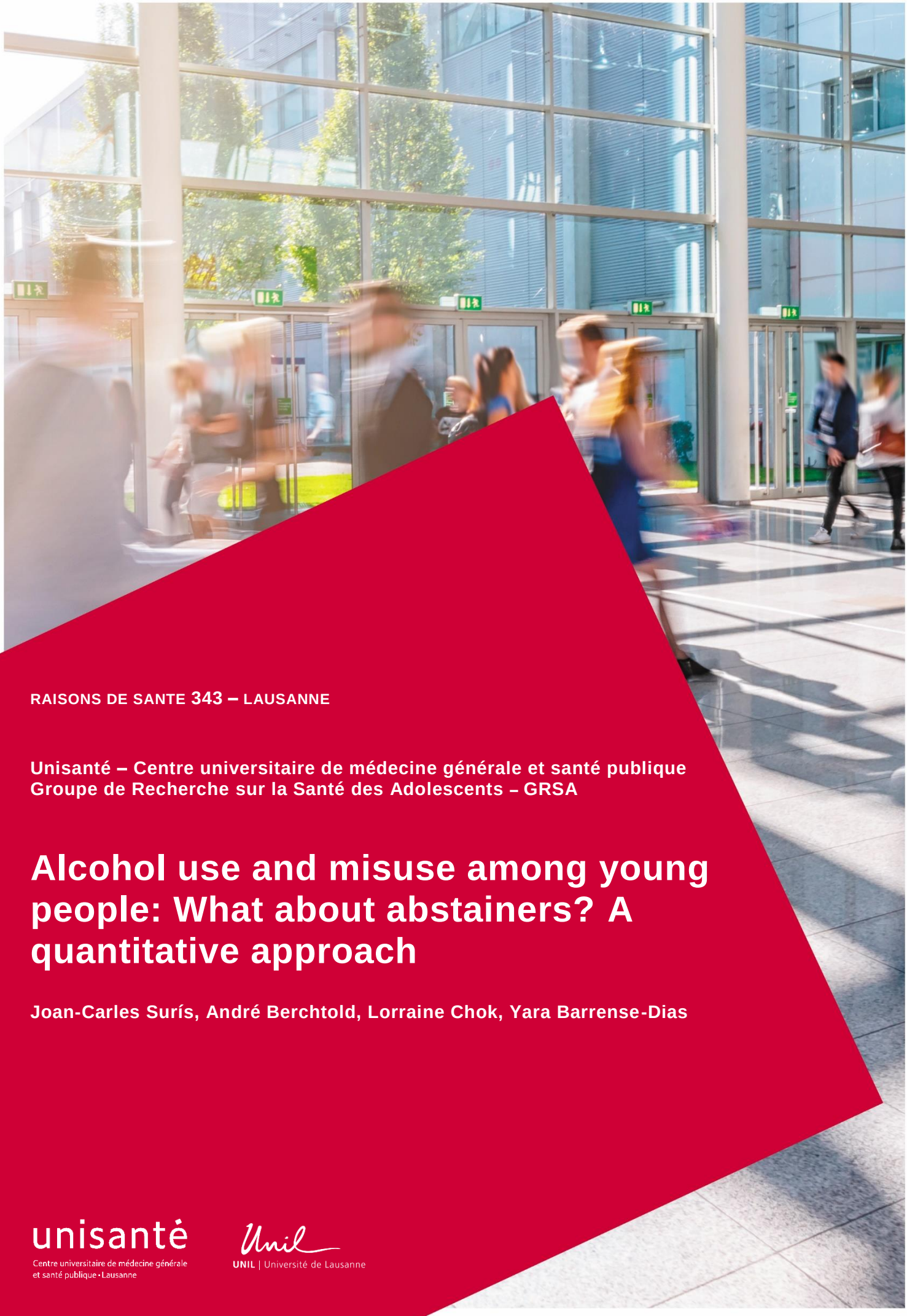

RAISONS DE SANTE 343 – LAUSANNE

Unisanté – Centre universitaire de médecine générale et santé publique
Groupe de Recherche sur la Santé des Adolescents – GRSA

Alcohol use and misuse among young people: What about abstainers? A quantitative approach

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Raisons de santé 343

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1 SUMMARY

1.1 Introduction

Youth's alcohol use and misuse is a public health problem due to its potential consequences. Acute consequences include accidents, other mortality factors, use of other drugs, withdrawal and hangover, risky sexual behaviors, poorer school performance or family functioning; while chronic use leads to effects on bone density and growth, liver function, brain development and mental health. For this reason, to date, most research on alcohol among young people refers to the prevalence of use or misuse and abstinence is rarely addressed.

In order to fill this gap related to abstainers, the objective of this research is to describe the characteristics of alcohol abstainers compared to other groups of drinkers, and whether abstinence evolves into alcohol use over time.

1.2 Methods

1.2.1 DATA

Three databases have been used for this project: Transition from Education to Employment (TREE) 1 and 2, and GenerationFRee.

1.2.1.1 The Transition from Education to Employment (TREE) cohorts

The TREE1 cohort is a longitudinal study based on a sample of more than 6000 young people living in Switzerland who participated in the Programme for International Student Assessment (PISA) survey of the year 2000 and left compulsory school the same year (mean age 16 years at baseline). The sample was followed annually from 2001 to 2007 and additionally in 2010 and 2014 for a total of nine waves. The TREE2 cohort is the second of the TREE cohorts. The design is the same, with a baseline in 2016 (mean age 16 years at baseline) and an annual wave since 2017, with only the first two waves available for analysis at the moment.

1.2.1.2 The GenerationFRee cohort

GenerationFRee is a longitudinal study carried in all post-mandatory schools in the Fribourg canton among students and apprentices (mean age 16 years at baseline) between academic years 2014-15 and 2018-19.

1.2.2 Alcohol consumption assessment and categorization

1.2.2.1 TREE 1 & 2

For the TREE cohorts, the question included in the questionnaire was “How many times have you drank alcohol in the last month?” The possible answers ranged from 1 [Never] to 5 [Every day].

Three categories were defined for the current analysis:

- Abstinent (Never);
- Light drinkers (1-3 times per month);
- Heavy drinkers (weekly or more often).

1.2.2.2 GenerationFRee

For the GenerationFRee cohort, the questions asked were “Do you drink alcohol?” and “Did you get drunk in the last 30 days?” The categories were defined as: Abstinent (never drank); Light drinkers (ever used alcohol but never been drunk); and Heavy drinkers (ever used alcohol and been drunk in the last 30 days).

1.2.3 Explanatory variables

1.2.3.1 TREE1

Gender, Age, Linguistic region at baseline; Nationality, Residence, Family structure, Siblings, Academic track, School grades, Adverse school event, Current tobacco smoking; Current cannabis use (in the last 30 days), Adverse personal episodes, Somatic symptoms, Social support, Self-esteem, Depression, Positive view of the future

1.2.3.2 GenerationFRee

Gender, Age, Residence, Family structure, Relationship with the mother, Relationship with the father, Nationality, Monthly available money, Current tobacco smoking, Current cannabis use (last 30 days), Physical activity, Social life, Positive view of the future, Academic track, School performance, Family socioeconomic status, Somatic health, Emotional well-being,

1.2.4 Imputation

The design of the cohorts used in this study is prone to have missing data. For example, only 1’421 full sequences could be retrieved for TREE1, meaning having valid answers for the alcohol consumption question at each of the nine time points (waves) available. In GenerationFRee, no participant had alcohol related data for the four available waves (maximum 3 waves available).

In order to increase the sample size to ensure sufficient power for the analyses, some of the missing data can be inferred, meaning being assigned their most probable value given the rest of the available data, a process known as imputation. Here, we applied the so-called multiple imputation method, which consists of imputing each missing data item several times (10 in this case) in order to preserve as much as possible the intrinsic variability of the sample. In order to keep as many participants while having trustable data, it was decided to keep persons having valid answers in at least 6 waves in TREE1 and in 2 waves in GenerationFRee.

This multiple imputation step led to a working sample of 3'347 full sequences for TREE1 and 1'645 for GenerationFRee.

1.2.5 Weighting

The samples studied in the current research did not represent the exact composition of the studied population. In order to correct for this and thus having representative results, weights were calculated to correct the structure of the samples. Criteria identified as relevant including age, gender, type of education and linguistic repartition were taken into account to apply that correction. All subsequent analyses were performed taking into account the weightings.

1.2.6 Trajectories of alcohol consumption

This analysis studied the sequence, which is the actual path followed by each participant in terms of variation of drinking status through the length of the study. The aim was to define a typology.

The concept of sequence relies on the identification of the state of the variable of interest (in this case the drinking status) at each observation time point. The aggregation of each of these states chronologically constitutes a sequence, and thus a trajectory for a given individual in the defined timeframe.

The analysis of the sequences is based on the sample regrouping the 10 replications (imputations) of the original sample, hence 33'470 and 16'450 sequences for TREE1 and GenerationFRee, respectively. Therefore, each individual has 10 possible trajectories, such variability being the consequence of missing data.

The analysis of sequences consists in identifying typical trajectories and recurrences in the sequences' structure. It relies on the comparison of the differences and similarities between sequences and thus allows the grouping of similar sequences in distinct groups using the Optimal Matching and clustering methods [1].

We generated the typologies splitting the sample into several corresponding groups, from a split in 2 groups to one in 7 (GenerationFRee) or 8 groups (TREE1).

For both cohorts, the split in 5 groups was selected (independently from the choice for the other cohort). Groups were then named according to the composition of the sequences constituting it.

Sequences analyses were performed using the TraMineR R package [2].

1.2.7 Statistical analyses

The groups of drinking trajectories previously defined (typology) were then confronted to the selected explanatory variables above mentioned for their respective cohort. First, a bivariate analysis was conducted for each variable through either an ANOVA for continuous variables or a chi-2 test for categorical ones. The threshold for statistical significance was set at $p<0.05$.

In a subsequent step, all significant variables at the bivariate level were incorporated into a multinomial backward regression, using Abstinent as the reference category. Using a backward selection, non-significant variables were thus consecutively eliminated until no more variables could be excluded from the model. Results are presented as relative risk ratios (RRR) with 95% confidence intervals.

As we were interested in young people not drinking alcohol, in a second step we put them further in evidence by comparing them to light and heavy drinkers. In this sense, for the TREE1 cohort, we compared Abstinent with the Lighter group (Light and Undecided) and Abstinent with the Heavier group (Light2heavy and Heavy). In both cases we first performed a bivariate analysis followed by a backward logistic regression using the Lighter or Heavier group as the reference category, respectively. Results are presented as odds ratios (OR) with 95% confidence intervals.

Similarly, for the GenerationFRee cohort, we compared Abstinent with the Lighter group (Light, Late onset Light and Undecided) and Abstinent with the Heavy group. In both cases we first performed a bivariate analysis followed by a backward logistic regression using the Lighter or Heavy group as the reference category. Results are presented as odds ratios (OR) with 95% confidence intervals.

All analyses were performed using STATA 16.0 (College Station, Texas).

1.3 Results

In the TREE1 cohort, 5 drinking trajectories based on the corresponding typology were found: Abstainer, Light, Undecided, Light2heavy and Heavy. Similarly, five drinking trajectories were also identified for the GenerationFRee cohort: Abstinent, Light, Undecided, Late onset light and Heavy.

Overall, the non-heavy drinkers groups (light and undecided) were relatively similar to abstainers but not completely. In the TREE1 cohort, abstainers were less likely to be Swiss-born or to be more tired than usual, and more likely to live in an intact family of to be out of the education system. In GenerationFRee, abstainers were less likely to live in an urban environment and to be current cannabis users. They also reported less monthly available money.

However, the heavy groups differed importantly from abstainers in both cohorts. In the TREE1 cohort, abstainers were more likely to be females and to be out of the education system and less likely to be Swiss-born, more tired than usual or current tobacco smokers. In the Generation Free cohort, abstainers were also more likely to be females, living in an intact family and in an urban setting. However, they were younger, less likely to be Swiss-born, and to be current tobacco smokers or cannabis users. They also reported a lower monthly allowance and social life.

1.4 Conclusions

Although there is a sizeable number of abstainers in the three databases, they clearly diminish over time. This may indicate that alcohol abstinence is more due to a lag in starting alcohol use than to remaining a life-time abstainer. Moreover, heavy drinkers continue to be the most represented group among these youths.

Nevertheless, some of the consequences of drinking described in the literature such as a decline in academic performance are not reflected in our results and may explain that drinking affects all kind of young people independently of their academic track or their academic results.

As it could be intuitively expected, light drinkers are quite similar to abstainers in a fair amount of characteristics but not in all of them. This highlights the need to study and analyze abstainers and light drinkers as separated groups and not compare them together to heavier drinkers.

