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RESEARCH REPORT

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# Expanding our understanding of long-term trends in alcohol abstention and consumption in England (2001–19) using two age–period–cohort approaches

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## Abstract

**Background and aims:** Alcohol consumption has decreased in England in recent decades, while alcohol-specific death rates have remained relatively stable. Age–period–cohort (APC) models offer the potential for understanding these paradoxical trends. This study aimed to use an APC model approach to measure long-term trends in alcohol abstention and consumption in England from 2001 to 2019.

**Design, setting and participants:** The study used grouped and proxy-variable APC models of repeat cross-sectional survey data, set in England (2001–19). Participants were residents in England aged 13 years or over who took part in the Health Survey for England.

**Measurements:** Outcome variables were alcohol abstention and consumption in units. We created nine age groups (13–15, 16–17, 18–24, 25–34, until 65–74 and 75+, reference 45–54 years), four periods (2001–04, 2005–09, 2010–14 to 2015–19, reference 2005–09) and 18 5-year birth cohorts (1915–19 to 2000–04, reference 1960–64). We proxied age effects (systolic and diastolic blood pressure), period effects (alcohol affordability, internet usage and household alcohol expenditure) and birth cohort effects (prevalence of smoking and prevalence of overweight).

**Findings:** The odds of abstaining were considerably larger at young ages, 13–15 years [odds ratio (OR) = 5.38; 95% confidence interval (CI) = 4.50–6.43], were lowest during the first period, 2001–04 (OR = 0.83; 95% CI = 0.79–0.86) and had a U-shaped pattern by birth cohort. For units of alcohol, the incidence rate ratio (IRR) increased until age 18–24 years (IRR = 1.41, 95% CI = 1.34–1.48) and decreased afterwards, were highest during the first period, 2001–04 (IRR = 1.07; 95% CI = 1.05–1.08) and showed an inverted J-shape by birth cohort. Our proxy variable approach revealed that using blood pressure measures, alcohol affordability and prevalence of overweight as proxies resulted in APC effects that differed from our base-case model. However, internet usage, household expenditure on alcohol and smoking prevalence resulted in APC effects similar to our base-case model.

**Conclusions:** The discrepancy between decreasing alcohol consumption and increasing alcohol-related deaths observed in England from 2001 to 2019 may, in part, be explained by the halt in abstention trends since 2010 and a slight consumption decline since 2001.

**KEYWORDS**
Abstention, age–period–cohort, alcohol, consumption, England, trends

## INTRODUCTION

Alcohol consumption is the fifth leading world-wide risk factor associated with morbidity and premature death [1]. In England, the alcohol-specific death rate increased considerably between 2001 and 2008 and remained relatively stable between 2012 and 2019 [2]. This relative stability in alcohol harm contrasts with the increased abstention observed in recent decades in England [3]. The percentage of adults (aged 16+) who drank alcohol during the last week fell from 67% in 1998 to 54% in 2019, while the most significant decline has been found among 8–15-year-olds. In this population, the percentage who ever had an alcoholic drink fell from 45% in 2003 to 15% in 2019 [4]. Studying long-term trends and population subgroup dynamics in alcohol abstention and consumption in greater detail may therefore contribute to understanding the discrepancy between consumption and harm trends observed in England.

Age–period–cohort (APC) models have been widely used to understand long-term trends. They aim to disentangle (or decompose) the effects of ageing or life-course transitions (age effects) from contextual or historical factors (period effects) and from generational or other social processes associated with the year of birth (cohort effects) [5–7]. Previous APC studies, mainly conducted in high-income countries, showed a clear age pattern of increased alcohol participation until around the age of 20 years [6], followed by a slow decline with age [7]. Period effects showed country-specific trends, while most cohort effects suggested a decrease in participation and consumption in birth cohorts born after 1985 [8–12]. There are two previous APC studies using data from Great Britain but these used earlier periods, 1984–2009, and only the adult population [13, 14]. These studies therefore require updating, while the omission of under-16-year-olds may lead to an underestimation of ongoing cohort trends visible in younger age groups.

In this study, we first replicated, updated and extended the grouped APC analysis by Meng et al. [13] to cover a later period (2001–19), more recent birth cohorts and a larger age range by incorporating people aged 13–15 years into the analysis. We then used an APC 'proxy variable' approach [6, 15, 16], specifying proxy variables which could theoretically be related to changes in alcohol abstention and consumption, to explore a more theoretical model identification process and then compare the results to those from our grouped APC model. Using these two estimation strategies combined provided benefits in two ways: first, it allowed us to check the robustness of our empirical approach and secondly, it allowed us to explore the association between the proxy theoretical variables and our APC effects.

## METHODS

### Data sources and study design

We used yearly cross-sectional individual-level data from a total of 227 900 respondents aged 13–85 years in the Health Survey for England (HSE) [17–44] for the years between 2001 to 2019 (excluding booster samples [45]). The HSE is an annual repeated cross-sectional survey representative of the population of England and monitors the population's health and care. It uses a stratified random sampling technique to select approximately 10 000 private households in England. It has collected information from each individual within the household on core questions such as smoking, alcohol and general health since 1992. Children aged 2–15 years were included in the sample from 1995 onwards, but the representativeness of this age group improved in 2001 [46]. The data sets are available to the public through the UK Data Service (https://beta.ukdataservice.ac.uk/datacatalogue/series/series?id=2000021).

