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Adolescent repeated alcohol intoxication as a predictor of young adulthood alcohol abuse: The role of socioeconomic context.

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ABSRACT. Aims. Trajectories of alcohol abuse from adolescence onwards are not well known. We examined the relationship between repeated alcohol intoxication in adolescence and later alcohol abuse, testing whether this association varies depending on individuals' socioeconomic context.

Methods. Study participants (n=674, age 22-35 years in 2009) belong to the French TEMPO cohort study; their parents also participate in an epidemiological study - the GAZEL cohort. Repeated alcohol intoxication was assessed by questionnaire in adolescence (1999) (defined by ≥3 episodes of alcohol intoxication in the preceding 12 months). In young adulthood (2009), alcohol abuse was assessed by the WHO AUDIT questionnaire. Socioeconomic characteristic studied was childhood family income. Data were analyzed using logistic regression models controlling for age, sex, childhood temperament, parental history of alcohol use and the quality of family relations.

Results. Among adolescents who reported repeated alcohol intoxication, 30.8% reported alcohol abuse in young adulthood (adjusted OR=4.27, 95%CI 2.21-8.27). This association appeared stronger in participants who grew up in families with low income (adjusted OR=11.86, 95%CI 3.35-41.94 vs. 2.49, 95%CI 1.09-5.68 for youths from families with intermediate or high income).

Conclusions. In most adolescents (69.2%), alcohol abuse is a time-limited behavior. Nonetheless, in participants from low income families, the likelihood of persistent alcohol abuse beyond adolescence may be increased. Although some limitations are noted, a preliminary conclusion is that alcohol abuse trajectories over time need to be monitored, particularly in certain subgroups.

Keywords: Socioeconomic position; Alcohol abuse persistence; Epidemiology; Longitudinal cohort; community sample.

INTRODUCTION

Alcohol abuse is a major public health problem worldwide (Rehm, Chisholm, Room, & Lopez, 2006). In France, alcohol consumption has generally declined in recent years (Batel, 2011; Beck, Tovar, Spilka, Guignard, & Richard, 2011), but levels of binge drinking and alcohol intoxication in young people may have increased (Beck, Tovar, Spilka, Guignard, & Richard, 2011).

Alcohol abuse most frequently occurs in adolescence and tends to decrease as individuals transition to adult occupational and family roles (Kuntsche, Rehm, & Gmel, 2004; Sanchez et al., 2011). Nonetheless, a minority of youths show patterns of alcohol abuse that persist into adulthood (Bobo, Greek, Klepinger, & Herting, 2012; Gotham, Sher, & Wood, 1997; Heron, Hickman, Macleod, & Munafo, 2011; Jacob, Bucholz, Sartor, Howell, & Wood, 2005; Jefferis, Power, & Manor, 2005; Pitkanen, Kokko, Lyyra, & Pulkkinen, 2008; Schulenberg & Maggs, 2002; Widome, Wall, Laska, Eisenberg, & Neumark-Sztainer, 2013; Wu, Mao, Rockett, & Yue, 2008). Alcohol abuse during this period of transition is especially frequent among young men (Kuntsche et al., 2004; Sanchez et al., 2011) and those who have low socioeconomic position as measured by educational attainment, employment status, or financial difficulties (Kuntsche et al., 2004). To date, evidence regarding the influence of childhood and adult socioeconomic position on alcohol use patterns among youths is mixed (Stone, Becker, Huber, & Catalano, 2012; A. Yaogo, Fombonne, Kouanda, Lert, & Melchior, 2013). While some prospective, community-based studies have suggested that low childhood socioeconomic position is associated with high levels of alcohol use disorders in youths, others suggest the opposite (Jackson, Sher, & Wood, 2000; McMorris & Uggen, 2000; A. Yaogo et al., 2013). Early alcohol abuse may indicate a vulnerability to alcohol use problems which can persist over time (Frone & Brown, 2010), yet it is not clear whether this vulnerability varies with individuals' socioeconomic environment.

Our study specifically examines the association between repeated alcohol intoxication in adolescence and young adulthood alcohol abuse, testing whether family income in childhood modifies this relationship. Our study is based on 674 individuals who participated in the TEMPO cohort, a

community-based study of French youths (aged 12 to 25 years in 1999 and 22 to 35 years in 2009). Our analyses control for factors that may influence the likelihood of adolescent alcohol abuse as well as long-term trajectories of alcohol use, including age, sex, childhood temperament (emotionality, impulsivity, sociability) (Dervaux, Laqueille, Bourdel, Olie, & Krebs, 2010; Kuntsche et al., 2004; Sanchez et al., 2011), parental history of alcohol use (Kuntsche et al., 2004) and the quality of family relationships in adolescence (Dantzer, Wardle, Fuller, Pampalone, & Steptoe, 2006; Kuntsche et al., 2004).