As largely reported in the literature, heavy drinking is mostly a manly attitude, while abstinence or light drinking is more frequently found among women.

The family situation, be it its structure, having siblings or the relationship between the youth and their parents, does not seem to have any impact on the level of alcohol use. Nevertheless, our data do not include neither the drinking patterns of other family members nor the family rules regarding alcohol use, which could bring differences. Similarly, the financial situation of the family is not associated either to alcohol use, proving that all social strata are implicated.

Rural youths seem to be more on the heavy drinking part of the spectrum than city residents. Although this has been described in the literature, it is important to note it from a prevention perspective, as rural youths would need to be especially targeted in alcohol prevention campaigns. Moreover, the *Jeunesses Villageoises* are associations of rural young people who have a tendency to drink in excess.

Similarly, drinkers, and particularly the heavy ones, were more likely to be Swiss-born. Whether this is due to the country of origin, cultural background or religion could not be examined with the current data but need further investigation.

It is also important to notice that, in both cohorts, drinking does not seem to have an impact on physical or mental health. Although one explanation might be that young people (and especially young males, whom are more represented among heavy drinkers) minimize or ignore their health problem, it is also possible that the effects of alcohol use on health appear later on in life.

Nonetheless, even though the literature starts to mention a normalization of alcohol abstinence, our results still show that abstainers report a poorer social life. It is clear, and especially in Switzerland, that part of the alcohol culture is related to social interactions. From this perspective, abstainers could be at a disadvantage. Further research is needed to expose to what point it represents really an issue for young people and what are the strategies they use to overcome it.

Alcohol drinkers, particularly the heavy ones, are more likely to also use tobacco but increased cannabis use is only observed in the GenerationFRee cohort, probably due to the different

definition of Light and Heavy drinkers used. In this sense it does not seem that there is a substance substitution effect but rather two substances used in parallel. To what extent alcohol use could open the path to the use of cannabis or other illegal substances cannot be ascertained with the present datasets.

2 Introduction

Youth's alcohol use and misuse is a public health problem due to its potential consequences. Acute consequences include accidents, other mortality factors, use of other drugs, withdrawal and hangover, risky sexual behaviors, poorer school performance or family functioning; while chronic use leads to effects on bone density and growth, liver function, brain development and mental health [3-5]. For this reason, to date, most research on alcohol among young people refers to the prevalence of use or misuse.

In this sense, data from the 2018 Swiss Health Behavior in School-aged Children (HBSC) survey [6] indicate that, among 15-year-olds, 18.5% of males and 10.8% of females had been drunk at least twice in their lifetime. In the same age group, around one quarter of males and females had drunk at least 5 drinks in a row (binge drinking) in the previous month. Among Swiss male conscripts, 24% were regular and 2% daily drinkers [7].

Despite all that, the percentage of adolescents who do not drink alcohol seems to have increased in the Western world in the past years [8-12]. Cross-sectional data seem to confirm these findings. In Norway, 27% of 15 year-olds reported not drinking alcohol nor smoking tobacco [13]. In a similar line, Haardörfer et al. [14] found that 26% of US college students aged 18-25 were abstainers (last 4 months), and a Swiss research among conscripts[7] reported that 6% were abstainers and 15% drank rarely.

Swedish data [8] show that among 15-16 year-olds, the number of non-drinkers increased from 23% in 2003 to 49% in 2015, while in Finland [9], among 14-year-olds, it increased from 50% in 1983 to 66% in 2013. In England[10], rates of non-drinking among 16-24 year-olds increased from 18% in 2005 to 29% in 2015, mainly due to increases in lifetime abstention. In Australia, the prevalence of 12-month alcohol abstention among 14-17-year-olds increased from 33% in 2001 to 50% in 2010 [11]. Similar trends are observed in Switzerland [12]. Data from the HBSC surveys [6] show that, among 15-year-olds, the percentage of those drinking alcohol at least weekly decreased from 21% in 1986 to 11% in 2018 for males, and from 11% to 4% among females. Likewise, binge drinking in the last month diminished from 36% in 2010 to 27% in 2018 for males and from 31% to 24% for females. Data from the School Survey Project on Alcohol and Other Drugs (ESPAD) among 15-16 year-olds in five European countries from 1999 to 2019 showed a diminution of both consumption volume and heavy episodic drinking, which were highly correlated [15].

Nevertheless, not surprisingly, the proportion of abstainers seems to decrease with age. In Norway, Pedersen[16] found that, by age 21, 11% of individuals had remained abstinent from alcohol all their life while at age 28 they represented only 5%. Among Canadian high-school students, 56% were non-drinkers at baseline and only 40% one year later [17]. In a longitudinal study encompassing over 30-years follow-up, Kerr et al. [18] found that between adolescence and their 50s, only 1.7% were lifetime abstainers and 14% lifetime minimal drinkers (3 drinks or less per month) in the US.

Factors associated with alcohol abstinence described in the literature [16, 19-25] include: younger age, religion, poverty, not having alcohol problems in the family, lower rates of illicit drugs use and smoking, lower rates of antisocial behavior, race, being foreign-born, female gender, parental

supervision and monitoring, parental disapproving of drinking, school engagement, loneliness, emotional wellbeing, having a chronic illness and reporting fewer friends. Recently, Addiction Suisse published a report [12] reviewing the possible explanations for the decrease in adolescent alcohol consumption. Among the hypotheses highlighted were environmental measures (hours of alcohol sales, for example), an increase in the use of new technologies instead of meeting to drink, or a change in adolescents norms and attitudes regarding alcohol use. The authors concluded their research indicating that the current state of research did not allow to really understand the decline in alcohol consumption among young people and that it was important to continue to research to improve understanding and be able to use it in prevention. Others [26] propose that drinking has lost its influence as a rite of passage into adulthood and that there is less pressure to drink. Still, Vashisththa et al. [27] report changes in parental and family practices, in alcohol policy and preventive interventions, in leisure time activities, economic reasons, or substitution with other substances or demographic shifts as explanations for this decreasing alcohol use. On their side, Caluzzi et al. [28] postulate a denormalization of drinking and a normalization of non-drinking. Finally, Scheffels et al. [29] concluded that there are three groups of reasons: influence of non-drinking peers and negative social norms towards alcohol, legal age and relationship to parents disapproving alcohol use, and non-drinking to stay in control. Parenting style [30] or health and lifestyle reasons [31] have also been described. Nevertheless, there is research indicating that the decline in adolescent alcohol use does not seem to be accompanied by an increase in healthier behaviors [32].

However, studies are not conclusive. For example, some [33, 34] report that parental monitoring is negatively associated with adolescent alcohol use, while others [8] state that the increased trend of non-drinkers could not be attributed to parental factors. Similarly, some describe that abstainers in young adulthood are more likely to present symptoms of anxiety or depression [16], whereas others [22] conclude that they are more emotionally healthy. Finally, a large study [35] carried out among young adults in 20 (mostly European) countries found that depression symptoms showed a U–shaped curve, with abstainers doing worse than moderate drinkers and similar to heavy drinkers.

Furthermore, not all youths seem to be abstainers for the same reasons and do not seem to form a homogeneous group. A Swedish study [36] described five latent classes among adolescent non-drinkers: computer gamers (8%), having strict parents (36%), having liberal parents (27%), having controlling but liberal parents (17%), and higher participation in sports (12%) and concluded that there is not one single explanation to describe the decrease in youths alcohol drinking. Besides, there are no strict criteria to define alcohol abstinence among young people, with definitions including *ever*[13, 19, 20, 37], *at the present time*[21], *the last two*[35, 38] or *four weeks*[33], *6*[39] or *12 months prior to the survey*[11, 24, 36, 40-42] or even without a specified time-frame (Ex: *how often do you use alcohol*?)[7, 9]. Moreover, the definition often also includes former or occasional drinkers[10].

To date, most research on youth alcohol (mis)use has been based on its short and long-term negative consequences, while reasons why some youths do not drink or drink very moderately are rarely explored[43]. Moreover, research on adolescent abstainers is scarce, and longitudinal studies are needed[23]. Yet, investigating the insights of non-drinkers would be helpful to design prevention strategies for youths[43, 44]. Furthermore, knowing the strategies non-drinkers use to avoid using alcohol would also help developing new prevention options[43, 44].

As a result of the current type of research, most alcohol prevention campaigns are based on the negative consequences of alcohol misuse. However, if youth's motivations to abstain from alcohol or drink very moderately could be clearly defined, it would allow giving a new positive perspective to alcohol prevention. In this line, the *Fondation vaudoise contre l'alcoolisme* (FVA) in the canton of Vaud has tested a new prevention approach (pilot project during the 2015-2016 school year) based on a questionnaire assessing the state of alcohol consumption before their intervention. Students are then divided in different groups according to their alcohol use and the intervention is therefore adapted to the state/consumption patterns. This method offers targeted messages adapted to the alcohol consumption of each group[45]. Although their objective mainly focused on risky alcohol consumption, the pilot project brought to light a significant group of alcohol abstainers. Other prevention messages had to be considered to enhance them and strengthen them in their choices. Therefore, in addition to fill the gap in the research field, understanding youth's experiences and motivations to abstain from alcohol would allow giving additional information for prevention.

Nonetheless, there is also the socializing aspect of alcohol use. For example, a Finish study found that moderate use of alcohol among girls (but not boys) was associated with a positive self-image in social relationships, academic success and abstinence from drugs[39]. Hoel et al.[22], in Norway, declared that alcohol use improved the quantity and quality of friendships. Likewise, in Sweden, Larm et al.[41] found an association between alcohol use and social media use. Moreover, several authors [7, 23] sustain that, in fact, abstinence could be viewed as a deviation from the social norm. However, in his review, Bailly[23] concluded that among psychologically sound adolescents, abstinence could be due to personality traits or life choices. Analyzing posts published in forums, an Estonian study[46] highlighted different strategies suggested by young people to justify non-drinking and showing the difficulty that such a choice can induce towards peers.

In order to fill this gap related to abstainers, the objective of this research is to describe the characteristics of alcohol abstainers compared to other groups of drinkers, and whether abstinence evolves into alcohol use over time.

3 Methods

3.1 DATA

Three databases have been used for this project: Transition from Education to Employment (TREE) 1 and 2, and GenerationFRee.

3.1.1 The Transition from Education to Employment (TREE) cohorts

TREE1

The TREE1 cohort is a longitudinal study based on a sample of more than 6000 young people living in Switzerland who participated in the Programme for International Student Assessment (PISA) survey of the year 2000 and left compulsory school the same year (mean age 16 years at baseline). The sample was then followed annually from 2001 to 2007 then in 2010 and 2014 for a total of nine waves. More information can be retrieved from the webpage of the project (www.tree.unibe.ch).

TREE2

The TREE2 cohort is the second of the TREE cohorts. The design is the same, with a baseline in 2016 (mean age 16 years at baseline) and an annual wave since 2017, with only the first two waves available for analysis at the moment (more information can be found at www.tree.unibe.ch). Therefore, this cohort is not suitable for defining trajectories yet and will only be used to observe changes in group affiliation one year later.

3.1.2 The GenerationFRee cohort

GenerationFRee is a longitudinal study carried in all post-mandatory schools in the Fribourg canton among students and apprentices (mean age 16 years at baseline) between academic years 2014-15 and 2018-19. Alcohol-related questions were not asked at the last wave, therefore in this study data will concern the baseline and three first waves (4 time points). The initial sample size was 5'834 respondents at baseline. More information can be found in the study's reports [47, 48].

3.2 Alcohol consumption assessment and categorization

3.2.1 TREE 1 & 2

For the TREE cohorts, the question included in the questionnaire was “How many times have you drunk alcohol in the last month?” The possible answers ranged from 1 [Never] to 5 [Every day].

Three categories were defined for the current analysis:

- Abstinent: answer “1” (Never)
- Light drinkers: answer “2” (1-3 times per month)
- Heavy drinkers: answers “3”, “4” or “5” (weekly or more often)

3.2.2 GenerationFRee

For the GenerationFRee cohort, the questions asked were Q1-“Do you drink alcohol?” and Q2-“Did you get drunk in the last 30 days?”

Q1 possible answers were “yes” or “no”

Q2 possible answers were: 1=“never”, 2=“1 to 2 times”, 3=”3 to 9 times”, 4= “10 times or more”.