We used an APC modelling approach and four strategies to address the 'identification problem' associated with APC models, which arises from the linear dependency between age (A), period (P) and birth cohort (C) since $C = P - A$ [5, 6]. First, we graphically displayed period and age trajectories to find descriptive patterns that could later be compared to the estimation results [5]. Secondly, we estimated a grouped APC model using categorical age, period and birth cohort, replicating, updating and extending an earlier study [13]. Thirdly, we estimated a 'proxy variable' APC model and compared it to our grouped APC estimation to test the robustness of the extended grouped APC analysis findings and generate hypotheses about the potential factors explaining age, period and cohort effects. Finally, we ran a series of sensitivity analyses using different age, period and birth cohort groupings to check our results' robustness.

### Outcome measures

#### Alcohol abstention

For those aged 16+, we created an alcohol abstention variable that had the value '0' if they reported drinking 'once or twice a year' or more frequently, and the value '1' if they reported that they did not drink alcohol nowadays or did not drink at all in the last 12 months. For those aged 13–15, the alcohol abstention variable created had the value '0' if they reported ever having a proper alcoholic drink or reported drinking at least 'only a few times a year' or more frequently.

In contrast, it had the value '1' if they had responded negatively to ever having a proper alcoholic drink or if they selected 'I never drink alcohol' on the alcohol frequency question.

## Alcohol consumption

The variable 'total units of alcohol consumed in the last 7 days', as used in Meng et al. [13], was unavailable between 2003 and 2010 for the group aged 16+. As no alternative variable was available for the whole study population, we used different variables for the two age groups. We used 'total units of alcohol on the heaviest drinking day in the last 7 days' for those aged 16+ and the variable 'total units of alcohol consumed in the last 7 days' for 13–15-year-olds [47]. These two variables were combined into one alcohol consumption variable measured units for our whole sample population (restricted to drinkers only). For more details, please see Supporting information, Figure S4.

For our sensitivity analysis, we created a second alcohol consumption variable that used the variable 'total units of alcohol per week' for the whole sample population (13–15-year-olds and 16+ drinkers only), but only for years 2001, 2002 and 2011 to 2019, when it was available.

## Grouped APC variables

We created the variables for our APC analysis based on Meng et al. [13] to replicate, update and extend their analysis for Great Britain for an earlier period (1984–2009). Therefore, we used the same categorical age variable with nine age groups (13–15, 16–17, 18–24, 25–34, 35–44, 45–54, 55–64, 65–74 and 75+); the same categorical period variable with 4-year periods but starting with 2001–04, and finishing with 2015–19; and the same categorical cohort variable with 5-year birth cohorts, starting with those born between 1915 and 1919 until those born between 2000 and 2004 (obtained by subtracting single years of age from survey year). We used a multiple imputation model to impute single years of age for all individuals between 2015 and 2019 who only had categorical age, as performed previously [48].

## APC proxy variables

Our proxy variable approach used proxies for age, period and cohort to check the robustness of our grouped estimation and explore theoretical underlying factors that could be associated with our APC effects. To proxy age, we used two variables in the HSE correlated with biological ageing [49]: systolic and diastolic blood pressure (in millimetres of mercury, mmHg). To proxy period, we used three variables evidenced or hypothesized to be associated with changes in alcohol behaviour: the alcohol affordability index [50, 51], the percentage of the population using the internet [52, 53] and the proportion of household income spent on alcohol [50, 54]. Finally, to proxy cohort, we chose two variables with a strong birth cohort component that have also been associated with alcohol use [55]: current smoking prevalence [56] and prevalence of being overweight [48] by survey year and 5-year birth cohort. More details about the distribution of our proxy variables can be found in Supporting information, Figures S1–S3.

## Statistical analysis

We first graphically compared trends by survey year for the prevalence of alcohol abstention (percentage) and alcohol consumption (measured in average units) separately for the population aged 13–15 and the population aged 16+. Secondly, we plotted 5-year birth cohort's age trajectories on our alcohol abstention and consumption outcome variables. Then, in line with Meng et al. [13], we estimated the APC models using logistic regression for abstention and negative binomial regression for consumption.

We first estimated our base-case grouped APC approach, where age, period and birth cohort were introduced simultaneously as explanatory categorical variables, and used the same reference categories as Meng et al. [13] for comparability. We graphically reported the estimated parameter and their 95% confidence interval (95% CI) for males, females and the general population (GP).

We then used the 'proxy variable' APC approach and three scenarios. The first scenario used two proxy variables for age effects, the second used three proxy variables for period effects and the third used two proxy variables for cohort effects. We reported results using line graphs (estimated parameter and 95% CIs) with a line for each of the following model specifications: (1) results from our base-case grouped APC analysis; (2) results from the model omitting the proxied effect (no age variable included in the first scenario, no period variable in the second and no cohort variable in the third); (3) results from models including each proxy at a time (one for diastolic blood pressure and one for systolic blood pressure when proxying age; one for alcohol affordability, one for internet usage and one for household income spent on alcohol when proxying period; one for birth cohort smoking prevalence, and one for birth cohort overweight prevalence when proxying cohort); (4) and finally, results from a model including all proxies at the same time.

We performed all our analyses in Stata version 18 without sample weights. The Supporting information reported coefficients from our regression analyses and replication results from Meng et al.'s analysis.

