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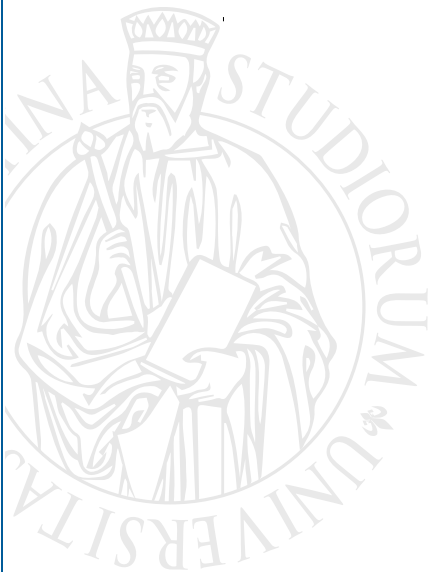
Adding up risks: Sexual debut and substance use among Italian university students

Fausta Ongaro[a], Valentina Tocchioni[b]

Abstract

BACKGROUND

The literature has analysed the effect of problem behaviours on the timing of first sexual intercourse, showing a positive association between them, but scant information is available about the effect on the other circumstances of sexual debut, such as the use of protection and having a casual partner, with few studies on Southern European countries.

OBJECTIVE

This study addresses whether and how the initiation and the timing of some risky behaviours (problem drinking and marijuana, ecstasy and other drug use) are associated with the timing of sexual debut, the use of protection and the type of first sexual partner.

METHODS

Event history analyses for the transition to first sexual intercourse – also in their competing risk form – are performed on data referring to Italian university students aged 18-26, collected in 2000-2001 and 2017.

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RESULTS

The risk of having first sexual intercourse steadily increases as the number of first-time risky behaviours increases. The negative effect of the accumulation of risky behaviours seems to be accentuated at very early ages; for those having their first intercourse with a casual partner; for young women having their first intercourse without any form of protection; and for young men having their first intercourse irrespective of the use of protection.

CONTRIBUTION

Our results show that even in a country such as Italy, where family and sexual norms are relatively traditional, young people confident with alcohol, marijuana and ecstasy use are more likely to experience risky sexual intercourse. This provides evidence for the political agenda on educating safe sex.

Keywords: First sexual intercourse; risky behaviour; substance use; survival models; university students; Italy

1. Introduction

Adolescence and youth are a period of great change during an individual's life. Young men and women are subject to biological, psychological and social development. They start their quest for autonomy from the authority of parents, family and school in order to become aware of themselves, to discover and try to find their place in the world (Steinberg and Sheffield Morris 2001). This is a period of experiencing first events in the transition to adulthood, but also sometimes of violating social norms on risky behaviours (Jessor 1984).

Sexual intercourse is one of the events in the transition to adulthood. With the disconnection of sexuality from the formation of a stable union (marriage) during the last century, sexual debut represents one of the first events of this process not only for men – as occurred in the past – but also for women.

However, if experienced in certain circumstances, it can be seen as a *risky* event. Experiencing first sexual intercourse without using proper protection places young women at risk of unintended pregnancy, and both young men and women at risk of contracting sexually transmitted diseases. These risks, as well as their possible negative consequences on an individual's life course, may be exacerbated if sexual debut occurs with a casual partner and/or early in the teenage years. Non-stable relationships offer fewer guarantees of protection against sexually transmitted diseases (Cates 1990) and fewer guarantees to overcome the possible complications arising from unintended pregnancy. Early age makes unintended consequences even more difficult to overcome. Those who initiate sex in early adolescence are less likely to practise effective contraception (Hayes 1987; Atkins and Hart 2008), such as using condoms (Sonnenstein et al. 1989), even in subsequent sexual activity, and they are more likely to experience adverse outcomes and related disadvantages in adolescence and into adulthood (Brew 2020).

The teenage years are when youth may be attracted by the desire to experience unconventional and norm-breaking behaviours in order to attain adult status as a sort of transition proneness (Jessor 1984; McCarty

et al. 2012; Inchley et al. 2020). Risky behaviours – such as substance abuse (alcohol or tobacco) and the use of marijuana or other drugs – may be seen by some teenagers as a way to emancipate their identity and achieve autonomy from the sphere of adults.

A large body of research has examined life events connected to first sexual intercourse, and some studies have even considered the relationship between some individuals' unconventional behaviours and sexual debut. However, this research is often limited in several respects. First, it tends to assess the impact of problem behaviour on the timing of first intercourse (Hofferth 1987; Crockett et al. 1996; Santelli et al. 2004; van Gelder 2011; Cha et al. 2016) without extending the analysis to other aspects of first intercourse, such as the use of protection or the type of partner. Second, most of these studies refer to Anglo-Saxon (especially U.S.) youth; few concern the countries (i.e., Southern European countries) where young people's transition to adulthood and first sexual experiences have timings and paths that are different from those observed in Anglo-Saxon contexts. Third, large-scale surveys mainly use a cross-sectional approach; a few works adopt a longitudinal perspective, and most of them refer to disadvantaged social classes or populations at risk of antisocial behaviour (Capaldi et al. 1996; Scott-Sheldon et al. 2010; Cavazos-Rehg et al. 2010).

In the light of these shortcomings, we contribute to the literature by addressing whether and how the initiation and timing of some risky behaviours are associated with the circumstances of sexual debut, focusing on a population with a relatively low propensity to risky behaviours: Italian university students. Italy is a country that greatly differs from the Anglo-Saxon countries in terms of institutional and cultural settings, and where family attachment and the Catholic religion continue to play a prominent role in regulating social norms and moderating young people's risky behaviours (Caltabiano et al. 2006; Dalla Zuanna and Micheli 2006). Moreover, university students tend to be a group of individuals aiming to invest in their future: their parents, who often belong to the middle and upper social classes, support and promote them in their education and future occupations (Forste and Haas 2002; Coppola 2007; Manlove

et al. 2012) and thus may have greater control over their children's behaviour. However, to what extent does substance use influence the circumstances of first sexual intercourse in this young population, where the parental control and cultural setting described above do not completely exclude such an association? To analyse the relationship between risky behaviours and university students' first sexual intercourse (in terms of timing, type of partner and use of protection), we used data pooled from two retrospective surveys conducted on university students in 2000-2001 and in 2017 and applied event-history models (in some cases, in their competing risks version); in doing so, we controlled for the role played by other individual and contextual factors suggested by the literature.

The paper is organized as follows: Section 2 presents the background and hypotheses; Section 3 describes data and methods; Section 4 presents the results of the models; and our conclusions are discussed in Section 5.

2. Background and hypotheses

2.1 Sexual behaviour as a risk-taking behaviour

Sexual intercourse is part of a healthy adult life. Thus, sexual exploration is part of young people's normal and typically healthy development. However, in certain circumstances, it may become a risky behaviour. Early sexual debut, for example, is seen as a risky behaviour given its association with a series of risk-taking behaviours during adolescence, such as more sexual partners and inconsistent contraceptive use (Cavazos-Rehg et al. 2007; Santelli et al. 1998; Magnusson et al. 2012). More sexual partners and unprotected sex (e.g. without pill or condom) are usually associated with a higher risk of unintended pregnancies and sexually transmitted diseases (Cates 1990; Harvey and Spigner 1995), unwanted outcomes that may have consequences both in the short and long term. Early unintended pregnancies –

which affect mainly young females' life course – may have, for example, numerous social consequences, including compromised economic prospects due to out-of-wedlock childbearing and adolescent parenting. More generally, as suggested by the life course approach (Elder 1995), sexual behaviours during adolescence may affect the cognitive, physical and emotional development that occurs afterwards (Dixon-Mueller 2008; Hays and Schmeer 2020), as well as the formation of attitudes, expectations and intentions, with an impact both on subsequent relationships and on sexual and contraceptive behaviour. Early unintended pregnancies are associated, for example, with subsequent unintended pregnancies (Guzzo and Hayford 2011), thus suggesting inconsistent contraception in either ongoing or new relationships, too. Furthermore, early sex and more sexual partners during adolescence seem to be associated with lower performance at high school (Lanari et al. 2020), spending more time in sexual relationships than peers and greater instability in sexual relationships during early adulthood (Brew et al. 2020).

2.2 What we know about the relationship between risky behaviours and sexual behaviour

Researchers have long been interested in describing the relationship between substance use (such as cannabis, cocaine, ecstasy and alcohol), which is fairly common in adolescence (Chick and Reyna 2012), and sexual debut. Given its impact on subsequent sexual life, most studies have focused on the timing of first sex, assuming that substance use may be a specific risk factor for early sexual initiation. This hypothesis is commonly stated in the literature (Elliott and Morse 1989; Rosenbaum and Kandel 1990; Capaldi et al. 1996; Crockett et al. 1996; Santelli et al. 2004; Cavazos-Rehg et al. 2010; Floyd and Latimer 2010; van Gelder et al. 2011; Cha et al. 2016). In their longitudinal study based on a U.S. rural population, Crockett et al. (1996) showed that more frequent substance use (getting drunk and high on

drugs) was associated with an earlier sexual debut for both genders. Similar results were found among adolescent males at risk of problem behaviours in the Oregon Youth Study (Capaldi et al. 1996): substance use (tobacco, marijuana and alcohol) was found to predict early onset of sexual intercourse. More recently, Cavazos-Rehg et al. (2010) found a significantly higher incidence of having become sexually active at 16 years of age or earlier among people aged 18-25 with alcohol problems, net of other *self-system* characteristics and familial and demographic factors. A positive association between substance use and the timing of first sexual intercourse was found even among less socially characterised samples of young people. For example, Cha et al. (2016), assessing the relationship between early sexual debut and cannabis use by gender and race/ethnicity in a sample of young people in the U.S., showed that later ages at sexual debut were associated with a lower risk of cannabis use. The results were overall consistent across gender and race/ethnicity.

Nevertheless, other studies have shown that the strength of this relationship may differ by young people's characteristics, such as age, gender, race/ethnicity and nationality, and type of substance. For example, El-Menshawi et al. (2019), who examined whether the age at which U.S. adolescents started to use cannabis was associated with their age at first sexual intercourse, reported that the strength of this relationship differed by gender: for adolescents younger than 13 years old, the effect was significantly higher for boys than for girls. Another study, involving African American and Latino students in the U.S., found a positive association between early drinking and sexual initiation for girls, but not for boys (Stueve and O'Donnell 2005). Finally, in their work on adolescents in five high-income countries (Finland, Scotland, France, Poland and the U.S.), Madkour et al. (2010) documented that the use of alcohol and tobacco was positively associated with early sexual experience among boys and girls across all countries, once adjusted for other background and individual determinants; however, the association was stronger in European countries than in the U.S.

