Curvilinear associations between sexual orientation and problematic substance use, behavioural addictions and mental health among young Swiss men

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Abstract

BACKGROUND AND AIMS: It is well documented that individuals with a minority sexual orientation face greater risks of problematic substance use (e.g. heavy episodic drinking, alcohol use disorder) and mental health problems. Far less is known about how that risk varies within this population and their risk of behavioural addictions. This study estimated the risks of problematic substance use, behavioural addiction and poor mental health across the spectrum of sexual orientation.

SAMPLE AND METHOD: A sample of young Swiss men (N=5294; mean age=25.5, SD=1.25; representative of 21 of Switzerland's 26 cantons) completed a self-reporting questionnaire on sexual orientation (attraction, 5-point scale) and criterion variables: problematic substance use (e.g. alcohol, cigarettes, cannabis and other illegal drugs), behavioural addictions (gambling, gaming, cybersex, internet, smartphone, work, exercise) and indicators of mental health (e.g. depression, stress). Curvilinear associations between sexual orientation (heterosexual, mostly-heterosexual, bisexual, mostly-homosexual or homosexual individuals) and criterion variables were explored using fractional polynomial regressions.

RESULTS: Although there were differences across criterion variables, in general, the highest risks of problematic substance use, behavioural addictions and mental health problems were estimated for mostly-heterosexual, bisexual or mostly-homosexual men, followed by homosexual men, and with heterosexual men facing the lowest risk.

DISCUSSION AND CONCLUSION: Aggregating the spectrum of sexual orientations into two or three distinct groups blurs important internal group differences. Outcome-specific explanations beyond minority stress and biphobia are necessary to understand the pathways between sexual orientation and risky behaviours. Considering sexual orientation is important to provide targeted healthcare prevention and interventions.

Keywords: sexual orientation, young adults, problematic substance use, behavioural addictions, Cohort Study on Substance Use Risk Factors (C-SURF).

1. INTRODUCTION

A growing body of evidence has shown a greater risk of problematic substance use and poor mental health among those with minority sexual orientations (i.e. lesbian, gay, bisexual; LGB) than among heterosexual individuals (for a review, see Blondeel et al., 2016; King et al., 2008; Plöderl, Sauer, & Fartacek, 2006; Plöderl & Tremblay, 2015; Vrangalova & Savin-Williams, 2014). King et al. (2008), for example, concluded that the risks of dependence on alcohol and other substances, but also of depression or anxiety disorders, during the past twelve months were 1.5 times higher among LGBs than among heterosexuals. The present study investigated associations between sexual orientation and substance use, behavioural addictions and mental health among young Swiss men, exploring the full spectrum of sexual orientations without reducing it to bivariate, heteronormative comparisons such as heterosexual vs non-heterosexual.

1.1 Sexual orientation as a continuum

Although sexologists initially operationalised sexual orientation as a continuum ranging from being heterosexual to being homosexual (Kinsey, Pomeroy, & Martin, 1948; Klein, Sepekoff, & Wolf, 1985), contemporary public health researchers rarely examine variations across the continuum of sexual orientations, and several studies have criticised this (e.g. Blum, Lust, Christenson, & Grant, 2019; Parnes, Rahm-Knigge, & Conner, 2017). Instead, the continuum is usually aggregated, reducing the options to three (e.g. heterosexual vs bisexual vs homosexual) or even only two (heterosexual vs non-heterosexual) distinct groups (Savin-Williams, 2016). Aggregating parts of the spectrum blurs potentially essential differences between groups, as shown in a large representative study of young men in the USA, where respondents could describe their sexual orientation as heterosexual, bisexual or homosexual (Copen, Chandra, & Febo-Vazquez, 2016). Among men who reported feeling "mostly sexually attracted to women" (4.1% of the sample), the majority (78.5%) described themselves as heterosexual, with considerably fewer (19.7%) describing themselves as bisexual. However, this differentiation is important: compared to "heterosexuals", individuals identifying themselves as "mostly-heterosexual" (e.g. 1 on the Kinsey scale of 0–6) often

exhibited higher risks of substance use and mental health problems than heterosexuals, as shown in a systematic review by Vrangalova and Savin-Williams (2014).

1.2 Sexual orientation as a risk factor

Considerable differences in terms of substance use and mental health have not only been found in comparisons between heterosexual individuals and those with a minority sexual orientation (Blondeel et al., 2016; King et al., 2008; Plöderl et al., 2006; Plöderl & Tremblay, 2015) but also between groups all across the spectrum of sexual orientation. For example, the above-mentioned systematic review by Vrangalova and Savin-Williams (2014) focussed on the heterosexual to bisexual part of that spectrum. It reported the highest alcohol use among mostly-heterosexuals and the lowest among heterosexuals, cannabis use was similarly highest among both mostly-heterosexuals and bisexuals, whereas the risks of smoking, other drug use and poor mental health (e.g. stress, mood, suicidality) clearly increased when moving along the continuum from heterosexual to bisexual. Similarly, at the other end of the spectrum, higher levels of substance use and lower mental health have been reported for mostly-homosexuals than for homosexuals (e.g. Bostwick, Boyd, Hughes, & McCabe, 2010; Hughes, Szalacha, & McNair, 2010; Parnes et al., 2017). Looking at the past year's illegal drug use in the Global Drug Survey, Demant et al. (2016) reported a higher prevalence of cannabis, LSD, psilocybe (magic mushroom) and amphetamine use among bisexual men than among either heterosexual or homosexual men. However, the prevalence of ecstasy use peaked among bisexual or homosexual men, and the use of poppers, methamphetamine, mephedrone and GHB steadily increased along the heterosexual to bisexual to homosexual men continuum (ibid.), a pattern that can be explained partially by their use in substance-linked sex (Giorgetti et al., 2017; Glynn et al., 2018), which is more common in non-heterosexual men (Maxwell, Shahmanesh, & Gafos, 2019). A recent systematic review and meta-analysis found that bisexual individuals reported higher rates of depression and anxiety than homosexuals, whereas the lowest rates were found among heterosexuals (Ross et al., 2018). Most studies exploring sexual orientation as a possible risk factor apply a group comparison approach (e.g. Bostwick et al., 2010;

Demant et al., 2016; King et al., 2008), thus not making an explicit assumption about the shapes of the risk curves. The few studies exploring sexual orientation as a continuous variable have chosen to use monotonically increasing or decreasing associations (Kendall's tau-b; Blum et al., 2019) or curvilinear associations (Parnes et al., 2017).

Observed associations between sexual orientation and substance use and mental health have often been explained by the minority stress theory (Meyer, 2003, 2007), which describes stressors in four broad domains: prejudice events, expected prejudice, concealment of identity, and internalised negative attitudes and beliefs (Hall, 2018; la Roi, Meyer, & Frost, 2019). Bisexuals may be the victims of biphobia, a second layer of stressors, as bisexuals challenge the binary conceptualisation of sexual orientation (i.e. being either heterosexual or homosexual), and they may experience discrimination or negative stereotyping (Bostwick & Hequembourg, 2014; Mulick & Wright Jr, 2002; Obradors-Campos, 2011; Ochs, 2011). Moreover, at a societal level, bisexuals have fewer role models to rely on and report lower connection to the Lesbian, Gay, Bisexual, Transgender, Intersex and Queer (LGBTIQ*) community than do homosexuals (Balsam & Mohr, 2007; Chan et al., 2020). Furthermore, variables associated with sexual orientation, such as personality traits , life-style , sexual practices (Lawn, Aldridge, Xia, & Winstock, 2019; Romanelli, Smith, Thornton, & Pomeroy, 2004), or marketing strategies (Blosnich, Lee, & Horn, 2013) have been shown to foster substance use or poor mental health, either independently of minority stress or biphobia or by moderating or mediating their effects.

1.3 The present study

The present study aimed to overcome four areas of limitations in the existing literature. First, we analysed sexual orientation on a five-point scale, with less blurring of potential associations caused by aggregating groups (see Savin-Williams, 2016; Vrangalova & Savin-Williams, 2014). Furthermore, unlike other studies that also treated sexual orientation as a continuum (e.g. Blum et al., 2019; Parnes et al., 2017), the link functions (e.g. linear) between sexual orientation and criterion variables were not selected *a priori*, enabling the identification of more complex curvilinear relationships.

Second, the present study was based on a large, non-self-selective, general population sample. A large part of the existing literature on sexual minority populations relies on nonprobability community-venue samples and therefore shows a selection bias due to an over-representation of individuals exhibiting higher substance use, suicidal ideation or risky behaviours such as greater numbers of sexual partners .

