

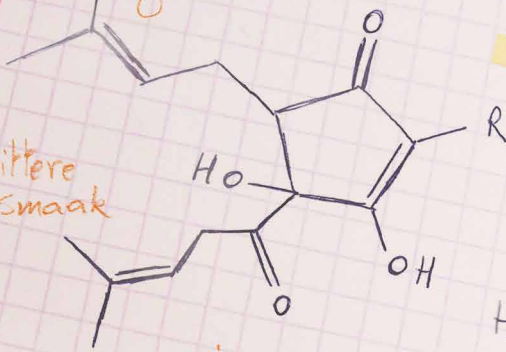
Determinants of alcohol use among students in higher education

Joris Van Damme

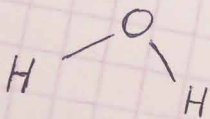
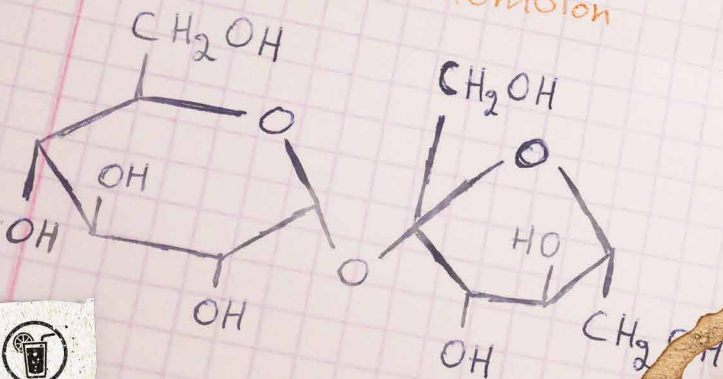
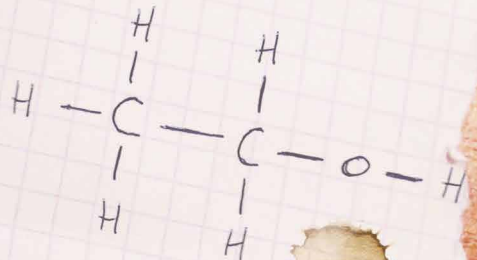
bacteriostatische eigenschappen

Hop

bittere smaak



isohumulon



*“Little drops of water,
Little grains of sand,
Make the mighty ocean
And the pleasant land.”*

Mrs. J.A. Carney (1845)

Joris Van Damme

Determinants of alcohol use among students in higher education

PhD thesis Ghent University

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Determinants of alcohol use among students in higher education

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Abbreviations

ANOVA	Analysis of Variance
AUDIT	Alcohol Use Disorder Identification Test
BAC	Blood Alcohol Concentration
CI	Confidence Interval
DALY	Disability-Adjusted Life Year
df	Degrees of freedom
DIC	Deviance Information Criterion
DMQ-R SF	Drinking Motive Questionnaire-Revised Short Form
DRSE	Drink Refusal Self-Efficacy
ESPAD	The European School Survey Project on Alcohol and Other Drugs
GDP	Gross Domestic Product
HBSC	Health Behaviour in School-aged Children
IGLS	Iterative Generalized Least Squares
LEA	Longitudinal Eating and Activity study
NIAAA	National Institute on Alcohol Abuse and Alcoholism
MCMC	Markov Chain Monte Carlo
OR	Odds Ratio
SD	Standard Deviation
SE	Standard Error
SPSS	Statistical Package for the Social Sciences
USA	United States of America
VPC	Variance Partition Coefficient

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Summary

Worldwide, alcohol is regularly consumed by a majority of students in higher education. Many people perceive (heavy) drinking as an inseparable part of student life, of which most students mature out once they graduate and take more responsibilities in life. However, for a considerable number of students this maturing out process has a less promising result, with heavy and problematic drinking patterns still being observed in former higher education students who often occupy leading functions in society. Moreover, alcohol has numerous short-term effects that already negatively affect students' health and well-being.

In an effort to support and improve future health promotion interventions that promote responsible alcohol use and target heavy and problematic use in higher education in Flanders, this dissertation presents an overview of the available research evidence as part of a needs assessment, which was performed according to the guidelines of the Intervention Mapping protocol. Along this needs assessment, various research gaps were identified, of which a number were addressed in this dissertation in four original research studies on Flemish students and emerging adults. Three studies were based on two cross-sectional waves of the "Student survey on substance use", with 16,953 participants in 2009 and 7,181 participants in 2013. One study was based on the "Longitudinal eating and activity study (LEA-study)", with 587 participants. In a first study, we investigated the characteristics and drinking motives of students who consume alcohol in the exam periods. These periods are typically characterized by less social interaction, and higher levels of stress and monotonous activities compared to periods without exams. In a second study, the relationship between students' drinking motives and indicators of more moderate and heavy drinking was investigated. In a third study, the long-term influence of parental drinking in late childhood on college-aged offspring's drinking nine years later was investigated. In this relationship the mediating role of drinking motives was further explored. The final study examined the relationship between both individual-level and faculty-level characteristics and students' frequent binge drinking.

Besides an extensive overview of the available literature about the prevalence and consequences of heavy alcohol use among students in European higher education, and about the behavioural and environmental elements that are related to this

behaviour, the first study in this dissertation found that in particular internal drinking motives (i.e., coping and enhancement motives) relate to (weekly) drinking in the exam periods. Overall, the frequency of all drinking motive dimensions decreased from periods without exams to periods with exams, but a significant smaller decrease was observed in internal drinking motives compared to external drinking motives (i.e., social and conformity motives). Moreover, the second study revealed that in periods without exams a positive relationship was found between social, enhancement and coping motives, and indicators of more moderate and heavy drinking, such as more than weekly drinking, monthly binge drinking, and being at risk for problematic use according to the Alcohol Use Disorder Identification Test (AUDIT). At interpersonal level, the third study found a positive indirect relationship between parental drinking in late childhood and college-aged offspring's drinking nine years later. This relationship operated through offspring's social and enhancement motives, which are among the known risk factors for heavy and problematic use in higher education. Finally at institutional level, the fourth study showed a relationship between faculty-level characteristics and frequent binge drinking in male students. This relationship was independent from individual-level characteristics in students. However, individual-level characteristics were found to cluster within faculties, which explained differences in frequent binge drinking between different faculties.

The performed needs assessment and the findings from the original research articles deliver an important base to support and develop future interventions. At individual level, interventional strategies are suggested that can be used in light of the current findings to target heavy and unhealthy drinking among students in higher education. At environmental level, the often underrated role of parents in students' alcohol use is discussed, and suggestions are made to develop interventions that target institution-related characteristics, such as the development and/or clear communication of policies towards alcohol use in students by higher education institutions. Finally, some reflections are presented on the needs assessment protocol, as described in the Intervention Mapping protocol.

Samenvatting

Wereldwijd wordt er geregeld door heel wat studenten in het hoger onderwijs alcohol geconsumeerd. Veel mensen hebben dan ook de perceptie dat (zwaar) drinken een substantieel onderdeel vormt van het studentenleven en dat studenten vaak uit dit gedrag “rijpen”, eenmaal ze afgestudeerd zijn en meer verantwoordelijkheden opnemen in hun leven. Voor verschillende studenten verloopt dit proces echter minder gunstig dan verwacht, waardoor geregeld zware en problematische drinkpatronen worden geobserveerd bij voormalige studenten die nu onder andere vooraanstaande functies bekleden binnen de maatschappij. Verder kent alcohol ook verschillende kortetermijneffecten die de gezondheid en het welzijn van studenten negatief beïnvloeden.

Om toekomstige gezondheidsbevorderende interventies te ondersteunen, die verantwoord alcoholgebruik in het hoger onderwijs in Vlaanderen promoten en die zwaar en problematisch alcoholgebruik bij studenten aanpakken, werd in deze thesis een overzicht gegeven van de wetenschappelijke literatuur rond dit topic als onderdeel van een ‘needs assessment’. Hiervoor werd gebruik gemaakt van de richtlijnen die beschreven staan in het “*Intervention Mapping protocol*”. Bij het uitvoeren van deze ‘needs assessment’ werden verschillende hiaten in de literatuur geïdentificeerd, waarvan er een aantal in deze thesis werden onderzocht door middel van vier originele studies bij Vlaamse studenten en jongvolwassenen. Drie studies waren gebaseerd op twee cross-sectionele data-afnames van de studentenbevraging rond middelengebruik, waarbij 16953 participanten werden onderzocht in 2009 en 7181 participanten in 2013. Eén studie was gebaseerd op de “*Longitudinal eating and activity study (LEA-study)*”, waarbij 587 participanten werden onderzocht. In een eerste onderzoek werden de eigenschappen en de drinkmotivatie van studenten die alcohol consumeren tijdens de examenperiodes onderzocht. Deze periodes worden, in vergelijking met periodes zonder examens, doorgaans gekenmerkt door verminderde sociale contacten, verhoogde stress en meer eenzijdige activiteiten. Een tweede studie bekeek de relatie tussen de drinkmotivatie van studenten en indicatoren van meer gematigd en zwaar alcoholgebruik. In een derde studie werd gekeken naar de langetermijneffecten van ouders hun drinkgedrag tijdens de kindertijd op het drinkgedrag van hun jongvolwassen kinderen negen jaar later. Voor deze relatie werd bijkomend de mediërende invloed van drinkmotieven onderzocht.

Een laatste onderzoek keek naar de relatie tussen zowel individuele als faculteitgerelateerde karakteristieken en regelmatig binge drinken bij studenten.

De “*needs assessment*” in deze thesis heeft enerzijds geleid tot een uitgebreid overzicht van beschikbare literatuur over de prevalentie en gevolgen van alcoholgebruik in het hoger onderwijs in Europa. Anderzijds resulteerde dit in een overzicht van de gedrags- en omgevingselementen die gerelateerd zijn aan alcoholgebruik bij studenten. De eerste originele studie in deze thesis wees uit dat de frequenties van alle types drinkmotieven daalden van periodes zonder examens naar periodes met examens, maar dat deze daling significant kleiner was voor interne drinkmotieven (“*coping*” en “*enhancement*” motieven) in vergelijking met externe drinkmotieven (sociale en “*conformity*” motieven). Verder werd enkel een relatie gevonden tussen interne drinkmotieven en (wekelijks) drinken in de examenperiodes. De tweede studie toonde in periodes zonder examens een relatie tussen sociale, “*enhancement*” en “*coping*” motieven en indicatoren van meer gematigd en zwaar gebruik, zoals meer dan wekelijks drinken, maandelijks binge drinken en het hebben van een risico op problematisch gebruik volgens de “*Alcohol Use Disorder Identification Test (AUDIT)*”. Op interpersoonlijk niveau werd in de derde studie een positieve indirecte relatie gevonden tussen het drinkgedrag van ouders tijdens de kindertijd en het drinkgedrag van hun jongvolwassen kinderen negen jaar later. Deze relatie verliep via de sociale en “*enhancement*” drinkmotieven van deze kinderen. Deze drinkmotieven zijn ook wel gekende risicofactoren voor zwaar en problematisch gebruik. Op institutioneel niveau werd in de vierde studie een relatie gevonden tussen faculteitgerelateerde kenmerken en regelmatig binge drinken bij mannelijke studenten. Deze relatie verliep onafhankelijk van individuele kenmerken bij studenten. Voor deze individuele karakteristieken werd echter wel een clustering binnen faculteiten gevonden, die de verschillen in regelmatig binge drinken tussen faculteiten wist te verklaren.

De uitgevoerde “*needs assessment*” en de bevindingen van de originele studies in deze thesis leveren een belangrijke basis voor de ondersteuning en ontwikkeling van toekomstige interventies. Op individueel niveau worden interventiestrategieën gesuggereerd die gebruikt kunnen worden in het licht van deze bevindingen om zwaar en risicovol alcoholgebruik in het hoger onderwijs aan te pakken. Op omgevingsniveau wordt de vaak onderschatte rol van ouders met betrekking tot het

drinkgedrag van hun studerende kinderen behandeld. Verder worden er ook suggesties gedaan voor de ontwikkeling van interventies die zich richten op aan onderwijsinstellingen gerelateerde kenmerken, zoals de ontwikkeling en/of duidelijke communicatie van een beleid met betrekking tot alcoholgebruik door studenten in het hoger onderwijs. Tot slot worden er een aantal bedenkingen geformuleerd met betrekking tot het “*needs assessment*” protocol, zoals beschreven in het “*Intervention Mapping protocol*”.

Part 1: General introduction

Many behaviour change interventions still fail to describe or refer to a thorough analysis of the behaviour they want to change (Bendtsen, Bendtsen, Karlsson, White, & McCambridge, 2015; Kenney & Grim, 2015; Prince, Maisto, Rice, & Carey, 2015; Witkiewitz et al., 2014). However, it has been well documented that an in-depth understanding of the behaviour and the factors related to this behaviour is needed to make good choices for effective interventions (Arthur & Blitz, 2000; Bartholomew, Parcel, Kok, Gottlieb, & Fernández, 2011; Wright, Williams, & Wilkinson, 1998).

Several systematic approaches for developing interventions are available in the literature. Examples are the 'Behaviour Change Wheel' (Michie, van Stralen, & West, 2011), the 'Medical Research Council Framework' (M. Campbell et al., 2000), the 'Integrated Behavioural Model for Water, Sanitation, and Hygiene' (Dreibelbis et al., 2013) and the 'European Drug Prevention Quality Standard' (Brotherhood & Sumnall, 2011). In this dissertation we choose the Intervention Mapping Approach (Bartholomew et al., 2011) as a guide for understanding alcohol use in students in higher education in function of intervention development, and for conducting new research in this field.

In this general introduction, first an overview will be given of the Intervention Mapping approach. Next, an in-depth analysis will be presented of alcohol use among students in higher education. This analysis will be introduced by a description of the method to conduct a needs assessment according to the Intervention Mapping protocol. Along this assessment, a number of research gaps are discussed that are subsequently addressed in *Part 3: Original research articles*.

1 Intervention Mapping

1.1 What is Intervention Mapping?

"Anyone with the responsibility to help individuals or communities change health risk behaviour, initiate health-promoting behavior [sic], change environmental factors, or manage illnesses must design or adapt existing effective interventions and develop plans to implement them. A systematic process is important in these endeavours."
(p.14) (Bartholomew et al., 2011)

A systematic approach is needed to organize the complex act of developing, implementing and evaluating interventions, and to prevent that important facets in these processes are overlooked. Using such a systematic approach and diffusing the plans that result from this approach contribute to the evidence-based practice in the health promotion field and help program developers in their ethical practice (Bartholomew et al., 2011). Program developers have the duty to develop interventions as effective as possible to promote health and social justice, with respect for the values and autonomy of individuals and communities (Kass, 2001; Society for Public Health Education, n.d.).

To guide program developers in this systematic approach, various planning protocols exist, of which a few examples have already been given. The protocol used in this dissertation is the Intervention Mapping protocol (Bartholomew et al., 2011). Intervention Mapping is one of the most comprehensive planning protocols that exist, since it encloses both the development, implementation and evaluation of theory- and evidence-based health promotion interventions. The development section of this protocol strongly focuses on performing an extensive needs assessment before describing the program objectives, the selection of behavioural change techniques and the translation of these techniques into program materials that are relevant for the target population and the context. In the implementation and evaluation sections, program developers are guided in the planning of the diffusion, implementation and evaluation of their newly developed or adapted intervention (Bartholomew et al., 2011).

1.2 Overview of Intervention Mapping

Intervention Mapping describes six steps that must be completed in order to develop, implement, and evaluate an intervention: (1) Needs assessment, (2) Preparing matrices for change objectives, (3) Selecting theory-informed intervention methods and practical applications, (4) Producing program components and materials, (5) Planning program adoption, implementation, and sustainability, and (6) Planning for evaluation (Figure 1) (Bartholomew et al., 2011). The authors describe that in each step necessary information is collected, created or selected to continue with the next step of the protocol, while revision of previous steps based on new insights from subsequent steps is also a common practice. As described in the protocol,

Intervention Mapping is an eclectic protocol that combines multiple theoretical models and encourages program developers to combine a variety of skills to finish each step (e.g., methodological and statistical skills to collect data, management and communication skills to manage a planning group, and insight in behavioural change techniques to select relevant techniques and correctly translate them to applications and materials). In Intervention Mapping the authors argue that the use of multiple models in the protocol is needed to capture the complexity of real life problems, because a theoretical model is always a simplification of reality. Throughout the protocol the authors introduce multiple logic models (e.g., PRECEDE model (Green & Kreuter, 2005), logic model of change) and existing theoretical frameworks (e.g., the socio-ecological model (Richard, Potvin, Kishchuk, Prlic, & Green, 1996) or the Diffusion of Innovations (Rogers, 2003)) to guide program developers through each step and to give program developers insight into the complex reality in which programs have to be developed and implemented (Bartholomew et al., 2011).

This dissertation is situated within step one of the Intervention Mapping protocol, more specifically in reviewing and expanding the available research evidence as part of a needs assessment on alcohol use among students in higher education. This dissertation wants to give an extensive overview of this behaviour as well as all factors that are currently known to relate to this behaviour in order to support future intervention development.

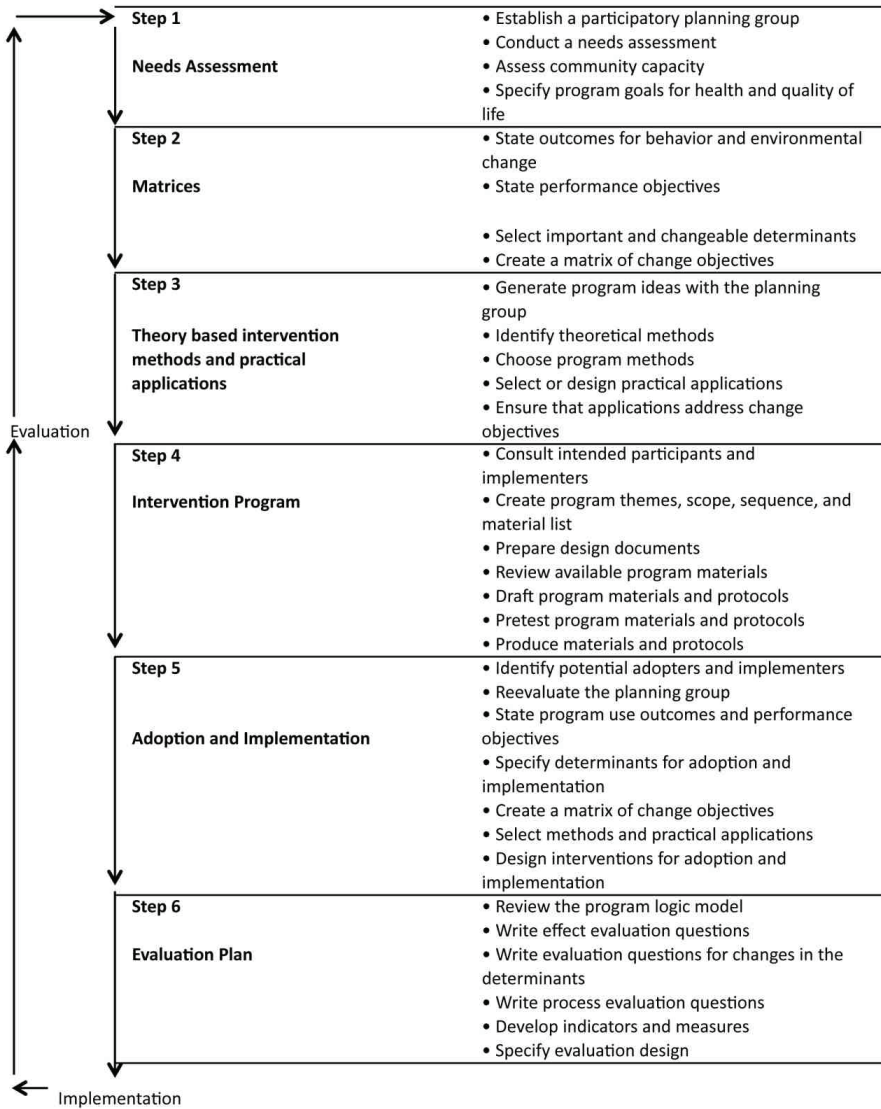


Figure 1: Overview of the Intervention Mapping steps and tasks (Bartholomew et al., 2011)

2 Needs assessment

Obtaining a clear understanding of the discrepancy between a current condition and a more desirable condition regarding the health or health behaviour of a population of interest, is essential for the development of relevant interventions (Bartholomew et

al., 2011). Therefore, a profound analysis of the prevalence of health and social problems, unhealthy behaviours, and the factors related to these behaviours, such as determinants and environmental factors, should precede each process to develop new interventions or to adapt existing interventions. Initially, this analysis should be as broad as possible within the boundaries of the project, to provide program developers (i.e., planning group) with all necessary information to subsequently make a well-advised decision to narrow the focus. These boundaries are the outlines of the project and are arbitrarily determined by the planning group that brings together the different views and experiences of important stakeholders and adds the expertise of actors familiar with the assessment of the problem. These decisions are extremely important, since they determine the elements that will be included, the change that can be pursued, and the intervention that will result from all of this (Bartholomew et al., 2011).

First a general overview is given of the logic model that guides the more factual part of a needs assessment, according to the Intervention Mapping protocol. Next, the relevance for such an analysis in the field of alcohol use in students in higher education is discussed. Finally, the actual overview of the available research evidence in this field is presented, and the need for more research on some of its components is highlighted.

2.1 Logic model for needs assessment (PRECEDE)

The more factual part of a needs assessment gives an extensive overview of the needs of a population at risk for specific health problems. In the Intervention Mapping protocol this analysis is structured by a logic model for needs assessment that is based on the PRECEDE-part of the PRECEDE-PROCEDE model (Bartholomew et al., 2011; Green & Kreuter, 2005). This logic model (Figure 2) describes how health problems lead to a reduction in quality of life, which are the short and long-term effects of health problems on an individual level and on society (e.g., school performance, life satisfaction, costs). Health problems are initiated by both individual lifestyle factors (e.g., risk behaviours) and environmental conditions at different levels. These environmental conditions either directly influence health problems or influence an individual's lifestyle, and are mainly the result of the behaviour of people in the environment of an individual (Simons-morton, Parcel, & Ohara, 1988).

Therefore, both the behaviour of an individual and the behaviour of environmental agents can be described by personal determinants that determine this behaviour. The authors of Intervention Mapping describe four distinct environmental levels, based on the socio-ecological approach (Richard et al., 1996): (1) the interpersonal level that refers to the social environment of an individual (e.g., peers, parents); (2) the organizational level that consists of individuals grouped within systems with specific objectives and a formal multilevel structure (e.g., schools, companies); (3) the community level that encloses both the interpersonal and organizational level and refers to the (geographical) collectives of people in which social networks exist that share common elements, such as common working or living locations, common values, norms, language etc. (e.g., neighbourhoods, cities, online communities); (4) and the societal level that controls all former environmental levels through legislation, enforcement, policies, resource allocation etc. (e.g., governments at different levels). To summarize, a needs assessment provides a social, epidemiological, behavioural and environmental analysis of health problems in a population at risk (Bartholomew et al., 2011; Kok, Gottlieb, Commers, & Smerecnik, 2008).

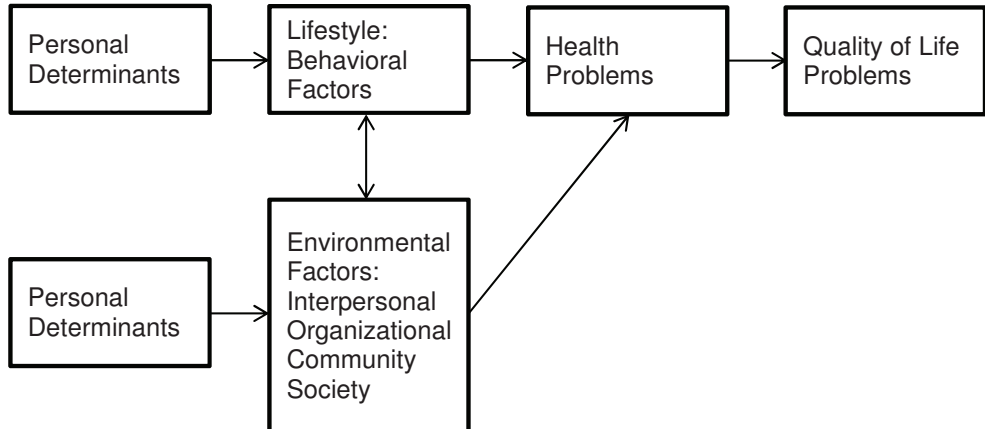


Figure 2: Logic model for Needs Assessment (PRECEDE) (Bartholomew et al., 2011)

Intervention Mapping describes that although the logic model for needs assessment is read from right to left, entering the model to start this analysis can be at any point in the model. The selection of the starting point mainly depends on the assignment a program developer receives. For example, when a program developer works for an agency that focuses on alcohol and drug use, the developer may enter the model at 'lifestyle'. On the other hand, when a program developer works for an agency related

to health policy, the developer may start at 'health problem'. Despite a different starting point, both developers need to complete the entire model, although in a different order (Bartholomew et al., 2011). The present dissertation is part of the research of the health promotion unit of the Department of Public Health, that focuses on understanding health behaviour of children, adolescents, and (emerging) adults. Therefore, the analysis presented in this dissertation will start at 'lifestyle', with alcohol use as risk behaviour in higher education students, being related to multiple health problems (see section 2.3.2).

2.2 Relevance of a needs assessment for alcohol use among students in higher education

Worldwide, alcohol is excessively and regularly consumed by a lot of students in higher education (Hingson, Zha, & Weitzman, 2009; Kypri et al., 2009; Wicki, Kuntsche, & Gmel, 2010), a persistent trend that is less seen in non-college peers (Carter, Brandon, & Goldman, 2010). Therefore, alcohol is an important cause of problematic health-related outcomes (e.g., premature mortality, injury), anti-social behaviours (e.g., vandalism), and decreased academic performance in students (Deliens, Clarys, De Bourdeaudhuij, & Deforche, 2013; Perkins, 2002b; A. White & Hingson, 2013). On the long term, excessive drinking among students in higher education increases the odds for alcohol abuse and dependence in adulthood (Jennison, 2004). A more extensive overview of this behaviour and its consequences will be given in section 2.3.1 & 2.3.2, respectively.

Today, most of the research conducted on alcohol use among students in higher education and most of the interventions that target alcohol use in students originate from the United States. For example, in a review of Tanner-Smith and Lipsey (2015) on brief alcohol interventions for adolescents and young adults, the authors report that 81% of the included studies on young adults were conducted in the United States. Similarly, Dotson, Dunn, and Bowers (2015) reported in their review on stand-alone personalized normative feedback for college student drinkers, that all except one of the included studies were conducted in the United states. Foxcroft, Moreira, Almeida Santimano, and Smith (2015) reported in their review on social norm interventions in students that 79% of the included studies originate from the United States. Furthermore, a search query in Web of Science in November 2015, looking

for studies on alcohol use among students in higher education conducted by American researchers yielded almost 5 times more hits compared to studies conducted by European researchers.

However, as stated by Wicki et al. (2010), the North American drinking context is fundamentally different from the drinking context in Europe. These authors give a few examples of elements that differ between both regions and that show the importance of carefully evaluating the relevance of insights from the North American literature, when using them for interventions in a different context. As a first example, the minimum legal drinking age in the United States is higher than in Europe, which has a considerable effect on drinking behaviour (Subbaraman & Kerr, 2012; Yoruk & Yoruk, 2011). In the United States people are allowed to drink alcohol from the age of 21 years, while in Europe the legal drinking age for alcohol is generally 18 years. In some European countries age limits are even lower, like in Belgium or in Germany where the legal age is 16 years for drinking beer and wine. In a few other countries, like in some Scandinavian countries, the minimum legal drinking age is 20 years (World Health Organization, 2014). Related to this example, Wicki et al. (2010) also discussed that large cross-national studies on health and risk behaviour among adolescents, like HBSC (Currie et al., 2012) and ESPAD (Hibell et al., 2011), consistently showed lower prevalence of alcohol use and risky drinking among adolescents in the United States compared to Europe. Therefore, drinking behaviour in freshmen is probably different in both regions. Also the membership to leisure-time organizations that relate to alcohol use are differently organized in the United States compared to Europe. Being a member of a sports club is related to excessive drinking and alcohol related problems (Ford, 2007; Ham & Hope, 2003; Musselman & Rutledge, 2010). However, sports activities in the United States are mainly organized by educational institutions, while in Europe sports activities are mainly practiced in a private setting, in a sports club or on individual base. Similarly, being a member of a fraternity/sorority or student society is also related to problematic alcohol use (Borsari, Hustad, & Capone, 2009; Ham & Hope, 2003; Rosiers et al., 2014). In the United States many fraternities/sororities are important sources for on-campus social activities (Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee, 1998), provide housing to their members, recruit new members on invitation, etc., while European student societies often organize off-campus activities (i.e., because campuses are often

located in city centres with a lot of bars and social events in the neighbourhood), do not provide housing, are often open for everyone, etc.

Furthermore, popular strategies to target excessive drinking among students in higher education are mainly individual-oriented strategies that try to affect individual determinants through personal (e.g., through email) or interpersonal channels (e.g., a counsellor). Examples of such strategies are providing personalized (normative) feedback (Dotson et al., 2015; Miller, Meier, Lombardi, & Leffingwell, 2015) and other social norm interventions (Foxcroft et al., 2015), motivational interviewing (Ickes, Haider, & Sharma, 2015), using goal setting and decision balance exercises (Tanner-Smith & Lipsey, 2015), teaching protective behavioural strategies (Scott-Sheldon, Carey, Elliott, Garey, & Carey, 2014), and expectancy challenge interventions (Scott-Sheldon, Terry, Carey, Garey, & Carey, 2012). However, many interventions that exclusively use such individual-oriented strategies have a small to moderate effect that in many cases only lasts for a short period of time (Dotson et al., 2015; Foxcroft et al., 2015; Ickes et al., 2015; Miller et al., 2015; Scott-Sheldon et al., 2014).

Other, more comprehensive strategies that target alcohol use among students in higher education at both the individual level and at (multiple) environmental levels have, despite their promising results, only been used by a limited number of program developers, and mainly in the North American higher education context, which leaves plenty of room to learn and to improve future interventions (Marchell et al., 2013; Newman, Shell, Major, & Workman, 2006; Saltz, 2011; Seo, Owens, Gassman, & Kingori, 2013; Turrisi, Jaccard, Taki, Dunnam, & Grimes, 2001; Wolfson et al., 2012). In contrast, such broader strategies are more commonly used in other domains like physical activity and nutrition, with positive effects on these behaviours (Bjelland et al., 2015; Golden & Earp, 2012; Kellou, Sandalinas, Copin, & Simon, 2014; Richard, Gauvin, & Raine, 2011; Roy, Kelly, Rangan, & Allman-Farinelli, 2015), that sustain on the long term (Haerens et al., 2006; Millar et al., 2011; Simon et al., 2014; Simon et al., 2008). By using such a socio-ecological approach, program developers deliver more effective and sustainable interventions (Golden & Earp, 2012; Kok et al., 2008; Richard et al., 2011), since individuals are in constant interaction with their social and physical environment. Individuals' behaviour is, apart from personal determinants, strongly determined by the environmental context in which individuals live and behave. In a socio-ecological approach this interrelationship between an individual

and his/her environment is investigated and targeted in efforts to improve health behaviour (Richard et al., 2011; Richard et al., 1996). Moreover, interventions larded with the socio-ecological approach, such as interventions designed according to Intervention Mapping, not only investigate and target personal determinants and environmental factors, but also invest in the collaboration with the target groups and their community in efforts to better understand contexts and social processes, gain support for interventions, create partnership, empower individuals and communities, develop community resources, etc. (Bartholomew et al., 2011; Richard et al., 2011).

To summarize, in the domain of alcohol use among students in higher education we are seeing a major worldwide problem, while most of the research on this topic is conducted in a North American context and most interventions on this topic mainly focus on individual determinants. However, more and more sound European research becomes available, and slowly but surely intervention developers choose for a socio-ecological approach in this domain. The overall aim of this dissertation is to review and expand the available research evidence that is relevant for the Flemish higher education context, as part of a needs assessment. Both individual-level determinants and the environment in which students live and behave will be taken into account. This analysis will provide a good starting point for program developers in their effort to develop interventions that target (excessive) drinking among students in higher education.

2.3 Needs assessment on alcohol use among students in higher education

2.3.1 Prevalence of alcohol use among students in higher education

a. Alcohol use and drinking frequency, quantity and location

For developing interventions a first crucial step is getting insight into the prevalence of alcohol use in the target population and the drinking culture of this target population. In Flanders, a quadrennial inter-institutional study has been set up to monitor several aspects of the drinking culture in Flemish students. Our research team participated in multiple waves of this study and took part in the coordination of the fieldwork and the reporting of the results of this study (Rosiers, Hublet, Van Damme, Maes, & Van Hal, 2011; Rosiers et al., 2014; Van Damme et al., 2013) (also see section 4.1). Below, several of our findings are discussed and compared with findings from other European countries.

Alcohol is a tremendously popular substance, with a worldwide average consumption of 6.2 litres of pure alcohol per capita (15+ years old) per year. In Europe this average is well exceeded with an average of 10.9 litres of pure alcohol per capita per year and in Belgium an average of 11.0 litres per capita per year. For comparison, the average amount of pure alcohol consumed in the United States is 9.2 litres per capita per year (World Health Organization, 2014).

In Belgium, alcohol is widely used (82% users in the past 12 months) in all age categories, with a modest increase from adolescents and young adults (15-24 years; 77% users in the past 12 months) to middle-aged people (45-54 years; 88% users in the past 12 months), and a decrease towards the elderly (75+ years; 65% users in the past 12 months). In Flanders, the prevalence is slightly higher than the Belgian average (84% users in the past 12 months), with a comparable age distribution, except for adolescents and young adults of whom 84% used alcohol in the past 12 months (Gisle, 2013).

In higher education in Flanders, 93.1% of the students consumed alcohol in the past 12 months (Rosiers et al., 2014), while the Health Interview Survey revealed that in the general population of emerging adults (18-25 years) in Flanders, 86.8% consumed alcohol in the past 12 months (Gisle, 2013). These numbers modestly indicate the differences that tend to exist between college students and their non-college peers, with college students drinking more and more frequently than their non-college peers (Carter et al., 2010). The prevalence of students who consumed alcohol in the past 12 months in Flanders is comparable to the prevalence found in the south of Belgium (i.e., Wallonia), where the prevalence was 94.0% (Lorant, Nicaise, Soto, & d'Hoore, 2013). When compared to other countries, Flemish students (90.2%) had a similar past 30 days alcohol prevalence as students in the Netherlands (90.6%), Denmark (91.2%), and Finland (89.6%), while a small difference was found in students from Sweden (84.9%) (Boot et al., 2012).

When looking at drinking frequency and drinking quantity, differences between some European countries become more visible. In Flanders, 44.2% (Van Damme et al., 2013) to 47.3% (Boot et al., 2012) of the students consume alcohol more than once a week, which is slightly less than the prevalence in the Netherlands (50.5%), but remarkably higher than the prevalence in the Scandinavian countries mentioned

above (between 9.0% in Finland and 36.8% in Sweden) (Boot et al., 2012). This Flemish prevalence is also higher than the prevalence in some eastern European countries, like Bulgaria (37.0%), Poland (15.0%), or Turkey (13.5%), but lower than the prevalence in the south of Europe in Spain (56.5%) (Stock et al., 2009). Concerning drinking quantity, Flemish students are among the more moderate students, since they consume on average 3.7 ($SD = 3.3$) drinks on a typical drinking day, while Turkish students consume the smallest number of drinks (2.1, $SD = 3.6$), and Danish students consume the largest number of drinks (5.9, $SD = 4.5$) of the seven countries that were investigated (i.e., Belgium (Flanders), Denmark, Germany, Slovak Republic, Spain, United Kingdom, and Turkey) (Stock et al., 2014).

With regard to drinking location, pubs were the most popular venues to be visited by Flemish students, with 78.2% of the students visiting bars or pubs at least monthly. Little more than half of the Flemish students (54.2%) visited parties (at home or at a commercial or social venue) at least once a month, and 30.7% of the students visited dancings or clubs at least monthly. In Flemish students, visiting pubs and parties was positively related to drinking frequency, especially for beer and spirits. Visiting dancings or clubs by students was only related to the consumption of spirits (Rosiers et al., 2014). When students were asked about the locations where they consumed alcohol in the past 12 months, the most popular locations were pubs, bars or restaurants (96.5%), parties (78.7%), (student) apartments or institutional housing facilities (63.5%), dancings or clubs (51.4%), and student activities (36.4%) (Rosiers et al., 2011).

b. Heavy drinking patterns

Prevalence of binge drinking, in literature also called heavy episodic drinking, is sometimes difficult to compare in different studies, because of the variation in definitions often used for binge drinking, and because of the variation in reference periods that are reported. In Flanders, binge drinking was defined as drinking six or more alcoholic drinks in two hours in men, and four or more alcoholic drinks in two hours in women. This definition is an adaptation to the Belgian context of the definition for binge drinking by the National Institute on Alcohol Abuse and Alcoholism (NIAAA), based on the quantity of pure alcohol in a standard drink in Belgium and the recommendations of Gmel, Kuntsche, and Rehm (2011) (for more

details see section 5.1) (NIAAA, 2004). In Flanders, 59.2% of the students performed in binge drinking at least once in the past 12 months. For 23.3% of the students this behaviour happened at least once a month, and for 7.8% at least once a week (Rosiers et al., 2014). More to the south of Belgium, in a French study, 29.0% of the students reported binge drinking at least once a month, but in this study binge drinking was defined as five or more drinks in one occasion (Franca, Dautzenberg, & Reynaud, 2010). In another French study that used the same definition for men, but another definition for women (i.e., four or more drinks in one occasion) 16.3% of the students reported binge drinking at least once a week (Tavolacci et al., 2013). East of Belgium, in a German study that used the same gender specific definition (≥ 4 and ≥ 5), 24% of the investigated medical students reported binge drinking once in the previous two weeks, and 28% reported two or more binge drinking episodes in the previous two weeks (Keller, Maddock, Laforge, Velicer, & Basler, 2007). Even more to the east, in a Serbian study, 11.3% of the students reported drinking six or more drinks in one occasion at least once a week (Visnjic, Jovic, & Grbesa, 2015). In a Scandinavian study (i.e., Sweden), that used the same ($\geq 4/\geq 5$) definition for binge drinking as Tavolacci et al. (2013) and Keller et al. (2007), a prevalence of 60.8% for at least monthly binge drinking was reported (Bendtsen, Johansson, & Akerlind, 2006). To conclude, in general Flemish students are among the students in Europe that engaged the least often in binge drinking. However, still almost a quarter of the students drink at least once a month a high volume of alcohol in a short period of time. As also mentioned at the beginning of this paragraph, caution is needed in interpreting and comparing the above discussed numbers.

