 9 years (2008), and at Wave 3 (2016) when they were 17/18 years old.

Representativeness of the analytic sample

Our analytic sample comprises 4729 participants in Wave 4 who were also present in Wave 1 and Wave 3 and represents 55% of the original sample in Wave 1. This attrition has been examined and factors responsible, which include refusal to participate, emigration, change of address, or unavailability at the time of surveying, reported elsewhere.³⁶⁻³⁸

The young adults and their parents in the analytic sample were comparable to the baseline cohort based on the distribution of background characteristics, such as household income and gender. This indicates that the analytic sample is representative of the baseline sample, allowing for meaningful comparisons to be made in our study. [Table 1](#) below describes the sample characteristics.

Measures

The main variables were extracted from the Wave 4 of the Young Adult Main Questionnaire ([Supplemental File 1](#)) and the Young Adult Self-Complete Questionnaire (their smoking and e-cigarette use) of Cohort '98, GUI.

Young adult mental health

Respondents were asked about their mental health diagnoses through two key questions. Firstly, they were asked if they had ever been diagnosed with depression or anxiety by a doctor, psychologist, or psychiatrist, with response options of Yes or No. Those who answered yes to this question were classified as having experienced depression or anxiety. Secondly, respondents were asked if they had been diagnosed with another psychological or psychiatric illness or disorder by a doctor, psychologist, or psychiatrist, with response options of Yes or No. These other disorders were Eating disorder (e.g. anorexia, bulimia), Post-traumatic stress disorder (PTSD), Obsessive Compulsive Disorder (OCD), Bipolar Disorder, Personality disorder, Schizophrenia, Other disorder including experience of hallucinations or delusions, and Other psychological or psychiatric disorder not listed above. Those who answered yes to this question were classified as having another psychological or psychiatric illness or disorder. These two questions were then combined into a

single variable indicating yes/no to self-reporting mental ill-health. This combined measure for mental ill-health is the variable that we report throughout the text.

Young adult smoking and E-cigarette use

We report only current rather than ever-smoking and ever e-cigarette use.

Current smoking. Those who responded yes to ever smoking a cigarette were asked (Question B3, Young Adult Self-Complete Questionnaire): "Which of the following best describes you?", response options were: "Only ever tried smoking once or twice", "Used to smoke but not now", "Smoke occasionally", "Smoke daily". Respondents indicating that they smoked occasionally or daily were classified as "current smokers" while all other responses were classified as "non-current smokers".

Former smokers. In the same question, those who responded yes to "Used to smoke but not now" were classified as "former smokers".

Current e-cigarette use. Respondents were asked (Question B8, Young Adult Self-Complete Questionnaire): "How often, if at all, do you currently use an electronic cigarette?" with response options "Daily" "Less than daily, but at least once a week" "Less than weekly, but at least once a month", "Less than monthly", "Not at all". Respondents indicating that they used e-cigarettes less than monthly or not at all were classified as not "current e-cigarette users" while all other responses were classified as "current e-cigarette users".

Current dual use. Respondents were classified as current dual users if they met the criteria for being both current smokers (smoking occasionally or daily) and current e-cigarette users (using e-cigarettes at least once a month or more frequently).

Demographic, behavioural, and family and peer characteristics

Young adult demographic variables were extracted from Wave 4 Young Adult Main Questionnaire (at 20 years old): gender (male, female); family income quintile (equivalized to account for household size and composition using the modified Organisation for Economic Co-operation and Development equivalence scale and presented in quintiles); household type (one parent, one child; one parent, two or more children; two parents, one child; two parents, two or more children; recoded into one-parent families, two-parent families). Young adult paid employment status was extracted from the Wave 4 Young Adult Main Questionnaire (Question H29a): "Are you currently in paid employment? – do not include the term-time employment or apprenticeship job you told us about already", response options yes/no. Young adult activity levels also came from the

Table 1. Characteristics of Study Participants by Smoking, E-Cigarette and Dual Use of Cigarettes and E-Cigarette Status.