Information is scarce on the association between substance use and other circumstances of first sexual intercourse. As far as we know, no empirical study has analysed whether and how the initiation of substance use has an impact on unprotected first sex or sexual debut with a casual partner. However, some suggestions can be offered by the relatively rich empirical research on the relationship between substance use and sexual risk-taking behaviours among sexually active adolescents. In their review of the 1990-99 empirical literature pertaining to the correlates of adolescent sexual risk-taking behaviours, Kotchick et al. (2001) documented an evident association between substance use and some sexually risky behaviours, such as irregular use of condoms and a high number of sexual partners. Subsequent studies, however, confirmed these results only partially. While a positive association between some substance use (drinking, marijuana, cocaine) and casual or multiple partners was documented by most studies (e.g., Khadr et al. 2016; Stueve and O'Donnell 2005; Howard and Wang 2004; Morrison-Beedy et al. 2011; van Gelder et al. 2011), the relationship between substance use and unprotected sex remains unclear. More specifically, while some studies have shown a positive correlation between binge drinking, tobacco or cannabis use and unprotected sex (Stueve and O'Donnell 2005; Parkes et al. 2007; Khadr et al. 2016), others have failed to link substance use and condom use (Floyd and Latimer 2010; Hair et al. 2009; Hensel et al. 2011). Some researchers have demonstrated that the link between substance use and unprotected sex may depend on the target population (van Gelder et al. 2011; Parkes et al. 2007) or the circumstances of sex. For example, Scott-Sheldon and colleagues (2010), in their study based on longitudinal data on sexually active, heavy-drinking U.S. college students, found that the link between alcohol consumption and condom use differed by gender and partner type. While alcohol consumption was not associated with condom use among men, those women who drank heavily were less likely to use a condom for sexual intercourse with a steady partner only. Sometimes, the substance itself has an impact (Howard and Wang 2004; van Gelder et al. 2011): among young men, using cocaine was associated with

unprotected sex, but this was not the case for marijuana use and injected drugs, nor among young women using any of the studied drugs (van Gelder et al. 2011).

2.3 A complex association

Mapping the association between substance use and sexual behaviours is not straightforward. Mixed results may derive from the inconsistency among target populations: while some studies are school-based, others focus on high-risk youth. Substances are also treated differently. For instance, some researchers focus on the joint effect of one or two substances, making broad statements about drug use, while others focus on the effects of a specific type of substance (i.e., Parkes et al. 2007; Scott-Sheldon et al. 2010).

In addition, large-scale studies are often designed to look only for a pure association between substance use and the timing of sexual debut: this makes it difficult to clearly account for the direction of the relationship between the two behaviours if – as in our case – different mechanisms may explain such an association (Clark et al. 2020; Capaldi et al. 1996). Broadly speaking, there are three main mechanisms through which the two behaviours may be related. First, substance use can directly influence young people's sexual behaviour (Rosenbaum and Kandel 1990). Alcohol, marijuana and other drugs may increase the likelihood of sexual activity and related sexually risky behaviours by impairing judgement, suppressing inhibitions, reducing the perception of risks and/or heightening desire (Elkingtong et al. 2010). The disorganising effect on cognitive functions is assumed to be dangerous especially among adolescents, whose cognitive functions are not completely developed (Baskin-Sommers and Sommers 2006). Second, the association between substance use and sexual behaviour may depend on the intention of having sexual intercourse. In this case, alcohol and drugs are seen as social cues for sexual activity,

therefore, it is the desire to engage in sexual activity that motivates substance use just before sexual intercourse (Ensminger 1987; Clark et al. 2020). Third, the relationship between substance use and sexual behaviour may occur because some young people are more predisposed to a wide array of problem behaviours. From this perspective, adolescent problem behaviours (e.g., substance use, delinquency and precocious sex) co-occur at high rates, and several theories propose that some risky behaviours depend on a common underlying vulnerability to disinhibited behaviours that is due to specific personal psychological characteristics (Iacono and McGue 2002; Harden 2014). Here, the association could reflect unobserved individual differences in pre-existing risk factors that contribute to a broad liability for a variety of problem behaviours.

Given these premises, this study aims to shed further light on how the initiation to some substances (alcohol, marijuana and other drugs) impacts the circumstances of sexual debut in a sample of Italian university students. Moving from the existing literature, we enlarge the exploration of the relationship between the initiation of risky behaviours and the timing of sexual debut, considering also the type of partner and the use of protection. In addition, we analyse the behaviours of young people living in Italy, a country whose socio-demographic characteristics and cultural context greatly differ from those of the U.S. or other Anglo-Saxon countries, for which studies are more widespread in the international literature. Finally, using a longitudinal perspective, we aim to control possible "disturbances" in interpreting the association between substance use and sexual behaviour. Taking into account the age at first sexual intercourse and at substance initiation, we can exclude the second mechanism of concomitant occurrence of sexual intercourse and substance use. Thus, only two mechanisms could explain the relationship between substance use and the circumstances of first sexual intercourse: a) a direct effect of substance use; and b) an individual underlying propensity to problem behaviour. However, because we focus on a population of youth who have demonstrated an inclination to invest in their future (university

students), we should avoid studying a population with an *a priori* high predisposition toward problem behaviours.

In the end, we ask if the initiation of drug use and/or alcohol abuse predicts a risky sexual debut even among individuals who, because of both cultural context and individual life opportunities, are at least *a priori* less likely to experience a risky first sexual intercourse. More specifically, our main questions are the following: (1) Are drug use and/or alcohol abuse predictors of early sexual debut? (2a, 2b) Are they also predictors of other risk-taking behaviours related to first sexual intercourse, such as having a casual partner or inconsistent protection? (3a, 3b) Is the relationship between drug use and/or alcohol abuse and first intercourse with a casual partner or inconsistent protection stronger at early ages? The analyses take gender differences into account.

2.4 The Italian context

In comparison with Western and Northern European countries, Italy has shown a delayed and slow transition towards Second Demographic Transition (SDT) family behaviours (van de Kaa 1987): unmarried cohabitation, children born outside marriage and marriage dissolutions are far less common than elsewhere in Europe, despite increasing rapidly in recent years (Pirani and Vignoli 2016). This continuous process co-exists with a *latest-late* transition to adulthood so that, compared with other Europeans, Italian young people are among the oldest to leave the parental home, start a union and have a child (Corijn and Klijzing 2001; Billari et al. 2002; De Rose et al. 2008; Assve et al. 2013). In addition, Italy has a very low percentage of teenage mothers (Gesano et al. 2007), which is one of the lowest in Europe. In 2017 in Italy, 1.6% of first-time mothers were younger than 20, compared with 6% in the UK and the 5% EU average (Eurostat 2019).

A similar slow process of de-traditionalisation has impacted changes in young people's intimacy. For a long time, Italy was notable for its double-standard system, which is quite different from the egalitarian system characterising Western and Northern European countries (Castiglioni 2004; Dalla Zuanna and Mencarini 2004; Bozon and Kontula 2014). Since the sexual revolution of the 1960s in Italy, the double-standard system has lost ground and a slow convergence in the age at first sexual intercourse of men and women has been recorded (Ongaro 2004; Caltabiano 2013). Women's age at first sexual intercourse has lowered, thus showing a separation between sexuality and family formation. Meanwhile, the rate of contraception at first intercourse has increased, with a reduction in gender differences: while less than 20% of young adults used contraception at first intercourse in 1960-1965, with lower rates among women than men, this increased markedly to around 70% in 2000, with the rates by gender narrowing (Ongaro 2004; Struffolino and Zagel 2021). The period between first sexual experience and full sexual intercourse has also shortened (Billari and Ongaro 2004). However, traits of traditional behaviours tended to be observed until very recently. At least up to individuals born in the 1980s in Italy, the age at first intercourse remained relatively high compared with that of their counterparts living in Central and Northern European countries (Ongaro 2004), and first intercourse was still closely linked to romantic relationships (Billari and Ongaro 2004). In this context, having a casual partner for first intercourse remained an exception. However, recent studies suggest a relevant anticipation of age at sexual debut among men and women born at the end of the past century and a partial convergence toward the "egalitarian regime", with young Italians' sexual activity frequently preceding the first romantic relationship for both genders and casual sexual partners becoming more common (WHO 2016; Minello et al. 2020).

3. Strategy of analysis

3.1 Data

This study is based on SIS, a survey driven by a group of researchers from the University of Messina, and SELFY, a survey driven by a group of researchers from the Universities of Padova, Firenze and Messina in Italy. The SELFY survey, carried out in the first half of 2017 with the aim to draw an updated picture of sexual and emotional attitudes and behaviours among Italian university students, reiterates the almost identical survey SIS carried out in 2000-2001. In 2000-2001, around 5,000 students were interviewed, and in 2017 around 8,000; all students were attending the first and second year of undergraduate courses in economics and statistics in Italian public universities. The surveys collected actual and retrospective information on family of origin, friendship, school attendance, sexual behaviour and risky behaviours. For further information on the survey methodology and respondents' characteristics, we refer to Dalla Zuanna et al. (2019).

Our sample is formed of university students who participated in either the survey conducted in 2000-2001 or that conducted in 2017. More specifically, it is composed of 6,166 young women aged 18-26 (43.2% of whom were interviewed in 2000-2001) and 5,779 young men aged 18-26[1] (32.5% of whom were interviewed in 2000-2001). In our sample, 71.5% of young women and 76.2% of young men had experienced their first intercourse before the interview date[2], and they were asked the month and year in which it happened. Among these, unprotected sex – namely, intercourse where the couple did not use a condom, the pill or IUD – was performed by 23.1% of young women and 19.5% of young men during their first intercourse; protected sexual intercourse was practised by the others. The partner was casual – a person the student knew at the time of first intercourse but without having a romantic relationship with them, or a person the student did not know – for 10.3% of young women and 30.7% of young men; the others had a stable partner – a person with whom the student had a romantic relationship, or their spouse.

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[1] We excluded 5 students who declared to be under 18 at the interview date, and 115 students who had lived abroad while at secondary school.

[2] 253 students were excluded because they declared to have had sexual intercourse but the date was missing; 255 students were excluded because they had experienced sexual intercourse but the information about the type of contraception or partner was missing.

Table 1 shows some descriptive statistics for the sample (see Table A1 in the Appendix for details on exposures and occurrences).