The AUDIT and its shorter version, the AUDIT-C, are other measures to identify students who are at risk for problematic drinking (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001; Saunders, Aasland, Babor, Delafuente, & Grant, 1993). Based on 10 questions for the AUDIT and three questions for the AUDIT-C, a score on 40 and 12, respectively, is calculated, with a higher score reflecting a higher risk for problematic use. For both measures, gender specific cut-offs are defined to identify students who are at significant risk for problematic use. For the AUDIT, these cut-offs are five for women and eight for men, and for the AUDIT-C, these cut-offs are four for women and five for men (see section 5.1 for details on AUDIT) (Reinert & Allen, 2007). In Flanders, 49.7% of the students were at risk for problematic use according to the

AUDIT, and 54.4% according to the AUDIT-C. This Flemish prevalence is lower than the prevalence reported in an Irish study, that found 66.3% of their students being at risk for problematic use according to the AUDIT-C (Davoren, Shiely, Byrne, & Perry, 2015). In this study the authors used a higher cut-off for both men and women (i.e., 5 and 6, respectively), which only reinforces the conclusion that the Irish prevalence is higher. A similar trend was found in an English study that found 60.6% of its students scoring eight or more on the AUDIT (Heather et al., 2011). In a French study 21.0% of the students scored eight or more on the AUDIT (Franca et al., 2010). Despite the use of no gender-specific cut-off point in the French study, more students are probably at risk for problematic use in Flanders compared to France. A similar trend was seen in a Finish study that found 33.4% of its students being at risk for problematic use according to the AUDIT (Pohjola, Rannanautio, Kunttu, & Virtanen, 2014). However, this study also used the non-gender-specific cut-off of eight. In a Spanish study that used the same cut-off points (i.e., 4 and 5) for the AUDIT-C as the Flemish study, a similar prevalence of being at risk for problematic use (52.2%) as in Flanders was found in nursing students (Sotos et al., 2015). To conclude, Flemish students are not amongst the worst in Europe regarding being at risk for problematic use, but still half of the Flemish students show a critical drinking pattern.

Other popular heavy drinking patterns in students are pre-drinking and playing drinking games. Pre-drinking is a drinking pattern in which students consume alcohol with friends when preparing to go out. In general, students who pre-drink drink more alcohol in one evening compared to evenings on which they do not pre-drink (Hummer, Napper, Ehret, & LaBrie, 2013). In a study conducted in a large southern Belgian university, 67% of the students were engaged in pre-drinking, with an average of 2.3 pre-drinking events per month (Lorant et al., 2013). Drinking games are social activities in which a set of rules are settled about the quantity and the moment that someone has to drink (Zamboanga et al., 2014). At such activities alcohol is often gobbled, which results in a rapid rise of the blood alcohol concentration (BAC) and an increased likelihood for blackouts (Ray, Stapleton, Turrisi, & Mun, 2014). To our knowledge, European data on drinking games participation is scarce, but in a review conducted by Zamboanga et al. (2014), with mainly American studies, prevalence between 25.0% and 60.5% were reported in studies conducted in samples with over 1000 students.

c. Socio-demographic differences

Gender

According to a review conducted by Wicki et al. (2010) on 65 European studies that investigated alcohol consumption in higher education, differences exist between male and female students regarding alcohol use. Overall, male students drink more frequently, drink higher volumes of alcohol, have higher prevalence of binge drinking, and have higher scores on instruments that measure (risk for) problematic use, like the AUDIT, CAGE and DSM-criteria. Similar gender differences were found in more recent studies (Lorant et al., 2013; Pohjola et al., 2014; Sebens, Orosova, Mikolajczyk, & van Dijk, 2011; Visnjic et al., 2015). However, some of these studies were not able to find such difference (Davoren et al., 2015; Heather et al., 2011; Sotos et al., 2015), which was also highlighted by Wicki et al. (2010). A small minority of studies found an opposite gender effect (Bartoli et al., 2014; Wicki et al., 2010). In Flanders, gender differences regarding drinking frequency were only found for beer, wine and spirits (not for appetizers), with a higher prevalence for more than weekly drinking in male students for beer (73.9% vs. 42.4% in female) and spirits (21.0% vs. 14.3% in female), and the opposite for wine (17.2% vs. 27.9% in female). Regarding binge drinking and being at risk for problematic drinking, gender differences were more straight forward and in line with the overall findings that men have higher prevalence of binge drinking (at least once a month: 33.0% vs. 15.4% in female) and are more at risk for problematic use (AUDIT \geq 8 or \geq 5: 53.3% vs. 46.7% in female) (Rosiers et al., 2014).

Living conditions

In general, students who live away from their parents or not with a partner/child, but in a student apartment with roommates or on their own, have heavier drinking patterns than students living with their parents or with a partner/child (Wicki et al., 2010). A positive relation also exists between the number of roommates a student lives with and his/her risk for frequent and abusive drinking (Lorant et al., 2013). A significant relationship between alcohol use and living conditions was also found in more recent studies (Bartoli et al., 2014; Davoren et al., 2015; Lorant et al., 2013; Sebens et al., 2011; Visnjic et al., 2015), as well as in Flanders where students who live in a student apartment had higher prevalence for monthly binge drinking (28.4%

vs. 18.7% in students living with their parents) and were more at risk for problematic drinking (AUDIT ≥ 8 or ≥ 5 : 56.6% vs. 42.1% in students living with their parents) (Rosiers et al., 2014).

Age

No clear conclusion could be distilled from the studies that investigated the relation between alcohol use and age. In some studies a linear relation was found between alcohol use (i.e., drinking volume, drinking frequency, binge drinking) and age (Lorant et al., 2013; Visnjic et al., 2015; Wicki et al., 2010), while in other studies a non-linear relation (e.g. with peaks at certain age categories) or totally no relationship was found (Davoren et al., 2015; Wicki et al., 2010). In the studies that found a linear relationship, different directions were reported (Wicki et al., 2010). In Flanders, no consistent relationship between age and drinking frequency was found (Rosiers et al., 2014), while in relation to indicators of problematic use (i.e., binge drinking, AUDIT), a non-linear relation was reported that was positive until the age of 21 years and went negative from the age of 22 years (Van Damme et al., 2013).

Fraternity/sorority membership

In the North American literature various studies are available that show the relationship between fraternity or sorority membership and alcohol (ab)use, with members of such organizations consuming more alcohol and being more involved in binge drinking than non-member students (Borsari et al., 2009; Ham & Hope, 2003). To our knowledge, in the European literature, studies on this topic are scarce, while differences exist between how European and North American fraternities and sororities are organized (see section 2.2). In Germany, some authors reported data on fraternity or sorority membership (Keller, Maddock, Hannöver, Thyrian, & Basler, 2008; Keller et al., 2007). However, in these studies too few students were member of such organization (i.e., 2% in Keller et al. (2007) and 3.8% in Keller et al. (2008)) to either report data on alcohol use or find any relation with alcohol use. In Flanders on the other hand, 28.4% of the students were member of a student organization and 4.7% of the students were board member of such an organization. In relation to alcohol use, Flemish members and board members both drink beer and spirits more frequently than non-members. Moreover, members and board members of regional

student organizations (i.e., student organizations that are not related to an educational program, but gather students living in the same region) were found being more at risk for problematic use (AUDIT ≥ 8 or ≥ 5 : 86.2% vs. 46.3% in non-members) (Rosiers et al., 2014).

Socio-economic status

European research on the relationship between alcohol use and the socio-economic status of students is rather limited. Based on the self-perceived socio-economic status of students, a positive relationship was found between students who perceived themselves belonging to the wealthier part of the population and heavy drinking (Poscia et al., 2015; Wicki et al., 2010). A similar relationship was found when looking at the educational level of students' parents as indicator for socio-economic status, with higher odds for risky drinking being found in students when parents had a higher educational level (Caamano-Isorna, Corral, Parada, & Cadaveira, 2008; Dantzer, Wardle, Fuller, Pampalone, & Steptoe, 2006). In conclusion, heavier drinking patterns occur in students with higher socio-economic status.

2.3.2 Consequences of alcohol use among students in higher education

a. Health problems and health-related outcomes

The consumption of alcohol has some immediate effects on a drinker. In a review by Zeigler et al. (2005) an overview is given of these acute effects. When sporadic drinkers reach a BAC of 50-150 mg/dL they will feel intoxicated. Depending on the level of their BAC, symptoms of euphoria, coordination- and balance disorder, drowsiness, loss of inhibition, being very talkative, gloominess, and aggressiveness are experienced. When the BAC further increases, drinkers start to encounter lethargy, bradycardia, hypotension, and respiratory depression, possibly complicated with vomiting and pulmonary aspiration. If someone still continues drinking alcohol he or she will run into an alcohol poisoning, with symptoms like stupor, coma, and finally death (median lethal BAC = 450 mg/dL) (Zeigler et al., 2005).

According to the World Health Organization (2014) alcohol consumption is a component cause (i.e., a causal element among other important causal elements) of over 200 health conditions, such as neuropsychiatric conditions (e.g., alcohol use disorders), gastrointestinal diseases (e.g., liver cirrhosis, pancreatitis), a variety of

cancers, intentional (e.g., violence) and unintentional (e.g., by reduced psychomotor abilities) injuries, cardiovascular diseases, foetal alcohol syndrome and preterm birth complications, and infectious diseases. In many of these cases alcohol alone does not cause the disease or injury, because mostly also other causal components need to be present to cumulatively cause a disease or injury. However, the importance of alcohol in causing a disease or injury is mostly dependent on how the alcohol is consumed, i.e., the volume that is consumed, the drinking pattern, and the quality of the alcohol that is consumed (e.g., when contaminated with the toxic methanol) (World Health Organization, 2014).

Worldwide, 5.9% of all deaths (7.6% in men and 4.0% in women) were related to alcohol use in 2012, which means that approximately 3.3 million people died from an alcohol-attributable cause (World Health Organization, 2014). In Europe this proportion was twice as high in 2004, with 11.9% of all deaths (13.9% in men and 7.7% in women) being related to alcohol use (Rehm, Shield, Rehm, Gmel, & Frick, 2012). When specifically looked at the main causes of alcohol-attributable death in 2010, alcohol-attributable cancers caused globally 4.9 deaths per 100000 people, which corresponds to 4.2% of all deaths by cancer; alcohol-attributable liver cirrhosis caused globally 7.2 deaths per 100000 people, which corresponds to 47.9% of all deaths by liver cirrhosis; and alcohol-attributed injuries caused 9.7 deaths per 100000 people, which corresponds to 13.2% of all deaths by injury (Rehm & Shield, 2013). In 15 to 34 years old Europeans, death by alcohol-attributable cancers, liver cirrhosis and injury counted for respectively 3.7%, 72.2% and 26.2% of all deaths by these causes in 2010 (World Health Organization, 2013). In 2012, alcohol consumption caused 5.1% of the global burden of disease and injury (=139 million disability-adjusted life years (DALY's)). The main causes for alcohol-attributable DALY's were neuropsychiatric disorders (24.6% of all alcohol-attributable DALY's), unintentional injuries (20.4%), cardiovascular diseases and diabetes (15.5%), and gastrointestinal diseases (13.6%) (World Health Organization, 2014). In Europe, alcohol consumption caused 4.043 million DALY's in 2004, which corresponds to 10.2% of all DALY's (Rehm et al., 2012). The main causes for these alcohol-attributable DALY's were mental and neurological disorders, unintentional injuries and liver cirrhosis in men, and mental and neurological disorders, liver cirrhosis and cancer in women (Rehm et al., 2012).

Several of the aforementioned consequences (e.g., liver cirrhosis, cancers) occur on the long term after prolonged exposure to alcohol and are less seen in students in higher education. However, other consequences happen more often in students: the most irrevocable consequence seen in students is premature death by alcohol-related traffic deaths or unintentional non-traffic deaths that involved alcohol (e.g., hypothermia, falling, drowning) (Hingson et al., 2009; G. S. Smith, Branas, & Miller, 1999). Other less definitive, but serious alcohol-related problems are non-fatal injuries, physical and sexual assault, unintended and unprotected sex (i.e., increasing the risk for an infection with a sexually transmitted disease and unintended pregnancy), suicide attempt, memory loss (i.e., fragmentary blackouts or complete amnesia for certain events), alcohol abuse and dependence, physical illness (e.g., hangover, nausea, vomiting), aggression (i.e., physically or verbally), overdose, appetite and sleeping problems (Kypri et al., 2009; Maddock, Laforge, Rossi, & O'Hare, 2001; Perkins, 2002b; Wechsler, Lee, Kuo, et al., 2002; A. White & Hingson, 2013). Furthermore, students involved in regular heavy drinking have higher risk for alcohol abuse and dependence later in life (Jennison, 2004; Sher, Grekin, & Williams, 2005).

In Flanders, having a hangover was the most reported consequence encountered in the last 12 months in students who drank in this period, with 68.0% of these students suffering from a hangover at least once in the last year and 15.1% facing it more than ten times in the last year. Feeling sick or vomiting was the second most often reported consequence, with 58.5% encountering this at least once. Feeling regret for something (32.6% at least once), having blackouts (30.7% at least once), and getting injured (14.2%) complete the top 5 of health-related consequences of alcohol use among students in higher education (Rosiers et al., 2014). Furthermore, 5.9% of the students had an increased risk for an alcohol use disorder (i.e., an AUDIT score of ≥ 16 on 40) (Rosiers et al., 2011). To our knowledge, no data is available on alcohol-related deaths in the student population in Belgium.

b. Alcohol-related behavioural problems

Besides health-related problems, alcohol consumption in higher education can also cause a number of other problem behaviours that are relevant in students. Therefore, an overview of these problem behaviours is given. A first category of problem

behaviours is anti-social behaviours, such as vandalism, stealing property, being removed from pubs or clubs, being arrested or other police involvement, driving under influence, and being engaged in illegal activities that are associated with drug use (Kypri et al., 2009; Maddock et al., 2001; A. White & Hingson, 2013). In Flanders, getting involved into a fight (13.9% at least once), driving under influence (8.4% at least once), getting in trouble with the police or school authorities (5.6% at least once), and vandalism (5.2% at least once) were the most prevalent anti-social behaviours in students who consumed alcohol in the last 12 months (Rosiers et al., 2014).

Another category of alcohol-related problem behaviours are the second-hand consequences. These consequences are no immediate burden for the drinkers themselves, but for the social environment of the drinkers. Examples are study and sleep interruption, having to take care of drunken students, being insulted or humiliated (Wechsler, Lee, Kuo, et al., 2002).

Finally, alcohol use among students in higher education is sometimes also related to the consumption of other substances like tobacco and illicit drug and is found to co-occur with other unhealthy behaviours like insufficient physical activity, and low fruit and vegetables intake (Keller et al., 2008; Wicki et al., 2010).

c. Quality of life problems

Alcohol-related problems are related to impaired quality of life and life satisfaction in students in multiple life domains (e.g., school, living environment, family) (Murphy, Hoyme, Colby, & Borsari, 2006; Murphy, McDevitt-Murphy, & Barnett, 2005). However, results are mixed for the relation between alcohol consumption and quality of life. Some studies did not find such relationship (Murphy et al., 2006), while others found a positive relationship between alcohol use and some quality of life or life satisfaction domains, like physical quality of life (Rakovac, Pedisic, Pranic, Greblo, & Hodak, 2013), and social satisfaction and belonging in men (Murphy et al., 2006; Murphy et al., 2005). A third category of studies found a negative relationship between alcohol use and quality of life in students and in adults (respectively, Kistic-Tepavcevic, Gazibara, Popovic, Trajkovic, and Pekmezovic (2013) and Okoro et al. (2004)). The absence of a relationship between alcohol consumption and quality of life may be explained by the compensation of impaired quality of life by improved

quality of life, since both positive and negative consequences occur in students, depending on the dose that is consumed (Murphy et al., 2006). An explanation for finding a positive relation for some quality of life and life satisfaction domains can be norm related, with alcohol being commonly accepted and sometimes even promoted (e.g., by media or industry) as desirable in social activities or gatherings, especially in men (de Visser & McDonnell, 2012; Murphy et al., 2006; Murphy et al., 2005; Rakovac et al., 2013).

A number of specific alcohol-related problems can be categorized as quality of life problems: having negative feelings (e.g., regret, sadness, feeling bad about oneself), impaired academic performance (e.g., missing classes, getting behind with school work), being unable to pay bills, and being reprimanded by someone from the social environment (Carrell, Hoekstra, & West, 2011; Kypri et al., 2009; Maddock et al., 2001; Rosiers et al., 2014; Wechsler, Lee, Kuo, et al., 2002; A. White & Hingson, 2013). In Flanders, 47.0% of the students who drank alcohol in the past 12 months missed a class at least once in this period, while 8.7% missed a class at least ten times. Fifteen percent (15.4%) of the students at least once performed bad on a test or important project. A little less than a quarter (23.1%) of the students who drank in the past year received at least once in this period a comment from someone they know (Rosiers et al., 2014). However, given the cross-sectional design in some of the discussed studies, caution is recommended in interpreting the direction of some of these results, especially about having negative feelings.

d. Socio-demographic differences in alcohol-related problems

A number of studies report differences in alcohol-related problems between men and women, with, in general, men encountering more alcohol-related problems than women (Murphy et al., 2005; Neal & Carey, 2007). A similar pattern was found in Flemish students (Rosiers et al., 2014). Mixed results were found for being a member of a fraternity or sorority, with one study finding a higher prevalence of alcohol-related problems in members of such organisations (Neal & Carey, 2007), and another study not finding such pattern (Murphy et al., 2005). However, these studies were inconclusive about the fact that the higher prevalence of alcohol-related problems in men and (in one study) in fraternity or sorority members is inherent to gender or fraternity or sorority membership, or is caused by the higher drinking prevalence that

is generally observed in these parties (Murphy et al., 2005; Neal & Carey, 2007). Moreover, in heavy drinking students and students who are engaged in pre-drinking and drinking games also a higher prevalence of alcohol-related problems is observed (Hummer, Napper, et al., 2013; Neal & Carey, 2007; Ray et al., 2014). For other socio-demographic characteristics, like age or the number of years in a school, no differences in alcohol-related problems were found (Murphy et al., 2005).

2.3.3 Individual determinants of heavy drinking among students in higher education

a. Motivational model of alcohol use

In this section the 'motivational model of alcohol use' will be introduced as a guide for discussing the determinants of heavy drinking among students in higher education (Cox & Klinger, 1988). In this model the assumption is made that people make a decision to drink (shown in Figure 3) or not to drink (not shown in Figure 3), based on their expectancies about the change in their affective state when drinking alcohol, compared to when not drinking alcohol. These expectancies are established by a number of historical factors (i.e., biochemical reactivity to alcohol, personality traits, socio-cultural and environmental influences, and past reinforcement from drinking) that contributed to a person's past experiences with drinking alcohol, and a number of current factors (i.e., situational factors and a person's current positive and negative incentives) (Cox & Klinger, 1988). These historical and current factors contribute to expectancies about the direct chemical effect (e.g., as mood enhancer) and indirect instrumental effect (e.g., peer acceptance) of alcohol through cognitive processes (e.g., thoughts, perceptions, memories).

Based on the sources of the expected effect of drinking alcohol (i.e., "internal" by the direct effect of alcohol, or "external" by the indirect effect of alcohol through e.g., the social environment) and the valence of the expected effect on the affective state (i.e., enhancing positive affect, or reducing negative affect), four distinct drinking motive dimensions for alcohol use can be distinguished: social motives (external, positive, to obtain social reward), enhancement motives (internal, positive, to enhance positive mood or well-being), conformity motives (external, negative, to avoid social rejection), and coping motives (internal, negative, to attenuate negative emotions) (Cooper, 1994; Cox & Klinger, 1988; Kuntsche, Knibbe, Gmel, & Engels, 2005). These drinking

motives are among the most proximal determinants of alcohol use and are conceptually distinctive from expectancies (Kuntsche, Knibbe, Engels, & Gmel, 2007; Kuntsche, Wiers, Janssen, & Gmel, 2010). Expectancies are someone's beliefs about the effect of alcohol. When someone drinks alcohol to achieve a desired effect (a.k.a. to drink for a specific drinking motive), he or she must have some expectancies about alcohol. However, expectancies alone will not necessarily lead to a drinking event, because at that point someone still has to decide whether he or she will drink. Once this decision is made, he or she will drink for a specific reason (i.e., drinking motive) that relates to his or her expectancies about alcohol. Therefore, a drinking motive always leads to a drinking event, because at that point the decision to drink is already made (Cooper, 1994; Cox & Klinger, 1988; Kuntsche et al., 2005). The decision to drink depends on all the factors in the model that differently predominate in different people. Even within one person different factors will outweigh when the decision is made at different time points (Cox & Klinger, 1988).

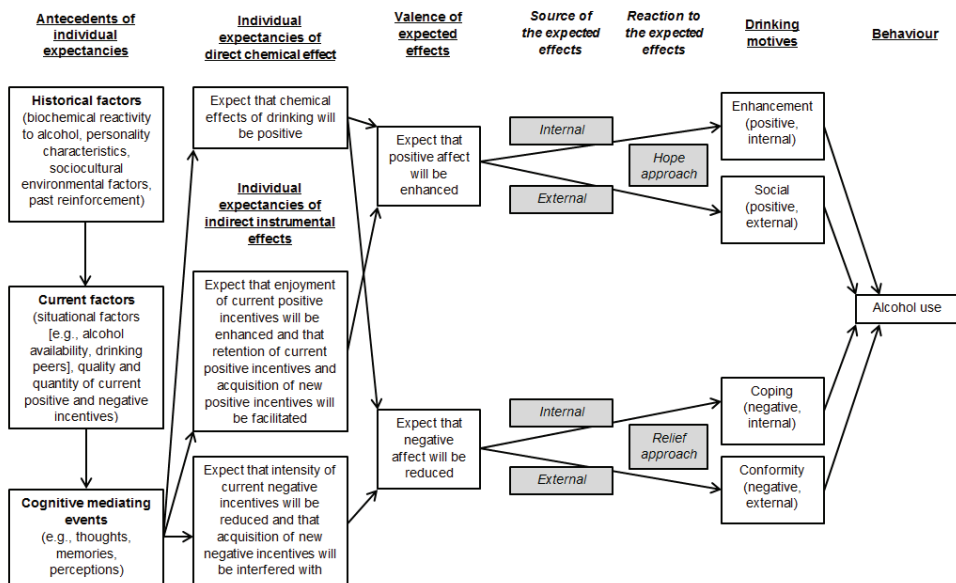


Figure 3: Antecedents, alcohol expectancies, drinking motives, and alcohol use according to assumptions of the motivational model of alcohol use (Cooper, 1994; Cox & Klinger, 1988, 1990; Kuntsche et al., 2005)

b. Overview of the determinants

Historical factors

The historical factors that are discussed below are determinants that frame a person's past experiences with drinking alcohol and, therefore, influence someone's current motivation to drink (Cox & Klinger, 1988). Three important categories of historical factors can be distinguished: biochemical reactivity to alcohol, personality characteristics, and socio-cultural environmental factors. The fourth factor, which is shown in Figure 3, i.e., past reinforcement, is in fact a (feedback) mechanism that describes how someone's positive experiences from drinking in the past, which results from the above mentioned historical factors, reinforce their drinking in the future. Along the way of facing these past experiences, classically conditioned responses to alcohol and the stimuli related to drinking are developed, which further influence the choice of drinking or not. Therefore, these historical factors both contribute to the instalment of habits and the incentive value of drinking (Cox & Klinger, 1988).

Biochemical reactivity to alcohol describes how people physically react to alcohol intake, which is mainly genetically determined (Cox & Klinger, 1988; Morozova et al., 2015). For example, a wide variation exists in the level of metabolic enzymes people produce, which affects the metabolism of alcohol and influences how people experience alcohol intake. Some people produce lower levels of metabolic enzymes, which results in slower metabolism of alcohol and in the experience of stronger negative physical effects, while other people produce higher levels of enzymes with an opposite effect (Cox & Klinger, 1988; Dickson et al., 2006). Another example is the difference in the physiological effects of alcohol between men and women. Women are in general smaller than men, have lower water content per kilogram body weight, or have lower activity of their gastric alcohol dehydrogenase enzyme, which all contribute to a higher BAC in women compared to men when an equivalent volume of alcohol is consumed (Nolen-Hoeksema & Hilt, 2006).

Regarding **personality characteristics**, in general three personality dimensions light up in relation to problematic alcohol use among students in higher education: (1) the traits labelled as sensation seeking, impulsivity and novelty seeking, for which a consistent positive relationship with problematic drinking has been found, especially

in men (Ham & Hope, 2003; Lejuez et al., 2010; Stautz & Cooper, 2013); (2) the traits labelled as neuroticism, emotionality and negative affect, for which both positive and negative relationships with problematic use have been reported depending on the traits considered (Ham & Hope, 2003); and (3) conscientiousness, for which a negative relation with heavy drinking has been found (Cook, Young, Taylor, & Bedford, 1998; Ham & Hope, 2003; Loukas, Krull, Chassin, & Carle, 2000). As expected from the motivational model of alcohol use, personality characteristics also relate to specific drinking motive dimensions, with students who drink for enhancement motives being more sensation seeking, extravert, impulsive, and aggressive types, while students who drink for coping motives being more neurotic types (Cox & Klinger, 1988; Kuntsche, Knibbe, Gmel, & Engels, 2006b). These drinking motives are found to mediate the relationship between personality traits and problematic alcohol use, with enhancement motives mediating the positive relationship between extraversion and heavy drinking, and the negative relationship between conscientiousness and heavy drinking, and with coping motives mediating the negative relationships between neuroticism and conscientiousness, and heavy drinking. (Kuntsche, von Fischer, & Gmel, 2008). Comparable results were found by Adams, Kaiser, Lynam, Charnigo, and Milich (2012), who observed that the positive relationship between both sensation seeking and premeditation (i.e., both impulsivity traits) and problematic drinking was mediated by enhancement motives, while for negative urgency (i.e., impulsive behaviour under conditions of negative affect) a mediating effect by coping motives was found (Adams et al., 2012). This latter result is comparable to those found by Kuntsche et al. (2008), given that negative urgency also relates to low conscientiousness, and high neuroticism (Settles et al., 2012). The mediating role of drinking motives in this personality-alcohol use relationship seems less relevant for external drinking motives, because external motives are more context dependent and less stable over time (Cooper, 1994; Kuntsche et al., 2006b; Stewart & Devine, 2000). Finally, novelty seeking (Hosier & Cox, 2011), impulsivity (Lejuez et al., 2010; Shin, Hong, & Jeon, 2012), and negative urgency (Kaiser, Milich, Lynam, & Charnigo, 2012) were also identified as significant predictors of alcohol-related problems.

Socio-cultural and socio-environmental factors comprise the cultural differences that exist concerning alcohol, and the influence of the social environment (Cox &

Klinger, 1988). As discussed in section 2.2, cultural differences exist between the North American drinking context and the European drinking context, but also within Europe cultural differences regarding alcohol exist between countries. Traditionally, a distinction was made between the wet and dry cultures, with wet cultures like the Mediterranean countries being very tolerant about alcohol (i.e., easy accessible and available, integrated into the daily life and activities, low abstinence rates), and dry cultures like the Scandinavian countries being very restrictive (i.e., more difficult to access and less available, less common in daily activities, high abstinence rates) (Bloomfield, Stockwell, Gmel, & Rehn, 2003). In recent years this dichotomization has been evolving to a homogenization of alcohol consumption over the different countries (Bloomfield et al., 2003; Nemeth et al., 2011), but the fact remains that some cultural differences remain up to date. For example, large variations still exist in the minimal legal drinking age between European countries (World Health Organization, 2014), and in some Scandinavian countries, like Sweden, the government still has a monopoly on alcohol sales, except in bars and restaurants where strict rules apply.

Besides cultural differences, influences from the social environment of people (e.g., peers, family) also affect one's drinking behaviour (Cox & Klinger, 1988). This topic is discussed in detail in section 2.3.4.

Current factors

Current factors are the determinants that play a role at the moment when someone makes a decision to drink or not to drink. Two types of current factors can be distinguished: the situation or context in which the decision to drink is made, and someone's current positive or negative incentives that determine the positive or negative affect that they experience (Cox & Klinger, 1988). Subsequently, these current factors and the previously discussed historical factors induce *cognitive processes* (e.g., thoughts, memories, perceptions) that determine people's expectancies about the effect alcohol can have on their affect (Cox & Klinger, 1988). These expectancies are discussed in the next paragraph.

The current situation or context is another puzzle piece that contributes to someone's decision to drink and to the reasons someone drinks for. Factors such as

the location (e.g. at home or in a bar), the day of the week (e.g., weekdays or weekends), the circumstances (e.g., a get-together, a party, an evening watching TV, with a meal), and the company (e.g., alone, with friends [same-sex, opposite-sex or mixed], with family, or group size) are all related to alcohol consumption and drinking motives (Kairouz, Gliksmann, Demers, & Adlaf, 2002; Patrick, Lewis, Lee, & Maggs, 2013; Studer, Baggio, Daeppe, et al., 2014). For example, drinking at a party or at a bar, with a meal, on Saturdays, or in a group with 4-9 people are all factors that relate to higher consumption (Kairouz et al., 2002). With regard to drinking motives, social drinkers typically drink at mixed-sex parties, in bars and together with their family, enhancement drinkers often drink with same-sex friends, at friends' homes and in bars, and coping drinkers more frequently drink at home (Cooper, 1994).

Current positive and negative incentives in a person's life determine, respectively, the positive and negative affect that one experiences, and contribute to someone's decision to drink and the reason one drinks for. When the quantity or quality of positive incentives are at a certain moment substandard and difficult to pursue, and therefore a low positive affect is experienced (e.g., feeling bored in your work when an important deadline is approaching), weight can be added to the expectation that alcohol can easily change this emotion and enhance positive affect. The opposite is also true when negative incentives are present and a high negative affect is experienced (e.g., feeling stressful for an upcoming test). Then, expectations are nurtured about alcohol easing these emotions (Cox & Klinger, 1988). These mechanisms are recently demonstrated in binge drinking college students who successfully participated in a brief mindfulness intervention. Mindfulness is a technique that makes people aware of current experiences and learns them to accept these experiences. This technique has been shown to have the potential to substitute alcohol in this matter (Mermelstein & Garske, 2015).

A period in the academic year in which contextual factors are less inviting to drink and in which current incentives are typically disproportional compared to the rest of the academic year, is the exam period. This period is characterized by more stress, less external triggers and mainly monotonous activities due to, e.g., a lower availability of peers, lower prevalence of parties and other events, and a different dedication to work. These characteristics go along with a decrease in the volume of alcohol that is consumed in the exam period (Del Boca, Darkes, Greenbaum, &

Goldman, 2004; Noel & Cohen, 1997; Tremblay et al., 2010). However, these “reassuring” findings are mainly based on drinking quantity measures, which leaves some important questions unanswered, e.g., about the prevalence of drinking in the exam period, and about the characteristics of students doing so. Such answers could deliver essential information for future intervention development and accountability on this topic, because of the negative consequences related to alcohol, such as impaired academic performance (Carrell et al., 2011; Deliens et al., 2013), and higher odds for dependence and alcohol abuse in adulthood (Jennison, 2004). These consequences become highly relevant in the exam period, since alcohol can keep students away from their best performance and alcohol consumption in high-demanding situations like the exam period holds the potential risk that alcohol is also (ab)used in high-demanding situations later in life.

In order to understand the characteristics of students who consume alcohol in the exam period, insights should first be gained in the motives that motivate students to drink in this period, since drinking motives are among the most proximal determinants of drinking, which leaves important opportunities for interventions (Cox & Klinger, 1988; Kuntsche et al., 2007; Kuntsche et al., 2010). Given the shift in contextual factors and current incentives in the exam period, students who drink in this period might drink more often to cope with stress, or to enhance or relive a positive affect in the absence of their friends, or for any other internal drinking motive (i.e., coping and enhancement motives) (Cooper, 1994; Crutzen, Kuntsche, & Schelleman-Offermans, 2013). However, to our knowledge, no prior studies investigated the drinking motives that characterize students who drink in the exam period.

A second batch of factors that can provide interesting insights into the characteristics of students who consume alcohol in the exam period are the socio-demographic variables and personality characteristics of these students. These variables are relatively stable over time, which makes them relevant and interesting for profiling (Cox & Klinger, 1988; Kuntsche et al., 2006b; McCrae et al., 2002), and as discussed earlier these variables play an important role in someone’s drinking behaviour and drinking motives. However, to our knowledge, again no other study described students who drink in the exam period in terms of socio-demographic factors and personality characteristics. To contribute in filling these gaps and helping to improve

future intervention development, this dissertation will address these gaps with own original research in *Part 3: Original research articles*.

Expectancies of direct chemical effect

Expectancies of the direct chemical effect of alcohol are people's expectations about how alcohol directly changes their affect through the chemical properties of alcohol (Cox & Klinger, 1988). In general, positive outcome expectancies about the direct effect of alcohol are related to increased consumption and drinking problems, while negative outcome expectancies generally relate to decreased alcohol consumption (Fromme & D'Amico, 2000; Kuntsche, Rehm, & Gmel, 2004; Leigh & Stacy, 1993; Wicki et al., 2010). In a review conducted by Ham and Hope (2003) about drinking in college students, global positive change (i.e., the belief that alcohol creates an overall positive feeling), arousal (i.e., the belief that alcohol heightens the state of physiological arousal, aggression and hostility), sexual enhancement (i.e., the belief that alcohol enhances sexual pleasure), tension reduction, and physical pleasure (e.g., the belief that alcohol makes you feel good) were discussed as positive outcome expectancies that related to increased (problematic) consumption or alcohol-related problems. Some of these relations between expectancies and problem drinking were only found in specific populations, e.g., for arousal-expectancies problem drinking was mainly found in females, and students with stronger tension reduction expectancies were more likely to have psychological problems. Besides these positive outcome expectations, Ham and Hope (2003) also discussed some negative outcome expectancies that increased alcohol consumption or were related to alcohol-related problems, like the expectancy that alcohol use causes cognitive and motoric impairment and feelings of depression. However, these relationships were only seen in heavy drinkers, which might suggest that these negative expectancies are perceived as less- or non-negative by heavy drinkers (Ham & Hope, 2003).

Other relevant examples of positive outcome expectancies related to heavy drinking are feeling more optimistic about life, to express feelings, being funnier, being wittier, forget disappointments, to get drunk, having fun through drinking games, risk-taking thrills, and self-medication of pain (Kuntsche et al., 2004).

Variations in outcome expectancies and drinking behaviour have been reported between people with different socio-demographic characteristics, such as age, gender and culture in a review by Monk and Heim (2013). Age- and gender differences in outcome expectancies were also found in a European review about the characteristics of binge drinkers by Kuntsche et al. (2004), but cultural differences were not supported by these authors. Age differences have mainly been described between the age category that includes students, and older or younger people. No age differences within the student age range have been reported (Kuntsche et al., 2004; Monk & Heim, 2013; Pabst, Kraus, Piontek, Mueller, & Demmel, 2014). Regarding gender differences, male students expressed more positive expectancies than female students (Wicki et al., 2010). However, assigning outcome expectancies to specific subpopulations seems a little bit tricky, because of the sometimes conflicting results between studies. Therefore, Monk and Heim (2013) plead for more attention to the discriminating variables, such as socio-demographic and contextual variables in future expectancy research, and for better standardization of the outcome measures. In their review, Monk and Heim (2013) described that outcome expectancies mainly affect drinking quantity and to a lesser extent drinking frequency. However, this distinction is often not clear in the context of expectancies research.

On the other hand, drinking frequency is rather affected by another type of expectancies, i.e. the efficacy expectancies (Monk & Heim, 2013). In this context, efficacy expectancies are defined as someone's perception of his or her ability to refuse alcohol, with low drink refusal self-efficacy (DRSE) predicting higher consumption. Moreover, high DRSE tends to neutralize the effect of outcome expectancies, with no differences being found in drinking volume between people with high compared to low positive outcome expectancies, while having high DRSE. On the other hand, in people with low DRSE, higher volumes of alcohol were consumed when they had more positive outcome expectancies. In problem drinkers mainly low DRSE and high positive outcome expectancies are found (Monk & Heim, 2013).

