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**Alcohol intoxication among adolescents
from the ecological theory of
human development perspective:**

A quantitative study on Norway and US

Master's Thesis in International Social Welfare and Health Policy

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Abstract

Introduction: The study examined social environmental factors of adolescents of grade 8 and 10 (age 13-16) in Norway and the US to determine which factors influence the behaviour of having been intoxicated on alcohol. Since alcohol intoxication can cause greater physical and mental harm in adolescents, preventing the onset of this risky behaviour of early alcohol intoxication is important. Based on Urie Bronfenbrenner's ecological theory of human development, the adolescent's social environmental factors and individual's characteristic factors were analysed including: one's individual characteristics, parent, peer, school influence and national policy.

Methods: 5,088 adolescents from the US and 13,931 from Norway completed respective national surveys about various health related behaviours. *Monitoring the Future* (2015) was selected as the US dataset and *Ungdata* (2010-2015) as the Norwegian dataset. Using nested logistic regression, the data from each country's survey was analysed separately. The results were subsequently compared to identify how each factor influenced the odds of adolescents having been drunk and how the factors are interrelated in each country.

Results:

US: Talking to parents about personal problems, having peers who drink or get drunk, number of skipped (cut) school days and having visited a therapist for alcohol use indicated of having a positive relationship with the odds of adolescents having been drunk at a statistically significant level. No other social environmental factors showed significant influence.

Norway: Sex, father's education, and talking to parents about one's problems showed a negative correlation with the odds of adolescents having been drunk at a statistical significant level. On the other hand, grade/age, depressed about future, having peers who drink or get drunk, number of cut school days, and visiting school nurse for substance use showed a positive correlation with the odds of adolescents having been drunk with statistical significance. No other social environmental factors showed significant influence.

Conclusion: Results showed peer-influence as the most influential factors on the odds of adolescents having been drunk for both US and Norway. Talking to parents about one's problems, number of school days cut and seeking professional help for alcohol or substance use was also influential. However, sex, being depressed about future, and father's education showed different results regarding their influence on the odds of adolescents having been drunk in the US and Norway.

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Definitions of Key Words

- ✓ **Public health policy:** Official plans that aim to promote healthy measures and spread awareness of the harmful consequences of dangerous life styles within a society.
- ✓ **Alcohol policy:** One of the approaches within public health policy; specific aims to limit alcohol consumption or spread the awareness of the consequences of alcohol.
- ✓ **Substance use disorder (SUD):** A medical condition diagnosed when alcohol or other substance use leads to health problems and incapability of meeting responsibilities at home, school or work (Grant et al. 2016)
- ✓ **Alcohol intoxication:** Also known as ‘drunkenness’, intoxication is a condition that follows after using a psychoactive substance with symptoms of disturbance in consciousness, behavior, perception and other physical functions (WHO n.d.). Alcohol intoxication is then disturbance caused after alcohol use.
- ✓ **Alcohol use disorder (AUD):** A medical condition diagnosed when a patient’s drinking behavior or habits is harmful or damaging mentally or physically (WHO 2014, 13). Alcohol abuse and dependency is defined as an AUD (NIH 2017).
- ✓ **Alcohol abuse:** People who “on average consume more than 10 cl alcohol a day (36.5 liter a year)” (Oslo Economics 2013, 26).
- ✓ **Alcohol dependency:** Alcohol dependency (or alcoholism) is related to using alcohol repeatedly because of inability to resist alcohol and have difficulty in controlling the usage. Alcohol becomes one of the highest priority for alcohol dependent patients even though this might bring hazardous consequences – the patient may also go through withdrawal when they stop consuming alcohol regularly (WHO 2014).
- ✓ **Binge drinking:** Binge drinking is defined as “a pattern of drinking that brings blood alcohol concentration (BAC) levels to 0.08 g/dL. This typically occurs after 4 drinks for women and 5 for men in about 2 hours” (NIH 2017).
- ✓ **Heavy episodic drinking (HED):** “Consumption of 60 or more grams of pure alcohol (6+ standard drinks in most countries) on at least one single occasion at least monthly (WHO 2014, 4). Heavy episodic drinking can cause alcohol poisoning, or other injuries and even violence.

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1 Introduction

The World Health Organization (WHO) (2014, 2) reports that alcohol causes about “3.3 million deaths each year” which mounts up to “5.9% of all deaths worldwide.” Furthermore, approximately “20% of the respective disease burden is attributable to alcohol” (WHO 2014, 46). This “psychoactive substance” can cause dependence issues and may also cause cardiovascular diseases, diabetes, cancer, neuropsychiatric disorders, gastrointestinal diseases and injuries (WHO 2014, 2). When it comes to adolescents (between age 10-19) (WHO 2018), alcohol can cause stunted growth problems and may damage the brain during its peak development period (U.S. Department of Health and Human Services 2016, 2-2). Early onset of alcohol consumption in adolescents also increases the chance of alcohol dependence in adult life (WHO 2014; U.S. Department of Health and Human Services 2016).

Despite its destructive impact, however, alcohol is closely linked to social settings which makes it easily accessible in daily life. Alcohol use in adolescents is a complex issue since adolescence is “a period of intensive biological growth and sexual, emotional and psychosocial maturation. In this period, they want to identify themselves, to experiment, to try out certain behaviours, because of curiosity, desire to imitate someone or self-assertion” (Rakiü, Rakiü, Milošević and Nedeljković 2014, 468). While most adolescents are taught about the negative effects of alcohol consumption and are legally prohibited from purchasing alcohol, it can be enticing because of its prohibition. Thus, the curious rebellious nature of adolescence might make one to be more susceptible towards experimenting with, or even possibly, abusing alcohol.

The most concerning behaviour regarding adolescents and alcohol use, is when adolescents choose to consume alcohol regularly. One may initially use a substance due to impulse, curiosity, positive or negative reinforcement such as pleasure or stress, but a substance addiction cycle begins when one chooses to use a substance by choice (U.S. Department of Health and Human Services 2016). This first stage of addiction is known as the binge/intoxication stage, which then leads to the second stage of withdrawal/negative affect stage; one gets physically ill when they stop using the substance they regularly use (U.S. Department of Health and Human Services 2016). The last stage of the addiction cycle is preoccupation/anticipation, in which people start reusing substance

after they have abstained from it for some time (U.S. Department of Health and Human Services 2016). The addiction cycle intensifies its hazardous effect physically and mentally every time it repeats itself (U.S. Department of Health and Human Services 2016). Since alcohol addiction exposes adolescents to even greater harmful risk, this thesis will be focusing on adolescents who have been intoxicated by choice to recognize those with higher odds of entering the first stage of addiction.

To prevent adolescents from entering the early stages of addiction, factors that influenced them to having been intoxicated by choice needs to be identified. Ennett et al. (2008, 1) suggests that “multiple social contexts and the interdependencies among contexts must be considered in explaining development of adolescent problem behaviors, such as alcohol misuse”. This is based on the idea of Urie Bronfenbrenner’s *Ecological theory of human development* (1979) which proposes that one’s personality and actions are a result of constant interaction with their social environment that includes family, friends, neighborhood and more.

Bronfenbrenner’s theory further explains the interrelationship of these social environment factors between an individual and other social factors using a nested model. The nested model, which the theory is built upon, consists of four layers surrounding an individual: micro, meso, exo and macro systems. Each layer includes different social environment factors ranging from the most proximal factors of an individual’s microsystem such as family and friends, to the most distant factors in macrosystem such as national policies and culture. Henceforth, this thesis will be utilizing Bronfenbrenner’s ecological theory of human development and the nested model to test which factors influenced adolescents to having been intoxicated, and the interrelationship of those factors.

To see whether social environment factors vary in its behavior and effect in different settings, Norway and the United States (henceforth referred to as US) are selected for comparison. Both countries share similar alcohol intoxication levels in adolescents despite their different alcohol policies; the US reported 10% of the whole population between the age of 15 to 16 to having been intoxicated the last 30 days, whereas Norway reported 8% (European School Survey Project on Alcohol and Other Drugs 2015). Thus, the social environment factors based on Bronfenbrenner’s nested model will be analyzed through a nested logistic regression for each country. Then, the

results are compared to see whether these influences differ in the two countries. For comparison and compatibility of the Norwegian and American datasets, grade 8 and 10 (adolescents between age 13-16) are specifically chosen as the sample population for this study.

The structure of this thesis is as followings: Bronfenbrenner's ecological theory of human development and its relation to alcohol use is explained in-depth in Chapter 2. Chapter 3 discusses what research has been done on integrating Bronfenbrenner's theory with alcohol use in adolescents, and how various social environment factors were correlated with alcohol use in previous research. Chapter 3 is subdivided according to the layers found in Bronfenbrenner's nested model. Chapter 4 provides specific aims and hypotheses of this thesis.

Since the data analysis includes examination of data from the US and Norway, each country is analyzed in different chapters and the results will be discussed separately. Nonetheless, the methodology used to analyze the survey-based datasets are the same. Therefore, Chapter 5 focuses on the methodology and analytical plan for analyzing the datasets. Then, Chapter 6 and 7 each represents US and Norway respectively, and contains in-depth discussion of alcohol policies such as legal drinking age, access to alcohol as well as treatment or prevention policies. The dataset used for each country is then explained in detail along with the dependent and independent variables that have been selected to fit Bronfenbrenner's theory. Diagnostics tools of the Wald test, classification table and Hosmer-Lemeshow statistics are also mentioned in each chapter to clarify the validity of this study. Finally, the results from nested logistic regression of the two countries are further discussed for comparison in Chapter 8.

Chapter 8 examines the similar and different results from the US and Norway's datasets to see which patterns were noticeable regarding factors that influenced adolescents to having been intoxicated. The results will be compared to see whether the study was able to support the hypotheses. Limitations of this study will also be mentioned in Chapter 8, and conclusions will be presented in the final chapter, Chapter 9.

2 Theoretical Framework

2.1 Ecological theory of human development (1979)

Urie Bronfenbrenner's ecological theory of human development proposes how individuals are influenced and shaped by continuous reaction of social environment factors surrounding their environment (Rosa and Tudge 2013). Bronfenbrenner explains:

“The ecology of human development involves the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as this process is affected by relations between these settings, and by the larger contexts in which the settings are embedded.” (Bronfenbrenner 1979, 21)

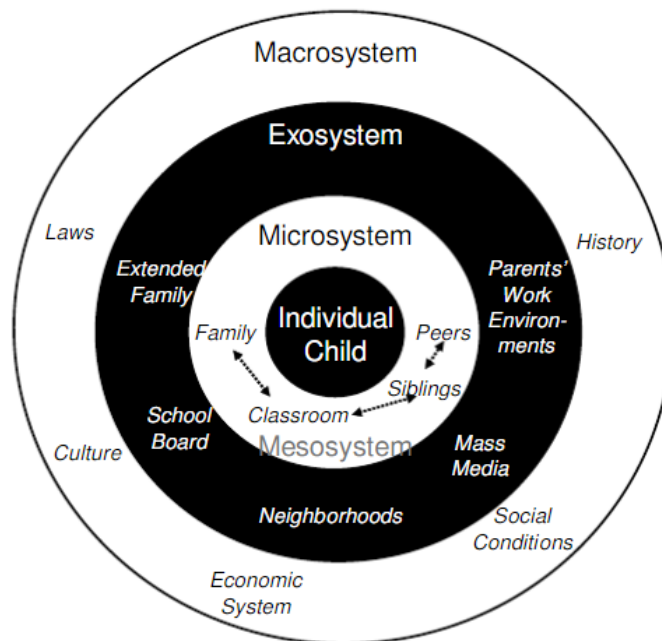
The theory emphasizes the ‘development’ aspect of an individual by studying the characteristics of one’s surrounding social environment factors such as family, neighborhood, religion, friends, and how one interacts with them. These factors not only have direct influence, but they also indirectly influence the individual when factors interact with each other. Moreover, the theory acknowledges that the interaction between an individual and social factors also progress and transform over time (Rosa and Tudge 2013).

Bronfenbrenner's theory is based on a nested model that divides one's surrounding social environment into four layers which illustrates the immensity of the system we function in. The four layers are: micro, meso, exo and macrosystem (Douaihy and Daley 2013):

- **Microsystem:** The most immediate layer surrounding an individual. Factors in this layer show a pattern of activities or roles played out by other individuals such as family, peers, teachers, co-workers and such. (Bronfenbrenner 1979; Douaihy and Daley 2013).

- Mesosystem: This layer signifies or includes interactions and relationships between an individual and other roles from the microsystem. The environmental setting where these interactions take place such religious institutions is also included in this layer (Hayes, O’Toole and Halpenny 2017). A mesosystem is comprised of microsystems, or “a system of microsystems” (Bronfenbrenner 1979, 25).
- Exosystem: The largest framework of where we live; this layer focuses on the more proximal environment than macro but is not in a direct social setting an individual actively partakes in. The factors in exosystem can be referred to as culture of the community, workplace environment, urban or rural cities. (Douaihy and Daley 2013, 64).
- Macrosystem: The biggest sphere and farthest layer away from an individual. This layer grasps the global and national framework of the place where we reside, such as: public policies, economic systems, cultural norms and history (Douaihy and Daley 2013).

Figure 1: Bronfenbrenner’s nested model



(diagram extracted from Eisenmann et al. 2008)

Figure 1 shows a diagram of Bronfenbrenner's nested model. The four layers grasp all the complex interactions that take place between different individuals in different environmental settings. Amid this complex social interaction, an individual is constantly shaped and evolving depending upon where and with whom they interact. Thus, Bronfenbrenner's ecological theory of human development emphasizes how one's social environment shape an individual, and how one's behavior is not only a result of their individual characteristics, but also a result of constant influence of the surrounding environment.

2.2 Alcohol use and Bronfenbrenner's ecological theory of human development

Since the ecological theory of human development is context-based, it can be used to study how social factors surrounding one's environment influence them to show specific patterns of behavior. If certain social environmental triggers are identified, measures could be prescribed to prevent risky behaviors like substance abuse (Connell, Gilreath, Aklin and Brex 2010; Cox, Burr, Blow and Cardona 2011). Bronfenbrenner's nested model is especially effective because it creates several layers of systems that helps researchers expand their focus on the environmental settings instead of limiting their scope to the interrelationship between individuals and/or other groups of people. Not only does it refer to settings such as schools and neighborhoods but also expands to national policies and even culture.

Sudhinaraset, Wigglesworth and Takeuchi (2016, 36) connects Bronfenbrenner's theory to alcohol use: "In the context of alcohol use, individuals are nested within their microsystem (their home, work, and school environments), which is nested itself within the larger community. Macrolevel factors, such as exposure to advertising, may influence family and peer network attitudes and norms, which ultimately affect individual attitudes and behaviors". This emphasizes the complexity of alcohol related issues; there are several factors that might trigger alcohol use in individuals, rather than one clear reason that can be pinpointed as the underlying cause.

Bronfenbrenner's theory also recognizes how there is constant change in one's role or even the environmental setting (Bronfenbrenner 1979). This takes into account the stress that is caused by

having to change one's role in a society, or when one's environmental setting is changed. An example of this transition could be moving to another place due to financial difficulties (Mason et al. 2017). An adolescent who started to experience stressful situations of family problems at home, can begin to display an increase in problematic behavior such as alcohol abuse (Mason et al. 2017).

To sum up, Bronfenbrenner's ecological theory of human development adds different aspects when identifying what factors compel adolescents to show risky behavior of alcohol use. Once the complex interrelationship between various social environment factors and patterns in alcohol use has been identified, researchers and policy makers can be brought a step closer to creating effective preventive measures that help adolescents with alcohol use, or alcohol dependency in general.

3 Literature Review

Much research has been done on the topic of the effects of social factors on adolescents with alcohol abusive behavior using Bronfenbrenner's ecological theory of human development. However, the research often focuses exclusively on one individual layer of Bronfenbrenner's four-layered nested model or considers the other layers, often leaving out the macrosystem layer. Thus, the literature review will be divided into three separate sections grouping the micro, meso and exosystem layer together in a similar manner that has been presented in previous studies that utilize Bronfenbrenner's four-layered nested model.

Individual layer: demographic factors and individual characteristics

For the individual layer, demographic factors such as age and sex were commonly evaluated. Starting with age, results showed that the older one is, the higher their level of alcohol consumption (Reboussin, Song, Wolfson 2012; Johnston et al. 2018). This falls in line with the findings of Johnston et al. (2018) that the younger age group's disapproving perception of binge drinking acts as a form of self-deterrence inhibiting from consuming alcohol in heavy quantities.

Males in general reported higher rates of alcohol and other drug usage than females (Connell, Gilreath, Aklin and Brex 2010; Casswell et al. 2018). However, in the study of Rakiü, Rakiü, Miloševiü and Nedeljkoviü (2014), this general trend of males consuming more alcohol than females differed amongst countries. Although most European countries including Norway showed males consuming alcohol more frequently, countries like Latvia, Iceland, Sweden and the US showed the opposite where females consumed alcohol more frequently than males (Rakiü, Rakiü, Miloševiü and Nedeljkoviü 2014, 471).

Individual characteristics are closely related to personalities one holds such as being introverted or extroverted. When it came to individual characteristics or behavior such as depressive symptoms, a positive correlation between depression and substance use was found (Connell, Gilreath, Aklin and Brex 2010). Rehm et al. (2015) reported that there was a correlation between mental disorders and alcohol consumption levels; 73.7% of all patients with alcohol use disorder (a medical condition that exhibits harmful drinking behavior that is damaging mentally or physically (WHO 2014)) showed at least one occurrence of diseases such as depression and anxiety disorders. However, the study of Nourse, Adamshick and Stoltzfus (2017) showed different results from those of Rehm et al. (2015); there was no statistically significant correlation between hazardous drinking behavior and depressive symptoms. Although the study found a connection between sex and binge drinking in which males drank significantly more and more frequently compared to females, there was no significant association between depression or anxiety and binge drinking behaviors.

