

# What do we know about alcohol consumption in youth? Trends, patterns, determinants and consequences

## 1. Introduction

The ultimate intention of this project is to provide specific information on the category of drinks that is the focus of the present project, i.e. alcoholic beverages with potentially particular appeal to minors (ABPPAM). This specific chapter though starts from a slightly broader perspective, by looking at alcohol consumption by youth (incl. minors) in general, while trying to work out, wherever such information is available, the potential specificities of the consumption of ABPPAM against the background of youth consumption as a whole. Doing so allows us to determine more precisely what if anything is “special” or “distinct” about youth consumption of ABBPAMs.

This review has three main purposes:

- to describe general trends and patterns in the consumption of alcohol by adolescents in the European Union;
- to describe the main consequences of consuming alcohol by the young;
- to review the existing (mostly recent) literature on the determinants of alcohol consumption by the young.

A related goal is to identify major gaps in the literature and so inform future research. Although, wherever possible, papers specific to the countries of the EU were reviewed, some important evidence already exists in other contexts (e.g. USA). Rather than ignore this work, the evidence from these papers was also included in this paper, although one should be cautious about assuming that such findings will generally apply to EU settings. The majority of the review in its present draft focuses on trends and determinants in the consumption of traditional drinks (e.g., spirits, beer), which still represent the greatest *actual* appeal to minors.

## 2. Recent trends and patterns

Overall consumption of alcohol by youth has declined in the European Union in recent years (Commission of the European Communities, 2006), although there have been important intra-regional variations. Thus, one important exception has been the consumption of alcohol in Eastern Europe, which rose for both boys and girls during 1999-2003 (Anderson, Baumberg, 2006). However, it is important to consider both quantity and pattern of consumption. Thus, the latest ESPAD survey data show that this **overall decline in EU-wide alcohol consumption has been accompanied by the increase in the proportion of youth with dangerous drinking patterns, including binge drinking** (Directorate General for Health and Consumers, 2009, Rabinovich, et al., 2009). Although this is seen mostly among young adults above legal drinking ages (Commission of the European Communities, 2006), it is also apparent among those living in the EU10 countries (Anderson, Baumberg, 2006). Binge drinking also increased in some other countries not covered by the ESPAD report, including Austria, Belgium, Spain and Switzerland (Anderson, Baumberg, 2006).

### *Use of alcohol*

According to the most recently available ESPAD survey data, the proportion of young European adults aged 15-16 years who have drunk alcohol at least once in their lifetime is about 90% (Hibell, Skretting, 2009), with the average age of initiation 12½ years. In the previous 12 months and 30 days, 82% and 61% respectively of surveyed students aged 15-16 responded that they drank alcohol at least once. At 11 years of age, more than 50% of all adolescents living in EU member states have tried alcohol at least once (Settertobulte, et al., 2001, cited in Cnossen, 2007).

There was relatively little change in the lifetime and past 12 months prevalence of drinking alcohol by 15-16 year old students between 1995 and 2007. However, there was an increasing trend in the 30 day prevalence until 2003 followed by a small fall from 2003 till 2007, mainly among boys (Hibell, Skretting, 2009). Portugal was a notable exception, with a rising lifetime prevalence for both boys and girls from 2003 to 2007 (Hibell, Skretting, 2009).

According to HBSC survey data, between 1998 and 2006 boys had a higher drinking prevalence than girls (Simons-Morton, et al., 2009). However the gender gap shrank considerably during this time. Before 2006, the prevalence of drinking was higher among boys than girls in almost all countries. In 2006, the situation reversed in seven countries (Simons-Morton, et al., 2009).

### *Frequency of use*

One measure of the frequency of alcohol use is the proportion of adolescents who have consumed alcohol 40 times or more in their lifetime. ESPAD survey data showed that, overall, this increased between 1995 and 1999, before stabilizing until 2007 (Hibell, Skretting, 2009), although with a decreased prevalence of frequent lifetime drinking among boys. Another metric is the prevalence of having consumed alcohol 20 times or more in the last 12 months. There was also a slight increase in this measure between 1995 and 2003 before stabilizing between 2003 and 2007 (Hibell, Skretting, 2009). Finally, the proportion of students who drank alcohol 10 or more times in the last 30 days was also relatively unchanged between 2003 and 2007.

According to ESPAD survey data, the average frequency of drinking alcohol among 15-16 year olds is highest in Central Europe, at about 5-9 times per month, and lowest in Northern Europe (two times per month). Adolescents in this age group living in Southern and Eastern Europe drink about 3-5 times a month (Anderson, Baumberg, 2006). HBSC survey data for 11, 13 and 15 year olds showed a similar picture, with adolescents from Northern Europe having relatively low rates of weekly alcohol drinking (with the exception of boys from the United Kingdom) (Currie, et al., 2008).

### *Drunkenness and binge drinking*

In the whole European Union, more than 1 in 8 adolescents aged 15-16 years have been drunk more than 20 times in their life (Anderson, Baumberg, 2006), and about 50% have been drunk at least once (Hibell, Skretting, 2009). The average age of first getting drunk in Europe is about 14 years, with

adolescents from Eastern and Central European countries trying alcohol earlier than those from Northern and Southern Europe (Anderson, Baumberg, 2006). Globally, a recent review based on 26 articles published in 2005-2006 found that the prevalence of hazardous drinking among college students in Australasia, Europe and South and North America was generally higher than in Africa and Asia (Karam, et al., 2007).

In ESPAD survey countries, about 18% of respondents reported that they were intoxicated in the previous 30 days (Hibell, Skretting, 2009). At the same time, as many as 43% (47% boys and 39% girls) reported that they had five or more drinks<sup>1</sup> on one occasion in the past month, which suggests that reported intoxication is a subjective measure that may substantially underestimate the real prevalence of drunkenness among adolescents. Some countries scored high on both measures in the ESPAD survey (e.g., Denmark, Isle of Man). At the same time, quite a few other countries (e.g., Estonia, Latvia) reported a high frequency of heavy episodic drinking measure but a low frequency of drunkenness (Hibell, Skretting, 2009).

Prevalence of drunkenness and binge drinking is the highest in Northern and Eastern Europe (Currie, et al., 2008, Hibell, Skretting, 2009). At the same time, there was a decline in the prevalence of binge drinking in several Nordic countries (Iceland, Finland, Norway) from 2003 to 2007, although it increased in Latvia and Estonia. In most ESPAD survey countries, there was an increase in binge drinking rates for both boys and girls between 1995 and 1999, although the trend became less clear from 1999 to 2003 (Anderson, Baumberg, 2006). The upward trend then resumed from 2003 to 2007, especially among girls (Hibell, Skretting, 2009). The greatest increase between 2003 and 2007 took place in Portugal, where the prevalence of heavy episodic drinking among students jumped from 25% to 56% (Hibell, Skretting, 2009).

For girls, the greatest increases in binge drinking rates during recent years took place in the Nordic countries (Ireland, UK, Norway, Sweden). As a result, the gender gap in drunkenness appears to be the lowest in the Nordic countries and the UK (Anderson, Baumberg, 2006). Overall, the difference between genders in terms of ever having been drunk is larger in EU10 countries compared to EU15 countries (Anderson, Baumberg, 2006). It is also considerably larger in Southern European countries than elsewhere (Anderson, Baumberg, 2006).

Similarly, the HBSC study showed that the number of 15-year old boys and girls who reported being ‘really drunk’ more than once has increased in the majority of countries during 1994-2002 (Anderson, Baumberg, 2006). It also showed that the prevalence of drunkenness among adolescents aged 11-15 years living in Northern European countries (Sweden, Norway, Finland and Denmark) declined from 1996 to 2006. On the other hand, the reverse trend was observed in Eastern European countries (except Poland and Czech Republic) (Simons-Morton, et al., 2009). There was no change in the prevalence of drunkenness in the Southern European countries over the same period except in Greece, where the prevalence of drinking declined in this age group (Simons-Morton, et al., 2009).

### ***Total consumption***

The national ranking by frequency of drinking and amount drunk per episode is quite different from ranking by total consumption. In almost all countries, boys drank more alcohol than girls (Hibell, Skretting, 2009), with the notable exception of Iceland. In addition, boys from Northern Europe tend to have the lowest total consumption of alcohol compared to other regions (2-3 litres a year), and those from

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<sup>1</sup> This is also how “heavy episodic drinking” or “binge drinking” was defined in the survey.

Central Europe are drinking the most (8-10 litres a year). The greatest total consumption takes place in the Netherlands- 14 litres a year. (Anderson, Baumberg, 2006)

Overall, countries that reported more frequent consumption also tended to report less being drunk on each occasion. There were, however, several exceptions to this rule, with Denmark and Austria having both high rates of alcohol consumption per occasion, as well as high frequencies of drinking (Hibell, Skretting, 2009).

### *Other patterns*

In general, ESPAD survey demonstrated that alcoholic beverages (especially beer) were considered easy to obtain by the majority of 15-16 year olds (Hibell, Skretting, 2009). The most popular drinks among adolescents in Europe are beer and spirits (Hibell, Skretting, 2009), with beer accounting for about 40% of total alcohol amount consumed on the last drinking occasion, followed by spirits (30%), wine (13%) and alcopops (11%). The picture is different if beverages are ranked according to the proportions of students who drank them in the last 30 days. Thus, beer was still the most commonly reported beverage (49%), followed by spirits (40%), wine (35%), alcopops (35%) and cider (28%).