## Sensitivity analyses

We ran four sensitivity analyses: two checked the robustness of our extended grouped APC model results, and two extra sensitivity analyses checked the robustness of our results to data limitations. To check the robustness of our grouped APC model, we first used different age, period and cohort groupings, as performed in previous studies [48, 56]. Secondly, we checked the robustness of our results to the alternative alcohol consumption variable, which was only available for 2001, 2002 and 2011–19. Thirdly, we first ran our grouped APC model using the available HSE sample weights (with the limitation that they were first introduced in 2003, they have been modified over time, and were revised in 2018 [57]). Fourthly, we ran the same model with clustered standard errors using the cluster variable for the HSE sample (also unavailable for the whole study period [58] and modified over time [49, 59–61]). Results for all sensitivity analyses are reported in the Supporting information.

# RESULTS

## Descriptive statistics

Our sample consisted of 161 909 individual observations for the whole study period (2001–19). Figure 1a shows that there was an increase in the prevalence of alcohol abstention among those aged 13–15 and those aged 16+ during the study period, from 38% classified as alcohol abstainers in 2001 for those aged 13–15 (95% CI = 34–41%) to 72% in 2019 (95% CI = 70–74%), while for the population aged 16+, it increased from 11% in 2001 (95% CI = 11–12%) to 19% in 2019 (95% CI = 19–20%).

Regarding alcohol consumption among drinkers (Figure 1b), there was a decrease between 2001 and 2017. Even though consumption among those aged 13–15 was more volatile, their mean total weekly units of alcohol consumption decreased from 7.4 total units per week in 2001 (95% CI = 6.1–8.7) to 3.0 in 2017 (95% CI = 2.5–3.5), while consumption among those aged 16+ decreased from 6.9 units on the heaviest day in the last 7 days in 2001 (95% CI = 6.7–7.1) to 5.6 in 2017 (95% CI = 5.5–5.7).

## Age trajectories by 5-year birth cohorts

The descriptive analysis in Figure 2 showed a steep decrease in alcohol abstention across the teenage years: from 69% classified as alcohol abstainers at age 13 to 14% at age 19 years. Abstention then remains relatively stable across age groups thereafter. Abstention

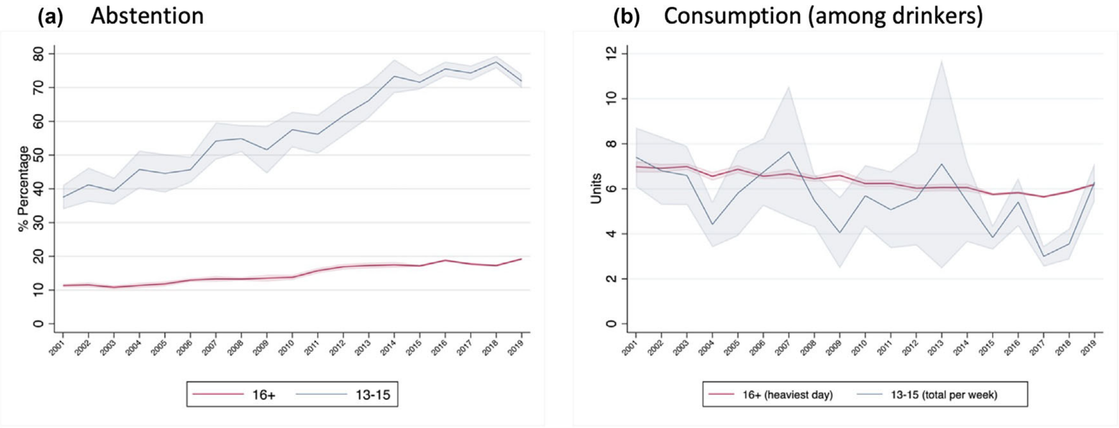


**FIGURE 1** Descriptive trends in alcohol use: (a) percentage of alcohol abstention and (b) average consumption in units (drinkers only) among population aged 13–15 years and those aged 16+ in the Health Survey England (2001–19). *Note*: Consumptionamong those aged 13–15 years was measured in average units per week, while for those aged 16+ was measured in average units on the heaviest day in the last week.

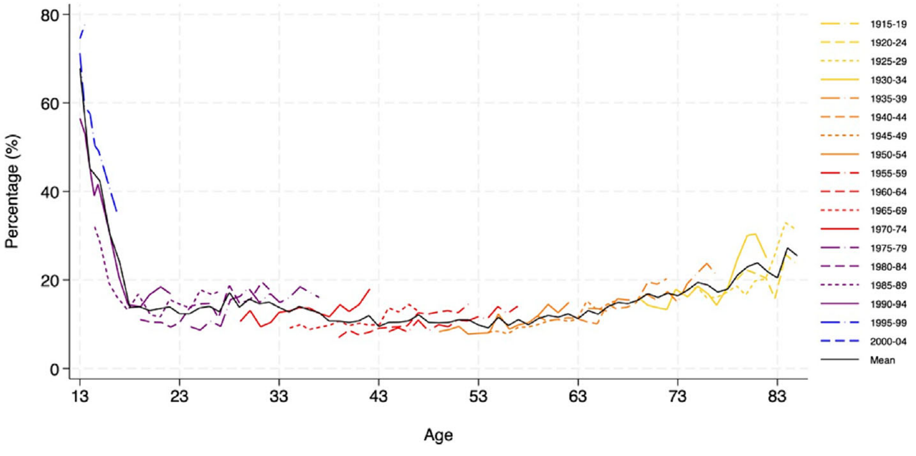


**FIGURE 2** Age trajectories in the percentage of the population classified as alcohol abstainers by age for each 5-year birth cohort in England (Health Survey England, 2001–19).

trajectories throughout birth cohorts were similar among all born before 1974. However, larger differences were found among more recent birth cohorts. We found evidence of an increasingly delayed initiation of drinking among successive birth cohorts. For example, the abstention rate at age 13 was higher in each of the three successive birth cohorts: 1990–94 (57%), 1995–99 (71%) and 2000–04 (75%).