In the surveys, the students were asked the age at which (if applicable) they got drunk, smoked marijuana or other drugs or used ecstasy or other pills[3] for the first time. In our sample, 39.7% of young women and 61.7% of young men got drunk for the first time before having had their first intercourse; 18.3% of young women smoked marijuana and 0.6% tried ecstasy for the first time before having their first intercourse, compared with 35.1% and 1.3% for young men, respectively.

Students' age at first intercourse was divided into classes, which were functional to our objectives. Because the percentiles of age at first sexual intercourse within the sample for young men and women were similar (see Table 1), we opted for the same categorisation of age for males and females for ease of comparability. The first age class, 12-16 years old, aims to identify those who had very precocious intercourse; the upper limit of this class is approximately the 15th percentile of age at first sexual intercourse within the sample for both young men and women. The second age class, 16-17.5 years old, defines those who had precocious intercourse; the upper limit of this class is approximately the 35th/40th percentile of age at first sexual intercourse within the sample for young men and women, respectively. The third age class, 17.5-20 years old, concerns the period during which first intercourse typically occurs; its upper limit is approximately the 65th/70th percentile of age at first sexual intercourse within the sample for young men and women, respectively. Finally, the fourth age class 20 years old and over, includes those who had late first intercourse and those who had not yet experienced it.

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[3] In the following, we refer simply to "marijuana" and "ecstasy" for indicating these two risky behaviours.

Table 1: Descriptive statistics of the sample. 2000-2001 and 2017. Females and males.

	% of those who had a first intercourse	Age at first intercourse 25° percentile	median	75° percentile	Got drunk % at the interview date	% before 1° intercourse	Tried marijuana % at the interview date	% before 1° intercourse	Tried ecstasy % at the interview date	% before 1° intercourse
FEMALES (N=6,166)										
First intercourse	71.49	16.75	18.42	-	58.19	39.66	32.21	18.31	1.64	0.59
with a stable partner	89.72	16.17	17.50	18.67	65.26	37.83	37.67	16.99	1.97	0.53
with a casual partner	10.28	16.42	17.92	18.92	78.81	55.63	56.07	29.80	3.75	1.10
with protection	76.91	16.17	17.50	18.67	66.37	39.09	38.14	17.46	1.56	0.44
without protection	23.09	16.08	17.50	18.67	67.58	41.55	44.30	21.12	4.13	1.08
MALES (N=5,779)										
First intercourse	76.16	16.58	18.08	21.42	78.75	61.71	53.61	35.11	4.78	1.32
with a stable partner	69.35	16.25	17.58	18.67	82.60	60.75	58.78	34.67	5.24	1.15
with a casual partner	30.65	15.92	17.17	18.42	88.88	63.90	65.01	36.10	7.56	1.70
with protection	80.48	16.17	17.50	18.58	83.79	61.58	59.03	34.22	5.19	1.19
without protection	19.52	15.92	17.25	18.50	87.54	62.28	67.52	38.77	9.08	1.86

3.2 Methods

To gain insight into initiation to substance use and sexual debut, we used event-history models, separately for young males and young females, in order to better understand their possible differences. First, we ran piecewise-constant exponential models on the transition to first sexual intercourse. Second, we performed piecewise-constant exponential models on the transition to first sexual intercourse with a casual partner or a stable partner, treating them as two competing risks. Third, we ran piecewise-constant exponential models on the transition to first protected or unprotected sexual intercourse, treating them as two competing risks.

a) Modelling the transition to first intercourse

To investigate our first research question about if and how drug use and/or alcohol abuse are predictors of early sexual debut, we estimated piecewise-constant exponential models on the transition to first sexual intercourse (Models 1a-1c). The process time is the time elapsed since 12 years old until sexual intercourse[4] or the time of the interview, whichever occurred first. The baseline duration is the age, grouped into four classes: under 16, 16-17.5, 17.5-20 and 20 and older. We adopted a stepwise procedure estimating nested models with three steps to assess how risky behaviours influence the transition to first sexual intercourse and if their effects hold once controlled for micro-, meso- and macro-level characteristics identified as relevant in the literature (i.e., Coppola 2007; Caltabiano 2007; Rostosky et al. 2004; Jones, Darroch and Singh 2005; Caltabiano, Dalla Zuanna and Rosina 2006; Guetto et al. 2020). First, we estimated a model with the baseline hazard, namely age classes, and the three risky behaviours as binary time-varying covariates indicating if the student smoked marijuana, used ecstasy or got drunk for the first time during the process time (see Model 1a). Second, we included individual behaviours, namely if the student was a smoker (rarely/never smoked, smoked 1-7 cigarettes a day or smoked 8+

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[4] We excluded 31 students who had their first sexual intercourse before the age of 12.

cigarettes a day) and how often she/he went to a disco (never, sometimes or often), a binary indicator, if she/he were a practising religious person or not, and the final score obtained at lower secondary school (low, medium and high score); meso-level covariates, such as the type of secondary school attended (lower secondary, lyceum, technical, vocational), parental education (distinguishing between tertiary education of at least one parent, upper secondary at most, or lower education), a binary indicator if the mother worked when the student was 11, if parents had separated or not; and contextual information (i.e., macro level) such as the year of interview (2000-01 or 2017), the geographic area (i.e., North, Centre or South of Italy) and the geographical size of the municipality in which the student attended upper secondary school (below 10,000 inhabitants, 10,000-50,000 inhabitants, 50,000-100,000 inhabitants, 100,000-500,000 inhabitants, or more than 500,000 inhabitants: see Model 1b). Finally, for investigating if and how risky behaviours have a stronger impact on early ages, we included interaction terms between the two youngest age classes (under 16 and 16-17.5) and the two most common risky behaviours (marijuana use and problem drinking: see Model 1c)[5]. Among all control variables, the final score obtained at lower secondary school, family background covariates, such as parental education, mother's work and parents' separation, and contextual information were all time-constant, whereas all remaining variables were time-dependent (sometimes with specified time shifts linked to the questions in the questionnaire).

b) Modelling the transition to first intercourse with/without a casual partner or with/without protection

To investigate if and how risky behaviours increase the propensity to have first sexual intercourse with a casual partner (research question #2a), we estimated piecewise-constant exponential models on the transition to first sexual intercourse with a casual partner or a stable partner, treating them as two

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[5] We tested the inclusion of the interaction terms between the different age classes and the three risky behaviours in various models and compared them through likelihood ratio tests, opting for the best solution among those tested.

competing risks (Models 2a-2c). Accordingly, to investigate if and how risky behaviours increase the propensity to have first sexual intercourse without using any contraceptive method (research question #2b), we estimated piecewise-constant exponential models on the transition to first protected or unprotected sexual intercourse, whichever occurred first, treating them as two competing risks (Models 3a-3c). In both kinds of model, the process time is the time elapsed since the age of 12 until three outcomes: first sexual intercourse with a casual partner/first protected sexual intercourse (i.e., the couple used a condom, the pill or IUD); first sexual intercourse with a stable partner/first unprotected sexual intercourse; or the time of the interview, whichever occurred first.

These two series of models have the same baseline, main explanatory variables and stepwise procedure as for the first research question. The inclusion of interaction terms between the two youngest age classes and risky behaviours (problem drinking and marijuana use only) is functional for studying research questions #3a and #3b about the eventuality of a stronger association between risky behaviours and casual sex/not having used any contraceptive method at younger ages (see Models 2c and 3c).

4. Modelling the effects of risky behaviours on sexual debut

Full model results are presented in the Appendix, Tables A2-A4[6]. To aid interpretation, the estimated hazard ratios of experiencing first sexual intercourse in the presence of risky behaviours for each final model that we ran are presented in Table 2. We estimated the hazard rates[7] and have reported them graphically in Figures 1-3.

4.1 Risky behaviours and timing of sexual debut

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[6] Our results confirm previous empirical findings with respect to the role played by other individual behaviours, meso-level characteristics and contextual information (see, e.g., Caltabiano, Dalla Zuanna and Rosina 2006; Coppola 2007).

[7] For estimating hazard rates, we set the control covariates at their reference value.

Experiencing one or more substance abuse increases the risk of sexual debut, especially at very early ages, before 16 years old; as for the interaction terms, both problem drinking and marijuana use coefficients at the youngest ages are positive and significant for young females, whereas for young males, only problem drinking for the youngest ages is statistically significant. On the contrary, for those students aged 16-17.5 years old, substance abuse does not seem to increase the risk of having first intercourse sooner (the hazard ratios for the two interaction terms are not significant and close to one: see Table 2, Model 1c). For answering RQ#1, drug use and/or alcohol abuse seem to be predictors of sexual debut at very young ages. Finally, while estimated coefficients for having got drunk and having smoked marijuana significantly increase the risk of first intercourse for both genders, the role of ecstasy appears to be consistent but not significant for young women (presumably because very few women had tried ecstasy in the sample: see Table A1 in Appendix), whereas it seems to be negligible for young men.

Figure 1 shows the effects of risky behaviours on male and female students, separately, on the hazard rate of the transition to first sexual intercourse, as resulting from Model 1c (see Table 2 for an extract of model results and Table A2 for full model results in the Appendix). Analysing the risk of first sexual intercourse by substance abuse (alcohol and marijuana), with age equal, the risk of having first sexual intercourse steadily increases as the number of first-time risky behaviours increases (from blue line to orange line). The negative effect of accumulation of risky behaviours seems to be accentuated for very young females: among those who previously experienced problem drinking and smoked marijuana (orange line), the risk of having first intercourse before 16 immediately follows the highest risk for 17.5- to 20-year-old females.

Figure 1: Hazard rate for the transition to the first sexual intercourse from piecewise constant exponential models: the role of problem drinking and marijuana use. Females and males.