In general, beer was the most popular drink among boys, while spirits were more popular among girls (Hibell, Skretting, 2009). Beer accounted for over half of total consumption among the young in 11 countries (including in 6 EU countries), while spirits were more popular in Norway, Italy and Portugal. Between 2003 and 2007, there was also a significant overall reduction in the proportion students that were drinking beer and/or wine in the last 30 days (Hibell, Skretting, 2009).

Alcopops<sup>2</sup> were the most popular drink<sup>3</sup> in Cyprus, the Netherlands and Slovenia (Hibell, Skretting, 2009). Alcopops were also considerably more popular in EU15 than in EU10 countries, while wine was found to be more popular among boys in EU10 than EU15 countries. At the individual country level, prevalence of past 30 day alcopop consumption ranged from 58% (Austria, Netherlands) to 5% (Poland). A higher proportion of girls than boys reported consuming alcopops in the last 30 days in 22 countries; the reverse was true in 10 countries. As a rule, boys were more likely to consume alcopops than girls in the southern Europe. The country with the greatest gender difference was the UK (33 vs 53%) (Hibell, Skretting, 2009). Ciders were the most popular drink in two Baltic countries (Estonia, Lithuania).

Some widely held stereotypes about the cross-country patterns of alcohol consumption do not appear to be justified. For example, even though Southern Europeans are expected traditionally to drink at meal times, adolescents (both males and females) living in the UK are more likely to drink with their meals than their peers living in France (Anderson, Baumberg, 2006). The Southern adolescents are also less likely to drink wine than beer, pointing to a degree of harmonization of alcoholic beverages preferences across countries (Schmid, et al., 2003, cited in Anderson, Baumberg, 2006).

Although, in general, the most common drinking contexts for young adults aged 15-16 years were on their own or someone else's home (accounting for about half of mentioned drinking places), those in Southern Europe were more likely to drink in public places than older adults from their countries. Eastern European adults were more likely to drink outdoors than their peers elsewhere in Europe. Overall, no

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<sup>2</sup> Hibell et al (2009) defined alcopops as "pre-mixed drinks with an alcohol content of about 5%". Note that defined this way, this class will not include all ABPPAM categories of drinks. However, because of data limitations, it is not possible to go further than discussing the trends in alcopops and ciders consumption.

<sup>3</sup> In terms of the proportion of students who said they drank a particular drink during the last 30 days.

more than a third of students in all countries reported that they drank alcohol outdoors on the last occasion (Coleman, Cater, 2005, cited in Anderson, Baumber, 2006).

### **3. Consequences of alcohol consumption among youth and adolescents**

In this section, we briefly review the major consequences of consuming alcohol by adolescents. We will omit most health-related events that may occur as a result of long-term consumption of alcohol (e.g., liver cirrhosis), and focus instead on events that develop rapidly.

The consequences of alcohol consumption by youth may be particularly important for several reasons. Cook and Moore (2002, cited in Cnossen et al, 2009) singled out three serious concerns. First, young adults often have particularly high rates of binge drinking. For example, in England, about 50% of men aged 16-24 men who drank alcohol in the past week consumed more than 8 units of alcohol on a single day. This proportion fell steadily with age, to 47%, 39%, 32%, 26%, 14% and 5% among the 25-34; 35-44; 45-54; 55-64; 65-74; 75+ age groups, respectively (Craig, Mindell, 2008). The declining trend with age for women was very similar. As a result, young people are considerably more likely to be involved in alcohol-related violent crimes and car accidents. Second, drinking at young ages may lead to habituation, establishing patterns for future consumption. Finally, an early initiation of drinking may have adverse consequences for subsequent development.

#### ***Death***

Death is the most dramatic potential outcome of excessive alcohol consumption by adolescents. According to one estimate, in the EU, “over 10% of female mortality and around 25% of male mortality in the 15–29 age group is related to hazardous alcohol consumption” (Commission of the European Communities, 2006). The World Health Organization has estimated that in 2002, about 600,000 Europeans died as a consequence of alcohol consumption. About 10% of all these deaths, or about 63,000, were among adolescents aged 15-29 years (Duarte, et al., 2007). If this number is restricted to men living in European Union only, about 13,000 young men die as a consequence of alcohol consumption each year, which accounts for about 25% of all deaths among young men in the EU. This number increases to more than 30% in the EU10. The alcohol-related death toll among young women is smaller but still substantial, with about 2,000 dying each year (Anderson, Baumber, 2006).

Alcohol increases the probability of death in adolescence mainly from the greater risk of intentional (e.g., homicides and suicides) and unintentional (car crashes) injury, rather than through heart disease and other chronic health conditions, which dominate in adults. For example, previous studies have shown that heavy drinking is a major risk factor for suicidal behaviour among adolescents (Andrews, Lewinsohn, 1992, Beautrais, 2000, Lesage, et al., 1994, cited in Anderson, Baumber, 2006). The link between alcohol consumption by adolescents and greater risk of injuries will be discussed next.

#### ***Injuries***

Alcohol-related harms and injuries are further potentially devastating consequences of excess alcohol consumption by adolescents. One cross-sectional study showed that the likelihood of experiencing acute alcohol-related harms is significantly lower in those 15-16 year olds who drink within

established guidance than in those who drink heavily or frequently (Bellis, et al., 2010). Of course, a serious potential problem with this and similar studies is that drinking above official guidance may be associated with other risk factors for alcohol-related harm.

Violence is a frequent cause of alcohol-related harms among youth. One study found, for example, that adolescents who drink are more likely to be both perpetrators and victims of violence (Giancola, 2002, Newburn, Shiner, 2001). Among young people, alcohol consumption is frequently associated with violence, as well as with sexual assaults on college campuses (Giancola 2002, cited in Newbury-Birch et al, 2009).

There is some evidence that this may reflect the level of aggression in youth who drink excessively (Giancola 2002, cited in Newbury-Birch et al, 2009), although some authors have questioned whether this association is spurious (White, 1997). Another potential factor is the association between alcohol consumption and weapon carrying and fighting (Melzer-Lange, 1998, cited in Newbury-Birch et al, 2009). Women are generally less likely to participate in alcohol-related violence than men (Newbury-Birch, et al., 2009).

One systematic review evaluated existing epidemiological evidence (mostly case-control and cohort studies) on the link between alcohol consumption and the risk of falls among adults. Eight studies were included, with three from Europe (Finland and Sweden). The evidence was strongest for acute alcohol consumption, and inconclusive for moderate consumption, suggesting a dose-response relationship. There was little control for potential confounding in the studies, and the findings were applicable to all age groups, not only adolescents (Kool, et al., 2009).

The young are also overrepresented in drunk driving statistics. Indeed, according to one estimate, nine out of ten alcohol-related road fatalities are caused by young male drivers (Cnossen, 2007).

### ***Performance in schools***

Performance of adolescents in schools can be affected by in several ways, including the impact of alcohol consumption on brain development (including memory and cognitive functions), as well as absenteeism. One recent review (Heffernan, 2008) concluded that young adults who drink excessively are more likely to report lapses in their short and long term memory than their non or low drinking counterparts, with a dose-response relationship observed (although the mechanism underlying this relationship is not clearly understood). Another study concluded that academic success in schools (including receiving good grades), as well as absenteeism can be related to adolescent alcohol consumption, as well as to early initiation of drinking (Loveland-Cherry, 2005, cited in Newbury-Birch et al, 2009). More specifically, it was found that drinking more than 5 units by male students, and more than 4 by female students, during a 2 week period, was associated with more than three times greater likelihood of falling behind in school, compared to moderate drinkers (Perkins, 2002, cited in Newbury-Birch et al, 2009). Based on a review of epidemiological and experimental studies, Courtney and Polich (2009) concluded that binge drinking and acute alcohol consumption may impair executive-type cognitive functions among young adults.

However, these studies tend to suffer from a lack of controls for potential confounders, from their cross-sectional design, and from the use of self report of alcohol drinking and prospective memory. Thus, (Clark, et al., 2008) concluded that the evidence on the link between alcohol use in adolescents and brain development is inconclusive, mainly due to the cross sectional designs of most studies and small sample sizes. In an attempt to deal with these limitations, Cook and Moore (1993) controlled for unobserved

confounding using instrumental variable analysis proxying youth drinking by state beer taxes and minimum purchase age. Their results indicated that heavy drinking in schools reduces the total educational attainment.

Another recent study, based on 1997 and 1999 US College Alcohol Study data, concluded that lower alcohol consumption among college students is associated with improved study habits (e.g., class attendance or academic performance) relative to heavy drinkers, but only among upper level students (Powell, et al., 2004). The strength of the study was its ability to control for potential unobserved confounding, with results suggesting that failing to do this would overestimate the effect of alcohol consumption on study habits. However, a more recent review has concluded that overall evidence for the effect of drinking on the performance of college students in USA is inconclusive (Newbury-Birch, et al., 2009), suggesting that most damage to academic performance probably occurs in earlier years.

### ***Risky sexual behaviour/premature pregnancies/STDs***

Adolescent alcohol consumption is also associated with risky sexual behaviour. Halpern-Felsher et al (1996) reviewed the association between adolescent alcohol consumption and involvement in risky sexual behaviour. The most rigorous studies used event analysis, comparing at least two discrete events for each subject<sup>4</sup>. They revealed a positive association between alcohol use and first sexual events, but lack of evidence for the link between adolescent alcohol consumption and other types of sexual relationships and risky behaviours. In addition, alcohol consumption among young women was associated with lower use of contraception (Kaestner, Joyce, 2001, Sen, 2002, cited in Grossman et al, 2005).