Expectancies of indirect instrumental effect

Expectancies of the indirect instrumental effect are people's expectations about how alcohol indirectly changes their affect through the proximal social environment (e.g., through peers) (Cooper, 1994; Cox & Klinger, 1988). Relevant examples in students that relate to (problematic) consumption or alcohol-related problems, are social assertion (i.e. the belief that alcohol increases sociability and assertiveness), social pleasure (e.g., the belief that alcohol adds warmth to social occasions) (Ham & Hope, 2003), sorting out interpersonal problems at home/work, getting closer to the opposite sex, getting along better on dates, social camaraderie (Kuntsche et al., 2004), improvement of social situations and social enhancement, and beliefs about how alcohol will affect the opposite sex (e.g., males drank more when they believed females would have a better time or alcohol would make them happier and more confident. Females drank more when they believed alcohol has an effect on males' tension and romance) (Monk & Heim, 2013). In a recent study, similar expectancies (i.e., sociability) were also found being related to regrettable social behaviours (e.g., sending a shameful message, having conversations you regret afterwards), which are less risky than the previously discussed alcohol-related problems, but are very prevalent and relevant in students. This relation was mediated by drinking quantity (Dunne & Katz, 2015).

In the context of expectancies about the indirect effect of alcohol, perceived social drinking norms are also relevant. Perceived social drinking norms are norms that students perceive from the network in which they are active and in which they drink alcohol (Berkowitz, 2004; Perkins, 2002a). Students want to fit in these networks in search for e.g., friendship, support or intimacy, and therefore drink according to what they believe important others drink (descriptive norm) and what they believe important others find acceptable (injunctive norm) (Berkowitz, 2004; Borsari & Carey, 2001, 2006; Perkins, 2002a). However, students often overestimate the actual drinking norm that rules in these networks (Berkowitz, 2004; Borsari & Carey, 2001; Perkins, 2002a). These misperceptions usually refer to same-sex referents (M. A. Lewis et al., 2011; M. A. Lewis & Neighbors, 2004), and often encourage students to drink more alcohol than they normally would do (Berkowitz, 2004; Perkins, 2002a). Variations exist in how male and female students misperceive the norm, with higher misperceptions in males compared to females (Monk & Heim, 2014). In students,

peers are important referents to estimate the social drinking norms. Clear relations exist between perceived norms about peers' drinking behaviour and a student's own drinking behaviour (Monk & Heim, 2014; Perkins, 2002a; Perkins & Wechsler, 1996), and students spend more time with peers compared to other referents, like parents (Borsari & Carey, 2001; Perkins, 2002a). Peers also often play an active role in alcohol offerings through peer pressure or provocations during social events (Black & Monrouxe, 2014; Borsari & Carey, 2001; Kuntsche et al., 2004; Kypri, Paschall, Maclennan, & Langley, 2007; Zamboanga et al., 2014).

Drinking motives

Based on the valence of the expected effect (i.e., expect that positive affect will be enhanced, or expect that negative affect will be reduced) and the source of the expected effect (i.e., internal, or external [e.g., through peers]), four dimensions of drinking motives can be distinguished, for which people actually drink: social motives (positive, external, e.g., because it makes social gatherings more fun), enhancement motives (positive, internal, e.g., because it's fun), conformity motives (negative, external, e.g., so you won't feel left out), and coping motives (negative, internal, e.g., to cheer up when you are in a bad mood) (Cooper, 1994; Kuntsche & Kuntsche, 2009). In a recent study that investigated affective responses to alcohol use, an increase in positive affect and a decrease in negative affect were observed prior to the initiation of drinking and upon the consumption of the first drink. The observed increase in positive affect did not maintain after drinking, while for negative affect the effect maintained. Effects in affective change and the perception of the effects (i.e., perceiving pleasure, perceiving relief) were even bigger when participants had stronger sociability- or tension-reduction expectancies, respectively (Treloar, Piasecki, McCarthy, Sher, & Heath, 2015). These findings illustrate the effect of alcohol when drinking for specific reasons.

Among students, social drinking motives are the most frequently reported reasons for drinking alcohol, followed by enhancement, coping and conformity motives (Nemeth et al., 2011). About these final three drinking motive dimensions a clear consensus exists concerning their relationship with alcohol use. Enhancement and coping motives consistently relate to heavy drinking and alcohol-related problems (Kuntsche et al., 2005; Kuntsche, Knibbe, Gmel, & Engels, 2006a; Kuntsche et al., 2008; Merrill

& Read, 2010; Nemeth et al., 2011), while for conformity motives in general a negative or no relationship is found with alcohol use (Merrill & Read, 2010; Nemeth et al., 2011). For social drinking motives the relationship with alcohol use in students is less consistent. Some studies found no relationship with heavy drinking and alcohol-related problems (Merrill & Read, 2010; Nemeth et al., 2011), while other studies have found a positive relationship (Corbin, Iwamoto, & Fromme, 2011; Labrie, Hummer, & Pedersen, 2007). Methodological and cultural differences between the aforementioned studies possibly explain this inconsistency.

Two methodological differences between these studies were identified: the use of a selected sample (e.g., only psychology students) (Labrie et al., 2007; Merrill & Read, 2010) versus the use of a more diverse sample (Corbin et al., 2011; Nemeth et al., 2011), and the operationalization of drinking motives by different instruments. The non-supportive studies used the Drinking Motive Questionnaire-Revised Short Form (DMQ-R SF), which is based on the four-dimensional structure discussed earlier (Cooper, 1994; Kuntsche & Kuntsche, 2009), while the supportive studies used other scales: the 'Reasons for Drinking Scale', which is based on only three dimensions (i.e., mood enhancement, social camaraderie, and tension reduction) (Cronin, 1997; Labrie et al., 2007), and a measure of 'broad social motives' that only measures social drinking motives (Corbin et al., 2011; Maggs, 1997).

Cultural differences that were identified were the minimum legal drinking age, and differences in drinking habits between different countries (i.e., United States, Spain, and Hungary). The minimum legal drinking age in the United States is 21 years, while for Hungary this is 18 years and for Spain even 16 years (World Health Organization, 2014). This discrepancy probably explains different drinking patterns in these countries, which might also explain differences in how social drinking motives relate to alcohol use (Subbaraman & Kerr, 2012; Yoruk & Yoruk, 2011). Furthermore, in Europe different drinking habits exist between different countries. For example, countries belonging to the former Soviet Union, e.g., Hungary, are difficult to compare to Western European countries, and even within Western European countries cultural differences towards alcohol exist (Mackenbach, Karanikolos, & McKee, 2013). For example, in Mediterranean countries, e.g., Spain, alcohol use is characterized by meal-related moderate wine drinking, despite a growing trend of 'botellon' (i.e., excessive drinking in large groups on open places) (Nemeth et al., 2011), while in

Belgium, students mainly drink in bars and at (public and private) parties (Rosiers et al., 2014). In *Part 3: Original research articles*, the ambiguity that exists about the relation between social drinking motives and heavy drinking among students in higher education will be further investigated with own original research, in an effort to better inform future developers and to contribute to fill these gaps in the literature.

2.3.4 Environmental factors of heavy drinking in higher education

a. Socio-ecological model

According to the socio-ecological model described in the Intervention Mapping protocol, four environmental levels can be distinguished (Figure 4). First, the interpersonal level that includes the direct social environment of individuals, with family being the initial source of socialization and one of the remaining influences throughout life, and with peers becoming a more important influence as individuals grow up. Besides family and peers other interpersonal environmental actors, such as teachers, coaches, etc. can also be influential through the role they play. The interpersonal level is embedded in a broader environmental level, i.e., the organizational level. This level consist of organizations like schools, leisure-time organizations (e.g., sororities/fraternities), bars, etc. with specific objectives and formal multilevel decision making processes, that bring together individuals from the constituent level. In these organizations specific norms, policies, practices, facilities etc. apply. The third environmental level is the community level. One of the most intelligible forms of a community is the geographical community (e.g., city, village or neighbourhood) that comprises individuals who are united in interpersonal and organizational units, sharing both the physical and social space. Therefore, these individuals are linked by social networks, and share commonalities, such as a shared living or working environment, common values, culture, norms, language, health-related problems etc. In Intervention Mapping communities are much broader defined, beyond the geographical definition. Groups that experience a sense of community but not share physical boundaries can also be seen as communities, such as demographic groups, ethnic groups, online communities, people with shared agendas etc. Finally, the “highest” environmental level in the socio-ecological model is the society level. This level controls aspects of the other three levels through legislation, enforcement, regulation, and resource allocation that relate to the policies that are conducted. Examples of systems in this level are local, national and

multinational governments. Besides a top-down influence, the socio-ecological model also describes that lower level environmental units can affect higher environmental levels, e.g., through elections or social action (Bartholomew et al., 2011).

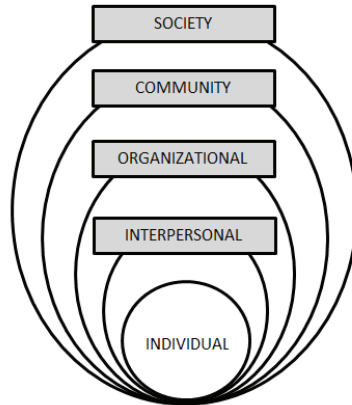


Figure 4: Socio-ecological model (Bartholomew et al., 2011)

b. Interpersonal level

Peers

As people develop through adolescence and enter into adulthood, parental influence decreases, while peer influence increases. In adolescence less time is spent with parents in favour of friends, and attempts of parents to control the selection of and association with friends are resisted. When an individual enters college these processes are intensified in efforts to establish a peer network that is a source for intimacy, support, and stability (i.e., parameters of quality peer relationships), and that can provide role models and social opportunities to assist students in the transition to college. (Borsari & Carey, 2001, 2006). Alcohol is a facilitator in this transitional process, and represents freedom from parental control. Alcohol is omnipresent in college life (e.g., present at many social events), which contributes to the influence of peers on an individual's behaviour and attitudes regarding alcohol (Borsari & Carey, 2001). In this context strong relationships have been found between an individual's drinking behaviour and attitudes, and these of his/her peers. Having more drinking buddies or being involved in heavy drinking networks have been related to an individual's own heavy drinking or increase in drinking (Barnett et al., 2014; Borsari & Carey, 2001; DeMartini, Prince, & Carey, 2013; Guo, Li, Wang,

Cai, & Duncan, 2015; Ham & Hope, 2003; Kuntsche et al., 2004; Reifman, Watson, & McCourt, 2006). Friendships between peers enhances this peer effect, but tend to be not a necessity for peers to have influence on an individual's drinking (Guo, Li, Owen, Wang, & Duncan, 2015).

The relationship between peers' and individuals' drinking can be explained by two mechanisms, peer selection and peer socialization. Peer selection is the search for friends who share similar characteristics as the individual (e.g., prior to alcohol consumption) (Steglich, Snijders, & Pearson, 2010). From a more sociological perspective, peer selection is explained by the interaction of people with similarities, who are attracted to joint activities that are organised around mutual foci (e.g., places people, social positions). Such interactions can then result in friendships (Feld, 1981). Peer socialization, on the other hand, is the mechanism of learning and adhering norms and behaviour from a peer group (Steglich et al., 2010). In relation to alcohol use, both mechanisms have been empirically confirmed in multiple studies (Abar & Maggs, 2010; Borsari & Carey, 2001; Capone, Wood, Borsari, & Laird, 2007; Kendler, Myers, & Dick, 2015; Kuntsche et al., 2004; Park, Sher, & Krull, 2008), and tend to be reciprocally related. For example, when entering college, heavy drinking individuals select heavy drinking peers. These heavy drinking peers then encourage these individuals to maintain or increase their heavy drinking through socialization (Capone et al., 2007; Park et al., 2008). When the individuals have to select new peers (e.g., after graduation), again like-minded peers are sought out (Boyd, Corbin, & Fromme, 2014).

According to the social learning theory, peer socialization or peer influence goes along two pathways, a direct active pathway and an indirect cognitive-based pathway (Maisto, Carey, & Bradizza, 1999). These pathways are uniquely associated with binge drinking and alcohol-related problems (Wood, Read, Mitchell, & Brand, 2004). The direct active pathway includes peer behaviours that focus on getting someone to drink. This behaviour can be gentle and polite (e.g., by buying a round, or getting someone a drink) or more coercive (e.g., by forcing someone to drink during drinking games) (Black & Monrouxe, 2014; Borsari & Carey, 2001). In general, these active offers can be more easily resisted by more mature and social-confident students (Borsari & Carey, 2001). The indirect cognitive pathway runs over three constructs: (1) social reinforcement or differential reinforcement, which is receiving

consequences for a behaviour. These consequences can be different in different social contexts; (2) modelling or vicarious learning, which is acquiring new behaviours based on observation of others or through verbal or written communication, and through perceptions of attitudes and behaviours that are typical and/or approved by others; and (3) cognitive processes (i.e., self-efficacy and outcome expectancies) that contribute to the interpersonal influence on drinking, by often mediating this relationship (Borsari & Carey, 2006). These cognitive processes and the role of perceptions in someone's decision to drink are also discussed in section 2.3.3, that covers the personal determinants of heavy drinking among students in higher education. In this section, the motivational model of alcohol use describes that social influences, such as peer influences, contribute to the development of cognitions, which then are taken into account in someone's decision to drink. This mediating role of cognitions in the positive relationship between social influence (i.e., peer pressure to misconduct) and alcohol outcomes (i.e., drinking volume and binge drinking) has also been empirically shown in a Swiss study that found mediation by internal drinking motives in this relationship in young men. Therefore, young men who experience a lot of peer pressure possibly learned the desirable effects of alcohol from their peers and consequently learned maladaptive strategies to regulate their affective state (Studer, Baggio, Deline, et al., 2014).

The influence of social reinforcement, modelling and cognitive processes on alcohol use tends to be affected by the quality of peer relationships (i.e., determined by the stability, intimacy and support of a relationship) (Borsari & Carey, 2006). This influence of the quality of peer relationships goes along three pathways. First, the lack or breakdown of quality peer relationships, in which mainly cognitive processes determine alcohol consumption to handle with the lack of stability, intimacy and support, and in which social reinforcement and modelling are less influential because of the absence of quality relationships. Second, good quality peer relationships in which alcohol is an integral part. In such relationships valued peers encourage alcohol use through social reinforcement and modelling. This social drinking goes along with positive outcome expectancies and low DRSE, which further reinforce alcohol use. Third, good quality relationships with peers who disapprove alcohol use or abstain from it, which leads to valued peers who encourage abstinence and light

drinking, through social reinforcement, modelling and cognitive processes (i.e., low expectancies and strong DRSE) (Borsari & Carey, 2006).

Finally, a number of model-related factors can be identified that influence an individual's alcohol consumption: the concurrent drinking of the model(s), that influences the amount of drinking and the decision to drink alcohol of an individual; the group composition, whereby an individual in a two-person group matches the drinking rate of the fastest drinker, and in larger groups the drinking rate of the majority; the sociability of the model, with individuals mainly matching sociable heavy drinking models, or in the company of unsocial drinkers increase drinking as reaction to the adverse environment or to fight boredom (Borsari & Carey, 2001); and the high status of the model, since high status members in a group are important to set and maintain group norms. These members often encourage others to drink by reinforcement, punishment or more direct behaviours (e.g., by buying drinks for others), and often drink a lot themselves (Dumas, Wells, Flynn, Lange, & Graham, 2014). A number of factors that increase an individual's sensitivity to peer influence can also be identified: being a heavy drinking individual, having a family history of drinking problems, being male, and having a medium genetic propensity for alcohol use (Borsari & Carey, 2001; Guo, Li, Wang, et al., 2015). However, caution should be exerted when transferring these factors to different cultures, since cultural differences in drinking culture can make some factors less relevant or the opposite (Kuntsche et al., 2004). For example, North-American students drink in rounds and match the speed of the fastest drinker, while Scottish students drink more at an individual pace (Delk & Meilman, 1996).

Parents

Despite the heightened influence of peers in college, parents still affect their children's drinking behaviour in higher education. Numerous studies have shown that (perceived) heavy or problematic drinking by parents, (perceived) permissive parenting towards alcohol (e.g., accepting underage drinking, being flexible in limits or setting no limits), lower levels of (perceived) parental monitoring and knowledge (e.g., about students' whereabouts, activities and associations), and/or having a poor parent-child relationship positively relate to alcohol use (Abar, 2012; Abar, Abar, & Turrisi, 2009; Abar, Turrisi, & Mallett, 2014; Boyd et al., 2014; Fairlie, Wood, & Laird,

2012; Glanton & Wulfert, 2013; LaBrie & Sessoms, 2012; Pearson, D'Lima, & Kelley, 2012; Steiner, Schori, & Gmel, 2014), and alcohol-related problems in students (Abar et al., 2009; Backer-Fulghum, Patock-Peckham, King, Roufa, & Hagen, 2012; Boyle & Boekeloo, 2006; Elliott, Carey, & Bonafide, 2012; LaBrie & Sessoms, 2012).

These parental characteristics are more influential when they appear in combination (e.g., parents who drink heavily and are permissive towards alcohol and know little about their children's whereabouts). In two studies by Abar (2012) and Abar et al. (2014), parenting profiles that were characterized by multiple of these risk factors clearly related to high levels of drinking, while differences in offspring's drinking between parenting profiles that contained various proportions of both risk and protective factors (e.g., high disapproval, high monitoring and knowledge, or good quality relationships), or only protective factors were less clear. In these latter profiles positive parenting qualities probably buffered less adaptive parenting qualities (Abar, 2012; Abar et al., 2014). Besides the combination of parental characteristics that reinforces the effect of parental influence, contextual factors also appear to play a role in parental influence. For example, perceived parental drunkenness in collegiate, sports, or public context (e.g., tailgating at football games) has a positive effect on students' alcohol use. This effect can possibly be explained by the association that students learn between heavy drinking and social or sports activities, or by the ease of recalling such salient moments when students have to make a decision to drink themselves (Abar, Turrisi, & Abar, 2011).

Parental communication about alcohol also has an influence on students' alcohol use. When parents mainly focus on the negative aspects and consequences of alcohol use (e.g., dangers of driving under influence, academic consequences) (Boyle & Boekeloo, 2009; Menegatos, Lederman, & Floyd, 2016) or mainly discuss harm reduction messages with their children, students are more driven towards risky consumption (compared to zero-tolerance or disapproving messages) (Abar, Morgan, Small, & Maggs, 2012; LaBrie, Boyle, & Napper, 2015). Students even consume more alcohol when they receive harm reduction messages from their parents compared to when they receive no messages at all (Abar et al., 2012). Despite the fact that harm reduction messages seem to work in other settings, like treatment settings or school, parental harm reduction messages tend to be equally perceived as parental approval towards alcohol, which has the opposite effect (Abar et al.,

2012). A number of studies have shown that parental communication is affected by parents' perceptions about the likelihood of alcohol-related consequences, and by perceptions about other parents' approval of alcohol use by their children. Parents often overestimated the likelihood of negative consequences (Napper, Grimaldi, & LaBrie, 2015) and often overestimate other parents' approval (LaBrie, Hummer, Lac, Ehret, & Kenney, 2011). Perceived likelihood for negative consequences has been found to predict parents' intention to communicate with offspring (Napper et al., 2015), while the overestimation of other parents' approval makes parents more permissive towards alcohol, which affects communication and monitoring (LaBrie et al., 2011).

In higher education parental influence operates more indirectly, since parenting behaviour has been found to affect peer selection (Abar & Turrisi, 2008; Boyd et al., 2014) and moderates the effect of peer influence on students' alcohol use and alcohol-related consequences (Wood et al., 2004). Students with parents who know little about their free-time pursuits and activities associate more with heavy drinking peers (Abar & Turrisi, 2008), and students with heavier drinking families have been found to select peers that they perceived as heavier drinkers (Boyd et al., 2014). When higher permissive parental drinking limits or lower levels of parental monitoring were perceived, relationships between peer influence and student's binge drinking or alcohol-related consequences have been found to be the strongest (Wood et al., 2004).

These indirect effects tend to operate through students' own cognitions that are affected by parental influence. For example, having the perception of high parental approval towards alcohol relates to a higher student's approval towards alcohol, compared to when low parental approval is perceived. However, when parental approval is perceived as low, a student's approval towards alcohol increases as less parental knowledge is perceived (Hummer, LaBrie, & Ehret, 2013). In another study, recently perceived parental alcohol use positively related to higher positive outcome expectancies, lower self-efficacy, and higher intention to use in offspring (Glanton & Wulfert, 2013). These findings are conform one of the three pathways that are described in the theoretical framework on the intergenerational transference of alcohol use from J. M. Campbell and Oei (2010). According to this framework, parental influence goes through (1) a genetic pathway that describes the role of the

inheritance of genes (i.e., the contribution of similarities in genetic makeup between parents and offspring to similarities in alcohol behaviour); (2) a genotype-environmental pathway that describes the effect of the relationship between genetic factors (e.g., specific genes) and environmental factors (e.g., poor family functioning, because of parental problem drinking); (3) and a cognitive pathway that describes the role of cognitive factors (e.g., alcohol expectancies) (J. M. Campbell & Oei, 2010).

Besides current parental influences on students drinking, long-term effects of parental drinking are also described (Seljamo et al., 2006; H. R. White, Johnson, & Buyske, 2000). However, little is known about how these long-term effects operate through offspring's cognitions, such as drinking motives. According to the cognitive pathway of the earlier discussed theoretical framework, parental drinking behaviour shapes offspring's drinking through cognitive factors like alcohol expectancies (Bandura, 1986; J. M. Campbell & Oei, 2010). As discussed in section 2.3.3, such alcohol expectancies play an important role in someone's drinking motives (Cox & Klinger, 1988; Kuntsche et al., 2007; Kuntsche et al., 2010; Muller & Kuntsche, 2011), which suggests that offspring's drinking motives mediate the intergenerational relations between parental drinking and offspring drinking. Despite a clear theoretical embedment (J. M. Campbell & Oei, 2010; Cox & Klinger, 1988), only a few cross-sectional studies have investigated this mediation, with mixed results on the type of drinking motives involved in the relationship between parental and offspring drinking (Muller & Kuntsche, 2011; Woldt & Bradley, 2002). One study found a mediating effect of enhancement and interpersonal facilitation motives (i.e., conformity motives) (Woldt & Bradley, 2002), while the other found a mediating effect for all but conformity motives (Muller & Kuntsche, 2011). A few differences exist between these studies that might explain these distinct findings. In one study participants were offenders of driving under influence, aged between 17 and 71 years in the United States (Woldt & Bradley, 2002), while in the other study participants were adolescents from the general population in Switzerland (Muller & Kuntsche, 2011). Moreover, different instruments were used to assess both drinking behaviour and drinking motives, which might also explain why both studies found different drinking motives that mediate this intergenerational relationship to alcohol use.

Besides these differences, both studies have a number of similar limitations. First, the cross-sectional study design in both studies only allows to draw conclusions on the

relation between parental drinking, and offspring's drinking and drinking motives at one specific point in time. By using a longitudinal design the influence of past parental drinking patterns on offspring's drinking can be investigated. Such long-term effects are important, because prior to the first drinking experience, cognitive foundations are established through parental modelling (J. M. Campbell & Oei, 2010; Van der Vorst et al., 2013). These cognitive foundations are then further reinforced after alcohol is (repeatedly) consumed (J. M. Campbell & Oei, 2010; Van der Vorst et al., 2013). A second limitation is that these studies only measured parental drinking as perceived by their offspring. Offspring are not the most accurate source for parental drinking and are only one source for this behaviour, while all family members experience alcohol-specific socialization (e.g., rule setting, talking about alcohol use) differently (G. T. Smith, Miller, Kroll, Simmons, & Gallen, 1999; van der Vorst, Engels, Meeus, Dekovic, & Van Leeuwe, 2005). Therefore, conclusions from these studies should be generalized with caution (van der Vorst et al., 2005) and the effect of parental drinking should be investigated from additional family viewpoints (e.g., parents themselves). Finally, with the available studies, only data from two countries is available, which makes replication in other countries necessary (Kuntsche et al., 2004). In *Part 3: Original research articles*, the relationship between parental drinking during childhood and offspring's drinking at college age will be investigated in a third original research paper.

Other interpersonal actors

Another interpersonal actor that influences alcohol use in students are sports coaches. In two studies that described the role of coaches in this matter in college athletes, a similar role is attributed to coaches as to parents. In these studies perceptions of coaches' attitudes towards alcohol and coaches' approval towards alcohol were related to alcohol consumption in college athletes. The direction of these relation was similar to those described in parents, with looser perceived attitudes and higher perceived approval being related to higher consumption in students (T. F. Lewis, 2008; Mastroleo, Marzell, Turrisi, & Borsari, 2012).

As discussed in section 2.3.4a, teachers can also be an influential interpersonal actor through the role they play. However, to our knowledge no evidence is available on the interpersonal influence of higher education staff on students' drinking behaviour.

University staff has been found to drink heavily (Awoliyi, Ball, Parkinson, & Preedy, 2014), which can affect students' drinking behaviour through modelling (e.g., when alcohol is consumed by staff in the presence of students) or through cognitive pathways. However, these mechanisms are hypothetical, and probably conditional (e.g., students must perceive staff members as role model) and culturally dependent. In the next section, the role of university staff's behaviour and cognitions in the development of norms at organizational level is described.

c. *Organizational level*

Educational institutions

Faculties (i.e., the colleges or schools in the Northern American educational system) are structures within an educational institution between which variations exist in alcohol use (Borsari & Carey, 2001; Bullock, 2004; Webb, Ashton, Kelly, & Kamali, 1997). These variations may be due to compositional differences between faculties, given that students with similar characteristics tend to cluster in faculties: for example, in some faculties the majority of students is male or female (Lorant & Nicaise, 2014), and in most faculties students share common personality traits (Lievens, Coetsier, De Fruyt, & De Maeseneer, 2002). These compositional differences lead to variations between faculties in the reference group that is used to estimate the drinking norm, which may explain the variation in alcohol use between faculties (Perkins, 2002a). Besides these compositional differences, real environmental characteristics may also play a role. For example, between faculties differences exist in the connections between students in these faculties, which relates to the drinking behaviour in these faculties (Lorant & Nicaise, 2014). In higher density faculties (i.e., faculties with many connections between students) drinking behaviour and drinking norms are easier spread than in lower density faculties. Other environmental characteristics that may differ between faculties are the behavioural and personal values communicated to students by staff members in those faculties (Perkins, 2002a; Wicki et al., 2010). Even these staff members are not immune for misperceptions of the social norms, which might affect, e.g., attitudes towards campaigns or the policy that is conducted (Berkowitz, 2004). These characteristics contribute to whether an environment is more permissive or restrained towards alcohol, which affects how students perceive norms and affects their drinking

behaviour (Perkins & Wechsler, 1996; Tankard & Paluck, 2016). However, to our knowledge, only a handful of European studies investigated differences in alcohol use between faculties (Bullock, 2004; Lorant & Nicaise, 2014; Webb et al., 1997). In *Part 3: Original research articles*, variance in frequent binge drinking at faculty level, and the differential relationship of individual and faculty-level factors with frequent binge drinking will be investigated with own original research, in an effort to provide more insight in this matter and to inform future intervention development.

Further literature on specific institution-related factors that influence college drinking is very limited, as we are aware of only one (Northern American) study that discusses such factors (Presley, Meilman, & Leichter, 2002). Examples are institutional affiliations (e.g., historically blacks' or women's institutions), the presence of a fraternity/sorority, the presence of athletics, 2- or 4-year designation, institution size and location, and residence type. However, several of these college characteristics are difficult to extrapolate to a European higher educational context. Besides institutional risk factors, numerous environmental actions are described that can be implemented on campuses to reduce alcohol consumption (DeJong & Langford, 2002; Toomey & Wagenaar, 2002). An effective example is implementing a policy at campuses that e.g., restricts alcohol availability, regulates pricing and advertising, works on social norms, and minimizes harm. Such findings suggest that institutions without such alcohol policies towards students (and staff) give a more permissive impression, which might affect alcohol consumption in the end. Again, cultural differences are very important to take into account in this matter. In Flanders, we are not aware of a thorough alcohol policy towards students in various (large) institutions, either because they are absent, or because they are badly communicated towards students and staff. However, both cases are problematic.

Fraternities and sororities

Another relevant organizational system that influences students drinking is a fraternity or sorority. As discussed earlier in section 2.3.1a, membership of such organizations is related to increased levels of alcohol consumption. However, to our knowledge no literature is available on organizational risk factors that contribute to increased consumption (e.g., the availability of only alcoholic beverages at a cantus, the intolerance towards drinking an alcohol-free drink in between alcoholic drinks at a

cantus). Furthermore, large regional differences exist regarding how fraternities and sororities are organized. For example, in Belgium, fraternities and sororities in one city have a patronized pub, while in another city many fraternities and sororities have a pub they exploit themselves.

Bars

A third organizational system worth discussing is bars. A number of bar characteristics are related to increased consumption or over-serving in bars. When bars advertised offerings with discounted prices, customers' consumption expectations were higher and exceeded or approached the levels of binge drinking (Christie et al., 2001). Loud environmental music in bars was also related to increased consumption and a decreased average time spent on drinking a glass (Guéguen, Jacob, Le Guellec, Morineau, & Lourel, 2008). In bars with a general indifference towards customers' behaviour, intoxication levels were higher (Hughes et al., 2012). Regarding over-serving, relations were found with poor lightning conditions and high levels of music (i.e., hampers ability of assessing intoxication level), gender of the intoxicated customer (i.e., likelihood for over-serving was higher in female customers) (Buvik & Rossow, 2015), the intoxication level of bartenders (Reiling & Nusbaumer, 2006), the age of the servers (i.e., young servers over-served more), and the presence of a bouncer (Hughes et al., 2014). According to bartenders, hectic working conditions, avoiding conflict and maintaining a good atmosphere are important reasons for over-serving. Furthermore, "serving is the rule, and denial of service is the exception" (p.1) (Buvik, 2013).

d. Community level

Offline communities

In higher education, higher binge drinking rates are found in 'wet' alcoholic environments. These environments are characterized by both on-premise (e.g., bars) and off-premise (e.g., shops) establishments with high availability of large volumes of alcohol, low alcohol prices, and frequent promotions and advertisements. Such alcohol promotions and advertisements occur frequently in student-dense areas, e.g., in alcohol outlets around campuses (Kuo, Wechsler, Greenberg, & Lee, 2003). 'Wet' communities are also characterized by high densities of alcohol outlets, which is

related to heavy and frequent drinking and alcohol-related problems in students (Scribner et al., 2010; Scribner et al., 2008; Weitzman, Folkman, Folkman, & Wechsler, 2003). Variations exist in the alcohol outlet density near university campuses, with higher rates of (binge) drinking and alcohol-related problems being found on campuses with more alcohol outlet located in the neighbourhood (Kypri, Bell, Hay, & Baxter, 2008; Wechsler, Lee, Hall, Wagenaar, & Lee, 2002). In such neighbourhoods also more second hand problems (e.g., noise, vandalism, litter) are experienced by people who live there (Kypri et al., 2008; Wechsler, Lee, Hall, et al., 2002). In more recent studies, a negative relation was found between the distance that someone is living from a bar and extreme drinking occasions and heavy drinking. Moreover, when someone's living distance to a bar decreased as a consequence of moving, risky alcoholic behaviour in that person increased (Halonen, Kivimäki, et al., 2013). Similar results were found for women living nearby off-premise outlets (Halonen, Kivimaki, et al., 2013). These results are very relevant in students, given that many students move from smaller towns with lower alcohol outlet densities to bigger cities with higher alcohol outlet densities when studying in higher education. In a Belgian study differences in (heavy) drinking by students were found between two university campuses, of which one was located in a student-dense area (i.e., about 50% of the inhabitants were students) with many drinking opportunities and of which one was located in an area with a more mixed population. On the campus located in the student-dense area alcohol use was found to be higher (Lorant et al., 2013). However, in this study no information was given on community characteristics, such as alcohol outlet density or the frequency of promotions etc., which makes it difficult to attribute the found differences in alcohol consumption to such community characteristics.

Online communities

In an overview by Moreno and Whitehill (2014), the influence of social media on young people's alcohol use is discussed. Social media, like Facebook and Twitter, are very popular online communities that form a new environment for exposure to and influence by alcohol-related content in young people. This content can be pro-alcohol messages, alcohol-related images and unregulated marketing, and correlates to offline alcohol behaviour and risky drinking. This way social media influence young people's drinking behaviour through peer alcohol behaviour and alcohol advertising.

On social media rarely negative consequences are displayed, which also adds to the stimulatory character of social media towards alcohol use. In an effort to better understand the influence of online communities, classical behavioural theories like the 'social learning theory' (i.e., the observation of peers) and the 'media practice model' (i.e., information is explored or content is displayed based on experiences or behaviours under consideration, which works reinforcing and promotional) provide interesting insights. However, a new model is in development (i.e., the Facebook Influence Model) that specifically maps and tries to explain the influencing aspects of social media. This model describes 4 general roles of Facebook (i.e., connection, comparison, identification, and immersive experience), that further contain (in total) 13 clusters of more detailed aspects about these roles (i.e., for connection: connection to people, far reaching, fast communication, business and promotion, accessible and adaptable, data and information; for comparison: curiosity about others, establishing social norms; for identification: identity expression, influence on identity; for immersive experience: distractions, positive experiences, negative experiences) (Moreno, Kota, Schoohs, & Whitehill, 2013).

e. Society level

At society level, macro-economic factors such as the Gross Domestic Product (GDP) have been found to relate to heavy drinking, with heavy drinking being more common in countries with a higher GDP (Dantzer et al., 2006). Furthermore, as discussed in section 2.3.3b, some societies are more permissive towards alcohol than others (Bloomfield et al., 2003). In such societies often higher rates of pure alcohol per capita are registered (World Health Organization, 2014). For example in Belgium, which is located at the upper end concerning pure alcohol consumption per capita in Europe, alcohol is socially well accepted and widely available. In Belgium the minimum legal drinking age is 16 years for beer and wine, and the maximum legal BAC for driving a vehicle (by young adults) is 0.05%, which are amongst the lowest and the highest, respectively, in Europe (World Health Organization, 2014). However, compliance of the minimum legal drinking age in Belgium seems rather limited, since a "mystery shopping" study in 2015 revealed that 4 in 5 bar keepers and 5 in 6 off-premise establishments did not obey the law by serving or selling alcohol to adolescents younger than 16 years (from a press release from the Association of Alcohol and other Drug Problems (VAD, 2015)). Furthermore, in Belgium alcohol

advertising, product placement, sponsorship and sales promotion are regulated through non-legal regulations (i.e., a covenant on behaviour and advertising regarding alcoholic drinks, which is co-regulated by the industry, consumer organizations, and the government) and some addenda to the federal general Consumer Act and the Flemish, Walloon, and German Media Decree (De Donder, 2014) However, advertising, -product placement, -sponsorship and -sales promotion are omnipresent in Belgium and often directed towards students and young adults (De Donder, 2013).

3 Overview objectives of the original research articles

Throughout the above performed needs assessment about alcohol use among students in higher education various research gaps were disclosed. In addition to describing this needs assessment, this dissertation wants to contribute in filling a number of the discussed research gaps. In an effort to create some clarity on these topics, four original research articles will be presented in *Part 3: Original research articles* (Figure 5). In the following paragraphs an overview will be given of the research aims of these original research articles. Furthermore, in *Part 2: Methodology* an overview is given of the study designs and general measures used in the original research articles.

3.1 Individual level

Objectives first original research article (also see section 2.3.3b, current factors)

The first original research article will shed a light on student drinkers in the exam period, since contextual factors are less inviting to drink in this period and current incentives are typically disproportional compared to the rest of the academic year by the increased stress, the lesser external triggers and the mainly monotonous activities that are typically experienced in this period. Given that to our knowledge the prevalence and profile of student drinkers in the exam period are unknown, the aim of this study is to investigate the prevalence of non-abstainers, as well as the magnitude of weekly drinking in the exam period in a heterogeneous (i.e., from a wide variety of disciplines) sample of students from a large Flemish (northern Belgian) university. Moreover, to inform future intervention development, this study wants to give insight

into the drinking motives, socio-demographic factors and personality characteristics that characterize those non-abstainers and weekly drinkers in the exam period.

Objectives second original research article (also see section 2.3.3b, drinking motives)

The second original article tries to obtain insights into the drinking motives of students in higher education in relation to heavy alcohol use, given that no consistent results are available on the relationship between social drinking motives and heavy use. Therefore, the aim of this study is to investigate the relationship between drinking motives and heavy alcohol use in a diverse and representative Flemish sample of higher education students. To add clarity on the methodological argument that different motive measures might explain different findings concerning the relation between social drinking motives and heavy alcohol use, the same instrument for drinking motives will be used as those in the studies that not found such relationship.

3.2 Environmental level

Objectives third original research article (also see section 2.3.4b, parents)

The third original research article will investigate the historical influence of parental drinking during childhood on college-aged adults' drinking, and tries to clarify the role of drinking motives in this relationship, because only cross-sectional studies with inconsistent results on the role of motives are available. Therefore, the aim of this third study is to longitudinally confirm the relationship between parental and offspring drinking in a general population of Flemish college-aged adults and their parents, and to investigate the mediating role of drinking motives in this relation. To clarify the differential and unique influence of maternal and paternal drinking on the drinking behaviour and motives of their sons and daughters, analyses were separately conducted for mothers and fathers (Vermeulen-Smit et al., 2012; Wickrama, Conger, Wallace, & Elder, 1999; Windle & Windle, 2012; Yu & Perrine, 1997).

Objectives fourth original research article (also see section 2.3.4c, educational institutions)

Given the limited European evidence on the differences in alcohol use between faculties and on the limited knowledge on faculty-level factors that influence alcohol use among students in higher education, the fourth original research article will

investigate the variance in frequent binge drinking at faculty level in all faculties of a large Flemish university. This study will further investigate the differential relationship of individual and faculty-level factors with frequent binge drinking. Faculty-level factors are in this study operationalized by the aggregated student-perceived drinking norms at faculty level, which functions as a proxy for the environmental factors of a faculty that collectively influence the perceived norms of students in that faculty (Tankard & Paluck, 2016).