	TOTAL N (%)	CURRENT SMOKING N (%)		CURRENT E-CIGARETTE USE N (%)		CURRENT DUAL USE N (%)	
		NO	YES	NO	YES	NO	YES
Total	4729 (100)	2949 (62.4)	1780 (37.6)	4092 (86.5)	637 (13.5)	4292 (90.9)	437 (9.2)
Mental health							
No	3827 (80.9)	2466 (64.4)	1361 (35.6)	3342 (87.3)	485 (12.7)	3499 (91.4)	328 (8.6)
Yes	902 (19.1)	483 (53.5)	419 (46.5)	750 (83.1)	152 (16.9)	793 (87.9)	109 (12.1)
Gender							
Male	2393 (50.6)	1455 (60.8)	938 (39.2)	1995 (83.4)	398 (16.6)	2119 (88.5)	274 (11.5)
Female	2336 (49.4)	1494 (64.0)	842 (36.0)	2098 (89.8)	238 (10.2)	2173 (93.0)	163 (7.0)
Household income (quintiles)							
Lowest	790 (19.9)	499 (63.2)	291 (36.8)	671 (84.9)	119 (15.1)	709 (89.7)	81 (10.3)
Second	826 (20.8)	529 (64.0)	297 (36.0)	694 (84.0)	132 (16.0)	739 (89.5)	87 (10.5)
Third	784 (19.7)	484 (61.7)	300 (38.3)	669 (85.5)	114 (14.6)	708 (90.3)	76 (9.7)
Fourth	792 (19.9)	497 (62.8)	295 (37.2)	679 (85.7)	113 (14.3)	711 (89.8)	81 (10.2)
Highest	786 (19.8)	451 (57.4)	335 (42.6)	694 (88.3)	92 (11.7)	715 (91.0)	71 (9.0)
Household type							
One parent	1037 (23.2)	614 (59.2)	423 (40.8)	860 (82.9)	177 (17.1)	928 (89.5)	109 (10.5)
Two parents	3433 (76.8)	2187 (63.7)	1246 (36.3)	3001 (87.4)	432 (12.6)	3122 (90.0)	312 (9.1)
Paid employment							
No	3247 (68.7)	2136 (65.8)	1111 (34.2)	2858 (88.0)	388 (12.0)	2975 (96.1)	272 (8.4)
Yes	1480 (31.3)	813 (54.9)	667 (45.1)	1232 (83.2)	248 (16.8)	1315 (88.9)	165 (11.1)
Moderate-intense activity							
None/1-6 days	2469 (52.2)	1499 (60.7)	970 (39.3)	2148 (87.0)	321 (13.0)	2241 (90.8)	227 (9.2)
7 to 13 days/everyday	2259 (47.8)	1450 (64.2)	809 (35.8)	1943 (86.0)	316 (14.0)	2050 (90.7)	209 (9.3)
Age when first smoked							
15 years or younger	1017 (29.4)	311 (30.6)	706 (69.4)	783 (77.1)	233 (22.9)	847 (83.3)	170 (16.7)
16 or older	2446 (70.6)	1372 (56.1)	1074 (43.9)	2064 (84.3)	383 (15.7)	2180 (89.1)	267 (10.9)
Primary caregiver smokes (Wave 4)							
No	3372 (77.5)	2179 (64.6)	1193 (35.4)	2952 (87.5)	420 (12.5)	3082 (91.4)	291 (8.6)
Yes	980 (22.5)	541 (55.2)	439 (44.8)	809 (82.6)	171 (17.4)	863 (88.1)	117 (11.9)
Peer smoking (at age 17, Wave 3)							
No	917 (19.7)	761 (83.0)	156 (17.0)	853 (93.0)	64 (7.0)	876 (95.5)	41 (4.5)
Yes	3729 (80.3)	2129 (57.1)	1600 (42.9)	3172 (85.1)	557 (14.9)	3349 (89.8)	380 (10.2)
Snapchat							
No	362 (8.3)	249 (68.8)	113 (31.2)	322 (88.7)	41 (11.3)	340 (93.9)	22 (6.1)
Yes	3985 (91.7)	2416 (60.6)	1569 (39.4)	3422 (85.9)	563 (14.1)	3588 (90.0)	397 (10.0)
Household class							
Professional/managerial	1938 (48.4)	1189 (61.4)	749 (38.6)	1693 (87.4)	245 (12.6)	1753 (90.5)	184 (9.5)
Non-manual/skilled/semi-/unskilled	2067 (51.6)	1301 (62.9)	766 (37.1)	1773 (85.8)	293 (14.2)	1874 (90.7)	192 (9.3)
Parental education							
Junior certificate	923 (20.6)	583 (63.2)	340 (36.8)	784 (84.9)	139 (15.1)	840 (91.0)	83 (9.0)
Leaving certificate	1869 (41.8)	1251 (66.9)	618 (33.1)	1631 (87.3)	238 (12.7)	1721 (92.1)	148 (7.9)
Certificate/diploma	916 (20.5)	543 (59.3)	373 (40.7)	799 (87.2)	117 (12.8)	823 (89.8)	93 (10.2)
Degree	762 (17.0)	424 (55.6)	338 (44.4)	647 (84.9)	115 (15.1)	666 (87.5)	95 (12.5)

