# Health and socio-economic impact of alcohol in a typical Russian City: Identifying dimensions of alcohol use among Russian men and their effects upon health and employment

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# Declaration of Authorship

I, Sarah Cook, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis

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# Abstract

Male life expectancy in Russia is extremely low for an industrialised country. Alcohol is an important contributory factor to low life expectancy and an important health determinant in Russian men. Conventional methods of measuring alcohol consumption may not fully capture distinctive aspects of Russian drinking. The aim of this PhD was to identify latent dimensions of alcohol use and to investigate their socio-demographic correlates and their effects on health and employment among working-age men (aged 25-60) in Izhevsk, Russia.

The data used were from the Izhevsk Family Studies (IFS -1 and IFS-2). IFS-1 included a cross-sectional survey of 1941 working-age men resident in Izhevsk (2003-6). Controls were followed up at IFS-2 (2008-10).Three latent dimensions of beverage alcohol intake (beer, wine and spirit intake) were constructed from questionnaire responses on frequency, usual volume and maximum volume of each beverage and one latent dimension of acute alcohol-related dysfunction from responses on frequency of hangover, excessive drunkenness, sleeping in clothes because of drunkenness and failing family or personal obligations because of drinking. The relationship between these latent dimensions of alcohol use, socio-demographic factors, employment and cardiovascular risk factors were investigated using structural equation modelling.

The latent factors of beverage alcohol intake were strong predictors of alcohol-related dysfunction, with spirit intake being the most influential. Alcohol-related dysfunction showed a strong association with education which was only partly explained by beverage alcohol intake and other observed aspects of alcohol consumption. Alcohol-related dysfunction was a strong predictor of employment status and an important mediator of the relationship between alcohol intake and employment. All four latent variables showed similar associations with serum lipids. Beer intake, spirit intake and alcohol-related dysfunction were strongly associated with hypertension.

Hazardous alcohol consumption in Russian men strongly influenced employment status and cardiovascular risk factors. A latent variable approach to measuring alcohol use particularly acute alcohol-related dysfunction provided information of the relationship between alcohol, health and socio-economic circumstances in Russian men beyond that obtained using more conventional observed measures such as total volume of ethanol.

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## Glossary of definitions and abbreviations

**ADH:** Alcohol dehydrogenase, an enzyme involved in the metabolism of ethanol

**Alcohol dependence:** A cluster of behavioural, cognitive and physiological phenomena that develop after repeated substance use and that typically include a strong desire to take the drug, difficulties in controlling its use, persisting in its use despite harmful consequences, a higher priority given to use than to other activities and obligations, increased tolerance, and sometimes a physical withdrawal state (ICD-10) or a maladaptive pattern of alcohol use manifested by recurrent and significant adverse consequences related to the repeated use of alcohol (DSM-IV)

**ALDH:** Acetaldehyde dehydrogenase, an enzyme involved in the metabolism of acetaldehyde (produced during metabolism of ethanol)

**ALT:** Alanine Transanimase, a liver enzyme which can be used as an alcohol biomarker

**ANOVA**: Analysis of variance. A statistical test of the evidence for a difference in means between several groups using the F statistic (the ratio of between group variance to within group variance)

**Apo A1:** Apoprotein A1, the main protein component of High Density Lipoprotein

**Apo B:** Apoprotein B, the main protein component of Low Density Lipoprotein

**AST:** Asparate Transanimase, a liver enzyme which can be used as an alcohol biomarker

**AUDIT**: Alcohol Use Disorders Identification Test

**BMI**: Body Mass Index

**CDT**: Carbohydrate Deficient Transferrin, an alcohol biomarker. CDT is a variant of the serum glycoprotein transferrin produced in the liver. The proportion of carbohydrate deficient transferrin molecules is raised after sustained heavy drinking.

**CFA:** Confirmatory Factor Analysis

**CFI:** Confirmatory Fit Index, a goodness of fit index

**CI:** Confidence Interval

**DSM-IV**: Diagnostic and Statistical Manual of Mental Disorders IV

**Factor Loading**: A measure of the strength of association between observed variables and an underlying latent factor

**Factor Score**: The predicted score someone would receive on a latent factor if it was observable.

**GGT**: Gamma glutamyl transferase, a liver enzyme which can be used as a biomarker of heavy alcohol consumption

**Harmful alcohol use:** Alcohol use that results in harm to physical or mental health

**Hazardous drinking:** A pattern of alcohol consumption that increases the risk of harmful consequence to the drinker and to others.

**HDL:** High Density Lipoprotein

**ICD-10:** International Classification of Disease 10

**IFS-1:** Izhevsk Family Study 1

**IFS-2:** Izhevsk Family Study 2

**IQR**: Inter-quartile range

**LDL:** Low Density Lipoprotein

**MAR:** Missing at random

**MCAR**: Missing completely at random

**MCV:** Mean corpuscular erthrocyte volume, can be used as an alcohol biomarker

**MLE**: Maximum likelihood estimation

**NMAR**: Not missing at random

**Non-beverage Alcohol:** Sources of alcohol not intended to be drunk such as eau de cologne and medicinal tinctures

**Polychoric correlation**: A measure of the correlation between two theoretically normally distributed continuous variables from two observed categorical variables

**Probit regression:** An analysis method for modelling binary outcome variables using an inverse cumulative standard normal distribution function

**RMSEA:** Root Mean Square of Approximation. A goodness of fit index

**SEM:** Structural Equation Modelling

**TLI:** Tucker Lewis Index: A goodness of fit index

**WHO:** World Health Organisation

**WLSMV:** Weighted least squares with mean and variance adjusted, an estimation method for structural equation models suitable for categorical data

**Zapoi:** A period of continuous drunkenness of several days or more during which a person does not work and is withdrawn from normal life

# Section I: Introduction, literature review and methods

# Chapter 1: Aims and Objectives

## 1.1 Rationale

Alcohol is an important determinant of morbidity and mortality in Russian men. In addition to contributing to high mortality in Russia, excessive alcohol use is a cause of a wide range of physical, psychological, and social problems.

In order to fully understand the impact of alcohol use in Russia it is necessary to have valid tools for measuring alcohol consumption both in terms of overall alcohol intake and how alcohol is consumed (drinking pattern). However there is no gold standard for measurement of alcohol consumption and alcohol-related problems. The necessity of using self-reported data from surveys introduces measurement error and bias. Previous studies of alcohol consumption in Russia have used conventional measures of alcohol intake (i.e. quantity-frequency, graduated-frequency and recent recall). However given the high prevalence of consuming unrecorded sources of alcohol such as non-beverage alcohol (sources of alcohol not intended for consumption) these methods may significantly underestimate actual alcohol intake. In addition distinctive features of Russian drinking such as very heavy episodic drinking and zapoi (a period of continuous drunkenness during which a person is withdrawn from normal social life), which may have substantial effects on health and other negative consequences of alcohol use such as alcohol-related violence, unemployment and relationship breakdown, may not be identified using conventional questions on quantity and frequency. Other less conventional questions such as the frequency of intoxication and hangover therefore could be used to provide additional information. However the short term effects of alcohol such as drunkenness show substantial inter- and intra-person variation due to differences in tolerance and alcohol metabolism which limits the use of questions on them unless used in conjunction with other variables.

The multi-dimensional nature of alcohol consumption limits the use of one alcohol variable alone as an adequate measure of an individual's drinking.  Measuring many different variables and then combining them using statistical methods such as factor analysis has potential advantages for maximising the use of the information available. This approach could be particularly useful for characterising Russian drinking since questions on drinking behaviours distinctive to Russia such as zapoi could be combined with more conventional questions such as quantity-frequency indexes.

The Izhevsk Family Studies collected a large amount of data on alcohol consumption and its acute consequences on a population sample of working age men aged 25-60 resident in Izhevsk, Russia at two time-points (2003-2006 and 2008-10). These studies included conventional questions on frequency and quantity of beer, wine and spirits but also included questions on the frequency of consuming non-beverage alcohol, drinking patterns including the prevalence of zapoi, and the acute consequences of alcohol consumption such as hangover and excessive drunkenness. The studies also collected a large amount of data on socio-economic, demographic and health variables.

Valid measurement of alcohol consumption both in terms of drinking pattern and overall amount of ethanol consumed is necessary in order to increase knowledge on the determinants of alcohol use and the effects of alcohol on health. The Izhevsk Family Studies offer a unique opportunity to explore the relationship between several different measures of alcohol use and therefore to develop a typology with several key dimensions of alcohol use that can be used in an analysis that fully exploits all the available information on alcohol to understand better the effects of alcohol on health and employment.

## 1.2 Aims

The aim of this thesis is to increase knowledge on the characterisation of drinking in Russia including drinking patterns and acute consequences of drinking in order to improve understanding of the relationship between alcohol use and health and socio-economic circumstances.

## 1.3 Objectives

1) To develop a typology of alcohol use by identifying key latent dimensions of alcohol use using data from the Izhevsk Family Studies.

2) To use these latent dimensions to investigate the relationship between alcohol, socio-economic factors and health in working-age men in Izhevsk, Russia.

## 1.4 Summary of thesis

The first part of the thesis (Section 1) explores in greater detail the existing literature of alcohol consumption in Russia and the strong link between hazardous drinking and mortality in Russian men. This is followed by a literature review on existing methods of measurement of alcohol use. Section 1 also contains a detailed description of the Izhevsk Family Studies including the distribution of socio-demographic, health and alcohol use variables and the methods used for identifying latent dimension of alcohol use (Objective 1). Overall three latent dimensions of alcohol intake (beer intake, wine intake and spirit intake) and one latent dimension of acute alcohol-related dysfunction were identified using observed variables from the Izhevsk Family Study interviews. In addition the factor structure of the internationally validated measure the Alcohol Use Disorders Identification Test (AUDIT) was investigated in this population and found to support a structure with two latent dimensions (alcohol consumption and alcohol-related problems).

Section 2 of the thesis contains the results of analyses investigating the relationship between latent dimensions of alcohol use developed in Section 1 and socio-demographic and health variables (Objective 2). The first three chapters of this section are concerned with the relationship between alcohol consumption and socio-demographic factors. The first two are written as research papers. The main substantive aim of Paper 1 was to investigate the cross-sectional association between socio-demographic variables such as age and education and the latent dimensions of the AUDIT. Following the finding in the Paper 1 that education was associated with alcohol-related problems but not alcohol consumption, structural equation modelling was used to investigate the relationship between education and alcohol-related dysfunction (Paper 2). A strong association was found between education and the latent dimension of acute alcohol-related dysfunction which could only be partly explained by aspects of alcohol consumption and drinking patterns. In the third chapter of this section (Chapter 9) the relationship between alcohol intake, acute alcohol-related dysfunction and employment is investigated using longitudinal data. Alcohol-related dysfunction was found to be a strong predictor of employment status and an important mediator of the relationship between alcohol intake and employment. The last chapter in the section (Chapter 10) examines the association between latent dimensions of alcohol use and cardiovascular risk factors. The focus of this chapter is on cardiovascular health because of the very high mortality among Russian men attributable to cardiovascular disease. The findings show strong positive associations between alcohol use and hypertension but paradoxically higher levels of alcohol consumption, even frequent dysfunctional drinking, were associated with a traditionally cardio-protective lipid profile.

The last section of the thesis (Section 3) contains a discussion of the findings both in terms of substantive findings on the relationship between alcohol use and health and socio-economic circumstances in Russian men and also the methodological findings in terms of using latent variables to measure alcohol use.

# Chapter 2: Alcohol use in Russia

## 2.1 Alcohol and Low Life expectancy in Russia

Life expectancy in Russia is extremely low for an industrialised country (1-3). Male life expectancy at birth in 2009 was 62.8 years and female life expectancy was 75.0 years (4). This difference in life expectancy between men and women is one of the largest in the world (5). Mortality rates in Russia have fluctuated over the past twenty years with the greatest variation seen in working-age men, although the same trends have been seen in working-age women. Conversely death rates in children have been declining and mortality in the elderly has remained relatively stable(3, 6-8). The most variation in mortality rates has been seen in causes directly related to alcohol consumption such as acute alcohol poisoning and liver cirrhosis (3), but also in causes which may be strongly related to alcohol such as accidents and cardiovascular disease (9, 10). Cardiovascular disease is the leading cause of death in Russia and the male mortality rate from cardiovascular disease is one of the highest in the world(7, 11). Limited data on trends in alcohol consumption have shown the same pattern of fluctuations as mortality (2, 3, 7, 12, 13). Alcohol consumption is an important contributory factor to the low life expectancy in Russia especially among men (1, 3, 6, 7, 9, 10, 13-16), although other factors such as smoking (14, 17-19),high levels of psychosocial stress (7, 19) and poor health care provision (19-21) are also important. Two separate case-control studies and a longitudinal study have estimated that 26%-59% of mortality in working-age men is attributable to hazardous drinking (1, 9, 22).

In addition to contributing to high mortality in Russia, excessive alcohol consumption also has negative effects not just for drinkers themselves but also those around them and society as a whole, e.g. through increased violence, crime, relationship breakdown and economic costs due to effects on work such as increased sickness absence and low productivity(16). Alcohol consumption has been estimated as the leading cause of disability adjusted life years lost in Russia (23).

## 2.2 Potential Drivers of Hazardous Alcohol Consumption

The collapse of the Soviet Union generated major socio-economic upheavals at least in part through privatisation and the speed at which change occurred. These changes were associated with increased levels of poverty and declines in living standards with high levels of unemployment, wage arrears, payment in goods rather than money and enforced unpaid leave but also with massive increases in income inequalities(24). High levels of psycho-social stress associated with the sudden collapse of the political, economic and social system resulting in instability and uncertainty have been considered as potential drivers of hazardous drinking and corresponding levels of high mortality(25, 26). Treisman (2010) also found that changes in mortality rate between 1990 and 2007 were strongly linked to the relative affordability of vodka. While the cost of many goods including food increased in the early 1990s, the relative price of vodka decreased(8). The causes of hazardous alcohol consumption in Russia are complex and it is likely there is interaction between several of the suggested factors. The underlying social, economic and political situation in Russia needs to be taken into account in understanding the relationship between alcohol consumption, socio-economic circumstances, and health.

## 2.3 Amount of alcohol consumed in Russia

The most conventional and commonly used measure of alcohol consumption is the total volume of ethanol consumed. At a national level this is measured in terms of amount of ethanol consumed per year for each member of the population aged over 15 years (per capita consumption). The main sources of data used to calculate per capita consumption are official statistics on alcohol sales, production or taxation (27). This is known as recorded consumption. Unrecorded alcohol consumption refers to alcohol not registered in the country where it was consumed such as illegally produced or smuggled products or homemade alcohol(28)and by its nature is very difficult to estimate accurately. Drinking in Russia includes the consumption of home brew (samogon) and non-beverage alcohol (sources of alcohol not designed for drinking such as eau-de-colognes and medicinal tinctures)(29). It is difficult to measure average per capita alcohol consumption in Russia because of high “unrecorded” consumption of these products and of illegal bootleg spirits (3).

The World Health Organisation (WHO) Global status report on alcohol and health 2011 estimated per capita consumption of alcohol in the Russian Federation to be 15.7 Litres of pure alcohol compared to 12.2 Litres in the WHO European region as a whole(30). This consisted of 11 Litres from recorded consumption and 4.7 Litres from unrecorded consumption. However it is unclear how the official estimates of unrecorded alcohol consumption are derived. Nemstov (2000) used an alternative method of calculating per capita consumption between 1980 and 1994 based on sales of sugar (used for production of home brew) and mortality from external causes(31).This yielded higher estimates than official data on both adult per capita consumption and the proportion from unrecorded sources, however even these estimates may underestimate the true amount of alcohol consumed (13). Estimated per capita alcohol consumption from 1990-2008 in Russia compared to the United Kingdom using both official World Health Organisation estimates and Nemstov’s estimates for 1990-1994 are shown in Table 2.1

**Table 2.1 Estimated per capita consumption of alcohol in Russia from different sources and estimated per capita consumption of alcohol in the UK (1990-2008)**

| Year | Russia | | | UK | |
|---|---|---|---|---|---|
| | World Health Organisation | | Nemstov 2000 (31) | World Health Organisation | |
| | Recorded(32) | Unrecorded | | Recorded(32) | Unrecorded |
| 1990 | 7.14 | - | 12.29 | 9.52 | - |
| 1991 | 7.54 | - | 12.67 | 9.41 | - |
| 1992 | 6.63 | - | 13.23 | 9.42 | - |
| 1993 | 7.83 | - | 13.90 | 9.18 | - |
| 1994 | 8.66 | - | 14.60 | 9.32 | - |
| 1995 | 11.17 | 4.9[a] | - | 9.55 | 2.0[a] |
| 1996 | 9.19 | | - | 9.42 | |
| 1997 | 9.14 | | - | 9.90 | |
| 1998 | 9.80 | | - | 10.15 | |
| 1999 | 10.57 | | - | 9.89 | |
| 2000 | 9.78 | | - | 10.36 | |
| 2001 | 10.02 | | - | 10.33 | |
| 2002 | 10.34 | | - | 11.46 | |
| 2003 | 11.26 | 4.7[b] | - | 11.70 | 1.70[b] |
| 2004 | 10.87 | | - | 11.78 | |
| 2005 | 10.98 | | - | 11.54 | |
| 2006 | 11.12 | - | - | 11.39 | - |
| 2007 | 11.45 | - | - | 11.23 | - |
| 2008 | 11.50 | - | - | 10.87 | - |

[a]Average estimated by group of key alcohol experts from 1995-2002 (33)

[b]Average estimated for 2003-2005(30)

## 2.4 Types of alcohol consumed

The main beverage type consumed in Russia is spirits (3, 15, 34). The World Health Organisation World status report on Alcohol and Health 2011 reported that 63% of recorded per capita alcohol consumption in the Russian Federation came from spirits, 33% from beer, 1% from wine and 3% from other recorded sources such as cider and fortified wines (30). This report does not include unrecorded sources of alcohol such as samogon and non-beverage alcohol.

The type of beverage consumed differs between men and women. A qualitative study of 20 women and 24 men aged 48 to 63 living in Novosibirsk found that while men preferred to drink vodka, the women mainly reported drinking wine, sparkling wine or martini (5).

There is a relatively high prevalence of drinking non-beverage alcohol, estimated at 7.2% from a cross-sectional survey of 1750 men aged 25-54 in Izhevsk, Russia (2). These products can be purchased legally throughout Russia from pharmacies, kiosks and small shops. They generally have a very high ethanol content, for example the average ethanol concentration of medicinal tinctures has been estimated at 70-78% ethanol by volume (29, 35), whilst normally costing much less than commercial vodka(29, 36, 37). Little is known about the health effects of consuming these sources of alcohol. There is some evidence that the quality of alcohol may have negative effects on health over and above those caused by consumption of ethanol in particular with regard to liver disease, alcohol poisoning and mortality, but it is extremely difficult to disentangle the effects of quality of alcohol from associated hazardous drinking(38). Potential reasons for harmful health effects of unrecorded sources of ethanol such as non-beverage and home-made sources of alcohol include higher overall content of ethanol, acetaldehyde and methanol and other additional toxins such as diethyphthalate which is sometimes used in cosmetic alcohol(38). Analysis of several types of non-beverage alcohol sold and consumed in Izhevsk found no impurities, although analysis of several samples of samogon from the same area were found to contain toxic alcohols such as 1-propanol, isobutanol and isoamyl alcohol (37).

## 2.5 Drinking Pattern

Distinctive features of Russian drinking include both what is consumed such as non-beverage alcohol and large volumes of spirits, and also how alcohol is consumed. Rates of problem drinking are higher in Russian men than in Polish men despite having a similar officially recorded per capita alcohol consumption(39). This may be in part due to limitations in measurement of alcohol consumption because of unrecorded alcohol but also because of differences in drinking pattern with Russian men drinking less frequently but more heavily on drinking occasions.

Russia is atypical in terms of drinking behaviour compared to the much of the rest of the world. Drinking spirits and drinking to intoxication are common and socially acceptable behaviours. The drinking culture in Russia is similar to the Northern European drinking pattern also found in Estonia, Latvia, Lithuania, Poland, Ukraine and the Nordic Countries (Denmark, Norway, Finland, Sweden and Iceland) which is characterised by drinking spirits, non-daily drinking, irregular heavy drinking episodes and the acceptance of public drunkenness (34). Rehm et al (2004) developed a system of ranking country-specific drinking patterns in terms of hazard involved per capita litre of alcohol using six markers of drinking pattern at the national level: amount drunk per occasion, frequency of drunkenness, frequency of festive drinking, frequency of drinking in public, frequency of drinking with meals and rate of daily drinking(40).Using this categorisation Russia was found to have one of the most detrimental patterns of drinking in Europe (34).

Russians recognise a phenomenon known as zapoi - a period of continuous drunkenness lasting several days in which a person is withdrawn from everyday life. This is different to the concept of “binge” drinking commonly recognised in Western Europe as drinking a large amount of alcohol on one occasion. A cross-sectional survey of 1750 men aged 25 - 54 in Izhevsk, Russia found 10% had had at least one episode of zapoi in the past year reported by a proxy(2).There is very little research onthe health effects of these very heavy bouts of drinking (3). The very extreme patterns of alcohol consumption that are seen in some men are poorly captured by conventional measures of quantity and frequency of drinking beverages.

## 2.6 Differences in drinking by gender and socio-economic status

There are large gender differences in alcohol consumption with men drinking much more than women (3, 5, 15, 41-43). There are also trends in alcohol consumption with education and marital status (2, 41-43). Data from three cross-sectional surveys of random samples of the population aged 25-64 in Novosibirsk, Russia from the time periods 1985/6, 1988/9 and 1994/5 were used to examine associations of alcohol consumption with education and marital status. Measures of alcohol consumption were mean alcohol intake in the past week, prevalence of drinking alcohol at least twice a week, mean alcohol intake per typical drinking episode and prevalence of binge drinking (defined as 80g or more of ethanol for men and 60g of ethanol or more for women). Men had much higher levels than women for all the drinking indices. In men there were differences in these measures of drinking with education at all three time periods except for mean alcohol intake in the past week where there was no evidence of a trend for 1994/5. Men with university education had the lowest levels of drinking for all drinking indices. The same trend was not seen for women. There was a general trend for higher levels of drinking in divorced and widowed men although this was inconsistent between measures of drinking and at different points in time(41). A cross-sectional survey from Taganrog, Russia of the general population aged 25-54 years also found higher levels of heavier drinking (160g or more of pure alcohol per week) in men with lower levels of education(42) and a cross-sectional survey from Moscow found that both men and women with higher education were less likely to binge drink (>80g of ethanol per occasion for men and >60g for women) than those with secondary education or less(43).A cross-sectional study of men aged 25-54 in Izhevsk found a strong association between education and hazardous drinking behaviours such as consumption of non-beverage alcohol, continuous drunkenness lasting two or more days and frequent hangover but not daily consumption of spirits. All these hazardous drinking behaviours were more prevalent in men with lower levels of education and least prevalent in men with university level education(2).

Mortality in Russia shows a strong gradient with education and socio-economic gradients in mortality are increasing, however relatively little is known about their determinants including the role of alcohol consumption (14, 17, 44, 45). This is a particularly important area given that many socio-economic and psychosocial factors, which may interact with heavy alcohol consumption such as psychosocial stress, unemployment, income and education, have been linked with low life expectancy in Russian men(7, 19).

## 2.7 Measurement of alcohol use in Russia (1985-2005)

There are several dimensions which can be considered when measuring alcohol consumption at the individual level: the total volume consumed, how alcohol is consumed (pattern of drinking) and short term effects of drinking such as intoxication or hangover.

Studies which have used survey data to measure alcohol consumption in Russia have mainly used conventional approaches for measuring the total volume of ethanol consumed. These include quantity-frequency approaches with questions on frequency and usual amount of beer, wine and spirits consumed and sometimes the maximum amount consumed (9, 46-49), graduated frequency approaches (5, 39), and recent recall approaches (48, 49). Questions on the frequency of intoxication and amnesia have also been used (39). Due to the high prevalence of spirit drinking one survey only asked about the frequency of drinking spirits and frequency of drinking more than 0.5 Litres of spirits on one drinking occasion (15).

Measurement of alcohol consumption and its consequences depends heavily on self-report, which is subject to measurement error and bias. A qualitative study of 20 women and 24 men resident in Novosibirsk found that some participants originally only reported drinking on special occasions but on closer questioning also reported other drinking patterns such as drinking after work. In particular many participants did not consider drinking small amounts of beer counted as “having a drink”(5). In Russia there are likely to be additional problems with using only conventional questions on quantity, usual frequency and frequency of heavy drinking using a threshold such as five or more “standard” drinks because the drinking culture includes sources of ethanol such as samogon and non-beverage alcohols where it is extremely difficult to estimate the quantity of ethanol consumed.

In conclusion hazardous drinking is extremely common in Russia and is a major cause of mortality and morbidity especially in men. Given the strong association between hazardous drinking and high mortality in Russian men, relatively little research has been done investigating socio-demographic correlates with drinking and effects of alcohol on health and social outcomes such as employment. A major aim of this thesis was to improve understanding of the relationship between alcohol use and health and socio-economic circumstances in Russian men. An important element in investigating this is having valid measures of alcohol use. Previous studies have used conventional measures of alcohol consumption which may not adequately capture the effects of characteristic features of Russian drinking such as consumption of non-beverage alcohol. In order to consider how best to measure alcohol use in Russia it is necessary to understand how alcohol use has been measured elsewhere and the strengths and limitations of various existing measures of alcohol consumption.

# Chapter 3: Literature Review on the Measurement of Alcohol Use

Alcohol is associated with many negative effects including physical, psychological and social problems. In order to understand the relationship between alcohol consumption and negative outcomes it is necessary to have valid measures of alcohol use. There is no gold standard for measuring alcohol use and the method used should depend on the purpose of the research. For example international comparisons will require standardised instruments with questions which translate across different cultures whereas methods for separating levels of risk within a single population will not.

## 3.1 Measuring Alcohol Intake

Conventional methods of measuring alcohol use have concentrated on measurement of quantity and frequency of alcohol consumed to estimate an overall measure of consumption, such as the average amount per day or total volume consumed per year. The accuracy needed is dependent on the purpose of data collected, for example ranking people in terms of alcohol use to stratify by risk compared to estimating the absolute volume consumed within a population.

The most commonly used method for measuring alcohol consumption is the quantity-frequency index (50).This in its simplest form measures alcohol consumption using two questions – the usual number of drinks on an average drinking occasion(quantity) and the number of drinking occasions within a stated time period (frequency). When asked about alcohol consumption using the quantity-frequency method there is evidence that respondents tend to report the modal rather than mean quantities and frequencies, which can result in underestimation since respondents do not report occasional episodes of heavy drinking (50-54).