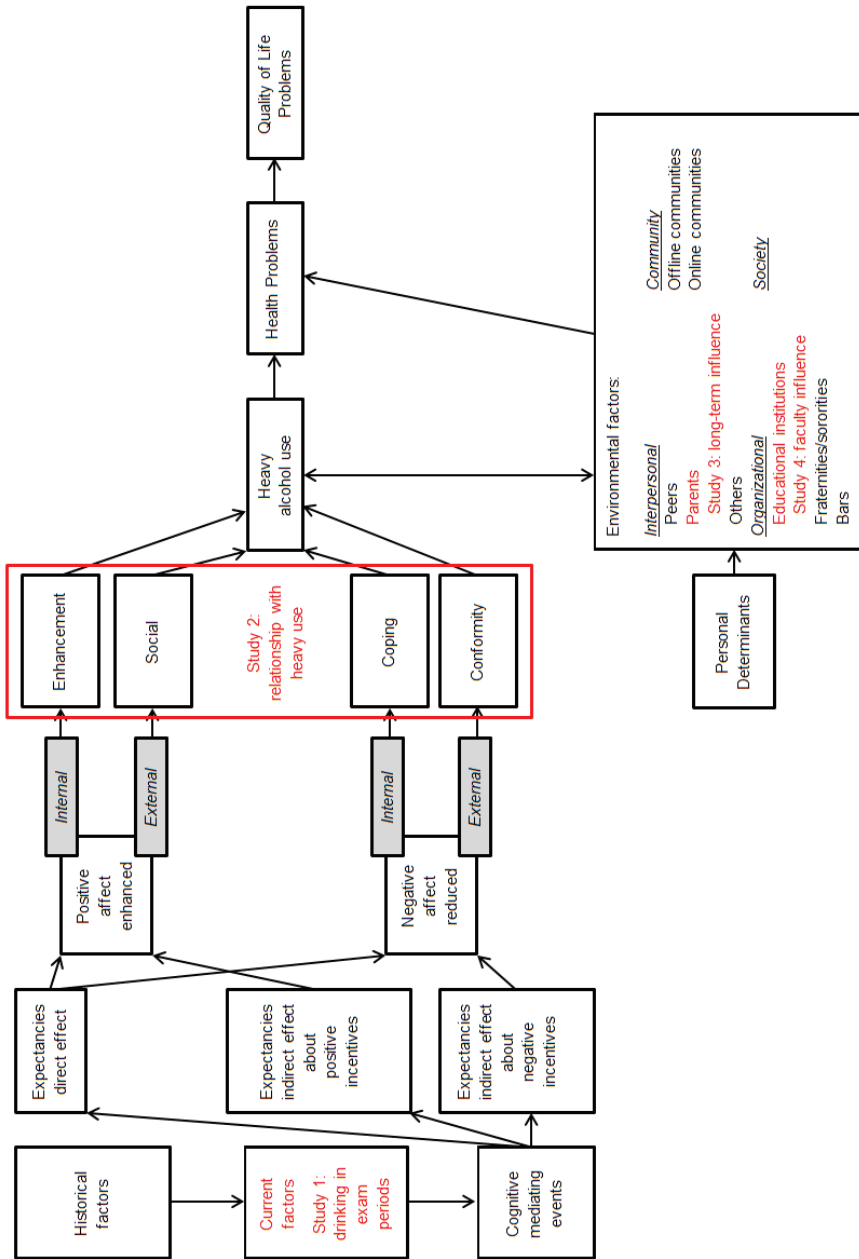


Figure 5: Overview original research studies, adaptation from the motivational model of alcohol use and the logic model for needs assessment (Bartholomew et al., 2011; Cooper, 1994; Cox & Klinger, 1988, 1990; Kuntsche et al., 2005)

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Part 2: Methodology

In this part an overview is given of all study designs used in this dissertation to investigate the aims of the original research articles, discussed in *Part 1: General introduction*. An overview is also given of the most commonly used measures throughout these studies. A detailed description of specific measures and of the statistical analysis in each original research article is provided further in this dissertation.

4 Study designs and recruitment

4.1 Student survey on substance use (2009 & 2013)

The student survey on substance use started in 2005 and is an initiative of the 'Association of Alcohol and other Drug Problems (official Dutch abbreviation: VAD)', 'Antwerp University', 'Centre for Mental Health Care (official Dutch abbreviation: VAGGA-Alttox)', and the 'City Counsel for Drugs Antwerp (official Dutch abbreviation: SODA)'. For this first wave, students from the 'Antwerp University Association' were questioned about substance use (i.e., smoking, alcohol use, medication use, illegal drugs use), problematic use, consequences of substance use, mental health, contextual factors, and prevention and care. In 2009, this consortium was expanded with the 'Association Ghent University', which resulted in a second wave that was assessed in students from both the 'Antwerp University Association' and the 'Association Ghent University'. In this second wave, similar questions were assessed as in 2005. In 2013, the consortium expanded further with the 'KU Leuven Association', and the 'University Colleges Leuven-Limburg'. A new survey was organized in 2013 in all students from the associations in the consortium. For this wave the survey contained a mandatory section for all participating institutions with comparable questions to those in 2005 and 2009, and an additional section with questions depending on an institution's interest.

For the first and fourth research aims in this dissertation (see sections 6.1 & 7.2), data were used from the wave in 2013 on students from Ghent University. This dataset contained 7181 students, who anonymously responded to an email invitation to fill out an online survey. This invitation was sent by the vice-chancellor of Ghent University. No reminders were sent and after completion of the survey, students could voluntarily enter a lottery to win a gift voucher or an iPad® mini. Students were

between 16 and 68 years, with 3.0% being older than 26 years. This cross-sectional study ran from mid-March until mid-April 2013 and was approved by the ethics committee of the Ghent University Hospital. The response rate for this sample was 22,0%.

For the second research aim in this dissertation, data were used from the wave in 2009 on students from the 'Association Ghent University' (see section 6.2). Data from a total of 16953 university and university college students were used (age between 16 and 63 years, with 2.5% being older than 26 years). These students anonymously responded to an invitation for a cross-sectional online study, which was sent by email by the vice-chancellors of the different institutions in the 'Association Ghent University'. No reminders were sent and after completion of the survey, students could voluntarily enter a lottery to win a gift voucher, an USB-stick or an iPod®. The survey ran from February until April 2009 and was approved by the ethics committee of the Ghent University Hospital. The response rate of this survey was 30.7%. To avoid semantic confusion, it is important to point out that in Belgium universities are characterized by at least 4 years of academic education, while university colleges mainly offer a shorter professionally oriented education.

4.2 Longitudinal Eating and Activity study (LEA-study) (2003-2012)

For the third research aim, data were used from the LEA-study (see section 7.1). This study observed 5th grade children and their parents for 9.5 years through six waves (i.e., in 2002, 2003, 2004, 2005, 2008, and 2012). In 2002, 100 schools from two Flemish regions were randomly selected and contacted, 59 schools agreed to participate. From these schools all fifth graders and their parents were invited ($n = 1957$), of whom 1725 children and parents were willing to participate to the study. In the context of the third research question in this dissertation, two waves of this study were used: wave two (2003), because then parental drinking was measured before drinking onset of the children, and wave six (2012), because then the offspring entered adulthood. At wave two, all children and parents from wave one were invited to complete a paper-and-pencil questionnaire that was distributed by the school. The children's questionnaire was assessed at school, while the parents' questionnaire was filled in at home. This procedure resulted in 1614 completed questionnaires (response rate 93.5%). At wave six, only offspring were questioned. These offspring

were at the moment of this assessment in their first year of higher education or employed, which made classroom-based questionnaires impossible. Therefore, all offspring with an available home address were sent a letter with an invitation to complete an online survey. For those respondents without internet access a paper version could be requested. In total, 651 questionnaires were completed (response rate 37.7%). Combining the parental data from wave two and the offspring's data from wave six resulted in a data set of 587 participants. For this study, approval was granted by the ethics committee of Ghent University Hospital.

5 Measures

5.1 Alcohol use and problematic use

Drinking frequency and quantity

Drinking frequency was assessed using beverage specific questions (i.e., beer, wine, aperitif, and spirits) for different periods in an academic year (i.e., during the academic year, during the exam periods, and during holidays). Two of these questions were of particular interest in this dissertation: *“How often did you drink [beverage type] during the academic year (excluding the exam periods and vacations)?”* and *“How often did you drink [beverage type] during the exam periods (January, July, re-examination, ad interim)?”* Both types of questions were used for the first research aim in section 6.1. The first type of questions were used for the second research aim in section 6.2, because these questions gave the most prevailing idea of a student's drinking frequency throughout the academic year. Each time six answering categories that varied from *‘no use’* to *‘daily’* were given. For each period, all beverage specific questions were combined into one frequency variable, based on the beverage with the highest frequency.

For the third research aim in section 7.1, the parental drinking frequency was assessed by asking a parent how many days a week he or she usually drinks an alcoholic drink. Seven answering categories were given: *‘never, less than one day a week/rarely, one day a week, 2-4 days a week, 5-6 days a week, every day 1 time, and every day more than once’*. The same question was asked concerning the questioned parent's spouse. The offspring's drinking frequency was assessed by asking how many days, in the last 30 days, he or she drank alcohol (beer, wine,

spirits, aperitifs, alcopops, cocktails etc.)? Seven answering categories were given: '0, 1-2, 3-5, 6-9, 10-16, 17-23, and 24-30'. Midpoints were calculated. The offspring's drinking quantity was assessed by asking how many drinks he or she usually drinks per day, when he or she drinks. Five answering categories were given: '1-2, 3-4, 5-6, 7-9, 10 or more'. Midpoints were calculated. For the highest category of this quantity question a value of 11 drinks was used (i.e., 10 drinks plus half the range to the midpoint of category 7-9 (Wicki, Gmel, Kuntsche, Rehm, & Grichting, 2006)). For the offspring the midpoints of the frequency and quantity questions were multiplied for the analyses.

Binge drinking

Binge drinking was assessed by the question: "How frequently do you drink four or more drinks (for women), or six or more drinks (for men) within a two-hour period?" This question is based on the NIAAA standard on binge drinking, adjusted for the Belgian context. The NIAAA defines binge drinking as a drinking pattern that brings the BAC to 80 mg/dL or more, which typically occurs when women drinks four and men drinks five US standard drinks within two hours (NIAAA, 2004). However, this standard cannot be applied as such to a Belgian context, since a standard drink in Belgium contains 10 grams of pure alcohol compared to 14 grams in the United states. To overcome this issue Gmel et al. (2011) described binge drinking as drinking 40-60 grams of pure alcohol by women and 60-70 grams pure alcohol by men. These ranges combined with the time window suggested by the NIAAA definition to reach a BAC of 80 mg/dL formed the basis for the Belgian definition above. The format of this question performed well in capturing risky alcohol use in students (Cranford, McCabe, & Boyd, 2006). Five answering categories were given: never, less than monthly, monthly, weekly, almost daily/daily. To identify frequent binge drinkers, a dummy coded variable was generated that distinguished students who binge drink less than monthly, and students who binge drink monthly or more (World Health Organization, 2014). This variable was used for research aim two (section 6.2) and four (section 7.2).

Alcohol Use Disorder Identification Test

The AUDIT is an instrument that aims to identify people with a harmful and hazardous drinking pattern before they encounter symptoms of dependence and serious harm (Saunders et al., 1993). The instrument contains ten items, of which the first three items assess general drinking frequency, quantity and binge drinking, and the final seven items treat dependence and alcohol problems (Saunders et al., 1993). Table 1 shows the items of this instrument. Responses are rated between zero and four and summed, resulting in a final score between zero and 40, with a higher score indicating a higher risk for problematic use. A score of eight for men and five for women identifies students with a significant risk for problematic use (Reinert & Allen, 2007). Therefore, these cut-offs were used to dummy code this variable and to identify those students at risk for problematic use. In this dissertation gender specific cut-offs were used, because a cut-off of five in women, compared to a unisex cut-off of eight, improves the sensitivity to identify 'at risk' drinking women (Reinert & Allen, 2007). Good psychometric properties were shown for the AUDIT, which was also the case for the Dutch version of this instrument (Adewuya, 2005; de Meneses-Gaya, Zuardi, Loureiro, & Crippa, 2009; Hildebrand & Noteborn, 2015; O'Hare & Sherrer, 1999; Reinert & Allen, 2007). This variable was used for research aim one (section 6.1) and research aim two (section 6.2).

Table 1: Items and scoring AUDIT (Saunders et al., 1993)

	0	1	2	3	4
1. How often do you have a drink containing alcohol?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
2. How many drinks containing alcohol do you have on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 to 9	10 or more
3. How often do you have six or more drinks on one occasion?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily
4. How often during the last year have you found that you were not able to stop drinking once you had started?					
5. How often during the last year have you failed to do what was normally expected of you because of drinking?					
6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?					
7. How often during the last year did you have a feeling of guilt or remorse after drinking?					
8. How often during the last year have you been unable to remember what happened the night before because of your drinking?					
9. Have you or someone else been injured because of your drinking?	No		Yes, but not in the last year		Yes, during the last year
10. Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?					

5.2 Drinking motives

Drinking motives were assessed with the Drinking Motives Questionnaire-Revised Short Form (DMQ-R SF) (Kuntsche & Kuntsche, 2009). This instrument measures

the frequency of three items for each of the four motivational dimensions: social motives (e.g., *'because it helps to enjoy parties'*), enhancement motives (e.g., *'because you like the feeling'*), coping motives (e.g., *'to forget problems'*) and conformity motives (e.g., *'so you won't feel left out'*). More examples are given in Table 2. Each item was rated on a five-point Likert scale, ranging from *'never/almost never'* to *'almost always/always'*. These scores were used to calculate a mean item score for each dimension. Good validity and reliability were shown for this instrument (Kuntsche & Kuntsche, 2009). Moreover, for the Dutch translation of both the long and the short version of this instrument also good validity was shown for the four dimensional structure of drinking motives (Crutzen & Kuntsche, 2013; Van Damme et al., 2013). This instrument was used in all research aims. In the 'student survey on substance use' wave one (2009) and the LEA-study, all motives were preceded by the question *"In the last 12 months, how often did you drink..."*. In the second wave of the 'student survey on substance use' (2009) a period specific question preceded the motives (i.e., during the academic year (excluding the exam period and vacations), during the exam period (January, July, re-examination, ad interim), during holidays). For the research aims that were investigated in this final study, either drinking motives for both periods were used (i.e. for research aim one; section 6.1), or only the social drinking motives for the academic year were used (i.e., for research aim four; section 7.2).

Table 2: Items DMQ-R SF

<p>Social motives</p> <p>...because it helps you enjoy a party?</p> <p>...because it makes social gatherings more fun?</p> <p>...because it improves parties and celebrations?</p> <p>Enhancement motives</p> <p>...because you like the feeling?</p> <p>...to get high?</p> <p>...because it's fun?</p>	<p>Coping motives</p> <p>...because it helps you when you feel depressed or nervous?</p> <p>...to cheer you up when you're in a bad mood?</p> <p>...to forget about your problems?</p> <p>Conformity motives</p> <p>...to fit in with a group you like?</p> <p>...to be liked?</p> <p>...so you won't feel left out?</p>
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5.3 Other measures

A number of measures were only used to investigate specific research aims (i.e., socio-demographic questions, stress susceptibility, sensation seeking, and perceived binge drinking norms). These measures are discussed in the respective sections of the studies that investigated these research aims.

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Part 3: Original research articles

6 Individual level

6.1 Who does not cut down? Comparing characteristics and drinking motives of university students who do and do not drink in the exam periods¹

¹ This section is based on Van Damme, J., Hublet, A., De Clercq, B., Kuntsche, E., Maes, L., Clays, E. Who does not cut down? Comparing characteristics and drinking motives of drinkers and abstainers in the exam periods. *Submitted* in Journal of American College Health. (IF: 1.656, Q1, 27/224 in education & educational research)

Abstract

OBJECTIVE: Drinking alcohol during the exams can affect academic performance and future career options, but is rarely investigated. Drinking motives, socio-demographic variables and personality characteristics are investigated in non-abstainers and weekly drinkers during the exams.

METHODS: Data was collected in 7181 Belgian university students. Logistic regressions and mixed design analysis-of-variance on cross-sectional data.

RESULTS: One-third of the students continued drinking during the exams, with 40% drinking weekly. Non-abstainers were mainly male, older, internally motivated when drinking, and housed with parents or living independently. Weekly drinkers were similar, except mainly housed in student apartments or living independently. Personality characteristics were non-significant. All drinking motives were less pronounced during the exams, but differences were smaller for internal compared to external motives.

CONCLUSION: Mainly linked to internal drinking motives, drinking during the exams in higher education cannot be neglected. The characteristics and motives of students doing so can be used in future interventions.

Introduction

Alcohol is regularly consumed by students in higher education (Wicki, Kuntsche, & Gmel, 2010). In the United States (US) approximately 65.0% of the students consumed alcohol in the past 30 days, while in Flanders (northern Belgium) the prevalence was 90.2% (Boot et al., 2012; White & Hingson, 2013). The prevalence for binge drinking in the last year was 56.1% in the US and 59.2% in Flanders (Dawson, Grant, Stinson, & Chou, 2004; Rosiers et al., 2014). Alcohol use among students is an important cause of problematic health-related outcomes (e.g., premature mortality, injury), anti-social behaviours (e.g., vandalism), and decreased academic performance (Perkins, 2002; White & Hingson, 2013; Wicki et al., 2010). Many students (45,9%) are at risk for problematic alcohol use (Van Damme et al., 2013).

Alcohol use among students in higher education is subject to strong variation through an academic year. Marked increases are observed in low-demanding periods and on specific events in the academic year (e.g., orientation week, 21st birthday, and Spring Break), while marked decreases in high-demanding periods, like during exam periods (Del Boca, Darkes, Greenbaum, & Goldman, 2004; Noel & Cohen, 1997; Tremblay et al., 2010). Those low-demanding periods and specific events receive a lot of attention in the current literature, with several event-specific interventions and studies being conducted (Neighbors et al., 2011; Neighbors et al., 2007; Patrick, Lee, & Neighbors, 2014; Steinka-Fry, Tanner-Smith, & Grant, 2015). In contrast, drinking in the exam periods is much less investigated, probably because of the reassuring decrease that is reported in previous studies (Del Boca et al., 2004; Noel & Cohen, 1997; Tremblay et al., 2010). However, these studies are mainly based on quantity measures, which only tell half the story and leave some important questions unanswered, e.g., about the prevalence of drinking in the exam periods and the profile of students doing so. Such information is essential for future intervention accountability and development on this topic, since alcohol use among students in higher education has a known negative effect on academic performance (Carrell, Hoekstra, & West, 2011), and shows higher odds for dependence and alcohol abuse in adulthood (Jennison, 2004). Specifically in the exam periods, alcohol might keep students from their best

performance, while holding the potential risk that alcohol will also be (ab)used in high-demanding situations later in life.

To better understand the characteristics of students who drink in the exam periods, insights in drinking motives are essential. Drinking motives are among the most proximal determinants of alcohol use and illustrate the reason why someone decides to drink, based on the change in affect someone expects to occur from drinking (Cox & Klinger, 1988; Kuntsche, Wiers, Janssen, & Gmel, 2010). Drinking motives can be grouped in four dimensions, based on the valence (i.e., positive or negative) and the source (i.e., external or internal) of the outcome that is expected from drinking alcohol. These dimensions are social motives (positive, external; e.g., *to make social gatherings more fun*), enhancement motives (positive, internal; e.g., *to get high*), conformity motives (negative, external; e.g., *to be liked*) and coping motives (negative, internal; e.g., *to cheer you up when in a bad mood*) (Cooper, 1994; Cox & Klinger, 1988). The motives someone is drinking for are in an important way determined by the context in which the drinking takes place (Cox & Klinger, 1988; Kuntsche, Knibbe, Gmel, & Engels, 2006b).

Drinking contexts can vary in terms of, e.g., the drinking location (e.g., at home, at a bar), the drinking circumstances (e.g., a party, a get together), the drinking day (i.e., weekdays or weekends), and the drinking company (e.g., alone, in group, with friends, with family) (Kairouz, Glikzman, Demers, & Adlaf, 2002; Patrick, Lewis, Lee, & Maggs, 2013; Studer et al., 2014). When students decide to drink in the exam periods, they take this decision in a stressful period with less external triggers, and mainly monotonous activities due to, e.g., the lower availability of student peers, the lower prevalence of parties and other events, and a different dedication to work. Therefore, it is likely that these students more often drink for internal motives (i.e., coping or enhancement motives), e.g., to cope with stress, or to increase or relive a positive affect in the absence of their friends (Cooper, 1994; Crutzen, Kuntsche, & Schelleman-Offermans, 2013). Given that internal drinking motives are related to problematic use in students (Kuntsche, Knibbe, Gmel, & Engels, 2005; Kuntsche, von Fischer, & Gmel, 2008; Merrill & Read, 2010; Nemeth et al., 2011), gaining insight into student's drinking motives in the exam periods is important. However, to our knowledge drinking motives of drinkers in the exam are never investigated before.

Socio-demographical factors and personality characteristics should also be taken into account, because of their important role in someone's drinking behaviour and drinking motives, and because of their stability over time (Cox & Klinger, 1988; Kuntsche et al., 2006b; McCrae et al., 2002). For example, male students have higher drinking prevalence and drink more often for social and enhancement motives, and sensation seekers drink more often for enhancement motives (for review see (Kuntsche et al., 2006b; Wicki et al., 2010)). Therefore, socio-demographical factors and personality characteristics are important control variables, that are also very useful for profiling drinkers in the exam periods. Such profiles are important in the light of future intervention development.

The current study aims to investigate the prevalence of non-abstainers as well as the magnitude of weekly drinking in the exam periods in an heterogeneous sample (i.e., from a wide variety of disciplines) of a large Flemish university (northern Belgium). Moreover, to inform future intervention development, another aim of this study is to give insight into the drinking motives, socio-demographic variables and personality characteristics that characterize those non-abstainers and weekly drinkers in the exam periods. In both groups, internal motives (i.e., coping and enhancement motives) are expected to be important. When drinking for these motives, people want to avoid a negative affect (e.g., cope with stress) or increase a positive affect (e.g., when they need some excitement), respectively (Cooper, 1994; Kuntsche, Knibbe, Gmel, & Engels, 2006a), which is expected to be relevant in a stressful and monotonous periods like the exam periods. Given the specific drinking context of the exam periods, stress susceptibility and sensation seeking were the personality characteristics of interest in this study. Students who drink in the exam periods are expected to be mainly stress susceptible students or sensation seekers who use alcohol as an easy accessible mean to handle with exam stress and lower levels of arousal (e.g., due to low availability of stimuli, high dedication to work and tiredness) (Corbin, Farmer, & Nolen-Hoekesma, 2013; Kuntsche et al., 2006b). Drinking for internal motives is also related to problematic alcohol use and drinking problems (Cooper, 1994; Kuntsche, Knibbe, Engels, & Gmel, 2010; Kuntsche et al., 2005; Van Damme et al., 2013). Therefore, students who drink in the exam periods are expected to be more at risk for problematic alcohol use.

Methodology

Participants and recruitment

Participants were 7181 students (response 22.0%) from all faculties of a large Flemish university, who anonymously responded to an email invitation to fill out an online survey on substance use. The invitation contained a link to the survey and was sent to the official university email addresses by the vice-chancellor. No reminders were sent, but to raise the response rate, participants could voluntarily enter a lottery to win a voucher or an iPad® mini. This cross-sectional survey ran from mid-March 2013 until end-April 2013 and was approved by the ethics committee of the Ghent University Hospital.

Materials and measures

Socio-demographic data

Questions included the assessment of gender, age, and living status (i.e., with their parents, at a student apartment, on their own).

Drinking frequency

Drinking frequency was separately measured for the academic year (excluding the exam periods and vacations) and the exam periods (i.e., referring to all exam periods in an academic year) with beverage specific questions. The questions were respectively: *'How often did you drink beer/wine/non-distilled aperitifs/spirits during the academic year (excluding the exam period and vacations)?'* and *'How often did you drink beer/wine/non-distilled aperitifs/spirits during the exam periods (i.e., January, July, re-examination, ad interim)?'* Six answering categories that varied from *'no use'* to *'daily'* were given. For each period, all beverage specific questions were combined into one frequency variable, based on the beverage with the highest frequency. These variables were used to identify abstainers in the different periods and to identify frequent drinkers for both periods, with a dummy variable indicating *'at least weekly drinking'* (Currie et al., 2012).

Problematic alcohol use

Problematic alcohol use was independently assessed from the academic year or exam periods with the AUDIT (Saunders, Aasland, Babor, Delafuente, & Grant, 1993). This instrument includes 10 items, with the first three items assessing general drinking frequency (i.e., not beverage specific), quantity and binge drinking, and the final seven items assessing indicators of dependence and alcohol problems. Responses were rated between zero and four and were summed, resulting in a final score between zero and 40. Internal consistency was good (*Cronbach's alpha* = 0.84). A dummy variable was created: a final score ≥ 8 for men and ≥ 5 for women was used as indicator for being at risk for problematic drinking (Reinert & Allen, 2007).

Drinking motives

Drinking motives were separately assessed for alcohol use during the academic year and in the exam periods, with the DMQ-R SF (Kuntsche & Kuntsche, 2009). This instrument measures the frequency of three items for each of the four motivational dimensions: social motives (e.g., '*because it helps to enjoy a party*'), enhancement motives (e.g., '*because you like the feeling*'), coping motives (e.g., '*to forget problems*'), and conformity motives (e.g., '*so you won't feel left out*'). Each item was rated on a five-point Likert scale, ranging from '*never/almost never*' (coded zero) to '*almost always/always*' (coded four). These scores were used to calculate a mean item-score for each dimension. *Cronbach's alphas* for the different dimensions were .90, .70, .84, and .70 for social, enhancement, coping, and conformity motives, respectively, in the academic year, and .88, .69, .85, .78 for the same dimensions in the exam periods. These internal consistencies are comparable to those from a large cross-national study (Kuntsche et al., 2014).

Stress susceptibility

Stress susceptibility was independently measured from the academic year or exam periods with the College Student Stress Scale (Feldt, 2008). This instrument assesses the frequency that someone is worried, anxious or in doubt about his/her abilities with regard to 11 items (e.g., *financial matters, not living at home, studies*). Each item was rated on a five-point Likert scale, ranging from '*never*' (coded zero) to

'very often' (coded four). A stress sum-score was calculated (*Cronbach's alpha* was 0.89).

Sensation seeking

Sensation seeking was independently assessed from the academic year or exam periods with the Arnett Inventory of Sensation Seeking (Arnett, 1994). This scale consists of 20 items that were rated on a four-point Likert scale, ranging from 'does not describe me at all' (coded zero) to 'describes me very well' (coded three). An example is 'I think it's fun and exciting to perform or speak in front of a group'. A sensation seeking sum-score was calculated (*Cronbach's alpha* was 0.67).

Statistical analyses

Since drinking motives can only be analysed among alcohol users, abstainers in both the academic year and exam periods ($n = 911$, 12.7%) were only taken into account in the description of the prevalence, and were excluded in all further analyses. Students with missing data on drinking frequency and motives ($n = 548$, 7.6%) were also excluded from the analyses. Therefore, the prevalence was reported for 6633 students and the analyses were performed on 5722 students. For students with only one missing item on drinking motives (academic year: $n = 222$, 3.1%; exam periods: $n = 309$, 4.3%) a mean item-score was calculated with the available data.

The prevalence is reported for total abstainers, abstainers only in the exam periods, occasional drinkers in the exam periods, and weekly drinkers in the exam periods. Descriptive statistics are separately presented for abstainers and non-abstainers in the exam periods. The differences between these groups of students were tested with chi-squared analyses and independent-sample t-tests.

Logistic regression analyses were used to investigate the factors that characterize non-abstainers in the exam periods compared to abstainers in the exam periods (i.e., socio-demographic characteristics, personality characteristics, drinking motives in the academic year, and problematic alcohol use).

Then, non-abstainers in the exam periods were more extensively investigated to gain more insight in their drinking motives and in the characteristics of weekly drinkers in the exam periods compared to occasional drinkers in the exam periods. A 2 (Periods

[academic year vs. exam periods]) X 4 (Motive Dimensions) mixed design analysis of variance (ANOVA), controlled for gender, age and living condition, was used to investigate in non-abstainers in the exam periods whether the discrepancy in motive mean scores between the academic year and the exam periods was different for different drinking motives. Logistic regression analyses were used to investigate the factors that characterize weekly drinkers in the exam periods compared to occasional drinkers in the exam periods (i.e., socio-demographic characteristics, personality characteristics, drinking motives in the exam periods, and problematic alcohol use). All analyses were done with SPSS 21.

Results

Figure 6 summarizes the prevalence of the different drinking patterns observed in the sample. Two-thirds of the students abstained from alcohol during the exam periods ($n = 4395$, 66.2% of total), while one-third continued drinking alcohol in the exam periods ($n = 2238$, 33.7% of total). Three quarters of the abstainers in the exam periods ($n = 3484$, 52.5% of total) only quit drinking during the exams, but consumed alcohol in the rest of the academic year. Four in ten students who drank in the exam periods ($n = 924$, 13.9% of total) consumed alcohol on a weekly base, while the rest ($n = 1314$, 19.8% of total) only occasionally drank alcohol. Less than 1% ($n=44$) of the students drank daily during the exam periods (not shown in Figure 6). All drinkers in the exam periods also consumed alcohol in the rest of the academic year.

Drinking profile	Prevalence	n
Abstainer only in exam periods	52,5%	3484
Occasional drinker in exam periods	19,8%	1314
Weekly drinker in exam periods	13,9%	924
Total abstainer	13,7%	911
		6633 students

Figure 6: Distribution and prevalence of drinking patterns in the academic year and exam period

Table 3 shows that 62.7% of the sample was female, 60.1% lived in a student apartment and the mean age was 21.03 ($SD = 2.64$) years. Moreover, in this table descriptive statistics are presented for both students who only abstain from alcohol in

the exam periods and non-abstainers in the exam periods. Table 4, Model A shows the characteristics related to not abstaining in the exam periods. Male students and older students were more likely to drink in the exam periods. Students living in a student apartment were less likely to drink in the exam periods compared to those living with their parents. Sensation seeking and stress susceptibility were not significant in Model A. For drinking motives only internal motives in the academic year were significantly related, i.e., those who drink for coping or enhancement motives in the academic year were more likely to drink in the exam periods. Being at risk for problematic use was also positively related to exam drinking.

Table 3: Descriptive statistics with differences between abstainers in the exam periods and drinkers in the exam periods

Variable	Total <i>n</i> =5722	Abstainers only in EP <i>n</i> =3484	Non-abstainers in EP <i>n</i> =2238
Socio-demographical characteristics			
Gender			
Male	37.3%	31.6%	46.3%
Female	62.7%	68.4%	53.7%
Age (mean (SD))	21.03 (2.64)	20.69 (2.31)	21.55 (3.00)
Living status (missings: 50)			
With parents	28.2%	28.1%	28.3%
Student's apartment	60.1%	63.8%	54.3%
On their own	11.7%	8.0%	17.4%
Personality characteristics (mean (SD))			
Stress susceptibility [<i>min</i> =0, <i>max</i> =44, missings: 100]	11.62 (8.00)	11.40 (7.92)	11.97 (8.10)
Sensation seeking [<i>min</i> =0, <i>max</i> =60, missings: 243]	29.81 (6.29)	29.25 (6.23)	30.71 (6.28)
Drinking motives AY (mean (SD))			
Social motives [<i>min</i> =0, <i>max</i> =4]	1.75 (1.09)	1.60 (1.04)	1.98 (1.11)
Enhancement motives [<i>min</i> =0, <i>max</i> =4]	1.21 (0.83)	1.05 (0.78)	1.44 (0.85)
Coping motives [<i>min</i> =0, <i>max</i> =4]	0.37 (0.59)	0.29 (0.51)	0.49 (0.69)
Conformity motives [<i>min</i> =0, <i>max</i> =4]	0.26 (0.49)	0.23 (0.45)	0.31 (0.54)
Drinking weekly or more frequent in AY	71.1%	64.6%	81.3%
At risk for problematic alcohol use according to AUDIT (missings: 122)	59.3%	53.6%	68.3%

A more extensive look at non-abstainers showed that male students and older students were more likely to drink weekly in the exam periods compared to drinking occasionally in the exam periods (Table 4, Model B). A similar relation was found for students living in a student apartment compared to those living with their parents. Sensation seeking was not significant, while stress susceptibility was significantly and inversely related to weekly drinking in Model B. Students who drank for coping or enhancement motives in the exam periods were more likely to drink on a weekly basis in the exam periods. A positive relation was also found between being at risk for problematic use and weekly drinking in the exam periods.

Moreover, the 2 X 4 mixed design ANOVA showed a significant ($F(1) = 419.030, p < 0.001$) main effect of period (academic year > exam periods), and a significant ($F(3) = 1,580.844, p < 0.001$) main effect of Motives (social > enhancement > coping > conformity) (Table 5). A significant interaction of Period X Motives ($F(3) = 830.123, p < 0.001$) was also found, with post hoc tests (Bonferroni) indicating that the discrepancy of motive mean-scores between the academic year and the exam periods is different per drinking motive dimension. This analysis suggests that motive mean-scores of external motives (i.e., social and conformity motives) decreased more from the academic year to the exam periods compared to internal motives (Table 5).

Table 4: Multiple logistic regressions: Profiles of non-abstainers in the exam period (Model A), and profile of weekly drinkers in the exam period (Model B)

Sample:	Model A Total (n = 5722)		Model B Non-abstainers (n = 2238)	
	Exp (B)	95%CI ^c	Exp (B)	95%CI ^c
Dependent variable	Abstainers (0) vs. non-abstainers (1) in the EP ^b		Occasional (0) vs. at least weekly drinking (1) in the EP ^b	
Demographics				
Gender				
Females ^a	1		1	
Males	1.667	[1.458, 1.906]***	1.976	[1.600, 2.440]***
Age	1.135	[1.104, 1.167]***	1.059	[1.019, 1.100]**
Living condition				
With parents ^a	1		1	
Student apartment	0.743	[0.649, 0.851]***	1.341	[1.062, 1.694]*
On their own	1.344	[1.074, 1.682]*	2.172	[1.552, 3.038]***
Personality				
Sensation seeking	1.007	[0.997, 1.018]	1.000	[0.983, 1.017]
Stress susceptibility	1.002	[0.994, 1.011]	0.974	[0.961, 0.987]***
Drinking motives in AY ^b				
Social motives	1.036	[0.958, 1.119]		
Enhancement motives	1.432	[1.296, 1.581]***		
Coping motives	1.372	[1.224, 1.538]***		
Conformity motives	1.024	[0.897, 1.169]		
Drinking motives in EP ^b				
Social motives			1.044	[0.925, 1.178]
Enhancement motives			1.568	[1.341, 1.834]***
Coping motives			1.984	[1.644, 2.395]***
Conformity motives			0.774	[0.585, 1.023]
Problematic alcohol use				
AUDIT				
not at risk for problematic use ^a	1		1	
at risk for problematic use	1.448	[1.261, 1.663]***	2.235	[1.781, 2.804]***
Nagelkerke R ²	0.147		0.218	

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^a reference category; ^b EP = exam period; AY = academic year; ^c CI = confidence interval

Table 5: differences in drinking motives between academic year and exam period in non-abstainers ($n = 2238$)

Drinking motives (mean (SD^b))	Academic year	Exam periods	Relative change ^a
Social motives	1.99 (1.11)	0.96 (1.05)	52%
Enhancement motives	1.44 (0.84)	0.94 (0.82)	35%
Coping motives	0.48 (0.68)	0.37 (0.63)	23%
Conformity motives	0.31 (0.53)	0.15 (0.40)	52%

Analyses controlled for gender, living status, and age; ^a relative change = (motive AY - motive EP)/motive AY;

^b SD = standard deviation

Discussion

This study shows the prevalence of non-abstainers and weekly drinkers in the exam periods in a heterogeneous sample from a large Flemish (northern Belgium) university. One-third of the students (33.7%) drank alcohol in the exam periods and 13.9% of the students drank on a weekly basis in the exams. This adds to previous studies showing that drinking quantity decreased in the exam periods, although not completely to zero (Del Boca et al., 2004; Noel & Cohen, 1997; Tremblay et al., 2010).

Another aim of this study was to describe the characteristics of non-abstainers and weekly drinkers in the exam periods. Male students were more likely to be non-abstainers and weekly drinkers. A possible explanation for this finding is that drinking in the exam periods is more socially accepted and perceived as less harmful in men, because of the strong drinking reputation of men (de Visser & McDonnell, 2012; Wicki et al., 2010). Similar results were found in older students who were also more likely to be a non-abstainer and weekly drinker in the exam periods. An explanation could be that older students have less fluctuating and more stable drinking habits (Kuntsche & Gmel, 2013). Students living in a student apartment were less likely to drink in the exams. However, when drinking in the exam periods they had higher odds for drinking on a weekly basis. In Belgium, students living in a student apartment often move in with their parents in the exam periods (e.g., to avoid losing time on housekeeping), which temporally separates them from their usual drinking environment and increases parental control. Both factors affect drinking (Clapp, Reed, Holmes, Lange, & Voas, 2006; Ham & Hope, 2003) and might explain the lower odds for not abstaining in the exam periods. Those students who do not move in with their parents stay in their natural drinking environment and might maintain more of their usual drinking pattern in the exam periods. This can explain why students who live in a student apartment and who drink in the exam periods, have higher odds for weekly drinking in the exam periods. However, more research is needed to confirm this hypothesis.

In this study personality characteristics were not related to not abstaining in the exam periods, while for weekly drinking in the exam periods only a significant relation was found with stress susceptibility. However, stress susceptibility only became significant

when coping motives were added to the model, which might suggest suppression. Suppression is a statistical phenomenon, in which a variable that is unrelated to the outcome becomes a significant predictor when a third variable is added to the model (Smith, Ager, & Williams, 1992). In the current case suppression was confirmed in further analyses, which indicates that the significant result for stress susceptibility has a non-substantive meaning (Smith et al., 1992). Consequently, personality characteristics seem not important in relation to drinking in the exam periods.