In a study conducted by Holway, Umberson and Thomeer (2017), the researchers found a correlation between sex, depression and drinking behavior. According to the researchers, “women are more likely to express distress through internalizing symptoms such as depression, and men are more likely to express through externalizing symptoms such as heavy drinking” (Holway, Umberson and Thomeer 2017, 1). Through this, the researchers concluded that drinking and depression was a consequence or influence of various stressors, rather than the two being in a direct association with each other. The researchers added that the relationship between alcohol consumption levels and stress was found to be stronger for males compared to females (Holway, Umberson and Thommer 2017).

Micro, Meso and Exosystem: Peer, family, school factors

Micro and mesosystems were combined together since microsystem points to influences from individuals, whereas the mesosystem grasps the interaction and relationship between individuals. The environmental setting where these interactions take place are both explained through meso and exosystems. Thus, three layers of micro, meso and exosystems are combined in this section.

A study from Reboussin, Song and Wolfson (2012) used peer cluster theory to demonstrate how peers influence adolescents to use alcohol or substance use in general. According to the researchers, peer cluster is a small peer group that shares similar attitudes and ideas, which ultimately creates a 'group norm' for using alcohol or drugs. The researchers further explained that "youth may be influenced by their peers directly (e.g., by observing peers' behavior, by peer pressure and by peers providing alcohol) and indirectly (e.g., by their perceptions of whether their peers are drinking)" (Reboussin, Song and Wolfson 2012, 890). Thus, peers become the main source of development during the period of adolescence (Connell, Gilreath, Aklin and Brex 2010; Reboussin, Song and Wolfson 2012). Therefore, the higher the number of peers using substances, the higher the odds of an individual being a substance user as well (Connell, Gilreath, Aklin and Brex 2010; Steketee, Jonkman, Berten and Vettenburg 2013).

Parents were also found to influence alcohol use in adolescents. Adolescents who drank with their peers led to consequences of increased likelihood of risky behavior such as heavy episodic drinking, which is consuming "60 or more grams of pure alcohol (6+ standard drinks in most countries) on at least one single occasion at least monthly" (WHO 2014, 4). On the other hand, drinking with parents from time to time showed a decrease in risky behaviors (Reboussin, Song and Wolfson 2012). Moreover, strong parental supervision decreased the odds of adolescents' use of substances. The longer adolescents were left without adult supervision, the higher their odds of engaging in risky behavior such as substance use (Connell, Gilreath, Aklin and Brex 2010; Steketee, Jonkman, Berten and Vettenburg 2013). Research related to parents' educational levels varied; Hoque and Ghuman (2012) found results that parents' education did not have any influence on the odds of adolescents' alcohol use. However, Ennett et al. (2008) reported that parents' education had a negative association with adolescents' alcohol consumption levels. Thus, the higher the education level of the parents, the lower the odds of adolescents' alcohol use.

The study of Rakiü, Rakiü, Miloševiü and Nedeljkoviü (2014) found that dysfunctional families increased the odds of adolescents showing risky behavior such as substance use. Low level of communication or even alienation amongst family members increased the odds of adolescents showing risky behavior. Therefore, like the findings of Connell, Gilreath, Aklin and Brex (2010), a close relationship with family members like parents was an important factor in preventing risky behavior in adolescents. However, family relationship was not the only factor that impacted the onset of risky behavior in adolescents. According to Rakiü, Rakiü, Miloševiü and Nedeljkoviü (2014, 472), ‘unstable’ families such as single parents or living with adopted families increased the odds of adolescents using substance; the authors added that having a ‘stable’ and functional family can be “a protective factor in prevention of substance use among young people” (Rakiü, Rakiü, Miloševiü and Nedeljkoviü 2014, 472).

School was another significant environmental factor that affected adolescents’ risk of substance use. Connell, Gilreath, Aklin and Brex (2010) reported on the importance of school performance. Engagement in school activities and academic performance showed a correlation with adolescents’ drug using behavior: high performance in school was shown to reduce risk and frequency of substance use for adolescents (Rakiü, Rakiü, Miloševiü and Nedeljkoviü 2014). Thus, there was a negative relationship between school performance and odds of substance use; the more one was involved in and attached to school, the less likely they were to engage in substance use (Connell, Gilreath, Aklin and Brex 2010).

Macrosystem: National policies

Within national policies, many researchers took different approaches in analyzing public policy regarding alcohol use. In the case of Boluarte, Mossialos and Rudisill (2011), the researchers divided policy approaches into two: restricting access, and changing the general perceptions and attitudes of the population. Restricting access is achieved through changing prices or limiting availability by the changing age that one can get legal access to alcohol (Boluarte, Mossialos and Rudisill 2011). Perceptions and attitudes of the population is, then, often controlled through marketing or social health warnings (Boluarte, Mossialos and Rudisill 2011).

The researchers found that policies and social marketing to raise awareness of alcohol use was effective in changing attitudes in youths. However, policy related to legal age and access to alcohol did not have much influence on people's perceptions to regard alcohol use as health hazard (Boluarte, Mossialos and Rudisill 2011). Although the policy itself did influence the level of alcohol consumption in youths, this was a short-term restrictive solution rather than a long-term and informative resolution that solved risky behaviour rising in youths (Boluarte, Mossialos and Rudisill 2011). Social health warnings and marketing increased public awareness towards risky behaviour but did not directly decrease the level of alcohol consumption.

Xuan et al. (2015) conducted a study to assess alcohol related policies that vary in different US states. The researchers took a different approach from Boluarte, Mossialos and Rudisill (2011), and divided the focus population of alcohol policies between population-oriented and youth-oriented. Population-oriented policies refer to policies that focus on the general population and uses policies such as alcohol taxes. On the other hand, youth-oriented policies target the youth population. Minimum drinking age is an example of youth-oriented policies (Xuan et al. 2015). Then, the researchers studied the relationship between youth-oriented, population-oriented policies and level of alcohol consumption in youths were (Xuan et al. 2015).

One of Xuan et al.'s (2015) findings was that a stringent policy environment led to a reduction in the odds of both youth drinking and youth binge drinking (Xuan et al. 2015). The stricter alcohol policies the state had, the more effective it was in decreasing the level of alcohol consumption. Furthermore, population-oriented policies were shown to have some effect on the odds of alcohol use in adolescents. Evidence also showed a correlation between adult binge drinking, state alcohol taxes (a population-oriented policy), and youth drinking. Thus, the researchers concluded that both population and youth-oriented policies are needed to control the alcohol consuming behaviours in youths.

4 Aims and Hypotheses

4.1 Aims

This thesis investigates which social environment factors influenced 8th and 10th grade adolescents in the US and Norway to having been drunk on alcohol, and how these factors interrelate. Based on Urie Bronfenbrenner's ecological theory of human development (1979), 11 specific social environment factors were chosen to be examined. The following are the factors selected for this study:

1. Factors that influenced the odds of adolescents having been drunk:
 - a. Individual level
 - i. Sex
 - ii. Grade/age
 - iii. How much one is satisfied with oneself (self-reflection)
 - iv. How depressed one is about their future
 - b. Micro and Mesosystem
 - i. Education level of one's parents
 - ii. Whether one (adolescent) talks to parents with personal problems
 - iii. How many friends one has that drink or get drunk
 - iv. How often one's friends drink
 - v. How much one is enjoying school
 - vi. How many days one has cut school
 - c. Exosystem (no variables chosen for this study)
 - d. Macrosystem
 - i. Has one received help from a therapist/professional helper/school nurse because of alcohol or substance use?

The aim of this thesis project is to:

2. Study the interrelationship of the 11 factors and test whether capturing these different relationships better the analytical model as an analytical tool

3. Compare the similarities and differences regarding how each factor influences the odds of adolescents having been drunk in US and Norway

4.2 Hypotheses

- ✓ Hypothesis 1. Each of the factors listed below influences the odds of adolescents having been drunk as the following:
 - *Sex: Male adolescents have higher odds of having been drunk than female adolescents.*
 - *Grade/age: Higher grade/age group has higher odds of having been drunk.*
 - *Individual characteristics: The more one is satisfied and less depressed about the future, the lower the odds of adolescents having been drunk.*
 - *Parental influence: Parents with a higher education and a close relationship with the adolescent decreases the odds of adolescents having been drunk.*
 - *Peer influence: The more number of friends who drink alcohol and get drunk one has, the higher odds of an adolescent having been drunk.*
 - *School influence: The more one cuts school and does not enjoy school, the higher the odds of the adolescent having been drunk.*
 - *Policy influence: The more regularly one visits/seeks professional help, the higher the odds of them having been drunk.*
- ✓ Hypothesis 2. All the factors are interconnected to each other and are correlated in some way; having more variables and factors improve the model of analysis.
- ✓ Hypothesis 3. The ways each factor affects the odds of adolescents having been drunk does not vary between the countries.

5 Analytical plan for US and Norway

Before analyzing and comparing each country's results, comparability between US and Norway's datasets will be discussed to ensure the validity of this study. Thus, a short description of similarities and differences between the datasets is presented. Furthermore, an explanation of the analytical method of nested logistic regression is also given for this chapter. In-depth information of the datasets and variables will be further provided in Chapter 6 and 7.

5.1 Comparability of the data

Since this is a comparison study between the US and Norway, it is essential to check whether the two datasets are comparable to begin with. The US dataset, *Monitoring the Future*, was acquired through University of Michigan whereas the Norwegian dataset, *Ungdata*, was acquired through the Norwegian Centre for Research Data (NSD). Both datasets target adolescents in each country and are nationally representative; *Monitoring the Future* is representative for the 8th and 10th grade students in public and private schools from 48 contiguous states (Johnston, Bachman, O'Malley, Schulenberg and Miech 2015b), whereas *Ungdata* consists of various datasets gathered from all secondary and high schools in all municipalities of Norway and was merged into a national representative data file (Bakken 2017).

The variables of this study were specifically chosen to fit the Bronfenbrenner's ecological theory of human development (1979). Though detailed information about the variables will be given in Chapter 6 and 7 for each country, the selected variables for this study are: demographic factors (sex and grade/age), individual characteristics (measuring level of satisfaction and depression), parental factors (influence of the parents and relationship between the parents and adolescent), peer factors (how many peers that already show risky behavior of alcohol use surrounding the adolescent), school factors (how much one enjoys school and how often one attends school) and policy factors (seeking professional help related to substance/alcohol use).

Specific variables were chosen to cover similar topics, but how the survey questions were formulated for some of these variables differ. This is an expected result because the two datasets were developed by different researchers from different institutions and cultural backgrounds. One example of the differently worded variables is a school-influence factor which asks whether one enjoys going to school. In the US dataset, the question asks how much one ‘enjoys’ going to school, whereas in the Norwegian dataset, the question asks how much one ‘dreads’ going to school. Although the difference may not seem significant, possibility of cultural difference in how words were formulated and chosen in each country’s data cannot be disregarded.

Nonetheless, the datasets were made to be as similar as possible. Specific questions with similar topics were selected for this study, and variables were recoded so that the two datasets look alike. Despite this process, however, the datasets were not combined into one for a direct comparison for the purpose of reducing the odds of error occurring from the differences of datasets. Rather, the two countries were analyzed separately in two datasets with two different results. Then, each result was compared to identify the similarities and differences in the discussion section of Chapter 8.

5.2 Analytical tool: nested logistic regression

5.2.1 Nested logistic regression

The methodology used for analyzing dataset was nested logistic regression for both countries. The same methodology was used to make the comparison process between two countries as efficient as possible. For this study, a total number of 6 models were analyzed - each model was divided according to different factors that affected the odds of adolescents having been drunk. This is because many of the selected variables were involved in both micro and mesosystems. Since it was difficult to divide the factors into each system, the model was not divided by the layers of micro, meso, exo and macrosystem from Bronfenbrenner’s ecological model, but rather subdivided into different social environment factors. This method also helped to weigh the strength of each factor and pinpoint which affected the greatest.

The first model started with demographic factors of sex and grade/age. The second model containing demographic factors was added another block of factors of individual characteristics of two variables. The third model had three extra variables, or the family factors whilst nesting both layers of demographic and individual characteristics. The fourth model then contained newly added peer factors, and family, individual characteristics and demographic variables from previous models. Fifth model had school factors while nesting family, individual characteristics and demographic variables, and a new factor of policy influence was introduced in the final sixth model.

This study focused on adolescents that have been drunk by choice, which implied that the total population was naturally small compared to those who did not show this risky behavior. Thus, the dependent variable of the study was heavily zero-inflated. To relieve of the issue of zero-inflation of the dependent variable, the dependent variable of adolescents who have ever been drunk the last 12 months, was recoded from categorical to a binary variable.

Logistic regression is often used to test binary dependent variables. This methodology also captures the S-curve pattern of a predicted probability changing from 0 to 1 using log functions (Acock 2010). Since logistic regression can also be used for nested models, nested logistic regression was used as an analytical method for this study. Once the logistic regression was conducted, odds ratio (OR) for each variable was analyzed across all 6 models for comparison.

OR is “a measure of association between an exposure and an outcome” which shows the odds of an event occurring after a particular exposure (Szumilas 2010, 227). OR is used in a binary variable analysis - how a variable affects the odds of an event occurring from ‘0: Event not occurring’, to ‘1: Event occurring’. In this case, the OR from nested logistic regression produced the odds of adolescents having been drunk. Three possible results were given through the OR: OR=1 showed no effect on the odds of an event occurring (no effect on odds of adolescents having been drunk), OR>1 showed a positive correlation or higher odds of event occurring (higher odds of having been drunk), and OR<1 showed a negative correlation or lower odds of event occurring (lower odds of having been drunk) (Acock 2010; Szumilas 2010). As mentioned earlier OR was only compared across models within the country and not across countries as direct comparison.

5.2.2 Criticism against nested logistic regression

Regarding nested logistic regression however, Mood (2010) showed a different point of view and took a critical viewpoint against the methodology. The main issue she raised about using OR to compare across models was the “unobserved heterogeneity”, or “the variation in the dependent variable that is caused by variables that are not observed (i.e. omitted variables)” (Mood 2010, 67). She further explained that this unobserved heterogeneity was likely to vary across groups because the independent variables in each model are different and will produce false results when the OR was compared across groups. Another problem was that this unobserved heterogeneity could vary “across the compared samples, groups or points in time” (Mood 2010, 68).

Since comparing OR across models was problematic, Mood (2010) suggested other alternatives to consider such as using percentages instead of OR and log-OR, or different analytical methods such as average marginal effect (AME) or a linear regression model (Mood 2010). In this case, an ordinary linear regression model was conducted to double check the results based on OR and nested logistic regression. Once the linear regression model was done, the result was compared to the original result of the nested regression model. Although the coefficients were slightly different, the relationships and strengths remained similar. Thus, nested logistic regression remained to be the analytical method for this study.

6 US

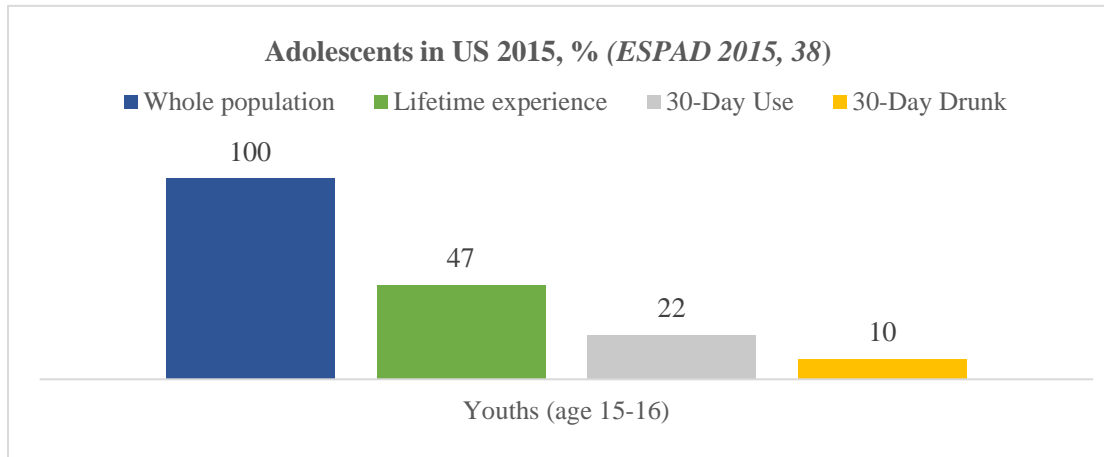
6.1 Alcohol Statistics and Policies

6.1.1 Alcohol statistics for youths

The European School Survey Project on Alcohol and Other Drugs (ESPAD) founded in 1993 collects data every 4 years on adolescents between the age 15 to 16 in 40 different countries all over the world (ESPAD 2015). The research covers topics of various substance use. Based on this data, 47% of the adolescent population in US answered that they have consumed alcohol at least

once in their life time. On the other hand, 22% reported having used alcohol the last 30 days, whereas 10% answered they have been intoxicated the last 30 days (ESPAD 2015, 38).

Figure 2: Adolescents and alcohol consumption in US (percent), 2015



6.1.2 Legal age and prevention policies

Legal drinking age

The legal drinking age in the US has been 21 ever since the Federal Uniform Drinking Age Act was initiated in 1984 (National Institute on Alcohol Abuse and Alcoholism n.d.; World Health Organization 2014). This law prohibits those under 21 from purchasing or possessing alcoholic beverages in public. Although the legal drinking age is a national regulation, specific regulations regarding possession or exception laws vary within states. States like Ohio and Wisconsin allows those under 21 years of age to possess and consume alcohol under parents' or guardian's supervision, while other states strictly forbids this for anyone under 21. (National Institute on Alcohol Abuse and Alcoholism n.d.; Alcohol Policy Information System n.d.a; Alcohol Policy Information System n.d.b).

Access to alcohol

When it comes to purchasing alcohol, each state has different regulations regarding how one can gain access to alcoholic drinks. The US does not have a state monopoly over production or sale of alcoholic beverages, but offers the license-based system where those that apply for license to sell

or produce alcohol can provide alcoholic beverages to its consumers (World Health Organization 2004). Each individual state can decide what type of alcoholic beverages a store can produce or sell. Moreover, hours and days of sales are also controlled by each state (World Health Organization 2004).