Third, we analysed the situation in Switzerland, thereby counterbalancing the fact that research on problematic substance use and/or poor mental health among LGBs relies largely on findings from English-speaking countries, particularly the USA (e.g. King et al., 2008; Plöderl & Tremblay, 2015). This is significant because the rare cross-cultural research carried out, such as that by Bloomfield, Wicki, Wilsnack, Hughes, and Gmel (2011), indicates that findings based on samples from the USA cannot be directly generalised to other countries.

Fourth, we also explored possible associations between sexual orientation and so-called behavioural addictions (for a discussion see Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015; Kardefelt-Winther et al., 2017), for which empirical evidence is scarce (Broman & Hakansson, 2018; Grant, Potenza, Weinstein, & Gorelick, 2010). There is a lack of empirical literature on smartphone, work or exercise addiction, and few studies have explored possible associations with gambling (Broman & Hakansson, 2018; Grant & Potenza, 2006; Richard et al., 2019), gaming (Broman, 2018) or cybersex addiction (Cooper, Delmonico, & Burg, 2000; Giordano & Cashwell, 2017), and these generally reported higher rates among non-heterosexuals than among heterosexuals.

In 2005, Switzerland became the first country to see a specific national referendum approve the legal registration of same-sex partnerships. In an international ranking of the least homophobic countries, Switzerland (16th) ranked behind the United Kingdom, Canada and New Zealand (10th to 12th) but ahead of Australia (21st) and the USA (24th) (Lamontagne et al., 2018). Given the international (Blondeel et al., 2016; King et al., 2008; Plöderl et al., 2006; Plöderl & Tremblay, 2015; Vrangalova & Savin-Williams, 2014) and national literature (Gios et al., 2019; Health Promotion Switzerland, 2017; Schmidt & Altpeter, 2019), we hypothesised that in Switzerland a) non-heterosexual men would report higher levels of

substance use, behavioural addiction and poor mental health than heterosexual men, but that b) meaningful differences along the sexual orientation continuum would be observed, e.g. higher levels among mostly-homosexual than among homosexual men.

2. METHODS

2.1 Sample

The present study was based on the third-wave questionnaire of the Cohort Study on Substance Use Risk Factors (C-SURF, www.c-surf.ch). C-SURF took advantage of a unique opportunity to enrol a sample of young Swiss men representative of 21 of Switzerland's 26 cantons. Military service in Switzerland is mandatory for men at the age of 19; they are obliged to report to one of six recruitment centres to determine their aptitude for military service. All young men reporting to the centres in Lausanne, Mels and Windish, between August 2010 and November 2011, were invited to participate in the study, and 7556 gave their written consent. Recruitment centres were used solely to inform and enrol participants; participation was independent of army procedures. Questionnaires were completed at home and vouchers were given as compensation. Study participants were shown to be highly similar to non-participants in terms of education, urbanicity and patterns of alcohol, cigarette and cannabis use (Studer, Baggio, et al., 2013). The Human Research Ethics Committee of the Canton of Vaud approved the study, and many further details have been reported previously (Gmel et al., 2015; Studer, Baggio, et al., 2013; Studer, Mohler-Kuo, et al., 2013). Between April 2016 and March 2018, 5516 men (73.0% response rate of those who had given informed consent at baseline) participated in the study's third wave. The present study excluded participants with missing values on the sexual orientation item (n = 93, 1.7%) and those who did not respond to an item among the criterion variables (n = 129, 2.3%). Such a low level of non-response in large datasets is commonly considered not to bias findings in complete case analysis (Bennett, 2001; Schafer, 1999). The final sample consisted of 5294 young men. Comparing participants with and without a missing value for sexual orientation found no significant differences for 21 of the 24 criterion variables. The relative bias due to missingness (Studer, Baggio, et al., 2013) was small and indicated only slight

overestimations (nicotine dependence: +0.6%) or underestimations (daily smoking: -1.7%; > weekly cannabis use: -2.0%) of prevalence. Furthermore, the distribution of sexual orientation did not differ significantly between the final sample and those excluded due to any missing values among the criterion variables ($X^2(4) = 5.6$, $p = .231$). Mean participant age at wave 3 was 25.5 years old (SD = 1.25); 57.1% (n = 3022) were French-speaking and 42.9% (n = 2272) were German-speaking.

2.2 Measurements

Criterion variables. Table 1 gives a full overview of the criterion variables and the instruments used to assess self-reported indicators of problematic alcohol, cigarette or cannabis use, one-year-prevalence for illegal drug use other than cannabis (psychedelics, psychostimulants, ecstasy, poppers, other potential sexually enhancing drugs [PSED] and other illegal drugs), behavioural addictions (gambling, gaming, cybersex, internet, smartphone, work, exercise) and major depression, mental health, satisfaction with life, and stress. Poppers were not grouped with PSED as they have a considerably lower risk profile than illegal drugs (Demant & Oviedo-Trespalacios, 2019). All criterion variables were coded so that a higher value corresponded to a less benign state.

Sexual orientation. Sexual orientation was operationalised using the Reduced Kinsey Scale (Bailey et al., 2016) with a focus on the dimension of sexual attraction (Patterson, Jabson, & Bowen, 2017). Our participants were asked, ''People feel different about sexual preferences. How do you yourself feel? Do you feel attracted to …''. Their five response options were "women only" (group A: heterosexual), "women predominantly" (group B: mostly-heterosexual), "both women and men equally" (group C: bisexual), "men predominantly" (group D: mostly-homosexual) and "men only" (group E: homosexual). As the continuous variable of sexual orientation (attraction), groups A–E were coded 1 to 5.

Sociodemographic variables. Participants' age and linguistic region (coded 0 and 1 for French- and German-speaking, respectively) were used for adjustments.

2.3 Statistical Analysis

Descriptive statistics for substance use, behavioural addiction and poor mental health variables were calculated for the total sample and the five sexual orientation groups (A–E). To test for associations between this spectrum of groups and the criterion variables, fractional polynomial (FP) regressions (Royston & Altman, 1994) were used and estimated using the FP-procedure in STATA 15 software (StataCorp, 2017). FP is a flexible method for modelling and smoothing potentially complex, non-linear relationships (Regier & Parker, 2015) while allowing a wide range of shapes. The selection of the optimal specification (e.g. linear or quadratic) is part of the estimation process and not fixed *a priori*. In line with recommendations (Royston & Sauerbrei, 2008), two polynomials for sexual orientation were estimated. Linear regression models were used for the continuous variables (mental health, stress, and satisfaction with life), and logistic regression models were used for all other criterion variables. All models were adjusted for age and linguistic region.

Marginal means were estimated for sexual orientation groups A–E (at mean age and linguistic region), a) to illustrate associations between the spectrum of types of sexual orientations and the criterion variables, and b) to explore the significance of pairwise group comparisons indicated by non-overlapping 95% confidence intervals. As an indicator of the effect size of between-group differences, Cohen's d were calculated based on the marginal means for groups with minimal and maximal estimates (Borenstein, Hedges, Higgins, & Rothstein, 2009) and interpreted according to Cohen (1988; d>.8 large effect, d>.5 medium effect, d>.2 small effect).

As a sensitivity analysis, differences in the observed criterion variables between individual groups (heterosexual vs mostly-heterosexual) or aggregated groups (e.g. heterosexual vs non-heterosexual) were tested. In the regression model, criterion variables were regressed on a dummy-coded variable for sexual orientation (e.g. heterosexual coded 0, mostly-heterosexual coded 1), age and linguistic region.

3. RESULTS

Regarding their sexual orientation (attraction), 89.2% of participants reported being attracted to "women only" (group A, see Table 2), 6.7% to "women predominantly" (group B), 1.1% to "both men and women" (group C), 0.7% to "men predominantly" (group D) and 2.4% to "men only" (group E). Problematic substance use and behavioural addictions varied in the total sample between 38.3% for heavy episodic drinking and 0.8% for one-year-prevalence for PSED. Except for smartphone addiction, prevalence rates for dichotomous outcomes and means for continuous outcomes did not increase or decrease monotonically across the sexual orientation spectrum: The highest prevalence rates or means were rarely found among heterosexuals or homosexuals, but rather in the mostly heterosexual to mostly homosexual part of the spectrum. Exceptions with highest prevalence rates or means were found among homosexual participants for PSED and other drug use, and for smartphone addiction.