Regarding drinking motives, a general decline in frequency of drinking motives from the academic year to the exam periods was found, with the frequency of external motives (i.e., social and enhancement motives) decreasing more strongly compared to the frequency of internal motives (i.e., coping and enhancement motives). The stronger decrease in external drinking motives' frequency may signify the lower frequency of social drinking opportunities during the exam periods, and underlines the relative importance of internal drinking motives in the exam periods.

These internal motives were found to characterize both non-abstainers and weekly drinkers in the exam periods. Students who drank in the academic year for internal motives had higher odds to not abstain in the exam periods, and students who drank in the exams for internal motives had higher odds for drinking weekly in the exam periods. First, these results show that students who drank in a stressful and monotonous period like the exam periods, also drank more often for internal motives in a period that is not characterized by stress or monotonous activities, like the academic year. These findings can either be explained by a feedback loop that shapes expectancies and drinking motives in the exam periods based on previous experiences in the academic year (Cooper, 1994; Cox & Klinger, 1988), or by the mechanism that the experienced effects of drinking motives in the exam periods induce drinking for the same or for other motives in the future (e.g., in the academic year after the exam periods) (Crutzen et al., 2013). Longitudinal research is needed to clarify the direction of these relations. Second, our results show that coping with negative feelings (e.g., to reduce tension) or enhancing positive affect (e.g., when feeling less aroused) in the exam periods were associated to weekly drinking in the exam periods. These findings are probably related to the spreading of the exams over multiple weeks, which regularly gives students who drink for these motives a good reason to drink alcohol.

Finally, as expected, not abstaining and weekly drinking in the exam periods relates to being at risk for problematic use. Students at risk for problematic use probably have more trouble taking a break from alcohol in the exam periods (American Psychiatric Association, 2013). Furthermore, internal drinking motives are known correlates for problematic alcohol use (Cooper, 1994; Kuntsche, Knibbe, et al., 2010; Kuntsche et al., 2005; Van Damme et al., 2013). Longitudinal research is needed to investigate the direction of the relation between drinking in the exam periods and being at risk for problematic use.

These results show that one-third of students drinks during the exams, which is related to being at risk for problematic alcohol use. Moreover, drinking in the exam periods is mainly driven by internal drinking motives, which are known risk factors for problematic use (Kuntsche et al., 2005; Kuntsche et al., 2008; Merrill & Read, 2010; Nemeth et al., 2011). Therefore, drinking in the exam periods should be taken into account in future interventions. Practitioners who develop such interventions could benefit from our findings. First, this study was the first to describe some characteristics of non-abstainers and weekly drinkers in the exam periods, which can help practitioners in identifying students who drink in the exam periods. Second, this study showed the relevance of monitoring and further investigating alcohol use in the exam periods. Finally, this study found that students who drink in the exam periods, mainly drink to cope with negative feelings (e.g., when feeling stressed) or to enhance positive feeling (e.g., when feeling less aroused). Therefore, practitioners should develop strategies that help students dealing with exam stress and help students having healthy and more stimulating breaks. Examples of potential strategies are encouraging students to be more physically active and to listen to music, and learning them mindfulness skills. (Jonker & Kuntsche, 2014; Reynolds, Keough, & O'Connor, 2015; Weinstock, 2010) These specific strategies can be tailored around exam periods, which would also fit into the event-specific approach that is recommended to address alcohol use in higher education. (Neighbors et al., 2007)

Despite the Belgian origin of this research, the current findings are internationally relevant. Worldwide students are regularly confronted with intensive and stressful exam periods, and in many countries students are familiar with the effects of alcohol, since alcohol is regularly consumed among students in many cultures. (Wicki et al.,

2010) Therefore, the role of internal drinking motives in the exam periods as described in this study is very likely to be similar in other countries. These drinking motives are also related to problematic drinking both in North-American and European students. (Kuntsche et al., 2005; Merrill & Read, 2010) Moreover, the significant proportion of drinkers in the exam periods in this study shows the importance of internationally investigating this behavior, since currently no other studies on this behavior are available. Similar to international variations in drinking prevalence (Boot et al., 2012; White & Hingson, 2013), prevalence of drinking in the exam periods is expected to vary depending on country.

Limitations

This study had a rather low response rate and was open for all students who could freely participate, which might affect the generalization of the results. However, a response rate based on all enrolled students might be an underestimation of the actual response rate, because several students might have missed the invitation to the survey through their official university e-mail by using mainly a private email address as standard account (Kuntsche et al., 2008). Furthermore, this study recruited a large heterogeneous sample from a large Flemish university. Due to the cross-sectional design conclusions on causality could not be drawn. In this study only weekly drinking was investigated as indicator for frequent drinking. Although a relation exists between not abstaining and weekly drinking in the exam periods and being at risk for problematic use, further research should also investigate more severe drinking patterns in the exam periods. Such patterns would probably relate even more to alcohol-related problems. Besides these more severe drinking patterns, future research should also investigate other characteristics, such as drinking context characteristics (e.g., at home, meal related). Finally, results might be underestimated, because of the self-reported nature of this study, which can lead to e.g., socially desirable answering or recall bias.

Conclusions

In the exam pperiods students have to perform at their best, while being confronted with high-demanding situations that share multiple similarities with those later in life (e.g., stress, high dedication to work, lower levels of arousal). Therefore, alcohol use

in the exam periods is a potential risk behavior, since alcohol use can negatively affect academic performance (Carrell et al., 2011) and maladaptive drinking patterns in higher education increase the risk for maladaptive drinking patterns later in life.(Jennison, 2004) This study showed that a considerable amount of students performs this behavior, which positively relates to being at risk for problematic use. Therefore, drinking in the exam periods cannot be neglected and should be addressed in future interventions and future research. The present study described characteristics of students drinking in the exam periods and showed that this behavior is mainly driven by internal motives.

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6.2 Social drinking motives should not be neglected in efforts to decrease problematic drinking among students in higher education²

² This section is based on Van Damme, J., Maes, L., Clays, E., Rosiers, J.F.MT., Van Hal, G., Hublet, A. (2013). Social motives for drinking in students should not be neglected in efforts to decrease problematic drinking. *Health Education Research*, 28, 640-50. (IF: 1.944, Q1, 22/219 in education & educational research)

Abstract

OBJECTIVE: High heavy drinking prevalence persists in students. Recently, drinking motivation received a lot of attention as an important determinant. Enhancement and coping motives are mostly positively related and conformity motives are mostly negatively related with heavy drinking. Relations are less clear for social motives. This study aimed at gaining more insight in the role of drinking motives in more moderate and heavy drinking students.

METHODS: Overall, 15897 Belgian university and college students (mean age: 20.7, $SD = 2.6$) anonymously participated in an online survey. Logistic regressions tested relationships between motives and more than weekly and heavy drinking (>weekly drinking, \geq monthly binge drinking and being at risk for problematic drinking by the AUDIT).

RESULTS: Social motives had the highest prevalence, followed by enhancement, coping and conformity motives. Men engaged more in more than weekly and heavy drinking and reported more motives, except for coping. Enhancement, coping and social-motivated students have higher risk for more than weekly and heavy drinking, while the opposite is true for conformity-motivated students.

CONCLUSION: Although this study found a similar ranking of motives as in other studies, a relationship between more than weekly and heavy drinking and all motives, including social motives, was revealed. This might indicate the different functions of social motives in heavy drinking in different cultures/sub-populations and countries. This finding is relevant for the development of interventions.

Introduction

Excessive alcohol use in students is a well-documented and worldwide problem (Hingson, Heeren, Winter, & Wechsler, 2005; Karam, Kypri, & Salamoun, 2007; Wechsler, Dowdall, Davenport, & Castillo, 1995; Wicki, Kuntsche, & Gmel, 2010). It is regularly performed in student environments and less detected in non-college peers (Carter, Brandon, & Goldman, 2010). Most students go through a 'maturing-out' process during their transition to adulthood, which results in a decrease of (heavy) drinking (Gotham, Sher, & Wood, 1997; Jennison, 2004), however some students persist in heavy drinking. This results in higher risk for alcohol abuse and alcohol dependence in occupational life (Jennison, 2004; Sher, Grekin, & Williams, 2005). In terms of short-term consequences, excessive drinkers often engage in alcohol-related harmful behaviour such as drinking and driving (Hingson et al., 2005; Hingson, Zha, & Weitzman, 2009; Kypri et al., 2009; Perkins, 2002), using cannabis, smoking cigarettes, having sex with multiple partners (Wechsler et al., 1995), having unprotected or unintended sex and performing anti-social behaviour (e.g. vandalism and aggression) (Hingson et al., 2009; Kypri et al., 2009; Perkins, 2002). They often experience unpleasant and harmful effects such as physical illnesses, personal injuries, blackouts (Kypri et al., 2009; Perkins, 2002), a decrease in academic performance and others (Pascarella et al., 2007; Perkins, 2002; Singleton, 2007; Thombs et al., 2009). Alcohol use involves a considerable cost for society, due to alcohol-related problems, absenteeism and premature mortality (World Health Organization, 2010). The persistent high prevalence of heavy drinking and alcohol-related problems might indicate poor implementation of effective interventions, given that effective strategies and channels are available to reduce alcohol use among students in higher education (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Carey, Scott-Sheldon, Elliott, Bolles, & Carey, 2009; Moreira, Smith, & Foxcroft, 2009). However, some studies find limited effects for heavy drinkers and suggest better designed effect studies for some strategies (Carey et al., 2007; White et al., 2010). This indicates the need to rethink implementation of effective strategies and the need to develop new programs that support existing strategies or reach groups until now not susceptible to interventions.

In this context, drinking motivation has attracted a lot of attention the last few years (Conrod, Castellanos-Ryan, & Mackie, 2011; LaBrie, Lac, Kenney, & Mirza, 2011; Patrick, Lee, & Larimer, 2011). The motivational model of alcohol use identifies drinking motives as the most proximal determinants and the strongest predictors of alcohol use (Cooper, Frone, Russell, & Mudar, 1995; Cox & Klinger, 1988). These factors function as a gateway between drinking behaviour and more distal factors, such as alcohol expectancies (Kuntsche, Knibbe, Engels, & Gmel, 2007; Kuntsche, Wiers, Janssen, & Gmel, 2010). They reflect the rationale that drives people to drink, based on the expected effects attributed to alcohol. These are determined by past drinking experiences, current situational factors and the current need for affective change (Cox & Klinger, 2004). Taking into account the source (internal or external) and valence (obtaining a positive outcome or avoiding a negative outcome) of these expected effects, four dimensions can be defined: social motives (external, positive, *e.g. because it makes social gatherings more fun*), enhancement motives (internal, positive, *e.g. to get high*), conformity motives (external, negative, *e.g. to be liked*) and coping motives (internal, negative, *e.g. to cheer you up when you are in a bad mood*) (Cooper, 1994).

Social motives are the most frequently reported motives in higher education, followed by enhancement, coping and conformity motives (Nemeth et al., 2011). Both coping and enhancement motives are related to heavy drinking and alcohol-related problems in students (Kuntsche, Knibbe, Gmel, & Engels, 2005, 2006; Kuntsche, von Fischer, & Gmel, 2008; Merrill & Read, 2010; Nemeth et al., 2011). Conformity motives are generally either negatively or not related to alcohol use and alcohol-related problems (Merrill & Read, 2010; Nemeth et al., 2011). This relation is less clear for social motives. Some sources reported no relation to heavy alcohol use and alcohol-related problems (Merrill & Read, 2010; Nemeth et al., 2011), while other studies showed the opposite (Corbin, Iwamoto, & Fromme, 2011; Labrie, Hummer, & Pedersen, 2007). Methodological differences might explain this lack of consensus. Some studies included only students following only one or a few specific trainings (*e.g. only psychology students* (Labrie et al., 2007; Merrill & Read, 2010)), while other studies use a more diverse sample of students (Corbin et al., 2011; Nemeth et al., 2011). Therefore, generalizing the results to all university students is not always possible. Also, different instruments to measure drinking motivation are used. Studies

not supporting the relation between social motives and problematic drinking used the DMQ-R SF based on the four-dimension structure mentioned above (Cooper, 1994; Kuntsche & Kuntsche, 2009). The studies supporting this relation used the Reasons for Drinking Scale (Cronin, 1997) (based on only three dimensions: mood enhancement, social camaraderie and tension reduction) or a measure of 'broad social motives' (Maggs, 1997) measuring social motives based on only six items.

Also, cultural differences (i.e. United States, Spain and Hungary) might explain different findings for social motives. For example, in the United States, the minimum legal drinking age is higher than in Belgium (i.e. 21 for the United States versus 16 for beer and wines and 18 for spirits in Belgium) and in many other countries, which might lead to different drinking patterns (Subbaraman & Kerr, 2012; Yoruk & Yoruk, 2011). Also, results from studies in countries belonging to the former Eastern Bloc, e.g. Hungary, are sometimes difficult to generalize to western (European) countries due to cultural differences. Also within Western European countries, drinking habits are very different, e.g. in Spain drinking for social reasons is characterized by meal-related moderate wine drinking (Nemeth et al., 2011), which is different from the drinking context in some other countries. In Belgium, for example, students mainly drink in bars and at parties (Rosiers, Hublet, Van Damme, Maes, & Van Hal, 2011).

This study is a part of the 'higher education patterns of substance use' study that aims to inform the development and evaluation of an intervention on acceptable and problematic drinking among students in higher education in Flanders (north of Belgium). We investigate the relation between drinking motives and more than weekly and heavy drinking in a representative sample of higher education students. Given the consensus in former research, we hypothesize that enhancement and coping motives will be positively related to more than weekly and heavy drinking. For conformity motives, we hypothesize a negative relationship. Due to the specific drinking culture and context in Belgium, we hypothesize a positive relation between social motives and all three outcome measures. To counter the second methodological issue mentioned above, this study will use the same instrument for measuring drinking motives as used in the studies not supporting the social motives–problematic drinking relation.

Methodology

Participants and recruitment

Participants were 16953 university and university college students anonymously responding to an email asking them to participate in an online cross-sectional study on substance use. No reminder email was sent. This survey ran from February until April 2009. Initially, all students of Ghent University and three colleges in Ghent and Kortrijk (in total, 55301 students) were contacted, which resulted in a response rate of 30.7%. This response rate is comparable with other online surveys with college students (Kuntsche et al., 2008; Nemeth et al., 2011). Furthermore, it is demonstrated that the prevalence of alcohol consumption is not different for responders compared with non-responders in web-based surveys. Although the participation in heavy episodic drinking and the frequency of alcohol use are lower with non-responders (Cranford et al., 2008). In Belgium, universities are characterized by at least 4 years of academic education, while university colleges offer mainly a shorter professionally oriented education. This study was approved by the ethics committee of the Medicine and Health Sciences Faculty of Ghent University (EC UZG 2009/037). Participants could voluntarily enter into a lottery to win a gift voucher, a USB stick or an iPod.

Materials and measures

Socio-demographic data

Socio-demographic questions as sex, age, faculty and living conditions were asked. Living condition assessed the extent to which students lived at home (e.g. with parents) or in a student apartment.

Alcohol use and problematic use

Drinking frequency was assessed beverage specific (i.e. beer, wine, aperitif and spirit) using the following question: '*How often did you drink "beverage type"?*' with six frequency categories, varying from '*no use*' (coded 1) to '*daily use*' (coded 6). Binge drinking was questioned by asking, '*How frequently do you drink four or more drinks (for women) and six or more drinks (for men) within a two hours period?*' This

question is based on the NIAAA standard on binge drinking adjusted to a Belgian standard drink of alcohol (Li & Warren, 2004). Five frequency categories were given, varying from 'never' (coded 1) to 'daily' (coded 5). Finally, problematic alcohol use was identified using the validated AUDIT (Saunders, Aasland, Babor, Delafuente, & Grant, 1993). A score ≥ 8 for men and ≥ 5 for women on the AUDIT is recommended as an indicator for being at risk for problematic drinking (Reinert & Allen, 2007).

Drinking motives

To assess drinking motives, the DMQ-R SF was used (Kuntsche & Kuntsche, 2009). This instrument is based on the four-dimensional structure mentioned above (i.e. coping, conformity, enhancement and social) and uses three motive items per dimension. Examples are 'because it helps to enjoy a party' (social motives dimension), 'because you like the feeling' (enhancement motives dimension), 'to forget about your problems' (coping motives dimension) and 'so you won't feel left out' (conformity motives dimension). The validity of the DMQ-R SF was shown in a 12- to 24-year-old population, with the majority being secondary school children (Kuntsche & Kuntsche, 2009; Mazzardis, Vieno, Kuntsche, & Santinello, 2010). This study used two answer categories (yes/no coded 1/0, respectively) to indicate the presence of each motive item in the last year instead of using a scale to mark the frequency of each item. Indicating more than one item was possible. The dimensional structure of the motives was first investigated using exploratory factor analyses in Mplus. Originally, the factor solution was restricted by four factors. Motive items were loaded exactly on one of the four dimensions, as hypothesized in the DMQ-R SF theoretical framework. Factor determinancies for coping, social, conformity and enhancement dimensions were 0.953, 0.950, 0.981, and 0.919, respectively. Second, a confirmatory factor analysis was performed in Mplus, which was highly significant ($\chi^2 = 44\ 377.38$; $p < 0.001$; $df = 27$) may be due to the large sample size. Results of other statistics for model fit were 0.982 for *comparative fit index*, 0.986 for *Tucker–Lewis index* and 0.037 for *root mean square error of approximation*, indicating good model fit.

Statistical analyses

Abstaining students were excluded from the analyses (1056; 6.2% of the total). About 2985 (17.6% of the total) alcohol-using students did not report any motive item as asked in the DMQ-R SF. Given the theoretical assumption that one always drinks alcohol for a reason, it is possible that these students drink for other motives than these asked. For this reason, their motivational scores were set to 0 for each dimension and were included in the analysis. Analyses were performed for a total sample of 15897 students.

For the descriptive statistics, chi-squared tests and independent-sample *t*-tests were performed to look for gender differences in all variables. Bivariate analyses were performed with chi-squared tests. Relationships between motive dimensions and problematic alcohol use were tested using multivariate logistic regression analyses. To improve reliability, different problematic alcohol use indicators were used as dependent variables (i.e., 'at least monthly binge drinking' and 'being at-risk for problematic drinking by the AUDIT'). These were created by dummy coding drinking and binge drinking frequency to define heavy drinkers and to deal with, respectively, negative and positive skewness and by dummy coding the AUDIT score by the earlier discussed cut-off points. For drinking motives, all the motive items were summed per motive dimension, resulting in scores between 0 and 3 for each motive dimension. These dimensions were used as predictors. All dimensions were set as categorical variables. First, to investigate a gradient in the relation between motive dimensions and problematic drinking indicators. If so, higher or lower (depending on the relation) odds are expected for problematic drinking as more motives are reported per dimension. If not, the number of motives per dimension is less significant. Also, the limited number of categories in the motive dimension variables (i.e. four categories from 0 to 3) did not allow us to treat these variables as continuous variables. All analyses were controlled for gender and living condition, known moderators for alcohol use in students (Wicki et al., 2010). Analyses were also controlled for institution (i.e. university and university college), age and other motives, as these were significantly related with the outcome variables. Finally, interaction effects were also tested with gender, living condition, institution and age. To increase the representativeness of this study, data were weighted by gender and institution, as

distributions of these variables in the sample were different from those in the population. All these analyses were performed using SPSS 19 (SPSS for Windows, Rel. 19.0.0 (2010). SPSS Inc.).

Results

Sample description

The average age was 20.7 ($SD = 2.6$) years and 57.6% lived in a student apartment (Table 6). In the unweighted sample, the majority were women (60.8%) and went to university (60.3%).

Table 6: Sample characteristics and gender differences in drinking motives and indicators of more moderate and heavy drinking

	Total	Male	Female	Statistics (<i>df</i>)
Sample size (%)	15897 (100.0)	6237 (39.2)	9660 (60.8)	
Mean age (<i>SD</i>)	20.7 (2.7)	20.8 (2.6)	20.6 (2.7)	$t = 4.88$ (15894)***
(missings) ^a	(9)	(5)	(4)	
Institution				
University college	52.0% (8265)	54.1% (3826)	50.2% (4439)	
University	48.0% (7641)	45.9% (3243)	49.8% (4398)	$\chi^2 = 23.83$ (1)***
(missings) ^a	(0)	(0)	(0)	
Living condition				
With parents	42.4% (6735)	45.1% (3185)	40.2% (3550)	
Students' apartment	57.6% (9165)	54.9% (3883)	59.8% (5282)	$\chi^2 = 38.10$ (1)***
(missings) ^a	(6)	(1)	(5)	
Enhancement motives (<i>n</i>)				
none	37.7% (6001)	33.5% (2369)	41.1% (3632)	
≥ 1 motive	62.3% (9905)	66.5% (4700)	58.9% (5205)	$\chi^2 = 96.24$ (1)***
(missings) ^a	(0)	(0)	(0)	
Sociale motives (<i>n</i>)				
none	27.6% (4384)	22.8% (1613)	31.4% (2771)	
≥ 1 motive	72.4% (11523)	77.2% (5457)	68.6% (6066)	$\chi^2 = 143.55$ (1)***
(missings) ^a	(0)	(0)	(0)	
Coping motives (<i>n</i>)				
none	76.2% (12122)	76.0% (5373)	76.4% (6749)	
≥ 1 motive	23.8% (3784)	24.0% (1696)	23.6% (2088)	<i>n.s.</i> ^b
(missings) ^a	(0)	(0)	(0)	
Conformity motives (<i>n</i>)				
none	87.9% (13985)	84.8% (5996)	90.4% (7989)	
≥ 1 motive	12.1% (1921)	15.2% (1074)	9.6% (847)	$\chi^2 = 116.20$ (1)***
(missings) ^a	(0)	(0)	(0)	
AUDIT score				
< 8 (men) & < 5 (women)	54.1% (7804)	50.2% (3207)	57.2% (4597)	
≥ 8 (men) & ≥ 5 (women)	45.9% (6631)	49.8% (3185)	42.8% (3446)	$\chi^2 = 69.93$ (1)***
(missings) ^a	(1435)	(581)	(854)	
Binge drinking frequency				
$<$ monthly	78.4% (11872)	68.6% (4542)	86.0% (7330)	
\geq monthly	21.6% (3279)	31.4% (2081)	14.0% (1198)	$\chi^2 = 663.48$ (1)***
(missings) ^a	(705)	(367)	(338)	
Drinking frequency				
\leq weekly	55.8% (8878)	38.0% (2684)	70.1% (6194)	
$>$ weekly	44.2% (7029)	62.0% (4386)	29.9% (2643)	$\chi^2 = 1643.93$ (1)***
(missings) ^a	(0)	(0)	(0)	

^a Number of missings using unweighted data; ^b *n.s.* = not significant; *** $p < 0.001$

Prevalence of more than weekly and heavy drinking, and drinking motives

The prevalence for more than weekly drinking was 44.2%, while 21.6% of the students binged at least monthly, and 45.9% was at risk for problematic drinking (Table 6). For all indicators, male students engaged significantly ($P < 0.001$) more in more than weekly and heavy drinking and were more at risk for problematic drinking than female students (Table 6). About 62.0% of the male students used more than weekly alcohol, 31.4% binged at least monthly and 49.8% was at risk for problematic drinking.

Social and enhancement motives had the highest frequencies (72.4% and 62.3%, respectively), followed by coping and conformity motives (23.8% and 12.1%, respectively) (Table 6). Male students drank significantly ($p < 0.001$) more for social, enhancement and conformity reasons than their female students, 77.2%, 66.5%, and 15.2%, respectively (Table 6). No significant gender difference was found for coping motives.

Relations between drinking motives and problematic alcohol use

Bivariate statistics

Table 7 shows higher prevalence for more than weekly and heavy drinking when students reported one or more motives for a specific dimension compared with none. This applies for all dimensions. Concerning living condition, higher prevalence was found for more than weekly and heavy drinking in students living in student apartments compared with those living at home. According to institution, drinking more than weekly was more prevalent in university students compared with university college students (46.4% versus 42.2%), while at least monthly binge drinking was more prevalent in university college students (22.4% versus 20.9%). No significant difference was found between institutions being at risk for problematic drinking. Up to the age of 21 years for some indicators and 22 years for others, the prevalence of more than weekly and heavy drinking increased as students became older. Depending on the indicator, prevalence descended again from the age of 22 and 23.

Table 7: Relation between drinking motives and socio-demographic variables and indicators of more moderate and heavy drinking

	More than weekly drinking	At least monthly binge drinking	AUDIT-score ≥ 8 (men) and ≥ 5 (women)
Enhancement			
0 motive items	25.8%	8.49%	22.7%
≥ 1 motive item	55.3%	28.7%	57.8%
χ^2 (df)	1319.81 (1)***	832.94 (1)***	1602.89 (1)***
Social			
0 motive items	25.7%	6.4%	18.4%
≥ 1 motive item	51.2%	26.5%	54.3%
χ^2 (df)	842.82 (1)***	655.91 (1)***	1337.33 (1)***
Coping			
0 motive items	39.6%	17.3%	38.7%
≥ 1 motive item	59.0%	34.8%	67.3%
χ^2 (df)	440.65 (1)***	512.87 (1)***	898.74 (1)***
Conformity			
0 motive items	43.0%	20.2%	44.2%
≥ 1 motive item	52.9%	31.8%	58.0%
χ^2 (df)	67.83 (1)***	134.94 (1)***	122.29 (1)***
Institution			
University college	42.2%	22.4%	45.6%
University	46.4%	20.9%	46.3%
χ^2 (df)	28.95 (1)***	4.89 (1)*	n.s. ^a
Living condition			
With parents	35.1%	18.1%	38.3%
Students' apartment	50.8%	24.2%	51.5%
χ^2 (df)	386.96 (1)***	82.49 (1)***	245.91 (1)***
Age			
18 or less	37.7%	19.8%	42.8%
19	39.4%	21.6%	45.2%
20	45.0%	23.8%	47.6%
21	47.0%	22.6%	48.4%
22	50.2%	22.9%	48.2%
23 or more	46.8%	18.2%	42.7%
χ^2 (df)	113.21 (5)***	31.93 (5)***	31.92 (5)***

^an.s. = not significant; presented data are weighted for gender and institution; *** $p < 0.001$; * $p < 0.05$

Multivariate statistics

The results of the multivariate logistic regression analysis in Table 8 show a similar pattern for all indicators of more moderate and heavy drinking. Generally, students drinking for enhancement, coping and social motives have higher odds for drinking alcohol more than weekly, bingeing at least monthly and being at risk for problematic drinking. The opposite is true for drinking for conformity motives. Only in female students, at least monthly binge drinking is not predicted by conformity motives. For social motives, the more motive items reported the higher the odds for all indicators of more moderate and heavy drinking. These differences between the lowest and the highest odds are significant for all indicators, both in men and women. For enhancement motives, a similar pattern is found, except for more than weekly drinking in women. Here, no significant difference was found between the lowest and the highest odds. For coping motives, no such pattern is found, except for being at

risk for problematic drinking in women. Also, for conformity motives, no such pattern was found. Explained variance (Nagelkerke R^2) was 20.5% (in men) and 19.1% (in women) for more than weekly drinking, 18.5% (in men) and 18.9% (in women) for at least monthly binge drinking, and 27.3% (in men) and 29.1% (in women) for being at risk for problematic drinking. No consistent significant interaction effects were found for gender, institution, living condition and age (not reported).

Table 8: Relation between drinking motive dimensions and indicators of more moderate and heavy drinking in multivariate logistic regression analyses

	More than weekly drinking		At least monthly binge drinking		AUDIT-score ≥ 8 (men) and ≥ 5 (women)	
	Men	Women	Men	Women	Men	Women
	OR ^a (95% CI) ^b	OR ^a (95% CI) ^b	OR ^a (95% CI) ^b	OR ^a (95% CI) ^b	OR ^a (95% CI) ^b	OR ^a (95% CI) ^b
Enhancement						
1 vs. 0 motive items	1.93 (1.67-2.22)***	2.32 (2.06-2.62)***	1.85 (1.54-2.21)***	2.17 (1.80-2.61)***	2.15 (1.84-2.52)***	2.20 (1.96-2.47)***
2 vs. 0 motive items	3.02 (2.54-3.59)***	3.11 (2.70-3.58)***	2.81 (2.32-3.40)***	3.31 (2.71-4.04)***	3.64 (3.05-4.34)***	3.61 (3.14-4.15)***
3 vs. 0 motive items	4.22 (2.84-6.28)***	3.46 (2.50-4.79)***	4.07 (2.96-5.59)***	4.44 (3.12-6.33)***	4.93 (3.43-7.09)***	6.25 (4.09-9.54)***
Social						
1 vs. 0 motive items	1.07 (0.89-1.30)	1.22 (1.05-1.42)**	1.36 (1.02-1.80)*	1.60 (1.23-2.07)***	1.45 (1.15-1.82)**	1.74 (1.50-2.02)***
2 vs. 0 motive items	1.48 (1.24-1.78)***	1.66(1.43-1.92)***	2.08 (1.61-2.68)***	2.60 (2.05-3.30)***	2.08 (1.68-2.57)***	3.11 (2.69-3.60)***
3 vs. 0 motive items	2.19 (1.84-2.61)***	2.20 (1.91-2.54)***	3.63 (2.85-4.61)***	3.86 (3.07-4.87)***	3.73 (3.05-4.57)***	4.59 (3.96-5.31)***
Coping						
1 vs. 0 motive items	1.41 (1.17-1.70)***	1.44 (1.26-1.65)***	1.23 (1.04-1.46)*	1.41 (1.19-1.67)***	1.70 (1.42-2.03)***	1.57 (1.36-1.81)***
2 vs. 0 motive items	1.74 (1.32-2.30)***	1.68 (1.40-2.02)***	1.77 (1.41-2.22)***	2.12 (1.72-2.61)***	2.08 (1.61-2.70)***	2.13 (1.74-2.61)***
3 vs. 0 motive items	1.70 (1.23-2.34)***	1.78 (1.44-2.21)***	1.39 (1.07-1.80)*	2.07 (1.64-2.61)***	2.33 (1.71-3.16)***	2.33 (1.82-2.99)***
Conformity						
1 vs. 0 motive items	0.70 (0.58-0.84)***	0.77 (0.64-0.91)**	0.83 (0.69-0.99)*	0.97 (0.79-1.19)	0.89 (0.74-1.08)	0.71 (0.59-0.85)***
2 vs. 0 motive items	0.62 (0.42-0.92)*	0.52 (0.34-0.80)**	1.03 (0.71-1.49)	0.80 (0.49-1.29)	1.14 (0.76-1.73)	0.74 (0.48-1.15)
3 vs. 0 motive items	0.37 (0.23-0.59)***	0.57 (0.35-0.92)*	0.63 (0.41-0.99)*	0.84 (0.50-1.41)	0.44 (0.27-0.71)**	0.48 (0.28-0.80)**

^aOR = odds ratio, ^bCI = confidence interval. Analyses were controlled for living condition, institution, age and for the other drinking motive dimensions.

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Discussion

This study assessed the prevalence of more than weekly drinking, binge drinking, being at risk for problematic drinking, and drinking motives in university and university college students in Flanders. The prevalence for all indicators of drinking in this study was 44.2% for more than weekly drinking, 21.6% for at least monthly binge drinking and 45.9% for being at risk for problematic drinking according to the AUDIT (score ≥ 8 for men and ≥ 5 for women). For bingeing, the prevalence is lower than in other studies. In a study in the United States, 44.7% of the students binged last month and in Scandinavian and Eastern European student populations, it was 50.3 and 42.2%, respectively, that binges monthly (A. Andersson, Wirehn, Olvander, Ekman, & Bendtsen, 2009; Hingson et al., 2009; Miskulin et al., 2010). The prevalence for more than weekly drinking is difficult to compare in other studies, as they report the prevalence for weekly together with more than weekly drinking. In Southern and Eastern European students, prevalence for weekly together with more than weekly drinking was, 35.8 and 49.3%, respectively (Nemeth et al., 2011). For the AUDIT score, the prevalence rates are comparable with other studies. However, these studies often use one cut-off point of eight for the entire sample (independent of gender), which can result in an overestimation of the prevalence in this study compared with other studies. Prevalence in the US student population ranges from 34.0 to 58.0% depending on the study (Shields, Guttmanova, & Caruso, 2004; Wallenstein, Pigeon, Kopans, Jacobs, & Aseltine, 2007). In New Zealand, 59.2% of the students score 8 or more on the AUDIT (Kypri, McGee, Saunders, Langley, & Dean, 2002), and for the European continent, the prevalence ranges from 41.0 to 43.8% (C. Andersson, Johnsson, Berglund, & Ojehagen, 2007; Miskulin et al., 2010). Differences in prevalence between this study and the other studies might be explained by differences in drinking culture, drinking habits and legislation in different regions. The finding that male students are heavier drinkers than their female counterparts was also shown in other studies (Wicki et al., 2010). Also, the relation between students living in student apartments and heavy drinking and being at risk for problematic drinking was found in the literature (Wicki et al., 2010).

This study tested three hypotheses in a large representative sample of university and university college students. In the first hypothesis, a positive relation between

enhancement and coping motives and more than weekly and heavy drinking was expected. This was confirmed in this study and this result is comparable with other studies (Kuntsche et al., 2005, 2006; Kuntsche et al., 2008; Merrill & Read, 2010; Nemeth et al., 2011). In the second hypothesis, a negative relation between conformity motives and more than weekly and heavy drinking was expected. This was partly confirmed, as no relation was found for female students bingeing at least monthly. Similar results were found in other studies (Merrill & Read, 2010; Nemeth et al., 2011). The third hypothesis was the most important one as there was no consensus in the literature on the relationship between social motives and heavy drinking. Based on methodological issues and cultural differences between countries in which heavy drinking in students was studied (Corbin et al., 2011; Labrie et al., 2007; Merrill & Read, 2010; Nemeth et al., 2011), we hypothesized that in Belgium, a positive relation between social motives and more than weekly and heavy drinking would be found. Also, this hypothesis was confirmed. This study contributes to a better insight in the function of social motives in heavy drinking for several reasons. A more representative sample was used than in many other studies. The findings concerning the positive relationship between social motives and heavy drinking can be generalized to all Flemish students as the sample included both university college students as well as university students from all faculties and departments. Furthermore, data were weighted for gender and institution (De Leeuw, Hox, & Dillman, 2008). In this study, the same instrument was used as in studies not finding a relationship between social motives and problematic drinking (Merrill & Read, 2010; Nemeth et al., 2011), making it less plausible that the use of a specific instrument leads to different findings. Finally, cultural differences were also discussed. Drinking culture, drinking context and drinking legislation vary between countries (Gordon, Heim, & MacAskill, 2012). Alcohol consumption and drinking motivation are context specific (Demers et al., 2002; Kairouz, Gliksmann, Demers, & Adlaf, 2002). This might explain differences in different countries. Furthermore, each drinking situation is typified by its own drinking rules and drinking norms, which are reinforced by social interaction (Demers et al., 2002). These rules and norms play an important role in alcohol consumption and alcohol-related behaviours. They form the base for attitudes towards alcohol and are obtained by socialization (Gordon et al., 2012). This might explain why the relation with heavy drinking for social reasons in particular differs in different cultures.

Finally, this study found a gradient in the relations between social and enhancement motives and indicators of more moderate and heavy drinking. For these relations, higher odds for more than weekly and heavy drinking were found when more motive items were reported. As some strategies show limited effects in heavy drinkers (Carey et al., 2007), different strategies might be needed to target highly social and enhancement motivated students compared with less motivated students. Similar results were found in other research (Kuntsche et al., 2005).

The results of this study can be important to develop tailored interventions. Former research suggests that adjusting programs to specific homogeneous groups, sharing similar characteristics, can improve effectiveness (Kuntsche, Knibbe, Engels, & Gmel, 2010). This study shows that the set of drinking motives related to heavy drinking can change from one culture to another. Given that drinking context can vary in different cultures and that drinking motivation is related to drinking context (Gordon et al., 2012; Kairouz et al., 2002), taking into account the drinking context would also be interesting (Kairouz et al., 2002). Adjusting programs to the specific set of drinking motives and contexts for a specific target population might give better interventions. As multi-component interventions are effective, this can be done by building programs around a selection of strategies based on relevant drinking motives and situations (Foxcroft & Tsertsvadze, 2011). Until now, little attention is given to social drinking motives in the context of heavy drinking while these are in specific cultures an interesting target. Existing methods, such as the social norms approach, might be a useful strategy, since social norm interventions are effective in reducing alcohol misuse by targeting normative misperception (Moreira et al., 2009). Further research on this is needed.

Limitations

Some limitations of this study have to be taken into account. First, due to the design of this study, it is not possible to state for sure that cultural differences explain the different findings of this study. Therefore, a comparative research between different countries is necessary. Second, the students in this study volunteered to participate in an open survey for all students, which can affect the generalization of some results. To minimize the effect of this limitation, data were weighted for known population variables. Third, due to restrictions for the length of the questionnaire, only

two answer categories were used for the items assessing drinking motives. Using a continuous scale would have given more detailed results. Finally, although the study was anonymous, the self-reported nature of this study possibly influenced the results because of, e.g. socially desirable answering or recall bias. This might result in an underestimation of these results.

Conclusions

Since in some cultures, social motives are related to heavy drinking, it might be interesting to consider the inclusion of social motives besides other motives when developing new interventions on heavy drinking among students in higher education. Using an adapted set of drinking motives in preventive programs on heavy drinking might improve the effectiveness of such interventions.