Another commonly used approach to measuring alcohol consumption is the graduated frequency approach which involves asking respondents how often they drank various quantities of standard drinks within a reference period(55). This could either involve using discrete or cumulative quantity thresholds. A discrete threshold approach would involve questions such as: how often have you had 5-7 drinks? How often have you had 8-11 drinks? Etc.  A cumulative threshold approach would involve questions such as: how often have you had eight or more drinks? How often have you had five or more drinks? Etc. Compared to simple quantity-frequency approaches graduated frequency approaches provide additional data on variability of amount consumed(52). One disadvantage with this method is that some respondents report more than 365 drinking days per year(54).

An important consideration when asking questions on alcohol consumption in epidemiological studies is the reference period used. This could include the past week, the past month or the past year. What reference period is chosen depends on the purpose of the study and the type of drinking behaviour being studied. If a drinking behaviour is rare a longer reference period will be needed (52). If the aim is to link alcohol consumption with alcohol-related problems the reference periods need to match up and the reference period for measuring alcohol problems should not come before the period for measuring consumption (51, 55, 56). A longer period such as the past year is recommended for this so that alcohol-related problems can be measured reliably (51, 57).

The quantity-frequency and graduated frequency approaches are generally asked about over a reference period of a year although this can vary (55). Other approaches to measuring alcohol consumption are recent recall approaches where respondents are asked about only very recent alcohol consumption (50). A recent recall approach would include a drinking diary for the previous week where a respondent recalled everything they had drunk in the past week. These methods can be either prospective or retrospective. Recall error is a large problem when asking about alcohol consumption. Recall of alcohol consumption decreases even over the short period of a week (58). Although recent recall approaches have the supposed advantage of minimising measurement error related to recall of drinking they have a major weakness in only capturing drinking behaviour over a short period of time which may not be typical of a respondents usual drinking. This is a particular problem in study populations with many infrequent drinkers(59).Even with the benefits of better recall,  longer periods are considered preferable for studying the relationship between drinking patterns and alcohol-related problems at the individual level because of variation in drinking over time including seasonal variation in drinking (52, 60).

The method used to measure alcohol consumption can have an important impact on results with varying estimates of overall volume obtained when different methods of measurement are used with quantity-frequency estimates tending to be lower than either graduated frequency or recent recall approaches (54, 59, 61). Survey data always results in lower estimates of alcohol consumption than sales data. This is thought to be due to under-reporting by respondents for example under-estimating drink sizes, therefore methods which result in larger estimates of alcohol consumption are generally considered more valid (51, 62). However despite differences in overall volume of alcohol reported using different methods correlation between methods has been found to be high (27).

Questions on alcohol consumption can ask either about overall consumption (global) or about consumption of individual types of beverages (beverage specific). Russel et al (1991) compared beverage specific and global questions measured with quantity-frequency questions using data from a 1986 telephone survey of 4367 adult drinkers in New York (62). They found that the average daily ethanol intake reported was higher using beverage specific questions (0.72 ounces of ethanol per day) compared to global questions (0.49 ounces of ethanol per day), although both measures were highly correlated (0.75). Dawson (1998) also found that beverage specific estimates yielded higher estimates of alcohol consumption than questions on quantity and frequency of overall amount of alcohol consumed(63). Beverage specific questions are recommended in conjunction with questions on overall consumption because drinking frequencies cannot be summed across beverages since respondents may drink more than one type of beverage on a single drinking occasion(55). Beverage specific questions can provide useful information on the risks associated with different beverage types. For example some evidence has suggested that mortality is lower in drinkers who prefer wine compared to other beverages such as beer and spirits, with various suggested reasons for this finding including high levels of non alcohol anti oxidants in wine, difference in drinking pattern with beverage type and confounding by other factors such as socio-economic status and lifestyle factors (64-66). However there are other studies which have not found this and evidence remains inconclusive (66). Beverage specific questions may also be useful for covering some sources of unrecorded alcohol. The term unrecorded alcohol refers to alcohol not registered in the country it was consumed such as illegally produced or smuggled products or homemade alcohol(28).

There is no gold standard method for measuring alcohol consumption and the choice of method used is dependent on the purpose of the study(51, 53). For example the World Health Organisation recommends the use of graduated frequency methods for national surveys on alcohol consumption but also suggests use of recent recall methods for measuring sources and amount of unrecorded alcohol consumed (27).

There are inherent difficulties when trying to measure alcohol consumption accurately: Alcohol consumption is conventionally expressed in grams of ethanol(50). However respondents cannot be expected to report this accurately. It is more usual to ask about “drinks” “units” “bottles” or “cans” and convert this information into a standardised form making assumptions about the portion size and alcohol content of a “standard” drink. Estimation of standard drinks is particularly difficult when people are drinking at home or at parties compared to drinking in licensed premises with standardised measures. Studies In Scotland and Holland have shown that self- poured drinks on average contain more ethanol than the standard drink in that country(67, 68). In many social settings even the number of drinks may be difficult to estimate since people may drink from a shared container(27). Strength of different drinks is also an issue. Even when asking about the same beverage there can be substantial variation in strength over time and place(27, 54). Standardisation of drinking measures is a particular issue when making cross cultural comparisons. The amount of ethanol in a standard drink is very variable across countries (27).

Only measuring total volume of alcohol consumed can be criticised because then it is not possible to distinguish different drinking patterns and variation in amount drunk on different occasions but it is still an important measure in alcohol research. Research has consistently shown that total volume of alcohol consumed is related to a large number of physical, emotional and social consequences (63, 69, 70).However information on alcohol consumption is more useful when combined with information on drinking pattern (39, 63).

## 3.2 Drinking Pattern

The relationship between alcohol use and alcohol-related problems is not defined by the single dimension of average or total volume of alcohol consumed (53, 70, 71). Drinking pattern has been shown to be important in addition to total volume of alcohol consumed for a variety of alcohol-related problems including mortality (39, 71-85). Drinking pattern can refer to anything related to alcohol use beyond the measurement of volume consumed. The term is commonly used in reference to frequency of heavy or binge drinking but could also include social setting, activities and circumstances surrounding drinking, temporal variation in drinking and beverage choice (71). Drinking patterns are substantially affected by both geographic location and  culture (34, 39, 86-88). Differences in drinking pattern have an important impact on the relationship between alcohol consumption and alcohol-related harm both at the individual and population level (39).

An important aspect of drinking pattern is the frequency of heavy or binge drinking. Binge drinking has been defined as drinking a large amount of alcohol on one occasion, drinking double the daily sensible drinking guidelines, or drinking to intoxication (85, 89). Heavy drinking has been linked to a variety of detrimental health and social consequences independent of total volume consumed and for some outcomes may even be a stronger predictor of alcohol-related harm (39, 53, 71, 76-78, 82, 84, 89, 90). Questions used to measure this involve asking about either the number of times a threshold number of standard drinks is exceeded on a drinking occasion or the maximum number of drinks consumed on one occasion during a reference period such as the past year (72).

Unfortunately there is no universally accepteddefinition of a  heavy drinking occasion (89). The most commonly used criteria especially in North American surveys is a threshold level of 5 or more drinks on one occasion (or 4 or more drinks in women) although there is no empirical basis for this cut-off(91, 92). The suggested threshold by the World Health Organisation as a cut-off for high risk drinking is 60g of ethanol for men. The number of standard drinks this corresponds to varies because the definition of a standard drink differs between countries. In North America the standard drink is usually 12g but sometimes 14g, in Canada it is 13.6g, in Australia and New Zealand 10g and the standard UK unit of alcohol is approximately 8g (27).A study of 115 young adults in North America comparing threshold levels ranging from +1 to +15 drinks as predictors for a variety of adverse outcomes at 10 months found no optimum threshold for predicting all of the outcomes but that the 5+ threshold was a good overall indicator of alcohol-related risk (91). Williams et al (1997) using data from the 1988 National Health Interview Survey in the US compared the predictive value of 5+ and 9+ drinks in predicting 10 different diseases including alcohol dependence(84). There was a strong relationship between both 5+ and 9+ drinks and alcohol dependence. The 9+ measure showed more associations with other diseases but with smaller numbers of people identified. The author's conclusion was "5 or more drinks per day works well as a measure of heavy drinking and for a single item, shows some robust associations to various health outcomes". However Hilton (1987) using data from a national survey of 5221 American adults found that the frequency of drinking 8+ drinks was a better predictor of alcohol-related problems than frequency of drinking  5+ drinks(93). A general population survey of 1760 adults in Finland found that drinking 8-12 drinks per drinking day accounted for most alcohol problems in the population amongst men. In this study one drink was defined as 12 grams of ethanol (94). Dawson et al (2010) used data from the 2001-2002 1st wave of the National Epidemiologic Survey on Alcohol and Related conditions in the United States to calculate the sensitivity and specificity of questions on the frequency of drinking 5+ drinks (4+ drinks in women) and on the maximum number of drinks per occasion as screening items for alcohol dependence, alcohol abuse and hazardous drinking (95). Both questions had high sensitivity and specificity for detection of all three outcomes.

Questions which only ask about frequency of drinking a certain number of drinks or the maximum number of drinks consumed still concentrate on the volume of alcohol consumed and overlook other aspects of drinking pattern such as speed of consumption. Absorption of alcohol is affected by many factors including the type of alcohol consumed (beverage type or strength); how much food has been eaten, and speed of drinking(85).

Questions on intoxication or drunkenness are more likely to include some indication of alcohol absorption than questions which only ask about total volume consumed, and therefore may be good markers of adverse drinking patterns.

Questions on frequency of drunkenness or intoxication have often been used as alternative methods of asking about heavy drinking. Again this has been asked about in a variety of ways such as the frequency of “drunkenness”, “getting drunk”, “feeling intoxicated and “really feeling the effects of alcohol” (88, 96-99). The phrasing of questions of this nature is important. Respondents in a Finnish survey were asked both how often they became intoxicated and how often they became intoxicated so much that they really felt it. In men the prevalence found in response to these questions was 14.3% and 6.8% respectively (99). However respondents in a national survey in the United States were more likely to report “feeling the effects of alcohol” than “feeling drunk”(92). Cultural definitions of drunkenness can vary making cross cultural comparisons difficult. For example in a survey comparing drinking patterns in Denmark, Sweden, Norway and Finland subjective reporting of intoxication was a very different measure than frequency of drinking 6+ drinks. There was a higher frequency of self-reported intoxication in Finland than Denmark but a much higher reported frequency of drinking 6+ drinks in Denmark than in Finland (99). For these reason participants at a 2000 conference focused on developing consensus on questionnaire items for measuring alcohol consumption and alcohol-related social problems criticised questions on drunkenness as a measure of heavy drinking but felt that questions about the culturally influenced experience of being drunk were valuable in their own right. They also recommended questions on the frequency of drunkenness or intoxication over questions on “feeling the effects” of alcohol(57). Frequency of self-reported drunkenness is a subjective measure which can be influenced by personal experience, and both biological and social factors(92). People differ in the number of drinks required to become intoxicated. People who drink more frequently are likely to have a higher tolerance for alcohol and need more drinks before they feel the effects(99). A national survey of 2178 adults living in the United States compared the predictive value of questions on frequency of feeling drunk, feeling the effects of alcohol and frequency of drinking 5 or more drinks measured using a graduated frequency approach. Outcomes were social problems, alcohol- related harm and alcohol dependence, assessed by two alcohol problem scales and a dependence symptom scale. Frequency of feeling drunk was the best predictor of all three outcomes and frequency of feeling the effects of alcohol was the worst predictor(92). Despite some limitations questions of intoxication may capture adverse drinking patterns better than number of drinks consumed per occasion since they include information on the short term effects of alcohol, and because intoxication reflects a state where alcohol is having a physiological effect on the body. Intoxication is a particularly important aspect of alcohol use when examining acute alcohol-related problems such as accidents or violence.

## 3.3 Physiology of alcohol absorption and metabolism

The importance of drinking pattern is related to how alcohol is absorbed and metabolised and to the physiological effects of alcohol in both the short and the long term. Alcohol is the term used for the molecule ethanol ($C_2H_5OH$) when ingested as a beverage. Ethanol is a water soluble molecule which is absorbed throughout the gastro-intestinal tract. Exposure to alcohol is greatest at the liver due to supply from the hepatic portal vein (85, 100). Once absorbed alcohol diffuses quickly to organs with a rich blood supply such as the brain and lungs (100, 101). Factors affecting absorption of alcohol include gender, body size, gastric emptying (which is affected by food and certain drugs), and the speed of drinking (85).

The majority of alcohol (90%) is metabolised in the liver although some is also metabolised in the gastric mucosa. Approximately 2-5% is excreted in sweat, urine and on the breath. Factors affecting the speed of alcohol metabolism are gender (women slower than men), frequency and quantity of alcohol intake, body weight and liver size. Alcohol is toxic and must be metabolised as soon as it is absorbed. There are three steps in alcohol metabolism (Figure 3.1): the oxidation of ethanol to acetaldehyde, acetaldehyde to acetate and acetate to acetyl Co enzyme A which can then enter the Krebs cycle (85).

**Figure 3.1 Metabolism of ethanol**

Ethanol $\longrightarrow$ Acetaldehyde $\longrightarrow$ Acetate $\longrightarrow$ Acetyl Co enzyme A

The first step has three different pathways. The main pathway shown in Figure 3.2 involves oxidation to acetaldehyde using the enzyme alcohol dehydrogenase (ADH) which is found in the cytoplasm of liver cells and gastric mucosa. This pathway involves the reduction of nicotinamide adenine dinucleotide ($NAD^+$)(85). Normal metabolism increases in heavy drinkers(100).

**Figure 3.2 Oxidation of ethanol ($C_2H_5OH$) to acetaldehyde ($CH_3CHO$) via the enzyme alcohol dehydrogenase (ADH)**

$$C_2H_5OH + NAD^+ \xrightarrow{\text{ADH}} CH_3CHO + NADH$$

A small amount of ethanol is metabolised via the Microsomal Ethanol Oxidising System (MEOS) which is induced in the liver and other tissues by repeated consumption of alcohol. This pathway is shown in Figure 3.3. The amount of alcohol needed to induce the MEOS varies from person to person. Metabolism to acetaldehyde is through oxidative phosphorylation and requires oxygen and nicotinamide adenine dinucleotide phosphate (NADPH). This reaction also involves cytochrome p450 and therefore there is competitive antagonism with various drugs. A larger proportion of alcohol is metabolised this way in those heavy and moderate drinkers who drink regularly. Once induced this pathway is only active at moderate to high concentrations of ethanol (101, 102).

**Figure 3.3 Metabolism of ethanol to acetaldehyde via the Microsomal Ethanol Oxidising System**

$$C_2H_5OH + NADPH + 2O_2 + H^+ \longrightarrow CH_3CHO + 2H_2O_2 + NADP^+$$

There is also an indirect pathway for the metabolism of ethanol which involves the enzyme catalase (Figure 3.4).

**Figure 3.4 Metabolism of ethanol to acetaldehyde via the enzyme catalase**

$$C_2H_5OH + H_2O_2 \xrightarrow{\text{Catalase}} CH_3CHO + H_2O$$

Acetaldehyde ($CH_3CHO$) is more toxic than alcohol and is converted to acetate using the enzyme acetaldehyde dehydrogenase (ALDH) as shown in Figure 3.5.

**Figure 3.5 Metabolism of acetaldehyde ($CH_3CHO$) to acetate ($CH_3COO^-$) via the enzyme acetaldehyde dehydrogenase (ALDH)**

$$CH_3CHO + NAD^+ + H_2O \xrightarrow{\text{ALDH}} CH_3COO^- + NADH + 2H^+$$

The final step in metabolism is the conversion of acetate to acetyl Co A using the enzyme acetyl Co A synthetase. This can then enter the Krebs cycle (85).

Genetic variation is seen in alcohol metabolism. There are several isoenzyme classes of ALDH. Individuals who are homozygous for the ALDH2 allele, which encodes a version of the enzyme that cannot break down acetaldehyde, have increased unpleasant side effects following alcohol consumption including facial flushing and headaches(85, 103). This genetic variant has been used as a proxy marker of alcohol consumption based on the principal of Medelian randomisation, since the unpleasant side effects mean that people with this genetic variant drink less alcohol (104, 105). However this allele is mainly found in East Asian populations therefore its potential use in Europeans is limited (103). Acetaldehyde has many direct physiological effects including vasodilation which leads to increased skin temperature and facial flushing, increased heart rate and respiratory rate, decreased blood pressure, nausea, headache and bronchoconstriction. Mechanisms involved include the release of catecholamine, opiate peptide, histamine, kinin and prostaglandin (106). Acetaldehyde has a role in several pathologies linked to alcohol use including cancers of the digestive system, upper airways and head and neck (105-107).There are also several variants of ADH. A rare genetic variant known as ADH1B is thought to encode an enzyme which increases ethanol metabolism. This variant is more common in the European population compared to ALDH2 and has also been used in Mendelian Randomisation studies as a marker of drinking propensity (103).

Individuals have different levels of tolerance to alcohol. Tolerance can be split into initial tolerance and acquired tolerance. Initial tolerance is the dose of alcohol needed to produce a desired effect at the first exposure (108). Acquired tolerance refers to the need for an increased dose of alcohol to have the same effects originally produced by a lower dose(108, 109). Acquired tolerance is usually what is meant when the term tolerance is used. Acquired tolerance is complex and can be chronic, rapid or acute (110-112). Acute tolerance refers to tolerance that occurs during a single drinking episode(112). It is seen when an individual shows a greater degree of intoxication on the rising slope of the blood alcohol curve than the falling slope for the same concentration of alcohol (110, 111, 113, 114). Chronic tolerance is a gradual change in amount of alcohol needed for intoxication following long term alcohol consumption, whilst rapid tolerance refers to a change in tolerance to alcohol occurring following only one previous dose of alcohol (111, 112).Tolerance to alcohol is acquired through drinking, both through physiological adaptation and through learnt cognitive and behavioural changes, but also has a genetic basis (101, 108, 111-113). Tolerance is considered important as the need to consume larger amounts to have the same effect is thought to increase the probability of dependence whilst increasing the amount consumed and increasing risk of alcohol damage to organs such as the heart and liver(112).

The peak blood alcohol concentration and area under the blood alcohol concentration time curve with the same amount of ethanol shows a wide range of inter and intra-person variation (101, 115, 116). The brain and blood alcohol level for a set number of drinks will vary with many factors related to both the individual (e.g. genetics, gender , and previous drinking history) and the drinking occasion( e.g. speed of consumption, beverage consumed and whether food has been consumed)(101, 115, 117-120). In a sample of 412 twins from the general population usual drinking history was found to affect both peak blood alcohol concentration and the rate of decline in blood alcohol concentration for the same dose of alcohol(118). Increasing levels of drinking were associated with higher peak blood alcohol concentration but a faster rate of decline in blood alcohol concentration. These differences were seen even comparing abstainers to very light drinkers.

## 3.4 Potential Mechanisms Underlying Harm From Alcohol

Alcohol consumption has many complex effects on physiology including effects on lipid metabolism, blood pressure and blood clotting. Physiological effects can be both short and long term. Moderate alcohol intake is associated with increased high density lipoprotein levels, which is one of the main mechanisms suggested for the protective effect of moderate alcohol consumption on coronary artery disease (71, 85, 121-124). However alcohol intake is also a cause of hyperlipidaemia (122). Ethanol has been found to interact with several pathways involved in regulating the synthesis, transport and oxidation of lipids (125). Alcohol has an anti-coagulant effect through various effects on clotting mechanisms including inhibition of fibrinogen, thromboxane A and decreased platelet adhesiveness (71, 85, 121, 123, 124, 126). Conversely alcohol seems to inhibit fibrinolysis in the short term and reactive thrombocytosis and increased platelet aggregation have been observed following alcohol withdrawal (71, 126-129). The effects of alcohol on haemostasis vary with level of alcohol consumption and heavy consumption tends to result in a more pro-coagulant state (124, 126).

The effects of alcohol on human physiology are likely to vary with drinking pattern, for example following binge drinking there is some evidence that there is no increase in high density lipoprotein levels but there may be an increase in low density lipoproteins which have adverse health consequences (128, 130-132). Episodic heavy drinking can result in cardiac arrhythmias and sudden cardiac death, although chronic alcohol consumption predisposes the heart to development of arrhythmias (127, 128, 133-135). High doses and low doses of alcohol can have opposite effects on physiological responses. For example at high concentrations ethanol is primarily metabolised via the Microsomal Ethanol Oxidising System increasing oxidative stress whilst at low concentrations it is mainly metabolised via ADH, resulting in the reduction of NAD to NADH and increasing antioxidant capacity(102, 124). Oxidative stress refers to an imbalance between the production of reactive oxygen species which can cause cell damage and the ability of the body to remove these via antioxidants(136). It is increasingly clear that pattern of drinking as well as total volume of alcohol consumed is important for investigating the effect of alcohol on health (137-140).

Other components of alcoholic beverages include plant derived bioactive phenol and poly phenol compounds in varying quantities and congeners (substances that flavour or colour drinks)(85). The relationship of these various substances to health is unclear: congeners have been linked to hangover whilst phenols and polyphenols (found particularly in red wine) may have health benefits (85, 121, 139, 141-143).

## 3.5 Measurement and Physiology of Hangover

Hangover refers to a cluster of symptoms that occur after heavy drinking shortly after all or most of the alcohol has been metabolised and blood alcohol concentration has returned to zero (144-146). It is common, with estimates from both experimental and survey data suggesting approximately 75% of drinkers have experienced a hangover (141, 144, 147, 148). Hangover is not normally experienced after consumption of small amounts of alcohol and experimental evidence suggests that in order to experience hangover peak blood alcohol concentration has to reach at least 0.11% (149, 150). Hangover has been measured in studies both as a marker of heavy drinking (2, 84, 88, 151, 152) and as an alcohol-related problem (91, 97, 98, 153, 154).

One method of measuring hangover is self-report using questions such as "in the last year how often have you had a hangover from drinking alcohol?" (151). This relies on respondents' understanding of hangover. Other approaches have involved asking about symptoms of hangover such as headache or nausea and several scales for measuring hangover have been developed (99, 148, 155-157). The main use of hangover scales is to measure severity of hangover.

There is limited evidence as to whether frequency of hangover is a good proxy measure of heavy drinking. In a cohort study of 2728 Finnish men self-reported frequency of intoxication and hangover in the past year were measured as exposure variables. The mean frequency of hangover rose with increasing frequency of intoxication. Frequency of hangover was higher than frequency of intoxication in 14.8% of men (152). The number of drinks per week has been found to be highly correlated with hangover frequency in Dutch students and the number of drinks consumed the previous evening has been found to be a strong predictor of next day hangover symptoms in two separate samples of American college students (158-160).

Susceptibility to hangover among individuals is variable. An estimated 25% of drinkers are resistant to hangover (144, 148). There is conflicting evidence about effect of usual drinking on hangover with some studies concluding that heavier drinkers have more frequent hangover(161), whilst other studies have found hangover is more common in light to moderate drinkers (141, 147). Probability of hangover following alcohol consumption can be affected by several factors unrelated to volume consumed including psychological factors and the congener content of drinks (146, 148, 149, 162). Congeners are substances that flavour or colour drinks. Beverages with high congener content such as red wine tend to produce hangover after consumption of fewer drinks (141, 146, 149). Under experimental conditions consumption of bourbon (high level of congeners) was associated with more severe hangover symptoms compared to consumption of the same volume of ethanol from vodka (low level of congeners)(163). Psychosocial factors associated with hangover include guilt about drinking, anger, depression when drunk and negative life events (148, 149, 164).

The underlying physiology of alcohol is still not well understood (146). Explanations for hangover have included alcohol withdrawal, effects of acetaldehyde or acetate, the direct effects of alcohol and the effects of congeners (141, 165, 166). It is likely that the direct effects of alcohol are at least partially responsible for hangover since many symptoms of hangover can be explained by physiological changes. Common symptoms of hangover include headache, nausea, diarrhoea, vomiting, tiredness and an overall poor sense of wellbeing (85, 147). Physiological explanations for these symptoms include dehydration and electrolyte imbalance, metabolic acidosis, gastro-intestinal disturbance, disruption of biological rhythms including sleep, vasodilation and increased cytokine production (85, 141, 146). Dehydration occurs because alcohol acts as a diuretic by suppressing anti diuretic hormone which is responsible for conservation of water (85, 141, 147). Renin and aldosterone concentrations are also raised during hangover(147). Gastro-intestinal disturbances include inflammation of the stomach and delayed gastric emptying leading to vomiting and diarrhoea. Effects on sleep include poorer quality sleep with decreased REM and shorter duration of sleep, all of which can lead to anxiousness and irritability. The exact mechanism for headache is unknown although vasodilatation, dehydration, increases in serotonin, prostaglandin and histamine, magnesium deficiency and increased cytokine production have all been suggested (85, 141). Cytokine levels of IL-10, IL-12 and IFN γ are increased during hangover and can explain many of the observed symptoms

(141, 146, 167). Hangover is also associated with short term hypoglycaemia although the mechanism is poorly understood (141, 147, 166). Haemodynamic changes seen in hangover include increased heart rate, ejection fraction and blood pressure (147).

Hangover may be an indicator of an adverse pattern of drinking. As a state of physiological and metabolic stress within the body frequent hangover may also have health consequences in itself. In a study of 2,683 middle-aged men resident in the town of Kuopio, Finland frequent hangover was associated with cardiovascular mortality even after adjustment for alcohol consumption, although this association was weak and was not seen after adjustment for all other confounders (161). The physiology of hangover remains poorly understood and the long term effects of hangover on health or social functioning are unknown.

## 3.6 Measuring Alcohol –Related Problems

In alcohol epidemiology an important goal is to link alcohol consumption with alcohol-related problems (55). A large number of negative outcomes have been linked to alcohol consumption including physical, psychological and social problems. Consequences of alcohol use can be both acute and chronic. How alcohol use is measured will depend on the outcome of interest. For example episodes of heavy drinking or intoxication are more likely to be important than average volume consumed when considering acute consequences associated with alcohol such as violence, accidental injury or impact on social interaction (53, 71).

The immediate effects of alcohol include intoxication or drunkenness, which may be followed by hangover. These consequences can be used as measures of alcohol exposure but are also outcomes in their own right. Hangover has been measured as an alcohol-related problem in many studies (91, 97, 98, 153, 154). Hangover is unpleasant, is associated with many physiological disturbances, can have negative consequences economically due to lost productivity, absenteeism and work-related accidents, and may increase the risk of injury e.g. while driving (141, 145-147, 149, 168, 169). There is some evidence that frequent hangover may be a risk factor for developing alcohol dependence

(141, 147, 157, 170, 171). Evidence on the short term effects of hangover on cognitive and psychomotor functioning is inconclusive with conflicting results but hangover has frequently been associated with short term cognitive impairment such as difficulty concentrating and memory problems (85, 145, 146, 149, 160, 163, 172, 173). Heavy drinking the previous evening has been found to be associated with impaired functioning the next day - both physical (hours of sleep, excessive tiredness and feeling unwell) and cognitive (ability to concentrate and to manage workload) among university students in New Zealand. These effects showed a dose response with the number of drinks consumed the previous night (174).