Figure 3 shows that alcohol consumption increased rapidly between ages 13 and 19 years and peaked at approximately age 20 at an average of 11 units. Differences between birth cohorts' age trajectories for alcohol consumption were larger until approximately age 43 years, with closer age trajectory lines after that age. Therefore, both Figures 2 and 3 suggest that there was more variation across birth cohorts at younger ages compared to middle and older ages.

## APC estimation results: base-case grouped APC analysis

The odds of being an alcohol abstainer compared to our reference category, ages 45–54, were higher at early ages [13–15 odds ratio (OR) GP = 5.38; 95% CI = 4.50–6.43; 16–17 OR GP = 1.28; 95% CI = 1.06–1.53] and remained close to 1 after the age of 18 (Figure 4a). Only a small difference was observed between males and females in the 25–34-year-old age group, where the odds of abstention were slightly higher for females (OR = 1.15; 95% CI = 1.00–1.32) compared to males (OR = 0.79; 95% CI = 0.66–0.96).

In terms of period effects (Figure 4b), the OR for alcohol abstention was lowest between the 2001–04 period (OR GP = 0.83; 95% CI = 0.79–0.86) compared to 2005–09 (reference). The odds then remained stable between the periods 2009–14 (OR GP = 1.29; 95% CI = 1.24–1.35) and 2015–19 (OR GP = 1.23; 95% CI = 1.16–1.31), with no statistically significant differences between males and females.

In terms of cohort effects (Figure 4c), we observed a U-shaped pattern, with higher odds of being an abstainer on either side of our reference cohort (1960–64). The odds of abstention were higher in more historical birth cohorts (with a large gap between males and females for those born between 1915 and 1934) and remained stable for cohorts born between 1940 and 1969 (with a small gap between males and females). They then rose slightly above the predicted trend in cohorts born from 1970 to 1984 before rising sharply for those born between 1995–99 (OR GP = 2.15; 95% CI = 1.78–2.79) and 2000–04 (OR GP = 3.46; 95% CI = 2.77–4.33). This confirms the descriptive results in Figure 2; that is, when controlling for age and period, the two most recent birth cohorts have higher odds of abstention than their close predecessors.

Figure 4.2 shows that for alcohol consumption, the incidence rate ratio (IRR) increased with age until its maximum at age 18–24 years (IRR GP = 1.41; 95% CI = 1.34–1.48), then lowered for the age group 25–34 (IRR GP = 1.11; 95% CI = 1.07–1.15) and continued lowering for each age group through to the age group 75+ (IRR GP = 0.82; 95% CI = 0.76–0.82). Period effects showed a slow decreasing trend in IRR during our study period (2001–04 IRR GP = 1.07; 95% CI = 1.05–1.08; 2015–19 IRR GP = 0.86; 95% CI = 0.84–0.88) compared to our reference period (2005–09). Finally, birth cohort effects showed an inverted J-shape, with lower IRR in the most historical birth cohort (1910–14 IRR GP = 0.40; 95% CI = 0.36–0.45), relatively stable around 1 for birth cohorts 1960–64 to 1995–99 and lower IRR for the most recent birth cohort 2000–04 (IRR GP = 0.77; 95% CI = 0.66–0.89).

While almost no statistically significant differences were observed between males and females in age and period effects for alcohol consumption, cohort effects showed that females born between 1990 and 2004 had slightly larger IRR (IRR 1990–94 = 1.20; 95% CI = 1.12–1.30, IRR 1995–99 = 1.14; 95% CI = 1.03–1.26, IRR 2000–04 = 1.05; 95% CI = 0.87–1.27) than males born in the same period (IRR 1990–94 = 1.04; 95% CI = 0.96–1.13, IRR 1995–1999 = 1.00; 95% CI = 0.90–1.11, IRR 2000–04 = 0.59; 95% CI = 0.48–0.73).

## APC estimation results: 'proxy variable' approach

Figure 5 shows the results for the three scenarios used for our 'proxy variable' APC approach for alcohol abstention. The main difference