We estimated non-linear models using fractional polynomial regressions adjusting for age and linguistic region. Marginal means for groups A–E are illustrated in Figure 1 (for the corresponding parameter estimates of fractional polynomial models, see Supplementary Table S1, and for the estimated marginal means, see Table 3). Findings generally confirmed the descriptive results in Table 2, while smoothing out divergent findings in groups with small sample sizes. For example, daily cigarette use was highest in descriptive statistics for bisexuals (n = 56), with a monotonically increasing function showing the best fit in polynomial regression.

For indicators of problematic alcohol use, the maximum on the estimated risk-curve was for mostly-heterosexuals, and it was significantly higher than for heterosexuals. The lowest values were found for homosexuals, and these were significantly lower than for mostly-heterosexuals for heavy episodic drinking and alcohol use disorders. For daily cigarette use or nicotine dependence, the highest risk was estimated for the mostly-homosexual and homosexual part of the spectrum. For weekly cannabis use and cannabis use disorder, the

highest risks were found for mostly-heterosexual and bisexual men. Two general patterns could be observed for the one-year prevalence of illegal drug use. For psychedelics, psychostimulants and ecstasy, the estimates were highest for mostly-heterosexual men and the curves decreased, but not significantly, towards homosexual men. Mostly-heterosexual men differed significantly from heterosexual men, for whom estimates were lowest. For poppers and PSEDs, the estimates increased continuously from heterosexual to mostly-homosexual (poppers) or to homosexual (PSEDs), and differences between heterosexual men and mostly-heterosexual, bisexual or mostly-homosexual men were significant. For behavioural addictions, the peak was often found in the middle part of the spectrum (mostly-heterosexual, bisexual and mostly-homosexual), except for smartphone (monotonically increasing), gambling and exercise addictions (no significant differences). Across the indicators of poor mental health and well-being, heterosexual men consistently exhibited the best scores. There were estimated peaks close to the bisexual part of the spectrum for major depression and for mostly-homosexual men for stress and low life-satisfaction. For SF-12v2 mental health, non-heterosexuals all had worse scores than heterosexual men.

In general, small to medium effects (Cohen's d) due to sexual orientation were found when comparing groups with the highest and lowest estimated marginal means (except for the large effects for poppers and PSED; Table 3).

As a sensitivity analysis, differences in the observed criterion variables between individual or partially reclassified groups were tested in regression models (see Supplementary Table S1) and illustrated for three partially aggregated groups (i.e. heterosexual, mostly-heterosexual/bisexual/mostly-homosexual, and homosexual; see Supplementary Figure S1). While these results give a less fine-grained picture (e.g. a bell-shaped risk curve instead of an inverse J-shaped risk curve) the results are largely comparable and confirm the results found using fractional polynomial models.

4. DISCUSSION

The present study explored the relationships between sexual orientation (attraction) and problematic substance use, behavioural addictions and poor mental health in a large, non-self-selective sample of young Swiss men (N = 5294). The vast majority (89.2%) considered themselves heterosexual and 2.4% were homosexual. The other groups were mostly-heterosexual (6.7%, attracted to "women predominantly"), bisexual (1.1%; attracted to "both women and men equally") and mostly-homosexual (0.7%, attracted to "men predominantly"). In line with the literature (e.g. Copen, 2016), a considerable proportion (8.4%) of participants reported feeling sexually attracted to women and men and thus did not fit into a binary conceptualisation (i.e. heterosexual or homosexual) of sexual orientation (Bostwick & Hequembourg, 2014). The present study showed that mostly-heterosexual, bisexual and mostly-homosexual men were at an even higher risk of substance use problems, behavioural addictions and poor mental health than homosexual men. This finding is of the utmost importance as most previous studies aggregated the continuum from heterosexual to homosexual into a spectrum of only two or three groups (for a critique see Blum et al., 2019; Parnes et al., 2017; Plöderl & Tremblay, 2015; Vrangalova & Savin-Williams, 2014) so that important differences along that spectrum were blurred and the effects of sexual orientation might have been underestimated.

The present paper's approach using fractional polynomial regressions has the advantage of analysing sexual orientation as it was originally conceptualised, as a continuous variable (Kinsey et al., 1948; Klein et al., 1985). This approach also smooths out extreme values in small subsamples and an area of highest risk can be estimated. One disadvantage, however, was that only one part of the present study's findings—that heterosexual men were often least at risk—is comparable with existing systematic reviews that used more broadly defined subpopulations (e.g. King et al., 2008; Plöderl & Tremblay, 2015). Nonetheless, our findings for mostly-heterosexuals were in line with existing reviews focussing on the

heterosexual to bisexual part of the sexual orientation spectrum (Vrangalova & Savin-Williams, 2014).

The present study's estimated risk curves for substance use, behavioural addictions or poor mental health mainly resembled inversed J-shapes, and the highest risks were often estimated in the mostly-heterosexual to mostly-homosexual part of the sexual orientation spectrum. However, for daily cigarette smoking, PSED and smartphone addiction, the highest risk was estimated for homosexual men.

The estimated risk curves for mental health indicators reflect what would be expected when combining the minority stress affecting all non-heterosexual respondents (Meyer, 2003, 2007) with biphobia—a second layer of stressors for those not exclusively attracted to women or men (Bostwick & Hequembourg, 2014; Mulick & Wright Jr, 2002; Obradors-Campos, 2011; Ochs, 2011). In line with the addiction syndrome model developed by Shaffer et al. (2004), minority stress, biphobia and poor mental health may contribute to an underlying vulnerability to problematic substance use (e.g. alcohol use disorder) or behavioural addictions.

However, the variety of risk curves for problematic substance use and behavioural addictions found in the present study make it clear that they cannot solely be explained by minority stress or biphobia. For example, the more monotonically increasing risks, from heterosexuals to homosexuals, for daily smoking, 12-month use of PSED or smartphone addiction are in contrast to the decreasing risks for problematic alcohol or cannabis use. Indeed, variables associated with sexual orientation have previously been shown to influence substance use, either independently of minority stress or biphobia, or by moderating or mediating their effects (e.g. Allen & Walter, 2018; Blosnich et al., 2013; Lawn et al., 2019; Romanelli et al., 2004; Trocki et al., 2009; Wang et al., 2014). Cultural factors may also play a role. In the USA, non-heterosexual men's reliance on bars or other heavy-drinking venues as their primary location for socialisation has been seen as an explanation

for their heavier drinking (e.g. Bloomfield et al., 2011; Jun et al., 2019). However, in Switzerland, the internet seems to have substituted bars or heavy-drinking venues as the new form of primary "location" for socialisation, and this could partially explain the higher risks of problematic internet and smartphone use among bisexual and (mostly) homosexual men.

The present study had several limitations. The cross-sectional design did not enable causal conclusions, and all variables were based on self-reporting. By using a Reduced Kinsey Scale, participants were only given the option to answer on a spectrum from heterosexual to homosexual, so that, for instance, asexual or pansexual participants were either forced to select a less adequate option or skip the question. Furthermore, as the sample's representativity was limited to young Swiss men, generalisations to women, other nationalities living in Switzerland and other age groups should be made with care. Non-heterosexual women have often been reported to be at similar or higher risk of problematic substance use or poor mental health than non-heterosexual men (Plöderl & Tremblay, 2015; Ross et al., 2018). The study could not include non-Swiss men residing in the country, but many originated from countries with higher societal levels of homophobia than Switzerland (Lamontagne et al., 2018). Furthermore, problematic substance use and mental health vary across age groups (e.g. substance-linked sex is more prevalent among men in their thirties/forties; Maxwell et al., 2019). These limitations may therefore have resulted in conservative risk estimates.

5. CONCLUSION

The present study showed that considering sexual orientation as a continuum of levels of attraction enabled us not only to identify those young Swiss men most at risk but also to add to the evidence that these risk-patterns vary across indicators of problematic substance use, behavioural addictions or poor mental health. This implies outcome-specific aetiological pathways. It appears crucial that future research (notably systematic reviews and meta-analyses) does not blur analyses of sexual orientation by aggregating subgroups. Ignoring

important differences along the continuum of non-heterosexual individuals contributes to seemingly contradictory or inconclusive findings about associations between sexual orientation and both physical and mental health outcomes (e.g. King et al., 2008; Plöderl & Tremblay, 2015) or their underlying aetiological pathways (cf. Blosnich et al., 2013). With regards to implications for practice, the present study highlighted the importance of addressing sexual orientation in primary care and especially in psychiatric care (Nuñez & Jäger, 2011). Knowledge about different sexual orientation subgroups and their associated risks and aetiological pathways would enable clinicians to tailor effective and efficient prevention efforts.