In another recent review (mostly of cohort studies), Baliunas et al (2010) reviewed evidence from 10 articles although not limited to adolescents. The main finding was that those who consume alcohol have about 77% higher risk of contracting HIV compared to teetotalers (risk ratio=1.77; 95% CI 1.43–2.19). For binge drinkers the risk relative to non-binge drinkers was even higher (RR= 2.20; 95% CI: 1.29–3.74). None of the evidence was from European countries. Surprisingly, another review found that heavy alcohol use was not associated with a higher probability of having adolescent sex (e.g., Rees, et al., 2001, Sen, 2002, cited in Grossman et al, 2005). Other reviewers concluded that the link between alcohol use and the probability of risky sexual behaviour differed between gay and heterosexual adolescents (Donovan, McEwan, 1995).

Cooper (2002) reviewed evidence for the association between drinking and risky sex in samples of college students and youth, with much of the evidence from the USA. The main finding was that college drinking was strongly related to a higher probability of having sex, and to risky sex in particular (for example, having multiple partners), although evidence on the association between drinking and condom use was inconclusive. The review mostly focused on methodologically stronger event-level studies. Similarly, Boyd et al (2005, cited in Newbury-Birch et al, 2009) concluded that heavy drinking by college students was significantly associated with risky sexual behaviour and aggression. More relevant to the European experience, a review of drinking behaviour by UK university students, by Gill (2002, cited in Newbury-Birch et al, 2009) showed that there was a significant positive association between alcohol consumption and the risk of having unplanned pregnancy and HIV infection, suggesting that alcohol consumption can have serious health consequences for adolescents from all socioeconomic classes. Another review based on 13 studies (4 of them looking specifically at adolescents) concluded that there was a weakly significant negative association between alcohol consumption and condom use at first

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<sup>4</sup> Event analysis is basically a discrete choice model. The most rigorous design will compare between two outcomes of interest (e.g., condom use in the previous two sexual encounters) for each subject. As each subject will serve as his/her own control, this will be similar to including individual fixed effects.

sexual relationship (Leigh, et al., 2008, cited in Newbury-Birch et al, 2009), although causality was uncertain.

A major problem with many individual-level studies is that they often suffer from serious methodological problems (Donovan, McEwan, 1995), including lack of controls for a range of potentially confounding unobservable variables. For example, impatience, and/or risk-seeking behaviour may be positively correlated with both of these variables and may be the real driver of the observed association. One approach to this problem is to take advantage of the fact that alcohol control policies (such as taxes, restrictions on alcohol sales, and drunk driving) are unlikely to affect choices made in relation to one's sex life, other than through their effect on individual alcohol consumption. Therefore, they may be used to gauge the extent to which alcohol consumption is related to risky sex, net of any individual and family-level confounders. This so-called "reduced form" approach was taken in a paper by (Grossman, et al., 2005). Their main finding was that taxes and zero tolerance policies for drunk driving were indeed related to lower area-level rates of STDs such as gonorrhea for young males, as well as to lower AIDS rates (relationship with HIV rates was not explored). One limitation of this study is that although area-level policies may indeed be exogenous to a particular individual, they may not be so in relation to area-level outcomes such as STD rates. This problem was partly addressed by using state-level dummies, but the issue of time-varying state level unobservables is still unresolved with such approach. At any rate, a similar negative association between state beer and liquor taxes and gonorrhea and syphilis rates were reported in another paper (Chesson, et al., 2000, cited in Grossman et al, 2005).

### *Alcohol dependency later in life*

Starting to drink early may determine attitude to alcohol later in life. Indeed, results from a 7-year long cohort study based on a sample of about two thousand individuals suggest that drinking frequently at age 14–15 years correlates with alcohol dependence at age 20–21 (Bonomo, et al., 2004). In another recent study (mostly based on ESPAD and Scandinavian data), heavy episodic drinking by boys aged 13 was one of the strongest predictors of heavy episodic drinking later in life (Danielsson, 2011). A recent review concluded that the age of initiation of regular drinking is predictive of alcohol-related problems later in life (Greenaway, et al., 2009). Another review also found that the earlier children start to drink, the more likely they are to suffer from alcohol-related harms (Hope, 2009). On the other hand, two other reviews concluded that the age of the first drink did not predict alcohol use by age 20, and that early age of drinking onset was only modestly related to heavy drinking later in life (Boyd, et al., 2005, Saunders, Baily, 1993, cited in Newbury-Birch et al, 2009).

It is obvious that there are many challenges in attributing alcohol-related problems in adulthood to age of initiation of drinking, given the presence of a host of unaccounted individual, family and community-level confounders. Norberg et al (2009) attempted to take advantage of differential state-level exposure to minimum drinking age laws in place in the USA in the 1970s and 1980s, in a sample of 33,869 respondents. If such laws are implemented effectively, then being exposed to different legal drinking ages would exogenously affect probabilities that a person would initiate alcohol consumption at an early age. They indeed found that alcohol use disorders were about a third higher among those people who were allowed to purchase alcohol before they were 21 compared to those who could only purchase it after they reached the age of 21 (OR 1.31, 95% c.i. 1.15). Controls for state and year fixed effects were also included in the analysis, along with several other individual and community-level variables. However, the authors attributed the association mostly to the frequency and intensity of drinking by adolescents, rather than earlier age of initiation *per se* (Norberg, et al., 2009).

Finally, alcohol consumption at young ages can potentially contribute to dependency on other substances, such as cannabis. Indeed, Boyd, McCabe and Morales (2005, cited in Newbury-Birch et al, 2009) found evidence of a relationship between cocaine use and binge drinking in college students. At the same time, Smart and Osborne (2000) and Golub and Johnson (1998) (cited in Newbury-Birch et al, 2009) found no association between alcohol consumption and using drugs other than cannabis.

### ***Consequences of drinking alcopops and other alcoholic drinks with potentially particular appeal to minors (ABPPAM)***

Consequences of drinking ABPPAM by adolescents can arguably be similar to those from consuming other alcoholic drinks; but there may be some that are specific to this class of drinks. For example, surveys of adolescents found that one important feature of alcopops and ciders is that they may conceal the unpleasant taste of alcohol, so contributing to higher consumption than otherwise would be the case (Romanus, 2000). Romanus (2000) described the introduction of alcopops and sweet ciders to the Swedish market in 1996. The author concluded that alcopops did not replace traditional alcoholic drinks but did seem to contribute to the overall increase in alcohol consumption among youth in Sweden.

One review (using evidence from the EU but mostly from the UK) specifically looked at the negative consequences of alcopop consumption by adolescents, such as frequency and quantity of alcohol consumption, alcohol-related negative events, and consumption of drugs (Metzner, Kraus, 2008). The reviewers concluded that the evidence for such links was inconclusive, although this was largely due to the methodological weaknesses of studies, such as self-selection of alcopop consumers. Thus, it is possible that the correlation between alcopop consumption and alcohol dependence is not specific to alcopops. Controlling for total alcohol consumption could address this issue but it is not consistently done. The review did find evidence in some studies that there was a link between total alcohol consumed (regardless of the type of drink) and the probability of adverse alcohol-related events; however, there was no additional “alcopops” effect beyond this.

Kraus et al (2010) used 2003 ESPAD data from Germany (for students aged 15-17 who reported drinking alcohol in the past 7 days) to answer the same questions. They concluded that there were no significant differences in problematic alcohol consumption behaviour between alcopops and non-alcopops drinkers after controlling for overall alcohol consumption.

On the other hand, Anderson and Baumberg (2006) cited evidence from several studies that wine coolers, designer drinks and alcopops contributed to heavier drinking among young people, as well as to a lower age of drinking initiation (Barnard, Forsyth, 1998, cited in Anderson and Baumberg, 2006, Goldberg, et al., 1994, McKeganey, et al., 1996). In addition, there is some evidence that energy drinks, regardless of whether they are mixed with alcohol or not, can lead to alcohol dependence later in life (Arria, O'Brien, 2011). For example, using a sample of 1,097 fourth year college students from the USA, Arria, Caldeira et al (2011) found that high frequency energy drink users (i.e., those consuming energy drinks on more than 51 days in the past year) were significantly more likely to become alcohol dependent than low or non-users of energy drinks (Adjusted Odds Ratio=2.40), even after controlling for a large range of confounders. However the mechanism underlying this relationship is not clear. One theory is that this can be attributable to caffeine's neuropharmacologic effects (Arria, O'Brien, 2011), as the amount of other putative components in such drinks (e.g., guarana, ginseng, taurine) is negligible (Clauson, et al., 2008). Excess caffeine consumption can reduce subjective feelings of being drunk and thus contribute to drunk driving and other risky behaviour, as well as delaying onset of sleep that would otherwise limit drinking by adolescents (Arria, et al., 2011). These conclusions were consistent with an earlier review of the effect of consuming energy drinks on the subjective feeling of being drunk (BfR, 2008).

## **4. Determinants of alcohol consumption among youth**

### ***Gender***

In the previous section we described the distribution of alcohol consumption in Europe by gender. Here, we briefly discuss the research evidence on why gender, in general, can be a predictor of alcohol consumption among adolescents.

One review has found that boys and girls differ in how they react to certain external factors (Schulte, et al., 2009). For example, researchers found that boys are more likely to become disruptive drinkers in response to certain physiological and social changes particular to adolescence, which may explain their higher representation among binge drinkers. On the other hand, biological (e.g. genetic risk) and psychosocial factors (e.g., impact of positive drinking expectations) were not found to affect boys differently from girls (Schulte, et al., 2009). Differences in drinking behaviour between genders can also be affected by media-driven stereotypes of gender roles. If this is true, the apparent convergence in drinking behaviour over recent years indicates either a changes in media strategies, or their diminishing role relative to other determinants. The study also called for more gender-sensitive studies to differentiate between determinants that can affect boys' and girls' drinking behaviours differently (Schulte, et al., 2009).