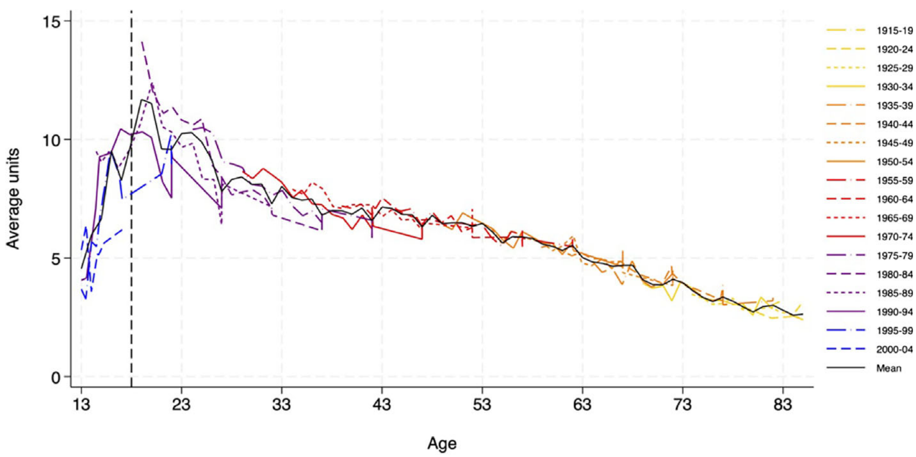


**FIGURE 3** Age trajectories of mean weekly alcohol consumption among drinkers in units by age for each 5-year birth cohort in England (Health Survey England, 2001–19). *Note*: Based on our consumption variable, which combines 'total weekly units of alcohol consumption' among drinkers aged 13–15 years, and 'total units of alcohol consumption on the heaviest day in the last 7 days' among drinkers aged 16+ years; the dashed line at age 18 years, which is the legal age for alcohol purchase in the United Kingdom.

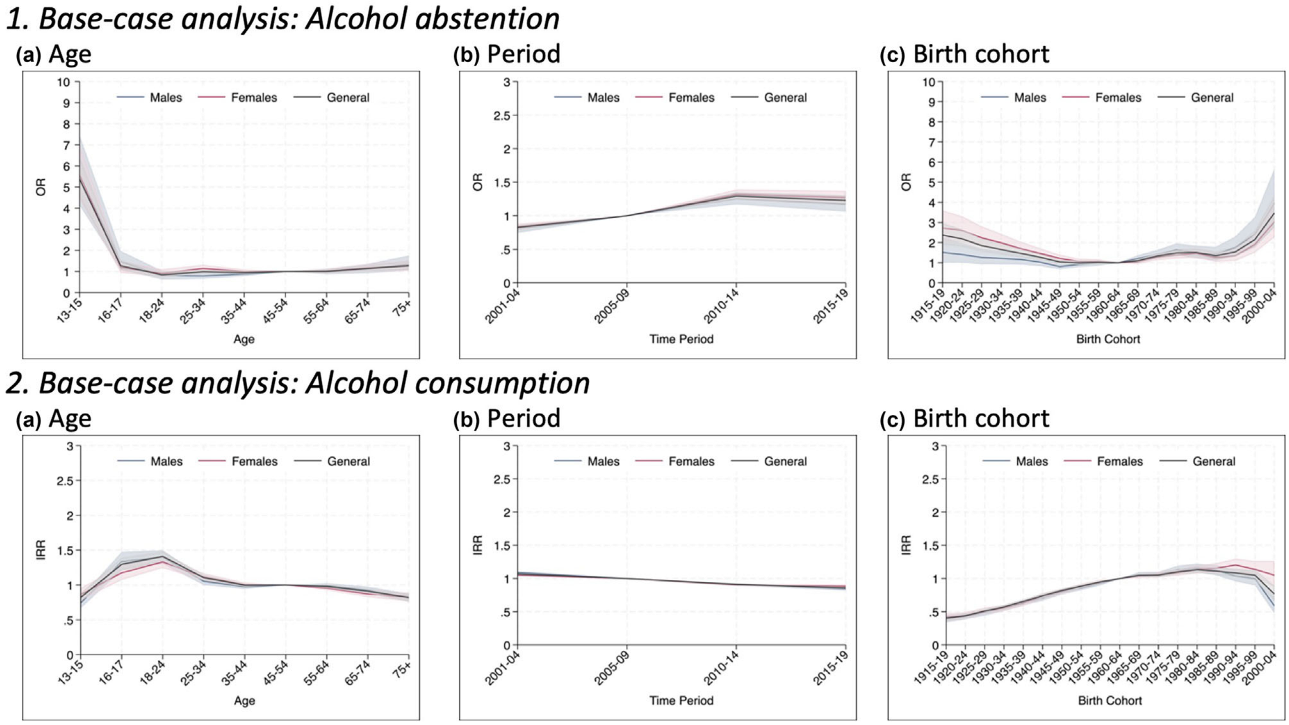


**FIGURE 4** Estimated ratio and 95% confidence interval of (1) being an alcohol abstainer compared to an alcohol drinker (odds ratio) and (2) incidence rate ratio for alcohol consumption among drinkers by age group, survey period and 5-year birth cohort for males, females and the general population (Health Survey England, 2001–19). *Note*: The reference age group is aged 55–64 years, the reference period is 2005–09 and the reference birth cohort is 1960–64. Consumption in children (aged 13–15 years) was measured in average units per week, while for adults (aged 16+ years) it was measured in average units on the heaviest day in the last week.

with our base-case grouped APC was found for cohort effects when proxying age (Scenario 1). When age was proxied or omitted from the model (Scenario 1), our most recent birth cohorts had considerably larger odds of abstaining than our base-case grouped APC. For Scenario 2, when period was proxied with internet usage, with the proportion of household expenditure on alcohol or when all proxies were included, results were much closer to our base-case grouped APC. Therefore, the proposed proxies appear to capture period effects well. Similarly, for Scenario 3, when cohort was proxied with current smoking prevalence by birth cohort, results were very similar to our base-case grouped APC, suggesting that this proxy appears to capture cohort effects well for alcohol abstention.