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Table 1 – Criterion variables: Descriptions and instruments used for the assessment of problematic substance use, behavioural addictions and mental health

Criterion variable	Description and instrument used	Items	Time frame	Cut-off
Alcohol				
high volume	drinking > 20 g per day on average, based on frequency and usual quantity (standard drinks) on weekdays and weekend days (Shield et al., 2017)	4 (mixed)	12 M	> 20 g/day
heavy episodic drinking	based on frequency of drinking six or more standard alcoholic drinks (i.e. 60 g alcohol) on a single occasion (World Health Organization, 2014)	1 (o_5)	---	≥monthly
alcohol use disorder (AUD)	moderate AUD based on the DSM-5 criteria (American Psychiatric Association, 2013; Knight et al., 2002)	12 (y/n)	12 M	≥ 4 out of 11 criteria
Cigarette				
daily use	frequency of cigarette smoking	1 (o_6)	12 M	≥ daily
nicotine dependence (ND)	based on the *Fagerström Test for Nicotine Dependence* due to cigarette use (Fagerström, Heatherton, & Kozlowski, 1992; Heatherton, Kozlowski, Frecker, & Fagerström, 1991)	6 (mixed)	---	≥ 3 out of 10 points
Cannabis				
> weekly use	frequency of cannabis use	1 (o_5)	12 M	> weekly
cannabis use disorder (CUD)	use disorder based on the *Revised Cannabis Use Disorder Identification Test* (CUDIT-R; Adamson & Sellman, 2003; Annaheim, Scotto, & Gmel, 2010)	10 (var)	12 M	≥ 8 out of 40 points
Other Illegal Drugs [1]				
psychedelics	natural and synthetic hallucinogens (e.g. mushrooms, PCP, 2-CB, 2-CL)	5 (y/n)	12 M	≥ once in past year
psychostimulants	cocaine, crack, freebase and amphetamines	2 (y/n)	12 M	≥ once in past year
ecstasy	ecstasy or methylenedioxy-methamphetamine (MDMA)	1 (y/n)	12 M	≥ once in past year
poppers	poppers, amyl nitrite, butyl nitrite [2]	1 (y/n)	12 M	≥ once in past year
potential sexually enhancing drugs (PSED)	other potential sexually enhancing drugs such as methamphetamine (e.g. crystal meth), GHB, GBL, 1-4 butanediol, research chemicals or legal highs (e.g. MDPV, mephedrone, butylone, methedrone) (Giorgetti et al., 2017; Glynn et al., 2018) [2]	3 (y/n)	12 M	≥ once in past year
other illegal drugs	heroine, morphine, opium, ketamine, DXM, spice, khat	4 (y/n)	12 M	≥ once in past year
Behavioural Addictions				
gambling	*mild gambling-use disorder based on DSM-5 criteria* (American Psychiatric Association, 2013)	9 (y/n)	12 M	≥ 4 out of 9 criteria
gaming	*Game Addiction Scale* (answers recoded to "never/rarely" vs "sometimes/often/very often"; Lemmens, Valkenburg, & Peter, 2009)	7 (L_5)	6 M	≥ 4 out of 7 points
cybersex	*Online Sexual Compulsivity* subscale of the *Internet Sex Screening Test* (ISST; Carnes, Delmonico, & Griffin, 2009; Delmonico & Miller, 2003)	6 (y/n)	12 M	≥ 3 out of 6 items
internet	*Compulsive Internet Use Scale* (CIUS; Meerkerk, van den Eijnden, Franken, & Garretsen, 2010; Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009)	14 (L_5)	---	≥ 28 out of 56 points
smartphone	*Smartphone Addiction Scale* (Haug et al., 2015; Kwon, Kim, Cho, & Yang, 2013)	10 (L_5)	---	≥ 31 out of 50 points
work	*Bergen Work addiction scale* (answers recoded to "never/rarely/sometimes" vs "often/very often"; Andreassen, Griffiths, Hetland, & Pallesen, 2012)	7 (L_5)	12 M	≥ 4 out of 7 points
exercise	*Exercise Addiction Inventory* (Terry, Szabo, & Griffiths, 2004)	6 (L_5)	---	≥ 24 out of 30 points

Mental Health

major depression	*mild major-depression based on the Major Depression Inventory* (WHO-MDI; Bech, Timmerby, Martiny, Lunde, & Soendergaard, 2015)	12 (L$_6$)	2 W	≥ 21 out of 50 points
SF-12v2 mental health $_{inv, std}$	the *mental health summary* (coded as per manual guideline) was based on the "*Medical Outcomes Study 12-Item Short Form Survey Instrument*" (SF-12v2; Ware, Kosinski, Turner-Bowker, & Gandek, 2002)	8 (mixed)	4 W	---
satisfaction with life $_{inv, std}$	*Satisfaction with Life Scale* (Diener, Emmons, Larsen, & Griffin, 1985)	5 (L$_7$)	---	---
stress $_{std}$	*Perceived Stress Scale 10* (Cohen, 1988)	10 (L$_5$)	1 M	---

Remarks: all criterion variables were coded so that higher values corresponded to less benign scores; inv = inverse coded; std = z-standardised scores.

items: number of items; response: response options (y/n = yes/no, L$_x$ = Likert-Scale with x points, o$_x$ = ordinal scale with x response options, var = various response options depending on item);

time frame = reference period in number of months (M), weeks (W) or not specified (---); cut-off = cut-off used to dichotomise the variable or "---" if continuous variable is used.

standard drink = an illustrative, beverage specific "standard drink" (on average 10 g alcohol/drink) given in the questionnaire.

[1] The questionnaire gave street-names and the distinct pharmacological agent for illegal drugs other than cannabis, [2] Poppers were not grouped with PSED as they have a considerably lower comparable risk profile than other illegal drugs (Demant & Oviedo-Trespalacios, 2019).

Table 2 – Prevalence of problematic substance use, behavioural addictions and poor mental health among young Swiss men by sexual orientation (attraction)

	total	A heterosexual	B mostly-heterosexual	C bisexual	D mostly-homosexual	E homosexual
	N = 5,294 (100.0%)	n = 4,722 (89.2%)	n = 355 (6.7%)	n = 56 (1.1%)	n = 36 (0.7%)	n = 125 (2.4%)
Alcohol						
high volume	17.5%	17.1%	23.9%	17.9%	19.4%	14.4%
heavy episodic drinking	38.3%	37.9%	47.3%	37.5%	38.9%	29.6%
alcohol use disorder	8.7%	8.3%	14.9%	12.5%	11.1%	6.4%
Cigarette						
daily use	20.6%	20.0%	23.1%	33.9%	19.4%	29.6%
nicotine dependence	14.2%	13.7%	16.1%	28.6%	19.4%	19.2%
Cannabis						
> weekly use	8.1%	7.8%	12.7%	7.1%	11.1%	4.8%
cannabis use disorder	7.8%	7.3%	13.0%	10.7%	16.7%	5.6%
Other Illegal Drugs						
psychedelics	4.8%	4.4%	10.4%	7.1%	5.6%	4.8%
psychostimulants	7.7%	7.1%	12.7%	8.9%	16.7%	10.4%
ecstasy	7.8%	6.9%	16.3%	8.9%	16.7%	11.2%
poppers	2.6%	1.8%	4.2%	10.7%	25.0%	20.0%
PSED	0.8%	0.6%	2.3%	0.0%	5.6%	5.6%
other	1.8%	1.6%	2.8%	1.8%	2.8%	4.8%
Behavioural Addictions						
gambling	1.3%	1.2%	3.1%	1.8%	2.8%	1.6%
gaming	7.1%	6.7%	10.7%	10.7%	22.2%	4.8%
cybersex	7.1%	6.6%	11.5%	8.9%	8.3%	11.2%
internet	4.9%	4.4%	8.5%	3.6%	22.2%	7.2%
smartphone	8.1%	7.7%	8.2%	10.7%	19.4%	20.0%
work	8.0%	7.6%	10.7%	8.9%	16.7%	10.4%
exercise	2.9%	2.9%	1.7%	5.4%	5.6%	0.8%
Mental Health						
major depression	7.9%	7.1%	14.9%	8.9%	27.8%	13.6%
SF-12v2 mental health $_{i./std.}$ M(SD)	.000 (1.000)	-.043 (.974)	.354 (1.158)	.147 (1.009)	.704 (1.215)	.365 (1.065)
satisfaction with life $_{i./std.}$ M(SD)	.000 (1.000)	-.029 (.984)	.179 (1.046)	.610 (1.266)	.455 (1.107)	.166 (1.134)
stress$_{std.}$ M(SD)	.000 (1.000)	-.032 (.993)	.190 (1.046)	.311 (.960)	.687 (.989)	.327 (.961)

Remarks: all criterion variables were coded so that higher values corresponded to less benign scores; inv = inverse coded; std = z-standardised scores; M(SD) = mean and standard deviation.