There are a vast range of alcohol-related social problems which may involve harm to the drinker, harm to others or occur at an aggregate level such as lower productivity at work (175). Social harm is by nature interactional – in order to constitute a problem a drinking behaviour must be seen as a harm by someone other than the drinker(175). The social consequences of drinking include violence, aggression, legal problems, problems at work, disruption of family and social relationships, financial problems, injuries and drunk driving (56, 71). Similarly to alcohol consumption, these have commonly been measured using cross-sectional surveys (56). Many of these consequences are related to the immediate effects of alcohol – for example intoxication from alcohol can lead to increased aggressiveness, risk taking and loss of inhibitions associated with harms such as accidents and violence (85).

A less immediate aspect of alcohol-related harm measured in epidemiological surveys is psychological or mental disorders caused by alcohol use such as alcohol dependence. The aim in surveys trying to measure prevalence of these disorders is generally to identify people who fit the diagnostic criteria of either the World Health Organisation's International Classification of Disease (ICD 10) or of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM IV). These diagnoses are summarised in the Figure 3.6 below. Instruments for measuring these alcohol use disorders in surveys include the CIDI (Composite International Diagnostic Interview), AUDADIS (Alcohol Use Disorder and Diagnostic Interview Schedule) and SCAN (Schedules for Clinical Assessment in Neuropsychiatry). Reliability and validity of these instruments has been tested in several countries as part of a World Health Organisation project (27). However these instruments are too long to be included in many surveys. There are also screening tools available such as the CAGE, the MAST (Michigan Alcoholism Screening Test) and the AUDIT(Alcohol Use Disorders Identification Test)(27, 176). The 20 item Severity of Alcohol Dependence Questionnaire (SADQ) which takes approximately 5 minutes to complete has also been adapted for use in the community (SADQ-C)(27, 177).

Scales for measuring alcohol-related problems often do not specify if harm is social, psychological or physical but ask a range of questions on social harm, respondent's mental state about drinking and self-reported health. Although scales for measuring alcohol - related harm are commonly used, particularly in the United States and Canada little is known about their psychometric properties and only a few attempts to validate them have been made.

Rehm et al attempted to test the construct validity of an alcohol-related harm scale commonly used in North American surveys (178). The scale consisted of 5 questions asking whether the respondent had experienced alcohol having a harmful effect on: friendships or social life; physical health; home life or marriage; work, studies or employment opportunities; and financial position, both in the past 12 months and ever in their lifetime. The data used were from three telephone surveys in 1994, 1995 and 1996 with sample sizes 2022, 994, and 2721 respectively. The scale had high internal validity with a Cronbachs alpha of 0.72 for men and 0.64 for women although the question on health was less strongly correlated than the other questions. The scale had moderate correlation with other measures of alcohol-related harm –the CAGE (0.49 in men) and a sum of 11 questions from the ICD 10 criteria for determining alcohol dependence (0.66 in men). Bondy and Lang examined the test-retest reliability of the same five question scale using data from 64 adults living in Ontario (179). They found poor reliability for questions on social harm particularly for reporting of problems in the past 12 months compared to lifetime problems, whereas quantity-frequency questions on alcohol consumption asked in the same survey showed high reliability and correlation. The authors concluded scales for measuring alcohol-related harm might be improved by asking more detailed questions about specific events.

**Figure 3.6 Diagnostic criteria for alcohol use disorders**

**International Classification of Disease -10 Diagnoses**

**Alcohol Dependence Syndrome**: a cluster of behavioural, cognitive and physiological phenomena that develop after repeated substance use and that typically include a strong desire to take the drug, difficulties in controlling its use, persisting in its use despite harmful consequences, a higher priority given to use than to other activities and obligations, increased tolerance, and sometimes a physical withdrawal state

**Harmful Alcohol Use:** a pattern of alcohol use that is causing damage to health. This includes physical or mental health problems but not social problems.

**American Psychiatric Association Diagnoses**

**Alcohol Dependence**: a maladaptive pattern of alcohol use manifested by recurrent and significant adverse consequences related to the repeated use of alcohol.

**Alcohol Abuse**: a maladaptive pattern of alcohol use manifested by recurrent and significant adverse consequences related to the repeated use of alcohol. Harmful consequences include a) failure to fulfil major role obligations at work, home or school, b) use of alcohol in situations in which it is physically hazardous c) alcohol-related legal problems and d) continued use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of alcohol

Selin and Room (2007) used data from 5469 telephone interviews with Swedish adults to develop separate scales to measure personal problems from alcohol (divided into impaired self-control and chronic health problems) and social problems (180). Their scale of social problems included items on public disorder, interpersonal problems, financial problems and work-related problems. This scale had good internal consistency with a Cronbachs alpha of 0.78. Test-retest showed fair to substantial reliability.

Although there are commonly used scales for measuring alcohol-related harm in specific sub populations such at the Young Adult Alcohol Problems Test (YAAPST)(181)there is no internationally valid scale for measuring alcohol-related harm including the social consequences of alcohol in the general population(180). Compared to health problems, social problems associated with alcohol are harder to measure objectively and likely to be more affected by cultural differences about what constitutes a problem (182).

In alcohol epidemiology respondents are often specifically asked about the role of alcohol in social and health consequences, for example “In the past year have you had problems with your partner because of alcohol?” Questions on social harms with attribution to alcohol generally ask about problems the respondent attributes to alcohol such as problems with a spouse or about events that occurred whilst drinking such as getting into a fight (57). This is different to the traditional epidemiological method of assessing the relationship between an exposure and an outcome where exposure and outcome are assessed independently and the respondent makes no attribution of causality. This method relies on a respondent’s subjective interpretation of the causal relationship between alcohol and their problems. The perceived affect attributable to alcohol may vary with level of consumption (183). The researcher also specifies both the temporal direction of relationship and that the relationship is harmful not protective, as well as increasing the risk of recall bias.  For these reasons this method of measuring the social consequences of alcohol consumption has been criticised (56, 83). However asking about attribution to alcohol may be unavoidable especially when measuring some problems such as drunk driving and hangover. Participants at the 2000 Conference on questionnaire items measuring alcohol consumption and social harm recommended surveys ask parallel questions about experience of problems with and without attribution to alcohol. This would be additionally useful in gaining a baseline level of social problems reported by non-drinkers(57). A cohort study following up 953 members of the Swiss general population over 8 years  measured social consequences of drinking using questions with and without attribution to alcohol(83). They found that overall a similar pattern of results was found with both types of question.

Other data sources used for measuring alcohol-related harm include hospital records, death registration data and police records. These types of data can be used in a variety of ways for example to check the validity of self-reported data, to measure outcomes, or, at the population level, as indicators of the amount of harm attributable to alcohol within a population.

Different data sources will have both strengths and limitations. For example when using hospital records to measure alcohol-related admissions, there should be useful information on diseases with alcohol specific causation such as alcoholic liver cirrhosis, but there may be no information on the role of alcohol in multi-factorial diseases such as stroke (27). Drink- driving is generally under-reported in surveys,(183) therefore using arrest data on drink- driving could be considered a more valid method of measurement. However the proportion of drink drivers arrested is related to police activity (27, 184). It is estimated that in the United States arrest data only covers 0.5% of the total self -reported episodes of drunk driving (184).

## 3.7 Methodological issues in using survey data to measure alcohol use

Measuring alcohol consumption at an individual level usually relies on survey data(55). Methodological issues involved in measuring alcohol use include response rate, mode of survey and the representativeness of the sample.

Under-reporting of alcohol intake is common for all methods of assessment (185). Survey estimates of alcohol consumption give substantially lower estimates of volume of consumption when compared to sales data (although there are also problems with using sales data for example not all alcohol sold may be consumed where and when it is purchased) (27, 62, 82). There is some evidence that under-reporting increases with frequency of drinking and level of consumption (186, 187). Alcohol-related problems may also be under-reported although with no aggregate data available for most problems this is difficult to know. In Sweden the annual number of drink driving occasions in 1997 measured by breath tests of random samples of drivers was estimated to be over 5 million per year. However using self-reported national survey data from the same year estimates were approximately 196 000 occasions per year (183).

Social desirability can lead to under-reporting of both alcohol consumption and alcohol-related social harm. The mode of interview can affect this, with higher self-reported alcohol use from self-completed postal surveys than from either face to face or telephone interviews (27). However Davies et al (2010) found that even with a confidential online survey respondents with high scores on a measure of their need to give a positive impression to others (Balanced Inventory of Desirable Responding) under-reported alcohol consumption by approximately 20-33% and alcohol-related harm by approximately 50% (188). In addition to social desirability, as discussed in section 3.1 even when participants attempt to report their alcohol consumption accurately there can be many barriers to doing so including difficulty in remembering accurately what has been consumed and difficulty in accurately estimating volumes. Accuracy of reporting is likely to be affected by drinking context with more problems when drinking at home or at parties where people may be drinking from shared containers compared to drinking in bars or pubs where drinks are more likely to be in standardised measures. Variability in drinking pattern can also make it very difficult for respondents to answer accurately questions on the “usual volume” they consume.

Selection bias is an important concern when using survey data since heavy drinkers are more likely to be under-represented in surveys. A 1967 national survey in Sweden had a high response rate of 80%. However 12.3% of non-responders were registered in the penal register for drunkenness compared to 4.5% of responders. In a 1997 survey the response rate in the Swedish general population was 75% but amongst those with two or more drunk driving convictions it was 34% (183). In a sample of 48,334 Norwegians both heavy drinking and abstaining from alcohol at baseline (1984-86) predicted non-response at follow-up (1995-97)(189). Among a sample of American college students surveyed in 2003 frequency of heaving drinking episodes and drunkenness and maximum number of drinks on one drinking occasion were all higher among those who were lost to follow up a year later(190). However among 2,727 Finnish men who were interviewed in 1953 and were followed up in 1956 there was no evidence of a difference in frequency of drinking, intoxication or hangover among those re-interviewed and those lost to follow up (152). Amongst women who took part in a 1981 national survey in the United States and were followed up at ten year intervals no differences in drinking pattern were observed between those who were re-interviewed and those who were lost to follow up (191).

## 3.8 Use of Proxy Informants for Measuring Alcohol Use

Proxy reports have been commonly used in epidemiological studies to provide information when the subject of the study is unable to do so because they are either deceased or in some way impaired for example in studies of Alzheimer's disease. Reliability of proxy-reported exposure is generally compared to an assumed gold standard of self-reported exposure (192, 193). However the validity of self-reported alcohol use and problems is also debatable and there is often under-reported although over-reporting is also possible (194, 195). A problem when comparing self and proxy reports of drinking behaviour is whether disagreement is due to under-reporting or over-reporting by the subject or misclassification by the proxy.

Most comparisons of self and proxy reports on alcohol use have found good percentage agreement and correlation (196-198). Agreement between proxy and self-reported alcohol consumption varies with the type of questions asked. There is good agreement for global drinking pattern and categorical measures of quantity-frequency(196, 199). Measures of  amount consumed show less agreement than  measures of frequency(196, 197). Proxy-reports show good agreement for observable drinking behaviours but poorer agreement for harder to observe or less well defined behaviours(196, 199).

In the Izhevsk Family study – a population-based case-control study investigating the association between hazardous alcohol consumption and premature mortality in Russian men – controls and proxies were asked detailed questions on alcohol consumption. Moderate agreement was found between proxy and self-report for the majority of questions (kappa coefficient 0.4-0.6). Questions with the highest agreement between self and proxy report were for behaviours proxies could observe easily such as consumption of non-beverage alcohols and receiving professional help for an alcohol problem(199). Questions with poorer agreement tended either to be more subjective such as whether drinking had changed within the past year, or questions about behaviour away from the home which proxies might be less likely to observe. Proxies were more likely to report behaviours related to hazardous drinking than index subjects.

Both self-report and proxy-report is subject to error. Both types of respondent may not recall behaviour accurately. Self-report may be affected by incentives to withhold or exaggerate behaviour e.g. the desire to respond in a socially desirable manner. Respondents with drinking problems may be in denial about the extent of the problem therefore may not report their own drinking behaviour accurately. While using proxies may avoid these problems proxy reports have their own limitations when behaviours are difficult to observe. Some proxies may also be reluctant to describe the drinking behaviour of a spouse or other close relative as heavy or problematic(196).

The level of agreement between proxy- and self-report may be affected by factors related to the proxy. Suggested factors include the relationship between the proxy and the subject, how much contact the proxy has with the subject and how certain the proxy is about the information being given (197, 198, 200-202). Some studies have found better agreement when the proxy is the subject's spouse (197, 200, 201). In the Izhevsk family study spouses were found to agree more closely than non-spouses however this association was not seen when controlling for household  by comparing responses of two proxies within the same household (spouse and non-spouse)with each other, and with the subjects' own report (199). Therefore it may be characteristics of the subject or the household they live in which is important when considering validity of proxy-reports (for example proxy-reports maybe more valid in married men).

The validity of proxy report can also be affected by the population under investigation. For example proxies have been found to consistently under-report the alcohol consumption of pregnant women (201). Poor agreement between subjects and proxies on alcohol use has been found if the subject is mentally ill (202, 203). Amongst college students proxies have been found to be more likely to under-report alcohol consumption if the subject was in trouble for violating campus alcohol policy (198). Therefore validity of proxy-reports for patients receiving treatment for alcohol problems may be different to the validity within the general population and may vary between cultures because of different attitudes to what drinking behaviour is acceptable, in the same way that the validity of self-reported alcohol use may vary.

There is no gold standard for measuring an individual's alcohol consumption and drinking behaviours (196, 197). Proxy and self-report can be viewed as two independent estimates of a variable with no gold standard estimate(196). Maisto and Connors (1992) in their review of literature on the use of proxy reports to measure alcohol consumption conclude that "there can be considerable confidence in the use of collateral reports as a measure of drinking"(196). In a systematic review of the literature on use of proxies in observational studies Tomkins (2006) concluded "proxy informants can be a useful source of information in observational epidemiology where the index is unable for whatever reason to provide information about him or herself"(199).

## 3.9 Biomarkers of alcohol use

The problems associated with self-report of alcohol consumption have led to the search for biomarkers of alcohol consumption to provide more objective evidence. Alcohol consumption has an effect on a wide range of biochemical and haematological parameters (204). Traditional markers of recent drinking are the liver enzymes gamma glutamyl transferase (GGT), aspartate transaminase (AST) and alanine transaminase (ALT) as well as mean corpuscular erythrocyte volume (MCV) (205). A more recently used biomarker is serum carbohydrate deficient transferrin (CDT). Other biomarkers of alcohol use include serum high-density lipoprotein cholesterol (HDL-C),5-Hydroxtryptophol in urine and ethyl glucuronide in hair(196, 205). Biomarkers of alcohol consumption have been used for a range of purposes including detection of any drinking, detection of heavy drinking, detection of complications from drinking, monitoring progress or detecting relapse in alcohol abusers, and as prognostic markers(204).

GGT is the most commonly used biomarker of heavy drinking(206). Serum levels of GGT tend to rise after 80-200g of alcohol per day for several weeks (207, 208). However the rise in GGT with alcohol is variable and may be influenced by age and gender with rises at lower levels in women and older individuals (209). GGT levels are only modestly correlated with alcohol consumption (204). GGT levels do not usually rise after one episode of heavy drinking except in individuals who have been heavy drinkers previously(204). Sensitivity and specificity of GGT as a screening tool for detecting regular heavy drinking is variable, but has generally been found to be low, especially in non-clinical samples (196, 204, 210). GGT levels can be affected by a variety of factors such as age, obesity, smoking and use of certain medications such as anticonvulsants and non-steroidal anti inflammatories (196, 208, 211-214). GGT levels are also raised in non-alcoholic liver disease and in certain other medical conditions such as diabetes (196, 204, 208).

Raised GGT is both a marker and a predictor of certain alcohol-related consequences such as hypertension, diabetes, coronary heart disease, stroke, the metabolic syndrome and all- cause mortality (204, 206, 215-218). The reason for this is unknown although there is speculation it may be because of the harmful pattern of drinking that a raised GGT represents sustained regular heavy drinking (> 60g of ethanol per day)(204). However the association with coronary heart disease and stroke has also been found in non-drinkers (218).

The other liver enzymes used as biomarkers of alcohol consumption(AST and ALT) are highly correlated with GGT but are less sensitive than GGT for detecting alcohol consumption (204). Like GGT they are raised by many factors other than alcohol including non-alcoholic liver disease and various medications such as antibiotics, anti-epileptics, statins and non-steroidal anti inflammatories (204, 213).

Mean Corpuscular Volume (MCV) increases with regular drinking but has a low sensitivity(196, 204). There are no experimental studies investigating the amount of ethanol or the duration of drinking associated with raised MCV levels(204). Since the life span of a red blood cell is 120 days long, there is a time delay between heavy drinking and changes in MCV. As with the liver enzymes MCV is affected by many other factors such as age, vitamin B12 and folate deficiencies, bleeding and non-alcoholic liver disease (204).

Carbohydrate deficient transferase (CDT) is a variant of the serum glycoprotein transferrin which is produced in the liver. Individuals who drink heavily have a higher proportion of transferrin molecules which are deficient in carbohydrate compared to those who do not drink heavily (219). Serum concentration of CDT is correlated with chronic alcohol consumption and on average rises when 60-80g of alcohol is consumed daily over at least

2 weeks (206, 208, 220, 221). The sensitivity of CDT for detecting heavy drinking (defined in studies variously as >60g of ethanol per day or >280g per week) is comparable to GGT but specificity is higher (205-207, 220). The relationship between alcohol intake and CDT may be modified by several factors including gender, body mass index, dyslipidaemia, hypertension, insulin resistance, metabolic syndrome, iron overload and smoking(222). Unlike GGT, AST and ALT, CDT is not raised in non-alcoholic liver disease although CDT is affected by primary biliary cirrhosis, chronic acute hepatitis, severely decompensated liver cirrhosis, advance cirrhosis with ascites and rare genetic conditions affecting glycoprotein metabolism (223, 224).

There is no one gold standard biomarker with adequate sensitivity or specific for detecting heavy drinking but this can be improved by using a combination of different biomarkers (213). Most research on biomarkers has focused on GGT and CDT because they have higher sensitivity and specificity than other markers(206). These two markers are not strongly correlated so can function as independent markers of heavy alcohol consumption (211, 219, 225). The combination of GGT and CDT is more strongly correlated with alcohol consumption than either marker alone (208, 226) and using CDT and GGT together increases sensitivity for detecting heavy alcohol consumption measured in terms of volume of ethanol consumed (measures used by studies to define heavy drinking were: >60g ethanol per day; >80g of ethanol per day; and >280g of ethanol per week) (207, 211, 219, 220).

The utility of biomarkers as measures of heavy drinking in the general population is unclear. Several studies have found that biomarkers including CDT and GGT perform poorly as screening tools for heavy drinking in the general population where there is a broad spectrum of drinking behaviour, with both low sensitivity for detecting hazardous alcohol use and poor correlation with alcohol consumption (207, 208, 211, 212, 222, 223, 227-229). Other studies have suggested that CDT and GGT might be reasonable markers of high risk alcohol consumption in men but not in women (211, 229). However there may be some benefit to using biomarkers alongside self-reported data on alcohol consumption. When the AUDIT was combined with GGT and CDT in routine work place health examinations in a sample of 570 employees in Sweden, the number of positive screens increased by 50% compared to using AUDIT alone (225). In a general population sample in France of 3178 adults, detection of heavy drinking was improved by combining clinical and biological markers including GGT with the CAGE questionnaire for detection of alcohol dependence (230).

The majority of studies which have examined the relationship between GGT and CDT and alcohol consumption have used measures of self-reported volume to define heavy drinking (e.g. >60 grams of ethanol per day). Disparate results on the effectiveness of biomarkers as measures of heavy drinking defined in this way may be related to differences in drinking patterns within populations. Experimental studies suggest alcohol consumption needs to be regular and sustained (e.g. over at least two weeks) to increase these biomarkers which limits their utility in detecting drinking which is heavy (e.g. more than 60 grams of ethanol per drinking occasion) irregular(204). The relationship between alcohol biomarkers an measures of acute dysfunctions such as hangover and drunkenness has not been investigated with the exception of Sillanaukee et al (2000) who found frequency of intoxication was correlated with both GGT and CDT in men and with CDT only in women(208).

## 3.10 Population based typologies of alcohol use

As has been discussed there are several dimensions to alcohol use including quantity, frequency, episodic heavy drinking and drinking context. No one dimension alone can be used to summarise an individual's drinking(53). In order to use all possible information on alcohol use, these different variables can be combined in typologies. These can be useful for describing the drinking patterns in a population(53). A suggested advantage of using a typology is that it can be used to examine correlates with specific drinking patterns(181). There have been several attempts to develop population based typologies of alcohol use (231-233). Some of these have been very basic and simply combined frequency and quantity together (231, 232). For example Gili et al (1989) divided frequency of drinking in to two categories (low and high) and maximum quantity consumed into three categories (low, medium and high) and then combined them together to form six categories of drinker (232). Others have used more sophisticated methods such as cluster analysis (233-236), latent class analysis (237-239), or factor analysis (240, 241).

Most typologies have used only data on quantity and frequency of consumption. An exception is Smith and Shevlin (2008) who tried to develop a population-based typology of drinking behaviour using Alcohol Use Disorder Identification Test (AUDIT) scores obtained from a large national sample of the British Population(238). A six class solution was reported – heavy consumption with multiple negative consequences, heavy consumption with negative consequences, heavy consumers with memory loss, moderate consumption, mild consumption with injury and social support suggest to cut down, and very mild consumption. These classes were compared on associations with socio-demographic variables (age, sex, education and employment status) and mental health problems (depressive episode, generalized anxiety disorder, mixed anxiety and depressive disorder and lifetime attempted suicide) and found to show different patterns of association to each other supporting the validity of the classes as distinct from each other. A limitation of this typology is that all the AUDIT questions were used as binary variables. This is likely to have resulted in significant loss of variation in responses in particular for the first three questions on alcohol consumption. For example the first AUDIT question is "how often do you have a drinking containing alcohol?" In these analyses answers were divided into never drinks alcohol versus all other frequencies of drinking. It seems unlikely that this categorisation could adequately capture the variation in alcohol consumption in this population.

The majority of population based typologies of alcohol use have tried to define categorical types of drinker with the assumption that there are distinct classes of drinker and within a class members consume alcohol in similar amounts and in a similar manner. Although this approach has many advantages in identifying types of drinker it does not take into account the multi-dimensional nature of alcohol use, since using this approach it would be hard to determine what aspects of alcohol consumption (e.g. alcohol intake versus drinking pattern) were important when investigating the relationship between alcohol consumption and more distal problems such as unemployment or cardiovascular disease. Approaches such as latent class analysis work best with categorical observed variables but can be limited when observed variables are continuous or represent underlying continuous variables such as alcohol consumption as in the latent class analysis of the AUDIT described above(238).An alternative approach to categorising drinkers into classes is to identify latent dimensions of alcohol consumption. Agrawal et al (2007) used factor analysis to develop a latent factor of "alcohol consumption" from four lifetime indices of consumption (volume of ethanol (frequency multiplied by quantity) consumed during lifetime heaviest drinking period, lifetime maximum number of drinks consumed in a 24 hour period, frequency of drinking 5 or more drinks in a 12 month period of heavy consumption, and frequency of intoxication during heaviest drinking period)(242). All these observed variables showed a strong association (i.e. high factor loadings) with the underlying factor and the model was found to have measurement invariance with gender and across two different study samples. The latent factor was associated with family history of alcohol problems, smoking and cannabis use. Agrawal et al (2011) later adapted this to use measures of alcohol consumption in the past 12 months only (frequency of drinking beer, wine and spirits, usual number of drinks per day, frequency of drinking 5 or more drinks per day and frequency of intoxication). This factor was strongly related to genetic factors influencing heavy drinking in young adults(243). Grant et al (2009) also adapted the original model to develop a measure of "heaviness of alcohol consumption" manifested by 5 observed indices of alcohol consumption (the lifetime maximum number of drinks consumed in a 24 hour period, maximum tolerance, typical weekly consumption, frequency of drinking 5 or more drinks over 12 months and the frequency of drinking to intoxication) and used this to assess genetic overlap between heaviness of alcohol consumption and alcohol dependence(240).

These studies only investigated alcohol use as one dimension however Khan et al (2002) identified three latent factors of alcohol use which they labelled as "alcohol use" (manifested by the observed variables ethanol intake -derived from quantity and frequency of beer, wine and spirits-, staying drunk for more than one day in a row and drinking more than eight drinks on one occasion in the past 12 months), "alcohol problems" (manifested by binge drinking, symptomatic drinking, loss of control, spouse's complaints about drinking, problems at work, problems with the police, health problems and accidents) and “alcohol dependence” (manifested by scores on three scales: Diagnostic Interview Schedule Version III Revised, the short form of the Alcohol Dependence Data Scale and the short form of the Michigan Alcoholism Screening Test). This model fitted the data well according to model fit indices. They then used structural equation modelling to investigate the effects of poverty and unemployment on these latent dimensions of alcohol use and the relationship between these dimensions of alcohol use at two time points. Their results showed poverty increased both the alcohol use and the alcohol problems factor. Recent unemployment was associated with decreases in the alcohol use but alcohol use increased with longer term unemployment (241).

## 3.11 Summary

Measurement of alcohol consumption has conventionally been dominated by measuring alcohol intake in terms of the average volume of ethanol consumed. This is most commonly assessed by measuring frequency of drinking and the usual volume consumed per occasion over a reference period such as the past year. Measuring volume of ethanol using self-reported survey data has many limitations due to problems with accurate recall of the amount consumed and possible social desirability bias. In addition to alcohol intake there are many other aspects of alcohol use which may be of interest to study with respect to their effects on health and socio-economic outcomes. These include the frequency of heavy drinking episodes, drinking with or without food, drinking to intoxication, and hangover. These can be split into measures of drinking pattern and measures of acute consequences of drinking such as drunkenness and hangover. These measures may provide additional information on alcohol use but may also be limited by social desirability bias and by individual variation in alcohol tolerance and metabolism. As well as self-reported survey data other potential sources of information on alcohol use are proxy-reports and alcohol biomarkers. These measures have different strengths and weaknesses to self-reported data. There is no gold standard measure of alcohol consumption and no one measure which captures the multi-dimensional nature of alcohol use. One potential solution to these problems is to combine different types of information on alcohol use with their different strengths and weaknesses together in a drinking typology.