The categories were defined as:

- Abstinent: answer “no” to Q1
- Light drinkers: Q1=”yes”, Q2=”1” (ever used alcohol but never been drunk)
- Heavy drinkers: Q1=”yes”, Q2=”2”, “3” or “4” (ever used alcohol and been drunk in the last 30 days)

3.3 Explanatory variables

3.3.1 TREE1

Gender: Male/Female

Age: At baseline

Linguistic region at baseline: German/ French/ Italian

Swiss-born: yes/no

Residence: Urban/Rural

Family structure: Parents living together vs. other situations (separated, divorced, deceased, other)

Number of siblings: none, one, more than one

Having an older sibling: yes/no

Academic track: Actual education status:

- Apprenticeship
- Professional school
- High-school
- Other
- None

Below average grades: self-reported (yes/no)

Adverse school event: At least one of the following events occurring in the last 12 months:

- I was refused an apprenticeship for which I applied
- I was not admitted at a school at which I applied
- I quit a school or apprenticeship
- I am currently repeating a year of school/apprenticeship
- I had insufficient grades or appreciations in my last school reports
- Events were added and dichotomized into none or at least one.

Current tobacco smoking: yes/no

Current cannabis use (in the last 30 days): yes/no

Adverse personal episodes: Having underwent at least one of the following negative life events in the previous year:

- My parents separated or divorced
- I had a serious illness or accident
- Someone who was close to me died
- I had trouble with the police
- I went through an unhappy love relationship

- I had serious conflicts at school or at work
- I had serious conflicts with family or friends

Somatic symptoms: each somatic symptom was dichotomized into at least weekly and less often during the previous month:

- Stomachache
- Lack of appetite
- Difficulty to concentrate
- Backache
- Vertigo
- Trouble falling asleep
- Being nervous and agitated
- Being more tired than usual
- Headache

Social support: scale of availability of social support computed as the average of the 4 following questions which answers were given on a 4-point scale (from 1 = not true at all, to 4= absolutely true):

- There are persons on whom I can always rely
- Others help me when there is too much for me to cope with
- There are persons who offer me help if I need some
- There is someone who supports me if I am worried
- The four questions were added and a higher score represented a higher social support. The Cronbach alpha for this study was .99. These questions were available from wave 5.

Self-esteem: five questions were included, rated on a 5-point scale (1: Completely disagree, to 5: Completely agree):

- On the whole, I am satisfied with myself
- I feel that I have a number of good qualities
- I am able to do things as well as most other people
- I feel that I am a person of worth, at least on an equal plane with others
- I take a positive attitude toward myself

- The five questions were added and a higher score represented a higher self-esteem. Cronbach's alpha for this study: .96.

Depression: five questions were included, rated on a 5-point scale (1: Completely disagree, to 5: Completely agree):

- At times I think I am no good at all
- I feel I do not have much to be proud of
- I certainly feel useless at times
- I wish I could have more respect for myself
- All in all, I am inclined to feel that I am a failure

The five questions were added and a higher score represented a higher degree of depression. Cronbach's alpha for this study: .91.

Positive view of the future: Scale including the 6 following questions, which were rated on a 6-point scale (1: absolutely false to 6: absolutely true):

- My future looks bright
- I am happy to live
- I am happy with the way my life unfolds
- I accept what I cannot change
- Whatever happens, I can see the positive side of it
- My life seems to be meaningful

The six questions were added and a higher score represented a more positive view of the future. Cronbach's alpha for this study: .96.

3.3.2 GenerationFRee

Gender: Male/Female

Age: At baseline

Residence: Urban/Rural

Academic track: Actual education status, four categories:

- High-school
- Professional school

- Apprenticeship
- Other

Family structure: Parents living together vs. other situations (separated, divorced, deceased, other)

Relationship with the mother: on a scale from 1 [Poor] to 10 [Excellent]. Presented as a mean.

Relationship with the father: on a scale from 1 [Poor] to 10 [Excellent]. Presented as a mean.

Born in Switzerland: Yes/No

Monthly available money: Amount at disposal on average monthly (in Swiss Francs)

Current tobacco smoking: Smokers vs. non-smokers (including former smokers)

Current cannabis use (last 30 days): Users vs. non-users

Physical activity: How many days per week they performed a physical activity of at least 60 minutes duration (range 0-7; presented as a mean)

Social life: scale of social life quality computed as the sum of the 4 following questions which answers were given on a 4-point scale (from 1 = not at all true, to 4= exactly true):

- I make new friends of the same sex very easily
- I make new friends of the other sex very easily
- Among my friends of same sex, I am very popular
- Among my friends of the other sex, I am very popular

The four questions were added and a higher score represented a better quality social life. Cronbach alpha for this study: .79.

Positive view of the future: Scale including the 6 following questions, which were rated on a 6-point scale (1: absolutely false to 6: absolutely true):

- My future looks bright
- I am happy to live
- I am happy with the way my life unfolds
- I accept what I cannot change
- Whatever happens, I can see the positive side of it
- My life seems to be meaningful

The six questions were added and a higher score represented a more positive view of the future. Cronbach's alpha for this study: .88.

School performance: Self-assessment of school performance compared to classmates (Below average / Average or above).

Family socioeconomic status: Question from the ESPAD study [49] "Compared to other families in Switzerland, would you say that your family's financial situation is…" with 7 possible options ranging from *Very much above average* to *Very much below average* and dichotomized into *Below average* and *Average or above.*

Somatic health: "Overall, do you think that your health is…", with 5 possible answers: *Excellent, Very good, Good, Fair,* and *Poor*, dichotomized into *Good* (good to excellent) and *Poor* (fair or poor).

Emotional well-being: Emotional well-being was defined using the WHO-5 index. It consists in five statements rated from 0 (At no time) to 5 (All of the time) concerning the last two weeks[50]:

- I have felt cheerful and in good spirits
- I have felt calm and relaxed
- I have felt active and vigorous
- I woke up feeling fresh and rested
- My daily life has been filled with things that interest me

The answers were summed up and dichotomized, with a score below 13/25 indicating poor wellbeing.

3.4 Imputation

The design of the cohorts used in this study is prone to have missing data. For example, only 1'421 full sequences could be retrieved for TREE1, meaning having valid answers for the alcohol consumption question at each of the nine time points (waves) available. In GenerationFRee, no participant had alcohol related data for the four available waves (maximum 3 waves available).

In order to increase the sample size to ensure sufficient power for the analyses, some of the missing data can be inferred, meaning being assigned their most probable value given the rest of the available data, a process known as imputation. Here, we applied the so-called multiple imputation method, which consists of imputing each missing data item several times (10 in this case) in order to preserve as much as possible the intrinsic variability of the sample. In order to keep as many participants while having trustable data, it was decided to keep persons having valid answers in at least 6 waves in TREE1 and in 2 waves in GenerationFRee.

This multiple imputation step led to a working sample of 3'347 full sequences for TREE1 and 1'645 for GenerationFRee.

3.5 Weighting

The samples studied in the current research did not represent the exact composition of the studied population. In order to correct for this and thus having representative results, weights were calculated to correct the structure of the samples. Criteria identified as relevant including age, gender, type of education and linguistic repartition were taken into account to apply that correction. All subsequent analyses were performed taking into account the weightings.

3.6 Trajectories of alcohol consumption

This analysis studied the sequence, which is the actual path followed by each participant in terms of variation of drinking status through the length of the study. The aim was to define a typology.

The concept of sequence relies on the identification of the state of the variable of interest (in this case the drinking status) at each observation time point. The aggregation of each of these states chronologically constitutes a sequence, and thus a trajectory for a given individual in the defined timeframe.

The analysis of the sequences is based on the sample regrouping the 10 replications (imputations) of the original sample, hence 33'470 and 16'450 sequences for TREE1 and GenerationFRee, respectively. Therefore, each individual has 10 possible trajectories, such variability being the consequence of missing data.

The analysis of sequences consists in identifying typical trajectories and recurrences in the sequences' structure. It relies on the comparison of the differences and similarities between sequences and thus allows the grouping of similar sequences in distinct groups using the Optimal Matching and clustering methods [1].

We generated the typologies splitting the sample in several corresponding groups, from a split in 2 groups to one in 7 (GenerationFRee) or 8 groups (TREE1). For both cohorts, the split in 5 groups was selected (independently from the choice for the other cohort). Groups were then named according to the composition of the sequences constituting it.

Sequences analyses were performed using the TraMineR R package [2].

3.7 Statistical analyses

The groups of drinking trajectories previously defined (typology) were then confronted to the selected explanatory variables above mentioned for their respective cohort. First, a bivariate analysis was conducted for each variable through either an ANOVA for continuous variables or a chi-2 test for categorical ones. The threshold for statistical significance was set at $p<0.05$.

In a subsequent step, all significant variables at the bivariate level were incorporated into a multinomial backward regression, using Abstinent as the reference category. Using a backward selection, non-significant variables were thus consecutively eliminated until no more variables could be excluded from the model. Results are presented as relative risk ratios (RRR) with 95% confidence intervals.

As we were interested in young people not drinking alcohol, in a second step we put them further in evidence by comparing them to light and heavy drinkers. In this sense, for the TREE1 cohort, we compared Abstinent with the Lighter group (Light and Undecided) and Abstinent with the Heavier group (Light2heavy and Heavy). In both cases we first performed a bivariate analysis followed by a backward logistic regression using the Lighter or Heavier group as the reference category, respectively. Results are presented as odds ratios (OR) with 95% confidence intervals.

Similarly, for the GenerationFRee cohort, we compared Abstinent with the Lighter group (Light, Late onset Light and Undecided) and Abstinent with the Heavy group. In both cases we first performed a bivariate analysis followed by a backward logistic regression using the Lighter or Heavy group as the reference category. Results are presented as odds ratios (OR) with 95% confidence intervals.

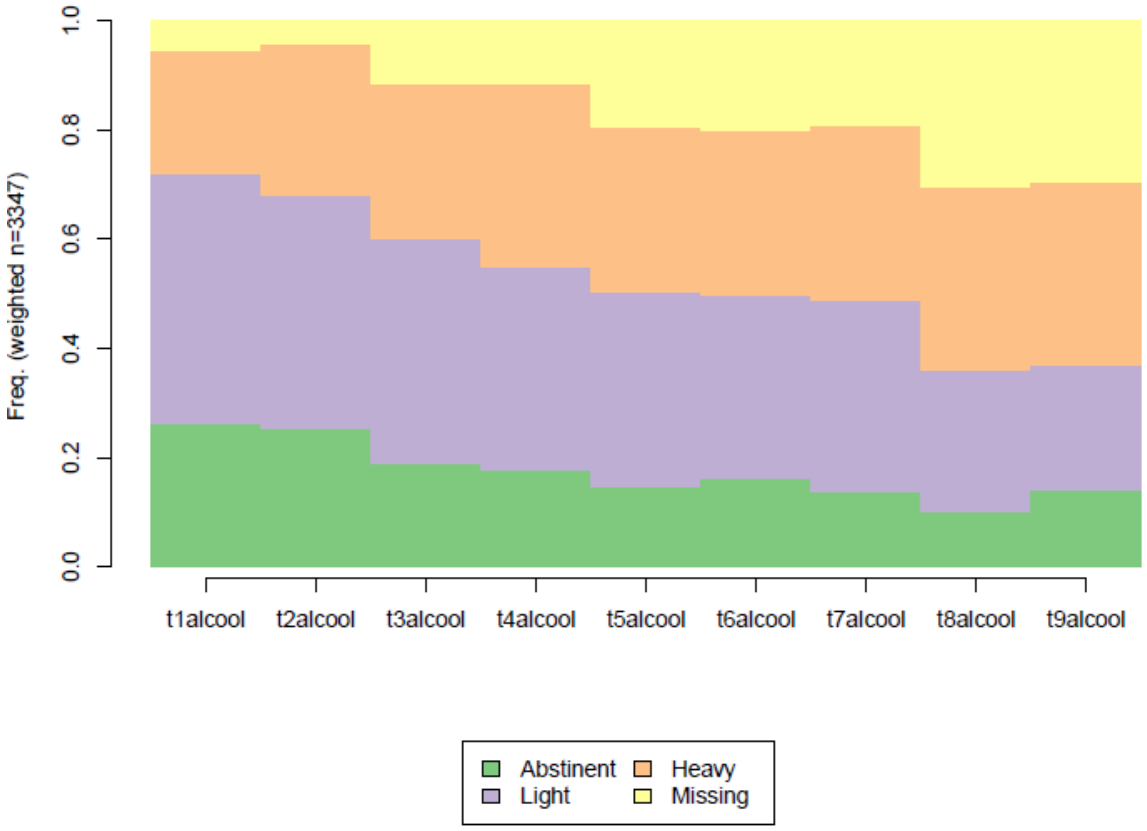
All analyses were performed using STATA 16.0 (College Station, Texas).

4 Results

4.1 TREE 1

The distribution of states across the follow-up timeframe is shown on figure 1. It comprises data from the 3'347 participants having valid alcohol consumption related data for at least six waves, before imputation. Therefore the rate of missing data appears logically increasing throughout the period. On the contrary, the rate of Abstinent decreased globally from first to last wave (Figure 1).