CUDIT-R = cannabis use disorder identification test, revised; PSED = possible sexually enhancing drugs (other than ecstasy and poppers) such as methamphetamine, GHB/GBL/1-4 butanediol, "research chemicals" (e.g. MDPV, mephedrone butylone, methedrone)

Table 3 – **Estimated marginal means** and 95% confidence intervals of the prevalence of problematic substance use, behavioural addictions and poor mental health among young Swiss men by sexual orientation (attraction)

		A Heterosexual mean [95% CI]	B mostly-heterosexual mean [95% CI]	C bisexual mean [95% CI]	D mostly-homosexual mean [95% CI]	E homosexual mean [95% CI]	Effect size (max vs min) d	
Alcohol								
high volume	%	16.9 [15.9, 18.0]	23.8 [19.5, 28.2]	19.4 [15.7, 23.1]	16.4 [11.7, 21.0]	14.4 [9.1, 19.8]	0.34	s
heavy episodic drinking	%	37.8 [36.4, 39.1]	47.2 [42.1, 52.3]	39.3 [34.8, 43.8]	33.6 [27.7, 39.5]	29.8 [22.7, 36.9]	0.41	s
alcohol use disorder	%	8.3 [7.5, 9.0]	14.8 [11.3, 18.3]	13.3 [10.1, 16.5]	9.9 [6.5, 13.4]	6.5 [2.5, 10.4]	0.51	m
Cigarette								
daily use	%	19.9 [18.8, 21.0]	23.6 [19.3, 27.9]	26.7 [22.7, 30.8]	28.4 [22.7, 34.1]	29.4 [22.4, 36.4]	0.29	s
nicotine dependence	%	13.6 [12.6, 14.6]	17.0 [14.5, 19.5]	22.3 [15.8, 28.7]	25.1 [17.3, 33.0]	18.9 [12.2, 25.7]	0.42	s
Cannabis								
> weekly use	%	7.7 [7.0, 8.5]	12.6 [9.2, 15.9]	9.8 [7.0, 12.5]	7.1 [3.9, 10.3]	5.2 [1.7, 8.6]	0.54	m
cannabis use disorder	%	7.3 [6.6, 8.0]	12.6 [9.7, 15.6]	15.0 [10.4, 19.6]	12.1 [7.9, 16.3]	6.0 [2.0, 9.9]	0.56	m
Other Illegal drugs								
psychedelics	%	4.4 [3.8, 4.9]	10.4 [7.3, 13.5]	7.1 [4.5, 9.7]	5.5 [2.5, 8.5]	4.7 [1.6, 7.9]	0.52	m
psychostimulants	%	7.1 [6.4, 7.9]	12.6 [9.2, 16.0]	11.9 [8.9, 15.0]	11.3 [7.3, 15.4]	11.0 [6.2, 15.7]	0.35	s
ecstasy	%	6.9 [6.1, 7.6]	15.9 [12.2, 19.7]	13.5 [10.2, 16.8]	11.9 [7.7, 16.0]	10.9 [6.3, 15.6]	0.52	m
poppers	%	1.7 [1.4, 2.1]	3.8 [2.9, 4.8]	11.4 [6.4, 16.3]	23.8 [14.0, 33.6]	19.3 [12.4, 26.1]	1.59	l
PSED	%	0.5 [0.3, 0.8]	1.9 [0.7, 3.2]	2.7 [1.0, 4.5]	3.7 [1.8, 5.6]	5.5 [1.6, 9.4]	1.31	l
other	%	1.6 [1.3, 2.0]	2.6 [1.1, 4.1]	3.0 [1.3, 4.7]	3.6 [1.8, 5.4]	4.6 [1.0, 8.2]	[0.59]	[m]
Behavioural Addictions								
gambling	%	1.1 [0.8, 1.5]	3.0 [1.2, 4.7]	2.3 [0.8, 3.7]	1.9 [0.1, 3.6]	1.7 [-0.2, 3.6]	[0.54]	[m]
gaming	%	6.7 [6.0, 7.4]	10.3 [8.4, 12.3]	16.3 [10.3, 22.3]	16.4 [9.4, 23.4]	5.2 [1.5, 9.0]	0.70	m
cybersex	%	6.6 [5.9, 7.3]	11.4 [8.1, 14.6]	10.9 [8.0, 13.8]	10.4 [6.5, 14.3]	10.1 [5.5, 14.7]	0.33	s
internet	%	4.3 [3.7, 4.9]	7.5 [5.6, 9.3]	12.1 [7.1, 17.2]	13.5 [7.8, 19.3]	7.6 [3.1, 12.0]	0.69	m
smartphone	%	7.7 [6.9, 8.4]	8.1 [5.4, 10.8]	12.1 [9.1, 15.1]	16.3 [12.1, 20.6]	20.3 [13.8, 26.8]	0.62	m
work	%	7.4 [6.6, 8.1]	10.3 [7.8, 12.8]	12.6 [8.1, 17.1]	12.9 [8.5, 17.4]	10.4 [5.2, 15.6]	0.34	s
exercise	%	2.9 [2.4, 3.3]	3.1 [1.9, 4.4]	3.2 [0.5, 5.9]	2.5 [0.0, 5.1]	1.2 [-0.7, 3.1]	[0.55]	[m]
Mental Health								
major depression	%	6.9 [6.2, 7.6]	14.4 [11.2, 17.7]	17.1 [13.0, 21.2]	16.8 [12.8, 20.8]	14.5 [8.5, 20.4]	0.56	m
SF-12v2 mental health i.	std	-.045 [-.073, -.018]	.363 [.265, .462]	.394 [.305, .483]	.395 [.274, .517]	.393 [.245, .541]	0.44	s
satisfaction with life i.	std	-.030 [-.058, -.002]	.205 [.135, .275]	.494 [.346, .641]	.589 [.423, .755]	.164 [-.008, .335]	0.62	m
stress	std	-.032 [-.060, -.004]	.173 [.103, .243]	.442 [.294, .590]	.583 [.416, .750]	.339 [.167, .510]	0.61	m

Remarks: Marginal means for groups by sexual orientation (at mean age (25.45) and linguistic region (0.43)) were estimated based on polynomial regression models adjusting for age and linguistic region; non-overlapping 95% CI were used as indicators for significant group differences. A/B/C/D/E = Reduced Kinsey Scale (A = "heterosexual" to E = "homosexual").

effect = Cohen's d as an indicator for effect size, i.e. comparison between groups with maximal vs minimal estimated marginal mean, l = large effect ($d > .8$), m = medium effect ($d > .5$), s = small effect ($d > .2$); [] = effect was not significant in the fractional polynomial regression.

All criterion variables were coded so that higher values corresponded to less benign scores; i = inverse coded; std = z-standardised scores; PSED = possible sexually enhancing drugs (other than ecstasy and poppers) such as methamphetamine, GHB/GBL/1-4 butanediol, "research chemicals" (e.g. MDPV, mephedrone butylone, methedrone).