Taxation and pricing

Taxes on alcoholic beverages such as beer, wine, and spirits differ in each state. According to Business Insider (Willett 2014), the taxes for beer can vary from “\$0.02 per gallon in Wyoming to \$1.17 per gallon in Tennessee”. Hence, depending on the level of the state taxes, the prices of alcohol vary across different states.

Prevention and treatment policies

The Patient Protection and Affordable Care Act was signed by President Obama in March 2010 along with the Health Care and Education Reconciliation Act of 2010 (altogether known as the Affordable Care Act) (Abraham et al. 2017). These health care laws allow broader health insurance coverage, which indicates that treatment for mental health and substance use disorders (SUD) have also been included for insurance coverage (Abraham et al. 2017). SUD occurs when alcohol or other substance use leads to health problems and incapability of meeting responsibilities at home, school and work (Grant et al. 2016). According to Abraham et al. (2017, 31), “historically, SUD (substance abuse disorders) treatment services have either not been covered at all under private and public insurance plans or have been limited through the higher copayments, annual visit limits, and placing medications on higher tiers. As a result, many Americans in need were unable to access affordable SUD treatment”. The Affordable Care Act now allows substance abuse disorder (SUD) patients to have access to cheaper medical and other SUD related treatments.

6.2 Methodology

6.2.1 *Monitoring the future*

The US analysis was based on a cross-sectional survey, the *Monitoring the Future* study. This survey-based research led by Institute for Social Research at University of Michigan is a long-term study on adolescents and college students in the US (Johnston, Bachman, O'Malley, Schulenberg and Miech 2015b). Starting from 1975, the main purpose of *Monitoring the Future* is to research drug-using behaviour in the young population of the country. The survey is answered by a target population of college students, young adults and 8, 10, and 12th graders (Monitoring the Future n.d.). Students in 8th and 10th grades are chosen randomly for the survey whereas the senior class that have already been chosen are followed up even after they have graduated high school.

The *Monitoring the Future* study from 2015 was conducted on a total population of 44,900 of 8th, 10th and 12th grade students from 382 secondary schools (Johnston, Bachman, O'Malley, Schulenberg and Miech 2015b). For 8th grade students, the response rate was 89% and 87% for 10th grade students (Johnston, Bachman, O'Malley, Schulenberg and Miech 2015b). Four different questionnaires were used for 8th and 10th grade students which covered topics such as lifestyles, relationships, personality and values. A total of six different questionnaire forms were handed out to the 12th grade students. The 12th grade questionnaires covered similar topics as the 8th and 10th grade questionnaires, but some additional questions were asked to 12th grade students that specifically focused on certain topics (Johnston, Bachman, O'Malley, Schulenberg and Miech 2015b). For the comparison purpose of this thesis, questionnaires for grade 8 and grade 10 students were used. Although the grade 12 questionnaire had more in-depth questions related to lifestyles and values, the questionnaire that had most overlapping questions with the Norwegian questionnaire had to be chosen.

The themes covered in the *Monitoring the Future* questionnaires are divided into 17 different areas of drugs, education, family, religion, health habits and more. Each topic is followed by subtopics with detailed questions. Nonetheless, the topics that were most suitable for the thesis were chosen as the following: demographic, individual personality, parents, peers, school, and national policy. Detailed information about these topics will be further discussed in the next section.

6.2.2 Measures

13 different variables including one dependent variable was selected from the *Monitoring the Future* (2015) dataset. For this section, which topics each variable covered, what type of variable it was, and how it was categorized and recoded will be explained.

Dependent variable

Have been drunk (*On how many occasions if any, have you been drunk or very high from drinking alcoholic beverages during the last 12 months?*)

The dependent variable asked adolescents how many times they have been drunk over the last 12 months. This variable was specifically chosen to illustrate how social environment factors surrounding the adolescent influenced one to be drunk. Since alcohol use is a huge part of a social activity where adolescents experiment alcohol use for curiosity reasons, the variable ‘*Have been drunk*’ was selected.

To make the variable between Norway and the US comparable, the 6-categorized scale variable was recoded into a binary variable of 0 and 1. Thus, “0: never” and “1: 1-2 times” categories were recoded into 0. Moreover, category “1: 1-2 times” was also counted as 0 to counter for those times when adolescents got drunk from curiosity or not by choice. To identify adolescents who have been drunk by choice, category “2: 3-5 times”, “3: 6-9 times”, “4: 10-19 times”, “5: 20-39 times” and “6: 40+ times” were all recoded into 1.

Independent variables

Demographic variables

For demographic variables, ‘*Sex*’ and ‘*Grade/age*’ were used. Both were binary variables, in which grade/age was divided by 8th and 10th graders. ‘*Sex*’ was recoded as “0: male” and “1: female” whereas grade was recoded as “0: 8th graders” and “1: 10th graders”.

Individual-factor variables

- I. Satisfied with self (*How much do you agree or disagree with each of the following statements? On the whole, I’m satisfied with myself*)

- II. Depressed about future (*How much do you agree or disagree with each of the following statements? The future often seems hopeless*)

Individual-factor layer consisted of two variables of ‘*Satisfied with self*’ and ‘*Depressed about future*’. These variables examined the individual characteristics one holds, especially regarding problematic or negative behavior and thoughts. None of these categorical variables were recoded. ‘*Satisfied with self*’ variable was a 5-scale category which ranged from “1: disagree” to “5: agree”. This variable was added as an individual-factor variable, to test how much one was satisfied with one’s self. ‘*Depressed about future*’ variable, was also a 5-scale category that ranged from “1: disagree” to “5: agree”. This variable measured how much one was depressed about the future and was specifically chosen because depression was known to have a correlation with alcohol use. Both categorical variables were treated as interval level of measurement in the correlation analysis but as dummies in the regression analysis.

Parental-influence variables

- I. Father’s education level (*What is the highest level of schooling your father completed?*)
- II. Mother’s education level (*What is the highest level of schooling your mother completed?*)
- III. Talking to parents about personal problems (*If you were having problems in your life, do you think you would talk them over with one or both of your parents?*)

Parental-influence variables were chosen to test how much parents’ educational status had influence on adolescents, or whether a close relationship between an adolescent and their parents affected odds of alcohol intoxication. Both ‘*Father’s education level*’ and ‘*Mother’s education level*’ were 6-scaled categories that were divided as such: “1: grade school”, “2: some high school”, “3: completed high school”, “4: some college”, “5: completed college”, “6: graduate or professional school after college”. The category of “7: don’t know or does not apply” was recoded along with the missing variables. ‘*Talking to parents about personal problems*’ was a 3-scale category of “1: no”, “2: yes, some” and “3: yes, most always” and was not recoded. All categorical variables were treated as interval level of measurement in the correlation analysis but as dummies in the regression analysis.

Peer-influence variables

- I. Number of peers who drink (*How many of your friends would you estimate drink*

alcoholic beverages? Liquor, beer, wine..)

- II. Number of peers who get drunk (*How many of your friends would you estimate get drunk at least once a week?*)

Peer-influence variables were ‘*Number of peers who drink*’ and ‘*Number of peers who get drunk*’. These variables did not test how close the relationships were between an adolescent and their peers, but mainly how alcohol consuming behavior of its peers affected the adolescent. None of these categorical variables were recoded. Both variables were 5-scale category variables, which ranged from “1: none”, “2: a few”, “3: some”, “4: most” to “5: all”. Both categorical variables were treated as interval level of measurement in the correlation analysis but as dummies in the regression analysis.

School-influence variables

- I. Enjoy going to school (*Now thinking back over the past year in school, how often did you enjoy being in school?*)
- II. Cutting school (*During the last four weeks, how many whole days of school have you missed because you skipped or ‘cut’?*)

School-influence layer consisted of two variables of ‘*Enjoy going to school*’ and ‘*Cutting school*’. The school-influence variables measured how much one thrived in the given environment. None of these categorical variables had been recoded. ‘*Enjoy going to school*’ is a 5-scale category variable, which ranges as such: “1: never”, “2: seldom”, “3: sometime”, “4: often” and “5: always”, whereas ‘*Cutting school*’ is a 7-category variable of “1: none”, “2: 1 day”, “3: 2 days”, “4: 3 days”, “5: 4-5 days”, “6: 6-10 days”, “7: 11+ days”. All categorical variables were treated as interval level of measurement in the correlation analysis but as dummies in the regression analysis.

Policy-influence variable

- I. Seeing a therapist for alcohol use (*Have you ever received any professional counseling, treatment, or therapy because of your use of alcohol or drugs?*)

Policy-influence layer variable tested whether seeking professional help for alcohol use had any influence on the odds of adolescents having been drunk. Since seeing a professional counselor was related to different policies and cultural aspects between Norway and US, the professional help was labeled as ‘policy-influence’. This variable was a 4-scale category variable that had not been

recoded, and ranged from “1: not at all”, “2: 1-2 times”, “3: 3-5 times” and “4: 6+ times”. This categorical variable was treated as interval level of measurement in the correlation analysis but as a dummy in the regression analysis.

6.2.3 Diagnostic tools

Variable fit: Wald test

The nested logistics regression command provides a table of Wald tests. This examines whether the newly added explanatory variables are statistically significant in improving the nested model, which is an essential process for this study. The **df** represents how many new variables have been added into each model; Model 1 has two new variables of ‘*Sex*’ and ‘*Grade/age*’, Model 2 has two new variables of ‘*Satisfied with self*’ and ‘*Depressed about the future*’ and so forth. The p-value of f-statistics then shows the results of each Wald tests of whether each newly added variable in the models are statistically significant in improving the analytical model.

Figure 3: Wald test for nested logistic regression (US)

Block	Wald chi2	df	Pr > F
1	132.34	2	0.0000
2	35.77	2	0.0000
3	27.07	3	0.0000
4	372.96	2	0.0000
5	24.35	2	0.0000
6	61.43	1	0.0000

Figure 3 shows the Wald test that was provided after the study’s results of nested logistic regression. Since all p-values were smaller than 0.001, all variables in each model were shown to have been selected accordingly to improve the model and help explain the study cases better.

Goodness of fit

Goodness of fit is important in determining whether the used model is successfully explaining all the cases accurately. Two types of tests were conducted to test goodness of fit for this study: the classification table and Hosmer-Lemeshow statistics. The classification table tells us whether cases are correctly or incorrectly identified using the analytical model that has been specified by the researcher. This information is provided through 'sensitivity' and 'specificity' of the model. Sensitivity and specificity are terms that are especially used for clinical tests, usually to identify those with a disease and those without a disease. For this study, the cases would be the adolescents who have been drunk and those who have not.

There are four ways of classifying cases in a sample population: true positive, false positive, true negative and false negative (Lalkhen and McCluskey 2008). A true positive and true negative is when the adolescents have been accurately identified: they truly have been drunk or have not been drunk. False positive and false negative, on the other hand, are the opposite. The results are false; those that show positive results of having been drunk are those that actually have not, and those that show the negative results of not having been drunk have in fact been drunk (Lalkhen and McCluskey 2008). Regarding these four methods of identifying cases, sensitivity then explains how well the model is identifying the true positive cases (Hilbe 2009). On the other hand, specificity shows the ability to correctly identify the true negative cases. For this study, the level of sensitivity was 20.32% and specificity of 98.94%. Since sensitivity measures the proportion of observed positives that are correctly identified, 20.32% of sensitivity means that only 20.32% of the cases were correctly identified as true positives. 98.94% of specificity shows that the model correctly reported 98.94% of the true negatives.

Figure 4 shows that the level of sensitivity was 20.32% and specificity of 98.94% for this study's analytical model. Since sensitivity measures the proportion of observed positives that are correctly identified, 20.32% of sensitivity meant that only 20.32% of the cases were correctly identified as true positives. 98.94% of specificity showed that the model correctly reported 98.94% of the true negatives.

Figure 4. Sensitivity, specificity and accuracy test for goodness of fit (US)

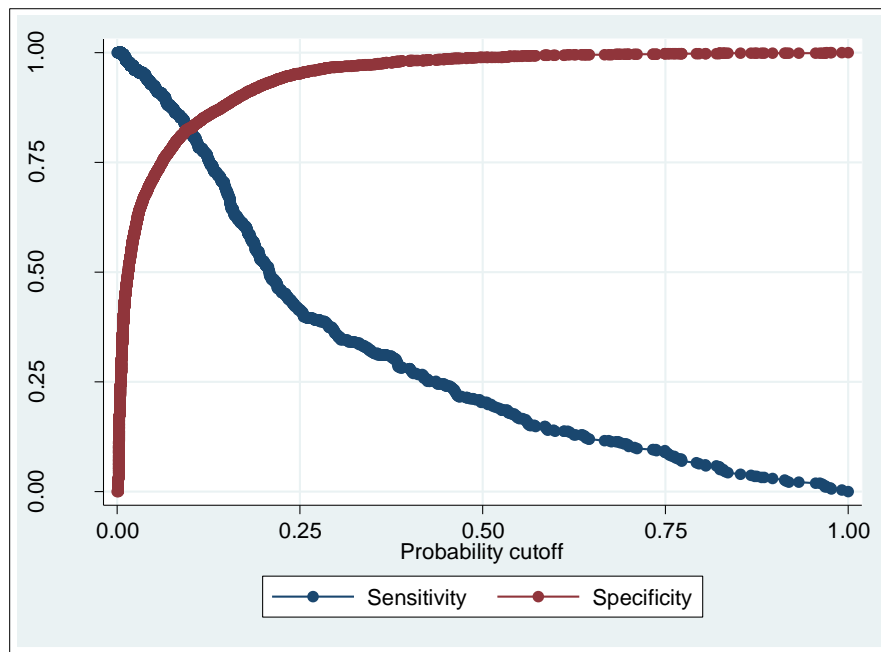
Logistic model for drunken			
Classified	True		Total
	D	~D	
+	77	50	127
-	302	4659	4961
Total	379	4709	5088
Classified + if predicted $\Pr(D) \geq .5$ True D defined as drunken != 0			
Sensitivity	$\Pr(+ D)$		20.32%
Specificity	$\Pr(- \sim D)$		98.94%
Positive predictive value	$\Pr(D +)$		60.63%
Negative predictive value	$\Pr(\sim D -)$		93.91%
False + rate for true ~D	$\Pr(+ \sim D)$		1.06%
False - rate for true D	$\Pr(- D)$		79.68%
False + rate for classified +	$\Pr(\sim D +)$		39.37%
False - rate for classified -	$\Pr(D -)$		6.09%
Correctly classified			93.08%

The reason behind low sensitivity may have been due to the high probability cutoff at 0.5, or 50%. A probability cutoff defines the probability of an event occurring, in which case, statistical analytics tool such as STATA automatically assumes as 50% (Hilbe 2009). Since this study aimed to look at the odds of adolescents having been drunk, the probability of this having occurred should be expected to be lower than 50%. The total sample population that reported having been drunk should be small compared to those that have never been drunk. Furthermore, the population number was made even smaller because the cases that have been intoxicated not by choice were excluded, and only those with risky behavior of having been drunk by choice were focused on.

Looking at the predictions of sensitivity and specificity and how they change along the probability cutoff in Figure 5, the highest point for both sensitivity and specificity was found at probability cutoff of 0.10 (10%). Thus, the low sensitivity should be fixed once the probability cutoff was brought down to 0.10. When the probability cutoff was changed to 0.10, sensitivity, specificity and accuracy changed: both accuracy and specificity decreased, and sensitivity increased from 20.32% up to 82.06%. Specificity decreased from 98.94% to 82.80%, and accuracy

changed from 93.08% to 82.74%. Despite the decrease in specificity and accuracy, the model proved that it correctly classified cases 82.74% of the time. Thus, the model was successful in categorizing cases accordingly.

Figure 5. Sensitivity/Specificity graph (US)



To confirm the results from the classification table, a second goodness-of-fit test was conducted. The Hosmer-Lemeshow statistic is one of the most frequently used goodness-of-fit tests. It divides cases according to their predicted probabilities that has been calculated through logistic regression model. Once it is divided into certain number of groups, often 10, the number of predicted probabilities of events occurring are compared to the number of actual events observed from the data (Yu, Xu and Zhu 2017). The more similar the two groups are, the better the model is fitting to explain the probability of events occurring.

Figure 6. Hosmer-Lemeshow statistic for goodness-of-fit (US)

Logistic model for drunken, goodness-of-fit test	
(Table collapsed on quantiles of estimated probabilities)	
number of observations =	5088
number of groups =	10
Hosmer-Lemeshow chi2(8) =	6.36
Prob > chi2 =	0.6064

Figure 6 shows that the p-value was higher than 0.05 which does not reject the hypothesis of model being a good fit. Hence, our analytical model was re-confirmed to be a good fit.

6.3 Results

The statistical analyses that was conducted based on the US dataset is illustrated in this section. The first part presents a descriptive table for the total sample population of the US. Mean and standard deviations are also provided for categorical variables. The second part illustrates the correlation between the variables that have specifically been selected for the analysis. The last part of this chapter concludes with the results attained through nested logistic regression.