Figure 1 **Distribution of states of alcohol consumption status at each observation period**

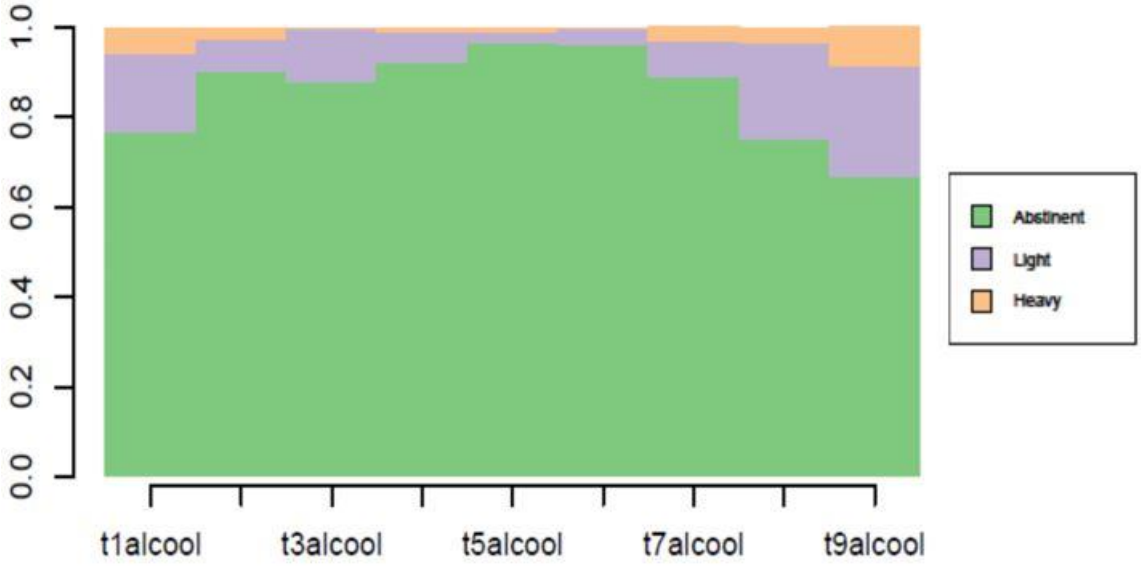


4.1.1 Trajectories of alcohol consumption

Figures 2 to 6 show 5 trajectories based on the corresponding typology (thus after applying the imputation). Among the different typologies observed (different number of groups), this one offered the best compromise in terms of groups composition, size, homogeneity within a group, and visual information allowing to assign to the group a name based on its characteristics.

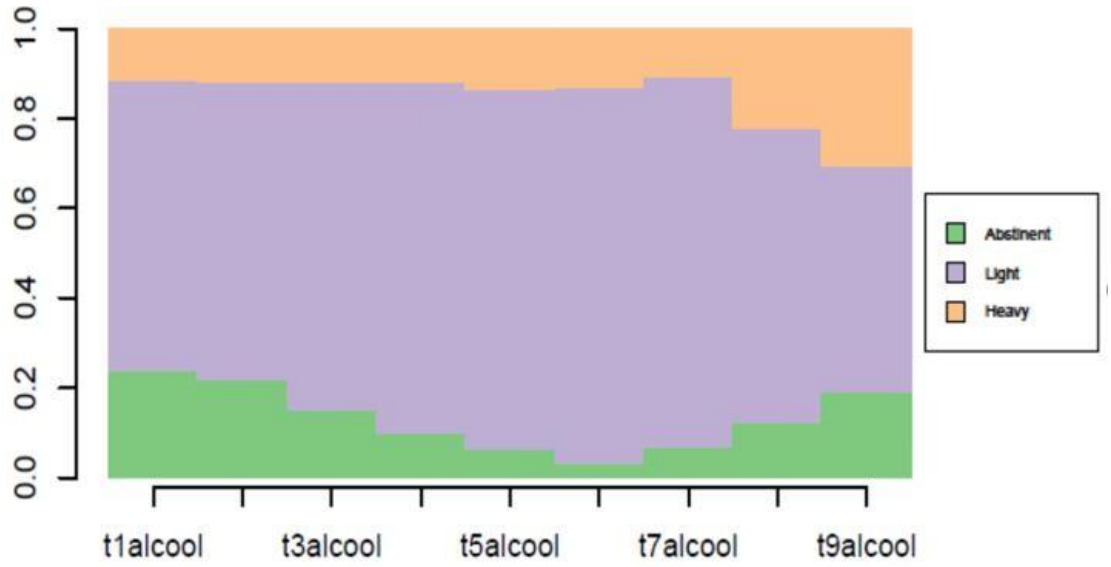
The first group (Figure 2) was named Abstinent. It was composed of youths who were non-drinkers at most of the observation points. It represented the reference group for the current study, and was the smallest in size (weighted n= 287, 8.6%).

Figure 2 Abstinent



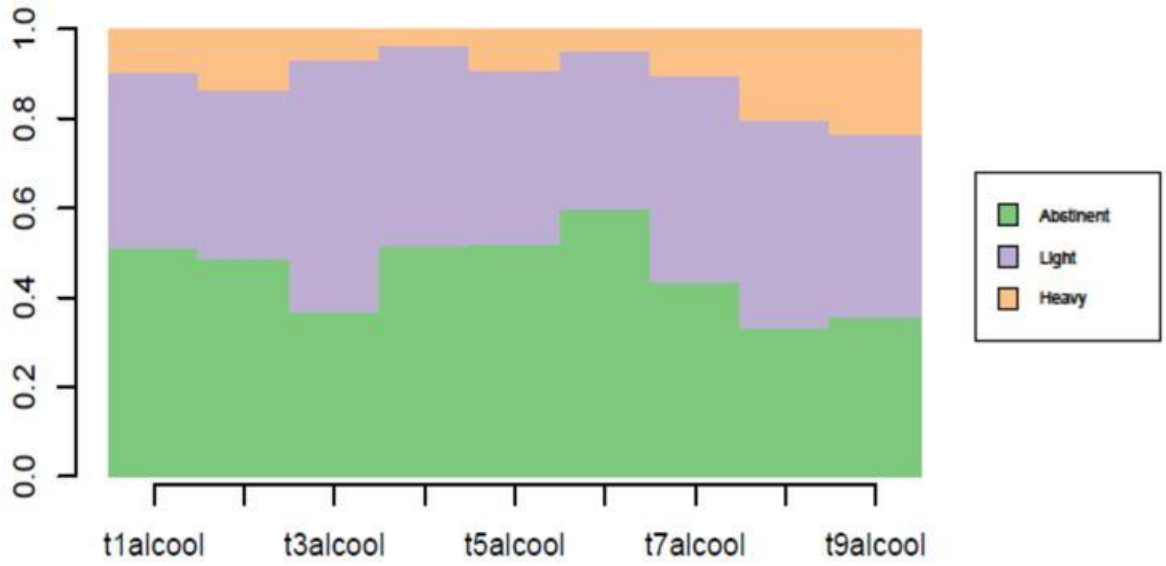
The second group (Figure 3) was the largest one (weighted n=1072, 32.0%), and was named Light drinkers. This group was composed of youths who were light drinkers during the large majority of the observation points.

Figure 3 Light drinkers



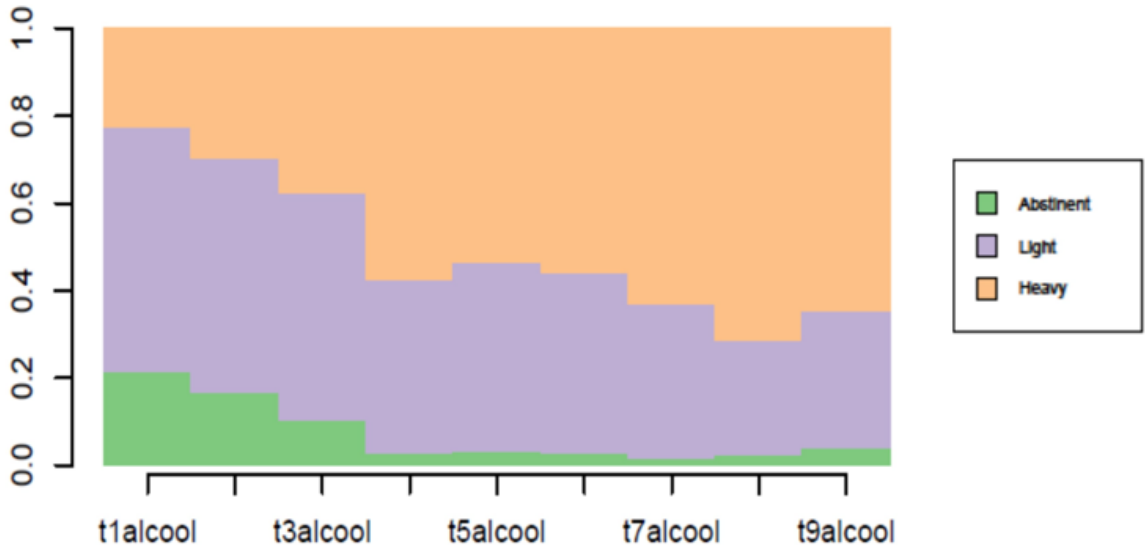
The third group (Figure 4) was named Undecided. This group included participants who did not have a clear pattern, but instead passed from one state to another and back through the observation period (weighted n=473, 14.1%).

Figure 4 Undecided drinkers



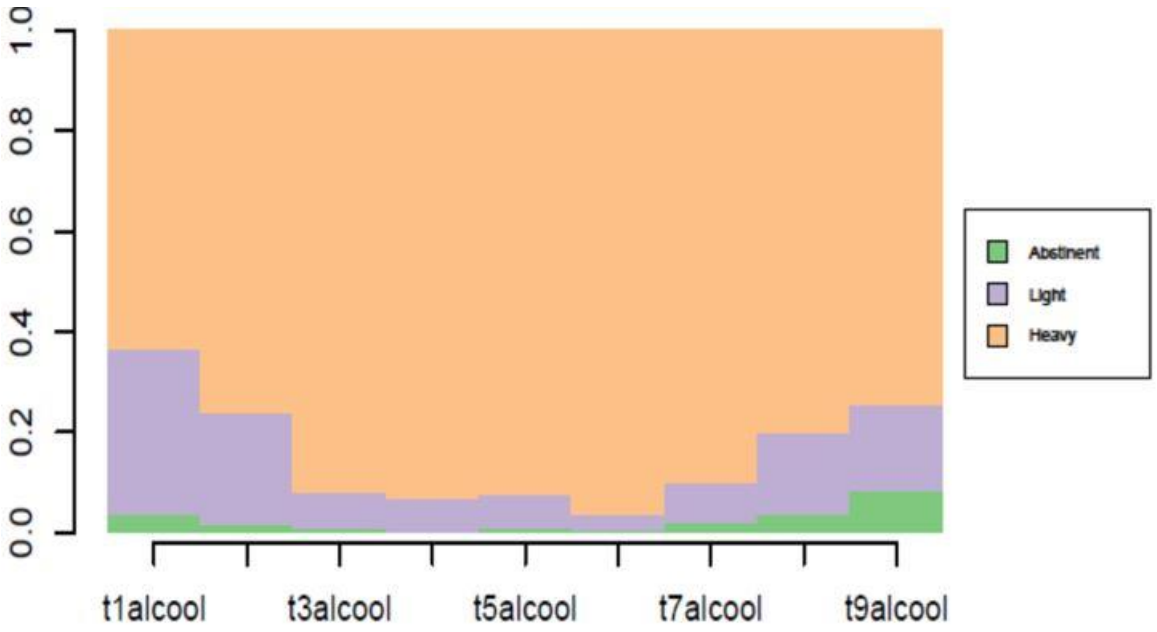
The fourth group (Figure 5) was named Light2heavy drinkers. It was composed of youths who were mainly light drinkers at the first wave, became heavy drinkers at some point in time and remained heavy drinkers afterwards (weighted n= 782, 23.4%).

Figure 5 Light2heavy drinkers



The last group (Figure 6) was named Heavy drinkers because it was composed of youths who drank often at most of the observation points (weighted n=733, 21.9%).

Figure 6 Heavy drinkers



4.1.2 Factors predicting the alcohol consumption trajectories

Light drinkers were the most numerous group (n=1073; 32.1%) followed by Light2heavy (n=782; 23.37%) and Heavy (n=732; 21.89%) drinkers. Undecided (n=473; 14.12%) and Abstinent (n=287; 8.58%) were the least represented ones.

At the bivariate level (Table 1), the Heavy group was the only one to have a minority of females. The Abstinent group was the one with fewer Swiss-born participants and most likely to live in an urban area. There were no significant differences at the family level, although Abstinent reported the highest prevalence of parents living together. Academically, more than half of the Heavy drinkers were apprentices and almost one fifth of Abstinent were not in school at baseline. No differences were observed for grades or for adverse school events.