For alcohol consumption (Figure 6), the largest differences between the proxy analysis and the base-case grouped APC were again observed in our birth-cohort trends when proxying age (Scenario 1). There were also differences among model specifications for age and cohort effects when proxying period (Scenario 2), with larger effect magnitudes when no period was included in the model and when using only affordability to proxy period. However, trends were again closer to our base-case grouped APC when period was proxied with internet usage and the proportion of household expenditure on alcohol (Scenario 2). Less clear evidence was found when cohort was proxied (Scenario 3). This suggests that internet usage and the proportion of household expenditure on alcohol were proxies that captured period effects well.

## Sensitivity analyses

Our APC estimation results using the sensitivity measure of consumption (Supporting information, Figure S8) showed similar patterns to those observed in Figure 4.2, although the IRRs were smaller in magnitude. The sensitivity analyses using different groupings for our APC model (2-year age groups, 5-year period groups and 10-year birth cohort groups) showed the same patterns observed in Figures 4 and 5. The only difference was a smaller consumption decline over time compared to Figure 5 (Supporting information, Figure S9). Results from the sensitivity analysis using sample weights and clustered standard errors aligned with our results in Figure 4, with slightly larger CIs (Supporting information, Figures S6 and S7).

# DISCUSSION

Our base-case grouped APC analysis updated, replicated and expanded the analysis in Meng et al. [13] by using the latest survey years, a larger age range and incorporating the population aged 13–15 years for the first time to analyse data for England after 2009. Our age effects showed a sharp decline in abstention during the early teenage years (aged 13–15 years), lower levels of abstention among 18–24-year-olds and then a slight increase in abstention through the

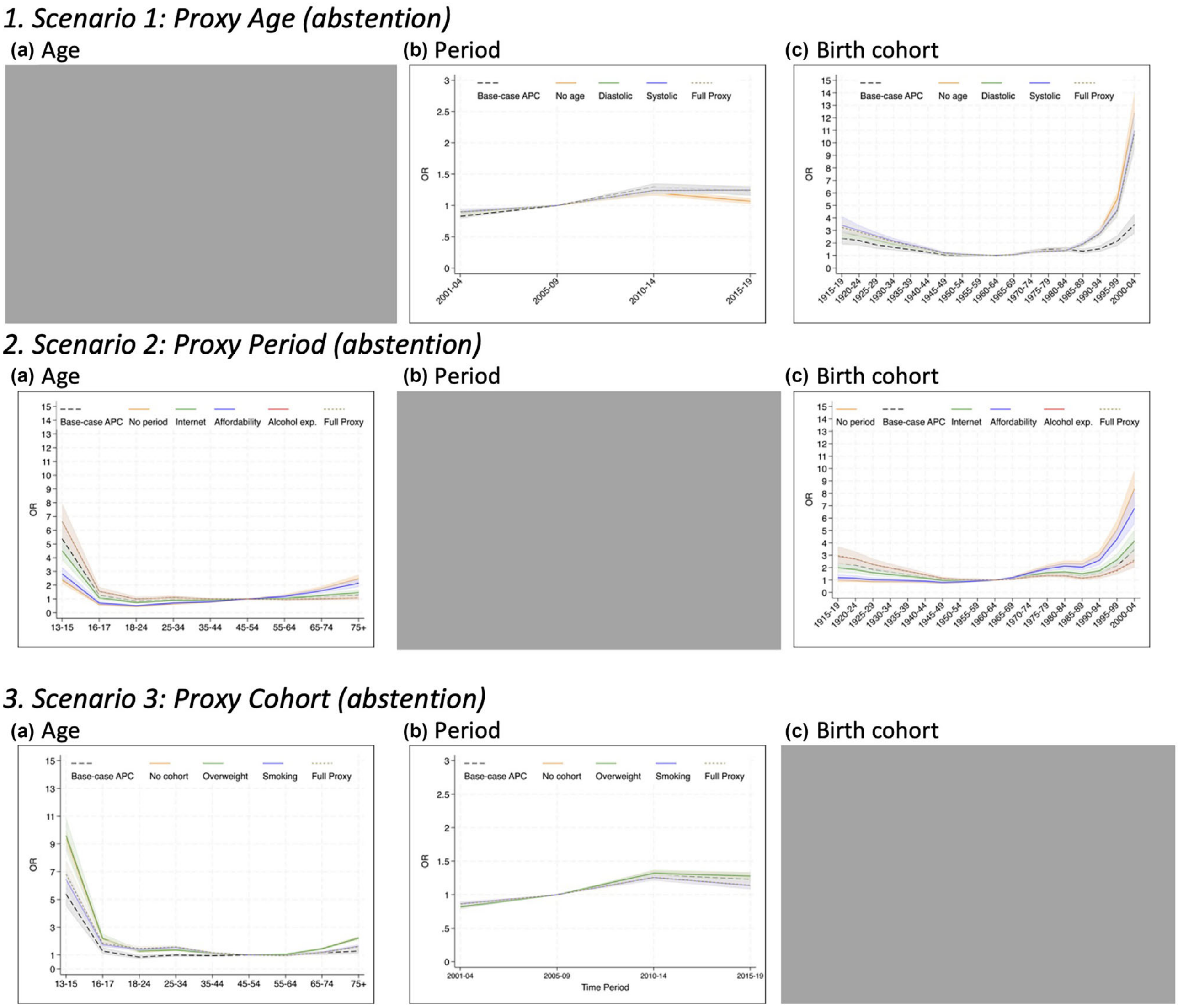


**FIGURE 5** Estimated odds ratio and 95% confidence interval of being an alcohol abstainer compared to an alcohol drinker by age group, survey period and 5-year birth cohort for males, females and the general population using a proxy variable approach (Health Survey England, 2001–19). *Note*: The reference age group is 55–64 years, the reference period is 2005–09 and the reference birth cohort is 1960–64. APC = age–period–cohort.

older age groups, while consumption peaked in the 18–24 group and declined slightly over the later age groups. Period effects were increasing linearly for alcohol abstention until the period 2010–14 and remained stable afterwards, while linearly decreasing slowly for consumption for the whole study period. Cohort effects showed a U-shaped pattern for abstention and an inverted J-shape for consumption.