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7 Environmental level

7.1 The influence of parental drinking on offspring's drinking motives and drinking: a mediation analysis on 9 year follow-up data³

³ This section is based on Van Damme, J., Maes, L., Kuntsche, E., Crutzen, R., De Clercq, B., Van Lippevelde, W., Hublet, A. (2015). The influence of parental drinking on offspring's drinking motives and drinking: a mediation analysis on 9 year follow-up data. *Drugs and Alcohol Dependence*, 149, 63-70. (IF: 3.423, Q1, 2/35 in substance abuse)

Abstract

OBJECTIVE: The influence of parental drinking on offspring's drinking is well documented. However, longitudinal evidence on the mediating role of drinking motives in this relationship is lacking. This study longitudinally investigates the mediating role of drinking motives in the relationship between parental and offspring's drinking.

METHODS: Using a prospective design, 587 Flemish children (response 30.0%) were followed for 9 years. Parental drinking was documented during the offspring's late childhood (10 and 11 years old) through paper-and-pencil questionnaires distributed by schools. The offspring's drinking habits and -motives were documented in early adulthood (18 and 19 years old) through a web-based questionnaire; invitations were sent by letter. Motives were measured using the DMQ-R SF, and mediation analyses were conducted with the product of coefficient test using bootstrapping.

RESULTS: Half the offspring were female (53.8%) and the mean age was 19.35 ($SD = 0.52$) years. A significant direct effect of maternal drinking during childhood on offspring drinking nine years later was found ($\beta = 0.091$, $t = 2.071$, $p = 0.039$). However, the association turned non-significant after stratifying the model for boys and girls. No direct effect was found for paternal drinking on offspring's drinking. Nevertheless, paternal drinking indirectly affected offspring's drinking through offspring's enhancement motives ($\beta = 0.041$, 95%CI[0.004, 0.082]) and maternal drinking indirectly affected male offspring's drinking through offspring's social motives ($\beta = 0.067$, 95%CI[0.007, 0.148]).

CONCLUSION: These results show that parental drinking during late childhood relates to a high level of those drinking motives among young adults that are known risk factors for heavy drinking in early adulthood.

Introduction

In Western countries, adolescents frequently drink alcohol, and this activity increases in prevalence in late adolescence and early adulthood (Currie et al., 2012; Hibell et al., 2011; Johnston, O'Malley, Bachman, & Schulenberg, 2013; Schulte, Ramo, & Brown, 2009; Steketee et al., 2013). The influence of parental drinking on adolescents' alcohol use and alcohol initiation is well documented (Seljamo et al., 2006; Vermeulen-Smit et al., 2012; White, Johnson, & Buyske, 2000). Adolescents who drink heavily often have parents who drink more frequently compared with adolescents who drink less (White et al., 2000), and adolescents with early drinking onset often have parents who heavily drink (Vermeulen-Smit et al., 2012).

Three pathways for explaining this intergenerational transference of alcohol use patterns have been described with some empirical support: the genetic pathway that describes the role of the inheritance of genes (i.e., the contribution of similarities in genetic makeup between parents and offspring to similarities in alcohol behaviour) (Campbell & Oei, 2010); the genotype-environmental pathway that describes the effect of the relationship between genetic factors (e.g., specific genes) and environmental factors (e.g., poor family functioning because of parental problem drinking) (Campbell & Oei, 2010); and the cognitive pathway that describes the role of cognitive factors (e.g., alcohol expectancies) (Campbell & Oei, 2010). According to the interventional perspective, this latter pathway is the most accessible, because cognitions are easier to change by interventions than genes or environmental factors, such as family functioning. This paper focuses on the cognitive factors in the intergenerational transmission of alcohol use patterns.

According to Bandura's 'social learning theory' and Campbell and Oei's 'cognitive model for intergenerational transference of alcohol use behaviour', parental drinking behaviour shapes offspring's drinking activity through cognition (e.g., alcohol expectancies) (Bandura, 1986; Campbell & Oei, 2010). In turn, these expectancies determine drinking motives that are repeatedly found to be more proximal to alcohol use than expectancies (Cox & Klinger, 1988, 2004; Kuntsche, Knibbe, Engels, & Gmel, 2007; Kuntsche, Wiers, Janssen, & Gmel, 2010; Muller & Kuntsche, 2011).

Based on the 'Motivational model of alcohol use', drinking motives can be grouped into four dimensions based on the valence (i.e., positive or negative) and the source (i.e., external or internal) of the expected outcome from drinking alcohol: social motives (positive, external; e.g., *to make social gatherings more fun*), enhancement motives (positive, internal; e.g., *to get high*), conformity motives (negative, external; e.g., *to be liked*) and coping motives (negative, internal; e.g., *to cheer you up when in a bad mood*) (Bandura, 1986; Campbell & Oei, 2010; Cox & Klinger, 1988, 2004).

Despite this theoretical embedment, only a few cross-sectional studies have empirically investigated the mediating effect of drinking motives in the intergenerational transference of alcohol use (Muller & Kuntsche, 2011; Woldt & Bradley, 2002). All of the studies found a mediating effect of drinking motives but found differences in the type of motives involved. One study found a mediating effect of enhancement, and interpersonal facilitation (similar to conformity) motives (Woldt & Bradley, 2002), and another study found that all except conformity motives had a mediating role (Muller & Kuntsche, 2011). These distinct findings might be caused by a few differences between these studies; one study investigated the mediating effect of drinking motives on the relationship between parental problematic drinking and alcohol use in offenders of driving under influence aged 17–71 years old in the US (Woldt & Bradley, 2002), whereas the other study investigated this relationship in a general population of adolescents in Switzerland (Muller & Kuntsche, 2011). Both studies also assessed drinking behaviour and drinking motives differently.

Furthermore, the available evidence has some important limitations. First, all available studies used a cross-sectional design (Muller & Kuntsche, 2011; Woldt & Bradley, 2002). By using a longitudinal design, the effect of past parental drinking patterns (e.g., during childhood) on current adolescents' drinking motives and drinking can be investigated. These long-term effects are important because prior to the first drinking experience, cognitive foundations are established through parental modelling (Campbell & Oei, 2010; Van der Vorst et al., 2013). These cognitive foundations are then further reinforced after alcohol is (repeatedly) consumed (Campbell & Oei, 2010; Van der Vorst et al., 2013). A second limitation is that previous studies only measured parental drinking through the offspring's perception of parental drinking. By using this method, these studies used a less accurate source

for parental drinking and only investigated the perception of one source (i.e., the offspring), whereas all family members experience alcohol-specific socialisation (e.g., rule setting, talking about alcohol use) differently (Smith, Miller, Kroll, Simmons, & Gallen, 1999; van der Vorst, Engels, Meeus, Dekovic, & Van Leeuwe, 2005). Therefore, the conclusions from the available studies should be generalised with caution (van der Vorst et al., 2005) and the effect of parental drinking should be investigated from additional family viewpoints (e.g., parents themselves). Finally, previous studies were only conducted in two countries, which make replication in other countries necessary (Kuntsche, Rehm, & Gmel, 2004).

The first objective of the current study was to longitudinally confirm the relationship between parental and offspring drinking in a general population of Flemish (northern Belgium) adolescents and their parents. Based on previous research (White et al., 2000), we hypothesised that parental drinking during their offspring's childhood positively relates to offspring's drinking when they are young adults. A second objective was to use a prospective design to investigate the mediating role of drinking motives in this relationship. Based on the findings from previous research that was conducted in a general population of adolescents in a west-European country (Switzerland) (Muller & Kuntsche, 2011), we hypothesised that the relationship between parental and offspring drinking would be mediated by social, enhancement and coping motives. Furthermore, we investigated the differential influence of maternal and paternal drinking and investigated interaction effects with offspring's gender to take into account the unique influence of each parent on both sons and daughters (Vermeulen-Smit et al., 2012; Wickrama, Conger, Wallace, & Elder, 1999; Windle & Windle, 2012; Yu & Perrine, 1997).

Methodology

Study design

Data were obtained from the LEA-study conducted in Flanders (Belgium). This study observed 5th grade children (mean age = 9.93 years, $SD = 0.48$) and their parents for 9.5 years, and data were collected in six waves (in 2002, 2003, 2004, 2005, 2008, and 2012). In 2002, 100 schools from two Flemish regions were randomly selected and contacted, and 59 schools agreed to participate. From these schools all fifth

graders and their parents were invited ($n = 1957$), and 1725 children and parents were willing to participate. The current study used two waves: wave two (2003; at that time, parental drinking was measured before drinking onset of the children) and wave six (2012; the time at which the offspring entered adulthood). In wave two (mean age = 10.96 years, $SD = 0.49$), all respondents and their parents from wave one were asked to complete a paper-and-pencil questionnaire distributed by the schools at school and at home, respectively. This procedure resulted in 1614 completed questionnaires (response 93.5%). At the time of wave six (mean age = 19.36 years, $SD = 0.52$), offspring were in their first year of higher education or employed, which made classroom-based questioning impossible. Therefore, all offspring who had an available address were sent a letter to their home address with an invitation to complete a web-based questionnaire. For those respondents without internet access a paper version could be requested. In total, 651 questionnaires were completed (response 37.7%). In this wave, only offspring were questioned. Combining the parental data from wave two and the offspring's data from wave six resulted in a data set of 587 participants in which both waves could be matched. Approval was granted by the Ethics Committee of Ghent University.

Participants

At wave two, parental questionnaires were mainly answered by mothers (82.9%). Consequently, 82.9% of the paternal data was retrieved through mothers, because at wave two only one parent was questioned. The gender distribution of the children was slightly different at wave six, with 46.2% of the offspring being boys compared with 51.6% at wave two.

Attrition analyses comparing the remaining participants at wave six to those who dropped out ($n = 1042$) showed no differences in maternal and paternal drinking at wave two. However, somewhat more boys (68.6% versus 60.4% girls) ($\chi^2 = 11.73$, $df = 1$, $p = 0.001$) and children not living in two-parent families (75.8% versus 62.6% living in two-parent families) at wave two ($\chi^2 = 15.66$, $df = 1$, $p < 0.001$) dropped out from the study.

Materials and measures

Socio-demographic data

Throughout the various waves, gender, age, and parent-identification (i.e., mother, father, stepmother, stepfather, or someone else) were measured. Stepparents were also seen as an important influence, because their drinking was also measured many years before offspring's drinking onset.

Parental drinking

Parental drinking was collected at wave two by asking a parent how many days a week he or she usually drinks an alcoholic drink. Seven answering categories were given (*never* (coded one); *less than one day a week/rarely*; *one day a week*; *2–4 days a week*; *5–6 days a week*; *1 time a day, each day*; *every day more than once* (coded seven)). A similar question was asked concerning the questioned parent's spouse, using the same seven answering categories.

Offspring's drinking

Offspring's alcohol use was assessed at wave six. Drinking frequency was asked by the question '*how many days, in the last 30 days did you drink alcohol (beer, wine, spirit, aperitif, alcopops, cocktails etc.)?*'. For this question seven answering categories (0, 1–2, 3–5, 6–9, 10–16, 17–23, and 24–30) were given, of which the midpoints were used for analyses. Drinking quantity was asked by the question '*When you drink, how many drinks do you usually drink per day?*'. For this question five answering categories (1–2, 3–4, 5–6, 7–9, 10 or more) were given, of which the midpoints were used for analyses. For the highest category of this question a value of 11 drinks was used (i.e., 10 drinks plus half the range to the midpoint of category 7–9) (Wicki, Gmel, Kuntsche, Rehm, & Grichting, 2006). Then, the midpoints of both questions were multiplied to become the number of drinks the adolescents drank in the last 30 days.

Drinking motives

Drinking motives were measured in the adolescents at wave six using the DMQ-R SF (Kuntsche & Kuntsche, 2009). This instrument measures four motivational dimensions with three items each: social motives (*e.g., because it helps to enjoy a party*), enhancement motives (*e.g., because you like the feeling*), coping motives (*e.g., to forget problems*), and conformity motives (*e.g., so you won't feel left out*). Each item was rated on a five-point Likert scale, ranging from 'never/almost never' (coded one) to 'almost always/always' (coded five). These scores were used to calculate a mean item-score for each dimension. *Cronbach's alphas* for the different dimensions were .85, .63, .81, and .60 for social, enhancement, coping, and conformity motives, respectively. These *Cronbach's alphas* were acceptable, given the low number of items (Iacobucci & Duhachek, 2003).

Statistical analyses

Descriptive statistics were retrieved and differences between boys and girls were examined using independent-sample t-tests.

To test the first hypothesis, the direct relationship between maternal and paternal drinking during childhood and young adult offspring's drinking was examined. For the second hypothesis the mediating effect of drinking motives for maternal and paternal drinking was investigated. To estimate the most parsimonious model, drinking motives were added individually to the models. If multiple significant mediators were found, a combined model was estimated. When no direct relationship was found, mediation analyses with drinking motives were still performed since these analyses can still show an indirect effect instead of a true mediation effect (Holmbeck, 1997; MacKinnon, 2008; Rucker, Preacher, Tormala, & Petty, 2011). Indirect effects without direct effect also give empirical insight in the earlier discussed theoretical pathway that describes the relationship between parental drinking and offspring's drinking (*i.e., parental drinking->offspring's drinking motives->offspring's drinking*). All models controlled for the other parent's drinking (*e.g., if the effect of maternal drinking was investigated, the analyses controlled for paternal drinking to obtain the net effect of maternal drinking that elucidates mothers' unique influence*), the parent answering the parental questionnaire, and the offspring's gender. Next, interaction effects

between parental drinking (i.e., separately for maternal and paternal drinking) and the offspring's gender were investigated and considered as significant if $p < 0.10$ (for further information see Marshall (2007) and McClelland and Judd (1993)). If a significant interaction effect was found, a stratified analysis by offspring's gender was performed. These latter analyses controlled for the other parent's drinking and for the parent answering the parental questionnaire.

To test for mediation, significance was tested for the product $a \times b$, which stands for the product of the effect of a predictor (i.e., parental drinking) on a mediator (i.e., drinking motives) with the effect of a mediator on an outcome (i.e., offspring's drinking) (MacKinnon, 2008; MacKinnon, Fairchild, & Fritz, 2007). Significance was tested by calculating a bias-corrected confidence interval for the mediated effect $a \times b$, using bootstrapping (Efron, 1987; MacKinnon, 2008; Preacher & Hayes, 2008a). All models were estimated using ordinary least square regression in SPSS 19, running a macro for bootstrapping and calculating bias-corrected confidence intervals (Preacher & Hayes, 2008a). If mediation was found, the completely standardised indirect effect (i.e., *the index of mediation*) (Preacher & Hayes, 2008b), was calculated as a measure for effect size.

Abstaining offspring ($n = 54$ (9.2%)) were included in the analyses and were assumed to have the lowest score (i.e., 'never/almost never') for all drinking motive dimensions, as this study wanted to investigate the effect of parental drinking behaviour on both offspring's drinking and non-drinking behaviour. Sensitivity analyses (i.e., analysis with and without abstainers) did not show substantially different results (results not shown). Non-abstaining offspring with more than one item missing per motive dimension ($n = 19$ (3.2%)) were coded as missing for that particular dimension, whereas for offspring with only one item missing ($n = 21$ (3.6%)), a score was calculated with the remaining items. This method was used to avoid exclusion of participants with only occasional missing data.

Results

Descriptive statistics in Table 9 show slightly more girls (53.8%) than boys in the sample at wave six (age range 17–21 years), with girls drinking less than boys in the last 30 days (16.53 versus 37.96 drinks). In girls, all drinking motive dimensions were less pronounced than in boys. However, the same rank order was found, with social motives being on average the most prevalent in both boys and girls. Furthermore, no gender differences in parental drinking were found.

Table 9: Descriptive statistics for parental drinking and offspring's socio-demographic data, alcohol use, and drinking motives with differences between gender.

Variable	Adolescent		t-value
	Boys (n = 271) mean (SD) / missings	Girls (n = 316) mean (SD) / missings	
Adolescents			
Age (years)	19.34 (0.55) / 0	19.37 (0.50) / 0	
n° of drinks in the last 30 days	37.96 (47.48) / 3	16.53 (22.37) / 6	6.767***
Drinking motives (ranging 1-5 ^b)			
Social	2.49 (1.21) / 6	1.95 (0.91) / 9	5.947***
Enhancement	1.93 (0.84) / 7	1.67 (0.71) / 9	4.022***
Coping	1.30 (0.63) / 8	1.20 (0.44) / 9	2.286*
Conformity	1.21 (0.43) / 9	1.11 (0.32) / 9	3.256**
Parents			
Weekly drinking frequency father (ranging 1-7 ^b)	3.40 (1.51) / 23	3.60 (1.57) / 16	-1.479
Weekly drinking frequency mother (ranging 1-7 ^b)	2.69 (1.31) / 10	2.80 (1.35) / 15	-1.046

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; ^a 1='never/almost never' to 5='almost always/always'; ^b 1='never' to 7='every day more than once'; n°= number

The direct relationship between parental drinking during childhood and young adult offspring drinking was significant for maternal drinking, but not significant for paternal drinking (Table 10). If drinking motives were individually added to both models, a significant prediction (*a-path*) was only found in maternal drinking for social motives and in paternal drinking for enhancement motives (Figure 7). Furthermore, all motives were significantly related (*b-path*) to offspring drinking, with enhancement motives having the strongest effect (Figure 7). For the models in which both a significant *a-path* and *b-path* were found, a significant mediated effect ($a \times b$) was found (Table 10). Consequently, social motives mediate the link between maternal drinking and offspring drinking, and paternal drinking indirectly affects offspring drinking through enhancement motives.

Table 10: Standardised coefficients (*t*-value) of the direct relationship between maternal/paternal drinking and offspring's drinking and the mediating effects of drinking motives (*n*=587).

	β (<i>t</i>)	Mediating effects (<i>a</i> x <i>b</i>)	
		β [95% CI] ^a	Adj. <i>R</i> ²
Maternal drinking			
Direct relationship (without motives)	0.091 (2.071); <i>p</i>=0.039		
Motives			
Social motives		0.039 [0.007, 0.075]	22.8%
Enhancement motives		0.032 [-0.008, 0.079]	
Coping motives		-0.000 [-0.028, 0.028]	
Conformity motives		0.007 [-0.000, 0.024]	
Paternal drinking			
Direct relationship (without motives)	0.069 (1.585)		
Motives			
Social motives		0.025 [-0.005, 0.059]	
Enhancement motives		0.041 [0.004, 0.082]	28.1%
Coping motives		0.017 [-0.008, 0.051]	
Conformity motives		0.001 [-0.007, 0.014]	

All analyses controlled for gender, the parent who completed the parental questionnaire and the other parent's drinking; ^a bias-corrected confidence interval retrieved using bootstrapping.

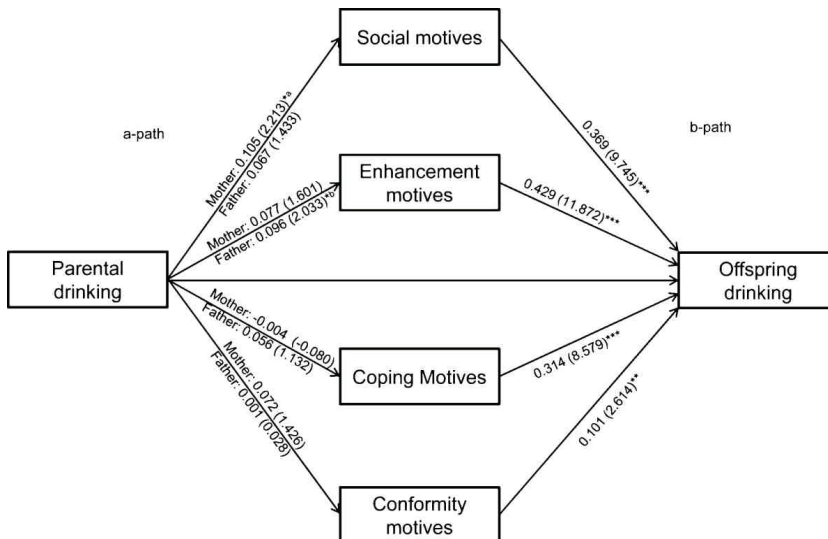


Figure 7: Standardised betas (*t*-value) for the a- and b-paths of the single mediation analyses in the relationship between parental and offspring's drinking. All analyses controlled for gender, the parent who completed the parental questionnaire and the other parent's drinking. ^a*p* = 0.027; ^b*p* = 0.042; ^{}*p* < 0.009; ^{***}*p* < 0.001.**

When an interaction term (i.e., ‘maternal drinking*offspring's gender’, ‘paternal drinking*offspring's gender’) was added to the maternal and paternal drinking model respectively, a significant interaction effect was only found between maternal drinking and the offspring's gender ($\beta = -0.285$; $SE = -0.155$; $p = 0.067$). A separate estimation of maternal drinking for boys and girls resulted in only a trend to significance for boys ($\beta = 0.154$; $SE = 0.084$; $p = 0.068$), while no significant direct relationship was found for girls (Table 11). For boys, individually adding drinking motives to the model, resulted in a significant effect of maternal drinking on social motives (*a*-path) and in significant relationships between all motives except conformity motives and male offspring drinking (*b*-paths) (Figure 8). Moreover, a significant mediated effect was found for social drinking motives in boys, which shows that maternal drinking indirectly affects boys' drinking through social motives (Table 11). For girls, individually adding drinking motives to the model, resulted in non-significant effects of maternal drinking on drinking motives, while the relationships between all drinking motives and female offspring drinking were significant (Figure 8). No significant mediated effect was found in girls.

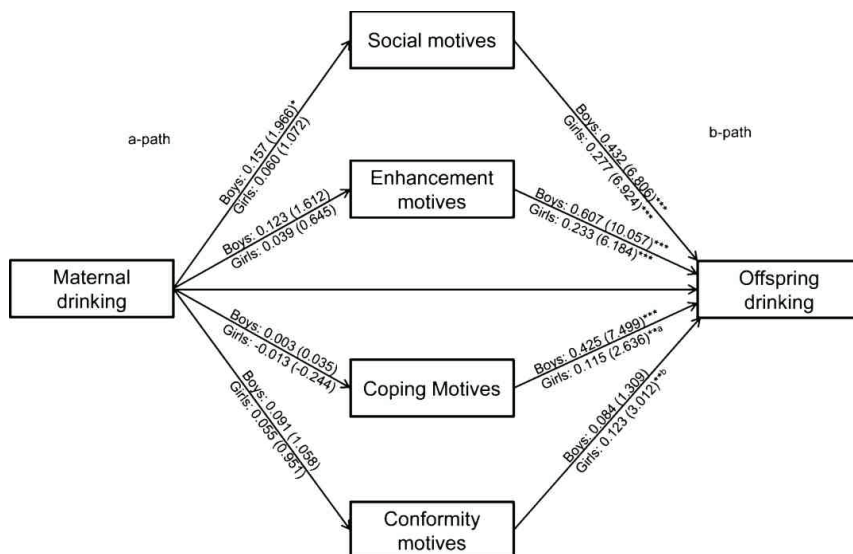


Figure 8: Standardised betas (*t*-value) for the *a*- and *b*-paths of the single mediation analyses in the relationship between maternal and offspring's drinking. All analyses controlled for the parent who completed the parental questionnaire and the other parent's drinking. * $p = 0.050$; ** $p = 0.008$; *** $p = 0.002$; **** $p < 0.001$.

Table 11: Standardised coefficients (t-value) per gender of the direct relationship between maternal and offspring's drinking, and the mediating effects of drinking motives.

Maternal drinking			
	β (t)	Mediating effects (a x b)	
		β [95% CI] ^a	Adj. R ²
Boys (n=271)			
Direct relationship (without motives)	0.154 (1.833)		
Motives			
Social motives		0.067 [0.007, 0.148]	17.6%
Enhancement motives		0.075 [-0.017, 0.182]	
Coping motives		0.001 [-0.062, 0.063]	
Conformity motives		0.006 [-0.004, 0.044]	
Girls (n=316)			
Direct relationship (without motives)	0.037 (0.922)		
Motives			
Social motives		0.017 [-0.011, 0.050]	
Enhancement motives		0.009 [-0.018, 0.039]	
Coping motives		0.000 [-0.015, 0.013]	
Conformity motives		0.008 [-0.003, 0.030]	

All analyses controlled for the parent who completed the parental questionnaire and other parent's drinking; ^a bias-corrected confidence interval retrieved using bootstrapping.

The *index of mediation* showed in the paternal drinking model, in which an indirect effect by enhancement motives was found, that the offspring's drinking increased with 0.041 standard deviations for every one standard deviation increase in paternal drinking (indirectly via enhancement motives). The *index of mediation* showed in the maternal drinking model, in which an indirect effect by social motives was found in boys, that the male offspring's drinking increased with 0.067 standard deviations for every one standard deviation increase in maternal drinking (indirectly via social drinking motives).

Discussion

This study aimed to longitudinally investigate the direct relationship between parental drinking during childhood and young adult offspring's drinking and aimed to investigate the mediating role of drinking motives in this relationship. Other than what was hypothesised, this study found no clear direct relationship between parental drinking during childhood (i.e., before drinking onset) and offspring's drinking at the age of 19 years. Initially, a direct relationship was found for maternal drinking and offspring drinking in general, but when the analyses were stratified for boys and girls (because of a significant interaction effect with offspring's sex), a trend to significance was only found for the relationship between maternal drinking and offspring's drinking in boys. As hypothesised, an indirect effect by drinking motives was found: maternal drinking indirectly affects male offspring's drinking nine years later through social motives, and paternal drinking indirectly affects both male and female offspring's drinking through enhancement motives.

The lack of a direct relationship between parental drinking and offspring drinking is not consistent with other studies (Vermeulen-Smit et al., 2012; White et al., 2000). A possible reason could be the nine years timespan between parental and offspring's drinking, in which many influences from outside the family context, could outweigh the parental effect, especially from early adolescence until early adulthood. Examples include the influence of deviant or pro-social peers or the participation in sports clubs, which are positively related to offspring's drinking (Fredricks & Eccles, 2005; Kuntsche et al., 2004). These effects, combined with a possible smaller long-term effect of paternal drinking, due to the often secondary role of fathers raising children compared with mothers (e.g., in spending time with the children) (Craig, 2006; Raley & Bianchi, 2006; Yu, 2003), might further explain the non-significant direct relationship for paternal drinking compared to the significant relationship for maternal drinking in the general sample. An indicator for the small parental effect over nine years is the trend to significance we found between maternal drinking and drinking in sons. In the general sample, maternal drinking had a significant effect, but splitting up the sample by gender reduced power and possibly resulted in only finding a trend to significance. Another reason for not finding similar results as previous research (White et al., 2000) could be a different measurement method for parental drinking. The current study questioned parents themselves about their drinking at a time when

their children were not yet drinking, whereas another study questioned the offspring about their parent's drinking at a time when their children were already drinking (White et al., 2000).

Despite the absence of a direct relationship for the gender-specific analyses, this study found evidence for indirect effects of parental drinking on offspring's drinking nine years later. Maternal and paternal drinking indirectly affect offspring's drinking through social and enhancement motives, respectively, which is comparable to other studies (Muller & Kuntsche, 2011). However, no indirect effect was found by the other motives, which is in contrast to previous research (Muller & Kuntsche, 2011; Woldt & Bradley, 2002). In our study, parental drinking in late childhood was not significantly related to these latter motives (*a-path*), which might indicate that the effect found in other (cross-sectional) studies are only short-term effects. Another explanation might be that other influences in early adulthood outweigh the long-term influence of parental drinking in late childhood, e.g., classmate drinking motives (Kuntsche & Stewart, 2009). A reason for why paternal and maternal drinking were found only affecting enhancement and social motives, respectively, can possibly be found in the parental drinking context young children often perceive. Offspring's drinking is shown to be influenced by parents' drinking context (Abar, Turrissi, & Abar, 2011; Dalton et al., 2005) and offspring's enhancement motives are shown to be related to paternal enhancement motives (Mares, Lichtwarck-Aschoff, & Engels, 2013). Therefore, it is possible that offspring's enhancement motives are partly shaped by often seeing their fathers drink in enhancement motivated contexts (e.g., while doing small jobs around the house, watching TV). Similarly, mothers are possibly often seen drinking in a social drinking context (e.g., family gatherings). However, sometimes children seem to misperceive their mothers' motives (e.g., drinking to relax at family gatherings), because other studies show that offspring's social motives are related to both maternal social and coping motives (Mares et al., 2013; Windle & Windle, 2012). Further research is needed to confirm these explanations and to investigate why girls are not affected by maternal drinking. Concerning the *b*-paths, the findings were comparable to other studies (Van Damme et al., 2013), except that conformity motives were positively related to offspring's drinking. A few authors found a similar positive relationship (Crutzen & Giabbanelli, 2014). Further research is needed to investigate why conformity motives are sometimes positively related.

The current study found evidence for a relation between parental drinking during late childhood and social and enhancement motives in young adults. Both motives are related to problematic drinking (Van Damme et al., 2013), which leaves interesting anchors for future alcohol interventions. The observed effects are rather small, but show that traces of parental drinking are still detectable in offspring's drinking nine years later. Therefore, this study supports the idea that future generations could benefit from involving (young) parents in preventive alcohol programs by making them aware of their impact on future generations' drinking behaviour (Jackson & Dickinson, 2009; Koning et al., 2009; Smit, Verdurmen, Monshouwer, & Smit, 2008; Van der Vorst et al., 2013). For current generations this study supports the use of social norm interventions (e.g. targeting the norm that social gatherings require alcohol), especially in boys, and the use of interventions targeting implicit cognitions as these strategies show promising results targeting social and enhancement motives, respectively (Moreira, Smith, & Foxcroft, 2009; Salemink & Wiers, 2014; Wiers, Eberl, Rinck, Becker, & Lindenmeyer, 2011). For further improvement of future interventions, more research should investigate the mediating or moderating role of other influencing factors (e.g., peer influence, parenting styles) in the observed relations.

Limitations

Despite the strengths of this study, such as the longitudinal design covering the time from late childhood to early adulthood and the multiple informant approach, some limitations should be mentioned. This study did not include drinking motives in all data collection waves, which made it impossible to control for the development of drinking motives over time (Crutzen, Kuntsche, & Schelleman-Offermans, 2013). This study assessed offspring's drinking motives and drinking behaviour at the same time. We assumed that drinking motives determine drinking behaviour, but due to the study design, we cannot exclude an opposite direction concerning these factors (namely that drinking behaviour can shape drinking motives). However, the theoretical and empirical evidence available gives a strong argument for the assumed direction. This study started with a high number of participants (response rate 82.4%) recruited from a large number of randomly selected elementary schools, which indicates representativeness. However, a high number of participants dropped out across the waves, with a higher attrition rate compared to other long-term longitudinal studies

(Dubow, Boxer, & Huesmann, 2008; Englund, Egeland, Oliva, & Collins, 2008; Windle & Windle, 2012). Although we believe that the size of the difference between the dropouts and remainders is not substantial for interpreting the results, this dropout possibly reduces the generalizability of the results. This study only questioned one parent to obtain information from both parents, which possibly led to a bias compared with the actual drinking of the non-questioned parent. However, the reliability of drinking reports by close collaterals is acceptable (Connors & Maisto, 2003), and all analyses controlled for the parent completing the parental questionnaire. In this study no distinction was made between problematic drinking parents and non-problematic drinking parents, while the former type of parents might have had a different influence on their offspring's drinking behaviour compared to the latter. Finally, an underestimation of the results might occur because of the self-reported nature of this study, which can lead to e.g. socially desirable answering or recall bias.

Conclusions

Using a longitudinal design, this study shows that parental drinking during late childhood indirectly relates to young adults' drinking through social and enhancement motives. These motives are shown to be related to problematic drinking (Van Damme et al., 2013), which makes these results interesting for future interventions.

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7.2 Context matters: faculty-level perceived binge drinking norms relate to binge drinking behaviour among students in higher education⁴

⁴ This section is based on Van Damme, J., Hublet, A., De Clercq, B., McAlaney, J., Van Hal, G., Rosiers, J., Maes, L., Clays, E. Context matters: faculty norms on binge drinking relate to binge drinking behaviour in higher education. *Addictive Behaviors*, 59, 89-94 (IF: 2.764, Q1, 6/35 in substance abuse)

Abstract

OBJECTIVE: Binge drinking among students in higher education is an important problem. To target binge drinking in students it is necessary to study the social context of students. Faculties (i.e., colleges or schools in Northern American education) are social contexts in which students behave, but little is known about how the faculty structure relates to monthly binge drinking. This study investigates the relationship with student-perceived binge drinking norms at faculty level in addition to known personal determinants.

METHODS: Data were collected in 7181 students within 22 faculty-level units, using an anonymous online survey. Multilevel analyses were used to investigate the relationship of both individual-level determinants (e.g., perceived norms, social drinking motives) and student-perceived binge drinking norms at faculty level on monthly binge drinking.

RESULTS: Two-third (62.2%) of the sample were female and the mean age was 21.06 ($SD = 2.85$) years. In males, significant faculty-level variance in monthly binge drinking was found. At faculty level, only same-sex student-perceived binge drinking norms showed a positive relationship ($OR = 2.581$; $95\%CI = [1.023, 6.509]$). At individual level, both opposite and same-sex perceived binge drinking norms, and social drinking motives positively related to monthly binge drinking. In females, no significant faculty-level variance was found. Only individual-level determinants positively related to monthly binge drinking. No cross-level interactions were found.

CONCLUSION: Besides individual determinants, especially in men, faculties are relevant environmental structures and networks to take into account when targeting binge drinking among students in higher education.

Introduction

Binge drinking (i.e., drinking a large amount of alcohol in a short period of time) is a well-established behaviour in higher education and a major cause of problematic health-related outcomes (e.g., premature mortality, injury), anti-social behaviours (e.g., vandalism), and decreased academic performance among students (Perkins, 2002b; White & Hingson, 2013; Wicki, Kuntsche, & Gmel, 2010). Many students mature out of binge drinking, but some of them persist in heavy drinking patterns as an adult (Jennison, 2004).

A popular strategy to target these problems is the use of individual-based interventions through channels such as computers and face-to-face communication, which focus on personal determinants such as perceived norms (Moreira, Smith, & Foxcroft, 2009; Sandler et al., 2014). However, the socio-ecological approach describes health as an outcome of individuals' behaviour as well as the environments in which these individuals live, which implies that interventions should focus both on personal determinants and environmental factors (Bartholomew, Parcel, Kok, Gottlieb, & Fernández, 2011; Kok, Gottlieb, Commers, & Smerecnik, 2008).

At the individual level, heavy drinking in students is strongly influenced by the perceived social drinking norms from the network (i.e., reference group) in which students are active and drink alcohol (Berkowitz, 2004; Perkins, 2002a). Students want to fit into these networks in search for friendship, support or intimacy, and therefore drink as much as they believe that significant others drink (i.e., descriptive norm) and find acceptable (i.e., injunctive norm). However, students often overestimate the actual drinking norms in these networks (Berkowitz, 2004; Borsari & Carey, 2001; Perkins, 2002a), which often encourage them to drink more alcohol than they would otherwise do (Berkowitz, 2004; Perkins, 2002a). Male students usually have higher misperceptions of existing drinking norms than female students (Monk & Heim, 2014) and these misperceptions generally refer to same-sex students (Lewis et al., 2011; Lewis & Neighbors, 2004). Peers are important referents for students, since they spend many more hours with their peers than with other referents like their parents (Borsari & Carey, 2001; Perkins, 2002a). Moreover, peers often play an active role in alcohol offerings, through peer pressure or provocations during social events (Black & Monrouxe, 2014; Borsari & Carey, 2001; Kuntsche,

Rehm, & Gmel, 2004; Kypri, Paschall, Maclennan, & Langley, 2007; Zamboanga et al., 2014). Therefore, a clear relation exists between the perceived norms about peers' drinking and a student's own drinking behaviour (Monk & Heim, 2014; Perkins, 2002a; Perkins & Wechsler, 1996). Besides these direct observations of peers' behaviour or expressed opinions, individuals also extract normative information from summary information about a reference group (e.g., in newspapers) and from signals spread by institutions like schools (e.g., through (the absence of) policies or disapproval) (Tankard & Paluck, 2016).

The relation between perceived norms and alcohol use is known to be mediated and moderated by social drinking motives (Halim, Hasking, & Allen, 2012; Lee, Geisner, Lewis, Neighbors, & Larimer, 2007). Drinking motives are the reasons for which someone drinks alcohol (Kuntsche, Knibbe, Gmel, & Engels, 2005). When students drink for social drinking motives, they drink to enhance their pleasant feeling with an external trigger, like peers (e.g., *to celebrate something with friends, or to be sociable*) (Arbeau, Kuiken, & Wild, 2011; Cox & Klinger, 1988). Social drinking motives are the most prevalent motives in students (Kuntsche et al., 2005; Van Damme et al., 2013), which indicates that drinking alcohol is mainly a social event (Kypri et al., 2007; Wicki et al., 2010). This social character explains why perceived norms motivate students to drink more often for social reasons, and why perceived norms stronger relate to alcohol use in those students drinking for social motives (Halim et al., 2012; Lee et al., 2007).

At an environmental level, a relevant structure that relates to alcohol consumption in students in higher education is their faculty (i.e., the college or school in Northern American education). Alcohol use was shown to vary between faculties (Borsari & Carey, 2001; Bullock, 2004; Webb, Ashton, Kelly, & Kamali, 1997). This variation may be due to differences in composition between faculties, since students with similar characteristics tend to cluster within faculties. For example, in some faculties the majority of students is male or female (Lorant & Nicaise, 2014), and in most faculties students share common personality traits (Lievens, Coetsier, De Fruyt, & De Maeseneer, 2002). Such differences in composition may lead to variations between students of different faculties regarding the perceived norms of their reference groups, which may explain the variance in alcohol use between students of different faculties (Perkins, 2002a). Besides these differences in composition, real

environmental characteristics may also play a role. Differences between faculties exist in the connections among students, which also relates to alcohol use. For example, in higher density faculties (i.e., with many connections between students) drinking behaviour and drinking norms are more easily spread than in lower density faculties (Lorant & Nicaise, 2014). Furthermore, variations between faculties also exist in the behavioural and personal values communicated to students by staff members (Perkins, 2002a; Wicki et al., 2010). Even misperceptions of the social norms exist in these staff members, which might also affect for instance attitudes towards campaigns or policies (Berkowitz, 2004). Such factors contribute to whether an environment is either more permissive or more restrained towards alcohol, which affects norm perceptions and drinking behaviour (Perkins & Wechsler, 1996; Tankard & Paluck, 2016). However, to our knowledge, only a handful of European studies investigated differences in alcohol use between faculties (Bullock, 2004; Lorant & Nicaise, 2014; Webb et al., 1997), while insights into this matter are important to develop interventions that focus both on personal determinants and environmental factors and structures.