First sexual intercourse - hazard rate for female students

Legend: no got drunk & no marijuana; got drunk & no marijuana; no got drunk & marijuana; got drunk & marijuana

First sexual intercourse - hazard rate for male students

Legend: no got drunk & no marijuana; got drunk & no marijuana; no got drunk & marijuana; got drunk & marijuana
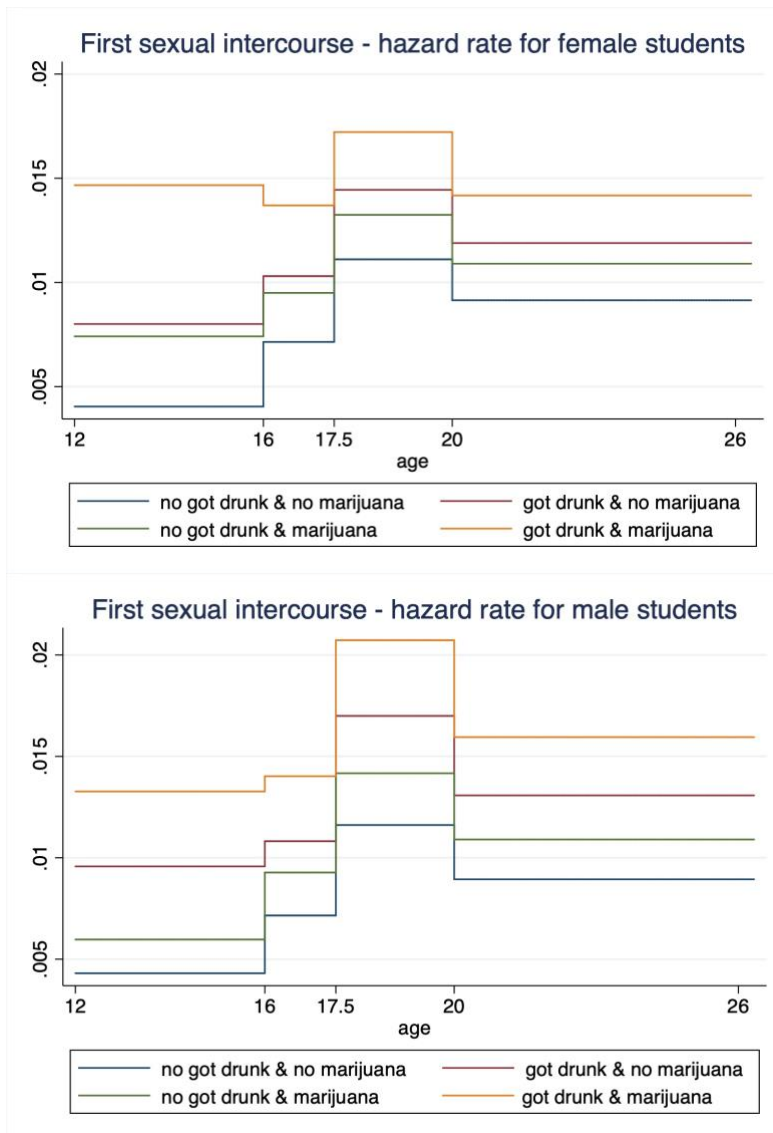
Data: own elaboration on SIS and SELFY data.
Note: control covariates were fixed at the reference value. Some interaction terms are not significant (see Table 2 for p-values).

4.2 Risky behaviours and other circumstances of sexual debut

Looking at the effects of substance use (RQ #2a), having got drunk and/or smoked marijuana at least

once in a student's life increases the risk of first intercourse both with a stable and a casual partner. For

young women, the effect of substance use is stronger when the sexual partner is casual: having got drunk

(having smoked marijuana) increases the risk of having first sexual intercourse with a casual partner by

137% (58%), while the risk of having first sexual intercourse with a stable partner increases by 21% with problem drinking and 13% with marijuana use (see the hazard ratios in Table 2, Model 2c for women). For young men too, in both cases the effect of substance use is stronger when the partner is casual: having got drunk (having smoked marijuana) increases the risk of having first sexual intercourse with a stable partner by 37% (19%), while the risk of having first sexual intercourse with a casual partner increases by 80% and 29%, respectively (see the hazard ratios in Table 2, Model 2c for men).

Having tried ecstasy is not significantly associated with the transition to first intercourse with a stable or a casual partner for both young females and males, even if the increased risk is always higher when the partner is casual.

For RQ #3a, the effects of having got drunk and smoked marijuana are even stronger at very young ages – before 16 – among females, increasing sooner the risk of having first intercourse with a stable partner or a casual partner. In contrast, for males aged under 16, problem drinking only increases the risk of first intercourse with a stable partner (all other hazard ratios are not significant and close to one: see Table 2, Model 2c for men). For females between 16 and 17.5 years old – problem drinking slightly increases the risk of having first intercourse with a stable partner, while marijuana use increases the risk of first intercourse with a casual partner. Among males, problem drinking and marijuana use do not anticipate the risk of first intercourse at early ages – between 16 and 17.5 years old – with a casual or a stable partner. Again, the results for RQ #3a suggest that substance use at very young ages has a strong role in young females' first sexual intercourse either with a casual or a stable partner.

Analysing the risk of first sexual intercourse by type of destination (namely, having sexual intercourse with a stable partner or a casual partner), both males and females have a higher risk of first sexual intercourse with a stable partner (see Figure 2); nevertheless, while females having a casual partner at least for the first experience is very uncommon (the risk is reduced by at least 90% for all age groups with respect to female students aged 17.5-20 having a stable partner), the risk of having a casual partner

has a smaller decrease for young males (as an example, for male students aged 17.5-20, the risk is reduced

by approximately 70%: see Table A3 in Appendix).

For both females and males, the risk of first sexual intercourse steadily increases as the number of first-

time risky behaviours (alcohol consumption or marijuana use) increases.

Figure 2: Hazard rate for the transition to the first sexual intercourse with a stable partner or a casual partner from piecewise constant exponential models: the role of problem drinking and marijuana use. Females and males.

First sexual intercourse - hazard rate for male students

Legend:
- stable partner: no got drunk & no marijuana; no got drunk & marijuana; got drunk & no marijuana; got drunk & marijuana
- casual partner: no got drunk & no marijuana; no got drunk & marijuana; got drunk & no marijuana; got drunk & marijuana
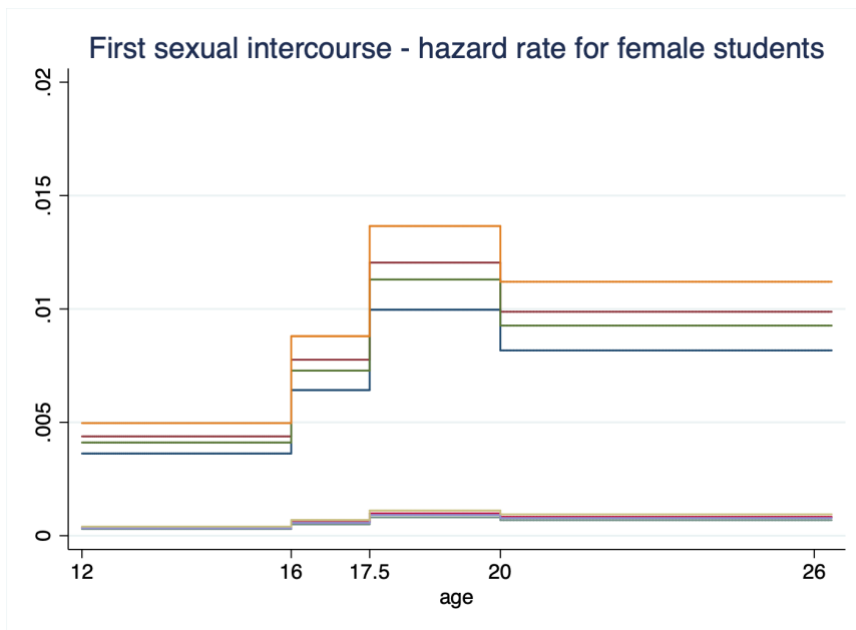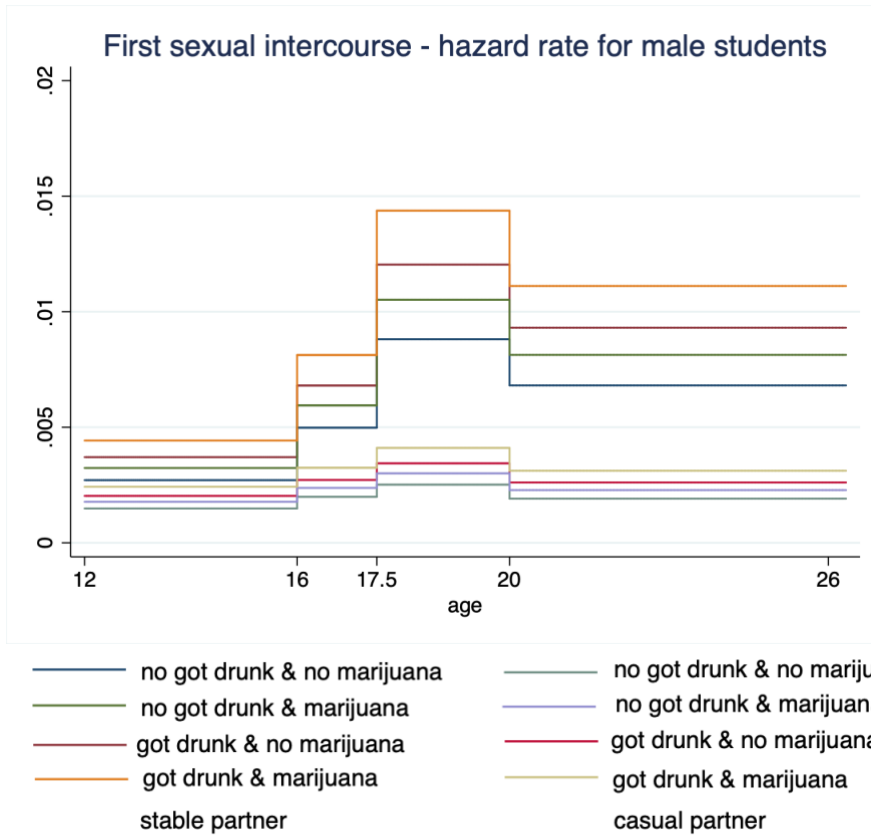
Data: own elaboration on SIS and SELFY data.
Note: control covariates were fixed at the reference value. Some coefficients are not significant (see Table 2 for p-values).

Looking at the role of risky behaviours in sexual debut with or without protection (RQ#2b), some differences emerge. For females, having got drunk increases the risk of first intercourse by 30% with or without protection, compared with those who did not drink and had first intercourse of the same type; having smoked marijuana increases the risk of first intercourse with protection by 9% (which is not significant) and without any form of protection by 55%. Having tried ecstasy significantly increases, by 114%, the propensity to have first sexual intercourse without any form of protection only (see the hazard ratios in Table 2, Model 3c for women). For young males, having got drunk and/or smoked marijuana at least once raises the risk of first intercourse both with or without protection, but while the increase is similar with problem drinking (48% for safe sex and 40% for unsafe sex), with marijuana use the increase is much higher for unsafe sex (55%) than safe sex (16%). Having tried ecstasy is not significantly

associated with the transition to first intercourse with or without protection for young males (but the hazard ratio is more than one for the transition to first intercourse without protection: see the hazard ratios in Table 2, Model 3c for men).