Figures in bold are statistically significant at $P < 0.05$.

from the Wave 4 Young Adult Main Questionnaire (Question E7): “How many times in the last 14 days have you done at least 30 mins of moderate-intensity activity, that is activity that causes a small increase in your heart rate and breathing (this includes brisk walking, cycling, swimming and active travel/transport on a daily basis)?” Response options were None, 1 to 3 days, 4 to 6 days, 7 to 9 days, 10 to 13 days, Everyday; recoded into a dichotomous variable (None/1-6 days and 7-13 days/Everyday). Age of the young adult when they first smoked was extracted from Wave 4 Young Adult Self-Complete Questionnaire (Question B3). Parental smoking data was extracted from the Parent/Guardian Wave 4 self-complete questionnaire.

We include peer use of cigarettes at Wave 3 (when the study participants were 17 years old) as this variable was not available in Wave 4. Peer smoking was measured by asking how many of their regular friends smoke or have ever smoked cigarettes (None/A few/Some/Most/All); recoded into No (None) vs Yes (all other categories). Social media use in Wave 4 was assessed by asking respondents, “Which of these apps do you use daily/almost daily?” The options provided were Twitter, Facebook, Instagram, Snapchat, LinkedIn, Pinterest, and Google+ (G+), with response options of Yes or No. Social media use was high across these platforms and Snapchat was chosen for this analysis because it offered the greatest differentiation compared to the other platforms.

A full description of the study including the design, instruments and data collection procedures have been described elsewhere.^{36,37,39} The data, in the form of a Researcher Microdata File (RMF), are archived in the Central Statistics Office and are available to researchers on request and following a formal application, training and approval process.

Ethical approval for GUI Wave 4 was granted by the GUI Research Ethics Committee, Department of Children and Youth Affairs, Ireland and we confirm that all methods were performed in accordance with the relevant guidelines and regulations. Informed consent was obtained from all subjects and/or their legal guardian(s) (e.g., https://www.growingup.gov.ie/pubs/9_Year_CC_Parent_Leaflet.pdf).

Statistical analysis

We used descriptive statistics to describe sample characteristics. We applied Pearson’s chi-square tests to test for associations between young adults with mental ill-health and their smoking and e-cigarette use, allowing us to compare departures from the expected distributions. This was followed by logistic regression models to examine associations between young adults with mental ill-health and their smoking and e-cigarette use, adjusting for demographic, familial and behavioural variables. In the latter, all associations are reported as adjusted odds ratios (aOR) and 95% confidence intervals (95% CI), and a $P < 0.05$ was considered statistically significant. Observations with missing data for any variable were excluded from the analysis to

ensure completeness and accuracy. Weighting, a minimum information loss algorithm developed by GUI, was used to adjust for differences between the GUI sample and the population at age 9, 13 and 17/18 years. These weights were applied in all analyses to enable inferences to be made about the entire population from which the study participants were selected. Further details regarding weighting in GUI can be found here: <https://www.gui.com/guide-to-datasets/>. All analyses were performed using SPSS version 27.

Results

Prevalence of smoking, e-cigarette use and mental ill-health

We confirm high prevalence of current smoking, e-cigarette and dual use for 20 year olds in Ireland at 37.6% ($n = 1780$), 13.5% ($n = 637$) and 9.2% ($n = 437$) respectively (Table 1), with 7.3% ($n = 344$) reporting that they were former smokers (Table 2). Prevalence of mental ill-health was also high. Almost one in five 20-year-olds (19.1%; $n = 902$) reported having been diagnosed by a doctor, psychiatrist or psychologist with depression/anxiety or other psychological or psychiatric disorder. 18.0% ($n = 842$) reported depression or anxiety, with considerable comorbidity between these and other psychological/psychiatric disorders and some differences in smoking and e-cigarette use between those with depression/anxiety and the other mental ill-health groups (Supplemental File 2).

Prevalence of ever-smoking (Table 2), current smoking, current e-cigarette use, and dual use (Table 1) were significantly higher in those with mental ill-health. There was no significant association between mental ill-health and being a former smoker (Table 2). Almost half (46.5%; $n = 419$) of those with mental ill-health were current smokers compared with just over a third of those without mental health problems (35.6%; $n = 1361$) and e-cigarette current use was 16.9% ($n = 152$) compared with 12.7% ($n = 485$). Dual use was 12.1% ($n = 109$) among those with mental ill-health compared with 8.6% ($n = 328$) among those without. Ever-use was also significantly higher in those with mental health conditions. Almost four out of five with mental ill-health were ever-smokers (78.3%; $n = 789$ vs 72.8%; $n = 3018$) and e-cigarette ever-use was 56.9% ($n = 574$) compared with 45.5% ($n = 1886$).