# Chapter 4 Data Sources: The Izhevsk Family Studies

## 4.1 Study Design

### 4.1.1 Study Setting

Izhevsk is the capital city of the Udmurt republic, part of the Russian Federation. The population of Izhevsk was 632,000 at the 2002 all Russia census. It is an industrial city located 1300km south east of Moscow, to the West of the Ural Mountains. The Udmurt Republic (population approximately 1.5 million), is fairly urbanised with 67.8% of its population living in cities in 2009 (244). Life expectancy in the Udmurt Republic in 2009 was 61.6 years for men and 75.0 years for women (life expectancy in the Russian Federation 2009: males 62.8 years, females 74.7) (4). The cause of death with the highest standardised death rate among men in the Udmurt Republic in 2008 was circulatory diseases (1062 deaths per 100,000 men) followed by deaths from external causes, a category which includes deaths from accidents and suicides (347.1 deaths per 100,000 men). These rates were slightly higher than for the Russian Federation overall (circulatory diseases 978.2 per 100,000 men; external causes 271.3 per 100,000 men)(244, 245). Mortality rates were also higher than the Russian Federation overall for respiratory (163.0 vs 95.4 deaths per 100,000 men) and digestive diseases (118.2 vs 81.8 deaths per 100,000 men) but lower for infectious diseases (34.0 vs 38.5 deaths per 100,000 men) and neoplasms (255.8 vs 267.2 deaths per 100,000 men).

**Figure 4.1 Map of Russia showing the location of the Udmurt Republic**


### 4.1.2 Overview of Study Design

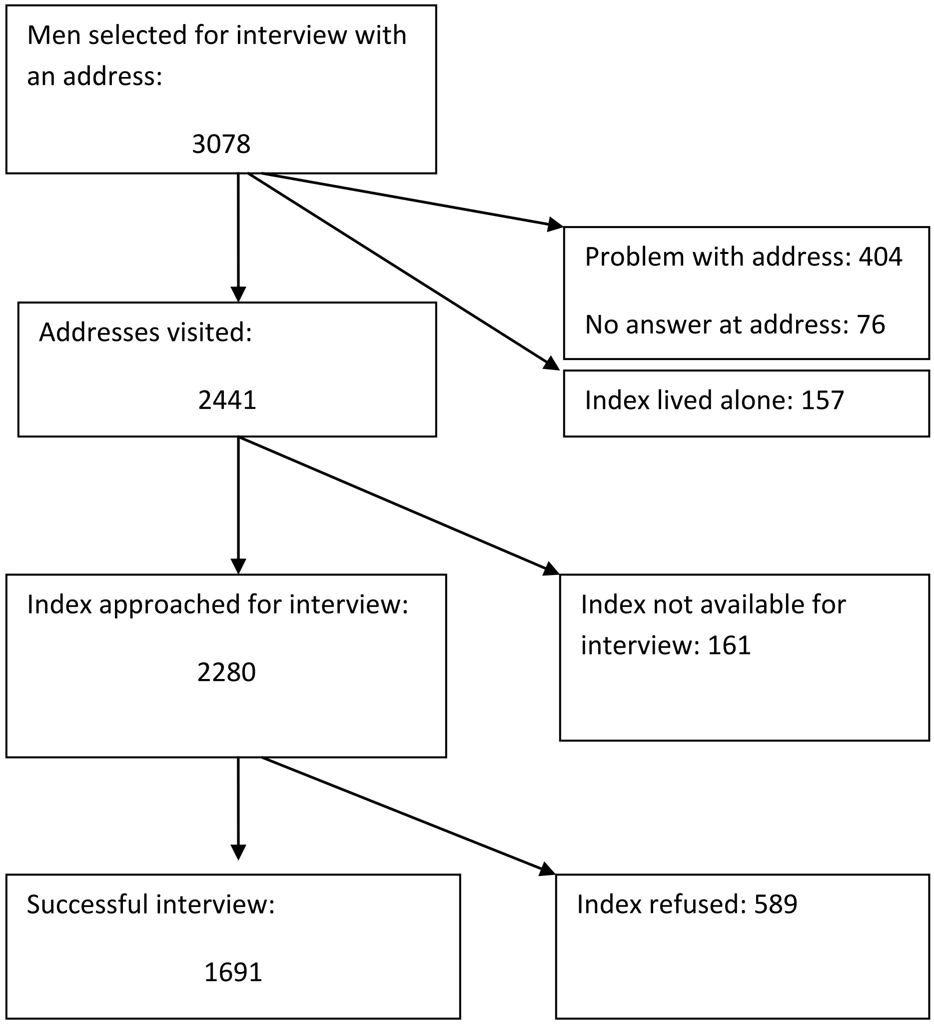
The Izhevsk Family Study 1 (IFS-1) was a population-based case-control study of the relationship between hazardous drinking and premature mortality in working-age men (25-54 years)(1). Cases were deceased male residents of Izhevsk dying from any cause over a twenty four month period (2003-2005) notified to the study team via the registrar of deaths (ZAGS). Controls were a random sample of living men selected from the 2002 population register of the city of Izhevsk. Controls were frequency matched to the age distribution of the cases and therefore the sample was weighted towards older ages. Interviews were carried out with proxy respondents for the cases, and with both the controls themselves and their proxy respondents. The need for a proxy informant meant that men who were living alone were excluded from the study. Proxies were people who had been living with the index subject (case or control) for at least 6 months prior to their death or the time of the interview. Where possible, proxies were wives or partners but if this was not possible another proxy living in the index subject's household was selected from a pre- specified list. Overall 1750 cases and 1750 controls were recruited for this study. In order to increase the sample size for potential follow-up an additional 250 controls and control proxies were also recruited in 2006 using the same protocol as for the case-control study. Interviews were conducted by trained interviewers.

Between January 2008 and March 2009 an attempt was made to locate and re-interview both controls and where possible the same proxy. Controls will from now on be referred to as indexes. Index men who were re-interviewed were then invited to a health check either at a polyclinic or in the index's home depending on their own preference. This typically took place 2-3 weeks after the interview although for some men the interval between interview and health check was several months. The health check consisted of a full medical history and examination, a blood test and a self-completed questionnaire. This follow up study is known as the Izhevsk Family Study 2(IFS-2).

#### 4.1.3 Study Sample

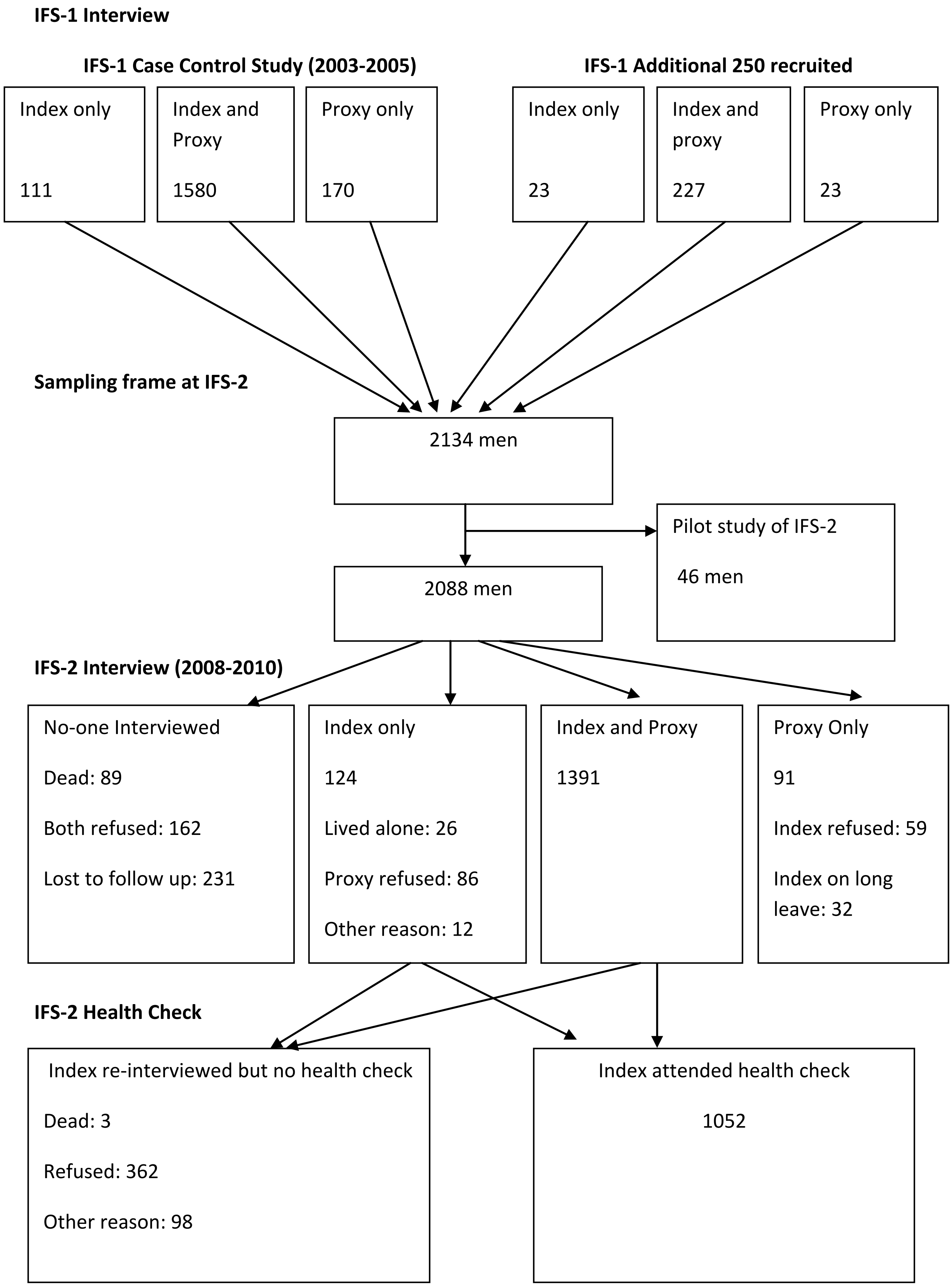
At IFS-1 index subjects (controls in the IFS-1 case-control study) were selected at random from a list of possible subjects on the electoral roll to match the age distribution of the cases. Subjects were men aged between 25 and 55 who were resident in Izhevsk. The information available for each man was their full name, address and date of birth. Interviewers were assigned households and then attempted to locate the index subjects. If the index no longer lived at the address they had been given the interviewer would attempt to identify their correct address. If the correct address could not be found subjects were excluded from the study. Once the correct household was identified interviewers would attempt to interview both the index man and a proxy respondent who lived in the same household (chosen by following a proxy selection protocol). All men who lived alone and did not have a proxy respondent available were excluded. Although the aim was to interview both index men and proxy respondents if it was impossible to do so, for example if one refused to participate in the study, only one interview was carried out. The flow of index participants at IFS-1 is shown in Figure 4.2.

**Figure 4.2 Flow chart of index participants at IFS-1**




At IFS-2 an attempt was made to follow up all index men and their proxies who had either a self- or proxy-reported interview at IFS-1. This included both men chosen as controls in the case-control study, and an additional 250 index men and 250 proxy respondents who were recruited after the original case-control study. The number of index and proxy participants at IFS-1 and IFS-2 is shown in Figure 4.3.

**Figure 4.3 Flow chart of participants at IFS-1 and IFS-2**



## 4.2 Data Collected

### 4.2.1 IFS-1 and IFS-2 Interviews

The questionnaire used for the IFS-1 interviews included questions on demographic and socio-economic variables, smoking and detailed questions on alcohol consumption. The questionnaire was modified slightly at IFS-2. Some questions were excluded and some additional questions added such as a question on who brought the index subject up. Two additional sections were added to the questionnaire: a section with more detailed questions on non-beverage alcohol use and a section specifically asking about change in circumstances since IFS-1 such as "has there been any change in your marital status since the last interview?" Table 4.1 gives a summary of the sections of the questionnaires administered to index subjects and the number of questions asked at IFS-1 and IFS-2.

**Table 4.1 Summary of questionnaire sections at IFS-1 and IFS-2 (index questionnaire)**

| Section | Summary | Number of questions | |
|---|---|---|---|
| | | IFS-1 | IFS-2 |
| B | Information on neighbourhood and crime | 7 | 3 |
| C | Household – composition, characteristics of dwelling, household assets | 18 | 15 |
| D | Vital status of index's parents | 6 | 7 |
| E | Socio-demographic information | 7 | 9 |
| F | Education and occupation | 17 | 18 |
| G | Life events and personal relationships | 11 | 15 |
| J | Disease and disabilities of index | 10 | 12 |
| K | Health and health related behaviour | 11 | 10 |
| L | Alcohol use | 50 | 60 |
| S | Non-beverage alcohol use | - | 9 |
| M | Smoking | 6 | 6 |
| N | Changes in circumstances and lifestyle since IFS-1 | - | 6 |
| X | Interviewer comments on circumstances of interview–reliability, difficulty, interruptions | 6 | 7 |

**Questions on Alcohol**

A substantial number of questions were asked on alcohol use at both IFS-1 and IFS-2. At IFS-1 questions on alcohol use included detailed assessment of quantity and frequency of beverage alcohols, frequency of non-beverage alcohol drinking and the frequency of adverse effects of drinking alcohol such as hangover. The questionnaire was modified for IFS-2 to give more detailed information about drinking behaviours and the circumstances surrounding drinking. Both questionnaires contained a mixture of conventional questions on alcohol consumption such as quantity and frequency and some unconventional questions such as the frequency of sleeping in clothes because of drunkenness. Questions were designed to be appropriate for use in Russia. Questions on the usual and maximum quantity of beer, wine and spirits consumed on one drinking occasion were asked in explicit categories that would be used by Russians in everyday life (beer in bottles, wine and spirits in grams). The questionnaires also asked about distinctive Russian drinking behaviours such as the consumption of non beverage alcohol and going on zapoi (defined for participants as a period of continuous drunkenness of several days or more during which the person does not work and is withdrawn from normal life).

Overall 69 questions on alcohol were asked in the IFS-2 interview with 36 of these questions asked in both the IFS-1 and IFS-2 interviews. A summary of the questions asked on alcohol in the IFS-1 and IFS-2 interviews is shown in figure 4.4.

The IFS questionnaires can be found in Appendix 3.

### 4.2.3 Health Check

The health check was conducted by one of four doctors and consisted of a full medical history and examination including measurement of weight, height, waist and hip circumference and three measurements of blood pressure.

A non-fasting blood sample was taken for assessment of biomarkers of alcohol consumption and damage (Gamma glutamyl-transferase (GGT), Aspartate transaminase (AST), Alanine transaminase (ALT) and Carbohydrate deficient transferrin (CDT)) and lipid profile and cardiovascular biomarkers (cholesterol, high density lipoprotein (HDL), low density Lipoprotein (LDL), apoprotein-A1, apoprotein-B, triglycerides, C reactive protein (CRP) and B-type natriuretic peptide (BNP)). Blood samples were placed in cool bags containing ice and taken to the Republican Blood Transfusion Centre in Izhevsk where they were spun in a cool centrifuge and alliquoted within 12 hours of venepuncture. Aliquots not used immediately were stored at -80°C and later transferred to Moscow under dry ice and stored at the VIGG genetics institute.

Index subjects who attended the health check were given a self-completed questionnaire to fill in. This included questions on self-reported health from the Short Form 12 (SF-12), the Alcohol Use Disorders Identification Test (AUDIT) and the Leeds Dependence Questionnaire. The self-completed questionnaire can be found in Appendix 3.

**Figure 4.4 Key alcohol variables available at IFS-1 and IFS-2**

| Dimension of alcohol use | Questions | IFS-1 | IFS-2 |
|---|---|---|---|
| Quantity-frequency | Frequency of drinking any alcohol | | ✓ |
| | Frequency of drinking beer, wine and spirits | ✓ | ✓ |
| | Frequency of drinking samogon, homemade wine and cocktails | | ✓ |
| | Usual volume of beer, wine and spirits | ✓ | ✓ |
| | Maximum volume of beer, wine and spirits | ✓ | ✓ |
| Drinking Pattern | Day of the week alcohol is consumed | | ✓ |
| | Day of the week that beer, wine and spirits are consumed | ✓ | ✓ |
| | Day of the week that samogon, homemade wine and cocktails are consumed | | ✓ |
| | Drinking alone | ✓ | ✓ |
| | Drinking before noon | ✓ | ✓ |
| | Drinking spirits with beer and wine | ✓ | ✓ |
| | Drinking spirits without eating | ✓ | ✓ |
| | Zapoi | ✓ | ✓ |
| Consequences of drinking | Frequency of hangover | ✓ | ✓ |
| | Frequency of excessive drunkenness | ✓ | ✓ |
| | Frequency of sleeping in clothes because of drunkenness | ✓ | ✓ |
| | Failure to fulfil family or personal obligations due to drinking alcohol | ✓ | ✓ |
| | Failure to fulfil work obligations due to drinking alcohol | ✓ | |
| | Missed work in the last month because unwell due to alcohol | | ✓ |
| | Arrested because of drunkenness | ✓ | ✓ |
| | Taken to sobering up centre | ✓ | ✓ |
| | Taken to hospital/clinic because of alcohol poisoning | | ✓ |
| | Attended narcology dispensary | | ✓ |
| Non-beverage alcohol use | Frequency of drinking non-beverage alcohol | ✓ | ✓ |
| | Day of the week non-beverage alcohol is consumed | ✓ | ✓ |
| | Volume of non-beverage alcohol usually consumed in mls and bottles | | ✓ |

## 4.3 Standard Instruments

### 4.3.1 SF-12

The Short form 12 (SF-12) is a 12 item health survey based on the longer short form 36 health survey(SF-36). It is designed to measure two domains of self-reported health: physical health and mental health. The 12 questions are intended to measure 8 health concepts: (physical functioning (2 questions), role physical (2 questions), bodily pain (1 question), general health (1 question)), role emotional (2 questions), mental health (2 questions), vitality (1 question) and social functioning (1 question). The SF-12 is intended for use internationally in clinical and in general populations (246).

### 4.3.2 AUDIT

The Alcohol Use Disorders Identification Test (AUDIT) was developed an as internationally applicable screening instrument for harmful or hazardous alcohol consumption in primary health care settings (247). The official Standard Russian Translation with minor modifications was used in the Izhevsk Family Studies. It is a 10 item questionnaire with a maximum score of 40. A cut point of eight or above is commonly used to identify hazardous consumption (248, 249). The AUDIT has recently been validated in Russia in a sample of 255 tuberculosis patients in Tomsk. It was found to have high internal consistency (Cronbach's alpha 0.91) and high sensitivity (91.7%) using a cut point of 8 for the detection of alcohol use disorders compared to the Composite International Diagnostic Interview (CIDI)(250).

The AUDIT score was designed to cover three domains of hazardous alcohol use – consumption, alcohol dependence and alcohol related harm. (247, 251) However evidence assessing the factor structure of the AUDIT suggests it has only two domains: alcohol consumption and alcohol-related problems (250, 252-254).

The AUDIT questions asked in the self-completed questionnaire in the IFS-2 health check were slightly modified from the standard AUDIT by i) adding the phrase “including substances not intended to be drunk” to Question 1 “ How often do you have a drink containing alcohol?” and ii) by using a reference period of three months for Questions 4 to 8 rather than the standard reference period of twelve months. The reference period was altered in order to use AUDIT scores in a trial with three month follow up in which a subset of men were enrolled(255, 256).

#### 4.3.3 Leeds Dependence Score

The Leeds Dependence Score was developed by the Leeds Addiction Unit to be part of an evaluation package for treatment of alcohol and opiate dependence. It has ten questions, each designed to elicit a different marker of dependence: pre-occupation, salience, compulsion to start, planning, maximisation of effect, narrowing of repertoire, compulsion to continue, primacy of effect, constancy of state and cognitive set. As well as evaluating alcohol dependence the score was intended to correlate with estimated alcohol intake. The Leeds Dependence Questionnaire was not intentionally designed for use in the general population or for making cross-cultural comparison and it is unclear what scores would represent among a non-clinical population in Russia (257).

### 4.4 Summary

The Izhevsk Family Studies have collected a unique set of data on both alcohol use and socio-economic, demographic and health variables on working-age men resident in Izhevsk at two points in times. Data on alcohol use was collected from a variety of sources: interviews with the index men and their proxy respondents, self-completed questionnaires (index men only) and alcohol biomarkers from blood samples. This dense volume of information on alcohol use provides an opportunity to improve understanding of drinking behaviour in Russian men and its effects on employment and health but also provides a challenge in terms of how to make best use of all the available data.

# Chapter 5: Description of Data

## 5.1 Distribution of Variables

### 5.1.1 Distribution of Alcohol Variables at IFS-1 and IFS-2 Interviews

There were 236 (12.2%) men who reported they did not drink any alcohol at IFS-1 and 202 (13.3%) men at IFS-2. The distribution of alcohol intake and drinking pattern variables at IFS-1 and IFS-2 by self- and proxy-report are shown in Table 5.1. A summary of the numbers of index men and proxy respondents who participated at each stage of the study can be found in Chapter 4. The most commonly reported beverage consumed was spirits (IFS-1 92.1% of drinkers; IFS-2 92.8% of drinkers), followed by beer (IFS-1 84.2 % of drinkers; IFS-2 79.8% of drinker) with only 38.6% of drinkers reporting that they consumed wine at IFS-1 (IFS-2 35.3%). Questions on the frequency of consumption and usual volume consumed per occasion (using the mid-point of each category) of beer, wine and spirits were used to calculate the total volume of ethanol consumed per year. This variable was skewed to the right at both IFS-1 and IFS-2 but was roughly normally distributed on log transformation except for a peak of non-drinkers. The distributions of self-reported total volume of beverage alcohol per year and log total volume of ethanol per year at IFS-1 are shown in Figure 5.1. At IFS-1 the median self-reported volume of ethanol consumed per year was 4.6 Litre/year (IQR 1.7-10.1 N=1917) among all men and 5.8 litres/year amongst drinkers (IQR 2.6-10.8 N=1681). At IFS-2 the median self-reported volume of ethanol consumed per year was 4.5 litres per year (IQR 1.4-10.8 N=1494) amongst all men and 5.8 Litres per year (IQR 2.4-13.2 N=1292) amongst drinkers. These volumes are considerably lower than corresponding estimates of recorded per capita alcohol consumption for the Russian Federation from the WHO (11.26 Litres in 2003; 11.50 Litres in 2008; for more detail see Table 2.1). However it is usual for self-reported survey data to yield lower estimates of per capita consumption compared to estimates from sales data (27, 62). These estimates are lower but more comparable with survey data on working-age men living in Novosibirsk where annual ethanol consumption estimated using the graduated frequency method was 6.68 Litres(258).

The distribution of acute alcohol-related dysfunctional behaviour variables by self- and proxy-report are shown in Table 5.2. At both IFS-1 and IFS-2 proxies reported higher levels of dysfunctional behaviours than index men.