6.3.1 Descriptive statistics

Table 1. Descriptive statistics for overall sample of US (N=5,088)

		Total	8th grade	10th grade
<i>Background variables</i>	Grade/age	5,088 (100%)	2,242 (44.06%)	2,846 (55.94%)
	Female	2,666 (52.40%)	1,197 (44.90%)	1,469 (55.10%)
	Male	2,422 (47.60%)	1,045 (43.15%)	1,377 (56.85%)
<i>Individual factors</i>	Satisfied with self	M (3.91) SD (1.27)*	M (3.95) SD (1.28)	MD (3.88) SD (1.25)
	Disagree (1)	394 (7.74%)	187 (8.34%)	207 (7.27%)
	Mostly disagree (2)	426 (8.37%)	163 (7.27%)	263 (9.24%)
	Neither (3)	679 (13.35%)	289 (12.89%)	390 (13.70%)
	Mostly agree (4)	1,313 (25.83%)	529 (23.60%)	785 (27.58%)
	Agree (5)	2,275 (44.71%)	1,074 (47.90%)	1,201 (42.20%)

	Depressed about future	M (1.96) SD (1.24)**	M (1.86) SD (1.22)	M (2.03) SD (1.25)
	Disagree (1)	2,672 (52.52%)	1,284 (57.27%)	1,388 (48.77%)
	Mostly disagree (2)	995 (19.56%)	392 (17.48%)	603 (21.19%)
	Neither (3)	691 (13.58%)	281 (12.53%)	410 (14.41%)
	Mostly agree (4)	427 (8.39%)	156 (6.96%)	271 (9.52%)
	Agree (5)	303 (5.96%)	129 (5.75%)	174 (6.11%)
<i>Parental influence</i>	Father's education level	M (4.17) SD (1.37)*	M (4.12) SD (1.35)	M (4.20) SD (1.36)
	Grade school (1)	117 (2.30%)	55 (2.45%)	62 (2.18%)
	Some high school (2)	463 (9.10%)	202 (9.01%)	261 (9.17%)
	Completed high school (3)	1,303 (25.61%)	621 (27.70%)	682 (23.96%)
	Some college (4)	704 (13.84%)	272 (12.13%)	432 (15.18%)
	Completed college (5)	1,567 (30.80%)	720 (32.11%)	847 (29.76%)
	Graduate or professional school after college (6)	934 (18.36%)	372 (16.59%)	562 (19.75%)
	Mother's education level	M (4.39) SD (1.27)*	M (4.39) SD (1.30)	M (4.47) SD (1.24)
	Grade school (1)	91 (1.79%)	46 (2.05%)	45 (1.58%)
	Some high school (2)	293 (5.76%)	143 (6.38%)	150 (5.27%)
	Completed high school (3)	939 (18.46%)	439 (19.58%)	500 (17.57%)
	Some college (4)	817 (16.06%)	346 (15.43%)	471 (16.55%)
	Completed college (5)	1,866 (36.67%)	789 (35.19%)	1,077 (37.84%)
Graduate or professional school after college (6)	1,082 (21.27%)	479 (21.36%)	603 (21.19%)	
	Talking to parents about personal problems	M (2.10) SD (0.73)	M (2.10) SD (0.73)	M (2.11) SD (0.72)
	No (1)	1,107 (21.76%)	502 (22.39%)	605 (21.26%)
	Yes, sometimes (2)	2,351 (46.21%)	1,036 (46.21%)	1,315 (46.21%)
	Yes, most always (3)	1,630 (32.04%)	704 (31.40%)	926 (32.54%)
<i>Peer influence</i>	Number of peers who drink	M (2.38) SD (1.22)**	M (1.85) SD (1.03)	M (2.80) SD (1.20)
	None (1)	1,614 (31.72%)	1,130 (49.20%)	511 (17.96%)
	A few (2)	1,314 (25.83%)	625 (27.88%)	689 (24.21%)
	Some (3)	1,018 (20.01%)	310 (13.83%)	708 (24.88%)
	Most (4)	915 (17.98%)	162 (7.23%)	753 (26.46%)
	All (5)	227 (4.46%)	42 (1.87%)	185 (6.50%)
	Number of peers who get drunk	M (1.73) SD (0.99)**	M (1.37) SD (0.75)	M (2.01) SD (1.06)
	None (1)	2,840 (55.82%)	1,674 (74.67%)	1,166 (40.97%)
	A few (2)	1,220 (23.98%)	378 (16.86%)	842 (29.59%)
	Some (3)	660 (12.97%)	126 (5.62%)	534 (18.76%)
Most (4)	297 (5.84%)	49 (2.19%)	248 (8.71%)	
	All (5)	71 (1.40%)	15 (0.67%)	56 (1.97%)
<i>School influence</i>	Enjoy going to school	M (3.15) SD (1.02)**	M (3.25) SD (1.04)	M (3.07) SD (1.00)
	Never (1)	372 (7.31%)	151 (6.74%)	221 (7.77%)
	Seldom (2)	762 (14.98%)	284 (12.67%)	478 (16.80%)
	Sometime (3)	2,131 (41.88%)	916 (40.86%)	1,215 (42.69%)
	Often (4)	1,370 (26.93%)	635 (28.32%)	735 (25.83%)

<i>Policy influence</i>	Cutting school	Always (5)	453 (8.90%)	256 (11.42%)	197 (6.92%)
			M (1.20) SD (0.70)**	M (1.16) SD (0.62)	M (1.23) SD (0.75)
		None (1)	4,528 (88.99%)	2,049 (91.39%)	2,479 (87.10%)
		1 day (2)	321 (6.31%)	112 (5%)	209 (7.34%)
		2 days (3)	120 (2.36%)	39 (1.74%)	81 (2.85%)
		3 days (4)	59 (1.16%)	18 (0.8%)	41 (1.44%)
		4-5 days (5)	35 (0.69%)	16 (0.71%)	19 (0.67%)
		6-10 days (6)	11 (0.22%)	5 (0.22%)	6 (0.21%)
	11+ days (7)	14 (0.28%)	3 (0.13%)	11 (0.39%)	
		Seeing a therapist for alcohol use	M (1.04) SD (0.27)**	M (1.02) SD (0.17)	M (1.06) SD (0.32)
	Not at all (1)	4,938 (97.05%)	2,212 (98.66%)	2,726 (95.78%)	
	1-2 times (2)	107 (2.10%)	22 (0.98%)	85 (2.99%)	
	3-5 times (3)	23 (0.45%)	5 (0.22%)	18 (0.63%)	
	6+ times (4)	20 (0.39%)	3 (0.13%)	17 (0.60%)	
<i>Dependent variable</i>	Have been drunk	No (0)	4,160 (81.76%)	2,074 (92.51%)	2,086 (73.30%)
		Yes (1)	928 (18.24%)	168 (7.49%)	760 (26.70%)
Note: *p < .05 **p < .001					

The total sample size of *Monitoring the Future 2015* was 31,162 but the final number of observations in this study was 5,088. The dataset showed quite a large portion of missing data because the four questionnaires from *Monitoring the Future (2015)* did not ask the same questions in each questionnaire. In other words, certain questions were not asked to all the respondents of 31,162. Hence, those that were not asked these questions were all re-coded as missing data which gave the remaining sample size for this study as 5,088. Within the sample population of this study, there were more female respondents (52.40%) compared to the male respondents (47.60%). Regarding age, there were more 10th grade students (55.94%) compared to 8th grade students (44.06%).

Both variables from the individual factors were categorical variables; the mean and standard deviations using a one-way ANOVA was thus provided. For ‘*Satisfied with self*’, both 8th and 10th grade students in general were neither satisfied nor unsatisfied with themselves (Mean=3.91, Standard Deviation=1.27). Although the mean category for both 8th and 10th graders were the same, there was a slight difference in the mean between the two groups at $p < .05$ level. When it came to ‘*Depressed about future*’ however, there was a greater difference in the mean of the two groups.

In general, both 8th and 10th grade respondents answered that they disagree with being depressed about the future (M=1.96, SD=1.24). Nonetheless, 8th graders showed that their mean was slightly lower than that of the 10th graders; 8th graders were less depressed than the 10th graders about their future (8th: M=1.86, SD=1.22; 10th: M=2.03, SD=1.25).

The parents' education level in parental influence factors showed that in average, both parents of 8th and 10th graders received some college education ('*Father's education*': M=4.17, SD=1.37; '*Mother's education*': M=4.39, SD=1.27). Nonetheless, the mean difference between 8th and 10th grade groups were statistically significant at $p < .05$ level; 10th grade students had more fathers and mothers that had some college education compared to 8th grade students. '*Talking to parents about personal problems*' on the other hand, did not show a statistically significant difference in the means between 8th and 10th graders. In average, all the respondents have responded that they sometimes talk to their parents about their problems (M=2.10, SD=0.73).

Peer influence factors showed the most difference in mean between groups. '*Number of peers who drink*' for 8th grade students answered that none of their peers drank alcoholic beverages (M=1.85, SD=1.03). However, 10th grade students answered on average that a few of their peers drank alcoholic beverages (M=2.80, SD=1.20). The difference in mean between the two groups mounted up to 0.95, which was the biggest difference in mean between groups amongst all the variables of the study. Similar difference was seen from '*Number of peers who get drunk*', in which 8th grade students answered in average that none of their peers got drunk (M=1.37, SD=0.75). On the other hand, 10th grade students responded in average, that a few of their peers got drunk (M=2.01, SD=1.06). Although the difference in mean between groups was smaller compared to '*Number of peers who drink*', the difference was statistically significant at $p < .001$ level. Thus, 10th grade students had more peers who drank alcoholic beverages and got drunk often compared to 8th grade students.

Within school influence factors, 8th and 10th grade groups did not show much differences in mean. For '*Enjoy going to school*', both groups responded in average that they sometimes enjoyed going to school (M=3.15, SD=1.02, $p < .001$). Although the mean difference was small, 8th grade students showed slightly higher mean than 10th grade students (8th: M=3.25, SD=1.04; 10th: M=3.07, SD=1.00). This indicated that 8th grade students enjoyed school slightly more than 10th

grade students did. For ‘*Cutting school*’ both 8th and 10th graders answered in average that they did not cut school at all (M=1.20, SD=0.70, $p < .001$). Again, the mean difference was small between the groups, but 10th grade students had slightly higher mean in cutting school (8th: M=1.16, SD=0.62; 10th: M=1.23, SD=0.75).

The last was the policy-influence factor. Both 8th and 10th grade students did not receive professional help because of alcohol or substance use (M=1.04, SD=0.27). Although small, the mean difference between two groups was statistically significant at $p < .001$ level.

In average, only 18.24% of all the respondents altogether had experienced having been drunk. However, there was a huge difference in the number of respondents for each 8th and 10th grade groups: amongst 8th grade students, 7.49% of the respondents had been intoxicated and 26.70% out of all 10th grade respondents had responded ever having been intoxicated during the last 12 months.

6.3.2 *Correlation analyses*

Pearson’s r was conducted to study the intercorrelation between variables and to check for multicollinearity issues. A high number closer to 1 indicated high correlation, whereas a low number indicated low correlation. A positive and negative number indicated the direction of the relationship. According to Table 2, all correlations were statistically significant except for ‘*Drunk*’ and ‘*Sex*’, ‘*Drunk*’ and ‘*Mother’s education*’, and ‘*Grade/age*’ and ‘*Satisfied with self*’. The highest coefficient amongst the correlations were 0.73 between ‘*Drinking peers*’ and ‘*Drunk peers*’. ‘*Mother’s education*’ and ‘*Father’s education*’ also showed a moderately high collinearity of 0.58. Nonetheless, no multicollinearity issues were found. More detailed correlation analyses are provided after Table 2.

Table 2. Intercorrelations between all variables (US)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Drunk	1.00												
2 Sex	-0.01	1.00											
3 Grade/age	0.16**	-0.02*	1.00										
4 Satisfied self	-0.1**	-0.14**	0.00	1.00									
5 Depressed future	0.07**	0.09**	0.03**	-0.42**	1.00								
6 Father education	-0.02*	-0.04**	0.05**	0.09**	-0.11**	1.00							
7 Mother education	-0.01	-0.04**	0.04**	0.10**	-0.10**	0.58**	1.00						
8 Talk with parents	-0.1**	-0.05**	0.02*	0.30**	-0.28**	0.11**	0.11**	1.00					
9 Drinking peers	0.36**	0.05**	0.34**	-0.08**	0.12**	-0.08**	-0.04**	-0.13**	1.00				
10 Drunk peers	0.35**	0.02**	0.27**	-0.08**	0.12**	-0.07**	-0.04**	-0.10**	0.73**	1.00			
11 Enjoying school	-0.1**	-0.02*	-0.06**	0.24**	-0.23**	0.06**	0.04**	0.19**	-0.15**	-0.13**	1.00		
12 Cutting school	0.18**	0.03**	0.06**	-0.08**	0.11**	-0.10**	-0.08**	-0.10**	0.19**	0.19**	-0.13**	1.00	
13 Seeking help	0.29**	-0.04**	0.06**	-0.07**	0.09**	-0.05**	-0.03*	-0.03**	0.21**	0.26**	-0.08**	0.20**	1.00

*p < .05 **p < .001

¹Drunk: Having been drunk

²Sex: (0) Male – (1) Female

³Grade/age: (0) 8th grade – (1) 10th grade

⁴Satisfied with self: (1) Disagree – (5) Agree

⁵Depressed about future: (1) Disagree – (5) Agree

⁶Father's education level: (1) Grade school – (6) Graduate or professional school after college

⁷Mother's education level: (1) Grade school – (6) Graduate or professional school after college

⁸Talking to parents about personal problems: (1) No – (3) Yes, most always

⁹Number of peers who drink: (1) None – (5) All

¹⁰Number of peers who get drunk: (1) None – (5) All

¹¹Enjoy going to school: (1) Disagree – (5) Agree

¹²Cutting school: (1) None– (7) 11+ days

¹³Seeing a therapist for alcohol or drug use: (1) Not at all – (4) 6+ times

Within demographic factors, 'Sex' did not show much correlation with any of the variables. One noticeable correlation was between 'Sex' and 'Satisfied with self' ($r = -0.14, p < .001$). The negative correlation implies that male adolescents were more likely to be satisfied with oneself compared to female adolescents. 'Grade/age' on the other hand, showed a noticeable correlation between the peer influence factors. 'Drinking peers' showed a correlation of 0.34 ($p < .001$) and 'Drunk peers' showed a correlation of 0.27 ($p < .001$). The positive correlation between the peer influence and 'Grade/age' showed that 10th grade students had more friends who consumed alcoholic beverages and got intoxicated than 8th grade students, which agrees with the results from descriptive statistics.

Both individual factor variables of 'Satisfied with self' and 'Depressed about future' showed a moderate correlation between 'Talking to parents about personal problems'. 'Satisfied with self' showed a positive correlation of 0.30 ($p < .001$), whereas 'Depressed about future' showed a negative correlation of -0.28 ($p < .001$). This can be interpreted as the more one was satisfied with oneself or was less depressed about the future, the more they talked to their parents about their personal problems. The individual factors also had similar correlations with 'Enjoy going to school' from the school influence factors. Similar to 'Talking to parents about personal problems', 'Satisfied with self' showed a positive correlation with 'Enjoy going to school' of 0.24 ($p < .001$) whereas 'Depressed about future' showed a negative correlation of -0.23 ($p < .001$). This implied the more one was satisfied with oneself, the less they were depressed about the future.

Parents' education did not show much correlation apart from the correlation with each other ($r = 0.58, p < .001$). Thus, if a father's education level was high, there was a higher chance that the mother's education level was high as well. '*Talking to parents about personal problems*' on the other hand, showed a positive correlation between '*Enjoy going to school*' ($r = 0.19, p < .001$). This implied that the more one talked to their parents about their problems, the more they enjoyed going to school.

Both variables from peer influence factors showed several significant correlations with other variables. Other than '*Grade/age*', both '*Drinking peers*' and '*Drunk peers*' showed high correlation with school influence factors of '*Enjoy going to school*' and '*Cutting school*'. For '*Enjoy going to school*', '*Drinking peers*' showed a negative correlation of -0.15 ($p < .001$) and '*Drunk peers*' a correlation of -0.13 ($p < .001$). With '*Cutting school*', both '*Drinking peers*' and '*Drunk peers*' showed a positive correlation of 0.19 ($p < .001$). This could be interpreted as the more peers who drink and get intoxicated one had, the less they enjoyed school and cut school more often.

Another variable that had a significant correlation with peer influence factors was '*Seeking help for alcohol use*'. Both peer influence factors showed a positive correlation: '*Drinking peers*' showed a correlation of 0.21 ($p < .001$) and '*Drunk peers*' a correlation of 0.26 ($p < .001$). Thus, the more peers who drink and get intoxicated one had, the more likely they were to seek professional help for alcohol use. '*Seeking help for alcohol use*' also showed a positive correlation with '*Cutting school*' from school influence factors ($r = 0.20, p < .001$). To interpret, the more one cut school, the more they were likely to seek help for alcohol use.

The dependent variable of '*Having been drunk*' showed the strongest correlation between peer influence factors of '*Drinking peers*' and '*Drunk peers*'. While '*Grade/age*' also showed a positive correlation of 0.16 ($p < .001$), '*Cutting school*' ($r = 0.18, p < .001$) and '*Seeking help for alcohol use*' ($r = 0.29, p < .001$) also showed a positive correlation with odds of adolescents having been drunk. This implied that 10th grade students and those who cut school more often had higher odds of having been drunk. Moreover, students who sought professional help for alcohol use also had higher odds of having been drunk.

6.3.3 Statistical analyses

This section provides the results from nested logistic regression in Table 3. With a total number of 6 nested models, each title for the models indicate the newly added factors to the model. Since the analytical model contained both binary and categorical variables, OR for each category of all categorical variables was also provided. Each model will explain if there were any changes to the previous factors because of the newly introduced variables, and what the relationship between the new factors and the dependent variable were.