Only two adverse personal episodes happening in the previous year were statistically significant: parents having divorced (most frequent among Light drinkers) and trouble with the police (most frequent among Heavy drinkers).

No differences were found for somatic symptoms when all the groups were compared. In the same line, no differences were found either for self-esteem, depression, positive view of the future or social support.

Regarding the current use of tobacco and cannabis, the differences were significant, with, in both cases, the Heavy group reporting the highest prevalence rates and Abstinent the lowest ones.

Table 1 Bivariate analysis comparing the five groups

	Abstinent	Light	Undecided	Light2heavy	Heavy	P
Gender (female)	**70.48%**	**76.94%**	**65.49%**	**55.13%**	**35.57%**	**<.0001**
Age (mean±SE)	15.82±.11	15.89±.12	15.75±.07	15.66±.05	15.84±.11	NS
Language region:						NS
German	68.86%	80.69%	75.60%	76.21%	78.90%	
French	25.71%	16.30%	20.84%	20.99%	19.44%	
Italian	5.43%	3.01%	3.55%	2.80%	1.66%	
Swiss-born (yes)	**65.4%**	**91.2%**	**81.5%**	**92.20%**	**92.80%**	**<.0001**
Residence (urban)	**74.31%**	**62.96%**	**69.26%**	**57.73%**	**58.61%**	**<.05**
Family structure (Parents together)	88.4%	72.72%	74.19%	77.75%	82.13%	NS
Number of siblings:						NS
None	4.29%	6.87%	7.08%	6.12%	4.85%	
One	42.34%	45.83%	44.68%	45.78%	46.67%	
More than one	53.37%	47.3%	48.24%	48.11%	48.47%	
Has older siblings (yes)	61.2%	62.3%	63.10%	56.40%	61.20%	NS
Academic track:						**<.0001**
Apprenticeship	**31.24%**	**41.17%**	**37.4%**	**47.34%**	**53.64%**	
Professional school	**14.39%**	**10.55%**	**12.77%**	**8.71%**	**5.66%**	
High-school	**20.04%**	**23.14%**	**19.83%**	**27.80%**	**29.88%**	
Other	**16.19%**	**23.44%**	**22.66%**	**15.02%**	**9.18%**	
None	**18.13%**	**1.70%**	**7.35%**	**1.12%**	**1.65%**	
Average grades (below)	39.71%	32.12%	43.93%	33.65%	33.40%	NS
Adverse school event (at least one)	56.68%	44.98%	56.01%	42.76%	42.00%	NS
Adverse personal episodes in the previous year:						
Parents divorced	**1.60%**	**6.67%**	**1.62%**	**3.78%**	**1.74%**	**<.01**
Had an accident or disease	2.31%	7.25%	3.15%	3.98%	6.71%	NS
Someone close died	22.91%	20.98%	18.06%	16.58%	18.46%	NS
Trouble with police	**2.98%**	**2.58%**	**5.47%**	**4.11%**	**10.84%**	**<.05**
Love problem	16.95%	20.12%	24.85%	21.24%	22.85%	NS
Trouble in school	2.39%	6.37%	9.63%	8.14%	6.21%	NS
Trouble with family or friends	9.31%	13.65%	19.51%	12.82%	14.29%	NS
Somatic symptoms (at least weekly):						
Stomachache	16.10%	14.01%	4.31%	10.79%	8.95%	NS
Lack of appetite	17.47%	16.44%	13.48%	12.53%	8.11%	NS

	Abstinent	Light	Undecided	Light2heavy	Heavy	P
Difficulty to concentrate	23.53%	36.2%	36.15%	34.79%	30.06%	NS
Backache	22.10%	23.37%	22.84%	19.32%	18.13%	NS
Vertigo	8.64%	15.49%	11.98%	15.16%	11.09%	NS
Trouble falling asleep	21.18%	33.11%	33.67%	23.21%	19.94%	NS
Nervous and agitated	22.96%	27.40%	25.85%	24.96%	18.40%	NS
More tired than usual	18.25%	29.62%	38.55%	32.95%	29.47%	NS
Headache	18.18%	14.72%	14.03%	10.96%	12.73%	NS
Self-esteem	20.74±1.21	20.75±.37	20.69±.58	20.81±.39	20.66±1.03	NS
Depression	13.66±1.45	12.92±.45	13.93±.54	11.80±.38	11.40±.89	NS
Positive view of the future	23.78±1.40	24.34±.40	24.33±.77	23.83±.45	23.94±1.19	NS
Social support	14.74±1.86	14.90±.65	13.04±1.36	15.37±.56	13.55±1.21	NS
Current tobacco smoker	**18.05%**	**30.49%**	**37.88%**	**39.21%**	**54.93%**	**<.0001**
Cannabis use (30 days)	**10.08%**	**13.99%**	**19.29%**	**19.20%**	**34.21%**	**<.001**

(Statistically significant results are in bold)

At the multivariate level (Table 2), the Light group only differed from Abstinent in the fact that they were more likely to be Swiss-born and to have their parents separated/divorced in the previous year. They were also less likely to be out of school. The only difference with the Undecided group was that they were more likely to be current smokers.

The Light2heavy group differed from Abstinent by being less likely to be females, to live in an urban area, or to be out of school, and more likely to be Swiss-born and current smokers. Finally, those in the Heavy group were less likely to be females or to be out of school and more likely to be Swiss-born and current tobacco smokers.

Table 2 **Multivariate analysis using a backward multinomial regression with Abstinent as the reference category (results expressed as Relative Risk Ratios with 95% confidence intervals)**

	Light	Undecided	Light2heavy	Heavy
Gender (female)	1.26 [0.68:2.33]	0.67 [0.33:1.37]	**0.45 [0.24:0.83]***	**0.19 [0.09:0.37]*****
Swiss-born (yes)	**3.69 [1.91:7.13]*****	1.99 [0.94:4.24]	**4.10 [2.09:8.04]*****	**6.61 [2.92:14.97]*****
Residence (urban)	0.73 [0.43:1.25]	0.90 [0.46:1.74]	**0.56 [0.32:0.97]***	0.61 [0.33:1.14]
Academic track:				
Apprenticeship	Reference	Reference	Reference	Reference
Professional school	0.54 [0.20:1.45]	0.79 [0.26:2.38]	0.52 [0.19:1.47]	0.41 [0.13:1.32]
High-school	0.97 [0.48:1.94]	1.01 [0.46:2.24]	1.44 [0.72:2.85]	2.00 [0.94:4.28]
Other	1.12 [0.55:2.26]	1.28 [0.56:2.94]	0.79 [0.38:1.65]	0.56 [0.23:1.35]
None	**0.11 [0.03:0.41]****	0.38 [0.09:1.65]	**0.07 [0.02:0.25]****	**0.09 [0.02:0.37]****

	Light	Undecided	Light2heavy	Heavy
Parents separated or divorced last 12 months	**3.29 [1.03:10.45]***	0.76 [0.21:2.83]	1.76 [0.52:5.97]	0.71 [0.17:2.97]
Current tobacco smoker	2.47 [0.85:7.18]	**3.29 [1.08:10.06]***	**4.30 [1.46:12.69]****	**10.95 [3.58:33.48]****

*p<.05; **p<.01; ***p<.001
(*Statistically significant results are in bold*)

In this part we put forward the Abstinent group by comparing it to the Lighter and Heavier groups that are used as the reference categories.

When comparing the Abstinent to the Lighter group (Light + Undecided) at the bivariate level, the former were less likely to be Swiss-born, to have their parents separated, an accident or disease or trouble in school in the previous year or to be more tired than usual. On the other side, they were more likely to live in an intact family and out of school. In the multivariate analysis, Abstinent were significantly more likely to live in an intact family and to be out of school, and less likely to be Swiss-born or to be more tired than usual (Table 3).

Table 3 **Bivariate analysis comparing the Lighter groups to Abstinent. Multivariate analysis using a backward logistic regression with Lighter as the reference category (results expressed as Odds Ratios with 95% confidence intervals)**

	Bivariate			Multivariate	
	Lighter	Abstinent	P	Abstinent	P
Gender (female)	73.44%	70.48%	NS		NS
Age (mean±SE)	15.85±.09	15.82±.11	NS		
Language region:			NS		
German	79.13%	68.86%			
French	17.69%	25.71%			
Italian	3.17%	5.43%			
Swiss-born (yes)	**88.26%**	**65.36%**	**<.0001**	**0.35 [0.18:0.67]**	**.001**
Residence (urban)	64.88v	74.31%	NS		
Family structure (Parents together)	**73.17%**	**88.40%**	**<.001**	**3.48 [1.44:8.41]**	**<.01**
Number of siblings			NS		
None	6.93%	4.29%			
One	45.48%	42.34%			
More than one	47.59%	53.37%			
Has older siblings (yes)	62.52%	61.17%	NS		
Academic track			**<.01**		
Apprenticeship	**40.10%**	**31.24%**		Reference	
Professional school	**11.24%**	**14.39%**		1.07 [0.52:2.22]	NS
High-school	**22.12%**	**20.04%**		1.29 [0.61:2.73]	NS

	Bivariate			Multivariate	
	Lighter	Abstinent	P	Abstinent	P
Other	**23.20%**	**16.19%**		0.81 [0.39:1.68]	NS
None	**3.44%**	**18.13%**		**3.64 [1.06:12.50]**	**<.05**
Average grades (below)	35.73%	39.71%	NS		
Adverse school event (at least one)	48.36%	50.68%	NS		
Adverse personal episodes in the previous year:					
Parents divorced	**5.13%**	**1.60%**	**<.05**		NS
Had an accident or disease	**6.00%**	**2.31%**	**<.05**		NS
Someone close died	20.09%	22.91%	NS		
Trouble with police	3.46%	2.98%	NS		
Love problem	21.57%	16.95%	NS		
Trouble in school	**7.37%**	**2.39%**	**<.01**		NS
Trouble with family or friends	15.44%	9.31%	NS		
Somatic symptoms (at least weekly):					
Stomachache	10.98%	16.10%	NS		
Lack of appetite	15.52%	17.47%	NS		
Difficulty to concentrate	36.18%	23.53%	NS		
Backache	23.20%	22.10%	NS		
Vertigo	14.37%	8.64%	NS		
Trouble falling asleep	30.06%	21.28%	NS		
Nervous and agitated	26.91%	22.96%	NS		
More tired than usual	**32.46%**	**18.25%**	**<.01**	**0.48 [0.26:0.86]**	**<.05**
Headache	14.50%	18.18%	NS		
Self-esteem	20.74±.31	20.74±1.21	NS		
Depression	13.23±.36	13.66±1.45	NS		
Positive view of the future	24.33±.36	23.78±1.40	NS		
Social support	14.33±.62	14.74±1.86	NS		
Current tobacco smoker	32.75%	18.05%	NS		
Cannabis use (30 days)	15.61%	10.08%	NS		

(Statistically significant results are in bold)

At the bivariate level, when compared to the Heavier group (Heavy+Light2heavy), Abstinent were significantly more likely to be females, living in an urban setting, in an intact family, and out of school, while less likely to be Swiss-born, having had an accident or trouble in school in the previous year, being more tired than usual, or being a current smoker or cannabis user.

In the multivariate analysis, Abstinent were significantly more likely to be females and to be out of school and less likely to be Swiss-born, more tired than usual or current smokers (Table 4).