As for RQ#3b, having got drunk and/or smoked marijuana at very early ages (before 16 years old) increases females' risk of precocious first intercourse (but the interaction coefficients are significant for protected sex only). For the youngest male group, problem drinking significantly increases their risk of first intercourse with or without protection, reinforcing the effect that problem drinking has for all age groups. If problem drinking and/or smoking marijuana was experienced at 16-17.5 years old, the risk of first intercourse does not significantly increase for both genders (the hazard ratios are very close to one for males, while slightly higher for females: see Table 2, Model 3c). Thus, while problem drinking increases young females' risk of first intercourse at all ages with or without protection, having smoked marijuana increases young females' risk of first intercourse without protection at all ages, and with protection only for the youngest group, which appears again as the most vulnerable group.

Analysing the risk of first sexual intercourse by protection, both genders show a higher risk of having first sexual protected intercourse (see Figure 3); for females, the risk of having first unprotected sex reduces by 74% for those aged 17.5-20, while the risk lowers by 80% for young males aged 17.5-20 (see Table A4 in Appendix). The difference in risk between protected sex and unprotected sex seems less for young women than for young men.

As in the previous models, young people who have experienced one or more risky behaviours (alcohol consumption or marijuana or ecstasy use) are at much greater risk of having protected/unprotected sex than those students who have not experienced any risky behaviour, with a "cumulative" effect of risky behaviours (see the various hazard rates in Figure 3).

Figure 3: Hazard rate for the transition to the first sexual protected or unprotected intercourse from piecewise constant exponential models: the role of problem drinking and marijuana use. Females and males.
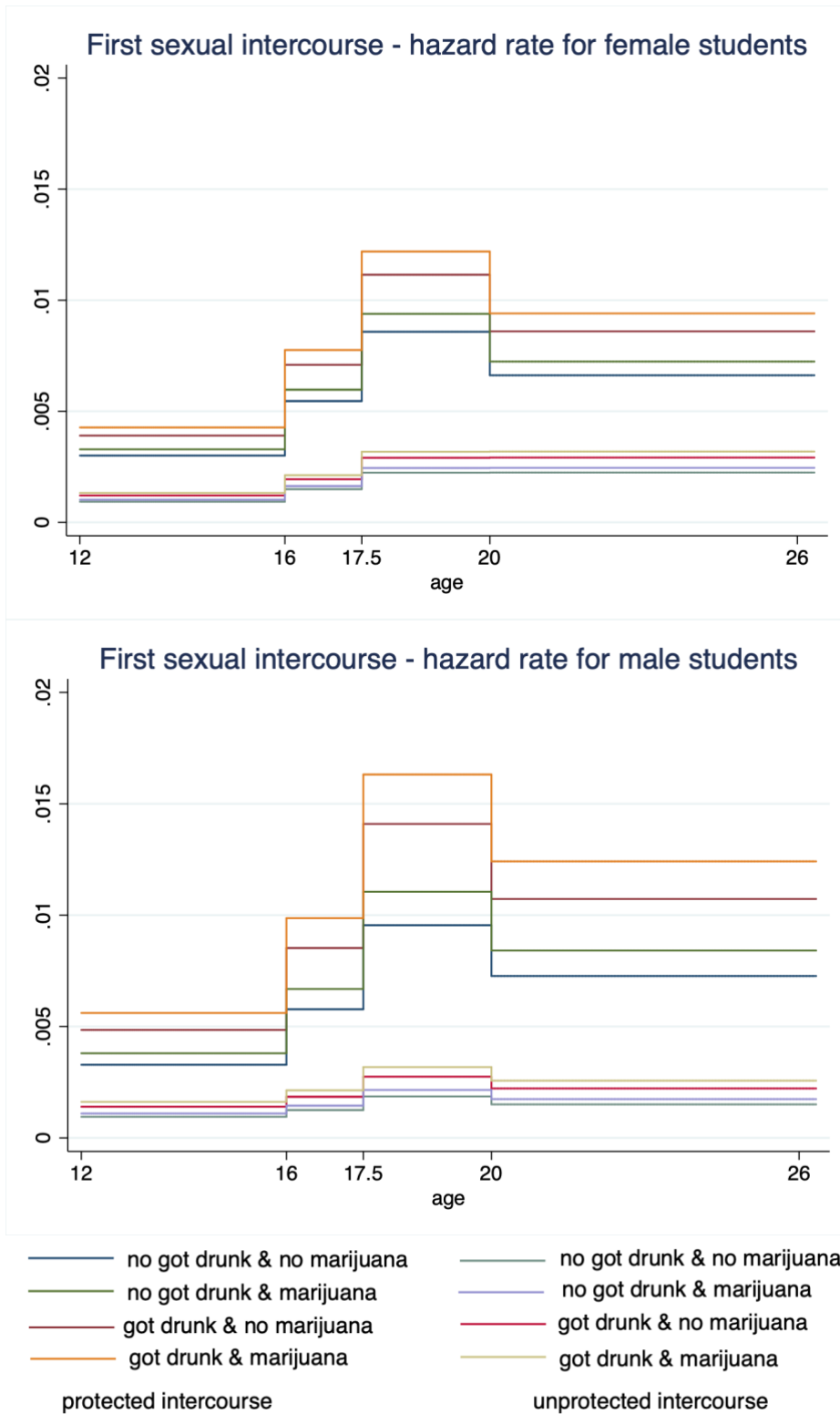
Data: own elaboration on SIS and SELFY data.

Note: control covariates were fixed at the reference value. Some coefficients are not significant (see Table 2 for p-values).

Table 2: Hazard ratios from piecewise constant exponential models of transition to: a first sexual intercourse (Model 1c); a first sexual intercourse with a stable/casual partner (Model 2c); a first protected/unprotected sexual intercourse (Model 3c). The role of problem drinking, marijuana use, other drug use. 2000-2001 and 2017. Females and males.

	Females			Males		
	haz ratio	std. Error	P>z	haz ratio	std. Error	P>z
Model 1c						
Risky behaviours						
got drunk	1.3	0.065	0	1.463	0.082	0
marijuana	1.192	0.07	0.003	1.22	0.061	0
ecstasy	1.307	0.262	0.181	1.058	0.145	0.684
<16*got drunk	1.522	0.165	0	1.519	0.146	0
<16*marijuana	1.537	0.236	0.005	1.136	0.128	0.256
16-17.5*got drunk	1.109	0.091	0.204	1.034	0.087	0.695
16-17.5*marijuana	1.115	0.116	0.294	1.063	0.089	0.465
Model 2c						
Risky behaviours						
got drunk (non-casual partner)	1.209	0.064	0	1.367	0.088	0
got drunk (casual partner)	2.373	0.352	0	1.797	0.202	0
marijuana (non-casual partner)	1.134	0.072	0.049	1.194	0.07	0.002
marijuana (casual partner)	1.584	0.232	0.002	1.292	0.12	0.006
ecstasy (non-casual partner)	1.255	0.279	0.307	0.925	0.162	0.655
ecstasy (casual partner)	1.577	0.717	0.316	1.359	0.298	0.162
<16*got drunk (non-casual partner)	1.501	0.175	0	1.61	0.186	0
<16*got drunk (casual partner)	1.707	0.52	0.079	1.26	0.215	0.175
<16*marijuana (non-casual partner)	1.689	0.276	0.001	1.149	0.16	0.32
<16*marijuana (casual partner)	0.826	0.379	0.677	1.092	0.209	0.647
16-17.5*got drunk (non-casual partner)	1.175	0.101	0.06	0.992	0.1	0.934
16-17.5*got drunk (casual partner)	0.711	0.189	0.2	1.061	0.169	0.713
16-17.5*marijuana (non-casual partner)	1.069	0.121	0.554	1.096	0.111	0.365
16-17.5*marijuana (casual partner)	1.661	0.472	0.074	0.984	0.145	0.915
Model 3c						
Risky behaviours						
got drunk (safe sex)	1.299	0.073	0	1.476	0.09	0
got drunk (unsafe sex)	1.303	0.134	0.01	1.399	0.188	0.012
marijuana (safe sex)	1.094	0.074	0.186	1.157	0.064	0.008

marijuana (unsafe sex)	1.549	0.176	0	1.553	0.179	0
ecstasy (safe sex)	1.018	0.267	0.946	0.953	0.154	0.765
ecstasy (unsafe sex)	2.136	0.659	0.014	1.459	0.375	0.142
<16*got drunk (safe sex)	1.595	0.195	0	1.515	0.162	0
<16*got drunk (unsafe sex)	1.294	0.301	0.267	1.556	0.327	0.035
<16*marijuana (safe sex)	1.598	0.281	0.008	1.143	0.147	0.297
<16*marijuana (unsafe sex)	1.388	0.435	0.295	1.034	0.243	0.888
16-17.5*got drunk (safe sex)	1.053	0.098	0.582	1.024	0.095	0.795
16-17.5*got drunk (unsafe sex)	1.315	0.222	0.105	1.081	0.216	0.699
16-17.5*marijuana (safe sex)	1.213	0.146	0.109	1.055	0.098	0.568
16-17.5*marijuana (unsafe sex)	0.863	0.179	0.48	1.059	0.2	0.762

5. Concluding remarks

This paper examines whether and how the initiation to some risky substances impacts the timing and other circumstances of first intercourse, such as the use of protection and the type of partner, usually ignored by the literature on this topic. Moreover, we have focused on a population of university students living in Italy, a country that – for its own pathway on the transition to adulthood and cultural background – greatly differs from the Anglo-Saxon countries to which most studies refer.

We found that experiencing the use of some substances has a relevant impact on the likelihood of having a risky sexual debut. Overall, for both genders, having got drunk or having used marijuana increases the risk of having first intercourse. In addition, the research suggests that the initiation to alcohol abuse or marijuana use is strongly associated with the other risky behaviours at first sexual intercourse, such as experiencing it with a casual partner or without proper protection. In contrast, the use of other drugs (mainly synthetic ones, such as ecstasy) has little impact on having a risky sexual debut. The only exception to this result is the use of protection among females: differently from males, ecstasy use is strongly associated with the risk of first intercourse without any form of protection, whatever the female's age.