Table 3. Result of nested logistic regression analyses predicting odds of adolescents having been drunk (US)

US	Independent variables	Model 1 (n=5,088)		Model 2 (n=5,088)		Model 3 (n=5,088)		Model 4 (n=5,088)		Model 5 (n=5,088)		Model 6 (n=5,088)	
		OR	SE	OR	SE	OR	SE	OR	SE	OR	SE	OR	SE
<i>Demographic variables</i>	Sex (ref.: Male (0))	0.85	0.09	0.80	0.09	0.79	0.09	0.61***	0.08	0.61	0.08	0.65	0.09
	Grade/age (ref.: gr. 8 (0))	6.0***	0.94	5.84***	0.92	6.04***	0.96	2.22***	0.39	2.44	0.44	2.40	0.44
<i>Individual layer</i>	Satisfied with self (ref.: Disagree (1))												
	Mostly disagree (2)	-	-	0.64	0.16	0.67	0.17	0.63	0.17	0.58	0.16	0.68	0.20
	Neither (3)	-	-	0.76	0.18	0.82	0.20	0.88	0.23	0.89	0.24	0.92	0.26
	Mostly agree (4)	-	-	0.81	0.17	0.94	0.21	1.01	0.25	1.03	0.26	1.14	0.29
	Agree (5)	-	-	0.70	0.15	0.87	0.19	0.84	0.20	0.90	0.22	0.98	0.25
	Depressed about future (ref.: Disagree (1))												
	Mostly disagree (2)	-	-	1.28	0.20	1.25	0.20	1.09	0.19	1.10	0.19	1.08	0.19
	Neither (3)	-	-	2.03***	0.35	1.89***	0.33	1.60*	0.30	1.50	0.29	1.35	0.27
Mostly agree (4)	-	-	1.62*	0.33	1.48	0.31	1.04	0.23	0.95	0.22	0.87	0.20	
Agree (5)	-	-	2.41***	0.52	2.11**	0.46	1.64*	0.40	1.50	0.38	1.35	0.35	
<i>Parental Influence</i>	Father's education level (ref.: Grade school (1))												
	Some high school (2)	-	-	-	-	1.07	0.42	1.02	0.44	1.11	0.50	1.13	0.52
	Completed high school (3)	-	-	-	-	0.73	0.28	0.74	0.31	0.80	0.35	0.85	0.38
	Some college (4)	-	-	-	-	0.63	0.25	0.66	0.28	0.77	0.34	0.81	0.38

	Completed college (5)	-	-	-	-	0.68	0.26	0.66	0.35	0.96	0.42	1.01	0.46
	Graduate or professional school after college (6)	-	-	-	-	0.64	0.26	0.74	0.32	0.88	0.40	0.93	0.44
	Mother's education level (ref.: Grade school (1))												
	Some high school (2)	-	-	-	-	0.95	0.47	0.93	0.49	0.83	0.45	0.80	0.45
	Completed high school (3)	-	-	-	-	1.01	0.46	0.90	0.45	0.77	0.39	0.73	0.39
	Some college (4)	-	-	-	-	1.33	0.61	1.30	0.65	1.11	0.57	1.02	0.54
	Completed college (5)	-	-	-	-	0.98	0.45	0.95	0.47	0.81	0.41	0.73	0.38
	Graduate or professional school after college (6)	-	-	-	-	0.97	0.46	0.90	0.46	0.77	0.40	0.65	0.35
	Talking to parents about problems (ref.: No (1))												
	Yes, sometimes (2)	-	-	-	-	0.68**	0.09	0.71*	0.11	0.75	0.11	0.80	0.13
	Yes, most always (3)	-	-	-	-	0.50***	0.08	0.61**	0.11	0.66*	0.12	0.70*	0.13
<i>Peer Influence</i>	Number of peers who drink (ref.: None (1))												
	A few (2)	-	-	-	-	-	-	3.26*	1.87	3.16*	1.81	3.34*	1.93
	Some (3)	-	-	-	-	-	-	12.4***	6.73	10.9***	5.94	10.3***	5.68
	Most (4)	-	-	-	-	-	-	39.8***	21.7	36.1***	19.7	36.0**	19.8
	All (5)	-	-	-	-	-	-	83.3***	47.0	73.9***	41.8	63.0***	36.3
	Number of peers who get drunk (ref.: None (1))												
	A few (2)	-	-	-	-	-	-	1.34	0.30	1.32	0.29	1.37	0.31
Some (3)	-	-	-	-	-	-	2.56***	0.57	2.58***	0.58	2.5***	0.57	
Most (4)	-	-	-	-	-	-	2.73***	0.67	2.66***	0.66	2.41**	0.61	
All (5)	-	-	-	-	-	-	2.05*	0.74	1.52	0.57	1.29	0.51	
<i>School Influence</i>	Enjoy going to school (ref.: Disagree (1))												
	Mostly disagree (2)	-	-	-	-	-	-	-	-	1.14	0.26	1.18	0.27
	Neither (3)	-	-	-	-	-	-	-	-	0.87	0.18	0.89	0.19
	Mostly agree (4)	-	-	-	-	-	-	-	-	0.52**	0.13	0.53*	0.13
	Agree (5)	-	-	-	-	-	-	-	-	0.75	0.25	0.69	0.23
	Cutting school (ref.: None (1))												

	1 day (2)	-	-	-	-	-	-	-	-	-	1.43	0.28	1.38	0.28
	2 days (3)	-	-	-	-	-	-	-	-	-	2.05**	0.58	1.66	0.49
	3 days (4)	-	-	-	-	-	-	-	-	-	1.90	0.68	1.79	0.67
	4-5 days (5)	-	-	-	-	-	-	-	-	-	6.52***	2.80	6.3***	2.67
	6-10 days (6)	-	-	-	-	-	-	-	-	-	7.20*	6.38	6.57*	5.79
	11+ days (7)	-	-	-	-	-	-	-	-	-	0.62	0.46	0.70	0.53
<i>Policy Influence</i>	Seeing a therapist for alcohol use (ref.: Not at all (1))													
	1-2 times (2)	-	-	-	-	-	-	-	-	-	-	-	4.2***	0.99
	3-5 times (3)	-	-	-	-	-	-	-	-	-	-	-	10.7***	5.94
	6+ times (4)	-	-	-	-	-	-	-	-	-	-	-	12.0***	7.18

*p < .05 **p < .01 ***p < .001

OR= Odds Ratio, SE= Standard Error

Model 1: Demographic variables

The first model consisted of two demographic variables of ‘Sex’ and ‘Grade/age’. Each variable showed a different relationship with the odds of adolescents having been drunk; ‘Sex’ (OR=0.85, p=not significant or n.s.) had a negative relationship while ‘Grade/age’ (OR=6.0, p < .001) had a positive relationship. Although statistically not significant, a negative relationship with ‘Sex’ indicated that male had higher odds than female adolescents in having been drunk. On the other hand, the positive relationship of ‘Grade/age’ implied that the higher the grade/age, the higher the odds of adolescents having been drunk. Since ‘Grade/age’ is a binary variable of only grade 8 and 10, the results showed that adolescents in grade 10 had a factor of 6.0 times higher odds of having been drunk than those in grade 8.

Model 2: Individual layer

The second model consisted of an additional layer of individual-factor variables. 'Sex' was still statistically insignificant with a negative correlation (OR=0.80, p=n.s.), and 'Grade/age' a positive relationship with statistical significance. Thus, grade 10 students had a factor of 5.84 times higher odds (OR=5.84, $p < .001$) of having been drunk compared to those in grade 8.

From the individual factors, although all categories showed a negative relationship none of the categories of 'Self-satisfaction' (p=n.s.) were statistically significant. A negative relationship implied the lower the self-satisfaction levels, the higher the odds of one having been drunk. On the other hand, all categories of 'Depressed about future' showed a positive relationship; the more one was depressed about one's future, the higher the odds of them having been drunk. Except for 'Mostly disagree (2)' (OR=1.28, p=n.s.), the rest of the categories of 'Neither (3)', 'Mostly agree (4)' and 'Agree (5)' were statistically significant. The category that had the highest OR from 'Depressed about future' was the 'Agree (5)' category. This implied that against the 'Disagree (1)', the base category, students who chose 'Agree (5)' had a factor of 2.41 times higher odds of having been drunk ($p < .001$). In other words, adolescents who fully acknowledged that they were depressed about the future had higher odds of having been drunk than those who disagreed about being depressed about their future.

By comparing the OR amongst the variables from Model 2, 'Grade/age' had the biggest influence on the odds of adolescents having been drunk. The second highest influence was the 'Depressed about future' variable, especially within the 'Agree (5)' category.

Model 3: Parental influence

Both 'Sex' and 'Grade/age' showed no difference in affecting the odds of adolescents having been drunk. 'Sex' (OR=0.79, p=n.s.) remained to have a negative correlation whereas 'Grade/age' (OR=6.04, $p < .001$) had a positive correlation with the odds of adolescents having been drunk. Thus, male and grade 10 adolescents continued to have higher odds of having been drunk.

The 'Satisfied with self' variable still had no influence on the odds of adolescents having been drunk. Although this variable was not statistically significant, it remained to have a negative

correlation. *'Depressed about future'* variable also did not show much change, except for the category of 'Mostly agree (4)' (OR=1.48, p=n.s.) that was no longer statistically significant. This could imply that the students who chose this category have been influenced by the additional layer of parental factors. Nonetheless, the 'Agree (5)' category remained to have the highest OR (OR=2.11, $p < .01$) from *'Depressed about future'* variable.

Except for *'Talking to parents about problems'*, none of the other variables were statistically significant. Father's and mother's education both showed varied correlations for each category. *'Talking to parents about personal problems'* showed a negative correlation: the more an adolescent talked to their parents about their problems, the lower the odds of them having been drunk. The category of 'Yes, most always (3)' showed an OR of 0.50 ($p < .001$), which can be interpreted as, compared to the base category of 'No, never (1)', adolescents who always talked to their parents about problems had a factor of 0.50 times lower the odds of having been drunk than those who never talked to their parents.

Similar to results of Model 2, *'Grade/age'* remained to be the biggest influence on the odds of adolescents having been drunk. The next biggest influence was still from *'Depressed about future'*.

Model 4: Peer influence

Demographic variables did not show much difference from the introduction of the peer-influence variables. One noticeable change was that *'Sex'* (OR=0.61, $p < .001$) now changed to being statistically significant. *'Grade/age'* (OR=2.22, $p < .001$) remained to have the same direction of relationship regarding the odds of adolescents having been drunk but has greatly decreased in the strength of its influence on the odds of adolescents having been drunk; the OR for previous models was around 6, whereas in model 4 the OR has decreased to 2.22. The only categories that were statistically significant from the individual layer were 'Neither (3)' (OR=1.60, $p < .05$) and 'Agree (5)' (OR=1.64, $p < .05$) of *'Depressed about future'*. From the parental influence layer, *'Talking to parents about personal problems'* was still the only statistically significant variable which remained to have a negative correlation with odds of adolescents having been drunk. The OR for talking with parents increased slightly after the additional layer of peer factors.

The two newly added variables from peer-influence factors both showed statistically significant relationships. In the case of '*Number of peers who drink*', the strength of odds became stronger along with the increase of number of peers who drink – the more peers who drink one had, the higher the odds of the adolescent having been drunk. Thus, adolescents with friends all drink (in category 'All (5)'), had the highest odds of having been drunk (OR=83.3, $p < .001$) compared to other categories. On the other hand, '*Number of peers who get drunk*' showed that adolescents who had most of their friends (in category 'Most (4)') rather than all their friends, had the highest odds of having been drunk (OR=2.73, $p < .001$). Compared in between the variables, the most influential one was '*Number of peers who drink*' than '*Number of peers who get drunk*'.

The newly added peer-influence factors showed reduced effect of '*Sex*' on odds of adolescents having been drunk. The OR in the fourth model showed that the '*Number of peers who drink*' variable had the biggest effect on the odds of adolescents having been drunk in Model 4. Categories 'Some (3)' and 'Most (4)' from '*Number of Peers who get drunk*' then showed the next biggest influence, and '*Sex*' as the third influential.

Model 5: School influence

All variables of the previous model showed similar effects even after the addition of school-influence variables, although the most noticeable change came from the demographic variables. '*Sex*' (OR=0.61, $p=n.s.$) and even '*Grade/age*' (OR=2.44, $p=n.s.$) was no longer statistically significant. Within '*Talking to parents about personal problems*', only the last category of 'Yes, most always (3)' was now statistically significant (OR=0.66, $p < .05$).

The variables from school-influence were both statistically significant, but the effect they had on the odds of adolescents having been drunk varied. The '*Enjoying school*' variable showed a negative relationship in general – the more one enjoyed going to school, the lower odds they had in having been drunk. However, the first category of 'Mostly disagree (2)' showed a positive correlation, although it was not statistically significant (OR=1.131, $p=n.s.$). In fact, the only statistically significant category within this variable was the third of 'Mostly agree (4)' (OR=0.52, $p < .01$). This could be interpreted as adolescents who mostly agreed that they enjoyed going to school had a factor of 0.52 times lower the odds of having been drunk than those that did not enjoy

going to school. *'Cutting school'* on the other hand, showed a positive relationship in general: the more one cut school often, the higher odds they had in getting drunk. The most influential category within this variable was the '6-10 days (6)' (OR=7.20, $p < .05$), whereas '11+ days (7)' category started to show a negative correlation with the odds of adolescents having been drunk (OR=0.62, $p=n.s.$). Except for the '11+ days (7)' category, this showed a pattern where the more days one skipped school from, the higher odds they had in having been drunk.

Although *'Number of peers who drink'* remained to be the most influential variable within this model, the last few categories from *'Cutting school'* showed the second highest influence on the odds of adolescents having been drunk. The third most influential then, was the *'Number of peers who get drunk'*.

Model 6: Policy influence

The final model with additional factor of policy-influence did not change much of the variables from previous models. The demographic variables remained to be statistically insignificant, whereas none of the variables from independent-layer or parental-influence except for *'Talking to parents about problems'* showed a statistically significant influence on the odds of adolescents having been drunk.

'Number of peers who drink' and *'Number of peers who get drunk'* showed little change in its influence even after the additional policy-layer. *'Enjoying going to school'* and *'Cutting school'* also showed little change, although the strength of influence of *'Cutting school'* slightly weakened. The last variable of *'Professional help because of alcohol use'* showed a positive relationship with the odds of adolescents having been drunk: the more one had received professional help for alcohol use, the higher odds they had in having been drunk.

The most influential variable in this final model remained to be the *'Number of peers who drink'* variable, whereas *'Cutting school'* recorded as second most influential. The third however, was now *'Professional help because of alcohol use'*, and fourth as *'Number of peers who get drunk'*.

Table 4. Summary of results from the hypotheses tests (based on model 6)

Hypothesis	Supported / Not supported
Male have higher odds of having been drunk than female adolescents.	Not supported
Higher grades/age have higher odds of having been drunk.	Not supported
The more one is satisfied and less depressed about the future, the lower the odds of adolescents having been drunk.	Satisfied: Not supported Depressed: Not supported
Parents with higher education and close relationship with adolescent decreases adolescents' odds of having been drunk.	Education: Not supported Relationship: Supported
The more number of friends who drink alcohol and get drunk one has, the higher odds of an adolescent having been drunk.	Supported
The more one cuts school and does not enjoy school, the higher the odds of the adolescent having been drunk.	Cut school: Supported Enjoy school: Not supported
The more regularly one visits/seeks professional help, the higher the odds of them having been drunk.	Supported

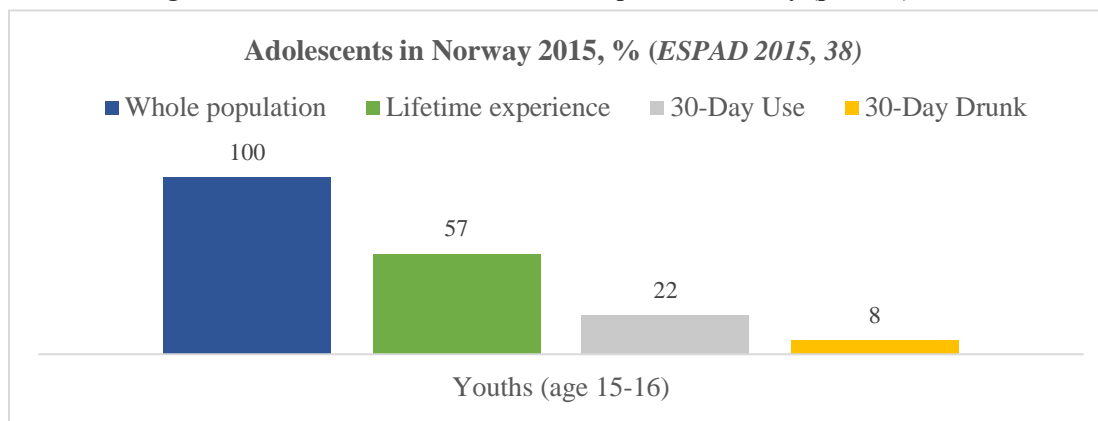
7 Norway

7.1 Alcohol Statistics and Policies

7.1.1 Alcohol statistics for youths

Norway shows one of the lowest rates in alcohol use (19%) amongst adolescents in Europe at the age of 13 or younger (ESPAD 2015). Amongst older adolescents, approximately 57% of students between the age of 15-16 answered they have tried alcohol in their lifetime, 22% answered that they have used alcohol in the past 30 days, and only 8% answered they have been intoxicated the past 30 days (ESPAD 2015). In Norway, female students showed higher rates of alcohol consumption compared to male students (ESPAD 2015; Ungdata n.d.).

Figure 7. Adolescents and alcohol consumption in Norway (percent), 2015



7.1.2 Legal age and prevention policies

Legal drinking age

The legal drinking age in Norway differs according to the alcoholic beverage. Alcoholic beverages such as beer and wine are sold to those over age 18, whereas spirits are sold only to those over age 20 (World Health Organization 2014).

Access to alcohol

All alcoholic beverages that are over 4.7% by volume are only available at state-owned retail stores also known as 'Vinmonopolet'. However, all alcoholic beverages under 4.7% can be bought in ordinary grocery stores (European Alcohol Policy Alliance 2016; Hallberg and Österberg 2016). In 1922, Vinmonopolet was first established as a government-owned enterprise. In 1939, the Ministry of Health and Social Affairs took over the ownership of Vinmonopolet and alcohol sales have become a state-regulated monopoly ever since (European Alcohol Policy Alliance 2016). A license is required for all on and off premise sales of alcoholic beverages under 4.7% (Solheim 2014).