Table 4 **Bivariate analysis comparing the Heavier groups to Abstinent. Multivariate analysis using a backward logistic regression with Heavier as the reference category (results expressed as Odds Ratios with 95% confidence intervals)**

	Bivariate			Multivariate	
	Heavier	Abstinent	P	Abstinent	P
Gender (female)	**45.67%**	**70.48%**	**<.001**	**3.26 [1.66:6.41]**	**.001**
Age (mean±SE)	15.75±.06	15.82±.11	NS		
Language region:			NS		
German	77.51%	68.86%			
French	20.24%	25.71%			
Italian	2.25%	5.43%			
Swiss-born (yes)	**92.47%**	**65.36%**	**<.0001**	**0.21 [0.11:0.41]**	**<.0001**
Residence (urban)	**58.15%**	**74.31%**	**<.01**		NS
Family structure (Parents together)	**79.87%**	**88.40%**	**<.05**		NS
Number of siblings:			NS		
None	5.50%	4.29%			
One	46.21%	42.34%			
More than one	48.29%	53.37%			
Has older siblings (yes)	58.73%	61.17%	NS		
Academic track			**<.0001**		
Apprenticeship	**50.29%**	**31.24%**		Reference	
Professional school	**7.28%**	**14.39%**		1.73 [0.80:3.75]	NS
High-school	**28.77%**	**20.04%**		0.83 [0.40:1.72]	NS
Other	**12.29%**	**16.19%**		1.81 [0.81:4.06]	NS
None	**1.37%**	**18.13%**		**10.82 [3.11:37.70]**	**<.0001**
Below average grades (yes)	33.53%	39.71%	NS		
Adverse school event (at least one)	42.39%	50.68%	NS		
Adverse personal episodes in the previous year:					
Parents divorced	2.79%	1.60%	NS		
Had an accident or disease	**5.30%**	**2.31%**	**<.05**		**NS**
Someone close died	17.49%	22.91%	NS		
Trouble with police	7.37%	2.98%	NS		
Love problem	22.02%	16.95%	NS		
Trouble in school	**7.21%**	**2.39%**	**<.01**		**NS**
Trouble with family or friends	13.53%	9.31%	NS		
Somatic symptoms (at least weekly):					
Stomachache	9.95%	16.10%	NS		
Lack of appetite	10.46%	17.47%	NS		

	Bivariate			Multivariate	
	Heavier	Abstinent	P	Abstinent	P
Difficulty to concentrate	32.58%	23.53%	NS		
Backache	18.76%	22.10%	NS		
Vertigo	13.24%	8.64%	NS		
Trouble falling asleep	21.64%	21.28%	NS		
Nervous and agitated	21.88%	22.96%	NS		
More tired than usual	**31.33%**	**18.25%**	**<.01**	**0.55 [0.31:0.99]**	**<.05**
Headache	11.79%	18.18%	NS		
Self-esteem	20.73±.54	20.74±1.21	NS		
Depression	11.61±.47	13.66±1.45	NS		
Positive view of the future	23.89±.62	23.78±1.40	NS		
Social support	14.49±3.67	14.74±1.86	NS		
Current tobacco smoker	**46.81%**	**18.05%**	**<.001**	**0.18 [0.06:0.52]**	**.001**
Cannabis use (30 days)	**26.46%**	**10.08%**	**<.05**		**NS**

(Statistically significant results are in bold)

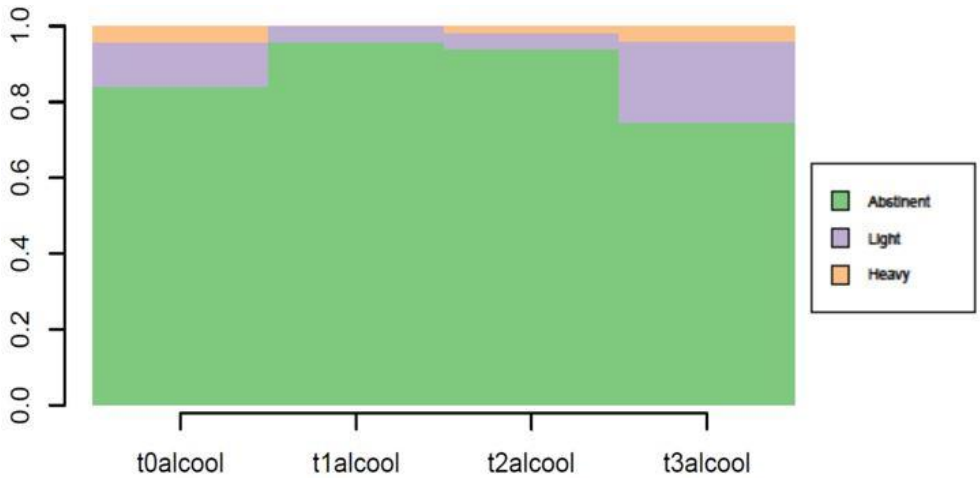
4.2 GenerationFRee

4.2.1 Trajectories of alcohol consumption

The five trajectories found in the analysis of the GenerationFRee cohort were very similar to the ones found in the TREE1 cohort: Abstinent, Undecided, Light, Late onset Light and Heavy drinkers.

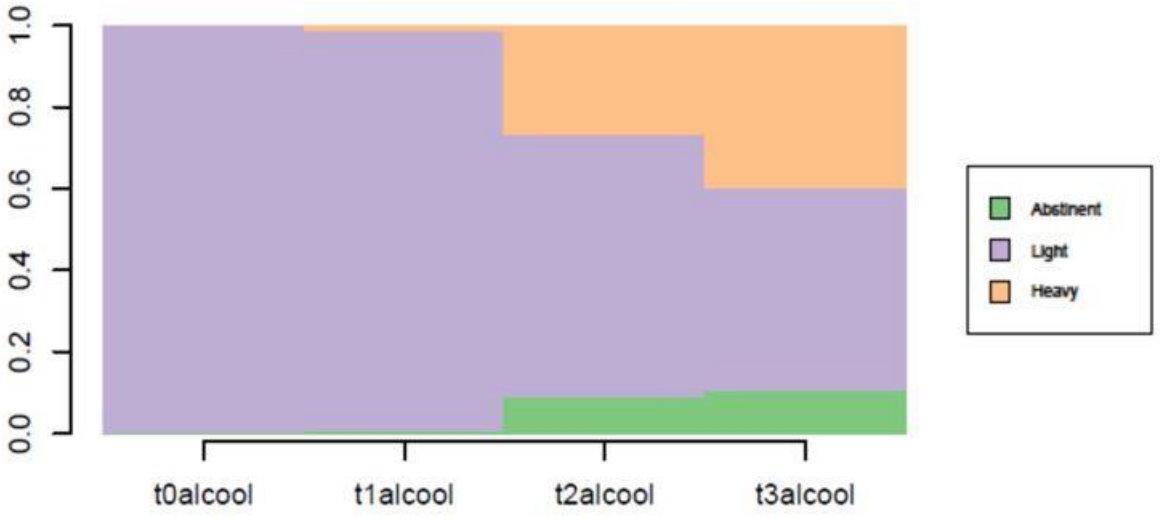
Abstinent (Figure 7) were youths who were basically abstinent during the whole follow-up period. One participant out of every six were included in this group (weighted n=276; 16.8%).

Figure 7 Abstinent



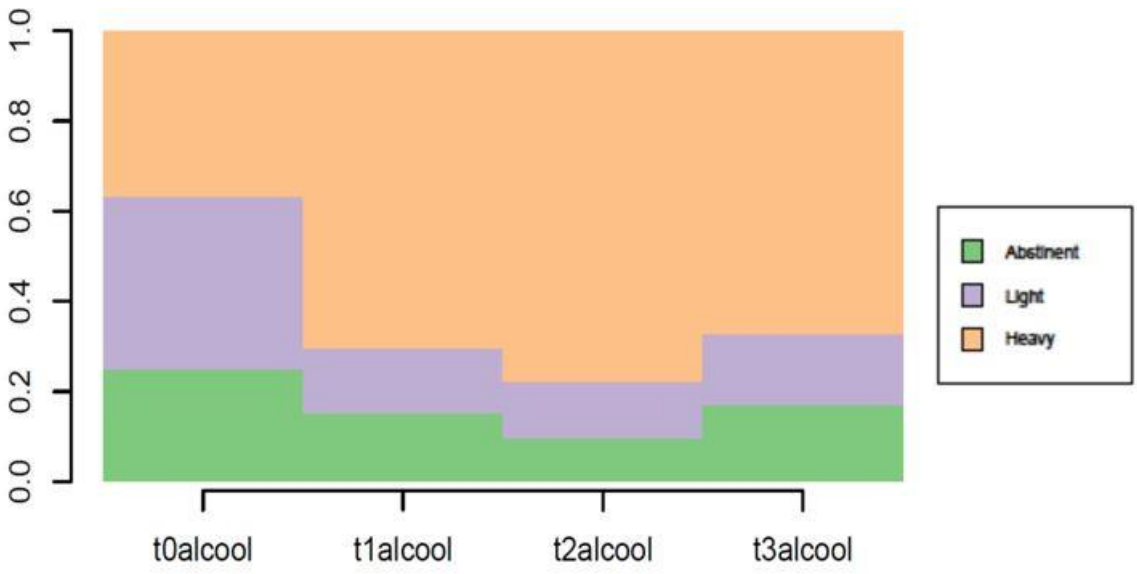
The second group (Figure 8), referred as Light drinkers, represented participants who drank alcohol without being drunk at most observation points. It is worth noting that by the end of the follow-up, about 40% had become heavy drinkers and about 10% abstainers. They represented 26.3% of the sample (weighted n=433).

Figure 8 Light drinkers



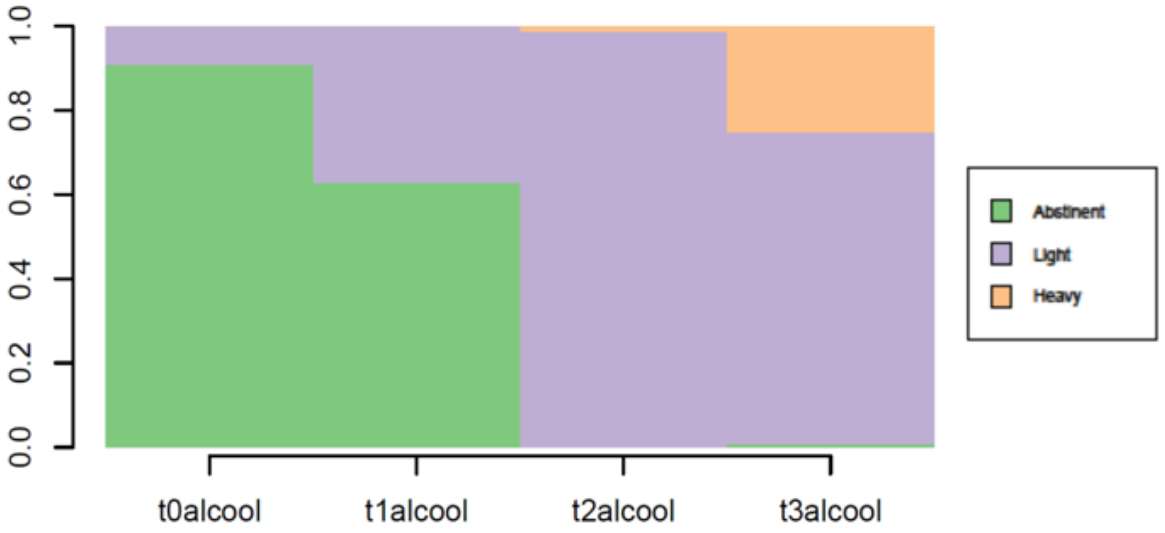
The third group (Figure 9) was small and represented the Undecided (weighted n=107; 6.5%). In this group, although abstainers were relatively stable in number, the percentage of heavy drinkers increased dramatically, mainly doubling from the beginning to the end of the observation period.

Figure 9 Undecided drinkers



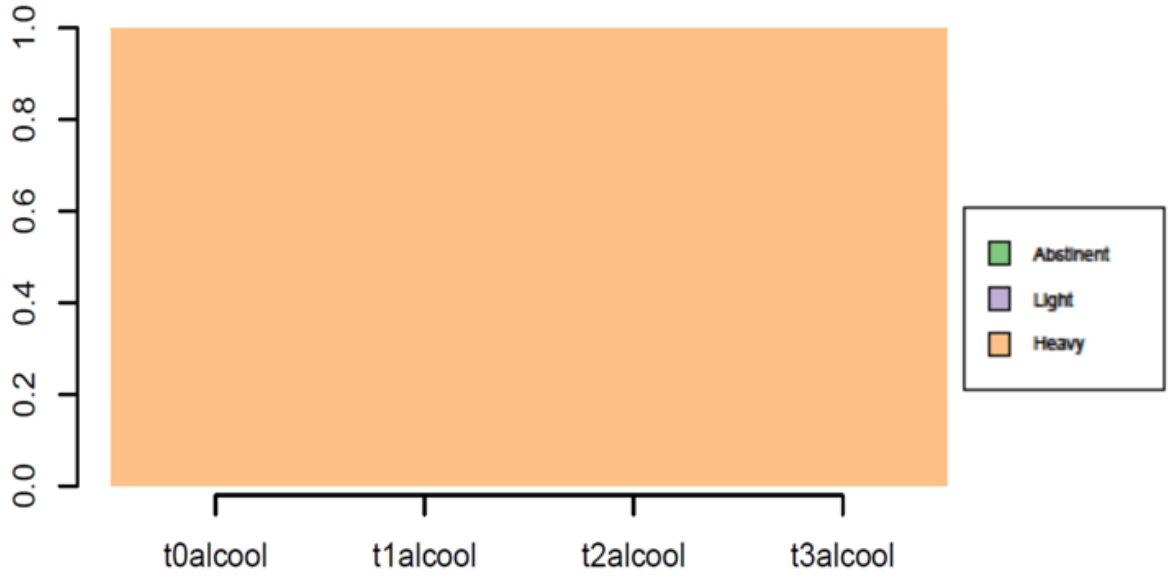
We named the fourth group (Figure 10) Late onset Light drinkers as the majority were Light drinkers after a period of abstinence, and about one fourth became heavy drinkers at the end of the follow-up. They represented the smallest group (weighted n=97; 5.9%).