Importantly, we found gender differences in the impact of substances on sexual behaviour, especially at early ages (under 16). As echoed by results from other studies (Cha et al. 2016; Cavazos-Rehg et al. 2010; Stueve and O'Donnell 2005), the risk of early sexual intercourse increases with involvement in substance use. However, substances have different impacts on the behaviours of boys and girls. Among boys, the abuse of alcohol is the only factor that further increases both the risk of early first intercourse and the risk of unsafe early first intercourse. Among girls, both substances – alcohol and marijuana – only have a strong effect on the risk of an early sexual debut.

In summary, the negative effect of the accumulation of risky behaviours due to multiple substances seems to be accentuated for young females, in particular very young females, who appear as the most vulnerable group.

What conclusions can we draw from these findings? Despite the evidence of the link between substance use and first sexual risk-taking, we cannot be sure about the mechanism behind this association. A longitudinal approach could suggest that substance use has a direct impact on sexual behaviour (Elkington et al. 2010). However, we cannot exclude psychological traits being at the foundation of both risky behaviours (Iacono and McGue 2002; Harden 2014). We do not have information about the factors related to general risk-taking personalities. Nevertheless, the sample is formed by university students who do not belong to marginal groups that are usually more at risk of risky behaviours. Our students are a selected population for first sexual intercourse, characterised by a low incidence of risky behaviours (the median age at sexual debut is relatively high: over 18 years) and most of the students (90% of young women and nearly 70% of young men) had their first sex with a stable partner and with protection (77% of women and 80% of men). In this respect, young males are more exposed than females to the risk of sexually transmitted diseases; having their first sexual intercourse with a casual partner, which exposes them mainly to the risk of sexually transmitted diseases, is still an unusual event for young females in Italy. On the other hand, it is worth noting that having first sexual intercourse without any form of

protection is not so rare for young males and more so for young females, exposing them to related risks, such as unintended pregnancy.

Our results show that even in a country like Italy, where family and sexual norms remain relatively traditional and family control delays the beginning of romantic and sexual life, young people who are confident with alcohol, marijuana and ecstasy use have a greater chance of experiencing risky sexual intercourse. This provides evidence for the political agenda on educating safe sex, starting from the first sexual relationships, as well as education on both the direct and indirect risks of substance use (alcohol included). Special attention should be devoted to girls, considering that females appear as the most vulnerable to risky behaviours but also have the most to lose if exposed to the negative consequences of unintended pregnancies (i.e., Herd et al. 2016).

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Appendix

Table A1: Exposures (person-month) and occurrences. Females and males.

	Exposure		Stable Partner (occurrences)		Casual partner (occurrences)		With protection (occurrences)		Without protection (occurrences)	
	abs.val.	%	abs.val.	%	abs.val.	%	abs.val.	%	abs.val.	%
FEMALES										
Age										
<16	26,288	55.3	901	22.8	85	18.8	756	22.3	230	22.6
16-17,5	10,662	22.4	1,131	28.6	112	24.7	957	28.2	286	28.1
17,5-20	8,658	18.2	1,642	41.5	218	48.1	1,445	42.6	415	40.8
20+	1,925	4.0	281	7.1	38	8.4	232	6.8	87	8.5
Risky behaviours										
did not got drunk	39,544	83.2	2,497	63.1	205	45.3	2,101	62.0	601	59.0
got drunk	7,989	16.8	1,458	36.9	248	54.7	1,289	38.0	417	41.0
did not use marijuana	44,607	93.8	3,308	83.6	323	71.3	2,825	83.3	806	79.2
used marijuana	2,926	6.2	647	16.4	130	28.7	565	16.7	212	20.8
did not use ecstasy	47,448	99.8	3,934	99.5	448	98.9	3,375	99.6	1,007	98.9
used ecstasy	85	0.2	21	0.5	5	1.1	15	0.4	11	1.1
MALES										
Age										
<16	30,209	66.2	674	18.3	375	90.4	810	25.6	239	25.7
16-17,5	10,342	22.7	832	22.6	406	97.8	998	31.6	240	25.8
17,5-20	7,399	16.2	1,346	36.6	496	119.5	1,513	47.9	329	35.3
20+	1,600	3.5	200	5.4	72	17.3	221	7.0	51	5.5
Risky behaviours										
did not got drunk	34,828	88.1	1,234	49.4	514	250.7	1,407	67.0	341	56.7
got drunk	14,722	37.2	1,818	72.8	835	407.3	2,135	101.6	518	86.2
did not use marijuana	42,846	81.5	2,021	42.4	880	154.1	2,365	57.5	536	43.8
used marijuana	6,704	12.7	1,031	21.6	469	82.1	1,177	28.6	323	26.4
did not use ecstasy	49,357	98.0	3,018	65.9	1,327	229.6	3,502	88.9	843	69.2
used ecstasy	193	0.4	34	0.7	22	3.8	40	1.0	16	1.3

Table A2: Hazard ratios of transition to a first sexual intercourse from piecewise constant exponential models: the role of problem drinking, marijuana use, other drug use. Females and males.

	Model 1a			Model 1b			Model 1c		
	haz ratio	std. Error	P>z	haz ratio	std. Error	P>z	haz ratio	std. Error	P>z
FEMALES									
Constant	0.015	0.000	0.000	9.96E-21	3.92E-20	0.000	4.27E-21	1.68E-20	0.000
Age									
<16	0.218	0.009	0.000	0.421	0.019	0.000	0.364	0.019	0.000
16-17,5	0.777	0.029	0.000	0.692	0.026	0.000	0.643	0.031	0.000
17,5-20	1.000	-	-	1.000			1.000		
20+	0.740	0.045	0.000	0.825	0.050	0.002	0.823	0.050	0.001
Risky behaviours									
got drunk	2.008	0.075	0.000	1.423	0.055	0.000	1.300	0.065	0.000
marijuana	1.546	0.071	0.000	1.253	0.060	0.000	1.192	0.070	0.003
ecstasy	1.368	0.272	0.114	1.293	0.259	0.198	1.307	0.262	0.181
Age*risky behaviours									
<16*got drunk							1.522	0.165	0.000
<16*marijuana							1.537	0.236	0.005
16-17.5*got drunk							1.109	0.091	0.204
16-17.5*marijuana							1.115	0.116	0.294
Smoke (ref. Never/rarely)									
smoker 1-7 a day				1.515	0.060	0.000	1.505	0.060	0.000
smoker 8+ a day				1.593	0.102	0.000	1.595	0.102	0.000
unknown				1.171	0.254	0.467	1.172	0.254	0.464
Disco (ref. Never)									
sometimes				1.418	0.062	0.000	1.391	0.061	0.000
often				1.544	0.078	0.000	1.529	0.077	0.000

unknown	0.961	0.272	0.888	0.964	0.272	0.897
Practicing religious (ref. yes)						
no	1.418	0.049	0.000	1.411	0.049	0.000
unknown	1.075	0.127	0.543	1.070	0.126	0.569
Final score (ref. Low)						
medium	1.063	0.046	0.152	1.062	0.046	0.160
high	1.018	0.043	0.669	1.017	0.043	0.685
Secondary school (ref. Lyceum)						
lower secondary	0.218	0.019	0.000	0.232	0.020	0.000
technical	1.036	0.036	0.302	1.029	0.035	0.404
vocational	1.013	0.091	0.884	1.004	0.090	0.969
unknown	1.263	0.309	0.338	1.264	0.309	0.337
Parents' separation (ref. No)						
yes	1.325	0.079	0.000	1.307	0.078	0.000
unknown	0.935	0.088	0.477	0.934	0.088	0.468
Mother's work (ref. No)						
yes	1.153	0.039	0.000	1.152	0.039	0.000
unknown	1.129	0.109	0.208	1.127	0.109	0.217
Parental education (ref. Upper secondary)						
lower secondary at most	0.948	0.192	0.792	0.953	0.193	0.813
tertiary	0.990	0.037	0.781	0.983	0.037	0.639
unknown	1.067	0.225	0.760	1.056	0.223	0.798
Year (ref. 2000)						
2017	1.021	0.002	0.000	1.021	0.002	0.000
Municipality size (ref. Below 10,000 inhab.)						
10-50000	0.943	0.037	0.136	0.945	0.037	0.154
50-100000	1.011	0.050	0.821	1.012	0.050	0.802
100-500000	0.991	0.056	0.872	0.994	0.057	0.923
500000+	0.943	0.054	0.306	0.944	0.054	0.312
unknown	0.881	0.063	0.078	0.880	0.063	0.076
Geographical area (ref. North-Centre)						
South	0.953	0.031	0.132	0.951	0.030	0.119

	M1			M2			M3		
unknown				0.996	0.202	0.986	1.000	0.202	0.998
MALES									
Constant	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Age									
<16	0.275	0.012		0.466	0.022	0.000	0.371	0.024	0.000
16-17,5	0.769	0.029		0.655	0.025	0.000	0.616	0.039	0.000
17,5-20	1.000			1.000			1.000		
20+	0.703	0.046		0.771	0.050	0.000	0.769	0.050	0.000
Risky behaviours									
got drunk	2.256	0.087	0.000	1.640	0.064	0.000	1.463	0.082	0.000
marijuana	1.516	0.057	0.000	1.250	0.049	0.000	1.220	0.061	0.000
ecstasy	1.180	0.160	0.224	1.039	0.143	0.782	1.058	0.145	0.684
Age*risky behaviours									
<16*got drunk							1.519	0.146	0.000
<16*marijuana							1.136	0.128	0.256
16-17.5*got drunk							1.034	0.087	0.695
16-17.5*marijuana							1.063	0.089	0.465
Smoke (ref. Never/rarely)									
smoker 1-7 a day				1.333	0.053	0.000	1.330	0.053	0.000
smoker 8+ a day				1.497	0.078	0.000	1.500	0.078	0.000
unknown				1.343	0.256	0.122	1.354	0.258	0.112
Disco (ref. Never)									
sometimes				1.743	0.086	0.000	1.706	0.084	0.000
often				2.315	0.123	0.000	2.282	0.121	0.000
unknown				1.328	0.316	0.234	1.288	0.307	0.289
Practicing religious (ref. yes)									
no				1.304	0.050	0.000	1.296	0.049	0.000
unknown				1.406	0.159	0.003	1.393	0.158	0.003
Final score (ref. Low)									

medium	0.954	0.036	0.213	0.956	0.036	0.236
high	0.893	0.036	0.005	0.899	0.036	0.007
Secondary school (ref. Lyceum)						
lower secondary	0.348	0.027	0.000	0.382	0.030	0.000
technical	0.950	0.034	0.147	0.946	0.033	0.116
vocational	1.072	0.119	0.528	1.062	0.118	0.588
unknown	1.005	0.171	0.975	1.006	0.171	0.970
Parents' separation (ref. No)						
yes	1.145	0.065	0.017	1.142	0.065	0.019
unknown	1.048	0.085	0.563	1.037	0.084	0.651
Mother's work (ref. No)						
yes	1.201	0.042	0.000	1.200	0.042	0.000
unknown	1.159	0.100	0.087	1.157	0.100	0.091
Parental education (ref. Upper secondary)						
lower secondary at most	0.863	0.207	0.538	0.856	0.205	0.516
tertiary	0.949	0.032	0.127	0.947	0.032	0.107
unknown	1.175	0.193	0.324	1.182	0.194	0.307
Year (ref. 2000)						
2017	1.014	0.002	0.000	1.015	0.002	0.000
Municipality size (ref. Below 10,000 inhab.)						
10-50000	0.951	0.040	0.235	0.953	0.040	0.255
50-100000	1.030	0.052	0.556	1.030	0.052	0.562
100-500000	0.967	0.050	0.519	0.968	0.050	0.534
500000+	1.094	0.058	0.090	1.090	0.058	0.104
unknown	1.105	0.123	0.369	1.087	0.121	0.456
Geographical area (ref. North-Centre)						
South	1.252	0.040	0.000	1.248	0.040	0.000
unknown	0.879	0.134	0.400	0.875	0.134	0.384

Table A3: Hazard ratios of transition to a first sexual intercourse with a non-casual/casual partner from piecewise constant exponential models: the role of problem drinking, marijuana use, other drug use. Females and males.