## Table 5.1 Distribution of alcohol intake and drinking pattern variables at IFS-1 and IFS-2 by self- and proxy-report

| | | IFS-1 | | | | IFS-2 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Self-report | | Proxy-report | | Self-report | | Proxy-report | |
| | | N | (%) | N | (%) | N | (%) | N | (%) |
| Frequency of drinking beer | Never | 505 | (26.0) | 484 | (24.2) | 46 | (30.8) | 455 | (30.7) |
| | A few times per year | 148 | (7.6) | 133 | (6.7) | 10 | (7.1) | 100 | (6.8) |
| | 1-3 times/month | 434 | (22.4) | 448 | (22.4) | 29 | (19.3) | 257 | (17.3) |
| | 1-2 times/week | 578 | (29.8) | 558 | (27.9) | 42 | (28.0) | 398 | (26.9) |
| | 3-4 times/week | 164 | (8.5) | 193 | (9.7) | 13 | (8.6) | 149 | (10.1) |
| | Nearly everyday | 90 | (4.6) | 125 | (6.3) | 70 | (4.6) | 74 | (5.0) |
| | Every day or more | 21 | (1.1) | 38 | (1.9) | 24 | (1.6) | 35 | (2.4) |
| Usual volume of beer consumed per occasion[a,d] | Never drinks beer | 503 | (25.9) | 478 | (23.9) | 46 | (30.8) | 455 | (30.7) |
| | 1 bottle or less (22.5 ml | 775 | (39.9) | 843 | (42.2) | 55 | (36.9) | 566 | (38.2) |
| | 2-4 bottles (67.5 ml ethanol) | 622 | (32.1) | 574 | (28.7) | 46 | (30.4) | 403 | (27.2) |
| | 5-6 bottles (123.8 ml ethanol) | 30 | (1.6) | 24 | (1.2) | 21 | (1.4) | 20 | (1.4) |
| | >6 bottles (180 ml ethanol) | 3 | (0.2) | 6 | (0.3) | 7 | (0.5) | 4 | (0.3) |
| Maximum volume of beer consumed per occasion[a,d] | Never drinks beer | 504 | (26.0) | 478 | (23.9) | 46 | (30.7) | 456 | (30.8) |
| | 1 bottle or less (22.5 ml | 306 | (15.8) | 348 | (17.4) | 26 | (17.2) | 288 | (19.4) |
| | 2-4 bottles (67.5 ml ethanol) | 794 | (40.9) | 837 | (41.9) | 61 | (40.3) | 550 | (37.1) |
| | 5-6 bottles (123.8 ml ethanol) | 217 | (11.2) | 131 | (6.6) | 10 | (8.9) | 92 | (6.2) |
| | >6 bottles (180ml ethanol) | 100 | (5.2) | 51 | (2.6) | 69 | (4.6) | 33 | (2.2) |
| Frequency of drinking wine | Never | 128 | (66.1) | 123 | (61.7) | 10 | (69.2) | 102 | (69.0) |
| | A few times per year | 347 | (17.9) | 369 | (18.5) | 26 | (17.4) | 221 | (69.0) |
| | 1-3 times/month | 205 | (10.6) | 232 | (11.6) | 13 | (8.7) | 135 | (14.9) |
| | 1-2 times/week | 84 | (4.3) | 91 | (4.6) | 49 | (3.2) | 56 | (9.1) |
| | 3-4 times/week | 16 | (0.8) | 24 | (1.2) | 13 | (0.9) | 15 | (3.8) |
| | Nearly everyday | 6 | (0.3) | 18 | (0.9) | 6 | (0.4) | 10 | (1.0) |
| | Every day or more | 0 | (0.0) | 9 | (0.5) | 1 | (0.1) | 5 | (0.7) |
| Usual volume of wine consumed per occasion[b,d] | Never drinks wine | 127 | (65.7) | 123 | (61.7) | 10 | (69.4) | 102 | (69.0) |
| | ≤200g (12.3 ml ethanol) | 219 | (11.3) | 284 | (14.2) | 17 | (11.4) | 175 | (11.8) |
| | 200-400g (45.6 ml ethanol) | 288 | (14.8) | 261 | (13.1) | 17 | (11.6) | 154 | (10.4) |
| | 400-600g (75.9 ml ethanol) | 87 | (4.5) | 80 | (4.0) | 56 | (3.7) | 47 | (3.2) |
| | 600-1000g (113.9 ml ethanol) | 60 | (3.1) | 48 | (2.4) | 50 | (3.3) | 43 | (2.9) |
| | >1 litre (189.9 ml ethanol) | 6 | (0.3) | 11 | (0.6) | 6 | (0.4) | 5 | (0.3) |
| Maximum volume of wine consumed per occasion[b,d] | Never drinks wine | 127 | (65.6) | 123 | (61.6) | 10 | (69.3) | 102 | (69.0) |
| | ≤200g (12.3 ml ethanol) | 99 | (5.1) | 145 | (7.3) | 10 | (6.9) | 111 | (7.5) |
| | 200-400g (45.6 ml ethanol) | 211 | (10.9) | 234 | (11.7) | 14 | (9.8) | 152 | (10.3) |
| | 400-600g (75.9 ml ethanol) | 149 | (7.7) | 126 | (6.3) | 81 | (5.4) | 59 | (4.0) |
| | 600-1000g (113.9 ml ethanol) | 151 | (7.8) | 113 | (5.7) | 90 | (5.9) | 66 | (4.5) |
| | >1 litre (189.9 ml ethanol) | 46 | (2.4) | 34 | (1.7) | 34 | (2.2) | 30 | (2.0) |
| Frequency of drinking spirits | Never | 368 | (19.0) | 405 | (20.3) | 29 | (19.5) | 311 | (21.0) |
| | A few times per year | 370 | (19.1) | 411 | (20.6) | 26 | (17.4) | 275 | (18.6) |
| | 1-3 times/month | 667 | (34.4) | 606 | (30.3) | 49 | (32.5) | 431 | (29.1) |
| | 1-2 times/week | 427 | (22.0) | 385 | (19.3) | 34 | (22.6) | 311 | (21.0) |
| | 3-4 times/week | 65 | (3.4) | 104 | (5.2) | 82 | (5.4) | 92 | (6.2) |
| | Nearly everyday | 36 | (1.9) | 57 | (2.9) | 29 | (1.9) | 39 | (2.6) |
| | Every day or more | 6 | (0.3) | 9 | (0.5) | 7 | (0.5) | 8 | (0.5) |

| | | IFS-1 | | | | IFS-2 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Self-report | | Proxy-report | | Self-report | | Proxy-report | |
| | | N | (%) | N | (%) | N | (%) | N | (%) |
| Usual volume of spirits per occasion[c,d] | Never drinks spirits | 365 | (18.8) | 401 | (20.1) | 294 | (19.4) | 309 | (20.9) |
| | ≤50g[e] (11.8 ml ethanol) | - | | - | | 37 | (2.4) | 41 | (2.8) |
| | 50-100g (35.5 ml ethanol) | 154 | (7.9) | 211 | (10.6) | 126 | (8.3) | 178 | (12.0) |
| | 100-200g (70.9 ml ethanol) | 465 | (24.0) | 408 | (20.4) | 372 | (24.6) | 288 | (19.4) |
| | 200-300g (118.2 ml ethanol) | 585 | (30.1) | 506 | (25.3) | 432 | (28.5) | 347 | (23.4) |
| | 300-400g (165.4ml ethanol) | 123 | (6.3) | 82 | (4.1) | 78 | (5.2) | 57 | (3.9) |
| | 400-500g (212.7 ml ethanol) | 194 | (10.0) | 202 | (10.1) | 147 | (9.7) | 147 | (9.9) |
| | >500g (330.9 ml ethanol) | 49 | (2.5) | 30 | (1.5) | 20 | (1.3) | 24 | (1.6) |
| Maximum volume of spirits consumed per occasion[c,d] | Never drinks spirits | 361 | (18.6) | 399 | (20.0) | 294 | (19.4) | 309 | (20.9) |
| | ≤50g[e] (11.8 ml ethanol) | - | | - | | 11 | (0.7) | 15 | (1.0) |
| | 50-100g (35.5 ml ethanol) | 46 | (2.4) | 67 | (3.4) | 45 | (3.0) | 55 | (3.7) |
| | 100-200g (70.9 ml ethanol) | 152 | (7.8) | 197 | (9.9) | 143 | (9.4) | 165 | (11.1) |
| | 200-300g (118.2 ml ethanol) | 327 | (16.9) | 333 | (16.7) | 280 | (18.5) | 255 | (17.2) |
| | 300-400g (165.4 ml ethanol) | 238 | (12.3) | 158 | (7.9) | 151 | (10.0) | 82 | (5.5) |
| | 400-500g (212.7 ml ethanol) | 504 | (26.0) | 422 | (21.1) | 361 | (23.8) | 284 | (19.2) |
| | >500g (330.9 ml ethanol) | 290 | (14.9) | 221 | (11.1) | 215 | (14.2) | 180 | (12.2) |
| Drinks non-beverage alcohol | Yes | 123 | (6.3) | 159 | (8.0) | 80 | (5.3) | 100 | (6.7) |
| Drinks a large volume of spirits without food | Never | 1685 | (86.8) | 1576 | (78.8) | 1361 | (89.8) | 1247 | (84.1) |
| | Sometimes | 235 | (12.1) | 293 | (14.7) | 133 | (8.8) | 148 | (10.0) |
| | Often | 20 | (1.0) | 63 | (3.2) | 19 | (1.3) | 53 | (3.6) |
| Drinks before noon | Never | 1413 | (72.8) | 1453 | (72.7) | 1088 | (71.8) | 1070 | (72.2) |
| | Occasionally | 501 | (25.8) | 450 | (22.5) | 404 | (26.7) | 354 | (23.9) |
| | Frequently | 25 | (1.3) | 71 | (3.6) | 23 | (1.5) | 42 | (2.8) |
| Drinks alone | Never | 1124 | (57.9) | 1152 | (57.6) | 777 | (51.3) | 769 | (51.9) |
| | Sometimes | 727 | (37.5) | 616 | (30.8) | 643 | (42.4) | 495 | (33.4) |
| | Often | 89 | (4.6) | 193 | (9.7) | 95 | (6.3) | 194 | (13.1) |
| Total[f] | | 1941 | (100) | 2000 | (100) | 1515 | (100) | 1482 | (100) |

[a] 1 bottle of beer considered to be approximately 500ml of beer at average strength of 4.5% ethanol by volume

[b] Wine measured in grams of wine and considered to have an average strength of 12% ethanol by volume

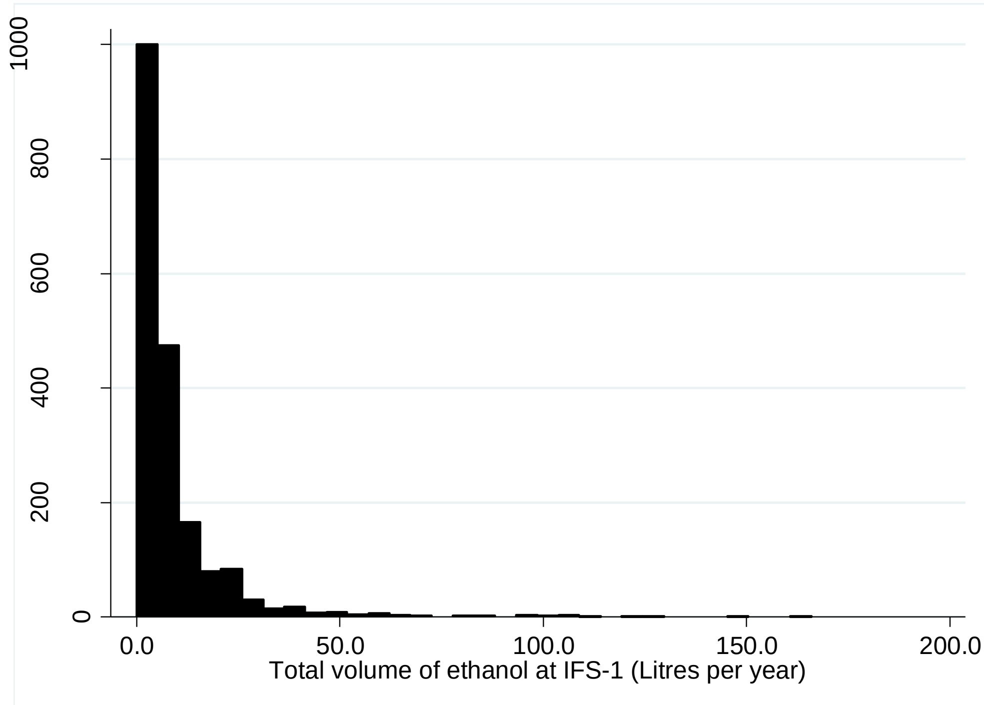
[c] Spirits measured in grams of spirits and considered to have an average strength of 40% ethanol by volume

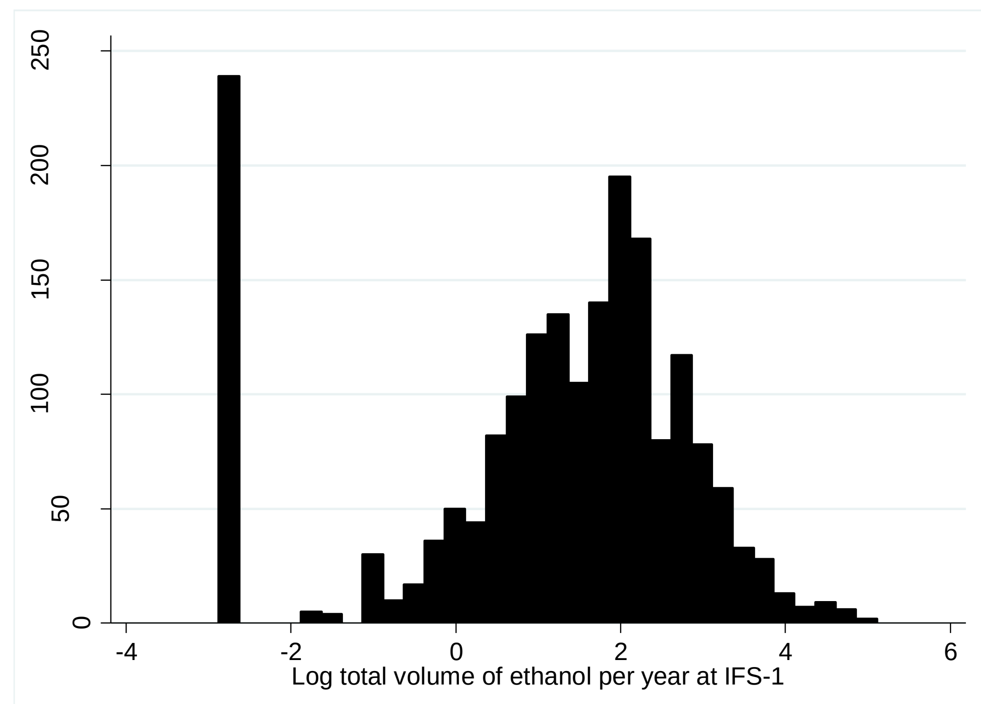
[d] Mid-point of each category in millilitres of ethanol given in brackets

[e] Category of <50 grams of spirits was not included in IFS-1 interview

[f] The number of men with proxy and self-report available at each stage of the study is shown in Chapter 4

**Figure 5.1 Distribution of total volume of ethanol from beverage alcohol (litres per year) and log total volume of ethanol from beverage alcohol at IFS-1**



## Table 5.2 Distribution of acute alcohol-related dysfunction variables at IFS-1 and IFS-2 by self- and proxy-report

| | | IFS-1 | | | | IFS-2 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Self-report | | Proxy-report | | Self-report | | Proxy-report | |
| | | N | (%) | N | (%) | N | (%) | N | (%) |
| Frequency of hangover | Never | 1121 | (57.8) | 1143 | (57.2) | 908 | (59.9) | 850 | (57.4) |
| | Less than once a month | 387 | (19.9) | 340 | (17.0) | 314 | (20.7) | 261 | (17.6) |
| | Once a month | 243 | (12.5) | 206 | (10.3) | 156 | (10.3) | 150 | (10.1) |
| | Several times a month | 90 | (4.6) | 110 | (5.5) | 66 | (4.4) | 73 | (4.9) |
| | Once a week | 46 | (2.4) | 60 | (3.0) | 37 | (2.4) | 44 | (3.0) |
| | Several times a week | 26 | (1.3) | 53 | (2.7) | 21 | (1.4) | 42 | (2.8) |
| | Every day | 11 | (0.6) | 24 | (1.2) | 2 | (0.1) | 8 | (0.5) |
| Frequency of excessive drunkenness | Never | 1122 | (57.8) | 1065 | (53.3) | 954 | (63.0) | 824 | (55.6) |
| | Less than once a month | 450 | (23.2) | 406 | (20.3) | 329 | (21.7) | 279 | (18.8) |
| | Once a month | 227 | (11.7) | 226 | (11.3) | 140 | (9.2) | 165 | (11.1) |
| | Several times a month | 55 | (2.8) | 105 | (5.3) | 43 | (2.8) | 89 | (6.0) |
| | Once a week | 45 | (2.3) | 79 | (4.0) | 22 | (1.5) | 39 | (2.6) |
| | Several times a week | 16 | (0.8) | 65 | (3.3) | 14 | (0.9) | 53 | (3.6) |
| | Every day | 9 | (0.5) | 24 | (1.2) | 1 | (0.1) | 6 | (0.4) |
| Frequency of sleeping in clothes because of drunkenness | Never | 1653 | (85.2) | 1556 | (77.8) | 1326 | (87.5) | 1192 | (80.4) |
| | Less than once a month | 153 | (7.9) | 162 | (8.1) | 87 | (5.7) | 105 | (7.1) |
| | Once a month | 74 | (3.8) | 114 | (5.7) | 44 | (2.9) | 52 | (3.5) |
| | Several times a month | 23 | (1.2) | 60 | (3.0) | 27 | (1.8) | 54 | (3.6) |
| | Once a week | 15 | (0.8) | 28 | (1.4) | 10 | (0.7) | 18 | (1.2) |
| | Several times a week | 11 | (0.6) | 55 | (2.8) | 14 | (0.9) | 42 | (2.8) |
| | Every day | 4 | (0.2) | 13 | (0.7) | 0 | (0.0) | 4 | (0.3) |
| Frequency of failing family or personal obligations due to drinking alcohol | Never | 1593 | (82.1) | 1511 | (75.6) | 1264 | (83.4) | 1132 | (76.4) |
| | Less than once a month | 141 | (7.3) | 135 | (6.8) | 92 | (6.1) | 102 | (6.9) |
| | Once a month | 99 | (5.1) | 122 | (6.1) | 72 | (4.8) | 81 | (5.5) |
| | Several times a month | 34 | (1.8) | 82 | (4.1) | 39 | (2.6) | 54 | (3.6) |
| | Once a week | 14 | (0.7) | 48 | (2.4) | 19 | (1.3) | 37 | (2.5) |
| | Several times a week | 12 | (0.6) | 47 | (2.4) | 13 | (0.9) | 40 | (2.7) |
| | Every day | 6 | (0.3) | 20 | (1.0) | 0 | (0.0) | 3 | (0.2) |
| One or more Episodes of zapoi | | 131 | (6.7) | 205 | (10.3) | 103 | (6.8) | 155 | (10.5) |
| Total[a] | | 1941 | (100) | 2000 | (100) | 1515 | (100) | 1482 | (100) |

[a] The number of men with proxy and self-report available at each stage of the study is shown in Chapter 4

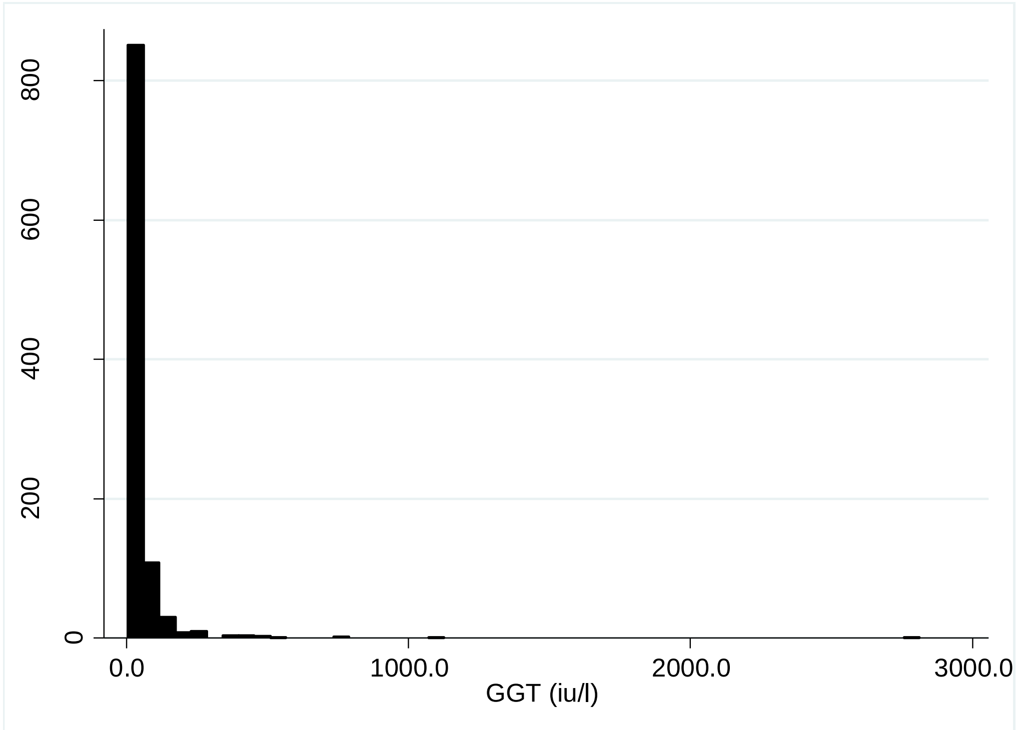
### 5.1.2 Distribution of Alcohol Variables at the IFS-2 Health check

At the IFS-2 health check 1005 men completed the 10 AUDIT questions on the self-completed questionnaire. The distribution of answers to the AUDIT questions is shown in Table 5.3. The distribution of the two alcohol biomarkers GGT and CDT are shown in Figures 5.2 and 5.3. These variables were skewed to the right but became closer to being normally distributed after log transformation.

**Table 5.3 Distribution of answers to the AUDIT questions from the self-completed questionnaire at IFS-2**

| AUDIT Question | Response | N | (%) |
|---|---|---|---|
| AUDIT Question 1: How often do you have a drink containing alcohol including substances not intended to be drunk? | Never | 146 | (14.5) |
| | Monthly or less | 187 | (18.6) |
| | 2-4 times per month | 373 | (37.1) |
| | 2-3 times per week | 200 | (19.9) |
| | 4 or more times per week | 99 | (9.9) |
| AUDIT Question 2: How many drinks (portions) containing alcohol do you have on a typical day when you are drinking? | 1-2 | 390 | (38.8) |
| | 3-4 | 303 | (30.2) |
| | 5-6 | 139 | (13.8) |
| | 7-9 | 75 | (7.5) |
| | ≥10 | 98 | (9.8) |
| AUDIT Question 3: How often do you have 6 or more drinks on one occasion | Never | 257 | (25.6) |
| | Less than monthly | 430 | (42.8) |
| | Monthly | 191 | (19.0) |
| | Weekly | 106 | (10.6) |
| | Daily or almost daily | 21 | (2.1) |
| AUDIT Question 4: How often in the last 3 months have you found you were unable to stop drinking once you had started? | Never | 856 | (85.2) |
| | Less than monthly | 87 | (8.7) |
| | Monthly | 36 | (3.6) |
| | Weekly | 17 | (1.7) |
| | Daily or almost daily | 9 | (0.9) |
| AUDIT Question 5: How often in the last 3 months have you failed to do what was expected of you because of drinking? | Never | 855 | (85.1) |
| | Less than monthly | 117 | (11.6) |
| | Monthly | 25 | (2.5) |
| | Weekly | 5 | (0.5) |
| | Daily or almost daily | 3 | (0.3) |
| AUDIT Question 6: How often in the last 3 months have you needed a drink first thing in the morning to get yourself going after a heavy drinking session? | Never | 776 | (77.2) |
| | Less than monthly | 164 | (16.3) |
| | Monthly | 37 | (3.7) |
| | Weekly | 16 | (1.6) |
| | Daily or almost daily | 12 | (1.2) |
| AUDIT Question 7: How often in the last three months have you had a feeling of guilt or remorse because of drinking? | Never | 645 | (64.2) |
| | Less than monthly | 212 | (21.1) |
| | Monthly | 62 | (6.2) |
| | Weekly | 52 | (5.2) |
| | Daily or almost daily | 34 | (3.4) |
| AUDIT Question 8: How often in the last 3 months were you unable to remember what happened the night before because of drinking? | Never | 785 | (78.1) |
| | Less than monthly | 164 | (16.3) |
| | Monthly | 39 | (3.9) |
| | Weekly | 11 | (1.1) |
| | Daily or almost daily | 6 | (0.6) |
| AUDIT Question 9: Have you or someone else been injured because of your drinking? | No | 781 | (77.7) |
| | Yes, but not in the last year | 185 | (18.4) |
| | Yes, during the last year | 39 | (3.9) |
| AUDIT Question 10: Has a relative, friend, doctor or other health worker been concerned about your drinking or suggested you cut down? | No | 590 | (58.7) |
| | Yes, but not in the last year | 139 | (13.8) |
| | Yes, during the last year | 276 | (27.5) |
| Total | | 1005 | (100) |

**Figure 5.2 Distribution of gamma glutamyl transferase (GGT) and log GGT at IFS-2**



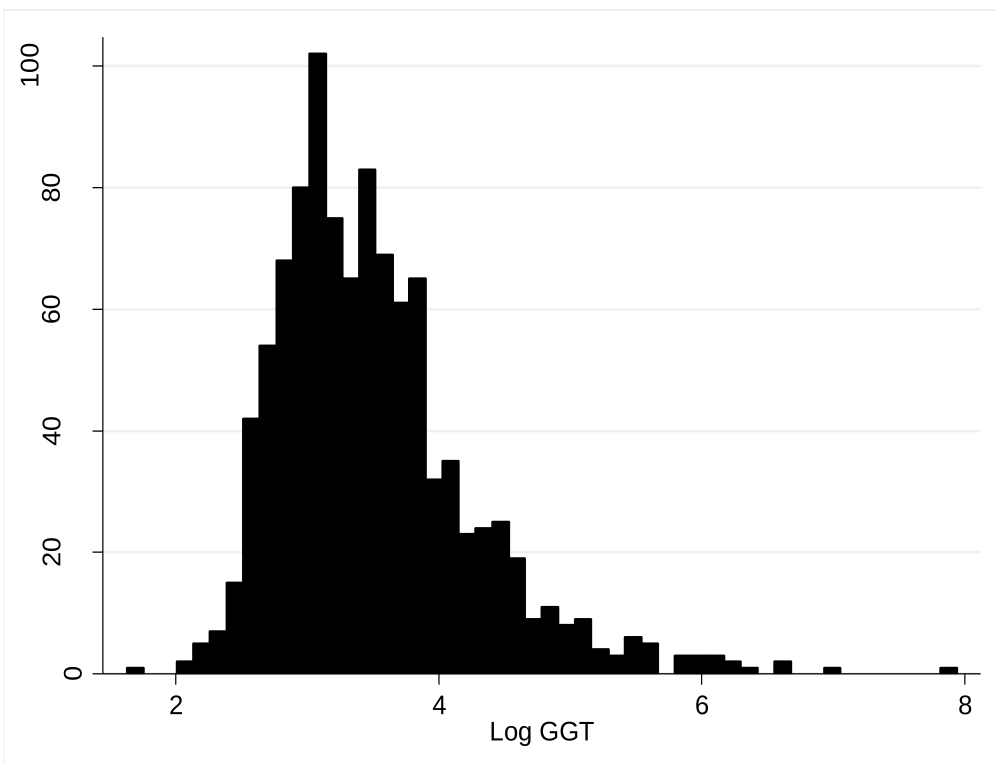
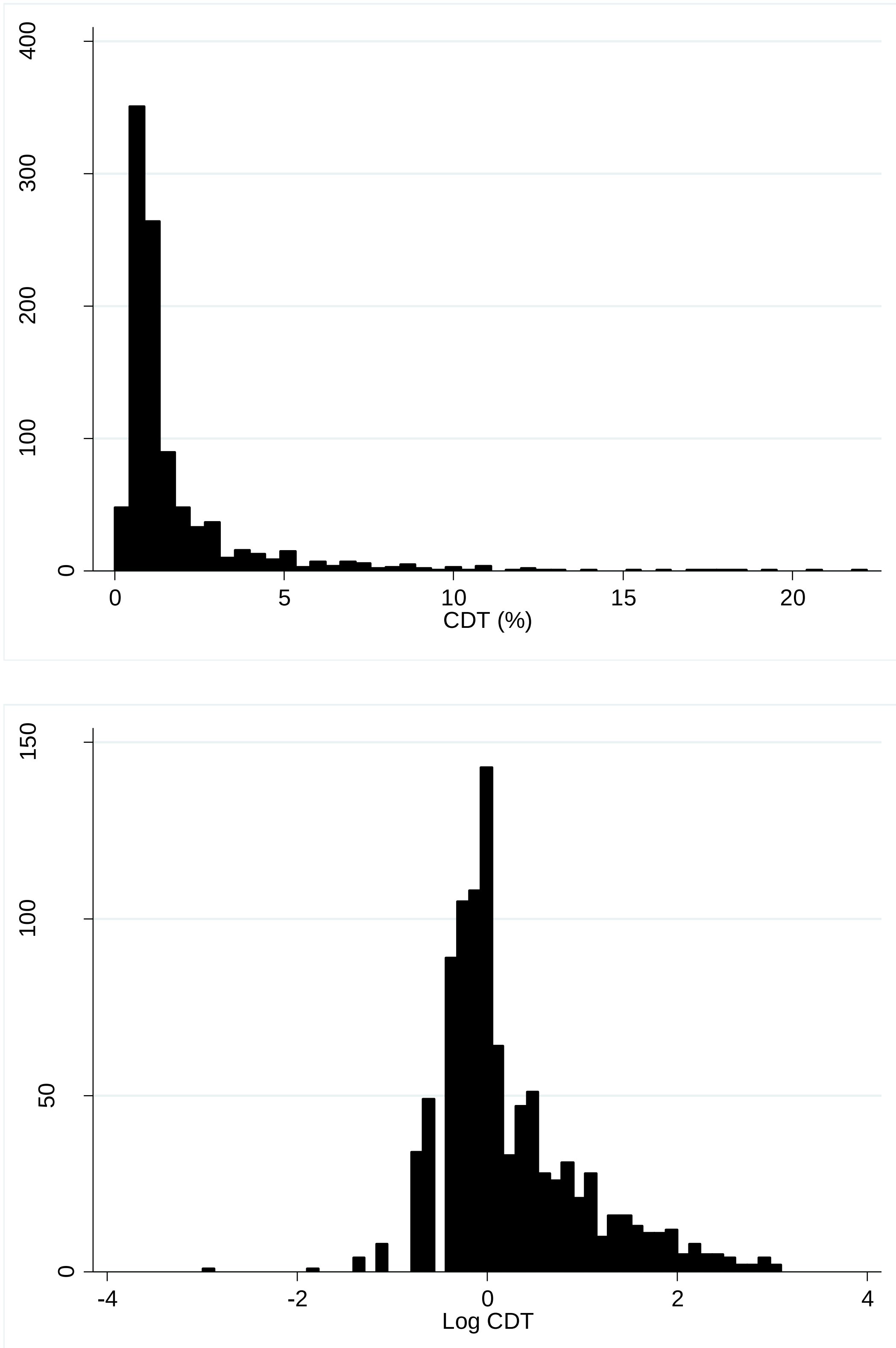



**Figure 5.3 Distribution of carbohydrate deficient transferrin (CDT) and log CDT at IFS-2**



### 5.1.3 Distribution of self-reported socio-demographic variables and potential confounders

The distribution of socio-demographic variables (age, education, marital status, employment status and level of amenities) and other variables measured in the IFS-1 and IFS-2 interviews which might be considered as potential confounders of the relationship between alcohol and health (smoking status and regular physical activity) are shown in Table 5.4. Body mass index (BMI) which may also be considered a potential confounder in some of the analyses was assessed at the IFS-2 health check. The distribution of BMI among the 1044 men who attended the IFS-2 health check was 59 men (5.7%) were underweight (BMI<20), 376 (36.0%) were normal weight (BMI 20-24), 416 (39.9%) were overweight (BMI 25-29), 153 (14.7%) were obese (BMI 30-34) and 40 (3.8%) were severely obese (BMI≥35).