Figure 10 Late onset Light drinkers



The fifth group (Figure 11), Heavy drinkers, included individuals who reported drunkenness episodes at each observation point. They were, by far, the most numerous group (weighted n=732, 44.5%.

Figure 11 Heavy drinkers



4.2.2 Factors predicting the alcohol consumption trajectories

In the bivariate analysis (Table 5), Heavy drinkers showed the lowest levels of females, were living in urban residence or in an intact family, and the highest prevalence of being Swiss-born. The Undecided group were on the other extreme of the spectrum. High school students were most numerous among Abstinent and apprentices among Heavy drinkers, with no differences in school performance. The Heavy group also reported the highest percentages of tobacco and cannabis use.

Table 5 Bivariate analysis comparing the five groups

	Abstinent	Light	Undecided	Late onset Light	Heavy	P
Gender (female)	**57.38%**	**54.20%**	**64.14%**	**45.36%**	**34.53%**	**<.0001**
Age (mean±SE)	16.66±.07	16.91±.11	16.71±.25	16.86±.22	17.16±.09	NS
Swiss-born (yes)	**87.65%**	**86.04%**	**79.50%**	**90.45%**	**93.86%**	**.0001**
Residence (urban)	**33.75%**	**54.55%**	**38.33%**	**28.45%**	**22.06%**	**<.0001**
Monthly available money (in CHF)	366.63	384.57	447.23	636.61	635.33	NS
Family structure (Parents together)	**76.20%**	**71.5%**	**77.22%**	**68.11%**	**65.74%**	**<.05**
Relationship with mother	8.82±.07	9.02±.10	9.02±.13	8.52±.21	8.77±.06	NS
Relationship with father	8.21±.11	8.22±.18	8.16±.31	7.79±.29	8.04±.12	NS
Family socioeconomic status (below average)	7.48%	9.62%	6.86%	5.19%	6.08%	NS
Academic track:						<.0001
High-school	30.79%	26.14%	26.42%	27.75%	16.56%	
Professional school	20.40%	24.27%	19.67%	12.96%	11.13%	
Apprenticeship	45.18%	43.34%	50.65%	56.57%	65.38%	
Other	3.64%	6.26%	3.27%	2.72%	6.92%	
School performance (below average student)	4.70%	6.78%	2.78%	4.07%	4.35%	NS
Physical activity (days/week)	2.66±.09	2.46±.13	2.54±.24	2.95±.22	2.94±.09	NS
Somatic health (poor)	5.51%	7.90%	3.05%	5.96%	7.87%	NS
Emotional wellbeing (good)	80.10%	82.21%	85.54%	83.24%	84.27%	NS
Positive view of the future	27.61±.27	27.80±.37	28.77±.56	27.24±.64	27.88±.26	NS
Social support	13.50±.14	12.91±.23	13.92±.35	13.20±.35	13.27±.13	NS
Social life	11.16±.12	10.99±.16	10.29±.27	11.79±.31	12.36±.10	NS
Current tobacco smoker	11.56%	13.36%	8.59%	45.94%	59.05%	<.0001
Cannabis use (30 days)	4.36%	9.21%	3.05%	24.26%	33.03%	<.0001

(Statistically significant results are in bold)

At the multivariate level (

Table 6), compared to Abstinent, Light drinkers were significantly more likely to live in an urban setting and less likely to smoke. Those in the Undecided group reported only a lower likelihood of smoking. Late onset Light drinkers were less likely to be females and more likely to use tobacco or cannabis. Finally, the Heavy group differed from Abstinent in all the studied variables: they were less likely to be females, to live in an urban setting, to live in an intact family, or to be in high-school, and more likely to be older, Swiss-born, current tobacco smokers or cannabis users.

Table 6 Multivariate analysis using a backward multinomial regression with Abstinent as the reference category (results expressed as Relative Risk Ratios with 95% confidence intervals)

	Light	Undecided	Late onset Light	Heavy
Gender (female)	0.91 [0.64:1.31]	1.47 [0.85:2.56]	**0.59 [0.36:0.95*]**	**0.37 [0.27:0.50]*** **
Age	1.06 [0.95:1.20]	0.95 [0.75:1.26]	1.08 [0.85:1.38]	**1.15 [1.05:1.27]** **
Swiss-born (yes)	1.01 [0.62:1.67]	0.54 [0.26:1.14]	1.59 [0.69:3.66]	**2.67 [1.47:4.85]** **
Residence (urban)	**2.27 [1.61:3.22]*** **	1.24 [0.70:2.22]	0.68 [0.39:1.18]	**0.48 [0.34:0.68]*** **
Family structure (Parents together)	1.00 [0.64:1.31]	1.10 [0.57:2.14]	0.74 [0.43:1.27]	**0.66 [0.27:0.50]***
Academic track:				
Apprenticeship	Reference	Reference	Reference	Reference
Professional school	1.19 [0.76:1.84]	0.70 [0.37:1.34]	0.70 [0.34:1.46]	0.65 [0.41:1.02]
High-school	0.88 [0.56:1.37]	0.70 [0.40:1.22]	0.94 [0.50:1.78]	**0.61 [0.42:0.88]** **
Other	1.49 [0.57:3.91]	0.80 [0.20:3.14]	0.65 [0.14:2.90]	1.42 [0.65:3.10]
Current tobacco smoker	**0.51 [0.30:0.85]** **	**0.34 [0.14:0.79]***	**3.64 [2.18:6.07]*** **	**5.65 [4.03:7.93]*** **
Cannabis use (30 days)	2.03 [0.82:5.03]	0.54 [0.07:4.21]	**6.35 [2.90:13.90]*** **	**9.40 [5.00:17.72]*** **

*p<.05; **p<.01; ***p<.001

(*Statistically significant results are in bold*)

In the following part we put forward the Abstinent group by comparing it to the Lighter and Heavy groups that are used as the reference categories.

Compared to the Lighter group (Light+Undecided+Late onset Light), Abstinent were significantly less likely to live in an urban setting, to have monthly income or to use cannabis. These three variables remained significant in the logistic regression (Table 7).

Table 7 **Bivariate analysis comparing the Lighter group to Abstinent. Multivariate analysis using a backward logistic regression with Light as the reference category (results expressed as Odds Ratios with 95% confidence intervals)**

		Bivariate		Multivariate	
	Lighter	Abstinent	P	Abstinent	P
Age (mean±SE)	16.86±0.10	16.66±0.07	NS		
Swiss-born (yes)	85.67%	87.65%	NS		
Residence (urban)	**45.38%**	**33.75%**	**<.001**	**0.58 [0.43:0.78]**	**<.0001**
Monthly available money (in CHF)	**453.68±38.3**	**366.63±17.6**	**<.05**	**0.99 [1.00:1.00][a]**	**<.05**
Family structure (Parents together)	71.9%	76.2%	NS		
Relationship with mother	8.91±.098	8.82±.07	NS		
Relationship with father	8.11±.14	8.21±.11	NS		
Family socioeconomic status (below average)	8.06%	7.48%	NS		
Academic track:			NS		
High-school	26.55%	30.79%			
Professional school	20.8%	20.40%			
Apprenticeship	47.8%	45.18%			
Other	4.85%	3.64%			
School performance (below average)	5.37%	4.70%	NS		
Physical activity (days/week)	2.58±.10	2.66±.09	NS		
Somatic health (poor)	6.56%	5.51%	NS		
Emotional wellbeing (good)	83.11%	80.10%	NS		
Positive view of the future	27.87±.28	27.61±.27	NS		
Social support	13.19±.17	13.50±.14	NS		
Social life	11.02±.14	11.16±.12	NS		
Current tobacco smoker	19.47%	15.87%	NS		
Cannabis use (30 days)	**11.32%**	**4.36%**	**<.001**	**0.30 [0.14:0.63]**	**.001**

[a]0.9996483 [0 .999323:0 .9999737]

(*Statistically significant results are in bold*)

When compared to the Heavy group, Abstinent were more likely to be females, living in an urban setting, in an intact family, and attending high-school. They were also younger, with lower income, and less likely to be Swiss-born, to report physical activity, a good social life, to smoke or to use cannabis.

At the multivariate level, all variables but academic track and physical activity remained significant (Table 8).

Table 8 **Bivariate analysis comparing the Heavy group to Abstinent. Multivariate analysis using a backward logistic regression with Heavy as the reference category (results expressed as Odds Ratios with 95% confidence intervals)**

	Bivariate			Multivariate	
	Heavy	Abstinent	P	Abstinent	P
Gender (female)	**34.53%**	**57.38%**	**<.0001**	**2.53 [1.84:3.50]**	**<.0001**
Age (mean±SE)	**17.16±.09**	**16.66±.07**	**<.0001**	**0.88 [0.79:0.98]**	**<.05**
Swiss-born (yes)	**93.86%**	**87.65%**	**<.001**	**0.44 [0.21:0.90]**	**<.05**
Residence (urban)	**22.06%**	**33.75%**	**.0001**	**2.59 [1.73:3.89]**	**<.0001**
Monthly available money (in CHF)	**635.33±35.9**	**366.63±17.6**	**<.0001**	**0.99 [1.00:1.00][a]**	**<.0001**
Family structure (Parents together)	**65.74%**	**76.2%**	**<.001**	**1.66 [1.14:2.43]**	**<.01**
Relationship with mother	8.77±.06	8.82±.07	NS		
Relationship with father	8.04±.12	8.21±.11	NS		
Family socioeconomic status (below average)	6.08%	7.48%	NS		
Academic track:			**<.0001**		NS
High-school	**16.56%**	**30.79%**			
Professional school	**11.13%**	**20.40%**			
Apprenticeship	**65.38%**	**45.18%**			
Other	**6.92%**	**3.64%**			
School performance (below average student)	4.35%	4.70%	NS		
Physical activity (days/week)	**2.94±.09**	**2.66±.09**	**<.05**		NS
Somatic health (poor)	7.87%	5.51%	NS		
Emotional wellbeing (good)	84.27%	80.10%	NS		
Positive view of the future	27.88±.026	27.61±.27	NS		
Social support	13.27±.13	13.50±.14	NS		
Social life	**12.36±.10**	**11.16±.12**	**<.0001**	**0.85 [0.79:0.92]**	**<.0001**
Current tobacco smoker	**59.05%**	**15.87%**	**<.0001**	**0.18 [0.12:0.25]**	**<.0001**
Cannabis use (30 days)	**33.03%**	**4.36%**	**<.0001**	**0.09 [0.05:0.18]**	**<.0001**

[a]0.9990656 [0.9985459:0.9995856]

(*Statistically significant results are in bold*)

4.3 TREE 2

At baseline, in the TREE2 cohort, almost one fourth of participants were abstinent. However, one year later at T2, the number of abstinent (in the previous month) decreased to 18% while the heavy users increased dramatically from 21% to 52% (Table 9).

Table 9 TREE2: Distribution of the three groups of alcohol consumers at T1 and T2.

	Abstinent	Light	Heavy
T1 wave	23.37%	55.81%	20.82%
T2 wave	18.14%	29.43%	52.43%

When TREE2 data were compared to TREE1, it could be observed that in 17 years things had changed. While in TREE1 the percentage of abstinent varied little between T1 and T2 remaining slightly over one quarter of participants, in TREE2 they decreased from around one quarter to less than one fifth of respondents. On the other extreme, while heavy drinkers increased 5 points between T1 and T2 in TREE1, it more than doubled between the two waves in TREE2 (Table 10).

Table 10 Comparison TREE1 and TREE2: Distribution of the three groups of alcohol consumers at T1 and T2.

		Abstinent	Light	Heavy
TREE1				
	T1 wave	27.85%	48.25%	23.90%
	T2 wave	26.36%	44.69%	28.96%
TREE2				
	T1 wave	23.37%	55.81%	20.82%
	T2 wave	18.14%	29.43%	52.43%

When looking at how participants at T1 were distributed at T2 (Table 11), it could be observed that the majority stayed in their same group (55% of abstinent, 51% of light and 73% of heavy). However, it is worth noting that one fourth of abstinent and one third of light at T1 became heavy consumers at T2. On the contrary, only 15% of light and about one heavy consumer out of every 25 became abstinent at T2.

Table 11 TREE2: Distribution alcohol consumer at T1 and at T2.