Apart from having a state-owned retail stores monopolizing and controlling access to alcohol, the state also regulates which time/days when one can purchase alcohol. Alcohol sales are restricted on Sundays and public holidays. Vinmonopolet is open from 10 a.m. to 6 p.m. during the weekdays and 9 a.m. to 3p.m. on Saturdays (Hallberg and Österberg 2016). For off premise

sales, alcohol can be purchased until 8 p.m. on weekdays and 6 p.m. on Saturdays and for on premise sales, alcohol can be purchased until 3 a.m (Solheim 2014).

Taxation and pricing

Amongst various policies related to alcohol, taxation and pricing are decided on the national level, which is considered the most effective way to regulate the public's access to alcohol (Rossow and Storvoll 2014). The burden of these taxes and prices are especially heavier in Norway; “on a European level the Nordic countries stand out as countries with high alcohol taxation. In a Nordic comparison, taxation is lowest in Denmark and highest in Norway” (Hallberg and Österberg 2016, 6). Alcohol excise duty rates for spirits are 77.3 euros per liter (around 737 NOK) of 100% alcohol, and 50.3 euros (around 481 NOK) for wine and beer (Hallberg and Österberg 2016).

Prevention and treatment policies

From 2004, the Substance Abuse Treatment Reform was introduced in Norway to handle substance abuse as a disorder, acknowledging the rights of SUD patients to be evaluated and treated of their illness (Muscat 2010; Bergly 2015). Moreover, with the responsibility of treating SUD patients passed onto the regional health authorities, the reform created room for improvement of specialized services focused on SUD patients (Muscat 2010). The Norwegian National Action Plan on Alcohol and Drugs was set into place to further deepen and widen the focus on alcohol and drug problems of Norwegian children and families. With the purpose of implementing various policies related to alcohol and drugs, the main objective of this national plan was to develop systems that can offer help in the earlier stages and prevent substance abuse (Norwegian Ministry of Health and Care Services 2008).

The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) (2017) reports that Norway currently has integrated prevention activities into the school environment. Through the Norwegian National Action Plan on Alcohol and Drugs, the Norwegian government planned to “establish 1060 new full-time equivalents in psycho-social work at child health clinics and school health services” to provide easier access to help for children and adolescents who are exposed to risk of substance use or other issues (Norwegian Ministry of Health and Care Services 2008, 37). Although daily curricular school-based prevention programs have been less used

recently, programs that include assistance from parents and families have also been widely utilized. Programs such as ‘Love and Limits’ strengthens social skills for adolescents at school and home environments (EMCDDA 2017).

7.2 Methodology

7.2.1 *Ungdata*

Ungdata is a questionnaire-based data used for the Norwegian analysis of this study. This cross-national data focuses on adolescents between the age of 13-19 from schools in majority of municipalities all over Norway. Topics such as youths, education, relationships, health/life behavior and substance use are covered. NOVA, or Velferdsforskningsinstituttet (the Norwegian Social Research), is a research institute at Oslo Metropolitan University that conducts the research of *Ungdata*. The regional Drug and Alcohol Competence Centers are also responsible for the municipal level surveys (Norwegian Centre for Research Data 2018).

The surveys have been conducted annually starting from 2010, whereas up to 2017 about 439,200 students have been estimated to have partook in the research from 405 municipalities (Bakken 2017). Although the response rates vary between municipalities where the highest response rates were close to 100, the average response rate in each municipality was around 80-90% (Norwegian Centre for Research Data 2018). For the dataset used for this study, the total population for the whole dataset was 260,999 with 180,099 (69% of the total sample population) respondents from middle school and 80,900 (31%) respondents from high school (Ungdata 2010-2015). The grades were divided from grade 8, 9, 10 for middle school and year 1, 2 and 3 for high school. To match the dataset of US, *Monitoring the Future* from 2015, data from 2015 and a target population of 8 and 10th grade students were specifically selected from *Ungdata*.

7.2.2 Measures

This section discusses the specific variables chosen from the *Ungdata* dataset. The topics each variable covered and how they were recoded will be explained in detail. Differences and similarities from the US dataset variables will also be mentioned.

Dependent variable

Have been drunk (*During the last 12 months, how many times have you drunk so much alcohol that you were clearly intoxicated?*)

The dependent variable for Norway was a 5-scale category that ranged as such: “1: never”, “2: 1 time”, “3: 2-5 times”, “4: 6-10 times”, “5: 11+ times”. This variable allowed us to measure how often an adolescent has been drunk during the past 12 months which is the same as the US. For the purpose of a nested logistic regression, this dependent variable was recoded into a binary variable of 0 and 1. Category “1: never” and “2: 1 time” were recoded into 0 to exclude the events of intoxication that occurred from curiosity or not by choice. To identify adolescents who have been drunk by choice, category “3: 2-5 times”, “4: 6-10 times” and “5: 11+ times” were recoded as 1.

Independent variables

Demographic variables

For demographic factors, ‘*Sex*’ and ‘*Grade*’ variables were measured. Both variables were binary; ‘*Sex*’ was recoded as “0: male” and “1: female” and for ‘*Grade/age*’, “0” was recoded for 8th graders and “1” was coded for 10th graders.

Individual-factor variables

- I. Satisfied with self (Choose that suits best for you: *I am very satisfied with myself*)
- II. Depressed about future (During the last week, have you complained about the following: *Felt hopeless when thinking of the future*)

The individual-factor consisted of two variables of ‘*Satisfied with self*’ and ‘*Depressed about future*’. The purpose of these selected variables coincided with the US variables: to study how much the individual characteristics one holds had effect on the odds of adolescents having been

drunk. None of these variables were recoded. ‘*Satisfied with self*’ had a 4-scale category in which respondents chose whether they were satisfied with one self. The categories of this variable ranged from “1: disagree”, “2: mostly disagree”, “3: mostly agree” and “4: agree”. ‘*Depressed about future*’ was also a 4-category variable where a respondent chose between “1: do not feel bothered at all”, “2: feel a little bothered”, “3: sometimes bothered” and “4: feels bothered a lot” to show how much one was bothered about their future being hopeless. Both categorical variables were treated as interval level of measurement in the correlation analysis but as dummies in the regression analysis.

Parental-influence variables

- I. Father’s education (*Has your father received high education?*)
- II. Mother’s education (*Has your mother received high education?*)
- III. Talking to parents about personal problems (*Think about the time when you had a personal problem. You feel sad and need someone to talk to. Who will you talk to or seek for help? Parents.*)

For parental-influence factors, the variables tested the influence of one’s parents on the odds of adolescents having been drunk. None of the variables were recoded. Father’s and mother’s education were both binary variables that questioned whether the parents had received high education or not; the choices were given as “0: no high education” and “1: yes, received high education”. The variable, ‘*Talking to parents about personal problems*’ asked the respondents whether they would be going to their parents for personal advices. The variable offered a 3-scale category which ranged from “1: very certain”, “2: maybe” and “3: no”. This variable was treated as interval level of measurement in the correlation analysis but as dummies in the regression analysis.

Peer-influence variables

- I. How often peers drink (*Do you have any peers who drink? If so, how often do they drink?*)
- II. How many peers get drunk (*How many of your peers of your age, have drank so much that they were heavily intoxicated?*)

Peer-influence factors consisted of two variables that asked how many peers that drink and get drunk one had, if any. None of the variables were recoded. ‘*How often peers drink*’ variable was a 5-scale category variable that ranged from “1: no, never”, “2: seldomly”, “3: about once a week”, “4: a few times a week” and “5: yes, daily”. ‘*How many peers get drunk*’ was a 3-scale category variable which ranged from “1: no one or almost no one”, “2: less than half” and “3: almost half”. Both categorical variables were treated as interval level of measurement in the correlation analysis but as dummies in the regression analysis.

School-influence variables

- I. Dreading going to school (*Do you agree/disagree to the following statement about school: I dread often going to school*)
- II. Cutting school (*Have you done or experienced the following during the past 12 months?: Skipping school*)

School-influence factors consisted of two variables: ‘*Dreading going to school*’ and ‘*Cutting school*’. The variables measured how much an adolescent thrived in their school environment. None of these variables were recoded. Although the US variable asked how much one enjoyed school, the Norwegian variable asked how much the respondent dreaded going to school. ‘*Dreading going to school*’ consisted of 4-scale categories, which ranged from “1: totally disagree”, “2: somewhat disagree”, “3: somewhat agree” and “4: totally agree”. ‘*Cutting school*’ asked the same question as US of how often one cut school. This was a 5-scale category variable categorized as: “1: never”, “2: 1 time”, “3: 2-5 times”, “4: 6-10 times”, and “5: 11+ times”. Both categorical variables were treated as interval level of measurement in the correlation analysis but as dummies in the regression analysis.

Policy-influence variables

- I. Seeking help for alcohol use (*What is the reason for visiting school nurse/school health service: Substance*)

Similar to the US variable, the policy-influence factor consisted of only one variable which asked the respondent whether they have ever used school health services or visited the school nurse because of substance related issues. The binary variable was not recoded and was divided as: “0: no” and “1: yes”.

7.2.3 Diagnostic tools

Variable fit: Wald test

Wald test examines whether the newly added variables help the model work better as an analytical tool, which is an essential process to go through for this study. The **df** column explains how many variables are newly added for each model. The p-values of the f-statistics then show whether these added variables make a statistically significant change onto the model or not. Figure 8 showed that all of the newly added variables were statistically significant; they added some values to the models by improving it and helping it explain cases better.

Figure 8. Wald test for nested logistic regression (Norway)

Block	Wald chi2	df	Pr > F
1	563.23	2	0.0000
2	239.07	2	0.0000
3	135.15	3	0.0000
4	764.34	2	0.0000
5	286.46	2	0.0000
6	8.55	1	0.0035

Goodness of fit

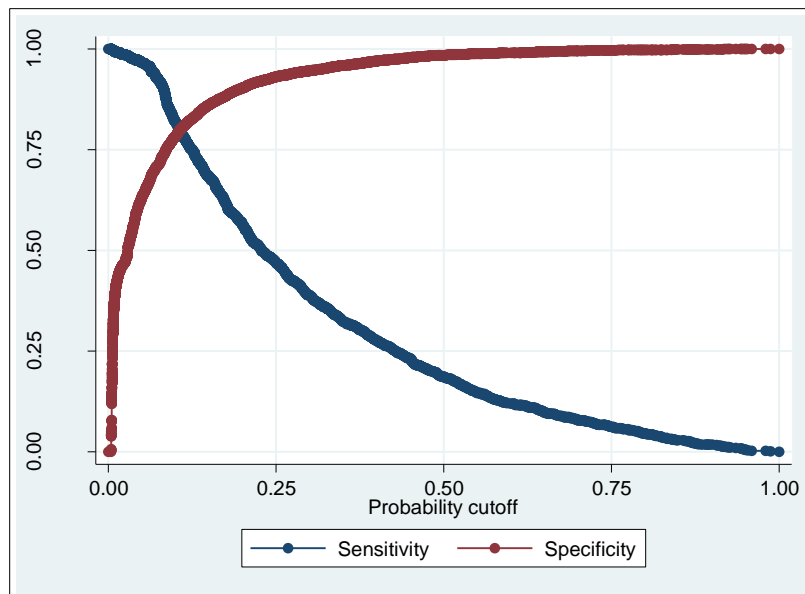
To see whether the analytical model is a good fit for the study cases, a classification table was conducted to study the sensitivity, specificity and accuracy of the model. As seen from Figure 9, the classification table showed similar results of the US; the Norwegian data also showed low sensitivity of 18.59% but very high specificity of 98.52% at a probability cutoff of 0.5 (or 50%). Detailed analyses are provided after Figure 9.

Figure 9. Sensitivity, specificity and accuracy test for goodness of fit (Norway)

Logistic model for drunk			
Classified	True		Total
	D	~D	
+	242	187	429
-	1060	12442	13502
Total	1302	12629	13931
Classified + if predicted $\Pr(D) \geq .5$ True D defined as drunk != 0			
Sensitivity		$\Pr(+ D)$	18.59%
Specificity		$\Pr(- \sim D)$	98.52%
Positive predictive value		$\Pr(D +)$	56.41%
Negative predictive value		$\Pr(\sim D -)$	92.15%
False + rate for true ~D		$\Pr(+ \sim D)$	1.48%
False - rate for true D		$\Pr(- D)$	81.41%
False + rate for classified +		$\Pr(\sim D +)$	43.59%
False - rate for classified -		$\Pr(D -)$	7.85%
Correctly classified			91.05%

The classification table also showed that the 91.05% of the cases were all correctly categorized. This implied that only 18.59% of the true positive cases were identified, whereas 98.52% of the true negative cases were identified. To see if the Norwegian data also has the problem of a high probability cutoff, a sensitivity/specificity graph is provided.

Figure 10. Sensitivity/Specificity graph (Norway)



The sensitivity/specificity graph of Figure 10 for Norway also showed a similar result of the US in which the probability cutoff should have been lower than 0.50. A lower probability cutoff indicated that the probability of adolescents being intoxicated was lower than 50% like the result of US data. Using the sensitivity/specificity graph and probability cutoff graph, the highest intercept point for the highest sensitivity and specificity was found to be around 0.15.

After lowering the cutoff to 0.15, sensitivity was increased from 18.59% to 68.43%. Although specificity decreased from 98.52% to 86.16% and accuracy slightly decreased from 91.05% to 84.50%, it still shows that 84.50% of the cases are categorized into the correct category. Therefore, at a probability cutoff point of 0.15 (15%), the model was able to identify 68.43% of the students who truly gets intoxicated and 86.16% of the students who truly does not get intoxicated. Since the analytical model classified 84.5% of the cases correctly, the model remained to be used as an effective analytical tool.

Nonetheless, to reconfirm the validity of the results from classification table, Hosmer-Lemeshow statistics was conducted.

Figure 11. Hosmer-Lemeshow statistic for goodness-of-fit (Norway)

<u>Logistic model for drunkt, goodness-of-fit test</u>	
(Table collapsed on quantiles of estimated probabilities)	
number of observations =	13931
number of groups =	10
Hosmer-Lemeshow chi2(8) =	10.42
Prob > chi2 =	0.2371

Showing the results of the Hosmer-Lemeshow statistic in Figure 11, p-value showed to be at 0.24, which implied that the null hypothesis of the model being a good fit could not be rejected. Like the classification table, this also proved that the analytical model was a good fit for the study cases.

7.3 Results

This chapter illustrates the statistical analyses using the Norwegian dataset. Starting with a descriptive table, general statistics summary of the variables selected for the dataset are given. The second part moves onto correlation analysis that provides information about the intercorrelation between all the selected variables. Lastly, the third part presents the results attained through nested logistic regression.

7.3.1 Descriptive statistics

Table 5. Descriptive statistics for overall sample of Norway (N=13,931)

		Total	8th grade	10th grade
<i>Background variables</i>	Grade/age	13,931 (100%)	6,480 (46.51%)	7,451 (53.49%)
	Female	7,185 (51.58%)	3,392 (47.21%)	3,793 (52.79%)
	Male	6,746 (48.42%)	3,088 (45.78%)	3,658 (54.22%)
<i>Individual factors</i>	Satisfied with self	M (3.13) SD (0.87)**	<i>M (3.26) SD (0.83)</i>	<i>M (3.03) SD (0.891)</i>
	Disagree (1)	813 (5.84%)	283 (4.37%)	530 (7.11%)
	Mostly disagree (2)	2,081 (14.94%)	760 (11.73%)	1,321 (17.73%)
	Mostly agree (3)	5,523 (39.65%)	2,401 (37.05%)	3,122 (41.90%)
	Agree (4)	5,514 (39.58%)	3,036 (46.85%)	2,478 (33.26%)
	Depressed about future	M (1.67) SD (0.93)**	<i>M (1.466) SD (0.796)</i>	<i>M (1.850) SD (1.00)</i>
	Not bothered (1)	8,104 (58.17%)	4,448 (68.64%)	3,656 (49.07%)
	Feel a little bothered (2)	3,298 (23.67%)	1,304 (20.12%)	1,994 (26.76%)
	Sometimes bothered (3)	1,531 (10.99%)	479 (7.25%)	1,061 (14.24%)
Feels bothered a lot (4)	998 (7.16%)	258 (3.98%)	740 (9.93%)	
<i>Parental-influence factors</i>	Father's high education			
	No (0)	5,013 (35.98%)	1,821 (28.10%)	3,192 (42.84%)
	Yes (1)	8,918 (64.02%)	4,659 (71.90%)	4,259 (57.16%)
	Mother's high education			
	No (0)	3,771 (27.07%)	1,328 (20.49%)	2,443 (32.79%)
Yes (1)	10,160 (72.93%)	5,152 (79.51%)	5,008 (67.21%)	

	Talking to parents about personal problems	M (2.30) SD (0.74)**	<i>M (2.41) SD (0.703)</i>	<i>M (2.196) SD (0.754)</i>
	No (1)	2,347 (16.85%)	814 (12.56%)	1,533 (20.57%)
	Maybe (2)	5,091 (36.54%)	2,165 (33.41%)	2,926 (39.27%)
	Yes (3)	6,493 (46.61%)	3,501 (54.03%)	2,992 (40.16%)
	How often peers drink	M (1.63) SD (0.88)**	<i>M (1.23) SD (0.62)</i>	<i>M (1.97) SD (0.923)</i>
	Never (1)	8,087 (58.05%)	5,435 (83.87%)	2,652 (35.59%)
	Seldomly (2)	3,619 (25.98%)	734 (11.33%)	2,885 (38.72%)
<i>Peer-influence factors</i>	About once a week (3)	1,657 (11.89%)	196 (3.02%)	1,461 (19.61%)
	A few times a week (4)	441 (3.17%)	74 (1.14%)	367 (4.93%)
	Yes, daily (5)	127 (0.91%)	41 (0.63%)	86 (1.15%)
	How many peers get drunk	M (1.03) SD (0.20)**	<i>M (1.00) SD (0.072)</i>	<i>M (1.05) SD (0.26)</i>
	No one/almost never (1)	13,649 (97.98%)	6,455 (99.61%)	7,194 (96.55%)
	Less than half (2)	187 (1.34%)	22 (0.34%)	165 (2.21%)
	Almost half (3)	95 (0.68%)	3 (0.05%)	92 (1.23%)
	Dreading going to school	MD (1.67) SD (0.89)**	<i>MD (1.56) SD (0.835)</i>	<i>MD (1.769) SD (0.92)</i>
	Disagree (1)	7,825 (56.17%)	4,056 (62.59%)	3,769 (50.58%)
	Somewhat disagree (2)	3,546 (25.45%)	1,449 (22.36%)	2,097 (28.14%)
	Somewhat agree (3)	1,853 (13.30%)	731 (11.28%)	1,122 (15.06%)
	Agree (4)	77 (5.08%)	244 (3.77%)	463 (6.21%)
<i>School-influence factors</i>	Cutting school	M (1.32) SD (0.79)**	<i>M (1.163) SD (0.568)</i>	<i>M (1.45) SD (0.92)</i>
	Never (1)	11,460 (82.26%)	5,846 (90.22%)	5,614 (75.35%)
	1 time (2)	1,157 (8.31%)	343 (5.29%)	814 (10.92%)
	2-5 times (3)	882 (6.33%)	205 (3.16%)	677 (9.09%)
	6-10 times (4)	203 (1.46%)	39 (0.60%)	164 (2.20%)
	11+ times (5)	229 (1.64%)	47 (0.73%)	182 (2.44%)
	Seeking help for alcohol use			
<i>Policy-influence factors</i>	No (0)	13,902 (99.79%)	6,474 (99.91%)	7,428 (99.69%)
	Yes (1)	29 (0.21%)	6 (0.09%)	23 (0.31%)
	Have been drunk			
<i>Dependent variable</i>	No (0)	12,629 (90.65%)	6,386 (98.55%)	6,243 (83.79%)
	Yes (1)	1,302 (9.35%)	94(1.45%)	1,208 (16.21%)
Note: *p < .05 **p < .001				

Although the total population for 2015 was 73,426, only grade 8 and 10 adolescents from the total population of 2015 were selected to match the US data. Those that were not within year 2015 or in grade 8 and 10 were recoded as missing data. Thus, the total number of observations for the Norwegian data analyses was 13,931. Out of these observations, there were slightly more females (51.58%) compared to male adolescents (48.42%). The samples were also comprised of 46.51% 8th grade students and 53.49% 10th grade students all over from Norway.