METHODS

Study population

The TEMPO cohort study began in 1991 among young participants whose parents participate in the GAZEL cohort study (Goldberg et al., 2007; A. Yaogo et al., 2012). They were initially surveyed in 1991 in a study on the prevalence of children's mental health problems and associated access to healthcare (Fombonne & Vermeersch, 1997). TEMPO study participants were initially selected to be a nationally representative of French youths, particularly with regards to the socio-demographic characteristics (Melchior, Chastang, Mackinnon, Galera, & Fombonne, 2010). The study sample was stratified by socioeconomic status and family size according to 1991 census data using the official social class codification system. The present study is based on individuals who participated in the 1999 and 2009 TEMPO study assessments (n=674, 12 to 25 years in 1999 and 22 to 35 years in 2009). In 1999, they were surveyed in a study on the prevalence of adolescent's mental health problems and associated access to healthcare (Fombonne & Vermeersch, 1997). The response rate to the 1999 TEMPO mailed questionnaire was 62.2% (n=1,333). In 2009, parents of eligible youths received a letter asking them to forward the TEMPO study questionnaire to their offspring. Of the 2,498 youths whose parents were alive and who could be contacted, 16 had died since 1991 and 4 were too ill or disabled to answer. The overall response rate to the 2009 TEMPO mailed questionnaire was 44.5% (n=1,103). This attrition may

lead to selection bias in our study, and may reduce generalizability of our findings. However these rates are comparable with response rates of other mental health surveys in France (Alonso et al., 2004). As in many longitudinal studies, in our sample, youths from lower socioeconomic background groups were less likely to participate (Melchior et al., 2010; A. Yaogo et al., 2013). Compared to 1991 study participants, our study included a higher proportion of women ($p<0.0001$), youths older than 16 years in 1999 ($p<0.0001$), who came from non-divorced families ($p<0.0001$) and families with intermediate/high income ($p=0.01$). However, follow-up participants and non-participants did not significantly differ with regard to psychological characteristics and their own alcohol use in 1999. Therefore, the effect of attrition on our findings is likely to be minimal. In previous papers on this study, more detailed methodological aspects are available (Fombonne & Vermeersch, 1997; Goldberg et al., 2007). TEMPO and GAZEL cohorts received approval from the French "Comité Consultatif sur le Traitement de l'Information en matière de Recherche dans le domaine de la Santé (CCTIRS)" and "Commission Nationale de l'Informatique et des Liberté (CNIL)", national commissions overseeing ethical data collection in France.

Measures

Alcohol abuse and other participants' characteristics were assessed in 1999 and 2009 TEMPO study questionnaires. Additionally, data on parental characteristics were available from parents' self-reports on the GAZEL study yearly questionnaire (Goldberg et al., 2007).

In young adulthood, alcohol abuse as reported by participants, was assessed in 2009 by the French version of the World Health Organization (WHO) Alcohol Use Disorder Identification Test (AUDIT) questionnaire (Redonnet, Chollet, Fombonne, Bowes, & Melchior, 2012; Rumpf, Wohlert, Freyer-Adam, Grothues, & Bischof, 2012). The AUDIT questionnaire is a 10-items screening test developed by the World Health Organization to match DSM IV criteria of alcohol abuse or dependence, which has been validated against clinical diagnosis (Bohn, Babor, & Kranzler, 1995). Following published guidelines,

participants' with an AUDIT score >=7 (women) or >=8 (men) were considered to abuse alcohol (yes vs. no).

Adolescent repeated alcohol intoxication as reported by participants, was assessed in 1999 by the following question "Have you experienced alcohol intoxication in the preceding 12 months" – participants who responded yes were asked the number of times this occurred. We defined repeated alcohol intoxication as ≥3 episodes of alcohol intoxication in the preceding 12 months (yes vs. no) (Beck, Tovar, Spilka, Guignard, & Richard, 2011). Additionally, we studied regular alcohol intoxication, defined as ≥10 episodes of intoxication in the preceding 12 months (yes vs. no) (Beck, Tovar, Spilka, Guignard, & Richard, 2011).