	T2 wave	Abstinent	Light	Heavy	Total
T1 wave					
	Abstinent	55.48%	20.34%	24.18%	100.00%
	Light	15.25%	51.34%	33.41%	100.00%
	Heavy	4.32%	22.51%	73.17%	100.00%

When TREE2 data were compared to TREE1, the majority of respondents also remained in their initial category (58% of abstinent, 57% of light, 58% of heavy). However, in TREE1 only 6% of abstainers were heavy drinkers one year later compared to 24% in TREE2 (Table 12).

Table 12 TREE1: Distribution alcohol consumer at T1 and at T2.

T2 wave	Abstinent	Light	Heavy	Total
T1 wave				
Abstinent	58.24%	35.89%	5.87%	100.00%
Light	15.78%	57.32%	26.89%	100.00%
Heavy	11.71%	30.50%	57.79%	100.00%

5 Discussion

Overall, the main differences found between the TREE1 and GenerationFRee studies are due to the different definitions of Abstinent, Light and Heavy drinkers in both cohorts, as it was constructed on frequency in the former and on drunkenness episodes in the latter. Additionally, the variables that could be analyzed also differed. Nevertheless, the analyses of both databases resulted in five very similar trajectories although with slightly different weights.

Nonetheless, the evolution of abstinent drinkers has evolved over the past years as can be observed when comparing TREE1 and TREE2. While the prevalence remains mainly the same between T1 and T2 in the TREE1 cohort, it is reduced by 5 points in TREE2. Moreover, while in TREE1 the prevalence of Light and heavy drinkers varies little, the same is not true for TREE2 where Light drinkers decrease dramatically with an impressive increase of heavy drinkers. This finding seems to indicate that rather than an important increase of Abstinent over time, what happens is that important drinking occurs later in life, as suggested by other authors [10, 28], or because they want to wait to have the legal age to drink [29].

In fact, if the groups Heavy and Light2heavy drinkers are added in the TREE1 study, they represent about the same percentage than Heavy drinkers in GenerationFRee (45.3% vs. 44.5%). The same happens when Light and Late onset Light drinkers are pooled together in GenerationFRee (29.5%), they reach a similar level than in TREE1 (32%). The main differences are between Abstinent, that are twice more frequent in GenerationFRee (16.8% vs. 8.6%) and Undecided that are more than twice represented among participants in TREE1 (14.1% vs. 6.5%). However, if Abstinent and Undecided are added, they show similar results in both cohorts (25.4% in TREE1, 20.6% in GenerationFRee), probably indicating that the notion of abstinence is not as accurate as we thought and some very light social drinkers may consider themselves as abstainers. Nevertheless, it is worth noting that in both studies the most frequent group are Heavy drinkers, although combined in the TREE1 cohort. In this sense, a study carried out among Swiss male conscripts [7] found that 6% of them were abstainers and an additional 15% rare drinkers (1-5 times per year). Overall, 14% of the Swiss population abstains from alcohol, with half of them having never drank and the other half being former drinkers [51]. In our two cohorts and also in the TREE2 study, abstinent are not the most frequent pattern or group, differing from a Canadian research [17]. A possible explanation might be that alcohol is easier to obtain in Switzerland together with the cultural/social norms of alcohol drinking in this country.

Overall and as expected, light drinkers are more similar to abstinent than heavy drinkers. Nevertheless, differences between abstinent and light drinkers are observed. This result is in agreement with Mugavin et al.'s work concluding that the profile of low-risk drinkers differs from the one of abstainers [42]. Moreover, other authors found that abstainers' profile was more similar to former drinkers than to low or heavy drinkers [52]. This result emphasizes the importance to study and analyze abstainers separately from the other groups.

As we were using cohorts, we did not expect to find age differences between our groups even though alcohol use increases with age [21, 53-55]. Nevertheless, we found a significant difference in the GenerationFRee cohort, where Abstinent were younger than Heavy drinkers.

There is an important difference regarding gender, with much fewer females in the heavy drinkers groups, while no differences are observed for the lighter groups. Although some studies did not find gender differences [54], most research indicates a higher prevalence of heavy drinking among males [55-57].

Although we found some differences in family structure (mainly between Abstinent and heavier groups) as described in the literature [56, 58], no differences were found for having siblings overall and older siblings in particular. However, in the TREE1 cohort having had their parents separated/divorced in the previous year was significant mainly when Abstinent were compared to Light drinkers. Whether starting to drink is a consequence of it remains to be studied. Moreover, although the literature indicates that parental disapproval of alcohol use [21] or supervision [24, 33] are protective factors, we did not find any difference regarding the relationship with their father or their mother. It is worth noting that an Australian study concluded that parental factors were not part of the increased abstinence trend [8].

Differences regarding residence were also observed, mainly with the heavier drinking groups more likely to leave in a rural environment. This result is in line with the literature [59, 60].

Drinkers (both Light and Heavy in TREE1 and only Heavy in GenerationFRee) were significantly more likely to be Swiss-born. The literature on differences on alcohol use based on nationality is not clear, with some finding differences [58] and others not [54]. These differences could also be due to religious [20] or community cultural norms [61]. However, our data do not allow making these distinctions and we can only analyze all non-Swiss-born youths together. Further research differentiating by country of origin, cultural norms and religion are needed.

There are no differences in the family financial situation between the groups, but Abstinent report less pocket money than their peers. Several studies [9, 53-55] found that higher levels of pocket money were a risk factor for alcohol consumption. However, regarding family income, a study carried out in the United Kingdom found that those in the lowest income quartile were less likely to drink [25], while a Swedish one [62] found no difference, agreeing with our findings.

Academic track has little effect except for those not in school in TREE1. We do not know, due to the relatively young age of the cohort, whether this might be due to the fact that some students take a year off between mandatory and post-mandatory education or because they decide to not pursue their schooling.

Additionally, we found no differences in academic grades. In this sense our results disagree with several authors who found that non-drinkers had better school performance [56, 62, 63]. Nonetheless, it is worth mentioning that in the UK they also found that young adults with the lowest activity levels were also more likely to be non-drinkers [25]. However, these results could also be interpreted in the sense that alcohol use and academic motives are not associated [64].

It is interesting to notice that, overall, there are no differences regarding physical health between the groups except for Abstinent in the TREE1 cohort being less likely to be tired. On the contrary, a Swedish study [40] indicated that, compared to stable moderate drinkers (which would correspond to Light drinkers in our research), all other alcohol trajectories (including stable non-drinkers) reported a poorer self-rated health. Interestingly, another Swedish study [62] reported that non-

drinkers had better health. Finally, a study carried out in England found an association between non-drinkers and healthier subgroups [10]. We did not find either that suffering from a chronic condition was a factor for being abstainer, contrary to the literature [25].

Moreover, no differences were observed in neither cohort concerning mental health status. This finding differs from other studies indicating that self-esteem was a predictor of reduced drinking [37] or that non-drinkers reported better mental health [10]. In a similar line, a Norwegian research [22] concluded that depression and psychosomatic problems increased with increasing frequency of intoxication. Nevertheless, a Brazilian research [65] described that abstainers and infrequent drinkers showed the higher prevalence of depressive symptoms. Laukkanen et al. [39] also found that heavy drinking was associated with psychosomatic symptoms, but only among girls. O'Donnell et al. [35], on their side, found a U-curve with abstainers and heavy drinkers being more depressed than moderate drinkers, while Mueller et al. [7] found a J-curve for psychosocial stressors among Swiss male conscripts.

In the GenerationFRee cohort, when compared to heavy drinkers, Abstinent seemed to report a poorer social life in the sense of having more difficulties to make friends, as related in the literature [16, 24]. In this sense, Hoel et al's study [22] found that alcohol use increased the quantity and the quality of friendships, while Lund & Scheffels [13] found that abstinent were less likely to even have a close relationship with their best friend. Laukkanen et al [39] also reported that heavy drinking was associated with more peer relationships, although only among males. The study by Gaete & Araya [53] reported that spending more time with friends, especially with those using alcohol, was associated with higher odds of drinking. This finding agree with what young people described in the qualitative part of the study[66].

Our results show differences in substance use, mainly between Abstinent and Heavier groups regarding tobacco, but not cannabis, in the TREE1 cohort and both substances in GenerationFRee. These are in agreement with the literature indicating that one of the main differences between abstinent and drinkers is the use of other substances [53], both for tobacco [10, 13, 21, 24, 39, 56] and cannabis, and other illicit drugs [24, 39, 56]. However, a Danish study found that 42% of youths used alcohol exclusively and only 9% used both alcohol and tobacco [67]. The reason why, in our case, cannabis use does not remain significant in the TREE1 cohort when controlling for other variables needs to be further studied.

6 Limitations

This study has some limitations that need to be noted. First, the cohorts were not specifically designed to study the evolution of alcohol drinking. This means that some important questions such as friend's influence or approval of drinking or believing that alcohol was easy to purchase [21, 37], religion [18, 20, 53], parental supervision [8, 13, 24, 30, 33, 34, 53] or style [36], family substance use [13, 53, 56], youth's lifestyle [31, 32] and leisure time activities [13, 34] were not included in the original questionnaires.

Second, for the TREE cohorts, alcohol consumption is limited to the previous month. Although this is a widely used indicator of current use, we cannot assure that they have not been drinking before that. This uncertainty could explain some of the results.

Third, the GenerationFRee cohort is limited to the canton of Fribourg, a rural canton, and the results are not necessarily generalizable to the rest of Switzerland.

Fourth, the definition of Heavy drinkers in the TREE1 cohort refers to drinking weekly of more often. In this sense, youth drinking just one beer a week, for example, would be included in this category when they should not. The way the question on alcohol use was formulated did not allow us doing differently.

Fifth, the baseline wave of the GenerationFRee study included only youth in post-mandatory education. This means that youths who decided not to pursue their education after the mandatory period at age 15 were not included. As these youths are often considered more at risk, the results may be in some way conservative. However, the percentage of youths who do not pursue their education after mandatory school is small (less than 10%). In this sense, the cohort includes the majority of young people in the canton.

Sixth, while the TREE1 cohort was followed during 14 years, the GenerationFRee one only takes into accounts four waves. This different follow-up length may also explain some of the differences found between cohorts.

Finally, data are based on self-report and a social desirability bias cannot be excluded. Nevertheless, self-administered questionnaires seem to limit it.

7 Conclusions

Although there is a sizeable number of abstainers in the three databases, they clearly diminish over time. This may indicate that alcohol abstinence is more due to a lag in starting alcohol use than to remaining a life-time abstainer. Moreover, heavy drinkers continue to be the most represented group among these youths.

Nevertheless, some of the consequences of drinking described in the literature such as a decline in academic performance are not reflected in our results and may explain that drinking affects all kind of young people independently of their academic track or their academic results.

As it could be intuitively expected, light drinkers are quite similar to abstainers in a fair amount of characteristics but not in all of them. This highlights the need to study and analyze abstainers and light drinkers as separated groups and not compare them together to heavier drinkers.

As largely reported in the literature, heavy drinking is mostly a manly attitude, while abstinence or light drinking is more frequently found among women.

The family situation, be it its structure, having siblings or the relationship between the youth and their parents, does not seem to have any impact on the level of alcohol use. Nevertheless, our data do not include neither the drinking patterns of other family members nor the family rules regarding alcohol use, which could bring differences. Similarly, the financial situation of the family is not associated either to alcohol use, proving that all social strata are implicated.

Rural youths seem to be more on the heavy drinking part of the spectrum than city residents. Although this has been described in the literature, it is important to note it from a prevention perspective, as rural youths would need to be especially targeted in alcohol prevention campaigns. Moreover, the *Jeunesses Villageoises* are associations of rural young people who have a tendency to drink in excess.

Similarly, drinkers, and particularly the heavy ones, were more likely to be Swiss-born. Whether this is due to the country of origin, cultural background or religion could not be examined with the current data but need further investigation.

It is also important to notice that, in both cohorts, drinking does not seem to have an impact on physical or mental health. Although one explanation might be that young people (and especially young males, whom are more represented among heavy drinkers) minimize or ignore their health problem, it is also possible that the effects of alcohol use on health appear later on in life.

Nonetheless, even though the literature starts to mention a normalization of alcohol abstinence, our results still show that abstainers seem to report a poorer social life, as also found in the qualitative study[66]. It is clear, and especially in Switzerland, that part of the alcohol culture is related to social interactions. From this perspective, abstainers could be at a disadvantage. Further research is needed to expose to what point it represents really an issue for young people and what are the strategies they use to overcome it. Prevention could thus help normalize alcohol abstinence and avoid malaise among young abstainers.

Alcohol drinkers, particularly the heavy ones, are more likely to also use tobacco but increased cannabis use is only observed in the GenerationFRee cohort, probably due to the different definition of Light and Heavy drinkers used. In this sense it does not seem that there is a substance substitution effect but rather two substances used in parallel. To what extent alcohol use could open the path to the use of cannabis or other illegal substances cannot be ascertained with the present datasets.

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