Figure 1 – Estimated marginal means and 95% confidence intervals of the prevalence of problematic substance use, behavioural addictions and poor mental health among young Swiss men by sexual orientation subgroup (attraction)
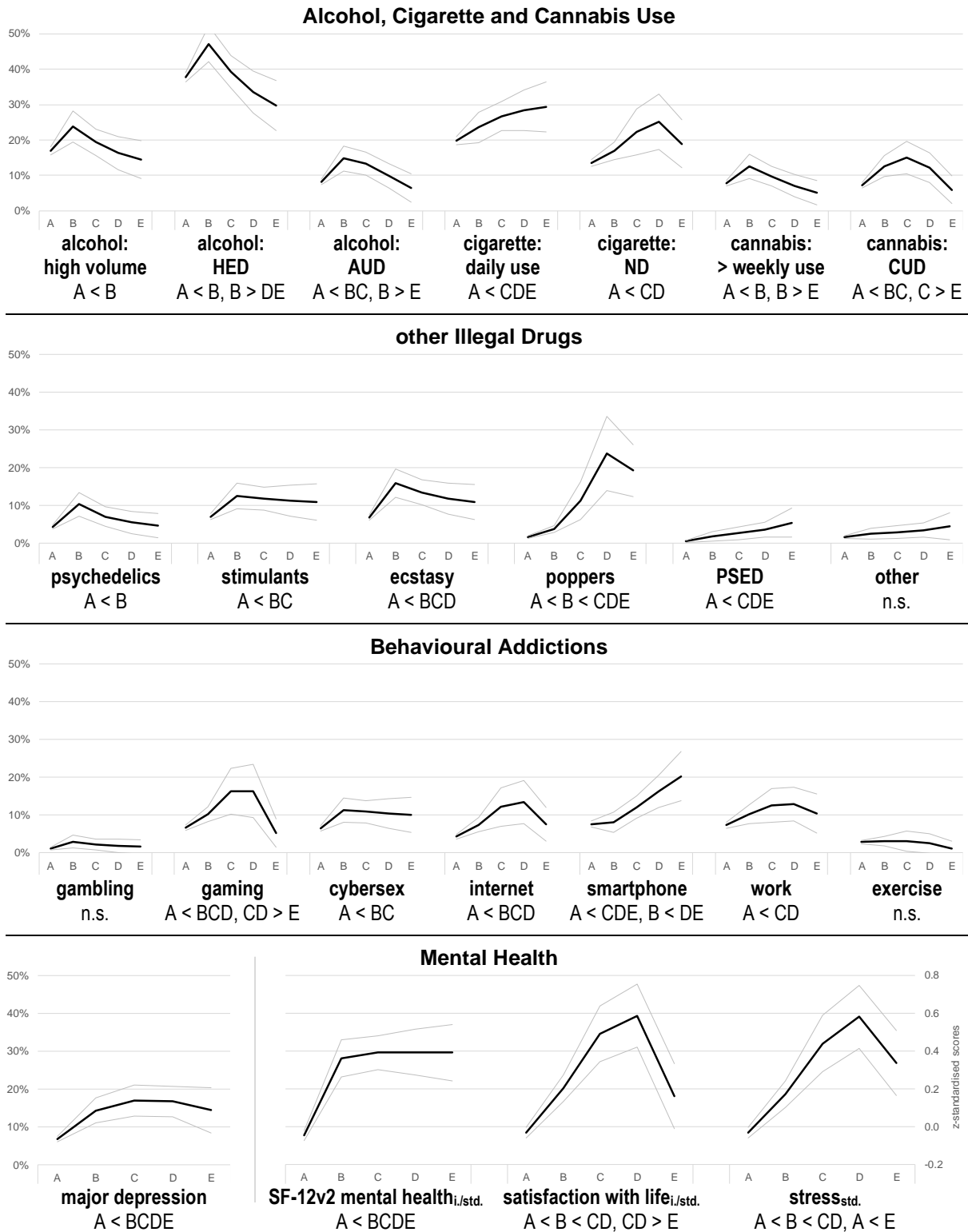
Remarks: A to E = Reduced Kinsey Scale (A = "heterosexual" to E = "homosexual"); comparisons are based on pairwise comparisons, e.g. "A < BC, B > E" indicates significant differences ($p < .05$) for A < B, A < C and B > E, whereas all other comparisons were not significant.

All criterion variables were coded so that higher values corresponded to less benign scores; i = inverse coded; std = z-standardised scores; high volume = high volume drinking; HED = heavy episodic drinking; AUD = alcohol use disorder; ND = nicotine dependence; CUD = cannabis use disorder; PSED = possible sexually enhancing drugs (other than ecstasy and poppers) such as methamphetamine, GHB/GBL/1-4 butanediol, "research chemicals" (e.g. MDPV, mephedrone butylone, methedrone).

SUPPLEMENTARY MATERIAL

Table S1 – **Fractional polynomial regressions** predicting problematic substance use, behavioural addictions and poor mental health by sexual orientation subgroup (attraction), age and linguistic region among young men in Switzerland (b-coefficients and 95% CI)

	Reg	p_1	sexual orientation p_1 b [95% CI]	p_2	sexual orientation p_2 b [95% CI]	age b [95% CI]	language b [95% CI]	intercept b [95% CI]	max
Alcohol									
high volume	log	x^{-2}	**-3.639 [-6.167, -1.111]**	x^{-1}	**4.606 [1.141, 8.072]**	**-.104 [-.165, -.042]**	**-.336 [-.485, -.186]**	.228 [-1.617, 2.074]	1.6
heavy episodic drinking	log	x^{-2}	**-4.074 [-6.128, -2.020]**	x^{-1}	**5.335 [2.544, 8.126]**	**-.149 [-.197, -.102]**	**-.253 [-.369, -.137]**	**2.150 [.710, 3.590]**	1.5
alcohol use disorder	log	x^{-2}	**-1.097 [-1.588, -.605]**	x^2	**-.055 [-.094, -.016]**	-.047 [-.128, .033]	.009 [-.189, .206]	-.053 [-2.185, 2.078]	2.1
Cigarette									
daily use	log	x^{-2}	**-.640 [-1.169, -.112]**	$x^{-2}\ln_x$	-1.516 [-4.547, 1.516]	**.093 [.041, .146]**	-.024 [-.163, .114]	**-3.118 [-4.561, -1.675]**	5.0
nicotine dependence	log	x^3	**.070 [.019, .121]**	$x^3\ln_x$	**-.041 [-.073, -.009]**	**.128 [.069, .187]**	.117 [-.043, .277]	**-5.229 [-6.766, -3.691]**	3.9
Cannabis									
> weekly use	log	x^{-2}	**-1.599 [-2.556, -.642]**	$x^{0.5}$	**-1.592 [-2.780, -.403]**	.055 [-.023, .132]	**-.287 [-.497, -.077]**	-.553 [-3.451, 2.346]	1.7
cannabis use disorder	log	$x^{0.5}$	**1.800 [.967, 2.633]**	x^3	**-.020 [-.031, -.009]**	.069 [-.009, .148]	-.123 [-.334, .087]	**-6.036 [-8.255, -3.818]**	3.0
Other Illegal drugs									
psychedelics	log	x^{-2}	.384 [-.672, 1.440]	$x^{-2}\ln_x$	**7.059 [1.686, 12.431]**	-.073 [-.181, .035]	-.207 [-.471, .057]	-1.521 [-4.473, 1.431]	1.6
psychostimulants	log	x^{-2}	-.350 [-1.105, .405]	$x^{-2}\ln_x$	2.099 [-2.050, 6.248]	-.001 [-.084, .082]	-.057 [-.268, .154]	-2.174 [-4.427, .079]	1.9
ecstasy	log	x^{-2}	-.235 [-.974, .505]	$x^{-2}\ln_x$	**4.433 [.479, 8.387]**	**-.119 [-.209, -.030]**	**-.251 [-.463, -.038]**	.770 [-1.621, 3.162]	1.7
poppers	log	x^3	**.208 [.139, .278]**	$x^3\ln_x$	**-.115 [-.158, -.072]**	-.119 [-.272, .035]	**-.686 [-1.069, -.303]**	-.940 [-4.874, 2.994]	4.4
PSED	log	x^{-2}	**-1.650 [-2.736, -.563]**	x^3	.006 [-.004, .017]	-.082 [-.346, .181]	-.416 [-1.065, .233]	-1.293 [-8.083, 5.496]	5.0
other	log	x^{-2}	-.580 [-1.489, .330]	x^3	.004 [-.006, .014]	-.043 [-.215, .130]	-.065 [-.487, .357]	-2.413 [-6.904, 2.078]	5.0
Behavioural Addictions									
gambling	log	x^{-2}	-.027 [-1.802, 1.748]	$x^{-2}\ln_x$	5.494 [-3.657, 14.644]	**.170 [.002, .338]**	.401 [-.080, .882]	**-8.923 [-13.596, -4.249]**	1.7
gaming	log	x^3	**.135 [.073, .198]**	$x^3\ln_x$	**-.085 [-.124, -.045]**	.061 [-.021, .144]	-.114 [-.334, .106]	**-4.292 [-6.429, -2.155]**	3.5
cybersex	log	x^{-2}	-.362 [-1.142, .419]	$x^{-2}\ln_x$	1.909 [-2.397, 6.215]	-.033 [-.120, .055]	**-.320 [-.543, -.097]**	-1.328 [-3.694, 1.038]	2.0
internet	log	x^2	**.337 [.161, .513]**	x^3	**-.060 [-.096, -.025]**	.013 [-.088, .115]	**-.522 [-.798, -.247]**	**-3.498 [-6.118, -.879]**	3.7
smartphone	log	x^{-1}	**-3.168 [-4.808, -1.528]**	$x^{-1}\ln_x$	**-4.388 [-7.576, -1.200]**	-.030 [-.112, .053]	-.139 [-.345, .068]	1.492 [-1.185, 4.169]	5.0
work	log	x	**.447 [.071, .823]**	x^3	-.011 [-.025, .002]	**.110 [.035, .186]**	**-.477 [-.694, -.259]**	**-5.574 [-7.570, -3.578]**	3.6
exercise	log	x^3	.031 [-.090, .152]	$x^3\ln_x$	-.023 [-.100, .054]	-.051 [-.188, .087]	-.024 [-.359, .311]	-2.247 [-5.783, 1.290]	2.7
Mental Health									
major depression	log	x^{-1}	**-1.704 [-2.333, -1.074]**	x^3	-.004 [-.010, .002]	**.145 [.071, .220]**	**-.225 [-.438, -.013]**	**-4.489 [-6.495, -2.483]**	3.4
SF-12v2 mental health i./std.	lin	x^{-2}	**-.421 [-.650, -.191]**	$x^{-2}\ln_x$	.538 [-.748, 1.824]	**.050 [.028, .071]**	**-.420 [-.474, -.366]**	**-.706 [-1.296, -.116]**	3.6
satisfaction with life i./std.	lin	x^3	**.064 [.044, .084]**	$x^3\ln_x$	**-.039 [-.051, -.026]**	**.077 [.055, .099]**	**-.061 [-.116, -.006]**	**-2.029 [-2.593, -1.466]**	3.8
stress std.	lin	x^3	**.054 [.034, .074]**	$x^3\ln_x$	**-.032 [-.044, -.019]**	**.052 [.030, .074]**	**.106 [.051, .161]**	**-1.462 [-2.026, -.897]**	4.0