Sample characteristics

As regards current smoking status and sample characteristics (Table 1), we note that among the 20-year-old sample overall, current smokers are significantly more likely to be male, in paid employment, and to have started smoking at a younger age (15 years or younger), be less likely to engage in moderate to intense physical activity, be daily or almost daily Snapchat users, be in one-parent households, have a primary caregiver who smokes, and have had peers who smoked when they were aged 17 years (at Wave 3).

Table 2. Characteristics of Study Participants by Mental Health Status (Self-Reported Doctor-Diagnosed Mental Ill-Health).

	TOTAL N (%)	WITHOUT MENTAL HEALTH CONDITIONS	WITH MENTAL HEALTH CONDITIONS	P VALUE
	4729 (100)	3827 (80.9)	902 (19.1)	
Gender				
Male	2394 (50.6)	2020 (84.4)	374 (15.6)	<0.001
Female	2336 (49.4)	1807 (77.4)	529 (22.6)	
Household income (quintiles)				
Lowest	790 (19.9)	641 (81.1)	149 (18.9)	0.18
Second	826 (20.8)	637 (77.0)	190 (23.0)	
Third	783 (19.7)	654 (83.4)	130 (16.6)	
Fourth	792 (19.9)	649 (82.0)	142 (18.0)	
Highest	786 (19.8)	632 (80.4)	154 (19.6)	
Household type				
One parent	1037 (23.2)	780 (75.2)	257 (24.8)	<0.001
Two parents	3434 (76.8)	2847 (82.9)	587 (17.1)	
Paid employment				
No	3247 (68.7)	2658 (81.9)	589 (18.1)	0.01
Yes	1480 (31.3)	1167 (78.9)	313 (21.1)	
Moderate-intense activity				
None/1-6 days	2469 (52.2)	1970 (79.8)	499 (20.2)	0.04
7 to 13 days/everyday	2259 (47.8)	1856 (82.2)	403 (17.8)	
Ever smoked				
No	1227 (26.1)	1029 (83.9)	198 (16.1)	<0.001
Yes	3466 (73.9)	2762 (79.7)	704 (20.3)	
Former smokers				
No	4383 (92.7)	3556 (81.1)	827 (18.9)	0.18
Yes	344 (7.3)	269 (78.2)	75 (21.8)	
Age when first smoked				
15 years or younger	1017 (29.4)	717 (70.5)	300 (29.5)	<0.001
16 or older	2447 (70.6)	2043 (83.5)	404 (16.5)	
Reasons for smoking				
Enjoy	699 (21.2)	534 (76.4)	165 (23.6)	<0.001
Stress	573 (17.4)	400 (69.8)	173 (30.2)	
Friends	848 (25.7)	718 (84.7)	130 (15.3)	
Others	1181 (35.8)	968 (81.9)	214 (18.1)	
Primary caregiver smokes (wave 4)				
No	3372 (77.5)	2784 (82.6)	588 (17.4)	<0.001
Yes	980 (22.5)	747 (76.2)	233 (23.8)	
Peer smoking (at age 17, wave 3)				
No	917 (19.7)	771 (84.2)	145 (15.8)	<0.01
Yes	3729 (78.9)	2983 (80.0)	746 (20.0)	
Social media use (snapchat daily/almost daily)				
No	362 (8.3)	258 (71.3)	104 (28.7)	<0.01
Yes	3986 (91.7)	3244 (81.4)	741 (18.6)	
Household class				
Professional/managerial	1938 (48.4)	1619 (83.5)	319 (16.5)	0.01
Non-manual/Skilled/semi-/unskilled	2066 (51.6)	1663 (80.5)	403 (19.5)	

(Continued)

Table 2. Continued.

	TOTAL N (%)	WITHOUT MENTAL HEALTH CONDITIONS	WITH MENTAL HEALTH CONDITIONS	P VALUE
Parental education				
Junior certificate	923 (20.7)	728 (78.9)	195 (21.1)	0.04
Leaving certificate	1869 (41.8)	1548 (82.8)	321 (17.2)	
Certificate/diploma	915 (20.5)	728 (79.6)	187 (20.4)	
Degree	762 (17.1)	621 (81.5)	141 (18.5)	

Figures in Bold are statistically significant at $P < 0.05$.