	Model 2a			Model 2b			Model 2c		
	haz ratio	std. Error	P>z	haz ratio	std. Error	P>z	haz ratio	std. Error	P>z
FEMALES									
Constant	0.014	0.000	0.000	0.006	0.001	0.000	0.007	0.001	0.000
Age									
(non-casual partner)									
<16	0.217	0.010	0.000	0.421	0.020	0.000	0.364	0.020	0.000
16-17.5	0.788	0.031	0.000	0.702	0.028	0.000	0.644	0.032	0.000
17.5-20 (ref.)	1.000			1.000			1.000		
20+	0.739	0.048	0.000	0.822	0.053	0.003	0.820	0.053	0.002
(casual partner)									
<16	0.019	0.002	0.000	0.036	0.004	0.000	0.030	0.004	0.000
16-17.5	0.056	0.006	0.000	0.051	0.006	0.000	0.051	0.007	0.000
17.5-20	0.082	0.009	0.000	0.084	0.009	0.000	0.081	0.010	0.000
20+	0.062	0.011	0.000	0.071	0.013	0.000	0.069	0.013	0.000
Risky behaviours									
got drunk (non-casual partner)	1.893	0.075	0.000	1.343	0.055	0.000	1.209	0.064	0.000
got drunk (casual partner)	3.407	0.398	0.000	2.369	0.270	0.000	2.373	0.352	0.000
marijuana (non-casual partner)	1.468	0.073	0.000	1.189	0.061	0.001	1.134	0.072	0.049
marijuana (casual partner)	2.129	0.259	0.000	1.734	0.210	0.000	1.584	0.232	0.002
ecstasy (non-casual partner)	1.315	0.290	0.215	1.240	0.275	0.333	1.255	0.279	0.307
ecstasy (casual partner)	1.638	0.744	0.277	1.567	0.712	0.323	1.577	0.717	0.316
Age*risky behaviours									
<16*got drunk (non-casual partner)							1.501	0.175	0.000
<16*got drunk (casual partner)							1.707	0.520	0.079
<16*marijuana (non-casual partner)							1.689	0.276	0.001
<16*marijuana (casual partner)							0.826	0.379	0.677
16-17.5*got drunk (non-casual partner)							1.175	0.101	0.060
16-17.5*got drunk (casual partner)							0.711	0.189	0.200
16-17.5*marijuana (non-casual partner)							1.069	0.121	0.554
16-17.5*marijuana (casual partner)							1.661	0.472	0.074

Smoke (ref. Never/rarely)						
smoker 1-7 a day	1.516	0.060	0.000	1.505	0.060	0.000
smoker 8+ a day	1.593	0.102	0.000	1.595	0.102	0.000
unknown	1.171	0.254	0.467	1.173	0.254	0.463
Disco (ref. Never)						
sometimes	1.418	0.062	0.000	1.391	0.061	0.000
often	1.544	0.078	0.000	1.529	0.077	0.000
unknown	0.961	0.272	0.888	0.964	0.272	0.896
Practicing religious (ref. yes)						
no	1.418	0.049	0.000	1.411	0.049	0.000
unknown	1.074	0.127	0.543	1.070	0.126	0.570
Final score (ref. Low)						
medium	1.063	0.046	0.152	1.062	0.046	0.160
high	1.018	0.043	0.667	1.017	0.043	0.683
Secondary school (ref. Lyceum)						
lower secondary	0.218	0.019	0.000	0.232	0.020	0.000
technical	1.036	0.036	0.301	1.029	0.035	0.403
vocational	1.014	0.091	0.881	1.004	0.090	0.966
unknown	1.263	0.308	0.339	1.263	0.309	0.338
Parents' separation (ref. No)						
yes	1.325	0.079	0.000	1.306	0.078	0.000
unknown	0.935	0.088	0.476	0.934	0.088	0.468
Mother's work (ref. No)						
yes	1.153	0.039	0.000	1.152	0.039	0.000
unknown	1.129	0.109	0.208	1.126	0.109	0.218
Parental education (ref. Upper secondary)						
lower secondary at most	0.949	0.192	0.794	0.953	0.193	0.813
tertiary	0.990	0.037	0.784	0.983	0.037	0.639
unknown	1.066	0.225	0.761	1.056	0.223	0.798
Year (ref. 2000)						
2017	1.418	0.047	0.000	1.430	0.048	0.000
Municipality size (ref. Below 10,000 inhab.)						
10-50000	0.943	0.037	0.135	0.945	0.037	0.155

50-100000				1.011	0.050	0.823	1.013	0.050	0.802
100-500000				0.991	0.056	0.871	0.995	0.057	0.923
500000+				0.943	0.054	0.305	0.944	0.054	0.312
unknown				0.880	0.063	0.077	0.880	0.063	0.076
Geographical area (ref. North-Centre)									
South				0.953	0.031	0.132	0.951	0.030	0.119
unknown				0.997	0.202	0.986	1.000	0.202	0.999

MALES

Constant	0.010	0.000	0.000	0.004	0.001	0.000	0.004	0.001	0.000
Age									
(non-casual partner)									
<16	0.226	0.012	0.000	0.390	0.022	0.000	0.308	0.023	0.000
16-17.5	0.694	0.031	0.000	0.592	0.027	0.000	0.565	0.042	0.000
17.5-20 (ref.)	1.000			1.000			1.000		
20+	0.707	0.054	0.000	0.775	0.059	0.001	0.773	0.059	0.001
(casual partner)									
<16	0.118	0.008	0.000	0.201	0.014	0.000	0.169	0.014	0.000
16-17.5	0.270	0.021	0.000	0.241	0.019	0.000	0.226	0.022	0.000
17.5-20	0.276	0.023	0.000	0.291	0.023	0	0.286	0.030	0.000
20+	0.191	0.026	0.000	0.221	0.030	0.000	0.217	0.033	0.000
Risky behaviours									
got drunk (non-casual partner)	2.051	0.095	0.000	1.516	0.069	0.000	1.367	0.088	0.000
got drunk (casual partner)	2.814	0.200	0.000	1.965	0.135	0.000	1.797	0.202	0.000
marijuana (non-casual partner)	1.493	0.067	0.000	1.232	0.057	0.000	1.194	0.070	0.002
marijuana (casual partner)	1.575	0.106	0.000	1.295	0.088	0.000	1.292	0.120	0.006
ecstasy (non-casual partner)	1.033	0.180	0.853	0.907	0.159	0.577	0.925	0.162	0.655
ecstasy (casual partner)	1.518	0.331	0.056	1.346	0.295	0.175	1.359	0.298	0.162
Age*risky behaviours									
<16*got drunk (non-casual partner)							1.610	0.186	0.000
<16*got drunk (casual partner)							1.260	0.215	0.175

<16*marijuana (non-casual partner)				1.149	0.160	0.320
<16*marijuana (casual partner)				1.092	0.209	0.647
16-17.5*got drunk (non-casual partner)				0.992	0.100	0.934
16-17.5*got drunk (casual partner)				1.061	0.169	0.713
16-17.5*marijuana (non-casual partner)				1.096	0.111	0.365
16-17.5*marijuana (casual partner)				0.984	0.145	0.915
Smoke (ref. Never/rarely)						
smoker 1-7 a day	1.332	0.053	0.000	1.330	0.053	0.000
smoker 8+ a day	1.496	0.078	0.000	1.500	0.078	0.000
unknown	1.344	0.257	0.121	1.354	0.259	0.112
Disco (ref. Never)						
sometimes	1.741	0.086	0.000	1.706	0.084	0.000
often	2.314	0.123	0.000	2.283	0.121	0.000
unknown	1.326	0.316	0.236	1.288	0.307	0.289
Practicing religious (ref. yes)						
no	1.303	0.050	0.000	1.296	0.049	0.000
unknown	1.405	0.159	0.003	1.393	0.158	0.003
Final score (ref. Low)						
medium	0.954	0.036	0.213	0.956	0.036	0.235
high	0.893	0.036	0.005	0.899	0.036	0.007
Secondary school (ref. Lyceum)						
lower secondary	0.350	0.027	0.000	0.382	0.030	0.000
technical	0.950	0.034	0.145	0.946	0.033	0.116
vocational	1.071	0.119	0.535	1.062	0.118	0.590
unknown	1.005	0.171	0.977	1.006	0.171	0.971
Parents' separation (ref. No)						
yes	1.144	0.065	0.017	1.142	0.065	0.019
unknown	1.047	0.085	0.570	1.037	0.084	0.652
Mother's work (ref. No)						
yes	1.201	0.042	0.000	1.200	0.042	0.000

unknown	1.158	0.100	0.088	1.157	0.100	0.091
Parental education (ref. Upper secondary)						
lower secondary at most	0.862	0.206	0.536	0.856	0.205	0.515
tertiary	0.949	0.032	0.125	0.946	0.032	0.107
unknown	1.177	0.193	0.321	1.182	0.194	0.307
Year (ref. 2000)						
2017	1.272	0.044	0.000	1.279	0.044	0.000
Municipality size (ref. Below 10,000 inhab.)						
10-50000	0.952	0.040	0.236	0.953	0.040	0.255
50-100000	1.030	0.052	0.557	1.030	0.052	0.562
100-500000	0.967	0.050	0.520	0.968	0.050	0.535
500000+	1.094	0.058	0.090	1.090	0.058	0.104
unknown	1.104	0.123	0.375	1.086	0.121	0.457
Geographical area (ref. North-Centre)						
South	1.252	0.040	0.000	1.249	0.040	0.000
unknown	0.879	0.134	0.399	0.875	0.134	0.384

Table A4: Hazard ratios of transition to a first safe/unsafe sexual intercourse from piecewise constant exponential models: the role of problem drinking, marijuana use, other drug use. Females and males.