Remarks: All criterion variables were coded so that higher values corresponded to less benign scores; i = inverse coded; std = z-standardised scores;
PSED = possible sexually enhancing drugs (other than ecstasy and poppers) such as methamphetamine, GHB/GBL/1-4 butanediol, "research chemicals" (e.g. MDPV, mephedrone butylone,

methedrone).reg/est = regression model (logistic, linear) and estimator (OR, b), p_1/p_2 = power of the first and second polynomial for sexual orientation; max = maximum for predicted criterion variable on the Reduced Kinsey Scale (1 = heterosexual, 2 = mostly-heterosexual, 3 = bisexual, 4 = mostly-homosexual, 5 = homosexual).

Legend: For high volume alcohol use, the maximum or peak of the risk curve was estimated to be at 1.6. Considering the Reduced Kinsey Scale (coded: 1 = heterosexual to 5 = homosexual) this means that the highest risk is expected to be in the area between "heterosexual" and "mostly-heterosexual".

Table S2 – **Observed differences**: Logistic and linear regressions predicting problematic substance use, behavioural addictions and poor mental health by dummy coded sexual orientation subgroup (attraction), age and linguistic region among young men in Switzerland (b-coefficients and 95% CI for dummy coded sexual orientation subgroup)

	reg	B vs A b [95% CI]	C vs A b [95% CI]	D vs A b [95% CI]	E vs A b [95% CI]	B/C/D vs A b [95% CI]	B/C/D/E vs A b [95% CI]	B/C/D vs E b [95% CI]	A/B/C/D vs E b [95% CI]
Alcohol									
high volume	log	**.431 [.175, .687]**	.075 [-.615, .764]	.111 [-.721, .943]	-.212 [-.718, .294]	**.365 [.131, .600]**	**.255 [.039, .470]**	**.567 [.020, 1.113]**	.246 [-.259, .751]
heavy episodic drinking	log	**.391 [.174, .609]**	-.009 [-.555, .537]	-.014 [-.690, .661]	-.384 [-.774, .006]	**.310 [.114, .506]**	.167 [-.010, .344]	**.696 [.267, 1.124]**	**.410 [.021, .800]**
alcohol use disorder	log	**.663 [.353, .973]**	.455 [-.344, 1.254]	.310 [-.735, 1.355]	-.279 [-1.003, .445]	**.613 [.329, .898]**	**.465 [.197, .733]**	**.892 [.128, 1.656]**	.345 [-.378, 1.068]
Cigarette									
daily use	log	.193 [-.064, .450]	**.739 [.180, 1.298]**	.003 [-.826, .832]	**.529 [.137, .920]**	**.255 [.026, .483]**	**.318 [.116, .520]**	-.285 [-.727, .156]	**-.505 [-.895, -.114]**
nicotine dependence	log	.189 [-.107, .485]	**.933 [.346, 1.520]**	.463 [-.367, 1.294]	.411 [-.043, .864]	**.324 [.068, .580]**	**.343 [.115, .572]**	-.107 [-.618, .404]	-.380 [-.833, .072]
Cannabis									
> weekly use	log	**.552 [.221, .883]**	-.066 [-1.090, .958]	.399 [-.648, 1.446]	-.521 [-1.349, .307]	**.478 [.171, .784]**	**.318 [.028, .608]**	**.991 [.121, 1.861]**	.569 [-.257, 1.396]
cannabis use disorder	log	**.640 [.312, .969]**	.434 [-.420, 1.289]	**.938 [.053, 1.822]**	-.288 [-1.059, .482]	**.645 [.347, .942]**	**.492 [.211, .773]**	**.931 [.117, 1.746]**	.357 [-.413, 1.126]
Other Illegal drugs									
psychedelics	log	**.937 [.569, 1.306]**	.540 [-.488, 1.567]	.209 [-1.226, 1.643]	.090 [-.742, .923]	**.846 [.502, 1.191]**	**.715 [.391, 1.040]**	.735 [-.144, 1.614]	.012 [-.818, .842]
psychostimulants	log	**.640 [.308, .972]**	.250 [-.675, 1.176]	**.950 [.066, 1.834]**	.411 [-.174, .996]	**.627 [.325, .928]**	**.581 [.306, .856]**	.204 [-.436, .844]	-.344 [-.927, .240]
ecstasy	log	**.966 [.662, 1.269]**	.293 [-.633, 1.220]	**.949 [.063, 1.836]**	.520 [-.047, 1.088]	**.897 [.616, 1.178]**	**.821 [.562, 1.080]**	.363 [-.252, .978]	-.411 [-.977, .155]
poppers	log	**.899 [.338, 1.461]**	**1.944 [1.064, 2.824]**	**2.866 [2.069, 3.662]**	**2.625 [2.134, 3.117]**	**1.392 [.961, 1.822]**	**1.779 [1.426, 2.132]**	**-1.236 [-1.813, -.658]**	**-2.408 [-2.887, -1.929]**
PSED	log	**1.444 [.643, 2.245]**	---	**2.366 [.879, 3.853]**	**2.372 [1.517, 3.228]**	**1.434 [.697, 2.171]**	**1.719 [1.100, 2.337]**	-.963 [-1.953, .026]	**-2.132 [-2.962, -1.301]**
other	log	.565 [-.104, 1.233]	.119 [-1.873, 2.110]	.535 [-1.468, 2.537]	**1.110 [.260, 1.961]**	.515 [-.102, 1.131]	**.671 [.150, 1.192]**	-.658 [-1.668, .351]	**-1.055 [-1.901, -.208]**
Behavioural Addictions									
gambling	log	**.986 [.330, 1.643]**	.413 [-1.583, 2.409]	.909 [-1.099, 2.916]	.312 [-1.110, 1.734]	**.924 [.311, 1.537]**	**.817 [.239, 1.395]**	.514 [-1.000, 2.029]	-.203 [-1.621, 1.215]
gaming	log	**.525 [.170, .881]**	.534 [-.321, 1.389]	**1.404 [.608, 2.199]**	-.350 [-1.178, .479]	**.620 [.309, .931]**	**.463 [.169, .758]**	**.958 [.088, 1.829]**	.416 [-.411, 1.244]
cybersex	log	**.622 [.276, .968]**	.349 [-.578, 1.276]	.218 [-.972, 1.407]	**.572 [.004, 1.141]**	**.563 [.244, .881]**	**.565 [.278, .851]**	-.009 [-.641, .623]	-.514 [-1.080, .053]
internet	log	**.721 [.321, 1.121]**	-.173 [-1.593, 1.247]	**1.841 [1.038, 2.644]**	.522 [-.171, 1.216]	**.785 [.430, 1.139]**	**.731 [.405, 1.056]**	.264 [-.491, 1.018]	-.431 [-1.122, .261]
smartphone	log	.070 [-.325, .465]	.373 [-.481, 1.227]	**1.050 [.217, 1.883]**	**1.098 [.646, 1.549]**	.222 [-.114, .557]	**.468 [.191, .745]**	**-.873 [-1.415, -.331]**	**-1.077 [-1.527, -.627]**
work	log	**.404 [.049, .759]**	.222 [-.706, 1.150]	**.944 [.058, 1.830]**	.349 [-.237, .935]	**.437 [.119, .754]**	**.417 [.131, .703]**	.112 [-.544, .768]	-.305 [-.891, .280]
exercise	log	-.573 [-1.397, .252]	.623 [-.553, 1.799]	.632 [-.805, 2.069]	-1.330 [-3.305, .646]	-.189 [-.811, .433]	-.352 [-.948, .245]	1.111 [-.949, 3.170]	1.313 [-.662, 3.287]
Mental Health									
major depression	log	**.861 [.548, 1.175]**	.290 [-.638, 1.217]	**1.692 [.951, 2.433]**	**.739 [.215, 1.264]**	**.890 [.607, 1.172]**	**.857 [.600, 1.114]**	.162 [-.415, .738]	**-.634 [-1.157, -.111]**
SF-12v2 mental health i./std.	lin	**.419 [.315, .523]**	.233 [-.017, .483]	**.763 [.451, 1.075]**	**.411 [.242, .580]**	**.424 [.330, .517]**	**.421 [.337, .504]**	.017 [-.201, .236]	**-.374 [-.547, -.202]**
satisfaction with life i./std.	lin	**.216 [.110, .322]**	**.653 [.394, .912]**	**.509 [.188, .830]**	**.199 [.025, .374]**	**.295 [.199, .390]**	**.274 [.188, .360]**	.090 [-.127, .307]	-.174 [-.351, .002]
stress std.	lin	**.222 [.115, .329]**	**.336 [.075, .597]**	**.739 [.415, 1.064]**	**.362 [.187, .538]**	**.278 [.182, .375]**	**.297 [.210, .383]**	-.075 [-.278, .128]	**-.338 [-.515, -.162]**