**Table 5.4 Distribution of self-reported socio-demographic variables and potential confounders at the IFS-1 and IFS-2 interviews**

| | | | IFS-1 | | IFS-2 | |
|---|---|---|---|---|---|---|
| | | | N | (%) | N | (%) |
| Age (years) | <30 | | 130 | (6.7) | 22 | (1.5) |
| | 30-34 | | 162 | (8.4) | 110 | (7.3) |
| | 35-39 | | 168 | (8.7) | 142 | (9.4) |
| | 40-44 | | 325 | (16.7) | 164 | (10.8) |
| | 45-49 | | 477 | (24.6) | 281 | (18.6) |
| | 50-54 | | 663 | (34.2) | 370 | (24.4) |
| | ≥55 | | 16 | (0.8) | 426 | (28.1) |
| Education | Incomplete secondary | | 109 | (5.6) | 71 | (4.7) |
| | Secondary | Complete secondary | 635 | (32.7) | 535 | (72.7) |
| | | Professional school | 319 | (16.4) | 204 | (13.5) |
| | | Specialised secondary | 441 | (22.7) | 361 | (23.8) |
| | Higher | Incomplete higher | 47 | (2.4) | 34 | (2.2) |
| | | Higher | 389 | (20.0) | 309 | (20.4) |
| Marital status | Living with a spouse in a registered marriage | | 1496 | (77.1) | 1199 | (79.1) |
| | Living with a spouse not in a registered marriage | | 207 | (10.7) | 147 | (9.7) |
| | Divorced | | 117 | (6.0) | 84 | (5.5) |
| | Widower | | 14 | (0.7) | 18 | (1.2) |
| | Never married | | 107 | (5.5) | 66 | (4.4) |
| Level of amenities | No car or central heating | | 147 | (7.6) | 116 | (7.7) |
| | Car or central heating | | 1038 | (53.5) | 726 | (47.9) |
| | Car and central heating | | 756 | (39.0) | 673 | (44.4) |
| Employment status | In regular paid employment | | 1619 | (83.4) | 1254 | (82.8) |
| | In irregular paid employment | | 321[a] | (16.54) | 78 | (5.2) |
| | Unemployed seeking work | | | | 66 | (4.4) |
| | Unemployed not seeking work | | | | 98 | (6.5) |
| | Other | | | | 19 | (1.3) |
| Takes regular physical activity | Yes | | 1819 | (93.7) | 1410 | (93.1) |
| Smoking status | Never smoked | | 362 | (18.7) | 292 | (19.3) |
| | Ex-smoker | | 269 | (13.9) | 264 | (17.4) |
| | Current smoker | | 1309 | (67.5) | 958 | (63.3) |
| Total | | | 1941 | (100) | 1515 | (100) |

[a] At IFS-1 the question on employment status had only two categories – in regular paid employment or not in regular paid employment

### 5.1.4 Distribution of self-reported health problems

The IFS interviews contained several questions on self-reported health in particular physical functioning such as the ability to carry out activities of daily living such as shopping and getting dressed. The distribution of self-reported health variables at both interviews is shown in Table 5.5. At IFS-1 47% of men reported at least one health problem (46.2% at IFS-2). The most commonly reported health problem was always having a cough in recent months (20.6 % IFS-1; 19.5% IFS-2).

**Table 5.5 Distribution of self-reported health problems at the IFS-1 and IFS-2 interviews**

| Health Problem | | IFS-1 | | IFS-2 | |
|---|---|---|---|---|---|
| | | N | (%) | N | (%) |
| Registered Disabled | Yes | 115 | (5.9) | 130 | (8.6) |
| Able to climb stairs without becoming breathless in recent months | Easily | 1746 | (90.0) | 1366 | (90.2) |
| | With some difficulty | 161 | (8.3) | 118 | (7.8) |
| | Too difficult | 27 | (1.4) | 29 | (1.9) |
| | Missing | 7 | (0.4) | 2 | (0.1) |
| Morning cough in recent months | Always | 400 | (20.6) | 296 | (19.5) |
| | Sometimes | 390 | (20.1) | 281 | (18.6) |
| | Rarely | 200 | (10.3) | 101 | (6.7) |
| | Never | 947 | (48.8) | 836 | (55.2) |
| | Missing | 4 | (0.2) | 1 | (0.1) |
| Difficulty in walking 1 km in recent months | No difficulty | 1742 | (89.8) | 1343 | (88.7) |
| | Slight difficulty | 148 | (7.6) | 108 | (7.1) |
| | Very difficult/impossible | 46 | (2.4) | 60 | (4.0) |
| | Missing | 5 | (0.3) | 4 | (0.3) |
| Problems with the activities of daily living | Yes | 28 | (1.4) | 24 | (1.6) |
| | Missing | 0 | (0.0) | 2 | (0.1) |
| Any health problem[a] | Yes | 913 | (47.0) | 700 | (46.2) |
| | Missing | 15 | (0.8) | 8 | (0.5) |
| Total | | 1941 | (100) | 1515 | (100) |

[a] Registered disabled and/or difficulty climbing stairs in recent months and/or always has a morning cough and/or difficulty in walking 1 km in recent months and/or problems with the activities of daily living

## 5.2 Missing Data

### 5.2.1 Inclusions, Exclusions and Missingness

The Izhevsk Family Studies include subjects with missing or incomplete data which is a potential source of selection bias.

There are four main reasons for missing data: non-response at IFS-1 (index and/or proxy), loss to follow up between IFS-1 and IFS-2 (index and/or proxy), loss to follow up between the IFS-2 interview and the health check (index only), and item non-response. The number of men and proxy respondents who took part in each stage of the Izhevsk Family Studies is summarized in Chapter 4. The need for a proxy at IFS-1 automatically excluded all men living alone in 2003-2006. This reduces the generalisability of the results from the study to all men living in Izhevsk. The overall rate of participation among indexes at IFS-1 was 54.9% and 56.9% among proxies. Excluding those who took part in the pilot study of IFS-2 (who are not included in the because of changes in the questionnaire between the pilot and main study) 524 (27%) index men were lost to follow up between IFS-1 and IFS-2. An additional 463 men were lost between the IFS-2 interview and health check. Therefore of the original 3078 households approached in IFS-1, 989 (32.1%) men participated in all parts of IFS-1 and IFS-2. In addition not all men had a proxy report at both time points. There were 1580/1941 (81.4%) men at IFS-1 with both self and proxy data available, and 1391/1515 (91.8%) men at IFS-2. It is probable that very heavy drinkers were more likely to be excluded at both surveys.

There are missing data for individual questions from both interviews and from the self-completed questionnaire. This occurred when men either refused to answer questions or found them difficult to answer. The amounts of data missing for questions on alcohol use in the IFS-1 and IFS-2 interviews by proxy and self-report are shown in Table 5.5. The amounts of missing data were similar at both IFS-1 and IFS-2. The amounts of missing data varied by question (for example at IFS-1 2 men did not answer the question on frequency of spirit consumption, 23 men did not answer the question on the maximum volume of spirits and 42 men did not answer the question on the frequency of failing family of personal obligations due to drinking alcohol). The amount of data missing per question ranged from 0% to 2.2% for self-reported data and 0.5% to 10.2% for proxy-reported data. There was more missing data for questions when the respondent was a proxy compared to the index participant himself for every question except frequency of failing family or personal obligations at IFS-1, however the amount of missing data for proxy respondents was particularly high for questions on usual and maximum volume of beer, wine and spirits consumed.

**Table 5.6 Item non-response to questions on alcohol at IFS-1 and IFS-2 by self- and proxy- report**

| Alcohol variable | IFS-1 | | | | IFS-2 | | | |
|---|---|---|---|---|---|---|---|---|
| | Self-report | | Proxy-report | | Self-report | | Proxy-report | |
| | N | (%) | N | (%) | N | (%) | N | (%) |
| Frequency of drinking beer | 1 | (0.05) | 21 | (1.05) | 1 | (0.07) | 14 | (0.9) |
| Usual volume of beer | 8 | (0.41) | 75 | (3.75) | 2 | (0.13) | 34 | (2.29) |
| Maximum volume of beer | 20 | (1.03) | 155 | (7.75) | 6 | (0.40) | 63 | (4.25) |
| Frequency of drinking wine | 0 | (0.00) | 24 | (1.20) | 3 | (0.20) | 18 | (1.21) |
| Usual volume of wine | 6 | (0.31) | 83 | (4.15) | 3 | (0.20) | 36 | (2.43) |
| Maximum volume of wine | 12 | (0.62) | 116 | (5.80) | 7 | (0.46) | 42 | (2.83) |
| Frequency of drinking spirits | 2 | (0.10) | 23 | (1.15) | 1 | (0.07) | 15 | (1.01) |
| Usual volume of spirits | 4 | (0.21) | 160 | (8.00) | 9 | (0.59) | 91 | (6.14) |
| Maximum volume of spirits | 23 | (1.18) | 203 | (10.15) | 15 | (0.99) | 137 | (9.24) |
| Consumption of non-beverage alcohol | 0 | (0.0) | 28 | (1.40) | 1 | (0.07) | 20 | (1.35) |
| Zapoi | 4 | (0.21) | 10 | (0.50) | 1 | (0.07) | 9 | (0.61) |
| Drinking spirits without food | 1 | (0.05) | 68 | (3.40) | 2 | (0.13) | 34 | (2.29) |
| Drinks alone | 1 | (0.05) | 39 | (1.95) | 0 | (0.00) | 24 | (1.62) |
| Drinks before noon | 2 | (0.10) | 36 | (1.80) | 0 | (0.00) | 16 | (1.08) |
| Frequency of Hangover | 17 | (0.88) | 64 | (3.20) | 11 | (0.73) | 54 | (3.64) |
| Frequency of Excessive Drunkenness | 17 | (0.88) | 30 | (1.50) | 12 | (0.79) | 27 | (1.82) |
| Frequency of Sleeping in clothes because of drunkenness | 8 | (0.41) | 12 | (0.60) | 7 | (0.46) | 15 | (1.01) |
| Frequency of failing family or personal obligations due to drinking | 42 | (2.16) | 35 | (1.75) | 16 | (1.06) | 33 | (2.23) |
| Any question | 117 | (6.3) | 476 | (23.8) | 63 | (4.2) | 295 | (19.9) |
| Total | 1941 | (100) | 2000 | (100) | 1515 | (100) | 1482 | (100) |

### 5.2.2 Predictors of Participation and Missing data

*Characteristics of men who were not re-interviewed at IFS-2*

The distribution of socio-demographic variables and smoking status at IFS-1 for men who were re-interviewed at IFS-2 and men who were not is shown in Table 5.6. Variables associated with re-interview at IFS-2 were employment status (p<0.001), marital status (p<0.001), level of amenities (p=0.05) and having one or more health problem (p=0.05). Men who were not re-interviewed at IFS-2 were less likely to be in regular employment (76.7% vs 86.0% P<0.001), less likely to be married (70.2% vs 79.6%), more likely to be divorced or separated (10.7% vs 4.3%) , more likely to have lower levels of amenities (9.9% vs. 6.7% with neither a car or central heating) and more likely to have a health problem (51.6% vs 46.1%) at IFS-1. There was no evidence of a difference in the age, education or smoking status of men who were re-interviewed compared to men who were not.

The distributions of alcohol variables at IFS-1 by whether men were re-interviewed at IFS-2 are shown in Table 5.7. There was no evidence that men who were not re-interviewed differed by whether they had consumed alcohol in the past year or by any of the beverage alcohol intake variables, however men who were not re-interviewed at IFS-2 were more likely to drink non-beverage alcohol (P=0.02), drink before noon (P=0.005), have been on zapoi in the past year (p<0.001), and more frequently had hangovers (p=0.03), got excessively drunk (p=0.03), slept in clothes because of drunkenness (p=0.007) and failed family or personal obligations due to drinking alcohol (P=0.01) at IFS-1.

*Characteristics of men who did not attend the health check at IFS-2*

Characteristics of men interviewed at IFS-2 in terms of socio-demographic variables, health problems, and smoking status stratified by whether men attended the IFS-2 health check are shown in Tables 5.8. There was strong evidence (P<0.001) that men who did not attend the health check had fewer amenities than men who did attend. There was no evidence of a difference by age, education, employment, marital status smoking status, or presence of health problems. The distribution of alcohol variables by whether men interviewed at IFS-2 attended the health check are shown in Table 5.9. There was some evidence that among men who drank wine, the mean usual volume consumed per occasion (P=0.03) and the mean maximum volume consumed per occasion (P=0.01) was higher in men who did not attend the health check. There was no evidence of a difference with any of the of the other alcohol use variable

**Table 5.7 Distribution of socio-demographic characteristics, smoking status and health problems at IFS-1 by whether men were re-interviewed at IFS-2**

| Predictors at IFS-1 | | Re-interviewed at IFS-2 | | Not re-interviewed at IFS-2 | |
|---|---|---|---|---|---|
| | | N | (%) | N | (%) |
| Age | 25-29 | 94 | (6.6) | 36 | (6.9) |
| | 30-34 | 123 | (8.7) | 39 | (7.4) |
| | 35-39 | 126 | (8.9) | 42 | (8.0) |
| | 40-44 | 235 | (16.6) | 90 | (17.2) |
| | 45-49 | 338 | (23.9) | 139 | (26.5) |
| | 50-54 | 490 | (34.6) | 173 | (33.0) |
| | ≥55 | 11 | (0.8) | 5 | (1.0) |
| | Chi square (df) | 2.7 (6) P=0.85 | | | |
| Education | Incomplete secondary | 71 | (5.0) | 38 | (7.3) |
| | Secondary | 1032 | (72.8) | 363 | (69.4) |
| | Higher and incomplete higher | 314 | (22.2) | 122 | (23.3) |
| | Chi square (df) | 4.3 (2) P=0.12 | | | |
| Employment status (missing=1) | In regular paid employment | 1217 | (86.0) | 402 | (76.7) |
| | Not in regular paid employment | 199 | (14.1) | 122 | (23.3) |
| | Chi square (df) | 23.6 (1) P<0.001 | | | |
| Marital status | Living with spouse in registered marriage | 1128 | (79.6) | 368 | (70.2) |
| | Living with spouse not in registered marriage | 144 | (10.2) | 63 | (12.0) |
| | Divorced | 61 | (4.3) | 56 | (10.7) |
| | Widower | 9 | (0.6) | 5 | (1.0) |
| | Never married | 75 | (5.3) | 32 | (6.1) |
| | Chi square (df) | 32.5 (4) P<0.001 | | | |
| Amenity Index | Neither car or central heating | 95 | (6.7) | 52 | (9.9) |
| | Either car or central heating | 761 | (53.7) | 277 | (52.9) |
| | Both car and central heating | 561 | (39.6) | 195 | (37.2) |
| | Chi square (df) | 5.8 (2) p=0.05 | | | |
| Smoking Status (missing =1) | Never | 265 | (18.7) | 97 | (18.5) |
| | Ex-smoker | 208 | (14.7) | 61 | (11.6) |
| | Current smoker | 943 | (66.6) | 366 | (69.9) |
| | Chi square (df) | 3.2 (2) P=0.21 | | | |
| Health problems[a] (missing=15) | No | 758 | (54.0) | 255 | (48.9) |
| | Yes | 647 | (46.1) | 266 | (51.1) |
| | Chi square (df) | 3.82 (1) p=0.05 | | | |
| Total | | 1417 | (100) | 524 | (100) |

**[a] Health problems defined as registered disabled and/or breathless climbing stairs and/or difficulty walking 1 km and/or always has a cough in the morning and/or problems with activities of daily living**

## Table 5.8 Distribution of alcohol variables at IFS-1 by whether men were re-interviewed at IFS-2

| Self-reported alcohol variable at IFS-1 | | Re-interviewed at IFS-2 (% or SD) | | Not re-interviewed at IFS-2 (% or SD) | | P value[a] |
|---|---|---|---|---|---|---|
| Drinks alcohol | No | 182 | (12.8) | 54 | (10.3) | Chi square (1 df) p=0.13 |
| | Yes | 1235 | (87.2) | 470 | (89.7) | |
| Drinks non-beverage alcohol | No | 1338 | (94.4) | 480 | (91.6) | Chi square (1 df) p=0.02 |
| | Yes | 79 | (5.6) | 44 | (8.4) | |
| Frequency of drinking beer (Missing=1) | Never drinks beer | 376 | (26.6) | 129 | (24.6) | Chi squares (6 df) p=0.22 |
| | A few times per year | 106 | (7.5) | 42 | (8.0) | |
| | 1-3 times per month | 318 | (22.5) | 116 | (22.1) | |
| | 1-2 times/week | 404 | (28.5) | 174 | (33.2) | |
| | 3-4 times/week | 132 | (9.3) | 32 | (6.1) | |
| | Almost daily | 65 | (4.6) | 25 | (4.8) | |
| | Daily | 15 | (1.1) | 6 | (1.2) | |
| Mean usual volume of ethanol from beer in beer drinkers (mls of ethanol) (Missing=8) | | 44.3 | (26.0) | 45.2 | (25.4) | ANOVA p=0.56 |
| Mean maximum volume of ethanol for beer in beer drinkers (mls of ethanol) (Missing=20) | | 54.4 | (48.9) | 55.9 | (48.4) | ANOVA p=0.88 |
| Frequency of drinking wine (Missing=6) | Never drinks wine | 939 | (66.3) | 344 | (65.7) | Chi square (6df) p=0.43 |
| | A few times per year | 255 | (18.0) | 92 | (17.6) | |
| | 1-3 times per month | 154 | (10.9) | 51 | (9.7) | |
| | 1-2 times/week | 53 | (3.7) | 31 | (5.9) | |
| | 3-4 times/week | 12 | (0.9) | 4 | (0.8) | |
| | Almost daily | 4 | (0.3) | 2 | (0.4) | |
| | Daily | 0 | (0.0) | 0 | (0.0) | |
| Mean usual volume of ethanol from wine in wine drinkers (mls of ethanol) (Missing=6) | | 44.7 | (31.0) | 50.0 | (38.8) | ANOVA p=0.07 |
| Mean maximum volume of ethanol for wine in wine drinkers (mls of ethanol) (Missing=12) | | 72.5 | (45.4) | 74.6 | (48.6) | ANOVA p=0.62 |
| Frequency of drinking spirits (Missing=2) | Never drinks spirits | 271 | (19.1) | 97 | (18.6) | Chi square (6df) p=0.47 |
| | A few times per year | 277 | (19.6) | 93 | (17.8) | |
| | 1-3 times per month | 492 | (34.8) | 175 | (33.5) | |
| | 1-2 times/week | 301 | (21.3) | 126 | (24.1) | |
| | 3-4 times/week | 49 | (3.5) | 16 | (3.1) | |
| | Almost daily | 23 | (1.6) | 13 | (2.5) | |
| | Daily | 3 | (0.2) | 3 | (0.6) | |
| Mean usual volume of ethanol from spirits in spirit drinkers (mls of ethanol) | | 117.7 | (64.0) | 119.6 | (62.1) | ANOVA p=0.60 |
| Mean maximum volume of ethanol for spirits in spirit drinkers (mls of ethanol) (Missing=23) | | 150.9 | (104.1) | 158.9 | (110.7) | ANOVA p=0.08 |
| Spirits without food (missing=1) | Never | 1240 | (87.6) | 445 | (84.9) | Chi square (df) (2df) P=0.28 |
| | Sometimes | 163 | (11.5) | 72 | (13.7) | |
| | Always | 13 | (0.9) | 7 | (1.3) | |
| Drink alone (missing=1) | Never | 823 | (58.1) | 301 | (57.4) | Chi square (2df) P=0.95 |
| | Sometimes | 529 | (37.4) | 198 | (37.8) | |
| | Often | 64 | (4.5) | 25 | (4.8) | |
| Drink before noon (missing=2) | Never | 1054 | (74.5) | 359 | (68.5) | Chi square (2df) P=0.005 |
| | Occasionally | 348 | (24.6) | 153 | (29.2) | |
| | Frequently | 13 | (0.9) | 12 | (2.3) | |
| Zapoi (Missing=4) | No | 1337 | (94.6) | 469 | (89.5) | Chi square (1df) P<0.001 |
| | Yes | 76 | (5.4) | 55 | (10.5) | |

| Self-reported alcohol variable at IFS-1 | | Re-interviewed at IFS-2 (% or SD) | | Not re-interviewed at IFS-2 (% or SD) | | P value |
|---|---|---|---|---|---|---|
| Frequency of hangover (Missing=17) | Never | 826 | (58.8) | 295 | (57.0) | Chi square (6df) P=0.03 |
| | Less than once a month | 283 | (20.1) | 104 | (20.1) | |
| | Once a month | 185 | (13.2) | 58 | (11.2) | |
| | Several times a month | 63 | (4.5) | 27 | (5.2) | |
| | Once a week | 28 | (2.0) | 18 | (3.5) | |
| | Several times a week | 17 | (1.2) | 9 | (1.7) | |
| | Every day | 4 | (0.3) | 7 | (1.4) | |
| Frequency of excessive drunkenness (Missing =17) | Never | 825 | (58.7) | 297 | (57.2) | Chi square(6df) P=0.03 |
| | Less than once a month | 337 | (24.0) | 113 | (21.8) | |
| | Once a month | 167 | (11.9) | 60 | (11.6) | |
| | Several times a month | 34 | (2.4) | 21 | (4.1) | |
| | Once a week | 29 | (2.1) | 16 | (3.1) | |
| | Several times a week | 10 | (0.7) | 6 | (1.2) | |
| | Every day | 3 | (0.2) | 6 | (1.2) | |
| Frequency of sleeping in clothes because of drunkenness (Missing =8) | Never | 1217 | (86.3) | 436 | (83.4) | Chi square (6df) P=0.007 |
| | Less than once a month | 107 | (7.6) | 46 | (8.8) | |
| | Once a month | 58 | (4.1) | 16 | (3.1) | |
| | Several times a month | 9 | (0.6) | 14 | (2.7) | |
| | Once a week | 9 | (0.6) | 6 | (1.2) | |
| | Several times a week | 8 | (0.6) | 3 | (0.6) | |
| | Every day | 2 | (0.1) | 2 | (0.4) | |
| Frequency of failing to fulfil family or personal obligations because of drinking alcohol (Missing =42) | Never | 1170 | (84.5) | 423 | (82.1) | Chi square(6df) P=0.01 |
| | Less than once a month | 104 | (7.5) | 37 | (7.2) | |
| | Once a month | 74 | (5.4) | 25 | (4.9) | |
| | Several times a month | 19 | (1.4) | 15 | (2.9) | |
| | Once a week | 6 | (0.4) | 8 | (1.6) | |
| | Several times a week | 9 | (0.7) | 3 | (0.6) | |
| | Every day | 2 | (0.1) | 4 | (0.8) | |
| | Total | 1417 | (100) | 524 | (100) | |

[a] P values from chi square test for categorical variables and analysis of variance (ANOVA) using the F statistic (a comparison of between group and within group variance) for continuous variables