As regards current e-cigarette use status and sample characteristics (Table 1), users are more likely to be male, in paid employment, and to have started smoking at a younger age (15 years or younger), be less likely to engage in moderate to intense physical activity, be in one-parent households, have a primary caregiver who smokes, and have had peers who smoked when they were aged 17 years (at Wave 3).

Dual users (smoking and e-cigarette use) were more likely to be male, in paid employment, and to have started smoking at a younger age (15 years or younger), have a primary caregiver who smokes, have had peers who smoke when they were 17 years (at Wave 3), be daily or almost daily Snapchat users, and have parents with a degree level of education.

Given the importance of socio-economic status in population-level smoking research, we used 3 separate measures, *viz.*, household income quintiles, household class, and parental education level and found none to be significantly correlated with either smoking or e-cigarette use in young adults (Table 1).

Respondents with mental ill-health differed significantly from their peers without mental ill-health on all variables included in our model (Table 2). Compared with those without mental health conditions, those who reported having mental health conditions were significantly more likely to be female, be in paid employment, and to start smoking younger. They were significantly less likely to report frequent moderate to intense physical activity and also less likely to be daily or almost daily Snapchat users. Their families were significantly less likely to be in professional/managerial social classes, and they were more likely to have less well-educated parents and to be one-parent households.

Likelihood of current smoking and e-cigarette use (ORs and aORs) for 20-year-olds with mental ill-health

Having a diagnosis of mental ill-health increases the odds of smoking and e-cigarette use; by 57% (36% – 82%) for current smoking, by 40% (15% – 70%) for current e-cigarette use, and by 46% (16% – 84%) for current dual use (Table 3). We report no significant association between former smokers and mental ill-health (OR 1.20, CI 0.92-1.57, $P = 0.17$, not shown). Females have significantly lower odds of being current smokers

(OR 0.87), e-cigarette users (OR 0.57) or dual users (OR 0.58) compared with males. Starting to smoke earlier and being in paid employment both increase the odds for smoking e-cigarette and dual use while partaking in more frequent moderate to intense physical activity is significantly associated with reduced odds of smoking but not with e-cigarette or dual use. As regards social media use, we observe significantly increased odds for smoking and dual use but not for sole e-cigarette use in those who are daily or almost daily Snapchat users. One significant difference in those with mental ill-health relates to reported reasons for smoking; those who smoke because of stress are more likely to use e-cigarettes (OR 1.28, CI 1.00:1.65). Those who say they are satisfied/extremely satisfied with their lives are more likely to smoke but not any more likely to use e-cigarettes or engage in dual use of both smoking and e-cigarettes.

Family and friends are important. Having a primary caregiver who smokes and particularly having peers who smoke greatly increase the odds of the young adult being a smoker, e-cigarette and also dual user. Being in a two-parent household appears protective for both smoking (OR 0.83) and e-cigarette use (0.70) but no clear associations with social class of origin are evident other than an increased odds of smoking for respondents whose parents have the highest education and who are in the highest income quintile. This association is not evident for e-cigarette and dual use, in fact higher household income is somewhat protective against both e-cigarette and dual use.

In summary, overall for the sample of 20-year olds, risk factors for smoking and e-cigarette use were having peers who smoked, primary caregivers who smoked, being in paid employment, and using Snapchat daily or almost daily. Protective factors against smoking and e-cigarette use were being female, later age of smoking initiation, and living in a two-parent family.

Our multivariable regression analysis (Table 4) shows some similarities and some differences between smoking, e-cigarette and dual use for young adults with and without mental ill-health. Those with mental ill-health are significantly more likely (aOR 1.28, CI 1.05:1.26) to be smokers and also more likely to be e-cigarette users (aOR 1.25, CI 0.98:1.58) and dual users (aOR 1.24, CI 0.94:1.63) but not at the level of statistical significance. Compared with females, males are significantly more likely to smoke, use e-cigarettes and engage in dual use. Starting smoking at a later age (16 years or older compared with

Table 3. Logistic Regression Analysis Showing Unadjusted Odds Ratios (OR) and 95% CI for Current Smoking, Current E-Cigarette Use and Current Dual Use in 20-Year Olds for all Variables.