As a first aim, this study investigates the variance in frequent binge drinking at faculty level, in all faculties of a large Flemish (northern Belgian) university. We expect to find such variance, because drinking behaviour has been shown to vary between faculties (Bullock, 2004; Webb et al., 1997). As a second aim, this study investigates the differential relationship of individual and faculty-level factors with frequent binge drinking, through multilevel analyses differentiated by sex. We expect to find a compositional effect of socio-demographic factors and personal determinants (i.e., perceived norms and social drinking motives) (Cox & Klinger, 1988; Perkins, 2002a; Wicki et al., 2010), and a relationship with the average student-perceived norm at faculty level. This latter variable serves as a proxy for the environmental factors of a faculty that collectively influence the perceived norms of students in that faculty (Tankard & Paluck, 2016).

Methodology

Participants and recruitment

Participants consisted of 7181 students (a response rate of 22.0%) from a large Belgian university, who anonymously responded to an email invitation to fill out an online survey on substance use. The invitation contained a link to the survey and was sent to the official university email addresses by the vice-chancellor. No reminders were sent, but to raise the response rate, participants could voluntarily enter a lottery. This cross-sectional survey ran from mid-March 2013 until end-April 2013 and was approved by the ethics committee of the Ghent University Hospital.

Materials and measures

Socio-demographic data

Questions include the assessment of sex, age, living status (i.e., with their parents, at a student apartment, on their own), fraternity/sorority membership (i.e., yes/no), faculty (i.e., Arts and Philosophy, Law, Sciences, Medicine and Health Sciences, Engineering and Architecture, Economics and Business Administration, Veterinary Medicine, Psychology and Educational Sciences, Bioscience Engineering, Pharmaceutical Sciences, and Political and Social Sciences) and program (i.e., bachelor or master).

Binge drinking

Binge drinking was assessed by the question '*How frequently do you drink four or more drinks (for women) or six or more drinks (for men) within a two hours period?*'. This question is based on the National Institute on Alcohol Abuse and Alcoholism (NIAAA) standard for binge drinking, adjusted to the Belgian context where a standard drink contains 10 g of alcohol instead of 14 g like in the USA (NIAAA, 2004). Five answering categories were given: *never, less than monthly, monthly, weekly, daily/almost daily*. Answers were dummy coded to '*less than monthly*' (coded zero) and '*monthly or more*' (coded one). This recoding was done to identify a pattern of regular binge drinking.

Perceived binge drinking norm

Perceived binge drinking norm was measured by the questions '*How frequently do you think a regular male student drinks six or more alcoholic consumptions within a two hours period?*' and '*How frequently do you think a regular female student drinks four or more alcoholic drinks in a two hour period?*'. For both questions the same answering categories as for binge drinking were given. Based on these questions and the participants' sex, two new variables were created that describe same-sex and opposite-sex individual-level perceived binge drinking norm, respectively. These latter variables were used in the analyses. For the average student-perceived binge drinking norms at faculty level, separate mean scores for these individual-level variables (i.e., same-sex perceived binge drinking norm, and opposite-sex perceived binge drinking norm) were calculated for each level-2 unit (i.e., faculties). Bachelor (i.e., first three years of university) and master (i.e., final year(s) of university) degree students of the same faculty were seen as two distinct level-2 units, because of differences in terms of e.g., study program, maturity, social context. In total, 22 level-2 units (11 faculties \times 2 programs) with an average of 327 students per unit ($SD = 182$, $min = 72$, $max = 712$) were distinguished.

Social drinking motives

Social drinking motives were assessed with the Drinking Motivation Questionnaire-Revised Short Form (DMQ-R SF) social motives subscale (Kuntsche & Kuntsche, 2009). This subscale consists of three items about the past-year frequency of different social drinking motives: '*to make gatherings more fun*', '*to help you enjoy a party*', and '*to improve parties and celebrations*'. Each item was rated on a five-point Likert scale, ranging from '*never/almost never*' (coded zero) to '*almost always/always*' (coded four). A mean social drinking motives score was calculated (*Cronbach's alpha* = 0.90). A comparable internal consistency was found in other large cross-national studies (Kuntsche et al., 2014; Kuntsche, Stewart, & Cooper, 2008).

Statistical analyses

Descriptive statistics, comparing males and females, were performed using chi-squared and independent-sample t-tests.

Given the nested structure of the data (i.e., students within faculties), we performed multilevel regression analysis (Hox, 2010). Students were defined as level-1 units and faculties, divided in bachelor and master students, as level-2 units. For the first aim, an intercept-only model without predictors was estimated to investigate the variance in regular binge drinking at faculty level. For the second aim, socio-demographic variables (i.e., age, living status, fraternity/sorority membership) and social drinking motives were added in model 2, and individual-level perceived binge drinking norms were added in model 3. For this third model, effects of same-sex and opposite-sex individual-level perceived binge drinking norm were separately estimated (in model 3a and 3b, respectively), because of multicollinearity between these variables. In a fourth model student-perceived binge drinking norms at faculty level were added. Effects of same-sex and opposite-sex perceived binge drinking norms at faculty level were separately estimated (in model 4a and 4b, respectively), also because of multicollinearity between these variables. All analyses were performed separately for male and female students, because students are mainly influenced by sex-specific norms and differently perceive norms according to sex (Lewis et al., 2011; Lewis & Neighbors, 2004; Monk & Heim, 2014). The *variance partition coefficient (VPC)* was calculated with the formula $\sigma^2_{uo}/(\sigma^2_{uo} + \pi^2/3)$, in which σ^2_{uo} is the variance of the faculty-level error (u_{0j}) and $\pi^2/3$ equals the variance of a logistic distribution (i.e., the individual-level error (e_{ij}) distribution under a link function) (Snijder & Bosker, 1999). Cross-level interactions were investigated. Abstainers were included in the analyses, because of their presence in the social environment investigated in this study and because they also perceive binge drinking norms.

Bayesian inference was used to estimate all parameters, because this method is less biased compared to quasi-likelihood methods in logistic multilevel analyses (Browne, Subramanian, Jones, & Goldstein, 2005; Goldstein & Rasbash, 1996). All estimations were done with *Markov-Chain-Monte-Carlo (MCMC)* simulations in MLwiN 2.31 software (Browne, 2015). *Metropolis-Hasting sampling* was used with non-informative prior distributions (set by the *iterative-generalized-least-squares (IGLS)* algorithm), because little was known about the model parameters in advance. The required *MCMC* chain-length for convergence after a burn-in of 5000 simulations was monitored by the *Raftery-Lewis diagnostic*. Model estimates in the tables are presented as *log odds* and are converted to *odds ratios (OR)* with a 95% *credible*

interval (CI) when discussed in the text. Model fit was tested with the *Deviance Information Criterion (DIC)*, with lower values indicating better fit.

Results

Descriptive statistics in Table 12 show no difference in age between males and females (mean = 21.06 years). More males (39.9%) were involved in monthly binge drinking than females (20.9%). Slightly more females lived in student apartments (58% versus 56.8%) or on their own (12.8% versus 10.9%), while males more often were member of a fraternity/sorority (49.9% versus 34.2%) and drank more often for social motives. See Appendix 2 for an overview of the proportions of monthly binge drinking in all level-2 units.

Table 12: Descriptive statistics with differences between sex

Variable	Student		Statistics (df)
	Male (n = 2711)	Female (n = 4470)	
Age (mean (SD)) / missings	21.04 (3.00) / 0	21.09 (2.69) / 0	$t = -0.784 (5239.851)$
Living status (missings)	(30)	(47)	$\chi^2 = 10.765 (2)^{**}$
With parents	32.4%	29.3%	
Student's apartment	56.8%	58.0%	
On their own	10.9%	12.8%	
Fraternity/sorority (missings)	(373)	(415)	$\chi^2 = 152.747 (1)^{***}$
Being no member	50.1%	65.8%	
Being member	49.9%	34.2%	
Binge drinking Frequency (missings)	(158)	(177)	$\chi^2 = 286.546 (1)^{***}$
< Monthly	60.1%	79.1%	
≥ Monthly	39.9%	20.9%	
Social drinking motives: range: 0-4 ^a (mean (SD)) / missings	2.01 (1.16) / 486	1.41 (1.06) / 630	$t = 19.947 (4330.117)^{***}$
Perceived binge drinking norm: range: 1-5 ^b			
About same sex (mean (SD)) / missings	3.68 (0.90) / 342	3.63 (0.88) / 360	$t = 2.107 (6477)^*$
About opposite sex (mean (SD)) / missings	3.46 (0.91) / 342	3.83 (0.89) / 366	$t = -16.063 (4832.789)^{***}$

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; a 0='never/almost never' to 4='almost always/always'; b 1='never' to 5='daily or almost daily'

The null model (model 1) in males showed a faculty-level variance of 0.156 ($SE = 0.071$) with a *VPC* of 0.045, which indicates that 4.5% of the variance in binge drinking in males can be explained by differences in faculties (Table 13). DIC statistics also showed better fit for a 2-level-structured model ($DIC = 3378.552$) compared to a single-level model ($DIC = 3436.762$). This difference confirmed

multilevel analyses for males. For females no significant faculty-level variance was found ($\sigma^2_{uo} = 0.067$; $SE = 0.037$), which means that none of the variance in binge drinking in females can be explained on faculty level (Table 14). However, *DIC* statistics showed better fit for a 2-level-structured model compared to a single-level model, with *DIC* statistics being respectively 4380.767 and 4405.529. Therefore, the nested structure of the female data was taken into account in further analyses. Model 2 in Table 13 and Table 14 presents the model with socio-demographic variables and social drinking motives added for male and female students, respectively. In both sexes *DIC* statistics decreased after adding these variables, which indicates improved model fit. In male students, faculty-level variance became non-significant when the socio-demographic variables and social drinking motives were added to model 2.

For male students, models 3a and 3b showed that respectively same-sex individual-level perceived binge drinking norms and opposite-sex individual-level perceived binge drinking norms significantly predicted monthly binge drinking (Table 13). The more male students perceived peer males ($OR = 2.111$; $95\%CI = [1.862, 2.393]$) and females ($OR = 1.826$; $95\%CI = [1.620, 2.058]$) perform in binge drinking, the higher the odds were for monthly binge drinking. When faculty-level variables were added in models 4a and 4b, a significant association was only found for same-sex student-perceived binge drinking norms at faculty level (Table 13). The higher the student-perceived binge drinking norms at faculty level about males, the higher the odds for monthly binge drinking ($OR = 2.581$; $95\%CI = [1.023, 6.509]$). In both series of analyses (model 2 \rightarrow 3a \rightarrow 4a, and model 2 \rightarrow 3b \rightarrow 4b), *DIC* statistics decreased with addition of the individual-level perceived norms and the student-perceived binge drinking norm at faculty level, which showed improved model fit (Table 13). For female students, only the individual-level same and opposite-sex perceived binge drinking norm was significant. Beliefs about peer males' and females' binge drinking resulted in higher odds for monthly binge drinking ($OR = 2.034$; $95\%CI = [1.819, 2.274]$ and $OR = 1.865$, $95\%CI = [1.667, 2.085]$, respectively) (model 3a and 3b, Table 14). *DIC* statistics only decreased when the individual-level perceived binge drinking norm was added to both series of analyses (Table 14). Both in males and females, no cross-level interactions were found.

Table 13: Fixed and random parameters of the multilevel monthly binge drinking models in male students.

	Model 1		Model 2		Model 3a		Model 4a		Model 3b		Model 4b	
	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE
Fixed parameters												
MALE STUDENTS (<i>n</i> =2711)												
Constant	-0.394	(0.098)*	-0.765	(0.125)*	-0.823	(0.117)*	-0.862	(0.117)*	-0.813	(0.121)*	-0.839	(0.119)*
<i>Individual level</i>												
Socio-demographics												
Age			-0.083	(0.027)*	-0.092	(0.026)*	-0.092	(0.026)*	-0.087	(0.026)*	-0.087	(0.026)*
Living status ^a												
Student's apartment			0.679	(0.117)*	0.673	(0.120)*	0.680	(0.121)*	0.679	(0.120)*	0.684	(0.119)*
On their own			0.446	(0.217)*	0.470	(0.223)*	0.481	(0.226)*	0.441	(0.222)	0.432	(0.222)
Fraternity/sorority ^b												
Being member			-0.152	(0.108)	-0.136	(0.110)	-0.086	(0.112)	-0.123	(0.109)	-0.094	(0.111)
Social drinking motives			0.922	(0.050)*	0.915	(0.052)*	0.909	(0.053)*	0.931	(0.052)*	0.927	(0.052)*
Perceived binge drink norm												
About same sex					0.747	(0.064)*	0.731	(0.064)*			0.602	(0.061)*
About opposite sex											0.594	(0.061)*
<i>Faculty level</i>												
Aggregated perceived binge drink norm												
About same sex							0.948	(0.472)*				
About opposite sex											0.577	(0.406)
Random parameters												
σ^2_{ω} (Faculty)	0.156	(0.071)*	0.081	(0.058)	0.032	(0.035)	0.025	(0.030)	0.051	(0.048)	0.042	(0.043)
DIC	3378.552		2366.744		2219.406		2217.135		2265.048		2264.857	

a: reference category = with parents; b: reference category = being no member; SE: standard error; *b*: logodds; **p* < 0.05

Table 14: Fixed and random parameters of the multilevel monthly binge drinking models in female students.

	Model 1		Model 2		Model 3a		Model 4a		Model 3b		Model 4b	
	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE
Fixed parameters												
Constant	-1.338	(0.072)*	-1.969	(0.106)*	-2.124	(0.110)*	-2.130	(0.109)*	-2.101	(0.112)*	-2.095	(0.108)*
<i>Individual level</i>												
Socio-demographics												
Age			-0.068	(0.025)*	-0.084	(0.025)*	-0.084	(0.025)*	-0.086	(0.026)*	-0.085	(0.025)*
Living status ^a												
Student's apartment			0.543	(0.109)*	0.535	(0.113)*	0.535	(0.112)*	0.534	(0.113)*	0.531	(0.110)*
On their own			0.242	(0.184)	0.312	(0.191)	0.316	(0.188)	0.324	(0.190)	0.318	(0.187)
Fraternity/sorority ^b												
Being member			0.205	(0.094)*	0.269	(0.097)*	0.274	(0.097)*	0.254	(0.095)*	0.251	(0.097)*
Social drinking motives			0.908	(0.106)*	0.889	(0.044)*	0.891	(0.045)*	0.889	(0.044)*	0.889	(0.044)*
Perceived binge drink norm												
About same sex					0.710	(0.057)*	0.709	(0.057)*				
About opposite sex									0.623	(0.057)*	0.625	(0.058)*
<i>Faculty level</i>												
Aggregated perceived binge drink norm												
About same sex							0.130	(0.443)				
About opposite sex											-0.025	(0.395)
Random parameters												
$\sigma^2_{\epsilon 0}$ (Faculty)	0.067	(0.037)	0.010	(0.013)	0.009	(0.011)	0.010	(0.012)	0.010	(0.013)	0.011	0.014
DIC	4380.767		3266.182		3092.497		3094.181		3128.623		3130.650	

a: reference category = with parents; b: reference category = being no member; SE: standard error; * $p < 0.05$

Discussion

This study aimed to investigate differences in frequent binge drinking between faculties in a large Belgian university, and the relationship with individual and faculty-level factors. In males, 4.5% of the variance in frequent binge drinking could be ascribed to differences between faculties. These differences were due to compositional differences between faculties, although a significant relationship was also found between student-perceived binge drinking norms about males at faculty level, and frequent binge drinking in males. In females, no significant level 2 variance and no effect of student-perceived binge drinking norms at faculty level were observed.

Consistent with former research, this study found differences in monthly binge drinking behaviour between faculties (Bullock, 2004; Webb et al., 1997). These differences were only found in men, which is in line with other research that found a larger variation in drinking between faculties in men compared to women (Webb et al., 1997). Differences between faculties were mainly caused by a composition effect, since level-2 variance became non-significant when individual-level variables were added. The added individual-level variables are known predictors of alcohol use among students in higher education and were found to vary between faculties (Lorant & Nicaise, 2014; Wicki et al., 2010). This phenomenon may be related to differences in student inflow and drinking habits in different faculties (Carlson, Johnson, & Jacobs, 2010; Lievens et al., 2002). The observed relationship with social drinking motives is consistent with another Belgian study in higher education, which also found a positive relation with monthly binge drinking (Van Damme et al., 2013). For individual-level perceived norms positive relationships were found for same and opposite sex, both in males and females, which is in line with other research (Lewis & Neighbors, 2004).

Besides these individual influences, this study found an additional relationship in men with same-sex student-perceived binge drinking norms at faculty level. In those faculties with higher average perceived norms, men had higher odds for monthly binge drinking. Faculty-level influences on binge drinking were previously reported by Lorant and Nicaise, who found that social networks could be different in different faculties, which was related to binge drinking and the diffusion of norms in these

faculties (Lorant & Nicaise, 2014). Differences between faculties also exist in how faculty staff members behave and communicate personal values, and how they perceive norms about drinking (Berkowitz, 2004; Perkins, 2002a; Wicki et al., 2010). Our results are consistent with these studies by showing that faculties as environmental structure relate to regular binge drinking, independent from individual factors. However, further research is needed to reveal the exact environmental characteristics of faculties that influence perceived norms and drinking behaviour of individuals studying within these faculties.

This study only found a significant association of same-sex student-perceived binge drinking norms at faculty level in men. This sole effect of same-sex norms is not surprising, since same-sex peers are often an important source for the perception of norms about drinking (Lewis et al., 2011; Lewis & Neighbors, 2004; Monk & Heim, 2014). In female students no such relationship was found. Previous research has shown that the relationship between sex and social drinking norms can vary by setting and country. In the US, for example, female students were observed to have greater misperceptions of peer alcohol use than male students, which has been argued to be a result of females visualizing the behaviour of males when asked to imagine a 'typical' student (Lewis & Neighbors, 2006), while research in Europe has failed to find such sex-effects on norm perceptions (Page, Ihasz, Hantiu, Simonek, & Klarova, 2008). Further research is needed to explain why no relationship with faculty-level determinants was found in females. However, individual-level binge drinking norms in female students were significant predictors, which is consistent with other research (Monk & Heim, 2014).

In the current study evidence was found that student-perceived binge drinking norms at faculty level relate to monthly binge drinking in men. This relationship was observed in addition to individual predictors and confirms the importance of the socio-ecological approach that targets both individual and environmental-level predictors. In this study individual-level determinants were shown to explain all variance at faculty level, which suggests that in some faculties students at risk cluster together. Based on this result, faculties are an interesting vehicle to focus the individual-based section of an intervention (e.g., by focusing on students in specific faculties when targeting individual-level determinants). At environmental level, our results further suggest that university-broad strategies can be used, since the observed

environmental effects did not explain variance at faculty level. Such university-broad interventions relate to the concept of the Health Promoting University, which has been endorsed by the World Health Organization (Cawood, Dooris, & Powell, 2010). This approach argues that educational institutions are ideally suited for health prevention and interventions, as they consist of large populations, develop professionals and leaders of the future, and can set an example to local communities. Effective examples of environmental strategies that influence drinking behaviour and norms are given in the 'Study to Prevent Alcohol-Related Consequences' (SPARC) intervention (Tankard & Paluck, 2016; Wolfson et al., 2012). This intervention implemented policies that, e.g., restrictions on-campus alcohol paraphernalia (e.g., empty beer cans, bottles, shot glasses), banned the distribution of alcohol flyers, clarified a student code of conduct, adopted dual judicial policies to address off-campus behaviour, increased sanction for alcohol violation and provided benefits for students in good standing (Wolfson et al., 2012).

Limitations

Despite the strengths of this study, such as the large variety of students who represents all faculties of a large Belgian university, and the use of a multilevel approach that controlled for important individual determinants and takes into account the nested structure of students within faculties, some limitations need to be mentioned. In this study perceived norms were assessed with a one-item instrument per sex and with a more general reference group. A multi-item assessment and a more specific reference group could enhance accuracy of the results. However, the perceived norm questions in this study differentiated by sex, which already contributes to the accuracy of the results (Monk & Heim, 2014). This study found an association with student-perceived binge drinking norms at faculty level, but provides no information on how these norms arise. Future research should investigate which environmental factors are important (see section 2.3.4c for potential factors), because such information is relevant for future intervention development. This study was open for all students, who could freely participate, which might affect the generalization of the results. However, incentives were given to increase response, and a high number of students from a wide variety of academic disciplines in a large university were recruited. Due to the cross-sectional design we are not able to draw

conclusions on causality. Finally, results might be underestimated, because of the self-reported nature of this study, which can lead to e.g., socially desirable answering or recall bias.

Conclusions

Frequent binge drinking among students in higher education relates to both personal determinants and environmental factors. These environmental factors were especially found in men, who were affected by same-sex student-perceived drinking norms at faculty level. This study stresses the relevance of faculties as an environmental structure and network, and the importance of interventions that target both the individual and the environment.

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Part 4: General discussion

In an effort to inform and improve future intervention development regarding alcohol misuse in higher education, this dissertation aims to give an overview of the available research evidence as part of a needs assessment on alcohol use among students in higher education that is relevant for the Flemish context. Worldwide, alcohol use among students in higher education is a major concern, but most research is conducted in North America and most interventions focus on a limited selection of individual determinants. However, more and more sound European research becomes available, and a modest shift towards a socio-ecological approach is seen. In this dissertation an overview was given of the most important, and for Europe and Flanders the most relevant research available concerning alcohol use among students in higher education. First, an extensive analysis was performed about drinking behaviour in students, the health-related and quality of life-related consequences of alcohol use in students, and the most important determinants of this behaviour. Next, a profound environmental analysis was presented that gives an overview of the most important interpersonal actors and the most important broad environmental factors that are related to alcohol use among students in higher education. Along this assessment, multiple gaps in the literature were highlighted, of which a number were addressed by own original research in this dissertation in *Part 3: Original research articles*.

In particular, four research questions were investigated in this dissertation. The first study (section 6.1) aimed to investigate student characteristics and drinking motives of those who drink in the exam periods. In exam periods many of the alcohol-promoting contextual factors are missing, and current incentives are often disproportional through increased stress and decreased excitement. To our knowledge, this was the first study that investigated the prevalence of students who drink in the exam period and that profiled these students based on their drinking motives, socio-demographics, and personality traits. The second study (section 6.2) aimed to clarify the relationships between different drinking motive dimensions and multiple indicators of problematic use. Despite consistent findings about the predictive value of internal drinking motives (i.e., coping motives and enhancement motives) for problematic alcohol use, and about the negative or absent relationship between conformity motives and normal alcohol use, no consistent evidence was available on the relationship between social drinking motives and problematic use in

higher education. Two important reasons for this inconsistency are the methodological and cultural differences that exist between the available studies. In this second study, drinking motives were investigated in a representative sample of the Flemish higher education context, with an instrument for drinking motives that was used in previous studies that did not find a relationship between social drinking motives and problematic use. The third study (section 7.1) aimed to investigate the historical influence of parental drinking during childhood on college-aged adults' drinking, with a particular interest for the role of drinking motives in this context. Cross-sectional studies reported inconsistent findings about the role of specific drinking motives in this relationship, while longitudinal studies were not available. In this third study, the mediating effect of drinking motives in the relationship between parental and offspring drinking was longitudinally investigated in a nine year follow-up study. Maternal and paternal drinking were separately studied, to clarify the differential and unique influence of both parents. Finally, the fourth study (section 7.2) aimed to study the faculty-level variance of frequent binge drinking and the differential relationship of faculty-level and individual-level factors on frequent binge drinking. European evidence on the differences in alcohol use between faculties, and knowledge on the influence of faculty-level factors on students' alcohol use is limited. Therefore, this fourth study investigated frequent binge drinking in all faculties of a large Flemish university by multilevel analyses. In this study, faculty-level factors were operationalized by the aggregated student-perceived drinking norms at faculty level, which function as a proxy for the environmental factors of a faculty that collectively influence student-perceived norms in that faculty.

8 Summary of the main findings

8.1 Overall findings

Findings from the first study in section 6.1 showed that one-third of the heterogeneous sample (i.e., from multiple disciplines) of Flemish students that was investigated, drank alcohol in the exam period. Fourteen per cent of these students drank on a weekly base. These behaviours were related to being at risk for problematic use. Male students were more likely to be non-abstainers and weekly drinkers in the exam period. This increased likelihood was also seen for each year a student was older. Living in a student apartment was a protective factor for drinking in

the exam periods. However, in those students who drank in the exam periods this characteristic became a predictive factor for weekly drinking. Personality characteristics seemed not related to drinking in the exam period. The frequency of drinking motives generally declined from the academic year (i.e., without exams) to the exam periods. This decline was stronger in external drinking motives (i.e., social and conformity motives) compared to internal drinking motives (i.e., enhancement and coping motives). Furthermore, internal drinking motives were found to characterize both non-abstainers and weekly drinkers in the exam periods. Students who drank for internal drinking motives in the academic year had higher odds for not abstaining in the exam periods. Students who drank for internal drinking motives in the exam periods had higher odds for weekly drinking in these periods.

The second study in section 6.2 found a positive relationship between internal drinking motives and all indicators of alcohol use (i.e., more than weekly drinking, monthly binge drinking, and being at risk for problematic use according to the AUDIT). These relationships were found in both men and women. For conformity motives a negative or absent relationship was found, depending on the alcohol use indicator and the gender of the students. No relationship was found between conformity motives and monthly binge drinking in women. Social drinking motives were positively related to all indicators of alcohol use, in both men and women. Additionally, this study found a gradient in the relationship between social and enhancement drinking motives, and all indicators of alcohol use. For these relationships, higher odds for more than weekly and heavy drinking were found as more drinking motives were reported.

Findings from the third study in section 7.1 showed that maternal drinking during childhood (i.e., before offspring's drinking onset) related to offspring's alcohol use at the age of 19 years. However, when this relationship was separately investigated for boys and girls, because of a significant interaction effect between maternal drinking and offspring's gender, this relationship became non-significant in girls and was reduced to a trend to significance in boys. Despite this lack of a clear direct relationship between parental drinking and offspring's drinking nine years later, this study found an indirect parental influence on offspring's drinking through a mediational effect of drinking motives. In this study maternal drinking during childhood influenced social drinking motives in boys nine years later, which was

related to alcohol use in these male emerging adults. Paternal drinking during childhood influenced enhancement drinking motives in both boys and girls nine years later. These enhancement motives further related to alcohol use in these grown-up offspring.

The final study in section 7.2 found a difference in monthly binge drinking between faculties in men. These differences between faculties were mainly caused by a compositional effect, which suggests that faculty differences in monthly binge drinking are the result of differences between faculties in student characteristics (i.e., age, living status, and fraternity/sorority membership). Moreover, social drinking motives and individual-level same-sex and opposite-sex perceived drinking norms were positively related to monthly binge drinking in both male and female students. Besides these individual-level correlates, this study found an additional relationship in men with same-sex faculty-level student-perceived binge drinking norms. This relationship showed higher odds for monthly binge drinking in men in those faculties with higher average perceived norms.

8.2 Overall discussion

Socio-demographic characteristics

Over the different studies that were conducted in this dissertation a number of interesting patterns became clear regarding the socio-demographic characteristics of students who showed unhealthy drinking patterns in higher education. Consistent with the gender differences that were discussed in the needs assessment (in section 2.3.1c), all studies in this dissertation found solid evidence that males were heavier drinkers compared to females. This difference was found for different sorts of drinking patterns, for various drinking measures and in multiple samples. Quantity measures in the study described in section 7.1 shows males drinking more than double the quantity of females. Frequency measures in the studies in section 6.2 and 7.2 shows that more male students drank 'more than weekly' or performed in binge drinking 'monthly or more' than their female counterparts. Even for the indicators of problematic and unhealthy use, such as being at risk for problematic use according to the AUDIT or (frequent) drinking in the exam period, the studies in section 6.1 and 6.2 found a similar trend. Quantity differences were found in a general sample of emerging adults, while the frequency differences and the differences in the indicators

of problematic and unhealthy use were found in students from two different samples, from two different “study-generations” (i.e., study cycles). These results compare to a generally observed tendency of males being heavier drinkers than females (Lorant et al., 2013; Pohjola et al., 2014; Sebena et al., 2011; Visnjic et al., 2015; Wicki et al., 2010). Drinking in males is probably more socially accepted and perceived less harmful in men, since (heavy) drinking and drunkenness often have a very masculine reputation and often tend to be less accepted when performed by women (de Visser & McDonnell, 2012). Moreover, males can generally endure higher amounts of alcohol than females before they encounter the effects of alcohol, because of physiological differences between both sexes (Nolen-Hoeksema & Hilt, 2006). These physiological differences might also explain the heavier drinking patterns in males.

Regarding living status, in general, higher drinking rates were observed in students living in a student apartment compared to those living with their parents. These findings are consistent throughout our own original studies that were presented in this dissertation, and join the general trend that was discussed in the performed needs assessment in section 2.3.1c (Bartoli et al., 2014; Davoren et al., 2015; Lorant et al., 2013; Sebena et al., 2011; Visnjic et al., 2015; Wicki et al., 2010). However, in relation to abstinence in the exam period, the study in section 6.1 showed a protective influence of living in a student apartment on drinking in the exam period. In Belgium, students who live away from their parents often move in with their parents in the exam period, e.g., to avoid losing time on housekeeping. This temporary separation from their usual drinking environment, and the increased parental control that comes with this move, might explain this protective effect (Clapp, Reed, Holmes, Lange, & Voas, 2006; Ham & Hope, 2003). Still, living in a student apartment seems only protective in the decision to drink or not to drink in the exam periods. Among students who drink in the exam periods, those living in a student apartment have higher odds for drinking on a weekly base in the exam periods. This finding is in line with the general trend of higher drinking rates in students living in student apartment, that was discussed in the performed needs assessment and was observed in the studies in section 6.2 and 7.2.

According to the needs assessment that we performed (in section 2.3.1c), age was a less consistent characteristic in relation to alcohol use. Different sorts of relationships have been described, i.e., a negative relationship, a positive relationship or a non-

linear relationship (Davoren et al., 2015; Wicki et al., 2010). A similar trend is seen in the four studies that were conducted in this dissertation. Different relationships between age and alcohol use were found, depending on the outcome measure and the sample that was investigated. In the sample of university and college students that was observed in 2009, a non-linear relationship that peaked around the age of 22 was observed for all heavy drinking indicators (study in section 6.2). In the sample that consisted of only university students, observed in 2013, a positive relationship was found with (frequent) drinking in the exam period (i.e., study in section 6.1), while a negative relationship was observed with frequent binge drinking (i.e., study in section 7.2). Results from this latter sample suggest that short-term variations in students' drinking (e.g., exam periods versus periods without exams) become more stable as students become older (Kuntsche & Gmel, 2013), while on the longer-term drinking patterns might attenuate towards graduation, for example to positively influence academic achievement to maximize employability (Carrell et al., 2011; Rothwell, Herbert, & Rothwell, 2008). The differences that were observed in the relationship between age and frequent binge drinking in the 2009 sample compared to the 2013 sample might be explained by the heterogeneity in study trajectories in the 2009 sample compared to the 2013 sample. College students' study trajectories are generally shorter than those of university students, which might result in different drinking patterns at different ages in college students compared to university students.

Drinking motives and faculty-level norms

Overall, the discussed original research articles that investigated all four drinking motive dimensions in sections 6.1, 6.2 and 7.1 found a similar drinking motives order as reported in the literature, with social drinking motives being the most frequently reported reasons for drinking alcohol, followed by enhancement, coping and conformity motives (Kuntsche & Kuntsche, 2009; Nemeth et al., 2011). The studies in section 6.1 and 6.2 found a positive relationship between enhancement and coping motives, and indicators of problematic or unhealthy use, which is consistent with the literature (Kuntsche et al., 2005, 2006a; Kuntsche et al., 2008; Merrill & Read, 2010; Nemeth et al., 2011). This list of risk-related motives was further expanded in the study in section 6.2, which found a relationship between social drinking motives and indicators of problematic use in both male and female Flemish students. A result that

was replicated in the study in section 7.2, that also found such positive relationship for both sexes with frequent binge drinking in another sample of Flemish students four years later. These latter findings add robustness to the findings of the former study in section 6.2. The socially-oriented drinking culture in Flemish higher education possibly explains why social drinking motives were related to indicators of problematic use in Flemish students, while this seemed not the case in other cultures and in adolescents (Kuntsche et al., 2005; Merrill & Read, 2010; Nemeth et al., 2011). As also discussed in earlier sections (2.2 and 2.3.3b), differences exist in drinking culture, drinking context, and legislation between different countries, which might explain differences in alcohol consumption and drinking motives between countries (Demers et al., 2002; Gordon, Heim, & MacAskill, 2012; Kairouz et al., 2002). Each of these drinking cultures and drinking contexts are typified by their own set of drinking rules and norms, which are obtained and reinforced by socialization processes and affect attitudes, drinking motives and drinking behaviour (Borsari & Carey, 2001, 2006; Cox & Klinger, 1988; Demers et al., 2002; Gordon et al., 2012; Kuntsche et al., 2007; Kuntsche et al., 2010). In a socially-oriented drinking culture, like in Flemish higher education, with for example high prevalence of alcohol consumption and high visit rates for pubs and parties in students (Rosiers et al., 2014), and a permissive (social) environment with, e.g., various advertisements and promotions towards young adults and students, that promote the social aspects of drinking (De Donder, 2013), alcohol consumption has become the standard in many social interactions, which might explain the positive relationship between social drinking motives and heavy drinking in such cultures.

The influence of a permissive environment towards alcohol was also indirectly shown in the study in section 7.2, in which a positive and independent relationship was found between student-perceived drinking norms at faculty level and frequent binge drinking in males. Various institution-related risk factors, such as the presence of a fraternity/sorority, the location of the campuses, the (absence of) institutional policies and denouncements concerning alcohol use, the network densities in faculties, and the communications and (mis)perceptions of staff members, are related to students' alcohol consumption and contribute to students' perceptions about alcohol use (Berkowitz, 2004; Lorant & Nicaise, 2014; Perkins, 2002a; Presley et al., 2002; Tankard & Paluck, 2016). The influence of such environmental factors was

investigated in the original research article in section 7.2, in which student-perceived drinking norms at faculty-level served as a proxy for these environmental factors (Tankard & Paluck, 2016). The observed relationship between same-sex student-perceived drinking norms at faculty level and frequent binge drinking suggests a permissive atmosphere towards alcohol in Flemish higher education institutions, which relates to heavy drinking, especially in male students. It is not surprising that in particular same-sex norms were significantly related to heavy drinking, given that same-sex peers are often the most important referents for perceived drinking norms (M. A. Lewis et al., 2011; M. A. Lewis & Neighbors, 2004; Monk & Heim, 2014). A potential reason for the masculine nature of this relationship can be the lower sensitivity of female students to these higher level environmental influences, because of a more aversive position towards heavy drinking in females compared to males. Heavy drinking is mainly seen as a masculine behaviour that is often less accepted in females (de Visser & McDonnell, 2012). Moreover, female students generally drink less than male students and often have less positive outcome expectancies towards alcohol (Wicki et al., 2010), which all contributes to a more aversive close environment around females compared to males. Such close environment influences the position of females towards heavy drinking in their efforts to build good quality relationships with this environment (Borsari & Carey, 2006). The findings from the study in section 7.2, combined with the mediated and moderated effect by social drinking motives in the relationship between students' alcohol use and perceived norms (Halim, Hasking, & Allen, 2012; Lee, Geisner, Lewis, Neighbors, & Larimer, 2007), that are partly determined by institution-related factors (Berkowitz, 2004; Tankard & Paluck, 2016), might further explain the positive relationship, found in section 6.2, between social drinking motives and heavy drinking in Flemish higher education.

The importance of drinking motives in relation to alcohol use among students in higher education varies throughout the academic year, which was shown in the study in section 6.1. This study revealed that internal drinking motives (i.e., enhancement and coping motives) were relatively more important during the exam periods compared to external motives (i.e., social and conformity motives). Despite a decrease in all drinking motive frequencies during the exam periods (compared to the academic year without exams), a stronger decrease was observed in external

drinking motives. Moreover, only students who drank for internal drinking motives in periods without exams had higher odds for drinking during the exam periods. Students who drank for internal motives during the exam periods had higher odds for weekly drinking in the exam periods. These results suggest that, while some students still drink for external motives during the exam periods, only internal motives were related to maladaptive behaviours in the exam periods. In periods without exams, results from the study in section 6.2 showed that both internal drinking motives and social motives were positively related to heavy drinking. A reason for internal drinking motives being important in relation to maladaptive and heavy drinking behaviour in periods with and without exams can be twofold. On the one hand, through a feedback loop, previous experiences in periods without exams might shape expectancies and drinking motives in stressful and monotonous periods, like during the exams (Cooper, 1994; Cox & Klinger, 1988). In this case, the unhealthy behaviours that relate to internal drinking motives in periods without exams might be continued in the exam periods. On the other hand, the experienced effects of internal drinking motives in exam periods might induce drinking for similar or specific other motives in the future (e.g., in a more stressful episode outside the exam periods) (Crutzen et al., 2013). Here, the maladaptive behaviours from the exam periods might be carried into periods without exams and relate to unhealthy behaviour in these latter periods.