Our second analysis showed that proxying age with systolic and diastolic blood pressure (biological age) did not fully capture the effect of age on alcohol abstention and consumption observed in our base-case analysis. However, internet usage and household expenditure on alcohol, used to proxy period, produced APC effects similar to those observed on abstention and consumption in our base-case grouped APC analysis. This was also observed when smoking prevalence was used to proxy cohort. Therefore, we can conclude that a strong statistical association can be inferred between these proxies and age, period and cohort effects for alcohol abstention and consumption during the last 20 years.

## Contribution to the literature

To our knowledge, this is the first APC analysis on alcohol to use data after 2016. Like most APC studies, our results for adults also showed a period decrease in alcohol participation and consumption [9, 11–13]. However, our later period analysis showed that abstention stabilized between 2014 and 2019, suggesting that the decrease in alcohol participation observed in Great Britain by Meng et al. [13] and in other countries in previous studies (using an earlier period) has since stopped.

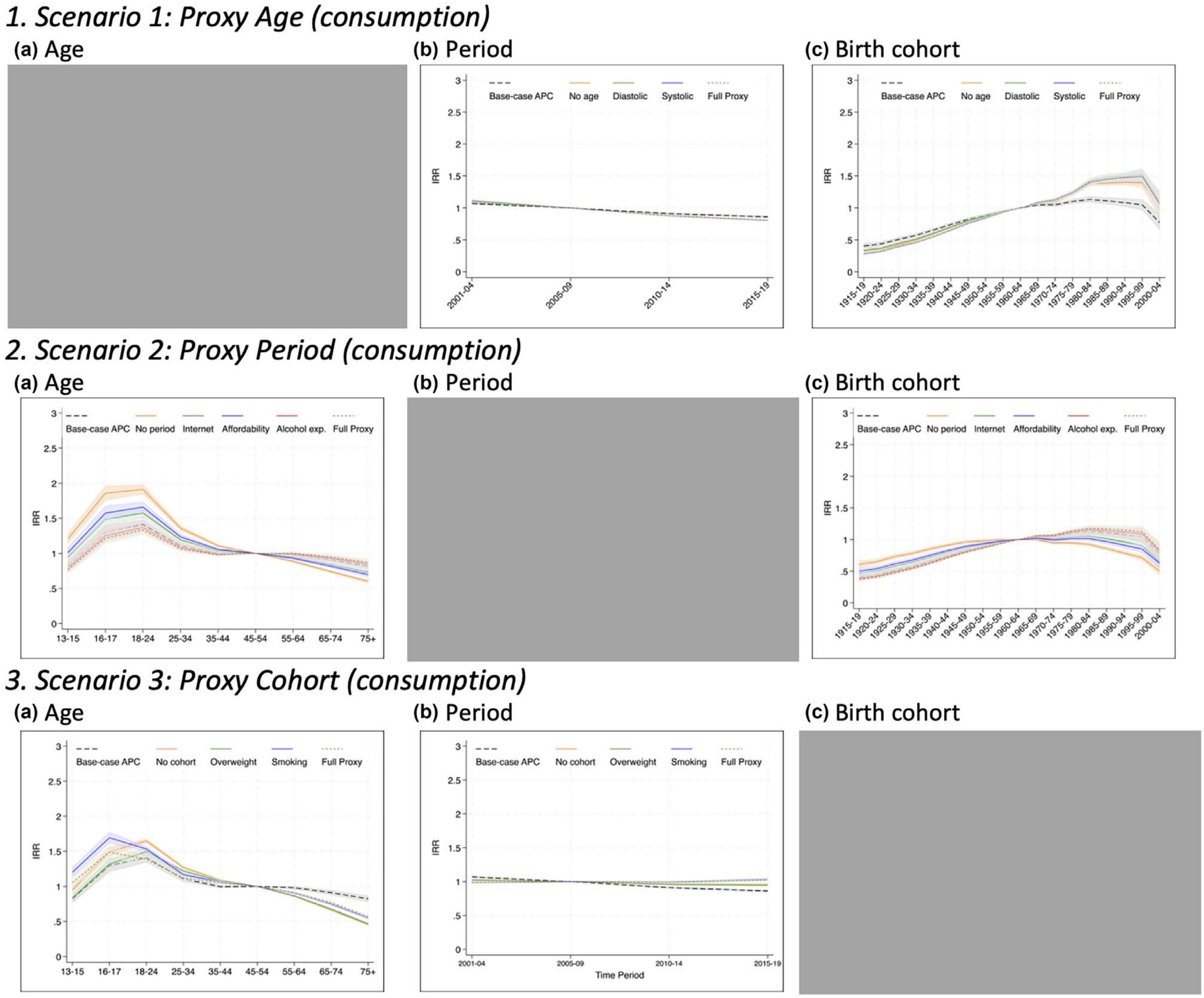


**FIGURE 6** Estimated incidence rate ratio and 95% confidence interval for alcohol consumption among drinkers by age group, survey period and 5-year birth cohort for males, females and the general population using a proxy variable approach (Health Survey England, 2001–19). *Note*: The reference age group is 55–64 years, the reference period is 2005–09 and the reference birth cohort is 1960–64. Consumption among 13–15-year-olds was measured in average units per week, while for those aged 16+ years it was measured in average units on the heaviest day in the last 7 days. APC = age–period–cohort.