Socioeconomic characteristic studied as potentially modifying the association between adolescent repeated alcohol intoxication and young adult alcohol abuse was family income during childhood as reported by participants' parents in 1989. In 1989, participants' parents were asked to report the range in which was their family income in Euros (€) per month (1= less than 762€ ; 2= [762€-991€ [; 3= [991€-1144€ [; 4= [1144€-1601€ [; 5= [1601€-1982€ [; 6= [1982€-2592€ [; 7= [2592€-3811€ [; 8= [3811€-4574€ [; 9= more than 4574€). The first quartile class was (6= [1982€-2592€ [). The median class was (7= [2592€-3811€ [). Family income above the first quartile class (6= [1982€-2592€ [) was considered to be intermediate or high: (low: <2592€ vs. intermediate or high: ≥2592€/month in 1989, which roughly corresponds to average family income in France at the time) (Bayet & Demailly, 1996; A. Yaogo et al., 2013). Additionally, we studied family income dichotomized at the median class (7= [2592€-3811€ [). Family income above the median class was then considered to be high: (low or intermediate: <3811€ vs. high: ≥3811€/month in 1989).

Our analyses accounted for: Age [>16 vs. ≤16 years in 1999; studies on a nationally representative sample of French youths reported that the average age at first alcohol intoxication was 16.1 years for males and 16.5 years for females (Com-Ruelle, Le Guen, & Lengagne, 2013)]; Sex (Male vs. Female); Childhood temperament (Kuntsche et al., 2004) assessed retrospectively by participants' parents in

1999 through the Emotionality Activity Sociability and Shyness (EAS) Scale (parents were asked to report on their children when they were 7-10 years of age). The EAS is a questionnaire which includes 20 items on children's temperament: emotionality (e.g. "He gets angry over nothing and cries easily"); impulsivity (e.g. "He reacts strongly when upset"); sociability (e.g. "He's very sociable")] (Gasman et al., 2002). Each item was rated on a scale from 0 to 5 and all items on each dimension of temperament are then summed. To compare participants with and without certain temperamental characteristics, we dichotomized the score at the top quartile (Yes vs. No).

Family characteristics were ascertained based on TEMPO participants' reports and their parents' reports on GAZEL study questionnaires. Parental heavy alcohol use was ascertained by TEMPO participants' reports of parental alcohol dependence, ascertained using a questionnaire adapted from the NIMH-FIGS in 2009 (Maxwell, 1992) and parents' yearly self-reported of heavy alcohol use between 1992 and 2008 [Following published guidelines, parents' with ≥ 21 units of alcohol/week in mothers, ≥ 28 units of alcohol/week in fathers (Kriegbaum, Christensen, Osler, & Lund, 2011) during the 12 preceding months were considered to present yearly heavy alcohol use]. Combining these two sources of information, we obtained a score to characterize parental heavy alcohol use during follow up period (1992-2008). Taking into account heavy alcohol use rates in general adult population in France [Studies on a nationally representative sample of French adults reported that the rates of heavy drinking varies from 7 to 14% (Beck, Tovar, Spilka, Guignard, & J.B., 2011)], parents who were scoring above the 85th percentile were considered to have heavy alcohol drinking during follow up period (present vs. absent). Parental divorce between 1992 to 2008 was ascertained by parental reports (yes vs. no) (Hope, Power, & Rodgers, 1998). The quality of family relationships in adolescence was ascertained using participants' self-reports in 1999 on 4 items ("Are you satisfied with your relation with your father?"; "Are you satisfied with your relation with your mother?"; "Are you satisfied with your relation with your brother?"; "Are you satisfied with your relation with your sister?"). Each item was rated on a scale of 1-5 (from 1="very satisfied" to 5="very unsatisfied"). For each item, to compare participants with and without satisfied

family relationships, we dichotomized the score at the top quartile. Participants above the top quartile on either item were considered to have unsatisfied family relationships (Bukowski & Sandberg, 1999) (not satisfied vs. satisfied).

Statistical analysis

Our aim was to examine the role of socioeconomic context in the association between adolescent repeated alcohol intoxication and young adulthood alcohol abuse. First, we tested unadjusted associations between adolescent repeated alcohol intoxication and young adulthood alcohol abuse. Second, we conducted multivariate regression analyses adjusted for covariates associated with alcohol use with a p-value ≤0.10 in univariate models. We chose to retain variables significant at p≤0.10 because some variables which are not statistically associated with the study outcome at p<0.05 statistical significance level in univariate regression models can become statistically significant in multivariate regression models. Thus, this strategy makes it possible to include the maximum number of covariates (A. Yaogo et al., 2012). Third, the analysis was stratified by family income: 1) Socioeconomic characteristic studied as potentially modifying the association between adolescent repeated alcohol intoxication and young adult alcohol abuse was family income during childhood as reported by participants' parents in 1989; 2) The interaction term was statistically significant for family income during childhood (p=0.006). We found no statistically significant interactions for sex (p=0.11) and for age (p=0.92); therefore different age groups were studied jointly. Finally, we conducted additional analyses examining the association between regular alcohol intoxication in adolescence and alcohol abuse in young adulthood. All analyses were carried out using logistic regression models in the SAS statistical software, version 9.3 (SAS Institute Inc, North Carolina).