	CURRENT SMOKING	CURRENT E-CIGARETTE USE	CURRENT DUAL USE
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Mental health			
No	Reference	Reference	Reference
Yes	1.57 (1.36, 1.82)	1.40 (1.15, 1.70)	1.46 (1.16, 1.84)
Gender			
Male	Reference	Reference	Reference
Female	0.87 (0.78, 0.98)	0.57 (0.48, 0.68)	0.58 (0.47, 0.71)
Household income (quintiles)			
Lowest	Reference	Reference	Reference
Second	0.96 (0.78, 1.18)	1.07 (0.82, 1.40)	1.02 (0.74, 1.41)
Third	1.06 (0.87, 1.30)	0.79 (0.73, 1.27)	0.93 (0.67, 1.30)
Fourth	1.02 (0.83, 1.25)	0.94 (0.71, 1.24)	0.99 (0.72, 1.37)
Highest	1.27 (1.04, 1.56)	0.75 (0.56, 1.00)	0.86 (0.61, 1.20)
Household type			
One parent	Reference	Reference	Reference
Two parents	0.83 (0.72, 0.95)	0.70 (0.58, 0.84)	0.85 (0.68, 1.07)
Life satisfaction			
Unsatisfied/extremely unsatisfied	Reference	Reference	Reference
Satisfied/extremely satisfied	0.83 (0.71, 0.96)	1.17 (0.94, 1.42)	1.05 (0.81, 1.35)
Paid employment			
No	Reference	Reference	Reference
Yes	1.58 (1.39, 1.79)	1.48 (1.25, 1.76)	1.38 (1.12, 1.69)
Moderate-intense activity			
None/1-6 days	Reference	Reference	Reference
7 to 13 days/everyday	0.86 (0.77, 0.97)	1.09 (0.92, 1.28)	1.01 (0.83, 1.23)
Age when first smokedAge when first smoked			
15 years or younger	Reference	Reference	Reference
16 or older	0.35 (0.30, 0.40)	0.62 (0.52, 0.75)	0.61 (0.50, 0.75)
Reasons for smoking			
Enjoy	Reference	Reference	Reference
Stress	0.87 (0.67, 1.14)	1.28 (1.00, 1.65)	1.06 (0.80, 1.39)
Friends	0.71 (0.14, 0.22)	0.62 (0.48, 0.80)	0.47 (0.35, 0.62)
Other reasons	0.15 (0.12, 0.19)	0.43 (0.34, 0.55)	0.35 (0.26, 0.46)
Primary caregiver smokes			
No	Reference	Reference	Reference
Yes	1.48 (1.28, 1.71)	1.48 (1.22, 1.80)	1.44 (1.15, 1.81)
Snapchat (daily/almost daily)			
No	Reference	Reference	Reference
Yes	1.43 (1.13, 1.80)	1.31 (0.93, 1.83)	1.70 (1.09, 2.64)
Peer smoking			
No	Reference	Reference	Reference
Yes	3.67 (3.06, 4.42)	2.36 (1.80, 3.09)	2.45 (1.76, 3.42)

(Continued)

Table 3. Continued.

	CURRENT SMOKING	CURRENT E-CIGARETTE USE	CURRENT DUAL USE
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Household class			
Professional/managerial	Reference	Reference	Reference
Non-manual/Skilled/semi-/unskilled	0.93 (0.82, 1.06)	1.15 (0.95, 1.37)	0.98 (0.79, 1.21)
Parental education			
Junior certificate	Reference	Reference	Reference
Leaving certificate	0.85 (0.72, 1.00)	0.83 (0.66, 1.04)	0.86 (0.66, 1.16)
Certificate/diploma	1.18 (0.97, 1.42)	0.83 (0.64, 1.08)	1.15 (0.84, 1.57)
Degree	1.37 (1.12, 1.66)	1.01 (0.77, 1.32)	1.45 (1.06, 1.98)

Figures in bold are statistically significant at $P < 0.05$.

15 years of younger) is protective for both smoking, e-cigarette and dual use. Being in paid employment and having peers who smoke both increase significantly the odds for smoking but not for e-cigarette or dual use. As regards family of origin, in our adjusted model there are no significant associations with household income or primary caregiver smoking, and household type (being in a two-parent family) is associated with significantly decreased odds only for e-cigarette use but not for smoking or dual use.

Those with mental ill-health differed significantly from those without mental ill-health regarding key protective (female, live in two-parent families) and risk factors (in paid employment, start smoking earlier, have a primary caregiver and peers who smoke). In our multivariable model adjusting for these independent variables that are also related to smoking and e-cigarette use, however, the odds of smoking and e-cigarette use remain higher for those with mental ill-health. In the case of the association between smoking and mental ill-health, the adjusted odds are statistically significant, indicating an additional likelihood of smoking for those with mental ill-health over and above all other risk factors identified, unlikely to be explained solely by chance or random factors.