Remarks: A to E = Reduced Kinsey Scale (A = "heterosexual" to E = "homosexual"); Group differences were tested by regressing the criterion variable on dummy coded group variables for sexual orientation, age and linguistic region. Grouping variables corresponded to separate or aggregated groups (e.g. A = heterosexual; B/C/D/E = non-heterosexual). The second group was coded as a reference group (for example in "B vs A", B = 1, A = 0); reg = regression model (log = logistic regression model, lin = linear regression); b-coefficients in bold are significant (p < .05). All models were adjusted for age and linguistic region. --- = model could not be estimated due to a prevalence of 0.0% in group C.

All criterion variables were coded so that higher values corresponded to less benign scores; i. = inverse coded; std = z-standardised scores; PSED = possible sexually enhancing drugs (other than ecstasy and poppers) such as methamphetamine, GHB/GBL/1-4 butanediol, "research chemicals" (e.g. MDPV, mephedrone butylone, methedrone).

Figure S1 – Observed means and 95% confidence intervals of the prevalence of problematic substance use, behavioural addictions and poor mental health among young Swiss men by sexual orientation subgroups (attraction)
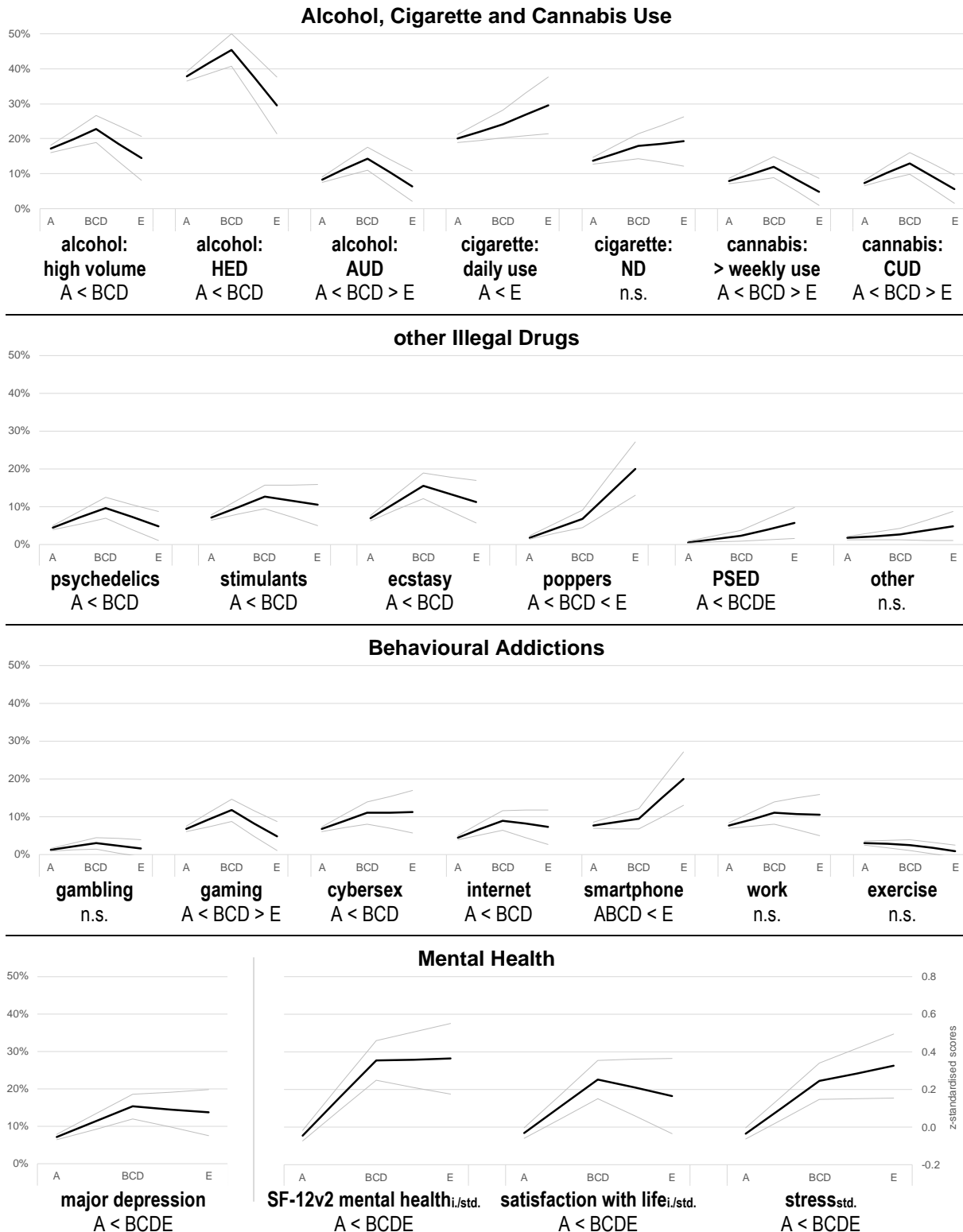
Remarks: A, BCD, E = Reduced Kinsey Scale reclassified in three groups (A = "heterosexual", BCD = "mostly-heterosexual, bisexual or mostly-homosexual", E = "homosexual"); comparisons are based on observed differences reported in Table S2, e.g. "A < BCE" indicates significant differences (p < .05) for A < BCD and A < E, whereas BCD vs E was not significant.

All criterion variables were coded so that higher values corresponded to less benign scores; i = inverse coded; std = z-standardised scores; high volume = high volume drinking; HED = heavy episodic drinking; AUD = alcohol use disorder; ND = nicotine dependence; CUD = cannabis use disorder; PSED = possible sexually enhancing drugs (other than ecstasy and poppers) such as methamphetamine, GHB/GBL/1-4 butanediol, "research chemicals" (e.g. MDPV, mephedrone butylone, methedrone).