As reported by Meng et al. [13], more recent birth cohorts were more likely to abstain. However, as our study observed birth cohorts born between 1985 and 1994 for a longer period, we found a decrease in their likelihood of being abstainers compared to their predecessors and a steep increase among birth cohorts born after 1994. For those born after 1994, our results were consistent with the literature for other countries, which showed more abstention among birth cohorts born during the 1990s [8, 9, 11, 12]. Our results expand on this, and suggest that abstention is even higher among birth cohorts born during the 2000s.

Regarding consumption, our age effects were similar to those of Meng et al. [13], but period and cohort effects differed. They differed for our main consumption variable and our sensitivity analysis consumption variable, which used a closer definition to Meng et al. [13]. This difference could be related to the years included in their study and in ours. While theirs (1986–2009) included a period of mainly increasing alcohol consumption in the British population, ours (2001–19) included a period of mainly decreasing alcohol consumption among the British population [62]. Therefore, this difference and the different life stages of the birth cohorts—due to the different years observed—may partly explain this difference.

## Strengths and limitations

A key strength of our study is that it used several strategies to address the identification problem, including two APC estimation strategies: an empirical approach that creates groups in the APC variables and a theoretical approach that uses proxies for the APC variables. Both aim to break the multicollinearity between the three variables, one using an empirical approach and the second using a more theoretical one. The literature proposing solutions to the identification problem in APC models is extensive, but no single agreed answer exists. Testing multiple approaches to assess robustness is, therefore, a good practice. We found consistency between our two approaches only when using certain proxies. Proxies such as internet usage, the proportion of household budget spent on alcohol and smoking prevalence by birth cohort closely resembled results from the grouped APC model; however, proxies such as systolic and diastolic blood pressure and overweight by birth cohort did not. Future research should explore other proxies and the effect of policy changes and hypothesize the mechanisms through which they correlate with age, period and cohort effects.

Another strength of our study was that it included 13–15-year-olds. This allowed us to study abstention and consumption since the early teenage years, which is less frequent in the literature. This has been possible by using the HSE, a large nationally representative survey with a long series of data on both children and adults, which provides enough observations per birth cohort to perform an APC analysis.

Our selection of variable definitions and analyses was constrained by our aim to replicate, update and extend the analysis Meng et al. [13]. We ran a series of sensitivity analyses to explore different outcome variables and groupings, which showed that our results were robust. Nevertheless, future research should aim to adopt more theoretically grounded definitions of reference categories and cover both the period of increasing alcohol consumption discussed in Meng et al. [13] and the subsequent decline addressed in our study to provide a more comprehensive understanding of the trends.

Another data limitation was the unavailability of a variable with single years of age between 2015 and 2019. This meant we had to use a multiple imputation model to obtain single years of age and create our birth cohorts. However, this approach has already been successful for studying obesity and overweight in England [48]. Finally, the data are repeated cross-sectional data. Longitudinal panel data would have been clearer to understand transitions from a life-course perspective. Nevertheless, our approach provides a good approximation, as our age-trajectories for abstention were fairly similar to those observed using longitudinal data for the United Kingdom [63].

## Conclusion

The stop in the increasing trend of abstention observed until 2010 and the slight decrease in alcohol consumption since 2001 are two potential explanations for the discrepancy between decreasing consumption and stable alcohol-related deaths observed in England since 2012. Changes in internet usage, the proportion of household budget spent on alcohol and smoking prevalence by birth cohort were potential theoretical factors underlying APC effects.

## AUTHOR CONTRIBUTIONS

**Magdalena Opazo Breton:** Conceptualization (equal); data curation (lead); formal analysis (lead); funding acquisition (equal); investigation (equal); methodology (equal); project administration (lead); supervision (lead); visualization (lead); writing—original draft (lead); writing—review and editing (lead). **Madeleine Henney:** Conceptualization (supporting); funding acquisition (equal); investigation (equal); project administration (supporting); visualization (supporting); writing—original draft (supporting); writing—review and editing (supporting). **Inge Kersbergen:** Conceptualization (supporting); investigation (equal); project administration (supporting); visualization (supporting); writing—original draft (supporting); writing—review and editing (supporting). **Alan Brennan:** Conceptualization (equal); funding acquisition (supporting); investigation (equal); methodology (equal); project administration (equal); supervision (equal); visualization (equal); writing—original draft (equal); writing—review and editing (equal). **John Holmes:** Conceptualization (equal); formal analysis (supporting); funding acquisition (equal); investigation (equal); methodology (equal); project administration (equal); supervision (equal); visualization (equal); writing—original draft (equal); writing—review and editing (equal).

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## DECLARATION OF INTERESTS

None to declare.

## DATA AVAILABILITY STATEMENT

The data underlying this article (Health Survey for England) are available with an End of User Licence at the UK Data Service website (https://beta.ukdataservice.ac.uk/datacatalogue/series/series?id=2000021).

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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