Both variables from individual factors were categorical, consisting of 4-categories. Along with the summary statistics, ANOVA was used to indicate the mean difference between groups of 8th and 10th graders. For '*Satisfied with self*', both 8th and 10th grade students in general were mostly satisfied with oneself (M=3.13, SD=0.87). Moreover, students in general were not really bothered with their future (M=1.67, SD=0.93). However, both '*Satisfied with self*' and '*Depressed about future*' showed a significant difference in between the groups; the results indicated that 10th graders were less satisfied with oneself and more depressed about the future compared to 8th graders.

For the parents' high education in parental influence factors, results showed that there were more students in 8th grade (71.90%) that had a father with higher education compared to 10th grade students (57.16%). Mother's higher education showed a similar result: there were more students with mothers that received higher education in 8th grade (79.51%) compared to 10th grade (67.21%). The overall result showed students in both 8th grade and 10th grade had more mothers that received higher education (72.93%) compared to fathers with higher education (64.02%). '*Talking to parents about personal problems*' showed that in general, students were maybe talking to their parents about their personal problems (M=2.30, SD=0.74%). However, there was a significant difference in mean between 8th and 10th graders, in which 8th grade students were more likely to talk to their parents than 10th graders.

Both 8th and 10th grade students answered for peer-influence that they did not have friends who drank or gets drunk in general ('*How often peers drink*': M=1.63, SD=0.88; '*How many peers get drunk*': M=1.03, SD=0.20). Nonetheless, there was a statistically significant difference in the mean between 8th and 10th grade students for '*How often peers drink*' - this indicated that 10th grade students had more number of peers that drank. Although there was a difference in mean for '*How many peers get drunk*' in between the groups as well, the difference was very small. Thus, both 8th

and 10th grade students did not have much peers that got drunk.

For school-influence factors, both 8th and 10th grade students in general did not dread going to school nor cut school often (*'Dread going to school'*: M=1.67, SD=0.89; *'Cutting school'*: M=1.32, SD=0.79). However, both variables indicated that there was a statistical significant difference in the mean between the groups of 8th and 10th grade students. Thus, 10th grade students were more likely to dread and cut school compared to 8th grade students.

Almost no students had used the school's nurse or school health services because of substance use in both 8th and 10th grade in average. Furthermore, there was no noticeable difference in the number of students that had sought help for alcohol use between the groups of 8th and 10th grade students.

In average for both 8th and 10th grade students, only 9.35% respondents answered that they have been drunk during the last 12 months. However, there was a significant difference in the population between the groups of 8th and 10th grade students; while 1.45% 8th grade students have answered that they have experienced intoxication, 16.21% of 10th grade students answered that they have been intoxicated the last 12 months.

7.3.2 Correlation analyses

Table 6 which is also a result of Pearson's r , showed that many of the correlations were statistically significant except for some that were correlated to *'Sex'* and *'Seeking help'*. The variables that did not have a statistical significance were the following: *'Sex'* and *'Father's education'*, *'Sex'* and *'Drunk peers'*, *'Sex'* and *'Cutting school'*, *'Sex'* and *'Seeking help'*, *'Mother's education'* and *'Seeking help'*, *'Drunk peers'* and *'Dreading school'*, *'Drunk peers'* and *'Seeking help'*, and *'Cutting school'* and *'Seeking help'*. The highest noticeable correlation coefficient was 0.49, which indicated no signs of multicollinearity.

Table 6. Intercorrelations between all variables (Norway)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Drunk	1.00												
2 Sex	0.02**	1.00											
3 Grade/age	0.26**	-0.02 *	1.00										
4 Satisfied with self	-0.09**	-0.28**	-0.13**	1.00									
5 Depressed future	0.16**	0.23**	0.20**	-0.49**	1.00								
6 Father education	-0.07**	-0.01	-0.14**	0.06**	-0.07**	1.00							
7 Mother education	-0.04**	0.004**	-0.13**	0.05**	-0.07**	0.49**	1.00						
8 Talk with parents	-0.11**	-0.06**	-0.14**	0.30**	-0.28**	0.07**	0.07**	1.00					
9 Drinking peers	0.48**	-0.02**	0.40**	-0.14**	0.21**	-0.08**	-0.06**	-0.16**	1.00				
10 Drunk peers	0.09**	0.002	0.09**	-0.03**	0.019**	-0.05**	-0.03**	-0.02**	0.073**	1.00			
11 Dreading school	0.06**	0.06**	0.11**	-0.33**	0.38**	-0.03**	-0.04**	-0.20**	0.12**	0.001	1.00		
12 Cutting school	0.34**	0.007	0.20**	-0.17**	0.26**	-0.07**	-0.07**	-0.18**	0.32**	0.013**	0.25**	1.00	
13 Seeking help	0.04**	-0.004	0.024*	-0.02*	0.03**	-0.012*	-0.006	-0.02**	0.035**	-0.005	0.009*	0.039	1.00

*p < .05 **p < .001

¹Drunk: Having been drunk

⁴Satisfied with self: (1) Disagree – (4) Agree

⁵Depressed about future: (1) Not bothered – (4) Feels bothered a lot

⁸Talking to parents (about personal problems): (1) No – (3) Yes

⁹Drinking peers (or How often peers drink): (1) Never – (5) Daily

¹⁰Drunk peers (or How many peers get drunk): (1) No one or almost no one – (3) Almost half

¹¹Dreading going to school: (1) Totally disagree – (4) Totally agree

¹²Cutting school: (1) Never – (5) 11+ times

¹³Seeking help (Seeking professional help for alcohol use)

One of the strongest correlation was within two groups of variables: '*Depressed about future*' and '*Satisfied with self*' ($r = -0.49, p < .001$) and '*Mother's education*' and '*Father's education*' ($r = 0.49, p < .001$). The first indicated that the more one was depressed about the future, the less likely they were to be satisfied with oneself. On the other hand, mother's education had a positive correlation with father's education which indicated if the mother had received higher education, it was also likely that the father has also received higher education.

One of the weakest variables that did not show much correlation with any of the variables were '*Drunk peers*' and '*Seeking help*'. Both had correlations that were below 0.1 and had more statistically insignificant correlations compared to other variables. This implied that none of the variables within this model explained the relationship of '*Drunk peers*' or '*Seeking help*'. The strongest correlation these two variables had was with the dependent variable, '*Having been drunk*'.

Both '*Sex*' and '*Grade/age*' from the demographic factors showed a strong positive correlation with '*Depressed about future*' ('*Sex*': $r = 0.23, p < .001$; '*Grade/age*': $r = 0.20, p < .001$). In other words, female adolescents or those in grade 10 were more likely to be depressed about the future than male adolescents or 8th grade students. Moreover, '*Sex*' showed an even higher correlation with '*Satisfied with self*' of -0.28 ($p < .001$). This showed that male adolescents were more likely to be satisfied with themselves compared to female adolescents. '*Grade/age*' showed a high correlation with '*Drinking peers*' ($r = 0.40, p < .001$) and '*Cutting school*' ($r = 0.20, p < .001$). With both variables having a positive correlation with '*Grade/age*', this showed that the 10th graders were likely to have more number of drinking peers and cut school often than 8th graders. On the other hand, '*Grade/age*' showed negative correlations with all variables from family-influence factors of '*Father's education*' ($r = -0.14, p < .001$) '*Mother's education*' ($r = -0.13, p < .001$) and '*Talking to parents about personal problems*' ($r = -0.14, p < .001$). This indicated that 10th grade students had less fathers and mothers who received higher education and that they did not talk with their parents as much as 8th grade students did.

Variables from individual factors of '*Satisfied with self*' and '*Depressed about future*' showed a high correlation between the school-influence variables of '*Dreading going to school*' and '*Cutting school*'. With '*Dreading going to school*', '*Satisfied with self*' showed a negative correlation of -0.33 ($p < .001$), whereas '*Depressed about future*' showed a positive correlation of

0.38 ($p < .001$). This implied that the less one was satisfied with oneself or was more depressed about the future, the more likely they were going to dread going to school. '*Cutting school*' showed a similar relationship, whereas '*Satisfied with self*' showed a negative correlation ($r = -0.17$, $p < .001$) and '*Depressed about future*' showed a positive correlation ($r = 0.26$, $p < .001$). Like the interpretation of '*Dreading going to school*', the less one was satisfied with oneself or was more depressed about the future, the more likely they were going to cut school often. Other than school-influence factors, both individual factor variables also showed a strong correlation with '*Talking to parents about personal problems*' ('*Satisfied with oneself*': $r = 0.30$, $p < .001$; '*Depressed about future*': $r = -0.28$, $p < .001$). The results indicated that the more one was satisfied with oneself or was less depressed about the future, the more they talked to their parents about their personal problems.

Although '*Drunk peers*' did not have strong correlations with any of the variables, '*Drinking peers*' had several strongly correlated variables. The strongest correlation '*Drinking peers*' had was with the dependent variable '*Having been drunk*' ($r = 0.48$, $p < .001$). This indicated that the more drinking peers one had, the higher odds one had of having been drunk. '*Drinking peers*' also showed a positive correlation with individual factors of '*Satisfied with self*' ($r = -0.14$, $p < .001$) and '*Depressed about future*' ($r = 0.21$, $p < .001$). This indicated that the more one has peers who drink alcohol, the less one was satisfied with oneself or was more depressed about the future. '*Talking to parents about personal problems*' also showed a negative correlation of -0.16 ($p < .001$). Thus, the more number of drinking peers one had, the less likely they were to talk to their parents about personal problems. '*Cutting school*' also had a high correlation with '*Drinking peers*' which showed a positive correlation of 0.32 ($p < .001$). Thus, the more drinking peers one had, the more likely they were to cut school often.

Both variables of '*Dreading going to school*' and '*Cutting school*' from school-influence showed a negative correlation with '*Talking to parents about personal problems*' ('*Dreading going to school*': $r = -0.20$, $p < .001$; '*Cutting school*': $r = -0.18$, $p < .001$). This implied that the more one dreaded going to school or cut school often, the less likely they were to talk to their parents about their personal problems. '*Cutting school*' also showed a high correlation with the dependent variable, '*Having been drunk*' ($r = 0.34$, $p < .001$). Thus, the more one cut school, the higher their

odds of having been drunk. Another noticeable correlation between the school-influence variables, was that they were both correlated to each other. Positive correlation between '*Dreading going to school*' and '*Cutting school*' ($r = 0.25, p < .001$) implied that the more one dreaded going to school, the more likely they were to cut school.

Lastly, the dependent variable of '*Having been drunk*' showed several positive correlations between the variables of '*Grade/age*' ($r = 0.26, p < .001$), '*Depressed about future*' ($r = 0.16, p < .001$), '*Drinking peers*' ($r = 0.48, p < .001$) and '*Cutting school*' ($r = 0.34, p < .001$). Thus, 10th grade students, those who were very depressed about their future, having many number of friends who drink or those who cut school often, had higher odds of having been drunk. A negative correlated variable with '*Having been drunk*' was '*Talking to parents about personal problems*' ($r = -0.11, p < .001$), which indicated that the less one talked to their parents about personal problems, the more they were likely to have been drunk.

7.3.3 *Statistical analyses*

Table 7 provides the results of nested logistic regression of the Norwegian data. There are 6 models in total, in which each title for the models show the newly added factors that have been selected based on Bronfenbrenner's ecological theory of human development. The purpose of this section is to see which factors have the highest influence on the odds of adolescents having been drunk, and whether these influences change when another variable is introduced into the model.

Table 7. Result of nested logistic regression analyses predicting odds of adolescents having been drunk (Norway)

Norway	Independent variables	Model 1 (n=13,931)		Model 2 (n=13,931)		Model 3 (n=13,931)		Model 4 (n=13,931)		Model 5 (n=13,931)		Model 6 (n=13,931)	
		OR	SE	OR	SE	OR	SE	OR	SE	OR	SE	OR	SE
<i>Demographic variables</i>	Sex (<i>ref.: Male (0)</i>)	1.01	0.06	0.72***	0.05	0.74***	0.05	0.77***	0.05	0.82**	0.06	0.82**	0.06
	Grade/age (<i>ref.: gr. 8 (0)</i>)	13.15***	1.43	11.06***	1.21	10.20***	1.12	3.82***	0.45	3.91***	0.47	3.91***	0.47
<i>Individual factors</i>	Satisfied with self (<i>ref.: Disagree (1)</i>)												
	Mostly disagree (2)	-	-	0.73**	0.09	0.80	0.09	0.84	0.10	0.86	0.11	0.86	0.11
	Mostly agree (3)	-	-	0.57***	0.07	0.68**	0.08	0.74*	0.09	0.78	0.10	0.78	0.10
	Agree (4)	-	-	0.45***	0.06	0.58***	0.08	0.67**	0.09	0.71*	0.10	0.71*	0.10
	Depressed about future (<i>ref.:Not bothered at all (1)</i>)												
	Feel a little bothered (2)	-	-	1.48***	0.12	1.41***	0.11	1.29**	0.11	1.24*	0.11	1.24*	0.11
	Sometimes bothered (3)	-	-	1.95***	0.18	1.74***	0.17	1.52***	0.15	1.33*	0.14	1.32**	0.14
	Feels bothered a lot (4)	-	-	2.44***	0.27	2.01***	0.22	1.59***	0.19	1.27	0.16	1.27	0.16
<i>Parental Influence</i>	Father's education (<i>ref.: No (0)</i>)	-	-	-	-	0.74***	0.05	0.77***	0.06	0.76***	0.06	0.76***	0.06
	Mother's education (<i>ref.: No (0)</i>)	-	-	-	-	0.93	0.07	0.92	0.07	0.97	0.08	0.97	0.08
	Talking to parents about personal problems (<i>ref.: No (0)</i>)												
	Maybe (2)	-	-	-	-	0.65***	0.05	0.73***	0.06	0.82*	0.07	0.82*	0.07
Yes (3)	-	-	-	-	0.42***	0.04	0.55***	0.05	0.64***	0.06	0.65***	0.06	
<i>Peer Influence</i>	How often peers drink (<i>ref.: Never(1)</i>)												
	Seldomly (2)	-	-	-	-	-	-	15.98***	2.46	13.94***	2.15	13.94***	2.15
	About once a week (3)	-	-	-	-	-	-	30.52***	4.81	24.02***	3.81	23.84***	3.79

	Few times a week (4)	-	-	-	-	-	-	35.63***	6.46	26.81***	4.95	26.77***	4.94
	Yes, daily (5)	-	-	-	-	-	-	61.29***	14.87	38.72***	9.83	38.48***	9.80
	How many peers get drunk (ref.: No one (1))												
	Less than half (2)	-	-	-	-	-	-	1.27	0.24	1.44	0.28	1.45	0.29
	Almost half (3)	-	-	-	-	-	-	2.77***	0.63	2.98***	0.69	2.99***	0.70
<i>School Influence</i>	Dreading going to school (ref.: Disagree (1))												
	Somewhat disagree (2)	-	-	-	-	-	-	-	-	0.98	0.08	0.99	0.08
	Somewhat agree (3)	-	-	-	-	-	-	-	-	0.86	0.09	0.87	0.09
	Totally Agree (4)	-	-	-	-	-	-	-	-	0.98	0.13	0.99	0.13
	Cutting school (ref.: Never (1))												
	1 time (2)	-	-	-	-	-	-	-	-	2.36***	0.22	2.37***	0.22
	2-5 times (3)	-	-	-	-	-	-	-	-	3.24***	0.31	3.20***	0.31
6-10 times (4)	-	-	-	-	-	-	-	-	5.10***	0.87	5.10***	0.87	
11+ times (5)	-	-	-	-	-	-	-	-	5.23***	0.86	5.17***	0.85	
<i>Policy Influence</i>	Seeking help for alcohol use (ref.: No (0))	-	-	-	-	-	-	-	-	-	-	3.62**	1.67

*p < .05 **p < .01 ***p < .001

Model 1: Demographic variables

The first model consisted of two variables of 'Sex' and 'Grade/age'; both 'Sex' (OR=1.01, p=n.s.) and 'Grade/age' (OR=13.15, $p < .001$) showed a positive relationship with the odds of adolescents having been drunk. 'Grade/age' was the only variable that was statistically significant, and this is interpreted as the only variable that affected the odds of adolescents having been drunk. Nonetheless, the positive relationship of 'Sex' implied that female adolescents had higher odds of having been drunk than males. The positive relationship of 'Grade/age' can be interpreted as the higher the grade level, the higher the odds of the adolescent having been drunk. Since 'Grade/age' was a binary variable, adolescents in grade 10 had a factor of 13.15 times higher odds of having been drunk compared to those in grade 8.