## Table 5.9 Distribution of socio-demographic characteristics, smoking status, and health problems at IFS-2 by whether men attended the IFS-2 health check

| Predictors at IFS-2 | | Attended Health Check | | Did not attend health check | |
|---|---|---|---|---|---|
| | | N | (%) | N | (%) |
| Age | 25-29 | 16 | (1.5) | 6 | (1.3) |
| | 30-34 | 76 | (7.2) | 34 | (7.3) |
| | 35-39 | 98 | (9.3) | 44 | (9.5) |
| | 40-44 | 120 | (11.4) | 44 | (9.5) |
| | 45-49 | 202 | (19.2) | 79 | (17.1) |
| | 50-54 | 261 | (24.8) | 109 | (23.5) |
| | ≥55 | 279 | (26.5) | 147 | (31.8) |
| | Chi square (df) | 5.3 (6) P=0.50 | | | |
| Education (missing=1) | Incomplete secondary | 48 | (4.6) | 23 | (5.0) |
| | Secondary | 771 | (73.3) | 329 | (71.2) |
| | Higher and incomplete higher | 233 | (22.2) | 110 | (23.8) |
| | Chi square (df) | 0.7 (2) P=0.71 | | | |
| Employment status | In regular paid employment | 877 | (83.4) | 377 | (81.4) |
| | In irregular paid employment | 48 | (4.6) | 30 | (6.5) |
| | Unemployed seeking work | 47 | (4.5) | 19 | (4.1) |
| | Unemployed not seeking work | 70 | (6.7) | 28 | (6.1) |
| | Other | 10 | (1.0) | 9 | (1.9) |
| | Chi square (df) | 5.3 (4) P=0.26 | | | |
| Marital status (missing=1) | Living with spouse in registered marriage | 849 | (80.8) | 350 | (75.6) |
| | Living with spouse not in registered marriage | 99 | (9.4) | 48 | (10.4) |
| | Divorced | 56 | (5.3) | 28 | (6.1) |
| | Widower | 9 | (0.9) | 9 | (1.9) |
| | Never married | 38 | (3.6) | 28 | (6.1) |
| | Chi square (df) | 9.2 (4) P=0.06 | | | |
| Amenity Index | Neither car or central heating | 66 | (6.3) | 50 | (10.8) |
| | Either car or central heating | 488 | (46.4) | 238 | (51.4) |
| | Both car and central heating | 498 | (47.3) | 175 | (37.8) |
| | Chi square (df) | 16.9 (2) P<0.001 | | | |
| Smoking Status (missing =1) | Never smoked | 202 | (19.2) | 90 | (19.4) |
| | Ex-smoker | 192 | (18.3) | 72 | (15.6) |
| | Current smoker | 657 | (62.5) | 301 | (65.0) |
| | Chi square (df) | 1.7 (2) P=0.43 | | | |
| Health Problems[a] | No | 566 | (54.1) | 241 | (52.4) |
| | Yes | 481 | (45.9) | 219 | (47.6) |
| | Chi square (df) | 0.35 (1) P=0.55 | | | |
| Total | | 1052 | (100) | 463 | (100) |

[a] Health problems defined as registered disabled and/or breathless climbing stairs and/or difficulty walking 1 km and/or always has a cough in the morning and/or problems with activities of daily living

## Table 5.10 Distribution of alcohol variables at IFS-2 by whether men attended the IFS-2 Health Check

| Self-reported alcohol variable at IFS-2 | | Attended Health Check (% or SD) | | Did not attend Health Check (% or SD) | | P value [a] |
|---|---|---|---|---|---|---|
| Drinks alcohol | No | 138 | (13.1) | 64 | (13.8) | Chi square(1df) P=0.71 |
| | Yes | 914 | (86.9) | 399 | (86.2) | |
| Drinks non-beverage alcohol (missing=1) | No | 999 | (95.1) | 435 | (94.0) | Chi square (1df) P=0.38 |
| | Yes | 52 | (5.0) | 28 | (6.1) | |
| Frequency of drinking beer (Missing=1) | Never drinks beer | 322 | (30.6) | 144 | (31.1) | Chi square (6df) P=0.22 |
| | A few times per year | 75 | (7.1) | 33 | (7.1) | |
| | 1-3 times per month | 219 | (20.8) | 73 | (15.8) | |
| | 1-2 times/week | 278 | (26.5) | 146 | (31.5) | |
| | 3-4 times/week | 94 | (8.9) | 36 | (7.8) | |
| | Almost daily | 46 | (4.4) | 24 | (5.2) | |
| | Daily | 17 | (1.6) | 7 | (1.5) | |
| Mean usual volume of ethanol from beer in beer drinkers (Missing=2) | (mls of ethanol) | 45.9 | (27.1) | 44.0 | (27.7) | ANOVA P=0.31 |
| Mean maximum volume of ethanol for beer in beer drinkers (Missing=6) | (mls of ethanol) | 68.7 | (39.3) | 70.7 | (43.9) | ANOVA P=0.47 |
| Frequency of drinking wine (Missing=3) | Never drinks wine | 731 | (69.6) | 318 | (68.8) | Chi square (6df) P=0.33 |
| | A few times per year | 181 | (17.2) | 82 | (17.8) | |
| | 1-3 times per month | 93 | (8.9) | 38 | (8.2) | |
| | 1-2 times/week | 29 | (2.8) | 20 | (4.3) | |
| | 3-4 times/week | 11 | (1.1) | 2 | (0.4) | |
| | Almost daily | 5 | (0.5) | 1 | (0.2) | |
| | Daily | 0 | (0.0) | 1 | (0.2) | |
| Mean usual volume of ethanol from wine in wine drinkers (Missing=3) | (mls of ethanol) | 43.3 | (35.1) | 51.4 | (38.3) | ANOVA P=0.03 |
| Mean maximum volume of ethanol for wine in wine drinkers (Missing=7) | (mls of ethanol) | 63.1 | (46.9) | 75.8 | (53.3) | ANOVA P=0.01 |
| Frequency of drinking spirits (Missing=1) | Never drinks spirits | 204 | (19.4) | 92 | (19.9) | Chi square (6df) P=0.43 |
| | A few times per year | 180 | (17.1) | 84 | (18.1) | |
| | 1-3 times per month | 345 | (32.8) | 148 | (32.0) | |
| | 1-2 times/week | 244 | (23.3) | 99 | (21.4) | |
| | 3-4 times/week | 54 | (5.1) | 28 | (6.1) | |
| | Almost daily | 17 | (1.6) | 12 | (2.6) | |
| | Daily | 7 | (0.7) | 0 | (0.0) | |
| Mean usual volume of ethanol from spirits in spirit drinkers (Missing=9) | (mls of ethanol) | 109.1 | (59.9) | 111.8 | (61.6) | ANOVA P=0.46 |
| Mean maximum volume of ethanol for spirits in spirit drinkers (Missing=15) | (mls of ethanol) | 178.2 | (87.1) | 186.7 | (89.7) | ANOVA P=0.12 |
| Spirits without food (missing=2) | Never | 950 | (90.5) | 411 | (88.8) | Chi square (2df) P=0.58 |
| | Sometimes | 88 | (8.4) | 45 | (9.7) | |
| | Always | 12 | (1.1) | 7 | (1.5) | |
| Drink alone | Never | 551 | (52.4) | 226 | (48.8) | Chi square(2df) P=0.41 |
| | Sometimes | 438 | (41.6) | 205 | (44.3) | |
| | Often | 63 | (6.0) | 32 | (6.9) | |
| Drink before noon | Never | 773 | (73.5) | 315 | (68.0) | Chi square (2df) P=0.06 |
| | Occasionally | 262 | (24.9) | 142 | (30.7) | |
| | Frequently | 17 | (1.6) | 6 | (1.3) | |
| Zapoi (Missing=1) | No | 977 | (93.0) | 434 | (93.7) | Chi square (1df) P=0.59 |
| | Yes | 74 | (7.0) | 29 | (6.3) | |
| Frequency of hangover (Missing=11) | Never | 632 | (60.5) | 276 | (60.1) | Chi square (6df) P=0.18 |
| | Less than once a month | 233 | (22.3) | 81 | (17.7) | |
| | Once a month | 99 | (9.5) | 57 | (12.4) | |
| | Several times a month | 43 | (4.1) | 23 | (5.0) | |
| | Once a week | 23 | (2.2) | 14 | (3.1) | |
| | Several times a week | 13 | (1.2) | 8 | (1.7) | |
| | Every day | 2 | (0.2) | 0 | (0.0) | |

| Self-reported alcohol variable at IFS-2 | | Attended Health Check (% or SD) | | Did not attend Health Check (% or SD) | | P value |
|---|---|---|---|---|---|---|
| Frequency of excessive drunkenness (Missing =12) | Never | 659 | (62.9) | 295 | (64.7) | Chi square (6df) P=0.16 |
| | Less than once a month | 242 | (23.1) | 87 | (19.1) | |
| | Once a month | 90 | (8.6) | 50 | (11.0) | |
| | Several times a month | 28 | (2.7) | 15 | (3.3) | |
| | Once a week | 19 | (1.8) | 3 | (0.7) | |
| | Several times a week | 8 | (0.8) | 6 | (1.3) | |
| | Every day | 1 | (0.1) | 0 | (0.0) | |
| Frequency of sleeping in clothes because of drunkenness (Missing =7) | Never | 933 | (89.0) | 393 | (85.4) | Chi square (5df) P=0.34 |
| | Less than once a month | 56 | (5.3) | 31 | (6.7) | |
| | Once a month | 29 | (2.8) | 15 | (3.3) | |
| | Several times a month | 16 | (1.5) | 11 | (2.4) | |
| | Once a week | 7 | (0.7) | 3 | (0.7) | |
| | Several times a week | 7 | (0.7) | 7 | (1.5) | |
| | Every day | 0 | (0.0) | 0 | (0.0) | |
| Frequency of failing to fulfil family or personal obligations because of drinking alcohol (Missing =16) | Never | 880 | (84.4) | 384 | (84.2) | Chi square (5df) P=0.81 |
| | Less than once a month | 66 | (6.3) | 26 | (5.7) | |
| | Once a month | 48 | (4.6) | 24 | (5.3) | |
| | Several times a month | 28 | (2.7) | 11 | (2.4) | |
| | Once a week | 14 | (1.3) | 5 | (1.1) | |
| | Several times a week | 7 | (0.7) | 6 | (1.3) | |
| | Every day | 0 | (0.0) | 0 | (0.0) | |
| | Total | 1052 | (100) | 463 | (100) | |

[a] P values from chi square test for categorical variables and analysis of variance (ANOVA) using the F statistic (a comparison of between group and within group variance) for continuous variables

*Predictors of item non-response*

The question with the largest amount of missing self-reported data was the frequency of failing to fulfil family or personal obligations due to drinking alcohol at IFS-1. The variables associated with missing data for this variable were investigated in more detail among drinkers. This analysis was restricted to drinkers as men who reported that they did not drink alcohol were not asked more detailed questions on their alcohol use including the question on failing to fulfil family or personal obligations and were therefore not at risk of having missing data for this question (since they were automatically coded as never experiencing this behaviour). The alcohol variable with the largest amount of missing data was investigated rather than investigating predictors of missing data on any alcohol use variable in order to determine if item non-response was related to alcohol consumption and experience of other alcohol-related dysfunctional behaviours.

The amount of missing data for failing to fulfil family or personal obligations due to drinking alcohol at IFS-1 by socio-demographic variables, smoking status and other alcohol use variables is shown in Table 5.10. There was strong evidence that the probability of missing data depended on employment status and some evidence that the probability of having missing data for this question depended on the education and marital status of the respondent. Men who were in not in regular paid employment were more likely to have missing data on this question than men in regular paid employment (1.8% in regular paid employment vs. 6.0% not in regular paid employment). Men with lower education and men who were widowers or never married were more likely to have missing data for this question than men who were married (2.4% married vs. 15.4% widower) or had a higher educational level (1.3% higher education vs. 4.5% incomplete secondary education). There was strong evidence that men who were current smokers were more likely to have missing data for this question than non smokers or ex smokers (0.6% non-smokers vs. 3.3% current smokers). There was strong evidence that non-response was associated with a higher frequency of drinking spirits, drinking large volume of spirits without eating some food, drinking before noon, going on zapoi and having a higher frequency of hangover, being excessively drunk and sleeping in clothes because of drunkenness. There was also some evidence that missing data was associated with frequency of drinking wine and beer.

**Table 5.11 Percentage of missing data on the question on failing to fulfil family or personal obligations due to drinking alcohol at IFS-1 by socio-demographic variables, smoking status and alcohol use among drinkers**

| Predictor at IFS-1 | | Amount of data missing on failing to fulfil family or personal obligations at IFS-1 (%) | | P value |
|---|---|---|---|---|
| Age | 25-29 | 1/120 | (0.8) | Chi square (6df) p=0.71 |
| | 30-34 | 3/143 | (2.1) | |
| | 35-39 | 5/156 | (3.2) | |
| | 40-44 | 7/283 | (2.5) | Test for trend p=0.54 |
| | 45-49 | 13/419 | (3.1) | |
| | 50-54 | 12/568 | (2.1) | |
| | ≥55 | 1/16 | (6.3) | |
| Education | Incomplete secondary | 4/89 | (4.5) | Chi square (2df) p=0.12 |
| | Secondary | 33/1217 | (2.7) | |
| | Higher | 5/399 | (1.3) | Test for trend p=0.04 |
| Marital Status | Living with spouse in registered marriage | 32/1315 | (2.4) | Chi square (4df) p=0.04 |
| | Living with spouse not in registered marriage | 4/178 | (2.3) | |
| | Divorced | 1/105 | (1.0) | |
| | Widower | 2/13 | (15.4) | |
| | Never married | 3/94 | (3.2) | |
| Employment status (missing=1) | Regular paid employment | 25/1422 | (1.8) | Chi square (1df) p<0.001 |
| | Not in regular paid employment | 17/282 | (6.0) | |
| Level of amenities | Neither car or central heating | 5/124 | (4.0) | Chi square (2df) p=0.18 |
| | Car or central heating | 26/923 | (2.8) | |
| | Car and central heating | 11/658 | (1.7) | Test for trend p=0.06 |
| Smoking Status (missing=1) | Never smoker | 2/324 | (0.6) | Chi square (2df) p=0.008 |
| | Ex smoker | 2/213 | (0.9) | |
| | Current smoker | 38/1167 | (3.3) | |
| Drinks non-beverage alcohol | No | 36/1583 | (2.3) | Chi square (1df) p=0.07 |
| | Yes | 6/123 | (4.9) | |
| Frequency of drinking beer (Missing=1) | Never drinks beer | 8/269 | (3.0) | Chi square (6df) p=0.03 |
| | A few times per year | 3/148 | (2.0) | |
| | 1-3 times per month | 10/434 | (2.3) | |
| | 1-2 times/week | 12/578 | (2.1) | Test for trend p=0.67 |
| | 3-4 times/week | 5/164 | (3.1) | |
| | Almost daily | 1/90 | (1.1) | |
| | Daily | 3/21 | (14.3) | |
| Frequency of drinking wine (Missing=6) | Never drinks wine | 20/1047 | (1.9) | Chi square (5df) p=0.07 |
| | A few times per year | 9/347 | (2.6) | |
| | 1-3 times per month | 7/205 | (7.1) | |
| | 1-2 times/week | 6/84 | (0.0) | Test for trend p=0.03 |
| | 3-4 times/week | 0/16 | (0.0) | |
| | Almost daily | 0/6 | (0.0) | |
| | Daily | 0/0 | (0.0) | |
| Frequency of drinking spirits (Missing=2) | Never drinks spirits | 0/132 | (0.0) | Chi square (6df) p=0.03 |
| | A few times per year | 5/365 | (1.4) | |
| | 1-3 times per month | 18/667 | (2.7) | |
| | 1-2 times/week | 15/427 | (3.5) | Test for trend p=0.003 |
| | 3-4 times/week | 1/65 | (1.5) | |
| | Almost daily | 2/36 | (5.6) | |
| | Daily | 1/6 | (16.7) | |
| Spirits without food (missing=1) | Never | 27/1449 | (1.9) | Chi square (2df) p=0.001 |
| | Sometimes | 14/235 | (6.0) | |
| | Always | 0/20 | (0.0) | |
| Drink alone (missing=1) | Never | 17/888 | (1.9) | Chi square (2df) p=0.31 |
| | Sometimes | 22/727 | (3.0) | |
| | Often | 3/89 | (3.4) | |

| Predictor at IFS-1 | | Amount of data missing on failing to fulfil family or personal obligations at IFS-1 (%) | | P value |
|---|---|---|---|---|
| Drink before noon (missing=2) | Never | 17/1177 | (1.4) | Chi square (2df) p<0.001 |
| | Occasionally | 23/501 | (4.6) | |
| | Frequently | 2/25 | (8.0) | |
| Zapoi (Missing=4) | No | 33/1570 | (2.1) | Chi square (1df) p=0.004 |
| | Yes | 8/131 | (6.1) | |
| Frequency of hangover (Missing=17) | Never | 11/885 | (1.2) | Chi square (6df) p=0.04 |
| | Less than once a month | 9/387 | (2.3) | |
| | Once a month | 10/243 | (4.1) | |
| | Several times a month | 3/90 | (3.3) | Test for trend p=0.004 |
| | Once a week | 3/46 | (6.5) | |
| | Several times a week | 1/26 | (3.9) | |
| | Every day | 0/11 | (0.0) | |
| Frequency of excessive drunkenness (Missing =17) | Never | 8/886 | (0.9) | Chi square (6df) p<0.001 |
| | Less than once a month | 12/450 | (2.7) | |
| | Once a month | 13/227 | (5.7) | |
| | Several times a month | 1/55 | (1.8) | Test for trend p=0.0009 |
| | Once a week | 3/45 | (6.7) | |
| | Several times a week | 0/16 | (0.0) | |
| | Every day | 0/9 | (0.0) | |
| Frequency of sleeping in clothes because of drunkenness (Missing =8) | Never | 22/1417 | (1.6) | Chi square (6df) p<0.001 |
| | Less than once a month | 9/153 | (5.9) | |
| | Once a month | 2/74 | (2.7) | |
| | Several times a month | 3/23 | (13.0) | Test for trend p<0.001 |
| | Once a week | 1/15 | (6.7) | |
| | Several times a week | 2/11 | (18.2) | |
| | Every day | 1/4 | (25.0) | |
| Total | | 42/1705 | (2.5) | |

### 5.2.3 Implications of Missing Data

#### 5.2.3.1 Item non-response

Methods for dealing with records with incomplete data in the thesis differ depending on the analysis method used, the outcome variable and more generally on what other variables are included in the model. Analyses using logistic regression were restricted to records with complete data on the exposures and outcome of interest. Where latent variables and structural equation modelling were used the estimation method (WMSLV) allows inclusion of records with incomplete data and performs analysis equivalent to a pairwise present analysis. This is a method which uses all available data to calculate each correlation and therefore sample size can vary for different correlations.

Both complete case analysis and pairwise present analysis may not be valid when the missingness mechanism is not missing completely at random (MCAR) (259). As shown in the previous section it is unlikely that data are missing completely at random since it is probable that data on alcohol use are more likely to be missing if men were heavy drinkers and therefore excluding records affected by non-response may have introduced bias in analyses. Whether bias is introduced by missing data depends on whether the probability that data are missing is related to both the exposure and the outcome of interest. The overall amount of data missing due to item non-response is small for self-reported data (cases with one of more alcohol variable missing at IFS-1 6.0%; IFS-2 4.2%). Although there is more data missing for proxy-reported data, proxy-report of beverage alcohol intake was not used because it is likely to be unreliable, therefore the larger amounts of missing data for these questions is not an issue. Proxy-report was only used for questions on non-beverage alcohol use and dysfunctional behaviours (zapoi, hangover, excessive drunkenness, sleeping in clothes because of drunkenness, and failing family or personal obligations because of drinking) for which the amount of data missing is smaller (cases with one of more variable missing at IFS-1 5.5%; IFS-2 6.3%).

#### 5.2.3.2 Loss to Follow Up

There is some selection bias in the study population at both IFS-1 and IFS-2. There is evidence that men who were not re-interviewed at IFS-2 reported higher levels of hazardous drinking behaviour at IFS-1 as well as differences in marital status, employment status and level of amenities. Overall this means  results may not be generalisable to all working-age men living in Izhevsk since the full range of drinking behaviour in this population may not have been captured. Loss to follow-up between IFS-1 and IFS-2 is particularly likely to affect the results of analyses which make use of the longitudinal nature of the data i.e. exposure measured at IFS-1 and outcome measured at IFS-2. Again bias may have been introduced if both the exposure and outcome of interest affects whether men are lost to follow up. In Chapter 9 alcohol use at IFS-1 is used to predict employment status at IFS-2 among men in regular employment at IFS-1. These results may be biased if probability of being re-interviewed at IFS-2 is also related to employment status at IFS-2. Since men who were not in regular employment at IFS-1 were less likely to be re-interviewed at IFS-2, it seems most probable that men who became unemployed between IFS-1 and IFS-2 may also be more likely to be lost to follow up, in which case the effects of alcohol on employment estimated in the subset with data on both may be underestimated.

#### 5.2.3.3 Exclusion of men living alone

It is also important to note that generalisability of the results is likely to have been affected by the exclusion of men living alone at baseline who are likely to be different to those included in terms of both their drinking behaviour and also socio-economic and health status. This is a particular problem when assessing differences in alcohol consumption by marital status as by default men living with a spouse would be more likely to be included. No data was collected on men living alone therefore it was not possible to assess to what extent differences between those included and those excluded for this reason may have affected the results.

#### 5.2.3.3 Summary

Missing data is a potential source of selection bias. The amount of data missing due to item-non response was small but selection bias may have occurred due to non-response at IFS-1 and differential loss to follow-up between IFS-1 and IFS-2. This may have had some influence on the results in particular with regards to generalisability to all working-age men in Izhevsk.

# Chapter 6: Using latent variables to measure Alcohol Use

## 6.1.1 What are latent variables?

Latent variables are variables that are not observable but can be identified from several related observed or manifest variables which represent aspects of the underlying variable of interest. For example different observable aspects of mental health such as those asked about in the SF 12 could be considered as manifestations of an underlying mental health variable which cannot be observed.  Statistical techniques which can be used to identify latent variables such as factor analysis (See Appendix 1) do not assume that all the observed variables show equally strong associations with the underlying variable. A statistical model specifying the relationship between observed and latent variables is known as a measurement model.

## 6.1.2 Why use latent variables to measure alcohol use?

As discussed in Chapter 2 there is no gold standard measure of alcohol use. There is a heavy reliance on self-reported data for measurement of personal alcohol use which is susceptible to measurement error. This may be non-differential due to incomplete recall of drinking occasions but could also be differential with respect to variables such as education because of variation in the social acceptability of particular behaviours such as drunkenness or understanding of questions e.g. what is understood by “average” consumption. One possible solution is to use several different observed measures of alcohol use. Although each observed variable is subject to measurement error, overall combining several sources of information on drinking under the assumption of non-differential error in the most common set up one could extract estimates of “true” alcohol consumption. The alternative i.e. using lots of alcohol variables with conventional statistical techniques such as logistic regression is problematic because these measures are likely to be highly correlated. Adjusting for several highly correlated drinking variables would therefore result in the different variables cancelling each other out. Combining the information on alcohol use contained in several observed variables by identifying underlying latent variables is one possible way to make best use of the available information. Given the dense amount of information on alcohol use collected in the Izhevsk Family Studies, there is a also a need to reduce the amount of data to a smaller number of key dimensions whilst not discarding variables which may provide important additional information on alcohol use.

### 6.1.3 Previous work using Latent Variables to measure alcohol use

Few epidemiological studies have used latent variables to measure alcohol use in the general population, although they have been used more frequently in clinical samples to develop typologies of alcohol dependence. Studies which have used latent variables to measure alcohol use in non-clinical samples have mainly used latent class analysis which involves identifying latent categorical groups or classes(260), to identify types of drinker. Factor analysis, which involves using correlations between observed variables to identify continuous latent dimensions(261, 262), has been used more rarely. Examples of alcohol typologies using latent class analysis and factor analysis are described in Chapter 2.

### 6.1.4 Development of Latent Variables used in the thesis

The first objective was to identify latent dimensions of alcohol use among working-age Russian men using data from the Izhevsk Family Studies. The method chosen to accomplish this objective was factor analysis(261, 262). The main principle behind factor analysis is that correlations between observed variables are due to variation in an underlying latent factor and therefore the correlation in these variables can be used to identify this factor. Factor analysis and the other statistical methods used are described in more detail in Appendix 1. Factor analysis was chosen rather than latent class analysis in order to identify whether different latent dimensions of alcohol use (e.g. alcohol intake compared to dysfunctional drinking) rather than groups or classes varied in their effects on employment and health outcomes.

Following the literature review of Chapter 2 three main dimensions of alcohol use were considered a priori: alcohol intake (how much alcohol is consumed), drinking pattern (mode of consumption) and acute alcohol-related dysfunction (the very acute consequences of alcohol consumption). Confirmatory factor analysis (CFA)(263) was used to test the fit of pre-specified models used to identify these latent dimensions. In CFA the relationship between observed and latent variables is specified in terms of the number of factors and which observed variables are indicators of each latent factor.

In a confirmatory factor analysis model the association between observed variables and the underlying latent variables is measured by factor loadings. Models throughout the thesis are presented with standardised factor loadings and their associated standard errors. The higher (closer to 1) a standardised factor loading is, the more strongly the observed variable is associated with the latent variable(261). A more general version of CFA where there is more than one latent factor allows for their correlation to be manifestations of another higher level latent factor. A latent factor manifested by other latent factors is known as a second order factor(264).

Models were fitted using estimation by Weighted Least squares with mean and variance adjusted (WMSLV) which is appropriate for categorical variables(264-266). Model fit was assessed using the Comparative Fit Index (CFI), the Tucker Lewis Index (TLI) and the Root Mean Square of Approximation (RMSEA). CFI and TLI values greater than 0.95 indicate good model fit with a minimum of 0.90 indicating acceptable fit (267, 268). For the RMSEA values greater than 0.10 indicates a bad fit, while less than 0.08 indicates a reasonable fit and values less than 0.05 indicate a good fit (268). As stated above in all models factor variance was fixed to one. All development of latent variable models was carried out using data from IFS-2, however only questions asked at both the IFS-1 and IFS-2 interviews were used so that the same models could be fitted using data from both surveys.

All analysis was carried out using Mplus 5(269).

**Alcohol intake**

Since alcohol intake (amount of alcohol consumed) is the most conventionally used measure of alcohol use, the first step was to identify observed variables measuring alcohol intake which might contribute to a latent variables. There were nine questions asked at both IFS-1 and IFS-2 on beverage alcohol intake: frequency of consuming beer, wine and spirits, usual volume consumed per occasion of beer, wine and spirits and maximum volume consumed per occasion of beer, wine and spirits. Questions on usual and maximum volume consumed per occasion were asked about in categories that Russians use in everyday life (beer in bottles and wine and spirits in grams). Questions on usual and maximum volume per occasion were converted to litres of ethanol using the mid-point of each category and used as continuous variables. Questions on frequency of consumption of beverage and non-beverage alcohol had seven categories: never or almost never, a few times per year, 1-3 times per month, once or twice a week, 3-4 times per week, nearly every day, and every day or more often.

As well as questions on the frequency of beer, wine and spirits both questionnaires also asked about the frequency of consuming non-beverage alcohols such as medicinal tinctures. Since the effects of non-beverage alcohol in addition to beverage alcohol were of interest in themselves, frequency of non-beverage alcohol use was not included in the measurement model of beverage alcohol intake. Drinkers were asked only one question on intake of non-beverage alcohol (frequency of drinking non-beverage alcohol) and therefore it was not possible to identify a latent factor of non-beverage alcohol use and non-beverage alcohol use was used as an observed variable.  Since there was a relatively low prevalence of non-beverage alcohol use the seven category variable of frequency of use was collapsed into a binary variable (drinks non-beverage alcohol or does not drink non-beverage alcohol).