	Model 3a			Model 3b			Model 3c		
	haz ratio	std. Error	P>z	haz ratio	std. Error	P>z	haz ratio	std. Error	P>z
FEMALES									
Constant	0.012	0.000	0.000	0.005	0.001	0.000	0.006	0.001	0.000
Age									
(safe intercourse)									
<16	0.211	0.010	0.000	0.408	0.021	0.000	0.350	0.020	0.000
16-17.5	0.763	0.032	0.000	0.679	0.029	0.000	0.636	0.034	0.000
17.5-20 (ref.)	1.000			1.000			1.000		
20+	0.693	0.049	0.000	0.773	0.055	0.000	0.771	0.055	0.000

(unsafe intercourse)									
<16	0.063	0.005	0.000	0.122	0.009	0.000	0.108	0.009	0.000
16-17.5	0.214	0.016	0.000	0.192	0.014	0.000	0.174	0.015	0.000
17.5-20	0.259	0.019	0.000	0.260	0.018	0.000	0.261	0.020	0.000
20+	0.234	0.028	0.000	0.262	0.031	0.000	0.262	0.032	0.000
Risky behaviours									
got drunk (safe intercourse)	1.987	0.084	0.000	1.409	0.062	0.000	1.299	0.073	0.000
got drunk (unsafe intercourse)	2.083	0.164	0.000	1.472	0.114	0.000	1.303	0.134	0.010
marijuana (safe intercourse)	1.455	0.077	0.000	1.179	0.065	0.003	1.094	0.074	0.186
marijuana (unsafe intercourse)	1.864	0.171	0.000	1.510	0.139	0.000	1.549	0.176	0.000
ecstasy (safe intercourse)	1.066	0.278	0.807	1.006	0.263	0.982	1.018	0.267	0.946
ecstasy (unsafe intercourse)	2.235	0.687	0.009	2.122	0.654	0.015	2.136	0.659	0.014
Age*risky behaviours									
<16*got drunk (safe intercourse)							1.595	0.195	0.000
<16*got drunk (unsafe intercourse)							1.294	0.301	0.267
<16*marijuana (safe intercourse)							1.598	0.281	0.008
<16*marijuana (unsafe intercourse)							1.388	0.435	0.295
16-17.5*got drunk (safe intercourse)							1.053	0.098	0.582
16-17.5*got drunk (unsafe intercourse)							1.315	0.222	0.105
16-17.5*marijuana (safe intercourse)							1.213	0.146	0.109
16-17.5*marijuana (unsafe intercourse)							0.863	0.179	0.480
Smoke (ref. Never/rarely)									
smoker 1-7 a day				1.516	0.060	0.000	1.505	0.060	0.000
smoker 8+ a day				1.593	0.102	0.000	1.595	0.102	0.000
unknown				1.170	0.254	0.468	1.172	0.254	0.465
Disco (ref. Never)									
sometimes				1.418	0.062	0.000	1.391	0.061	0.000
often				1.544	0.078	0.000	1.529	0.077	0.000
unknown				0.961	0.272	0.889	0.964	0.273	0.898
Practicing religious (ref. yes)									

no	1.418	0.049	0.000	1.411	0.049	0.000
unknown	1.074	0.127	0.544	1.070	0.126	0.569
Final score (ref. Low)						
medium	1.063	0.046	0.152	1.062	0.046	0.160
high	1.018	0.043	0.667	1.017	0.043	0.683
Secondary school (ref. Lyceum)						
lower secondary	0.218	0.019	0.000	0.232	0.020	0.000
technical	1.036	0.036	0.301	1.029	0.035	0.402
vocational	1.013	0.091	0.883	1.004	0.090	0.966
unknown	1.263	0.309	0.339	1.264	0.309	0.337
Parents' separation (ref. No)						
yes	1.325	0.079	0.000	1.307	0.078	0.000
unknown	0.935	0.088	0.476	0.934	0.088	0.467
Mother's work (ref. No)						
yes	1.153	0.039	0.000	1.152	0.039	0.000
unknown	1.129	0.109	0.208	1.126	0.109	0.217
Parental education (ref. Upper secondary)						
lower secondary at most	0.948	0.192	0.792	0.954	0.193	0.814
tertiary	0.990	0.037	0.781	0.983	0.037	0.640
unknown	1.067	0.225	0.760	1.056	0.223	0.797
Year (ref. 2000)						
2017	1.418	0.047	0.000	1.430	0.048	0.000
Municipality size (ref. Below 10,000 inhab.)						
10-50000	0.943	0.037	0.136	0.945	0.037	0.154
50-100000	1.011	0.050	0.821	1.013	0.050	0.801
100-500000	0.991	0.056	0.876	0.995	0.057	0.927
500000+	0.943	0.054	0.307	0.944	0.054	0.314
unknown	0.881	0.064	0.078	0.880	0.063	0.076
Geographical area (ref. North-Centre)						
South	0.953	0.031	0.132	0.951	0.030	0.119
unknown	0.997	0.202	0.987	1.001	0.202	0.998

MALES

Constant	0.011	0.000	0.000	0.004	0.001	0.000	0.004	0.001	0.000
Age									
(safe intercourse)									
<16	0.251	0.013	0.000	0.429	0.022	0.000	0.344	0.024	0.000
16-17.5	0.747	0.031	0.000	0.637	0.027	0.000	0.605	0.042	0.000
17.5-20 (ref.)	1.000			1.000			1.000		
20+	0.695	0.050	0.000	0.762	0.055	0.000	0.761	0.055	0.000
(unsafe intercourse)									
<16	0.072	0.006	0.000	0.122	0.010	0.000	0.099	0.010	0.000
16-17.5	0.158	0.015	0.000	0.139	0.013	0.000	0.131	0.015	0.000
17.5-20	0.181	0.018	0.000	0.188	0.017	0.000	0.195	0.023	0.000
20+	0.134	0.022	0.000	0.152	0.024	0.000	0.158	0.027	0.000
Risky behaviours									
got drunk (safe intercourse)	2.242	0.096	0.000	1.640	0.070	0.000	1.476	0.090	0.000
got drunk (unsafe intercourse)	2.305	0.208	0.000	1.630	0.142	0.000	1.399	0.188	0.012
marijuana (safe intercourse)	1.433	0.060	0.000	1.183	0.051	0.000	1.157	0.064	0.008
marijuana (unsafe intercourse)	1.926	0.164	0.000	1.574	0.134	0.000	1.553	0.179	0.000
ecstasy (safe intercourse)	1.065	0.171	0.696	0.937	0.152	0.686	0.953	0.154	0.765
ecstasy (unsafe intercourse)	1.620	0.415	0.060	1.434	0.368	0.161	1.459	0.375	0.142
Age*risky behaviours									
<16*got drunk (safe intercourse)							1.515	0.162	0.000
<16*got drunk (unsafe intercourse)							1.556	0.327	0.035
<16*marijuana (safe intercourse)							1.143	0.147	0.297
<16*marijuana (unsafe intercourse)							1.034	0.243	0.888
16-17.5*got drunk (safe intercourse)							1.024	0.095	0.795
16-17.5*got drunk (unsafe intercourse)							1.081	0.216	0.699
16-17.5*marijuana (safe intercourse)							1.055	0.098	0.568
16-17.5*marijuana (unsafe intercourse)							1.059	0.200	0.762

Smoke (ref. Never/rarely)						
smoker 1-7 a day	1.333	0.053	0.000	1.330	0.053	0.000
smoker 8+ a day	1.497	0.078	0.000	1.500	0.078	0.000
unknown	1.344	0.256	0.122	1.354	0.258	0.112
Disco (ref. Never)						
sometimes	1.742	0.086	0.000	1.706	0.084	0.000
often	2.314	0.123	0.000	2.282	0.121	0.000
unknown	1.326	0.316	0.236	1.288	0.307	0.289
Practicing religious (ref. yes)						
no	1.303	0.050	0.000	1.296	0.049	0.000
unknown	1.406	0.159	0.003	1.393	0.158	0.003
Final score (ref. Low)						
medium	0.954	0.036	0.214	0.956	0.036	0.235
high	0.893	0.036	0.005	0.899	0.036	0.007
Secondary school (ref. Lyceum)						
lower secondary	0.348	0.027	0.000	0.382	0.030	0.000
technical	0.950	0.034	0.146	0.946	0.033	0.116
vocational	1.072	0.119	0.530	1.062	0.118	0.589
unknown	1.005	0.171	0.975	1.006	0.171	0.970
Parents' separation (ref. No)						
yes	1.145	0.065	0.017	1.142	0.065	0.019
unknown	1.048	0.085	0.565	1.037	0.084	0.651
Mother's work (ref. No)						
yes	1.200	0.042	0.000	1.200	0.042	0.000
unknown	1.159	0.100	0.087	1.157	0.100	0.091
Parental education (ref. Upper secondary)						
lower secondary at most	0.863	0.206	0.537	0.856	0.205	0.516
tertiary	0.949	0.032	0.126	0.946	0.032	0.107
unknown	1.175	0.193	0.325	1.182	0.194	0.308
Year (ref. 2000)						
2017	1.272	0.044	0.000	1.279	0.044	0.000

Municipality size (ref. Below 10,000 inhab.)						
10-50000	0.951	0.040	0.236	0.953	0.040	0.255
50-100000	1.030	0.052	0.557	1.030	0.052	0.561
100-500000	0.967	0.050	0.520	0.968	0.050	0.535
500000+	1.094	0.058	0.090	1.090	0.058	0.104
unknown	1.105	0.123	0.371	1.087	0.121	0.456
Geographical area (ref. North-Centre)						
South	1.252	0.040	0.000	1.249	0.040	0.000
unknown	0.879	0.134	0.400	0.875	0.134	0.384