### ***Education, income, SES***

Drinking behaviour can also be affected by an individual's income and education (which are different from family socioeconomic status). Here, we are interested in the effect of pocket money, schooling and other measures of socioeconomic status of adolescents, rather than the income level and educational attainment of their parents.

One study has found a significant link between greater pocket money and increased alcohol consumption among 14-year olds in Finland (Lintonen, et al., 2000, cited in Rabinovich et al, 2009). Another cross-sectional study found that UK children aged 15-16 years who had greater expendable income were more likely to exceed guidance on amount consumed (Bellis, et al., 2010). Similarly, research in Spain and the Netherlands found that young people's income was positively related to consumption and drunkenness (Duarte, et al., 2007, Poelen, et al., 2005). Also, unemployed young adults in some countries were found to drink more than their employed peers, although this trend was reversed after they reached the mid-twenties (Casswell, et al., 2003, Temple, et al., 1991, cited in Anderson, Baumberg, 2006).

Educational attainment (and educational problems) is another correlate of drinking behaviour (Currie, et al., 2000, Duarte, et al., 2007, cited in Anderson, Baumberg, 2006), although it may be very difficult to establish the direction of causality in cross-sectional studies. However, some studies have found a rather surprising positive correlation between higher education and alcohol consumption in young people. Thus, using data from the British Cohort Study, researchers found that higher educational attainment was associated with greater odds of daily alcohol consumption, as well as with problem drinking (Huerta, Borgonovi, 2010), and this association was stronger for females than males. Moreover, those who achieved higher test scores in childhood were at a significantly higher risk of excessive alcohol

in adulthood. The finding of this study are in line with those reported elsewhere (Caldwell, et al., 2008, Jefferis, et al., 2008, Maggs, et al., 2008, cited in Huerta, Bogoni, 2010).

One suggested explanation is that limited income may constrain alcohol spending by willing adolescents (UN Department of Social Affairs 2005, cited in Anderson, Baumberg, 2006). A related explanation for the association between educational attainment in childhood and later alcohol consumption is that a higher socioeconomic status can promote greater social interaction and thus alcohol consumption later in life (Månsdotter, et al., 2008, cited in Huerta, Bogoni, 2010). Finally, the strength of relationship between socio-economic status and alcohol consumption among adolescents can be country-specific (Hibell, et al., 2004).

Family socioeconomic status is another potential determinant of alcohol use in children but the nature of the association is not straightforward. As with individual level determinants, higher family socio-economic status may be associated with children's greater disposable income and greater opportunities for social interactions, and thus greater alcohol consumption. On the other hand, this may be counterbalanced by greater parental investments into childrearing, thus lowering demand for alcohol. One cross-sectional study found that family affluence was positively correlated with the risk of drunkenness in male children in nine of twenty eight countries. Interestingly, the same effect for female children was only found in one country (Richter, et al., 2006, cited in Rabinovich et al, 2009). In another study conducted in Italy, a positive link between family wealth and the likelihood of children drinking (including unsupervised drinking) was also found (Buonanno, Vanin, 2007). On the other hand, in a large systematic review of longitudinal studies, little evidence on the correlation between childhood SES and alcohol use later in life was found (with 7 of 11 selected studies based on EU data). However, it should be noted that binge drinking was not an outcome of interest in any study that was reviewed. Moreover, most studies reported unadjusted associations, which may very well be affected by confounding (Wiles, et al., 2007).

In another European (but non-EU) country- Ukraine, it was found that long term unemployment and wage arrears affecting one parent actually increased the probability of drinking among young adults. Specifically, living in a household with wage arrears increased the odds of young adult drinking by 18 percent. The effect of paternal drinking was even greater- about 25% (Avdeenko, et al., 2010). It should, however, be noted that this is different from the finding on the effect of family socio-economic status mentioned above, suggesting that the effect can be both variable and country-specific.

### ***Family attitudes and practices***

One potentially important family-level determinant of adolescent alcohol initiation and intensity of use is parental provision of alcohol. In one study, a researcher used data from three different sources (longitudinal cohort survey of 1,222 adolescents from Stockholm aged 13 to 19 years; cross-sectional study of 3,000 adolescents from Sweden aged 15 to 17 years; as well as the ESPAD survey with 38,370 participants), and found that the parental provision of alcohol in the 7th grade significantly increased the odds for heavy alcohol use in girls after two years. However the family can play a positive role: it was found that secure bonds between girls and their parents decreased the risk of heavy episodic drinking. Surprisingly, this held true even when parents offered them alcohol or when the girls were friends with somebody who drank alcohol (Danielsson, 2011). Similarly, some other studies have found that drinking alcohol under the supervision of parents can protect against heavy drinking (Dent, et al., 2005, Foley, et al., 2004, cited in Greenaway et al, 2009).

Having said that, in another study based on Swedish data, a researcher found that parental supply of underage children with alcohol was related to the latter's heavier and more frequent consumption and

to drunkenness in the future (Lundborg, 2002). In the USA, a longitudinal study looked at the link between parental supply and the age of the onset of alcohol consumption (Warner, White, 2003, cited in Greenaway et al, 2009). The authors concluded that parental supply of alcohol was correlated with later problem drinking.

Another potentially important factor is a parental drinking habit, and the related issue of intergenerational transmission of drinking behaviour. Several studies have reported this phenomenon (e.g. Buonanno, Vanin, 2007, Moore, et al., 2010, Newbury-Birch, et al., 2009). In one study, using German survey data, researchers utilized an econometrically sophisticated methodology. Specifically, they controlled for the heterogeneity of the effect on the alcohol use of children by using censored quintile regression technique (Schmidt, Tauchmann, 2010). Their main finding was that the effect was stronger in the upper tail of the distribution of children's alcohol consumption, with the effects for the 95th percentile being more than three times larger than those for the median. In other words, the intergenerational transmission effect was found to be particularly strong for heavy drinking behaviour. Also, this was only true for the effects of paternal drinking on sons and for the effects of maternal drinking on daughters. In contrast, there was little evidence for cross-gender intergenerational transmission. In a 5 year retrospective cohort study using a sample of 12,686 US young adults, Jennison & Johnson (1998) found that male children of alcoholic parents had the greatest probability of starting to drink and to consume excessive amounts of alcohol, followed by female children of alcoholics, and children of non-alcoholics of either gender.

The psychological atmosphere inside a family can also shape drinking preferences of young adults. For example, previous studies have established a link between positive family environment (including positive parental communication and parental awareness) and a lower probability of risky alcohol use (Currie et al., 2000; Hibell et al. 2004., cited in Anderson, Baumberg, 2006). Similarly, in a study of 6,628 secondary schoolchildren aged 11-16 years living in Wales, it was found that parental monitoring and family closeness were associated with lower levels of alcohol consumption among children (Moore, et al., 2010). A meta-analysis by Foxcroft and Lowe (1991) concluded that both lax family control and support were associated with greater adolescent drinking, although the association of underage drinking with parental control was more curvilinear (Foxcroft, Lowe, 1991).

Drinking preferences of adolescents can also be affected by the family structure. Thus, some researchers found that living with a single parent or step-parent was correlated with greater frequency of alcohol consumption, as well with heavier drinking in Europe (Bjarnason et al. 2003 cited in Anderson, Baumberg, 2006). A similar finding was obtained from the National Educational Longitudinal Study conducted in USA. Specifically, researchers found that teenagers living in families where parents were unmarried were more likely to drink alcohol (DeLeire, Kalil, 2002), although the outcomes were not worse for those living with a single mother and at least one grand parent than for those living in married households. There was also a study concluding that children living in disrupted families are more likely to become early substance abusers (Rutter, 2007, cited in Newbury-Birch et al., 2009).

Finally, one study of 1,214 twin pairs living in the UK considered several determinants of alcohol use initiation, as well as of progression to heavier alcohol use. The researchers found that environmental influences were more important for drinking initiation, while genetic determinants had stronger influence on the intensity of alcohol use (Fowler, et al., 2007).

A common problem with many studies in this group is unobserved heterogeneity, which can be community, individual and family-level. The last of these can be dealt with by using family, or siblings fixed effects, as well as by some other advanced approaches. For example, using US data, Antonji et al (2010) studied whether substance abuse by an older sibling had any effect on the substance use by a younger sibling at time  $t$ , controlling for older sibling's behaviour before and after time  $t$ . They argued

that such an approach will allow controlling for common unobserved influences, although this will be subject to the assumption that the direction of causality is indeed from older to younger sibling. In another specification, they specifically controlled for siblings fixed effects, taking advantage of the longitudinal nature of the data. Finally, they allowed for habit formation by estimating a dynamic model of siblings behaviour. As a result, they found that indeed alcohol use among younger siblings can be affected by the example of older siblings (Altonji, et al., 2010).

### ***Marketing and advertising***

Recently, a large review of studies commissioned by the NICE Centre for Public Health Excellence (mainly drawn from USA, but also Belgium, New Zealand, Germany, and a few other countries) summarized evidence on the link between alcohol advertising and alcohol consumption, particularly among young people. Overall, the evidence was supportive of an association (Jackson, et al., 2009). The authors found, for example, that exposure to alcohol advertising was associated with the onset of adolescent alcohol consumption among baseline non-drinkers, as well as with greater consumption of alcohol by adolescent drinker (Booth, et al., 2008), while exposure to television and other broadcast media was linked mainly to the initiation of alcohol consumption. It was also found that the impact of advertising was potentially strongest in younger age groups, and on 15 to 17 yr old girls (Jackson, et al., 2009).