Discussion

Young adults who suffer with mental ill-health are significantly more likely to smoke than are young adults who do not. We find similar patterns exist for e-cigarette use as for smoking but are less pronounced. E-cigarette use is evolving rapidly in Ireland and the situation is more volatile.^{40,41}

Mental ill-health and smoking operate differently for males and females. Young adult females are more likely to report mental ill-health, but young adult males and particularly those with mental ill-health are more at risk of smoking and e-cigarette use.

We confirm that age of initiation is significantly associated with both smoking and e-cigarette use in the whole sample. Starting smoking after the age of 16 years rather than before is

highly protective for 20-year-olds both in terms of their smoking and their e-cigarette use. Age of initiation remains a significant predictor in our adjusted model even after other known predictive variables have been taken into account. For young adults with mental ill-health, age is particularly important as we show that they are significantly more likely to start smoking at an earlier age compared with their peers who do not have mental health problems. This suggests a clear additional need for education, intervention and cessation supports for younger teenagers, especially those who are at risk of mental ill-health.

Availability of resources influences prevalence of tobacco use and we confirm previous findings that young people in paid employment are more likely to smoke.^{12,42} Their use of e-cigarettes is also somewhat influenced by being in paid employment but is more ambivalent than smoking. In Ireland, e-cigarettes are much less regulated and less expensive than cigarettes, marketed as such, and widely considered to be so, and it would appear that the very high price of cigarettes in Ireland compared with e-cigarettes has served to act as a prohibition to young adult smoking for those who do not have paid employment at age 20 years. Ireland was slow to ban e-cigarettes and it was December 2023 before the Minister for Health commenced section 28 of the Public Health (Tobacco Products and Nicotine Inhaling Products) Act to prohibit the sale of nicotine inhaling products such as e-cigarettes to persons under 18 years.⁴³ This recent legislative actions marks a crucial step, but our findings point to an urgency in regulating e-cigarette use further (flavours, marketing, disposables) and increasing price through taxation as a means of protecting young people and in particular young adults with mental ill-health.

Peers are important for the whole sample, with greatly increased odds of smoking (OR 3.67), e-cigarette use (OR 2.36), and dual use (OR 2.45) associated with having peers who smoked when the respondents were 17 years old. However, in our adjusted model accounting for mental ill-health status, smoking remained statistically significant but not e-cigarette use. This may be explained to some extent by the evolving

Table 4. Multiple Regression Analysis Showing Adjusted Odds Ratios (aOR) and 95% CI Current Smoking, Current E-Cigarette Use and Current Dual Use.^a

	CURRENT SMOKING	CURRENT E-CIGARETTE USE	CURRENT DUAL USE
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Mental health			
No	Reference	Reference	Reference
Yes	1.28 (1.05, 1.56)	1.25 (0.98, 1.58)	1.24 (0.94, 1.63)
Gender			
Male	Reference	Reference	Reference
Female	0.71 (0.60, 0.83)	0.48 (0.39, 0.60)	0.47 (0.37, 0.59)
Household income (quintiles)			
Lowest	Reference	Reference	Reference
Second	1.08 (0.83, 1.39)	1.08 (0.79, 1.48)	1.14 (0.72, 1.63)
Third	1.25 (0.96, 1.62)	1.18 (0.86, 1.62)	1.15 (0.80, 1.67)
Fourth	1.06 (0.82, 1.37)	1.04 (0.76, 1.44)	1.08 (0.75, 1.57)
Highest	1.19 (0.92, 1.54)	0.78 (0.56, 1.09)	0.95 (0.65, 1.39)
Household type			
One parent	Reference	Reference	Reference
Two parents	0.91 (0.75, 1.10)	0.78 (0.62, 0.99)	0.99 (0.75, 1.30)
Paid employment			
No	Reference	Reference	Reference
Yes	1.32 (1.11, 1.57)	1.19 (0.97, 1.47)	1.12 (0.88, 1.43)
Moderate-intense activity			
None/1-6 days	Reference	Reference	Reference
7 to 13days/Everyday	0.87 (0.74, 1.02)	1.13 (0.93, 1.39)	1.00 (0.80, 1.26)
Age when first smoked			
15 years or younger	Reference	Reference	Reference
16 or older	0.43 (0.36, 0.51)	0.63 (0.51, 0.78)	0.68 (0.53, 0.87)
Primary caregiver smokes			
No	Reference	Reference	Reference
Yes	0.98 (0.81, 1.19)	1.09 (0.86, 1.38)	1.23 (0.98, 1.60)
Snapchat			
No	Reference	Reference	Reference
Yes	1.27 (0.94, 1.73)	1.10 (0.74, 1.62)	1.39 (0.86, 2.24)
Peer smoking			
No	Reference	Reference	Reference
Yes	2.43 (1.89, 3.11)	1.26 (0.91, 1.73)	1.18 (0.82, 1.70)

Adjusted odds ratios (aOR) in bold are significantly different to those of the reference category ($P < 0.05$).