Of the three drinking motive dimensions that have been related to heavy drinking in Flemish higher education (in section 6.2 and partly in section 7.2), two have their origin in childhood. The results from the study in section 7.1 showed that maternal and paternal drinking during childhood indirectly related to fledged offspring's drinking through social motives (in males) and enhancement motives (in both males and females) nine years later, respectively. This indirect relationship is consistent with other research (Muller & Kuntsche, 2011), but was unexpectedly limited to two drinking motive dimensions. The absence of a relationship with other drinking motive dimensions can have multiple reasons. The mediating relationship that was described for these other drinking motive dimensions in a number of cross-sectional studies (Muller & Kuntsche, 2011; Woldt & Bradley, 2002) might only reflect the short-term influences of parental drinking on offspring's cognitions. As discussed in the needs assessment in section 2.3.4b, parents in higher education still influence

the cognitions of their fledged children (J. M. Campbell & Oei, 2010; Glanton & Wulfert, 2013; Hummer, LaBrie, et al., 2013). Another reason can be the encountering of various other influences in early adulthood, such as those from classmates and other peers, that might outweigh the long-term effects of parental drinking during childhood (Kuntsche & Stewart, 2009). As discussed in section 2.3.4b these other influences can initiate or reinforce cognitions (e.g., drinking motives) independent from parents. The gender specificity in the parental influence on offspring's drinking motives can be explained by the drinking context in which offspring often saw their parents drink alcohol. The parental drinking context has been shown to relate to offspring's drinking (Abar et al., 2011; Dalton et al., 2005). Therefore, offspring's enhancement motives can originate from often seeing fathers drink in enhancement motivated contexts, like gardening and watching TV, given that offspring's enhancement motives have been found to relate to fathers' enhancement motives (Mares, Lichtwarck-Aschoff, & Engels, 2013). Similarly, in childhood, offspring might often see their mothers drink in a social context (e.g., on family gatherings). However, these social contexts tend to be sometimes misperceived, since offspring's social drinking motives relate to both maternal social and coping motives (e.g., drinking to relax on family gatherings) (Mares et al., 2013; Windle & Windle, 2012).

9 Implications and recommendations

9.1 General implications and recommendations

Findings from the original studies in this dissertation deliver interesting insights that can improve future intervention development on alcohol misuse in (Flemish) higher education. As shown in the second and final original study that was conducted in section 6.2 and 7.2, in Flanders, social drinking motives play an important role in heavy drinking, apart from internal drinking motives, which are also known risk factors in this matter (Kuntsche et al., 2005, 2006a; Kuntsche et al., 2008; Merrill & Read, 2010; Nemeth et al., 2011). Future interventions could benefit from these findings by paying more attention to the normative beliefs about social drinking among students in higher education. Although two meta-analytic reviews on social norm interventions concluded that these type of interventions only have a relatively small impact on college students, both reviews also reported large heterogeneity

between the included studies, which could have contributed to finding only small overall effect sizes (Dotson et al., 2015; Foxcroft et al., 2015). When looking at a number of individual studies, promising results have been reported, especially for personalized normative feedback interventions in heavy drinking students that showed significant reductions in norm misperceptions, drinking behaviours or alcohol-related consequences (Bewick et al., 2010; M. A. Lewis & Neighbors, 2006; Neighbors, Larimer, & Lewis, 2004; Ridout & Campbell, 2014). Moreover, McAlaney et al. (2015) concluded that social norms interventions seem also relevant in European students in higher education. In Flanders, we are aware of one initiative that was undertaken towards correcting normative beliefs in higher education by the Association for Alcohol and other Drug Problems. This Flemish organization launched a social norm campaign in 2012 (*i.e.*, *'Proven black on white: students also have fun without alcohol'*) that intended to make students aware that students can have fun at parties without the necessity to drink alcohol (VAD, n.d.). However, to our knowledge, this is one of the unique cases in recent years in Flemish higher education.

Besides social drinking motives, future interventions should also target coping and enhancement motives in students in higher education, both in periods with and without exams. Based on the results in section 6.1, interventions should specifically focus on internal drinking motives during the exam periods, while the focus on social drinking motives can be attenuated in this period. For periods without exams, internal drinking motives should be targeted in addition to social drinking motives. First, because of the relationship with the indicators of heavy use in periods without exams that was discussed in section 6.2 and that was found in multiple studies (Kuntsche et al., 2005, 2006a; Kuntsche et al., 2008; Merrill & Read, 2010; Nemeth et al., 2011). Second, to prevent drinking for internal drinking motives in the exam periods based on experiences from periods without exams, or to obviate maladaptive drinking behaviours “learned” in the exam periods and continued in periods without exams (section 6.1). In our opinion, tailoring alcohol interventions around exam periods might be a realistic recommendation in Flemish higher education. Nowadays, in the exam periods, Flemish higher education institutions and organizations working on substance use often disseminate specific tips and tricks towards students to get healthy through the exam periods. For example, the intervention from the Association

for Alcohol and other Drug Problems about '*Studying and medication do not go hand in hand*' (Matthys, 2012) often receives special attention on various channels during the exam periods. A number of promising intervention strategies that can be used for targeting internal drinking motives are encouraging students for substance-free activities, such as physical activity that serve as an alternative for the mood enhancing or stress reducing effects of alcohol (Weinstock, 2010) or listening to music that can serve as a coping strategy instead of alcohol use (Jonker & Kuntsche, 2014); learning students mindfulness skills, which seems particularly favourable for targeting coping motives (Reynolds, Keough, & O'Connor, 2015); increasing the use of protective behavioural strategies, e.g., finding alternatives to drink in coping drinkers (Linden, Kite, Braitman, & Henson, 2014; Walker & Stephens, 2014); or expectancy challenge interventions that try to influence alcohol expectancies (Scott-Sheldon et al., 2012).

Results from the study in section 7.2, about the independent relationship of student-perceived drinking norms at faculty-level factors with frequent binge drinking in men, underline the importance of a socio-ecological approach in targeting alcohol use among students in higher education. At individual level, the clustering of individual-level determinants in faculties, that also characterize students with specific drinking patterns (e.g., heavy drinking, drinking during the exam periods) (see sections 6.1, 6.2 & 7.2), denote faculties as an interesting vehicle for the individual-based sections of interventions. For example, interventions could emphasize on students in specific faculties when targeting specific individual-level determinants. To target institution-related factors, university-broad strategies are recommended. Such university-broad interventions relate to the concept of Health Promoting Universities, which has been endorsed by the World Health Organization (Cawood, Dooris, & Powell, 2010). This approach argues that educational institutions are ideally suited for health promotion and interventions, as they consist of large populations; help develop professionals and leaders of the future and can set an example to local communities. Effective examples of such university-broad strategies are the development and implementation of policies that restrict on-campus paraphernalia (e.g., empty beer cans, bottles, shot glasses), ban the distribution of alcohol flyers, clarify a code of conduct for students, adopt dual judicial policies to address off-campus behaviour etc. (Wolfson et al., 2012). However, in Flanders, a clear institutional policy towards

alcohol use in students seems lacking or is not clearly communicated towards students and staff in the case it is available. The only document that we are aware of in this context is a baptise decree for fraternities/sororities, which is an agreement between fraternities/sororities, involved stakeholders, and higher education institutions, to regulate baptise ceremonies. In these decrees often only a limited number of lines are included about alcohol use during these ceremonies (e.g., not forcing people to drink, or not exaggerating with alcohol), besides various other engagements like prohibiting nudism, or the use of garbage, blood or animals during ceremonies (STIP, 2012; Universiteit Gent, 2015).

The long-term relationship that was found between parental drinking in childhood and offspring's drinking nine years later in section 7.1, supports the idea that future generations could benefit from involving (young) parents in preventive alcohol programs by making them aware of their impact on future generations' alcohol use (Jackson & Dickinson, 2009; Koning et al., 2009; Smit, Verdurmen, Monshouwer, & Smit, 2008; Van der Vorst et al., 2013). For current generations, the finding that the parent-offspring alcohol use relationship is mediated by social and enhancement motives further supports the necessity for targeting these drinking motives, especially in freshmen, to further prevent heavy drinking (see sections 6.2 and 7.2). Moreover, as discussed in the needs assessment in section 2.3.4b, even in higher education parents have an influential role in the drinking behaviour of their children. Therefore, interventions in higher education should also make parents aware of this influence, and recommend them to e.g., stay involved and interested in their children's activities and friends.

Finally, to inspire potential program developers in the development of future interventions that target alcohol use among students in higher education, a number of potential goals are formulated according to the principles of the second step of Intervention Mapping in Appendix 1. These goals are based on the implications and recommendations discussed above.

9.2 Reflections on needs assessment

In this dissertation the more factual part of a needs assessment was performed according to the PRECEDE model that is described in the Intervention Mapping protocol (Bartholomew et al., 2011). A comprehensive literature review combined

with own original research provides more insight into the problem of alcohol use in Flemish higher education. This information serves as a good starting point for future intervention development. However, in order to develop an intervention, this information needs additional research and needs further consideration through the opinions, experiences, and expertise of different stakeholders involved in this domain (i.e., a planning group) (Bartholomew et al., 2011).

A good planning group is essential for the success of an intervention, since they have to collect, interpret and judge the best available evidence, have to conduct additional research in some cases, and have to make all the decisions. One intervention cannot possibly target all the determinants and environmental factors that are uncovered when reviewing and expanding the available evidence. This complexity implies that program developers have to make decisions, for example on which subpopulations, determinants and environmental factors will be the focus of their intervention. These decisions are partly based on the factual epidemiological evidence about, e.g., the importance and causality of each factor (if clear), but is also based on the personal opinions, experiences and expertise of the planning group, the available resources, the context in which the intervention has to be implemented, and the population that will be targeted. These conditional elements are all discussed in Intervention Mapping and are in line with the different domains that are essential in evidence-based decision making, which is a key in evidence-based public health practice (Bartholomew et al., 2011; Jacobs, Jones, Gabela, Spring, & Brownson, 2012) (Figure 9). Therefore, a needs assessment is an incredibly valuable instrument to reveal the amount of knowledge that is available, and to guide program developers in determining the focus of their intervention or in conducting additional research. Moreover, this instrument is an assessment of the decisions that have been made early in the developmental process, which is of great importance for evaluation purpose (Bartholomew et al., 2011). Making decisions does not automatically mean that the best decisions were made, but documenting, motivating, and evaluating decisions is already a big step in the good direction.

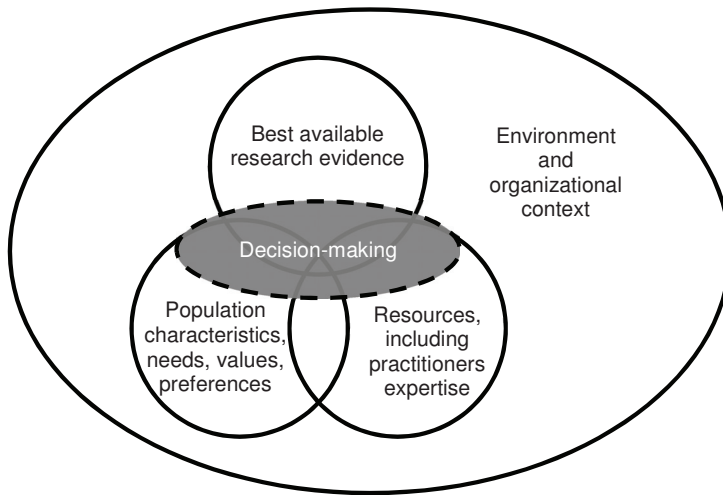


Figure 9: Domains that influence evidence-based decision making (Satterfield et al., 2009)

In Flanders, being a member of a planning group is often volunteer work done in addition to many local practitioners' daily work. Time and resources are often too limited, and skills are sometimes inadequate to develop, implement and evaluate interventions according to the essential principles that are described in the Intervention Mapping protocol. In everyday practice these principles are not always (completely) followed. Therefore, sometimes crucial elements are overlooked in the development and implementation of interventions, with negative consequences for program efficacy. Stakeholders who provide financial resources are often very result-focussed, which implies that they want as much tangible value for their money in as little time as possible, while being less concerned about the process that precedes these results. Therefore, the success of an assignment is often only measured by the developed program materials, and the implementation and evaluation of these materials, despite the limited resources that are often reserved for implementation and evaluation, and the often limited knowledge and skills, and perceived fear (e.g. for future funding) of local practitioners to conduct decent evaluations (Dubuy, 2014).

The necessity for conducting thorough needs assessments makes this reality even more complex, because needs assessments often pay off on the long term, are time-consuming, and require resources and specific skills. Therefore, many organizations skip the needs assessment or conduct it in a limited fashion, in favour of the program

materials, and the (sometimes limited) implementation and evaluation of the materials. However, a high-quality needs assessment is the backbone of a successful intervention, implementation and evaluation that get most out of the limited resources available. Therefore, specific effort should be invested in closing the gap between developing state-of-the-art interventions or adapting existing interventions, and the limitations of everyday practice. Ideally, more financial resources should be provided for the development, implementation and evaluation of health promotion interventions in Flanders, but in times of austerity this might be a utopian demand. However, allocating an amount of the money or resources specifically to conducting high-quality needs assessments, that allow a thorough review of available evidence, that allow high-quality evidence-based decision making, and that potentially allow the performance of new research (e.g., in cooperation with academic institutions) would be a smart deployment of the limited resources. Therefore, policy and funding organizations should become aware of the importance of assessing the available evidence before developing a new intervention and should also focus more on training local practitioners in conducting all aspects of a needs assessment, which will pay off for the development of new interventions and the adaptation of existing interventions. Finally, strategies should be explored and implemented that stimulate better cooperation and communication between different health promotion organizations and policy domains in Flanders. Currently, strong fragmentation (e.g., in themes and tasks) exists between these actors, which prevents the possibility of sharing financial and other resources (e.g., expertise) for mutual projects, and which (sometimes wrongly) creates the perception that an actor is not mandated for conducting specific tasks, like conducting a needs assessment, implementing interventions, or conducting evaluations (Moncarey et al., 2015).

In an effort to support future intervention development in Flanders, the current dissertation provides an overview of the best available evidence on alcohol use among students in higher education, completed with the results of four original studies that addressed a number of gaps that were revealed with this factual analysis. However, during this analysis a number of difficulties were encountered that are discussed below. The absence of a planning group to determine the boundaries and the focus of this needs assessment was an important disadvantage. In an effort to make this more factual needs assessment as valuable as possible for the

development of multiple future interventions on this topic, we kept a broad scope and provided an overview of as much relevant evidence as possible. Nonetheless, along the way we had to set some boundaries ourselves, because otherwise options would become interminable.

For most of the determinants and environmental factors, we reviewed the literature ourselves, but when high-quality overview articles were available we used these overview articles to back up this part of the needs assessment. The sections based on these overview articles provide a good summary of the main findings about these factors, but would sometimes benefit from some additional reading and research when a planning group decides to focus their intervention on these specific determinants. For example, in section 2.3.4d we gave an overview of the influence of online communities on alcohol use in young people. While the most important issues to understand this environmental factor are covered in this dissertation, program developers probably need to perform a more detailed analysis on this topic if they particularly want to target the influence of online communities in their intervention. Another example of a decision we had to make was the determination of the environmental actors and factors that we discussed in this analysis. Guided by the socio-ecological framework, we have described all the (f)actors that we encountered in the available literature, and that seemed potentially relevant for interventions on alcohol use among students in higher education. Therefore, we believe that the most important (f)actors available in the literature are covered in this needs assessment. However, undoubtedly additional (f)actors might exist for which less research is available and that need additional research. In that case, the current needs assessment saves future program developers time and resources to learn more about the (f)actors that are covered in this analysis. Finally, in the environmental analysis we did not provide a full analysis of the environmental actors and their determinants. At interpersonal level we described the environmental actors, but did not describe their determinants. At the other environmental levels we did not describe the responsible actors for the environmental factors, and consequently, we did not describe the determinants of these environmental actors' behaviour. However, the large variability in responsible actors depending on the context, made us decide to leave this analysis up to future program developers.

A second difficulty we encountered when performing the needs assessment, was the presence of second-hand behaviours that are related to heavy drinking among students in higher education. Examples of such behaviours are driving under influence, having unsafe sex under influence, using other substances, and performing anti-social behaviours under influence. Although these second-hand behaviours can be seen as consequences of alcohol use, they probably have specific determinants that cause these behaviours in combination with alcohol, and that need some specific consideration in interventions. Since Intervention Mapping remains relatively vague about how to deal with these second-hand behaviours, we decided in the current analysis to describe these behaviours as consequences of heavy drinking. Fully analysing these behaviours would have led us too far away from the main focus of this dissertation. However, future intervention developers need to explore these behaviours in more detail, if they decide to focus their intervention around these topics. Possibly, Intervention Mapping could be more explicit about how to handle with these types of behaviours and about how they can influence the entire focus of an intervention.

Finally, since we entered the PRECEDE model at “lifestyle” and not at health problem, also some positive consequences of alcohol use among students in higher education can be considered. For example, alcohol consumption actually makes people more confident or actually relieves people’s tensions. Given the strong problem-focussed approach in Intervention Mapping, we decided to not explicitly discuss this type of consequences. However, these positive consequences can be potentially relevant to keep in mind when developing interventions. Eventually, Intervention Mapping could be more explicit on how to deal with this type of consequences.

10 Strengths, limitations and suggestions for further research

A number of limitations should be discussed, despite the various strengths in this dissertation. Examples of these strengths are our contribution to expanding the European literature on alcohol use among students in higher education and young adults, the use of multiple study designs, the use of different study samples from higher education, the use of large heterogeneous samples from large Flemish institutions, the use of various analytical techniques (e.g., multilevel analyses,

mediation analyses, logistic regression analyses), the use of validated multi-item measures (e.g., DMQ-R SF, AUDIT) and the presentation of studies that were among the first to investigate specific topics, such as the characteristics of alcohol use in the exam periods, or the relationship between faculty-level characteristics and alcohol use in students. Moreover, in this dissertation an extensive literature overview is presented about alcohol use among students in higher education, the consequences and determinants of this behaviour and the environmental factors that relate to this behaviour. This analysis, together with the findings from the original research articles, delivers a base for future intervention development regarding alcohol use among students in higher education.

However, a first limitation in this dissertation is that only retrospective survey data were used in the studies that were conducted in this dissertation. One of the big advantages of surveys is the large number of participants that can be reached against a relatively low cost, especially when online survey tools are used. However, the big drawbacks of this kind of data are the risk for socially desirable answering, the risk for recall bias, the sometimes poor data quality in participants that get demotivated along longer surveys, and the impossibility to measure implicit cognitions or automatized behaviours. Therefore, in future research the current results should be expanded by the use of alternative data collection techniques and designs. Examples are the collection of real-time data in real-life situations, using portable devices such as smartphones and smart watches in e.g., ecological momentary assessments and/or Global Positioning System-tracking studies (Byrnes et al., 2015; Kuntsche & Labhart, 2014; Mitchell et al., 2014; Shiffman, Stone, & Hufford, 2008), the use of natural experiments to investigate e.g., environmental influences (Wagner, Li, Liu, & Guo, 2013) or observational studies (Hughes et al., 2012), or the use of implicit measures, such as implicit association tests (Lindgren et al., 2013).

Objective BAC measurements show that light to moderate drinkers slightly overestimate their drinking when they are asked about their drinking afterwards, while heavy drinking students (BAC: ≥ 80 mg/dL) underestimate their drinking in proportion to how much they drank before (Carey & Hustad, 2002; Grant, LaBrie, Hummer, & Lac, 2012; Hustad & Carey, 2005). However, it is unclear whether these underestimations are caused by socially desirable answering (e.g. by the realization

of the heavy drinking) or by a recall bias that is caused by the heavy drinking. Therefore, both options were stated in the text above when the underestimation of some results was discussed.

In all studies in this dissertation, participants could freely participate to the studies (i.e., no randomised sampling was performed), which might affect generalization of some results, because of a potential selection bias (e.g., not reaching some subpopulations). However, to minimize the effect of this limitation, various measures were undertaken across the different studies. Examples are providing incentives to increase the response rate, recruiting high numbers of students from a wide variety of disciplines, controlling the analysis for important covariates, and weighting data on known population variables (section 6.2).

Despite the use of a longitudinal design in one study, other studies were conducted using a cross-sectional design. This latter design has the major disadvantage of being inconclusive about the direction of observed relationships. For example, in the study in section 6.1, about alcohol use during the exam periods, further longitudinal research is recommended to investigate whether drinking motives in periods without exams are either a result of drinking during the exams, or cause drinking during the exams. Furthermore, longitudinal research is needed to determine whether being at risk for problematic use is either a characteristic or a consequence of drinking in the exam periods.

Another limitation in this dissertation is that the study in section 7.2 did not identify specific institution-related characteristics that influence alcohol use in students. To our knowledge one American study is available that explicitly describes such institution-related characteristics (e.g., the presence of a fraternity/sorority, the presence of athletics, 2- or 4-year designation, institution size and location, and residence type) (Presley et al., 2002). In an effort to be more specific on the institution-related characteristics that should be targeted in future interventions, more research is needed to investigate the validity of the characteristics that were identified in a North American context by Presley et al. (2002), and to identify potential additional characteristics in the Flemish context.

In all studies in this dissertation no data were available on diversity among students in higher education (e.g., ethnic origin, socio-economic status). Moreover, to our knowledge, European literature is very limited on such indicators in relation to alcohol use among students. Given the recent trend of growing diversity among students in higher education, such indicators should be included in future research.

Moreover, despite the assumption of a causal relationship between a determinant and behaviour, often no such data is available in reality. Therefore, program developers often have to critically judge the available information (e.g., based on designs, theoretical assumptions) to select the variables that potentially cause specific behaviour (Bartholomew et al., 2011). In the needs assessment in this dissertation we ran upon the same problem. So we have tried to either describe the determinants for which we thought empirical or theoretical arguments exist to assume causality, or to indicate when variables have to be used with caution.

A final limitation relates to the critical reflection that was made in section 9.2. In this dissertation we performed the more factual part of a needs assessment on alcohol use in among students higher education. We extended this needs assessment with four original studies, based on research gaps that were identified. However, no planning group was consulted to determine the boundaries and the focus of this needs assessment. Therefore, some topics will need further consideration when it comes to the actual development of an intervention in a specific context. On the other hand, this dissertation serves as a good starting point for future program developers in Flanders, that will save them time, money and other resources to gain important insights into alcohol use among students in higher education.

11 Conclusions

Alcohol use is a complex problem with a worldwide high prevalence in higher education, and multiple negative physical, psychological and social consequences on the short and the long term. Health promotion interventions that target this problem would benefit from a socio-ecological approach, since the needs assessment in this dissertation identified multiple individual-level determinants (e.g., drinking motives, perceived drinking norms and alcohol expectancies) and multiple environmental actors and factors (e.g., peers , parents and educational institutions) that influence alcohol use among students in higher education. The original studies in this

dissertation revealed that in Flemish students social, enhancement, and coping motives are related to indicators of heavy alcohol use. Given that drinking motives are amongst the most proximal determinants of alcohol use, these drinking motives deserve special attention in future interventions. Moreover, in an effort to target these drinking motives, the variability of drinking motives depending on the period in the academic year should be taken into account. In one of the original studies in this dissertation, in particular internal drinking motives were related to (weekly) drinking in the exam periods, while external drinking motives seemed less important.

At environmental level, the parental influence on students' drinking motives and drinking was shown on the long term. For future generations, interventions should focus on these long-term influences in young parents. For current generations, interventions should focus on the current influences that parents still have on their children's drinking in higher education. Moreover, in this study an extra argument was found to target social and enhancement drinking motives in interventions, since these motives mediated the relationship between parental and offspring drinking. At institutional level, our findings showed that faculties would serve as a good vehicle for focussing the individual-level sections of interventions. However, to target institution-related characteristics that influence alcohol use in students, a university-broad strategy is recommended. In Flanders, higher educational institutions would benefit from a clear(-ly communicated) policy towards alcohol use in students.

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Appendix 1

Step 2: preparing matrices of change objectives

1 Potential program goal

Given the high prevalence of alcohol use, monthly binge drinking and being at risk for problematic use among students in higher education, and given the numerous health- and quality of life-related problems linked to the consumption of alcohol, future programs should aim for a decrease in students' alcohol consumption both in heavy and non-heavy drinkers.

The specific time frame and intended decrease in consumption should be defined by the planning group, as these numbers depend on the available resources and the ambitions of the planning group.

2 Potential behavioural and environmental outcomes

2.1 Potential behavioural outcome:

Decrease alcohol consumption towards an acceptable drinking pattern.

For Belgium the following guidelines for acceptable drinking are advised (De Doncker, De Donder, & Mobius, 2015):

- Men: on average max. 21 standard drinks/week, max. 5 standard drinks at a time, at least 2 non-alcoholic days/week
- Women: on average max. 14 standard drinks/week, max. 3 standard drinks at a time, at least 2 non-alcoholic days/week

This goal dramatically decreases the risk for alcohol-related consequences in heavy drinkers (i.e., those who binge drink monthly, are at risk for problematic use), and helps to prevent non-heavy drinkers to evolve into a heavy drinking pattern (Rehm, Gmel, & Shield, 2015).

Moreover, this goal is in accordance with the following Flemish health goals:

- Lowering the prevalence to at least 13% of drinking more than 6 standard drinks a day, more than once a week, in youth (15-25y).
- Lowering the prevalence to at least 10% for men and 4% for woman of drinking more than 21/14 standard drinks a week in men and women ($\geq 16y$), respectively.

2.2 Some examples of relevant environmental outcomes:

Parents:

Follow-up students' (leisure time) activities.

Create an open and reciprocal atmosphere to discuss concerns about/problems with alcohol use among students in higher education and to express disapproval towards excessive drinking.

Educational institutions:

Define an institutional policy about alcohol use among students (and staff).

Clearly communicate towards students and staff about the institutional policy about alcohol use among students (and staff).

3 Matrix for change objectives

This dissertation gave an overview of the determinants of alcohol use among students in higher education and discussed the important environmental factors and interpersonal actors. An analysis of the other environmental actors and of the actors' determinants at all environmental levels was beyond the scope of this dissertation. Therefore, only a matrix with change objectives for the behavioural outcome will be described in this section. Moreover, the objectives formulated below are preliminary suggestions that need further validation by a planning group.

3.1 Performance objectives:

In order to compose a matrix with change objectives, first a number of performance objectives need to be defined.

“Performance objectives clarify the exact performance expected from someone affected by the intervention. To determine the performance objectives, planners ask: What do the participants in the program or the environmental agents need to do to perform the behavior [sic] or to make the environmental change stated in the behavioral [sic] or environmental outcomes?” (p.257-256) (Bartholomew et al., 2011).

The performance objectives in the matrix below were formulated based on the Self-Regulation Theory. Self-regulation is a cyclic process of observation and evaluation, setting goals, determining a strategy, and reacting accordingly, instead of following e.g. habits or tradition (Clark, 2003; Clark & Zimmerman, 1990). In the context of alcohol use among students in higher education, it makes sense to aim for such a cyclic process in students, because students often run into a variety of drinking opportunities in which a conscious decision to drink is preferred to following an habitual reaction. To help students in deciding not to drink, drinking motives are good anchor points. Drinking motives are the actual reasons for drinking alcohol, which on the other hand helps focusing the development of alternative strategies (e.g., to cope with stress).

3.2 Determinants:

An essential component for the matrix with change objectives is a list with important and changeable determinants of the health behaviour that is pursued. For the current matrix the determinants knowledge, attitude, perceived norm, self-efficacy and skills were selected. This selection is based on the literature review and selection that was made for an intervention that targeted at-risk drinking in a general population, also by using a self-regulation approach (Brendryen, Johansen, Nesvåg, Kok, & Duckert, 2013). However, further validation of the importance and changeability of these determinants is advisable, when an actual program is developed.

3.3 Change objectives:

When the performance objectives and determinants are combined in a matrix, change objectives are formulated at the intersection of both components.

“The question that leads the formulation of a change objective for personal determinants is: What needs to change to the determinant for the program participants to do the performance objective?” (p. 283) (Bartholomew et al., 2011).

These change objectives are preliminary suggestions and need further validation by a planning group.

Performance objectives	Knowledge	Attitude	Perceived norms	Self-efficacy/skills
Monitor own drinking behaviour and compare against the norm for acceptable drinking	<p>Define a standard drink and how this relates to drinks that are frequently consumed</p> <p>Define the norm for acceptable drinking</p>	<p>Express the advantages of being aware of your own drinking</p> <p>Recognize that evaluating own drinking behaviour helps to prevent excessive drinking</p>		<p>Express confidence of keeping track of own drinking behaviour, even when many drinking occasions occur</p> <p>Demonstrate the ability to correctly estimate drinking behaviour</p>
Set the goal to not exceed the norm for acceptable drinking	<p>List important and relevant alcohol-related problems</p>	<p>Express that the norm for acceptable drinking not totally eliminates the risk for alcohol-related problems, but drastically minimizes this risk</p>	<p>Recognize that most peers drink less than often perceived</p>	<p>Express the confidence in setting the goal to not exceed the norm for acceptable drinking, even when many drinking occasions occur</p>
Identify drinking motives in frequently occurring drinking occasions	<p>Describe the different dimensions of drinking motives</p> <p>Recognize the drinking motives in different situations</p>	<p>Explain that insights in drinking motives helps to better understand own drinking behaviour and helps to detect difficult situations</p>		<p>Show the skill to correctly categorize drinking occasions by drinking motives</p>
Determine alternative strategies for internal drinking motives to accomplish similar effect without drinking	<p>List different alternative strategies to enhance positive affect or reduce negative affect without alcohol</p>	<p>Explain the importance of having a plan for difficult situations</p> <p>Explain that other</p>	<p>Recognize that most peers do not drink alcohol to reduce negative affect (e.g. based on low prevalence</p>	<p>Show confidence in own ability to determine alternative strategies</p>

<p>alcohol</p>		<p>strategies can be as effective as alcohol to enhance positive affect or reduce negative affect</p> <p>Express that many of the perceived advantages of drinking alcohol are temporary or superficial solutions (e.g., tension reduction, sleep enhancement, feeling more optimistic)</p> <p>Express that some of the perceived advantages of drinking alcohol are wrong (e.g., sexual enhancement)</p>	<p>of coping motives, based on prevalence exam (drinking)</p>	<p>Illustrate alternative strategies for internal drinking motives in different potential drinking occasions</p>
<p>Determine strategies to resist social drinking motives</p>	<p>List different strategies to receive social reward without alcohol</p>	<p>Explain the importance of having a plan for difficult situations</p> <p>Explain that alcohol is not essential in social interaction and in receiving social reward</p> <p>Express that drinking (too much) alcohol can have adverse effects on</p>	<p>Recognize that most peers drink less than often perceived</p> <p>Recognize that many students can have fun at parties without alcohol (e.g. based on experiment with non-alcoholic beer at party)</p>	<p>Show confidence in own ability to socially interact without alcohol</p> <p>Demonstrate skills to make contact with peers without alcohol.</p> <p>Demonstrate skills to have a good time without alcohol</p>

		<p>social interactions (e.g., conversations you regret afterwards, sending shameful messages)</p>	<p>Recognize that tasteful non-alcoholic alternatives become more and more available</p>	<p>Show confidence in refusing an alcoholic drink when offered</p> <p>Show confidence in taking a non-alcoholic drink, even when only limited options are available</p> <p>Demonstrate skills to refuse an alcoholic drink without creating an awkward situation</p> <p>Demonstrate the ability to look for bars with tasteful non-alcoholic alternatives</p> <p>Express confidence in own ability to perform (alternative) strategies in difficult situations</p> <p>Express confidence in</p>
<p>Do not drink alcohol when norm for acceptable drinking is reached</p>	<p>State that it is better to stop drinking when the norm for acceptable drinking is reached</p>	<p>Describe the advantages of not drinking alcohol when the norm for acceptable drinking is reached</p>		
<p>Perform (alternative) strategies</p>			<p>Recognize that peers also use (alternative) strategies to not drink alcohol</p>	

<p>Evaluate strategies and adjust if necessary</p>	<p>State that some strategies might fail and need some adjustment for future use</p> <p>Describe where to seek help if needed</p>	<p>Express that evaluating strategies helps to improve strategies for the future</p>		<p>the effectiveness of (alternative) strategies</p> <p>Show confidence in ability to change strategies when they seem ineffective</p> <p>Demonstrate the ability to monitor the efficacy of strategies</p> <p>Demonstrate skills to change ineffective strategies</p>
<p>Maintain performing former performance objectives</p>	<p>Describe that maintaining former performance objectives helps to internalize these steps and create a healthy habit</p> <p>State that failure now and then in keeping the norm for acceptable drinking is normal in an effort to adjust own drinking pattern</p>	<p>Express that failure now and then in keeping the norm for acceptable drinking is instructive for future drinking occasions</p>	<p>Recognize that peers also fail now and then in keeping the drinking norm for acceptable drinking</p>	<p>Show confidence to detect the reasons for failure and to tackle these reasons in future situations</p>

Appendix 2

Proportions of monthly binge drinking per faculty

Unweighted			Weighted on sex & faculty		
Faculty	Monthly binge drinking	Total	Faculty	Monthly binge drinking	Total
A	25,3%	899	A	26,2%	858
B	25,5%	1155	E	26,4%	193
C	25,8%	784	B	26,7%	1198
D	26,3%	300	C	26,7%	727
E	26,3%	175	D	27,4%	310
F	27,7%	491	F	28,6%	437
G	34,0%	592	G	35,2%	701
H	36,0%	303	H	37,7%	260
I	37,7%	525	I	38,1%	443
J	39,7%	446	J	41,2%	449
K	44,6%	455	K	46,3%	561

Proportions of monthly binge drinking per level-2 unit

Unweighted			Weighted on sex & faculty		
Faculty-level unit	Monthly binge drinking	Total	Faculty-level unit	Monthly binge drinking	Total
A2	19,3%	404	A2	19,8%	388
B2	20,6%	535	B2	21,3%	544
C2	21,5%	209	C2	22,2%	194
D2	22,2%	117	D2	23,3%	120
E1	24,6%	118	E1	24,6%	130
F1	26,3%	312	F1	27,0%	278
C1	27,3%	575	C1	28,2%	532
G2	28,9%	218	G2	30,0%	257
D1	29,0%	183	E2	30,2%	63
B1	29,7%	620	D1	30,4%	191
E2	29,8%	57	B1	31,1%	655
A1	30,1%	495	F2	31,4%	159
F2	30,2%	179	A1	31,6%	472
I2	33,6%	214	I2	34,3%	181
H1	35,6%	177	H1	36,4%	151
H2	36,5%	126	I1	36,4%	151
G1	36,9%	374	G1	38,3%	444
J2	39,1%	220	H2	38,9%	108
J1	40,3%	226	J2	41,2%	221
I1	40,5%	311	J1	41,2%	228
K1	44,1%	304	K1	45,7%	374
K2	45,7%	151	K2	47,8%	186

[letter]1 = Bachelor; [letter]2 = Master

[letter]1 = Bachelor; [letter]2 = Master

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Curriculum vitae

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Name: Joris Van Damme
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Education

- 2010-2016 Doctoral Schools Training Program
- Multilevel analysis for grouped & longitudinal data, *organized by Institute for Continuing Education in Science*
 - Advanced Academic English: Writing skills (Life Sciences & Medicine), *organized by University Language Centre*
 - Gevorderde Kwantitatieve Technieken, *organized by the Master of Science in Sociology*
 - Authentic Networking, *organized by the Doctoral Schools Life*
 - Bayesian Statistics, *organized by Institute for Continuing Education in Science*
 - Speed-reading, *organized by the Doctoral Schools*
 - Communication skills (basics + negotiation skills), *organized by the Doctoral Schools*
 - Effective Graphical Display, *organized by the Doctoral Schools*
- 2012-2013 Professional Development Programme: EU health advocacy training, *organized by European Public Health Alliance*
- 2011 Systematic Review Workshop (3 days), *organized by the Methodology of Educational Sciences Research Group of the K.U.Leuven in collaboration with the Belgian Campbell Group*
- Docententraining: Multiple Choice, *organized by Ghent University*
- Preparing Data for Analysis, *organized by Radboud University Nijmegen*
- Seminaries onderwijskunde, *organized by Association Ghent University*
- 2010 Summer Course Intervention Mapping, *organized by the Psychology lab of Ghent university, taught by G. Kok & G.J. Peters (Maastricht University)*
- Survey Analysis, *organized by Institute for Continuing Education in Science*
- Basisassistententraining, *organized by Ghent University*
- Seminaries onderwijskunde, *organized by Association Ghent University*
- 2007-2009 Master of Science in Health Promotion at Ghent University
Thesis: Level of physical activity and evolution of weight in the transition from secondary to higher education
- 2004-2007 Bachelor in Nursing, graduated at University College Ghent in 2007
Thesis: Honey therapy in wound care

Professional experience

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Assistant, Ghent University, Department of Public Health, Unit Health Promotion

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Memberships

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A1 publications

Van Damme, J., Maes, L., Kuntsche, E., Crutzen, R., De Clercq, B., Van Lippevelde, W., Hublet, A. (2015). The influence of parental drinking on offspring's drinking motives and drinking: A longitudinal study. *Drug and Alcohol Dependence*, 149, 63-70.

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Abstracts

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Worldwide, alcohol is regularly consumed by a majority of students in higher education. Many people perceive (heavy) drinking as an inseparable part of student life, of which most students mature out once they graduate and take more responsibilities in their life. However, for a considerable amount of students this maturing out process has a less promising result. Moreover, alcohol use has also numerous short-term effects that negatively affect students' health and well-being.

In an effort to support and improve future interventions that promote responsible alcohol use and target heavy and problematic alcohol use in Flemish higher education, this dissertation presents an overview of the available evidence as part of a needs assessment, which is based on the guidelines of the Intervention Mapping protocol. Along this needs assessment, various research gaps were identified, of which a number were addressed in this dissertation in four research articles on Flemish students and emerging adults.

Joris Van Damme