Others, however, have concluded that alcohol advertising has little, if any effect, on consumption by youth. For example, one paper examined count data for alcohol advertisements placed in 28 magazines in 2001-03. One of the main findings was that there was little evidence that advertisers target underage youth (Nelson, 2010). The same researcher criticized some of the previous research on the effects of advertising on alcohol demand (Nelson, 2010), concluding that serious methodological shortcomings usually prevent causal interpretation of results.

However, studies denying the link between advertising exposure and alcohol-related outcomes for adolescents tend to be mostly of econometric nature (Hastings, et al., 2005), and most such studies have serious deficiencies, including lack of high quality longitudinal data, lack of controls for important variables, focus on whole populations rather than the young, and inadequate advertising exposure (often measured by advertising expenditures) (Hastings et al., 2005). Also, there may be little variation in advertising exposure over time, which may make it difficult to detect any effect (British Medical Association, 2009).

One problem is how to measure advertising exposure. Advertising expenditures may be attractive because of its simplicity but it is crude (Casswell, 2004). For example, for their review, Anderson et.al (2009) selected articles that defined exposure by such variables as estimates of the volume of media and advertising time, ownership of branded merchandise, as well as recall and receptivity. Another recent review summarized the evidence from 10 studies, and found that in 8 of them, there was a statistically significant relationship between media exposure and alcohol use among children and adolescents (Nunez-Smith, et al., 2010). The authors chose to define media exposure in a number of ways, including viewing alcohol scenes in movies, and the number of TV hours watched weekly. It is notable that all 5 longitudinal studies reviewed concluded that media exposure was related to increased alcohol use after one or two years. A limitation of this review is that advertising media includes more than film and television- a focus in this particular study.

A recent systematic review of exposure to advertising and marketing and drinking behaviour was distinguished by inclusion of only prospective cohort studies, and its large size: more than 13,000 adolescents aged 10 to 26 were included in total. Seven studies were included. Exposure variables

included hours of TV and music video viewing, including portrayal of alcohol drinking in films, music videos, and TV programmes, and related advertising time. Exposure to print media was also considered. The main finding was that nondrinkers at baseline were significantly more likely to become a drinker later on, with greater exposure to alcohol advertisements (Smith, Foxcroft, 2009). For example, Robinson (1998, cited in Smith, Foxcroft, 2009) concluded that for each additional hour of TV viewing per day, the risk of drinking initiation increased by 9% in the following month. Sargent (2006) found that for each additional hour of exposure to alcohol use depicted in popular movies there was a 15% greater chance of having tried alcohol 13 to 26 months later. However, there was little effect of advertising exposure on the intensity of drinking for baseline drinkers.

The authors also noted that two recent cohort studies that would have met the inclusion criteria for their review (but were published too late for inclusion) demonstrated similar findings: among 11 year old, being in the highest quartile of exposure to TV beer advertisements, alcohol ads in magazines, in-store beer displays and beer concessions, radio listening time and ownership of beer promotional items was associated with a 50% greater likelihood of drinking alcohol, than was the case for youth in the lowest quartile of exposure one year later, even after controlling for demographic and psychosocial factors and prior drinking (Collins, et al., 2007, cited in Smith, Foxcroft, 2009). In a second study, non-drinkers aged 11 to 15 years who owned or wanted to own alcohol branded promotional items were 77% more likely to start drinking alcohol use one year later, compared to the reference group of youth without such items (Henriksen, et al., 2008, cited in Smith, Foxcroft, 2009).

There were several problems with the studies selected by Smith and Foxcroft (2009) for review, including the unavailability of important control variables, such as peer drinking and parental attitudes towards drinking, as well as some socio-economic variables that could contribute to the observed association between TV viewing and drinking behaviour.

Some longitudinal studies were conducted in New Zealand and in the USA (e.g. Collins, et al., 2007, Connolly, et al., 1994, cited in EAPA, 2008). For most part, they showed that exposure to alcohol advertisements is associated with higher likelihood of adolescents to start drinking alcohol, as well as with increased consumption of alcohol amongst baseline drinkers. Alcohol advertising can also affect outcomes other than demand for alcohol. For example, one cross-sectional US study revealed a significant effect of advertising on traffic fatalities (Saffer, 1997).

In econometric studies, it may be hard to establish a link between area-level variables such as advertising expenditures and individual-level consumption. One approach to this problem is to examine the perception of the advertising message, for example in consumer studies (Hastings et.al., 2005), or by using qualitative techniques employed by market researchers (Casswell, 2004). One review found that the content of alcohol advertising was generally positively perceived by young people who were attracted by the desirable images of lifestyle associated with alcohol consumption (Jackson et al, 2009). The studies mainly took place in the UK and Ireland. Another study found a high level of brand recognition among adolescents aged between 12 and 16 (ELSA, 2004). Interestingly, alcopops and beers were overrepresented in the list of appealing alcoholic beverages. Another study found that drinking is generally portrayed as “being an important part of sociability, physical attractiveness, masculinity, romance, relaxation and adventure” (Chen, et al., 2005, cited in EAPA, 2008). In a recent study, in Ireland, alcohol advertising was identified positively by the majority of teenagers surveyed (Dring, Hope, 2001, cited in EAPA, 2008). Repeated exposure of US college students to beer advertising was associated with alcohol being perceived as less risky and more beneficial, compared with non-exposed students (Snyder, Blood, 1992, cited in Caswell, 2004). One potential problem with this approach, of course, is that positive perception of the advertised message does not necessarily lead to greater alcohol consumption.

The first study - according to its authors - to show that exposure to alcoholic commercials was linked to alcohol consumption was recently conducted in the Netherlands (Engels, et al., 2009). The authors invited 40 young adult male pairs (80 total persons) to watch a movie clip for 1 hour, with two commercial breaks, allowing them to choose drinking alcohol and non-alcohol beverages. The main finding was that participants assigned to the conditions with significant alcohol exposure drank, on average, 1.5 glasses more of alcoholic drinks than those with no alcohol portrayal.

Another way to measure the influence of alcohol advertising is by examining the effect of advertising bans on alcohol consumption. Here the evidence seems to be less convincing than with the impact of advertizing *per se*. For example, one recent review of evidence was based on two systematic reviews, with the majority of studies conducted outside of the EU (Booth, et al., 2008, FDS International and Volterra Consulting, 2008, cited in Jackson et al, 2009). The evidence was declared to be inconclusive, although it should be noted that the selected population was not restricted to adolescents, and that the FDS International Review (2008) was commissioned by the Advertising Association.

Nelson (2010) used cross-country panel data to study simultaneous effects of alcohol advertising bans and other policies designed to reduce alcohol demand. The main strength of this approach was that the author could control for the effect of other policies. While alcohol price controls had significant effect on demand, this was not the case for advertising bans (Nelson, 2010). This study did not, however, look at individual behaviour. As mentioned above, the strongest association between alcohol demand and alcohol advertising is usually found in younger people.

In contrast, one study specifically looked at the effect of alcohol advertising bans on adolescent consumption (Saffer, Dave, 2006). Using large US datasets, researchers concluded that “a complete ban on all alcohol advertising could reduce adolescent monthly alcohol participation by about 24 percent and binge participation by about 42 percent.” The effect was also found to be stronger for females. One strength of this study is its panel design, and thus the ability to control for individual-level fixed effects. In fact, controlling for individual-level heterogeneity actually strengthened the effect of advertising. The effect was stronger when the outcome was binge drinking. Another interesting conclusion of the study is that advertising bans can be more effective than price increases. Thus, raising alcohol prices by 100% could result in monthly alcohol consumption by adolescents falling by 28%, and binge drinking by 51%, similar to total elimination of alcohol advertising (Saffer, Dave, 2006). In another study, researchers analyzed pooled time series data from 20 countries over 26 years, and found that advertizing bans indeed decrease alcohol consumption (Saffer, Dave, 2002, cited in Casswell, 2004). Another systematic review suggested that although advertising bans can be effective, they must be comprehensive rather than partial, as in the latter case, substitution between different types of media can occur (Saffer, 2002).

Advertising is but one aspect of marketing. The marketing “package” may include other strategies, such as price promotions and point of sale displays, use of new media, product placements and sponsorships (Hastings, et al., 2005, Jones, Jernigan, 2010). Nevertheless, most existing research has focused only on advertising (Jones, Jernigan, 2010), and there is distinctive lack of evidence on how alcohol marketing reaches adolescents through new media. This is especially true for alcopops and energy drinks marketing (Simon, Mosher, 2007). One potential problem is that exposure to these media are very difficult to measure (Hope, 2009).

Notwithstanding this problem, the European Commission’s Science Group recently adopted unanimously the statement that “there is a positive relationship between marketing communication and the volume and pattern of young people's consumption of alcohol.” (Directorate General for Health and Consumers, 2009). As for specific marketing strategies, one systematic review recently concluded that “there is evidence of moderate and consistent association between point of purchase promotions and effects on alcohol consumption among underage drinkers”. (Booth et al., 2008, cited in Jackson et al,

200). The majority of the studies included in the review by Booth et al. were drawn from the USA, with others from Belgium and New Zealand. (Jackson, et al., 2009)

A recent longitudinal study showed that the effect of possessing a promotional item can be even greater than being exposed to televised or printed alcohol advertisement (Collins et al. 2007 cited in EAPA, 2008). Another study found that non-drinkers aged 12-13 years who were exposed to in-store beer displays, were likely to start drinking by age 14-15 years (Ellickson, et al., 2005, cited in Anderson, Baumberg, 2006).