RESULTS

Table1 presents participants' characteristics. 11.7% of participants reported repeated alcohol intoxication (≥3 episodes of alcohol intoxication in the preceding 12 months) in adolescence vs. 2.3% of adolescents who reported regular alcohol intoxication (≥10 episodes of alcohol intoxication in the preceding 12 months). 14.0% abused alcohol in young adulthood. Among participants who reported repeated alcohol intoxication in adolescence, 30.8% met criteria of alcohol abuse by young adulthood (46.7% among participants who reported ≥10 episodes of alcohol intoxication in the preceding 12 months in adolescence). In 1999, among participants who reported reported repeated alcohol intoxication, there was a higher proportion of men (p=0.002), of youths older than 16 years (p<0.0001), of subjects who presented parental heavy alcohol use (p=0.1) and who were not satisfied with the quality of family relationships (p<0.0001).

Associations between participants' characteristics and their patterns of alcohol abuse in 2009 are presented in **Table 2**. Adolescent repeated alcohol intoxication was associated with an increased likelihood of alcohol abuse by young adulthood (univariate OR=3.27, 95%CI 1.90-5.63).

In multivariate analyses (**Table3**) adjusted for age, sex, childhood temperament, parental history of alcohol use, quality of family relationships in adolescence, the OR associated with adolescent repeated alcohol intoxication increased to 4.27, 95%CI 2.21-8.24. **Table 4** presents results of analyses examining associations between participants' adolescent repeated alcohol intoxication (in 1999) and their young adult alcohol abuse (in 2009) stratified by childhood family income. Adolescent repeated alcohol intoxication was more strongly associated with young adult alcohol abuse in youths from low income families than in those from intermediate/high income families (adjusted OR=11.86, 95%CI 3.35-41.94 vs. OR=2.49, 95%CI 1.09-5.68) and the interaction term was statistically significant (p=0.006).

In additional analyses, regular alcohol intoxication in adolescence (≥10 episodes of alcohol intoxication in the preceding 12 months) was more strongly associated with young adult alcohol abuse than our main indicator (univariate OR=5.64, 95%CI 1.99-15.94 and adjusted OR= 4.18, 95%CI 1.31-13.38).

In additional analyses using childhood family income dichotomized at the median class, adolescent repeated alcohol intoxication was more strongly associated with young adult alcohol abuse in youths from low or intermediate income families than in those from high income families (adjusted OR=6.00, 95%CI 2.60-13.78 vs. OR=2.34, 95%CI 0.72-7.67). This result is slightly lower but consistent with the main findings we report using childhood family income dichotomized at the first quartile class.

DISCUSSION

Main findings: Using data from a large, prospective, community-based cohort study of young adults, we found that most individuals who reported repeated alcohol intoxication in adolescence did not exhibit alcohol abuse by young adulthood. Nonetheless, adolescent repeated alcohol intoxication (defined as ≥3 episodes of alcohol intoxication in the preceding 12 months) was associated with a threefold increase in the likelihood of later alcohol abuse. Participants from low-income families may be especially likely to have persistently unfavorable alcohol use pattern in case of adolescent repeated alcohol intoxication. Overall, adolescent repeated alcohol intoxication does appear to predict long-term patterns of alcohol abuse, especially certain subgroups of the population may be more likely to engage on a persistent unfavorable alcohol use pattern from a young age onwards.

Adolescence repeated alcohol intoxication and young adult alcohol abuse: comparison with prior results: In our study, 11.7% of participants reported ≥3 episodes of alcohol intoxication in the preceding 12 months in adolescence and 14.0% abused alcohol in young adulthood. These rates are comparable to rates found in France in general population studies (Beck, Tovar, Spilka, Guignard, & Richard, 2011). According to French Monitoring Centre for Drugs and Drug Addiction, in 2000, 15.8% of participants (aged 12 to 75 years old) experienced at least one episode of alcohol intoxication in the past 12 months with a peak in individuals aged from 15 to 25 years old (Guilbert et al., 2000). Consistently with prior studies, we found that most young adults who abuse alcohol did not have alcohol

related problems in adolescence. However, adolescent repeated alcohol intoxication is associated with an increased likelihood of alcohol abuse later on in life (Chassin, Pitts, & Prost, 2002; Dubow, Boxer, & Huesmann, 2008; Jefferis et al., 2005; Lee et al., 2012; Windle, Mun, & Windle, 2005). The higher the degree of alcohol abuse, the higher the likelihood of later alcohol abuse, which is also consistent with other studies (Bobo et al., 2012; Gotham et al., 1997). We also found that in emerging adulthood, among participants who didn't abuse alcohol, there was a higher proportion of women and youths from low-income families which is consistent with prior studies (Stone et al., 2012; A. Yaogo et al., 2013).