Model 2: Individual layer

The addition of the individual-factor layer brought a noticeable change in the 'Sex' variable (OR=0.72, $p < .001$): the variable was now statistically significant and the relationship with the dependent variable changed from positive to negative. Thus, the model with the introduction of the individual factor layers implied that males had higher odds compared to females in having been drunk. The 'Grade/age' variable (OR=11.06, $p < .001$) remained unchanged – it was still statistically significant with a positive relationship.

'Satisfied with self' variable from the individual layer showed a negative relationship with the odds of adolescents having been drunk. This implied that the more satisfied one was with oneself, the lower the odds they had in having been drunk. The last category of 'Agree (4)' (OR=0.45, $p < .001$) from 'Satisfied with self' showed that the students who were fully satisfied with themselves had a factor of 0.45 lower the odds of having been drunk compared to the reference category students who were fully dissatisfied with themselves (category Agree (1)). On the other hand, 'Depressed about future' showed a positive relationship with the odds: the more one was depressed about the future, the higher the odds of one having been drunk. Adolescents from the last category of 'Agree (4)' (OR=2.44, $p < .001$), or those that fully agreed that they were depressed about the future, showed that they had a factor of 2.44 times higher odds of having been drunk than those in the reference category of 'Disagree (1)' that fully disagreed that they were depressed about their

future. Within this model, the most influential variable that affected the odds of adolescents having been drunk was the ‘*Grade/age*’ variable from the demographic factors.

Model 3: Parental influence

The addition of parental-influence did not bring much change to the pre-existing variables. The four variables from demographic and individual-factor layers remained to have the same direction of relationships and were statistically significant.

‘*Father’s education*’ (OR=0.74, $p < .001$) showed a negative relationship with the odds of adolescents having been drunk: the higher the father’s education, the lower the odds of adolescents having been drunk. ‘*Mother’s education*’ (OR=0.93, $p=n.s.$), although statistically insignificant, also showed a negative relationship – the higher the mother’s education, the lower the odds of adolescents having been drunk. The third variable from parental-influence layer, ‘*Talking to parents about personal problems*’ also showed a negative relationship. This implied that the more one communicated with their parents about personal problems, the lower their odds of having been drunk. The last category of ‘Yes (3)’ (OR=0.42, $p < .001$) from ‘*Talking to parents about personal problems*’ showed that adolescents who discussed their problems with their parents had a factor of 0.42 lower odds of having been drunk compared to those that didn’t discuss their problems. Adolescents who sometimes discussed problems with their parents (category ‘Maybe (2)’): OR=0.65, $p < .001$) on the other hand, had a factor of 0.65 times less the odds of having been drunk compared to those who did not discuss their problems. Although adolescents from this category had lower odds than those that did not talk with their parents at all, they had higher odds of having been drunk than those who always discussed their problems with their parents.

Model 4: Peer influence

The fourth model added an extra layer of peer-influence variables. Despite the additional layer, the pre-existing variables remained statistically significant and kept the same relationship with the odds of adolescents having been drunk.

‘*How often peers drink*’ had a positive relationship with the odds of adolescents having been drunk: the more drinking friends one had, the higher their odds of having been drunk. The odds of

adolescents having been drunk increased rapidly depending on how often one's peers drank; the last category of 'Yes, daily (5)' (OR=61.29, $p < .001$) indicated a factor of 61.29 times higher odds of adolescents having been drunk compared to the base category of 'Never (1)'. '*Number of Peers getting drunk*' also showed a positive relationship with the odds of adolescents having been drunk. Adolescents from category 'Almost half (3)' (OR=2.77, $p < .001$), or those who had half of their peers who got drunk showed that they had a factor of 2.77 times higher the odds of having been drunk compared to those who did not, or almost did not have a friend who got drunk often (base category 'None, or almost none (1)').

Unlike the previous models, the '*How often peers drink*' variable showed to have the greatest influence on the odds of adolescents having been drunk. '*Grade/age*' was second and '*How many peers get drunk*' was third most influential.

Model 5: School influence

The extra layer of school-influence did not bring much change except for making some of the categories within variables in individual layer of '*Satisfied with self*' and '*Depressed about future*' no longer statistically significant. Most of the pre-existing variables remained to have similar relationship with the odds of adolescents getting drunk.

'*Dreading going to school*' showed a negative relationship in general, although none of the categories were statistically significant. A negative relationship implied that the more one dreaded going to school, the lower the odds they had in having been drunk. '*Cutting school*' on the other hand, showed a positive relationship with the odds of adolescents having been drunk and was statistically significant. Thus, the more frequent one cut school, the higher their odds of having been drunk. In the case where adolescents cut school more than 11 times (in category '5: 11+ times': OR=5.23, $p < .001$), they had a factor of 5.23 times higher odds of having been drunk compared to those students who never cut school.

The most influential variable remained to be '*How often peers drink*' in Model 5, and the second most influential was '*Cutting school*' variable. '*Grade/age*' was then the third most influential and '*Number of peers getting drunk*' the fourth most influential.

Model 6: Policy influence

With the final layer of policy-influence added, little change was detected in the influence of the variables from the previous models. ‘*Seeking help for alcohol use*’ (OR=3.62, $p < .01$) showed a positive relationship: the more often one visited their school nurse for substance use, the higher odds of them having been drunk. This does not imply a causal relationship between the two, but merely that they have a positive relationship and not a negative one.

The most influential variable that affected the odds of adolescents having been drunk remained to be ‘*How often peers drink*’ in the final model, whereas ‘*Cutting school*’ was the second most influential. ‘*Grade/age*’ was still the third and ‘*Seeking help for alcohol use*’ was the fourth most influential, based on the OR.

Table 8. Summary of results from the hypotheses tests (based on model 6)

Hypothesis	Supported / Not supported
Male have higher odds of getting drunk than female adolescents	Supported
Higher grades/age have higher odds of getting drunk	Supported
The more one is satisfied and less depressed about the future, the less odds of adolescents getting drunk	Satisfied: Not Supported Depressed: Supported
Parents with higher education and close relationship with adolescent decreases adolescents’ odds of getting drunk	Education: Not supported Relationship: Supported
The more number of friends who drink alcohol and get drunk one has, the higher odds of an adolescent having been drunk.	Supported
The more one cuts school and does not enjoy school, the higher the odds of the adolescent getting drunk	Cut school: Supported Enjoy school: Not supported
The more regularly one visits/seeks professional help, the higher the odds of them getting drunk.	Supported

8 Discussion

8.1 Comparison between US and Norway

For this section, the results from the two countries are compared to show where there are similarities and differences in patterns and to determine whether the hypotheses of this study have been supported for both countries. To begin with, factors were shown to be interconnected to each other and correlated in some way. From the US dataset, ‘*Sex*’ changed its influence on the odds of adolescents off having been drunk once peer-factor variables were introduced in Model 4; the variable changed to not having any statistically significant influence to having a statistical significant influence. Moreover, from Model 5 when school-factor variables were introduced, both ‘*Sex*’ and ‘*Grade/age*’ were no longer statistically significant; the variables did not influence the odds of adolescents having been drunk. Results from Norwegian dataset also showed evidence of interrelationship between factors. ‘*Sex*’ changed its direction of relationship with the odds of adolescents having been drunk from positive to negative once individual factors were introduced. The fact that strength or directions of factors’ influence changed when different variables were introduced, supports the importance of recognizing the interconnectedness of social environmental factors.

Next, whether each factor’s hypothesis has been supported or not supported are determined. Starting with sex, the US did not support the hypothesis; male adolescents did not have higher odds of having been drunk than female adolescents. In fact, sex had no statistical significance in the US, which implies that sex did not play much role in influencing the odds of adolescents having been drunk. On the other hand, Norway supported the hypothesis by showing a negative correlation with the odds of adolescents having been drunk. These results, however, did not correspond with the findings from the ESPAD report (2015), which showed that female adolescents had higher intoxication levels compared to male adolescents in Norway, whereas intoxication rates for both female and male were the same in the US.

Regarding grade/age, the results from the US data supported the hypothesis; higher grade/age had higher odds of having been drunk. However, this was only up to a certain point. Grade had a statistical significance and a positive correlation with the odds of adolescents having been drunk

until Model 4, which contained demographic, individual characteristics, family and peer factors. Nevertheless, once school factors and policy factors were introduced, grade/age was no longer statistically significant. Norway on the other hand, supported this hypothesis thoroughly; the result showed there was a positive correlation between grade/age and odds of adolescents having been drunk. This agrees with the results of Reboussin, Song, Wolfson (2012) and Johnston et al. (2018), where the level of alcohol consumption increased with age.

For parental influence, both education levels of the parents did not have any statistically significant influence on the odds of having been drunk for adolescents in the US, which did not support the hypothesis. However, father's education had a significantly negative association with the odds of adolescents having been drunk in Norway, although mother's education did not have any influence like the result of US. Similar studies have been conducted to research parental influence on adolescents' substance use, but many of them had mixed results when it came to parental education levels. Hoque and Ghuman (2012) reported that the level of education of the parents did not have much influence, whereas a study conducted by Ennett et al. (2008) reported that parents with low education levels had negative association with the odds of adolescents' alcohol misuse. Thus, the results of US supported the findings of Hoque and Ghuman (2012), whereas Norway supported a part of the findings from Ennett et al. (2008). Although it was difficult to examine why there was a difference in the results between Norway and US regarding father's education, difference in the cultural aspect may be offered as an explanation.

Regarding parents' relationship with the adolescent, both the US and Norway's results supported the hypothesis that the more regularly one communicated with their parents about personal problems, the lower the odds adolescents had in having been drunk. This agrees with the research of Connell, Gilreath, Aklin and Brex (2010) in which holding a close relationship with one's parents and family members plays a significant role in preventing the onset of risky behaviours in adolescents such as alcohol use.

Both US and Norway showed results that peer factor had the highest influence on the odds of adolescents having been drunk. If one had more peers that get drunk and drink alcohol, they had higher odds of having been drunk. This corresponds with the results of many research that studied factors encouraging alcohol consuming behaviours (Reboussin, Song and Wolfson 2012; Steketee,

Jonkman, Berten and Vettenburg 2013; Sudhinaraset, Wigglesworth and Takeuchi 2016; Mason et al. 2017). Hence, the hypothesis has been supported by both countries.

Both countries showed that the second most influential factor that increased the odds of adolescents having been drunk was how often one cut school. The results from both countries showed a positive correlation: the more one cut school, the higher odds they had in having been drunk. This also corresponded with the results of previous research of Steketee, Jonkman, Berten and Veteenburg (2013) Rakiü, Rakiü, Milošević and Nedeljković (2014), which emphasize the importance of future research on the correlation between the risky behaviour of cutting school and its effect on alcohol intoxication. The hypothesis of enjoying or dreading school was not supported by both countries; whether one enjoys or dreads school did not have much influence on the odds of an adolescent having been drunk.

For policy influence factor, the two countries showed that seeking professional help/seeing school nurse had strong influence on the odds of adolescents having been drunk. Thus, the hypothesis was supported by both US and Norway. However, this should not be interpreted as a causal relationship but that there was a correlation between adolescents who have been drunk and those that visited professional helper or school nurse for alcohol and substance issues.

Lastly, comparing the results between Norway and US showed that the strength and the direction of the relationships of each factor with the odds of adolescents having been drunk, does vary in between the two countries. Thus, hypothesis 3 was not supported. Although the factors that had the most effect on the odds of adolescents having been drunk were similar between the US and Norway, it did not show that they had the same degree of strength in its effect. In fact, both countries had factors that showed quite different strengths or different relationship with the odds of adolescents having been drunk.

8.2 Limitation of the study

This research held a broad perspective over different factors from individual characteristics to national policies and studied their influence regarding adolescents having been drunk. The strength of this study is that it offers possibilities to see how different factors interact with each other and how complex these interrelationships are. Comparing these interrelationships between two countries allows one to study how these relationships change in a different social or cultural environments. However, this specific strength can also bring certain limitations to the study.

First, one of the limitations of this study is that the study is based on a self-report questionnaire, which is limiting since it lacks direct information. Thus, the possibility of a biased data from being underreported or overreported cannot be disregarded. This means that accuracy and validity of this data can be questionable. Moreover, since this is also a secondary data analysis, there is a limit to how much one can familiarize oneself with the given data or be aware of the quality of the given data (Bryman 2012). Especially since this study is based on two different datasets that are extremely complex and different from each other, it requires more work to make sure that one is familiar enough with each dataset to extract the right information.

The second limitation of this study comes from the fact that this is a comparison study based on two datasets. Using two different datasets from two different countries mean that there are many steps to go through to make the two datasets comparable. During this process, there may be some variables that have been strained to match the other country's dataset. This means that variables that did not fully match were still used to fit the theoretical model used for this thesis. For example, in *Monitoring the Future*, the peer factors were 'Number of peers who drink' and 'Number of peers who get drunk'. However, in *Ungdata*, the peer factor variables were 'How often does your peers drink' and 'How many peers get drunk'. Although the question regarding peers who get intoxicated required answers related to number of peers, the question related to peers who consume alcohol asked for different answers. Moreover, the policy factor of seeking professional help had different focus in each country: US asked if adolescents have sought help from a professional helper such as psychiatrists for alcohol use. On the other hand, Norway questioned whether adolescents visited the school nurse or school health clinic for substance use in general. For these reasons, the two datasets were not combined and made into one dataset for direct comparison of the two countries.

Since one of the aims of this study was to examine similarities and differences of the influential social environment factors that influenced adolescents to having been drunk, the datasets were kept separated and analysed accordingly. However, this still did not resolve limitations such as datasets being different due to cultural definitions, the purpose of asking certain questions, or the method used to code variables.

The third limitation comes from how this study could not go in-depth into certain relationships. Although the study has given insight to various inter-relational factors that is associated with odds of adolescents having been drunk, it does not provide enough detailed aspects. This is because only certain variables were chosen to make the dataset comparable and fitting based on the theoretical framework. The most fitting example is the father's education from parental-influence factors. Father's education level was one of the variables that showed different correlations with the odds of adolescents having been drunk between US and Norway. Although there were more variables that asked questions about the behaviour of the father to discern how his relationship is with the adolescent, these were not selected for comparison reasons. For further in-depth research, choosing one country with one dataset might be preferable.

The fourth limitation comes from missing data. As mentioned earlier, the US data of *Monitoring the Future 2015* consisted of 6 different questionnaires that had been distributed to different areas of the country. Each questionnaire had some questions that were the same and some that were not. Therefore, if a certain question was only asked in only a few selected questionnaires, the total sample size decreased rapidly, which for this study, created a huge quantity of missing data for the US.

The fact that this study is cross-sectional and not longitudinal also gives less strength to the relationship between factors and the odds of adolescents having been drunk. This study does not study the causal effects of the factors on the odds of adolescents having been drunk, and therefore bases the study on cross-sectional methods to analyse the data. Although the cross-sectional data allowed more room for comparison between the two countries at a certain point in time, a longitudinal data would have created the possibility of studying the trend in the factors and how they change over time (Bryman 2012).

Despite these limitations, however, the study shed light on the importance of the interconnectedness and complexity of different influential factors regarding adolescents and having experienced intoxication by choice. Therefore, these limitations can provide guidance as to how the topic of adolescents and alcohol use could be approached for future research.

9 Conclusion

This study examined how social environment factors chosen from Urie Bronfenbrenner's ecological theory of human development (1979) affected adolescents in Norway and in the US to participate in risky behavior of having been intoxicated by choice. This is especially important since getting intoxicated by choice from adolescence leads to higher odds of alcohol addiction, dependence, and hazardous health consequences. Studying and comparing the influence of social environment factors of demographic variables, individual characteristics, parental, peer school, and policy-influence in different cultural settings of Norway and US provides a clearer idea about how these social influences can vary in different settings.

Both the US and Norway showed peer factors as the strongest social environment factors influencing the odds of adolescents having been drunk. The next most influential factors for both countries were number of school days cut, number of times one has visited a therapist/professional helper/school nurse for substance use, and talking to parents about personal problems, although not necessarily in this order for each country.

Moreover, the results of this study showed that the two countries differed in terms when it came to the role of sex, being depressed about one's future, and father's education on the odds of adolescents having been drunk. Sex did not have significant influence on the odds of adolescents having been drunk in the US, whereas in Norway, the results showed that male adolescents had higher odds of having been drunk compared to female adolescents. Being depressed about one's future and father's education level also showed to have more significant influence on Norwegian adolescents, but these did not have much influence in the US.

Identifying common factors that showed the strongest influence on the odds of adolescents having been drunk in both countries provide insight for researchers and policy makers as to which approach they should take in creating policies and other preventive measures regarding adolescents and alcohol use. Moreover, recognizing the differences in the influence of factors between the two countries show that there may be other environmental and cultural factors that are at play. This implies how complicated the interrelationships between various social environment factors and alcohol use can be. Nonetheless, by recognizing this complexity, this study acts as a stepping stone towards creating better preventive approaches for adolescents and alcohol use.

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