In another cross-sectional study, it was found that such factors as availability of large volumes of alcohol (e.g., 24- and 30-can cases of beer), and frequent promotions and advertisements at both on- and off-premise establishments were associated with higher rates of binge drinking on college campuses. The main problem with this study is that it is correlational, and at a population level (Kuo, et al., 2003).

Another recent prospective cohort study took place in Scotland. Exposure to thirteen different types of alcohol marketing were assessed for their effect on drinking behaviour among 920 secondary school pupils (Gordon, Harris, 2009). Controlling for media exposure, demographics and parental and peer influence, the researchers found significant associations between awareness of, exposure to, and involvement in, alcohol marketing, and drinking behaviours and attitudes towards alcohol.

### ***Outlet density***

One other potential environmental determinant of alcohol consumption among adolescents and youth is outlet density, an important determinant of the general availability of alcohol. A recent systematic review of reviews (Cohen, et al., 2006, Her, et al., 1999, Mäkelä, et al., 2002, cited in Jackson et al, 2009) conducted in Scandinavia, USA and Canada. The Scandinavian review summarized evidence from several natural experiments, concluding that greater alcohol outlet density was associated with increases in alcohol consumption and alcohol-related morbidity and mortality in Scandinavian countries (Mäkelä et al., 2002, cited in Jackson et al., 2009). Similar results were reported in the two remaining systematic reviews focusing on North America (Her et al., 1999 Cohen et al., 2006, cited in Jackson et al., 2009).

These three reviews were not limited to the young. However, there were several studies focusing on young people that reached similar conclusions (Jackson et al., 2009). Two studies by Kuntsche (2008, 2005) were conducted in Europe (Switzerland).

Another study looked beyond the effect of outlet density on adolescent alcohol consumption, and considered other outcomes, including violence, drunk-driving, pedestrian injury, and child maltreatment (Livingston, et al., 2007, cited in Jackson et al, 2009), finding a positive association between outlet density and these adverse outcomes. The studies in this review were mainly conducted in the USA.

### ***Peer pressure and social norms***

In one study, self-reported drunkenness in Europe was found to be associated with spending time with friends (Currie et al. 2000). In another using Swedish and ESPAD data, the author found that peer alcohol use was strongly correlated with heavy drinking, both cross-sectionally and longitudinally (Danielsson, 2011)

Using the 2004 Spanish Survey on Drug Use in the School Population data (Duarte, et al., 2007), the authors found that belonging to a class with a 10% higher consumption rate than another one was associated with an increase in the probability of being a heavy drinker of around 9.9 percent, and with an increased probability of truancy of 9.7 percent. One methodological problem with this paper is that the class consumption level may be correlated with other school and area-level unobserved characteristics, which may in turn be correlated with the outcome variable. In an attempt to deal with this issue, Fletcher (2011) attempted to control for unobservable covariates by utilizing school-level fixed effects and instrumental variable methodology. Specifically, availability of alcohol in classmates' homes and classmates' parental alcohol abuse was used as an instrument for the proportion of classmates who drink in a class. The main finding was that a 10% increase in the proportion of classmates who drink leads to a 5 percent higher probability that an individual drinks alcohol (Fletcher, 2011).

An recent experimental study on the role of imitation in drinking behaviour was conducted in the Netherlands (Larsen, et al., 2009). 135 young adults were exposed to either non-drinking, light-drinking or heavy-drinking partners (all dyads were same-sex). The main finding was that the participants consumed substantially more alcohol when exposed to heavy-drinking colleagues compared to light and non-drinking colleagues. There was no sex difference in the levels of imitation. A limitation of the study was its focus on same sex-dyads, while some previous studies found that in mixed-sex groups, males had higher levels of imitation than females (Larsen, et al., 2009).

This peer effect can be a byproduct of social norms for alcohol consumption among adolescents. Some researchers have found an association between social supply of alcohol and binge drinking (e.g., Dent et al., 2005, Warner and White, 2003, Lundborg, 2002, cited in Greenaway et al., 2009).

### *Age limits and their effectiveness*

Although a great majority of European countries have minimum age limits for selling alcohol, ultimately their effectiveness will depend on the degree of enforcement by the sellers, and compliance by buyers. Surprisingly, most 15-16 year old respondents in the ESPAD, survey conducted in 2007 said that it was either fairly easy, or very easy to buy alcoholic beverages, with beer being most accessible, followed by wine and then spirits (Directorate General for Health and Consumers, 2009).

Another recent review included seven papers, including one extensive systematic review (Jackson, et al., 2009) and found inconclusive evidence of an association between minimum legal age of alcohol purchase and alcohol consumption. The authors found 19 papers on enforcement of a minimum legal age for alcohol purchase. Their conclusion was that retail managers were not always committed to enforcing the ruling. They also found that licensees and servers perceived little risk in breaking this rule. Compliance checks by the police were not found to be always effective either (Jackson, et al., 2009).

There is one comprehensive systematic review of the association between minimum legal drinking age and alcohol consumption (Wagenaar, Toomey, 2002, cited in Jackson et al, 2009). Again, the evidence was inconclusive. The majority of studies included were conducted in North America, with the remainder from Australia, New Zealand, Switzerland and Norway.

In contrast to the studies on the effect of *existing* minimum drinking age laws, a review of 132 studies found strong evidence for a beneficial effect of *changes* on youth drinking and alcohol-related harm, such as road traffic accidents (Wagenaar and Toomey 2000, cited in Anderson, Baumberg, 2006). An interesting finding was that this effect remained well after adolescents reached the legal drinking age.

In yet more studies, it was found that raising the minimum legal drinking age from 18 to 21 years was associated with a decrease in single vehicle night time crashes involving young drivers of up to 16% (Anderson, Baumberg, 2006), and a reduction in alcohol-related fatalities (Anderson, Baumberg, 2006). Finally, Carpenter et al (2007) accounted for state and year fixed effects in modeling the effect of minimum drinking age laws on consumption and heavy episodic drinking. They found that “increases in the MLDA [minimum legal drinking age] (from 18 to 21) in the late 1970s and 1980s and adoption of zero tolerance (ZT) laws in the 1990s both significantly reduced alcohol consumption by high school seniors, with larger effects for the MLDA than for ZT laws” (Carpenter, et al., 2007).

### *Prices/taxation*

The literature on the link between alcohol prices/taxation and alcohol demand is extensive (although mostly not limited to young and underage drinking), and in general suggestive of a strong relationship. In the general population, studies based on aggregate data suggest the price elasticity of demand for beer to be -0.3; for wine -1; and for distilled spirits -1.5 (Leung, Phelps, 1993, cited in Chaloupka, 2002). Given the high share of beer in the total consumption of alcohol by the young, such low elasticity may imply some inefficiencies in the use of alcohol taxation policy.

Having said that, individual-level data yields greater price elasticity estimates for alcohol consumption, especially among younger people (Chaloupka, et al., 2002), as well as for longer term consumption (as long term elasticity can take into account the habituating nature of alcohol) (Cnossen, 2007). The greater price elasticity of alcohol consumption by youth can be expected because of their smaller budgets. A counterargument is that as a considerable proportion of the youth alcohol budget is spent on beer, the price elasticity may be lower than expected (Rabinovich, 2009). Indeed, a recent meta-analysis by Gallet (2007, cited in Rabinovich, 2009) found that price elasticity for youth drinkers was smaller than for adults. In one US-based study, the price elasticity of beer consumption in the past month was estimated at about -0.28, while the price-binge participation elasticity was estimated at about -0.51 (Saffer, Dave, 2006). A recent study using British data concluded that price elasticity of consumption by youth is greater than by the population at large (Meier, et al., 2008, cited in Rabinovich et al, 2009). In addition, Manning, et al (1995, cited in Cnossen et al, 2009) concluded that heavy drinking is less price elastic than moderate and low drinking.

One study found insignificant effects of price on drinking among male college students and relatively small effects for female college students (Chaloupka, Wechsler, 1996). The authors suggested that measurement error can be a problem in this (and similar) studies. Specifically, they argued that researchers often use averaged local retail prices as a main independent variable, which may neglect situations when alcohol is consumed for free (or for much lower prices) at parties, happy hours and other similar occasions.

A more recent review concluded that there was evidence of negative relationship between the price of alcohol and adolescent alcohol consumption (Jackson et al, 2009). Another author reached similar conclusions based on additional evidence (Rabinovich 2009), suggesting that price increases are related not only to reduced frequency of drinking, but also to less alcohol drunk on each occasion.

A larger evidence base exists for the whole population (i.e., not restricted to the young). Jackson et al (2009) identified studies of the link between price/tax increases for alcohol, and alcohol-related harms. Decreases in the price of alcohol were associated with increases in alcohol-related deaths; increases in taxes with decreases in alcohol-related deaths; and no increase in interpersonal violence rates following a decrease in alcohol prices (Jackson et al, 2009).

One of the most recent reviews found a consistent association between higher alcohol prices/taxes and lower prevalence of youth drinking in nine out of six studies (Coate, Grossman, 1988, Cook, Moore, 1994, Grossman, et al., 1995, Kenkel, 1993, Laixuthai, Chaloupka, 1993, Pacula, 1998, cited in Elder et al, 2010), with an elasticity reaching -3.54 for binge drinking among women aged 18-21 years.