The role of childhood family income in the association between adolescent and young adult alcohol abuse: Our study main contribution is that we found that childhood family income modified the association between adolescent and young adult alcohol abuse. In case of adolescent repeated alcohol intoxication (≥3 episodes of alcohol intoxication in the preceding 12 months), participants who grew up in families with low income were 11.86 times more likely to show persistent alcohol abuse while those who came from families with higher income were only 2.49 times more likely to show persistent alcohol abuse. This result may be explained by differences in social integration (Kuntsche et al., 2004) according to socioeconomic background. Indeed, low socioeconomic situation during childhood may have hindered study participants' academic success and their career mobility, resulting in their working in a low occupational grade. A low occupational grade may be more likely to expose to social isolation through a reduction of social functions of job (support from colleagues, exchanges) (A. Yaogo et al., 2012) and social isolation is associated with alcohol abuse (Mowbray, Quinn, & Cranford, 2014). Our results may also be explained by differences in the perception of psychoactive substances according to socioeconomic status. Indeed, studies suggest that low socioeconomic status is correlated with underestimation of the risks of psychoactive substances abuse (de Walque, 2007; Legleye, Beck, Khlat, Peretti-Watel, & Chau, 2012). Individuals from low income families may also be less sensitive to

information on the health hazards of psychoactive substances abuse because their material difficulties give them a short term perspective (Legleye et al., 2012).

Strengths and limitations: Our study has limitations that need to be acknowledged before interpreting the results: 1) we had no measures of participants' alcohol use between 1999 and 2009, which limits the degree to which we can study factors that influence alcohol use in young adulthood. Future studies should consider examining the way in which youths' patterns of alcohol use evolve over time, using closer measurements; 2) Our analyses did not control for some factors known to influence young adulthood alcohol abuse because they were not available or not measured at the right time in our study [early onset of alcohol abuse (Kuntsche et al., 2004), quality of romantic relationships or family situation (Sher & Gotham, 1999)]. Future studies should account for these factors; in addition, impulsivity was not assessed using a specific scale such as Barratt Impulsivity Scale (Patton, Stanford, & Barratt, 1995) or a task such as the Balloon Analog Risk Task (BART)(Lejuez et al., 2002). We used Emotionality Activity Sociability and Shyness (EAS) Scale. Previous research has shown that this instrument has good psychometric properties and is generally valid against clinical diagnosis (Gasman et al., 2002). 3) Even though our study included a large community sample of youths followed prospectively from childhood to young adulthood and a prospective assessment of parental characteristics directly by parents, that is independently of youths' assessments of alcohol use, some characteristics which were self-reported may be susceptible to recall bias. Our study's main strengths are: 1) a community sample of youths followed from childhood to young adulthood, which allowed us to study alcohol abuse prospectively over time; 2) parental socioeconomic and substance use characteristics which were reported directly by parents, that is independently of youths' assessments of alcohol use, which limits information bias; 3) the ability to control for sociodemographic, psychological and family factors associated with alcohol abuse in young adulthood.

CONCLUSION

Most adolescents who abuse alcohol do not have alcohol-related problems in young adulthood. Nonetheless, adolescent repeated alcohol intoxication is predictive of adult alcohol abuse, particularly in adolescents from low income families. As secular trends in alcohol use change over time, the ways in which long-term trajectories of alcohol abuse evolve need to be monitored. A preliminary conclusion is that trajectories of alcohol abuse over time need to be monitored, particularly in certain subgroups of the population identified through this study.

Authors disclosure

Contributors: Ahmed YAOGO, Maria MELCHIOR and France LERT designed the study and Ahmed YAOGO wrote the protocol. Ahmed YAOGO managed the literature searches and summaries of previous related work, undertook the statistical analysis and wrote the first draft of the manuscript. All authors contributed to and approved the final manuscript.

Conflict of interest: All authors declare that they have no conflict of interest to report. The authors alone are responsible for the content and writing of the paper.

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