^aAdjusted for gender, household income, household type, being in paid employment, physical level of activity, primary caregiver's smoking status, engaging in moderate-intense activity, age when first smoked, Snapchat use, peer smoking.

different trajectories of young smokers and e-cigarette users, many, or perhaps now the majority, of whom are e-cigarette users, never having smoked when they first tried e-cigarettes.^{40,44} This highlights the need for targeted prevention strategies, particularly for those with mental ill-health, that address the influence of peer groups on smoking behaviour.

We did not have measures of nicotine intake or dependence in our study but people with mental health problems have greater nicotine intake and increased prevalence of nicotine dependence.¹⁹ Furthermore people with mental illness experience greater withdrawal symptoms and have lower successful cessation rates when attempting to stop smoking compared to

the general population,¹⁹ all pointing to a need for urgent intervention for young adults with mental ill-health who smoke and use e-cigarettes.

Worsening youth mental health, particularly during Covid-19 pandemic, has been an increasing public health concern. Ngui and colleagues,¹⁵ in their global overview of mental disorders and health inequalities, point to inequalities relating to access to care, use and outcomes of care (e.g. morbidity and mortality), and occurring by geographical region, gender, socioeconomic status, racial or ethnic background, and sexual orientation among other things. Inequalities in mental health are pervasive and often ignored,¹⁵ and associations between mental ill-health and multiple inequalities are complex, interactive, multi-directional, and cumulative.

Separately, tobacco use is associated with and causes inequalities.⁴⁵ Smoking prevalence is higher among disadvantaged groups,⁴⁶ and associated with multiple measures of socioeconomic disadvantage.²⁵ Associations between mental ill-health and tobacco use are well-established,^{10,16,17,25,47} contributing to substance-use morbidity known to exacerbate inequalities in those with mental ill-health.¹⁵

We provide further evidence for these substance-use exacerbations of inequalities in young adults with mental ill-health as regards smoking, and to a more limited extent, as regards increased e-cigarette use when compared with those without mental ill-health and recommend education and interventions specifically focused on this population group. We show that, in terms of characteristics (gender, employment, age of smoking initiation) that predict smoking and e-cigarette use, young adults with mental ill-health differ from their peers without mental ill-health, and we draw attention specifically to young males in paid employment at 20 years and who start smoking before age 16. If these vulnerable groups are not to be excluded and left behind, tailored and targeted consideration and interventions are needed when developing tobacco control interventions. Otherwise, the current stagnant state of smoking in post-Smoking Ban Ireland and further afield will continue and e-cigarette use will continue to increase.

Limitations

The lack of smoking prevalence data in mental ill-health in Ireland in this age group prior to the smoking ban is a significant limitation in interpreting the effects of the ban but it is clear that 20 year olds with mental ill-health have higher rates than those not reporting being diagnosed with mental ill-health.

Conclusion

Young adults with mental ill-health have an additional likelihood of smoking, over and above all other risk factors identified. Similar associations with mental health ill-health exist for e-cigarette use as have been shown to exist for smoking but differences are also observed suggesting that both commonality and differentiation are required when considering and

developing targeted education, prevention and cessation interventions as well as tobacco control policy measures and legislation. For 20 year-olds with mental ill-health, a clear need exists for education and cessation interventions to address their significantly higher rates of smoking and also their e-cigarette use, addictive behaviours which are likely to exacerbate health inequalities among this vulnerable group.

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Author contributions

JH: conceptualization, methodology, analysis, writing - original draft, writing - review & editing, visualization, supervision, funding acquisition. **SS:** analysis, visualisation, methodology, review & editing. **LC:** conceptualization, methodology, writing - review& editing, supervision, funding acquisition.

Ethical statement

Ethical approval

Ethical approval for GUI Wave 4 was granted by the GUI Research Ethics Committee, Department of Children and Youth Affairs, Ireland and we confirm that all methods were performed in accordance with the relevant guidelines and regulations. Informed consent was obtained from all subjects and/or their legal guardian(s) (eg, https://www.growingup.gov.ie/pubs/9_Year_CC_Parent_Leaflet.pdf).

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