The evidence on the effect of alcohol price increases (e.g. through taxes) on adolescent consumption and other related outcomes appears to be even stronger than for prices *per se*. One piece of evidence suggests, for example, that raising alcohol taxes in the EU15 by 10% could prevent over 9,000 deaths during the following year, while approximately €13bn of additional excise duty revenues could be collected (Anderson, Baumberg, 2006). Increase alcohol price was also found to have a greater effect on consumption by those younger people who drank most often (Anderson, Baumberg, 2006). The same review identified a strong association between alcohol price increases and lower traffic accidents and fatalities, particularly for younger drivers (Anderson, Baumberg, 2006). Another study found that a 10-percent increase in the price of alcoholic beverages would reduce the probability of drinking and driving by about 7.4 percent for men and 8.1 per-cent for women (Kenkel 1993, cited in Chaloupka et al, 2002), with even larger reductions (12.6 percent for men and 21.1 percent for women) among those 21 years and younger.

Despite a relatively low price elasticity for beer consumption, one study estimated that direct increases in state beer taxes in the US had a significant effect on reducing youth alcohol consumption (Carpenter, et al., 2007). Chaloupka et al (1993) reached similar conclusions not only with respect to alcohol consumption by the youth, but also in terms of alcohol-related harm outcomes such as traffic fatalities.

Finally, the effectiveness of any alcohol taxation policy in the EU can be constrained by cross-border trade. Thus, residents of high-excise-duty Member States can often easily go alcohol-shopping to the neighboring countries with lower alcohol prices. Some examples are the Öresund region and Helsinki-Talinn routes (Karlsson, Tigerstedt, 2005, cited in Cnossen et al, 2009). It was estimated that “at least one in six tourists in the EU returns from trips abroad with alcoholic drinks, carrying an average of over 2 liters of pure alcohol per person in several countries” (Leifman, 2001, cited in Cnossen et al, 2009).

As for pricing/taxation of alcopops, one paper concluded that there is as yet little evidence on the effectiveness of alcopop taxes in reducing alcohol consumption and harms among younger drinkers (Metzner and Kraus 2007 cited in Rabinovich et al, 2009). For example, even where such taxes led to the reduction in alcopop consumption, it is not clear if young drinkers reduced their total alcohol consumption, or whether they substituted their alcopops with other alcoholic drinks (Rabinovich, et al., 2009). Having said that, another paper argued that additional excise duties on alcopops sales in Denmark, France, Germany and Luxembourg led to the reduction in their consumption by adolescents, without noticeable substitution of other alcoholic drinks (Cnossen, 2007)

### ***Effectiveness of other regulations***

Overall, alcohol control policies aimed at restricting alcohol consumption among adolescents (aged 15-17 years) living in Europe appear to be effective, as evidenced by a recent study based on 2003 ESPAD and national secondary school surveys in Spain, Canada, Australia, New Zealand and the USA (Paschall, et al., 2009). Specifically, authors found that more comprehensive alcohol policies, as measured by alcohol policy index (API), alcohol availability and advertising control ratings were

inversely correlated with the past-30-day prevalence of alcohol use and prevalence rates for drinking 3-5 times and 6 or more times (Paschall, et al., 2009).

### ***Opening hours and other availability restrictions***

In Australia, extension in the trading hours of licensed stores was associated with greater violence and traffic accidents, as well as increases in arrests of drunk drivers aged 18 to 25 (Chikritzhs, Stockwell, 2007, cited in Jackson et al, 2009). On the other hand, community restrictions on availability of alcohol were related to modestly favorable outcomes, such as lower alcohol consumption and violence (d'Abbs, Togni, 2000, cited in Jackson et al, 2009). In a before-after study conducted in Reykjavik, Iceland, it was found that introduction of unrestricted serving hours of alcohol was associated with an increase in police activity; higher emergency admissions at weekends; and increases in suspected drunk driving incidents (Ragnarsdóttir, et al., 2003, cited in Jackson et al, 2009). In Sweden (in a controlled before-after study), Saturday opening of alcohol retail outlets led to increases in sales, but no change in alcohol-related harms (Norstrom, Skog, 2003, cited in Jackson et al, 2009). One paper reviewed evidence from several small natural experiments which took place in Scandinavia (Mäkelä, 2002, cited in Jackson et al, 2009), and found that restrictions on alcohol licensing typically resulted in decreased alcohol consumption. Typically, these studies were not restricted to adolescents only (with the exception of Chikritzhs & Stockwell, 2007, cited in Jackson et al, 2009).

Availability can also be restricted by total or partial sales bans at certain places. One study found that bans on the sale of alcohol at college campuses is a greater deterrent for abstainers who may become moderate drinkers than for moderate drinkers who may become heavy drinkers (Williams, et al., 2005). At the same time, a caution on the “natural experiment” nature of bans and sales restrictions is in order. Even though such bans can be exogenous to an individual drinker, at a community level such variables may well be endogenous to alcohol abuse rates, and therefore their effect may be biased and underestimated (Williams, et al., 2005).

Sales of alcohol can also be restricted where individuals are already intoxicated. However one review found little evidence for the effectiveness of server training on overall alcohol consumption, although some results suggest that server training was associated with refusals to serve alcohol to intoxicated individuals (Ker, Chinnock, 2006, cited in Jackson et al, 2009). Another study on the effects of enforcing laws prohibiting the service of alcohol to intoxicated patrons of bars and restaurants (McKnight, Streff, 1994, cited in Jackson et al, 2009) found that although after the introduction of the law refusals to serve alcohol to such individuals increased, after 3 months, they declined. Finally, a RCT was conducted in the USA to assess the effectiveness of interventions designed to train owners and managers of alcohol establishments not to sell alcohol to obviously intoxicated individuals. Again, at the first follow up, rates declined in the intervention group relative to the control group, but this effect did not persist over time (Toomey, et al., 2008, cited in Jackson et al, 2009).

### ***Low blood alcohol concentration (BAC) laws***

A review containing six articles (all of them of ecologic design, conducted in Australia and the USA) asked whether laws specifying low blood alcohol concentrations in younger drivers reduce motor vehicle injuries (Zwerling, Jones, 1999) and showed that there was a reduction in injuries (of up to 33%) and crashes after implementation. The results were significant in three studies. One study that compared different BAC limits found a dose-response relationship (Hingson, et al., 1994, cited in Zwerling, Jones,

1999). In states specifying a limit of 0.02% BAC, the reduction averaged 17% and in states with 0.04 to 0.06% BAC, the reduction was only 7% (Zwerling, Jones, 1999).

In another American study introduction of a limit of 0.02% for young or inexperienced drivers reduced fatal crashes by between 9% and 24%. In Sweden, a similar policy change in 1990 led to a reduction of fatal alcohol-related accidents by up to 10% (Anderson, Baumberg, 2006).

### *Self regulation*

The alcohol and advertising industries have promoted the use of voluntary codes as an alternative to legislation (Hill and Casswell, 2004). These do not work and tend to be highly selective, covering only the most visible media such as television or employing methods known to be of limited effectiveness (Casswell, 2004).

### *Other determinants*

Other determinants of excess drinking among adolescents include boredom, psychological distress, and communication problems (Milgram, 2001). Some researchers have highlighted the role of time preferences and impatience among children and adolescents. For example, in an experimental study among 661 children and adolescents aged ten to eighteen years, impatience was an important factor predicting expenditure on alcohol (Sutter, et al., 2010). Boredom was also identified in a British study of 11,879 schoolchildren aged 15-16 years (Bellis, et al., 2010)

Some researchers have grouped reasons for drinking by youth into two broad categories: to ease socializing process (or “to have a good time”), and to cope with stress and negative emotions (Smith, et al., 1993). After reviewing the evidence, Kuntsche, et. al. (2006) concluded that most young people prefer to drink for social reasons and considerably fewer surveyed reported coping motives as a reason for drinking. In addition, they found that social motives tend to lead to moderate alcohol use, while coping motives lead to alcohol-related problems. In another review, extraversion and sensation-seeking were most strongly correlated with social enhancement motives, while neuroticism and anxiety was strongly associated with coping motives for drinking.

Another significant correlate of alcohol consumption among adolescents is smoking. In Europe, children aged 11-15 years who have never smoked were found to be considerably more likely to have never drunk alcohol. Frequent smoking was particularly strongly associated with frequent beer drinking (Currie et al. 2000; Duarte and Molina 2004, cited in Anderson, Baumberg, 2006). A common factor may be a sensation seeking personality trait (Anderson, Baumberg, 2006), which can be seen in impatience as mentioned above. Another potential common factor suggested in the literature is antisocial behaviour (Bonomo et al. 2004, cited in Anderson, Baumberg, 2006).

### *Cost effectiveness considerations*

Even the most effective policies have a cost that economic evaluation should take into account when choosing among them. Some studies have attempted to address this issue, although they are still rare. For example, various strategies can be compared in terms of the monetary cost per disability-

adjusted life years averted (Cnossen, 2007). In a recent study, Chisholm et al (2004, cited in Cnossen, 2007) estimated that in countries with high level of hazardous alcohol consumption (i.e., more than 5% of all drinkers, which is the case in the UK and some other northern EU countries), population-level interventions such as alcohol taxes, reduced access to alcohol, random breath testing, and lower BAC limits for young or professional drivers can be highly cost-effective strategies. Thus, in Estonia, increased alcohol taxes were indeed found to be the most cost-effective intervention (Lai, et al., 2007). On the other hand, cost-effectiveness evidence on promotion control strategies (such as advertising bans) is still scarce (Latimer, et al., 2010). One review (Booth et al, 2008, cited in Latimer et al, 2010) suggests that advertising bans may be cost-effective, but only in areas with low hazardous drinking prevalence. Finally, another study analyzed the cost effectiveness of opening hours regulations (Chisholm et al. 2004, cited in Latimer et al, 2010). The conclusion was that they were less cost effective than both taxation policies and advertising bans.

## 5. Conclusions and future topics

Summary of the main trends in recent years (2003-2007):

- Average total consumption of alcohol by adolescents has been on the decline in the European Union in recent years.
- However, this has been accompanied by the increase in overall drunkenness, as well as prevalence of binge drinking
- Overall, there was little change in lifetime and last 12 months prevalence of drinking alcohol by adolescents, as well as little change in alcohol consumption frequency from 2003 till 2007.
- At the same time, frequency of drinking alcohol was found to be the greatest in Central, and lowest in Northern Europe.
- The difference between genders in terms of ever having been drunk is larger in EU10 countries than in EU15 countries
- As a general rule, countries that had more frequent rates of consumption, also tended to have less consumption of alcohol on each occasion
- Portugal is the country with the most worrying trends from 2003 till 2007. Thus, it has been the only country in the recent ESPAD survey which has registered rising lifetime prevalence of drinking alcohol by both boys and girls aged 15-16. This is also the country where the greatest increase in heavy episodic drinking took place during the same period, from 25% to 65%.

Summary of the main findings relating to the consequences part:

- Alcohol consumption is associated with a higher probability of being both a perpetrator and victim of violence.
- 90% of alcohol-related road fatalities are caused by young male drivers
- Dose-response relationship between alcohol consumption and poor outcomes is often found. Binge drinking can have especially severe effects on cognitive function, risk of contracting STDs (including HIV), as well as lead to higher probability of drug use.

- There was mixed evidence on the link between age of alcohol drinking initiation and later alcohol consumption, with the majority of reviews finding positive association.
- There is relatively little evidence on the contribution of alcopops to problematic drinking and other negative events beyond the effect of the alcohol they contain (not least because there have been few studies investigating the issue). There is more evidence on the negative effect of energy drinks on alcohol consumption, and alcohol-related problems.

Summary of main findings relevant to determinants part:

- Surprisingly, in many studies, a positive association between individual and family socio-economic status (including income and education), and adolescent as well as later adult alcohol consumption, was found. Potential explanations for this include greater opportunities for social interactions for the more educated/wealthier people, as well as greater amount of money to spend on alcohol. Definitive explanations are still lacking, however.
- There is considerable evidence that parental provision and attitude to alcohol may affect adolescent alcohol consumption. In addition, family structure as well as presence or lack of supporting family environment appear to be important determinants.
- The positive link between advertising and adolescent alcohol consumption seems to be well-established, although the effect of advertising bans is less clear. Most of the supporting evidence comes not from econometric, but from consumer studies.
- The effectiveness of alcohol control policies on consumption is mixed (although there is more evidence on the effect of changes in the MLDA laws).
- Outlet density, as well as general availability of alcohol are correlated with alcohol consumption/ alcohol related morbidity and mortality
- Peer pressure was found in some recent work (including experimental research) to have significant effect on alcohol consumption of the young.
- Alcohol prices and taxes were in general found to have the predicted effect on adolescent consumption. Effect of alcohol price increases (eg through taxes) appeared stronger than the effect of prices themselves.
- As a rule, beer was found to have the smallest price elasticity of demand. In addition, the young also had the lowest elasticity of demand relative to other age group, probably because a large proportion of income spent on beer (although this finding was not uniform across studies).
- The effect of higher alcohol taxes can be negated because of cross border trade.
- The evidence on the effectiveness of alcopop taxes is mixed. Even where there was evidence of some alcopop consumption decrease after prices were raised, it is possible that the affected drinkers simply switched to some other drinks (without affecting total alcohol consumption).
- Restrictions/expansions of alcohol trading hours generally had predicted effect. Low BAC laws were also usually found to be effective, although most of the evidence comes from the USA studies.
- Self regulation of sales and marketing of alcohol to adolescents is ineffective.

There were a number of methodological problems in the reviewed articles:

- One potential issue with ESPAD survey findings in 2007 is the change in methodology for some indicators compared to the previous survey. For example, in 2007, definition of heavy episodic

drinking was changed to include alcopops and cider. However, the authors of the report argued that a test of new and old versions of a questionnaire in eight countries revealed no significant differences in results.

- Another problem with both ESPAD and HBSC surveys is that they only apply to certain age groups (11,13 and 15 years for HBSC survey, and 15-16 years for ESPAD). On the other hand, the general definition of young people encompasses people aged up to 24 (or even 29) years. Therefore, our results are necessarily limited, at least as far as the trends part of our review is concerned. In addition, findings often applied to the young age group, but were not specific to them. Finally, quite a few studies were conducted on the population rather than individual level, which may lead to missing the identification of the age-specific effect.
- The ESPAD survey focused on the trends in the consumption of beer, spirits, wine, alcopops and ciders. In the survey, alcopops were defined as pre-mixed drinks with an alcohol content of about 5%. However, there is a broader class of alcoholic beverages which may have a particularly high appeal to minors (e.g., wine coolers, designer drinks, alcohol-containing foods) not covered in the survey. However, because of data limitation reasons, it was not possible to include this information in this review in any detail.
- On a related note, the great majority of literature covered the determinants of general alcohol consumption among minors, with very few articles devoted specifically to studying the determinants of consuming ABPPAM (with the exception of the effectiveness of alcopop taxes). To the extent that ABPPAM truly constitute a drink class with qualities that make them markedly different from more traditional beverages, this is a literature gap that will need to be addressed in the future.
- In many studies, alcohol consumption was self-reported, which may introduce systematic measurement error. A related issue is that certain determinants may have been measured with error, which may lead to a downward bias. For example, advertising exposure was often measured by the amount of expenditure, which may be too crude an indicator.
- Many studies were conducted outside of the European Union. In the great majority of cases, they were conducted in high-income countries, but there can still be geographic and cultural factors which may limit their applicability to the European Union.
- In general, control for potential confounding was rare in the majority of reviewed studies. Cross sectional design is common, as are small samples. Some promising approaches to deal with unobserved confounding included using longitudinal data with individual fixed effects, as well as applying innovative instrumental methodology. A few studies used experimental designs.
- Cost effectiveness studies are still rare, which is another considerable gap in the literature identified in this review. Even the most effective strategies may incur substantial cost, which must be taken into account for policy-making purposes.

## Search strategy:

As a first step, the author reviewed a number of articles/reviews sent to him by the experts/people knowledgeable on the subject. This initial list contained more than 30 sources. Next, the author conducted Pubmed and Google scholar searches, using the following strategy:

### 1) Pubmed:

((("alcohol drinking"[MeSH Terms] OR ("alcohol"[All Fields] AND "drinking"[All Fields]) OR "alcohol drinking"[All Fields]) AND ("young adult"[MeSH Terms] OR ("young"[All Fields] AND "adult"[All Fields]) OR "young adult"[All Fields] OR ("young"[All Fields] AND "adults"[All Fields]) OR "young adults"[All Fields])) AND systematic[sb] 59 results

((("alcohol drinking"[MeSH Terms] OR ("alcohol"[All Fields] AND "drinking"[All Fields]) OR "alcohol drinking"[All Fields]) AND ("young adult"[MeSH Terms] OR ("young"[All Fields] AND "adult"[All Fields]) OR "young adult"[All Fields] OR ("young"[All Fields] AND "adults"[All Fields]) OR "young adults"[All Fields])) AND Review[ptyp] 147 results

"alcohol drinking"[MeSH Terms] AND "adolescent"[MeSH Terms] AND (Review[ptyp] AND English[lang] AND ("1990"[PDAT] : "2011"[PDAT])) 297 results

"alcohol drinking"[MeSH Terms] AND "adolescent"[MeSH Terms] AND (English[lang] AND systematic[sb] AND ("1990"[PDAT] : "2011"[PDAT])) 113 results

((("alcoholic beverages"[MeSH Terms] OR ("alcoholic"[All Fields] AND "beverages"[All Fields]) OR "alcoholic beverages"[All Fields]) AND ("adolescent"[MeSH Terms] OR "adolescent"[All Fields] OR "adolescents"[All Fields])) AND (Review[ptyp] AND English[lang] AND ("1990"[PDAT] : "2011"[PDAT])) 40 results

((("ethanol"[MeSH Terms] OR "ethanol"[All Fields] OR "alcohol"[All Fields] OR "alcohols"[MeSH Terms] OR "alcohols"[All Fields]) AND ("marketing"[MeSH Terms] OR "marketing"[All Fields]) AND ("adolescent"[MeSH Terms] OR "adolescent"[All Fields] OR "adolescents"[All Fields])) AND (Review[ptyp] AND English[lang] AND ("1990"[PDAT] : "2011"[PDAT])) 31 results

The studies were screened by reviewing the abstracts in each identified reference. When promising, an attempt was made to download the whole article. When it was not possible (in a very small minority of cases), the author attempted to extract as much information from the abstract as possible. When the whole article or review was downloaded, the author studied its whole content.

In the next step, the author went through all systematic literature reviews on the subject, referring to specific articles when more information was needed. On a number of occasions, the author also looked at specific articles that either were not mentioned in the reviews, or had additional information in them which was not contained in the reviews. As a final step, additional references mentioned in identified articles were sometimes looked for through Google Scholar. The findings were limited to English speaking sources only. Only sources dating from 1990 till now were selected.

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