Two possible measurement models were considered for beverage alcohol intake (Figure 6.1): Model A had observed variables on frequency of consuming alcohol loading on one factor and variables on volume per occasion (usual volume per occasion and maximum volume per occasion) loading on a second factor whereas Model B separated variables measuring intake of beer into one factor, wine intake variables into a second factor and variables measuring spirit intake into a third factor. When these models were fitted on the data Model A would not converge as the correlation between the two factors ("frequency" and "volume") was considered too high by the analysis programme used (MPlus 5) however a model with one single factor of beverage alcohol intake had very poor fit (CFI=0.18; TLI=0.18; RMSEA=0.40), therefore Model B, which had reasonable fit, was chosen as the model for beverage alcohol intake. It is worth noting that a minimum of three observed variables per latent variable is preferable. In a model similar to Model B but using only usual volume of ethanol per occasion and frequency of drinking each beverage type the latent factors were not properly identified as the standardised factor loadings for frequency of consumption of each beverage type were greater than one.

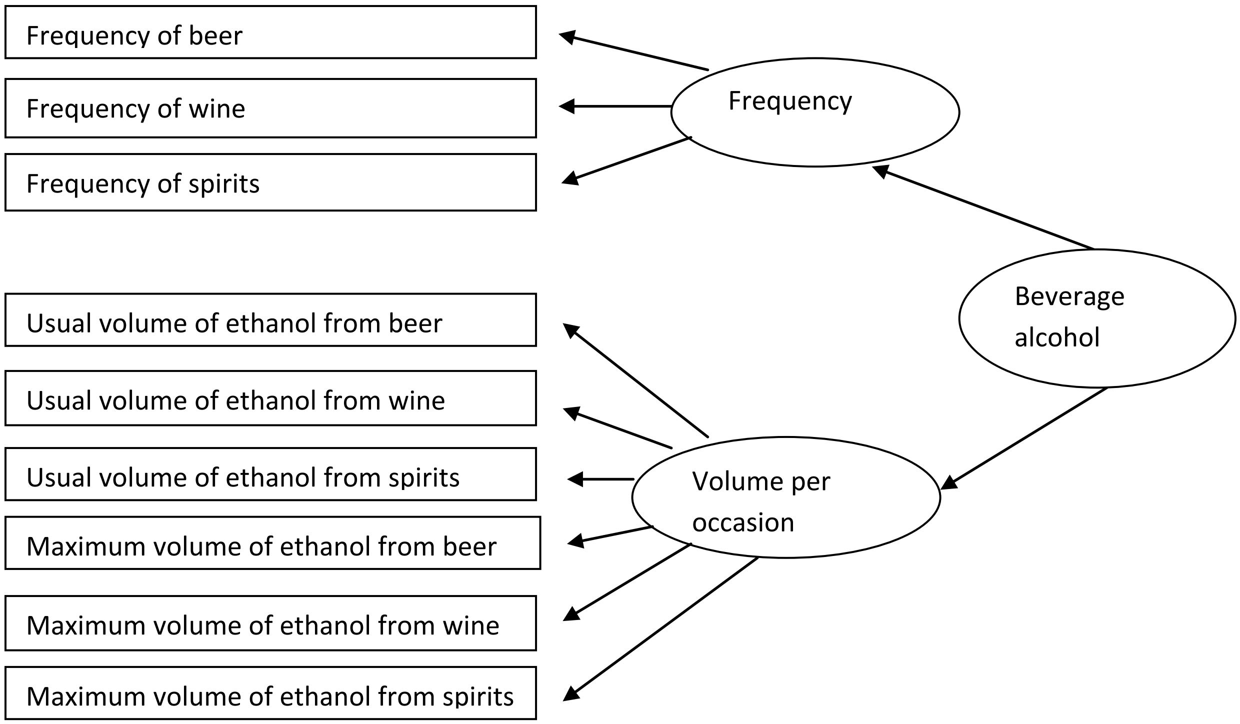
Model B was fitted on all men interviewed at IFS-2 and then separately only on men who had consumed alcohol in the past 12 months (Figure 6.2). When the model was fitted on all men there was a reasonable correlation between the beer and spirit intake factors supporting a further underlying factor (second order factor) of beverage alcohol intake. However when the model was fitted only on men who had consumed alcohol in the past 12 months this correlation was strongly reduced suggesting this correlation was because most men who drink alcohol drink both beer and spirits (73.9% of drinkers at IFS-2 reported drinking both beverages). The wine intake factor was not highly correlated with either the beer or spirits factor in either model. For these reasons the final model for alcohol intake used "beer intake", "wine intake" and "spirit intake" as separate factors and did not include an overall second order factor of "beverage alcohol intake" although the model allowed for the correlation of the three factors.

The distributions of predicted factor scores at IFS-2 on the latent factors of beer intake, wine intake and spirit intake based on the model fitted on all men are shown in Figure 6.3. Although the model assumes that latent scores are normally distributed the nature of the manifest variables was categorical leading the predictions of these scores to have a nonsmooth distribution. For each latent factor there was a large peak of men with the lowest factor score representing non-drinkers and men who do not drink that particular beverage type. This was particularly high for wine intake since the majority of men did not drink wine (33.9% of men reported drinking wine at IFS-1 and 30.6% at IFS-2).

The model was re-fitted using data on all men and on drinkers only at IFS-1 (Figure 6.4). The factor loadings at IFS-1 were very similar to IFS-2 although model fit at IFS-1 was better than IFS-2.

**Figure 6.1 Alternative hypothesized measurement models of alcohol intake**

**MODEL A)**




**MODEL B)**

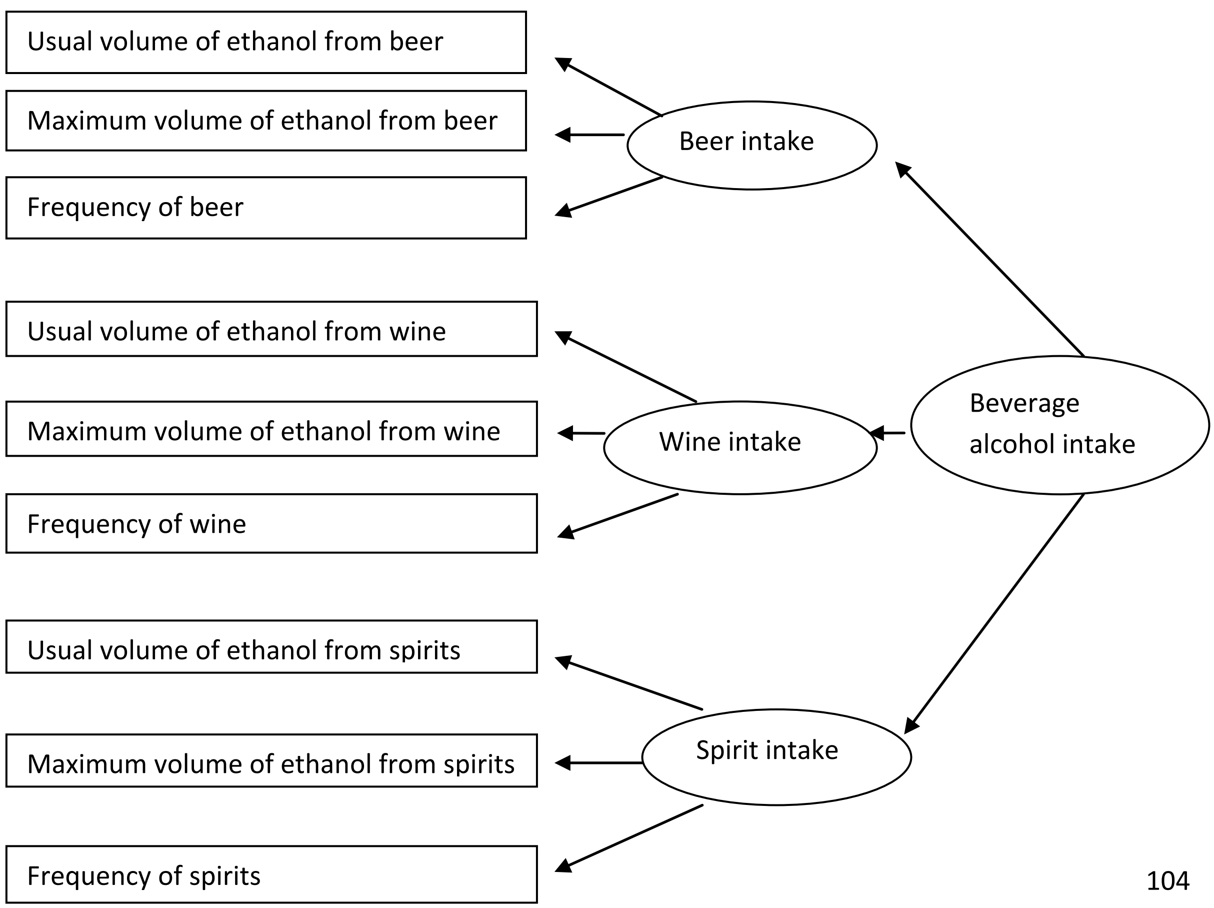
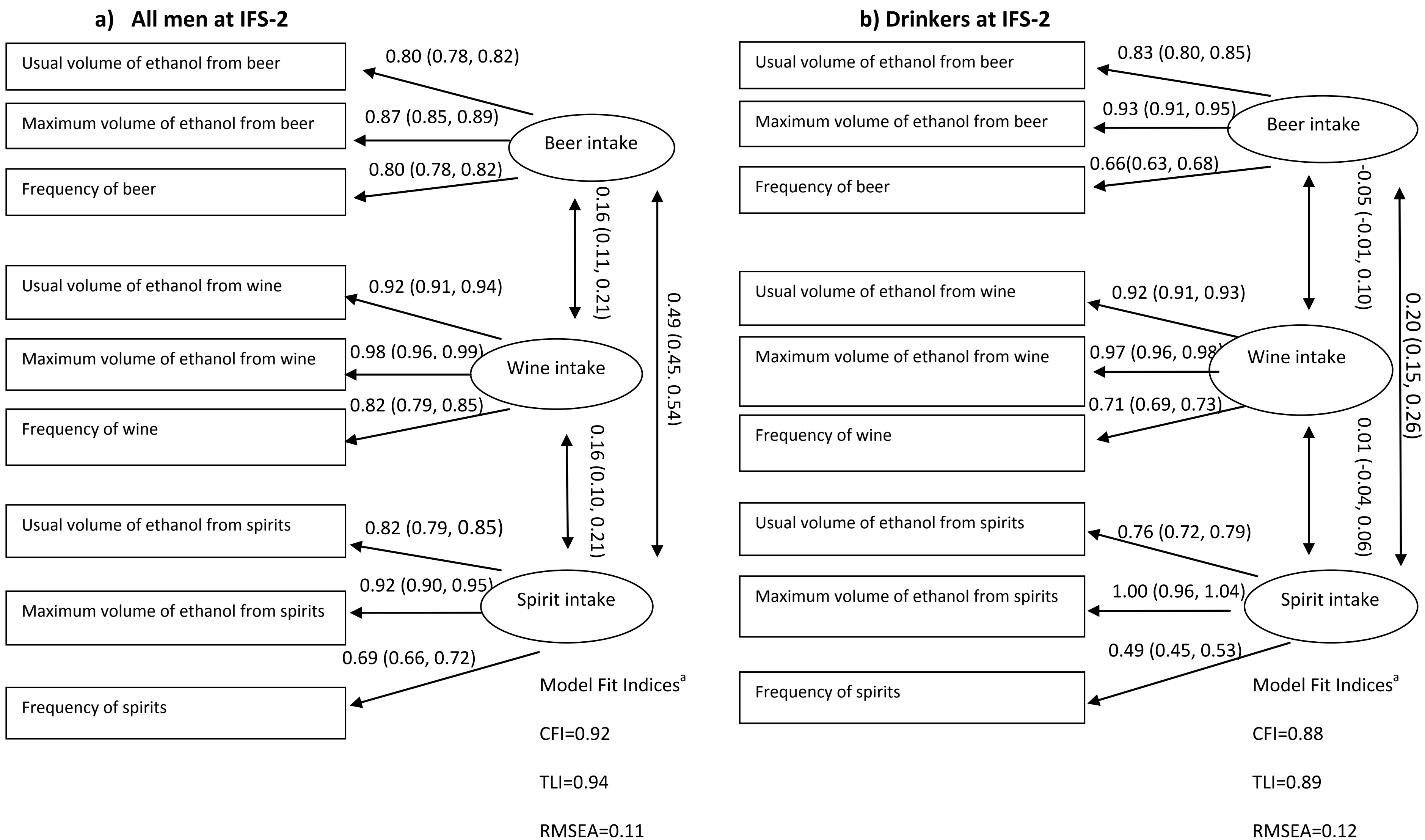


**Figure 6.2 Confirmatory factor analysis models of beverage alcohol intake at IFS-2 with standardized factor loadings (95% confidence intervals) fitted on all men at IFS-2 (n=1515) and restricted to drinkers at IFS-2 (n=1313)**




[a] CFI Confirmatory Fit Index; TLI Tucker Lewis Index; RMSEA Root Mean Square of Approximation

**Figure 6.3 Distribution of predicted factor scores on beverage alcohol intake (beer, wine and spirits) at IFS-2**

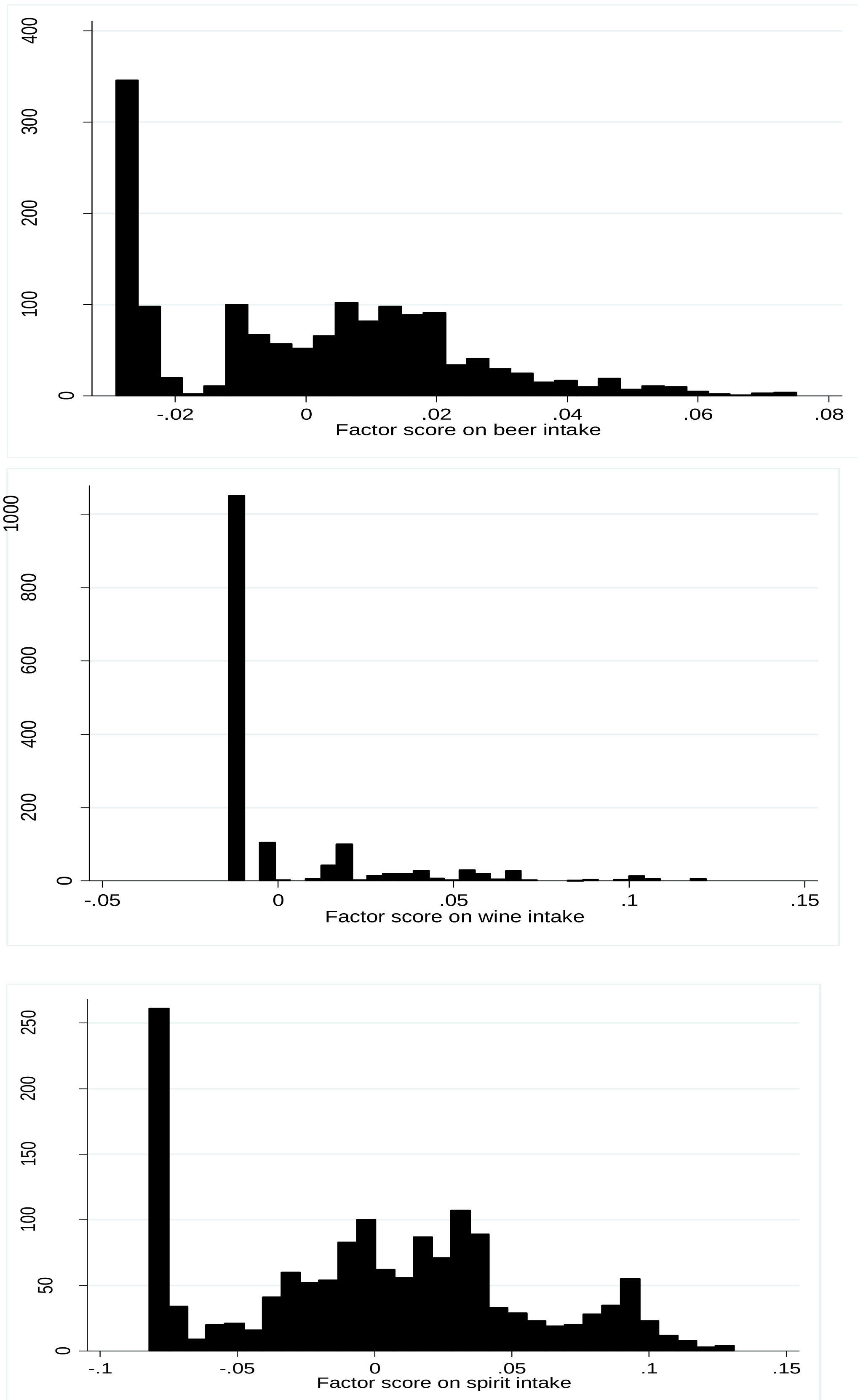
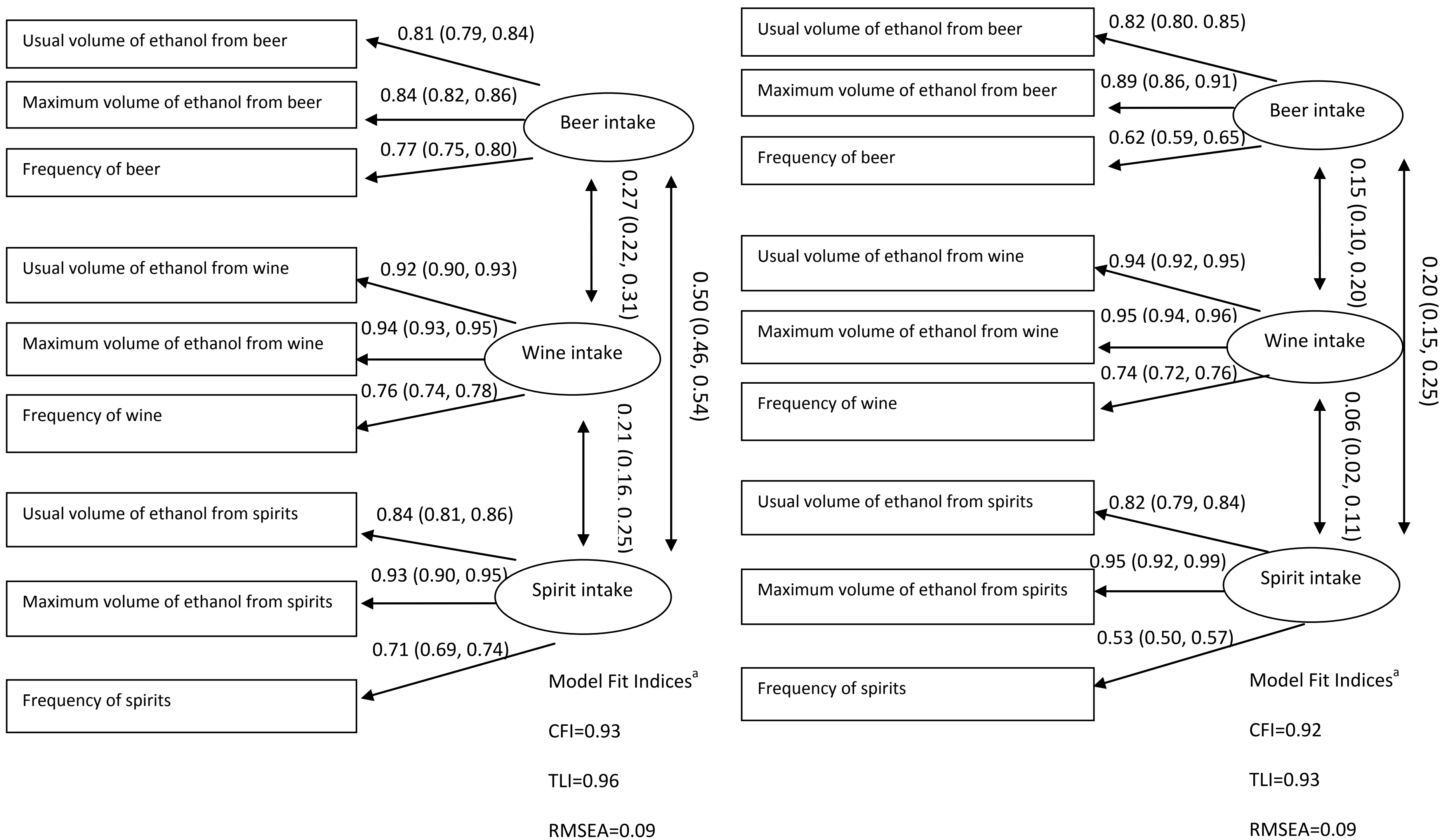


**Figure 6.4 Confirmatory factor analysis models of beverage alcohol intake at IFS-1 with standardized factor loadings (95% confidence intervals) fitted on all men at IFS-1 (n=1941) and restricted to drinkers at IFS-1 (n=1705)**

**a) All men at IFS-1** **b) Drinkers at IFS-1**




[a] CFI Confirmatory Fit Index; TLI Tucker Lewis Index; RMSEA Root Mean Square of Approximation

### Drinking Patterns

The next dimensions considered were additional aspects of how alcohol was consumed other than quantity and frequency. These are referred to for simplicity throughout the thesis as drinking patterns but could also be called drinking behaviours or mode of drinking. Three drinking patterns were asked about at the IFS interviews: drinking large volumes of spirits without also eating some food, drinking alone and drinking before noon. These three variables were categorical each with three categories: drinking spirits without food (never, sometimes and always), drinking alone (never, sometimes and often) and drinking before noon (never, occasionally and frequently). The polychoric[1] correlations between these three variables are shown in Table 6.1. Although there was a moderate correlation between drinking before noon and both of the other two drinking patterns, there was only a low correlation between drinking alone and drinking spirits without food, therefore the drinking patterns were used separately as observed variables rather than as manifestations of a latent variable.

**Table 6.1 Polychoric correlation between drinking patterns at IFS-2**

| **IFS-2**<br>**(all men)** | Drinks large volumes of spirits without eating | Drinks alone | Drinks before noon |
|---|---|---|---|
| Drinks large volumes of spirits without eating | 1.00 | - | - |
| Drinks alone | 0.36 | 1.00 | - |
| Drinks before noon | 0.57 | 0.50 | 1.00 |
| **IFS-2 (drinkers only)** | | | |
| Drinks large volumes of spirits without eating | 1.00 | - | - |
| Drinks alone | 0.29 | 1.00 | - |
| Drinks before noon | 0.53 | 0.41 | 1.00 |

[1] Polychoric correlation is a measure of the correlation between two theoretically normally distributed continuous variables from two observed categorical variables

**Acute Alcohol-Related Dysfunction**

The last dimension considered was dysfunctional behaviour such as hangover or excessive drunkenness following closely from alcohol intake. These behaviours were considered separately from alcohol intake and drinking pattern as, by definition, they occur after alcohol is consumed and are therefore consequences of alcohol consumption. It should be noted that experience of these consequences could also be used as proxy measures of frequency of extremely heavy drinking although with limitations due to individual variation in tolerance and alcohol metabolism (88, 92, 152, 270, 271).

Four observed acute dysfunctional behaviours were used to specify this model (Figure 6.5): frequency of hangover, excessive drunkenness, sleeping in clothes because of drunkenness, and failing to fulfil family or personal obligations because of drinking alcohol. These variables were all categorical with seven categories: never or almost never, less than once a month, about once a month, several times a month, about once a week, several times a week, and every day. They were assumed to be manifestations of a single latent variable (See Figure 6.5). Model fit for this model was very good and all four observed variables were strongly associated with the underlying latent variable (i.e. the standardised factor loadings were very high). The distribution of predicted factor scores on acute dysfunction at IFS-2 for all men is shown in Figure 6.6. Again predicted factor scores are not normally distributed since there is a large peak of non-drinkers and drinkers with no dysfunction. Among drinkers with dysfunction the distribution is skewed to the right.

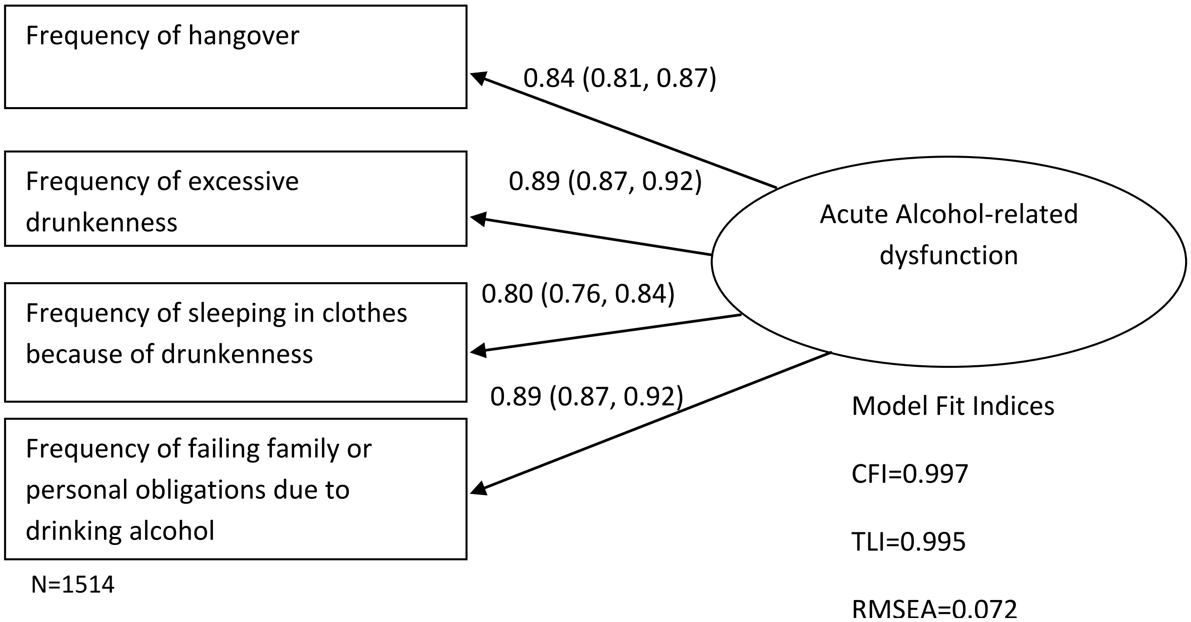
Since the observed variables hangover, excessive drunkenness, sleeping in clothes because of drunkenness and failing family or personal obligations due to drinking alcohol are all observable behaviours which could be accurately reported by a proxy, a similar model was fitted using proxy-reported data (Figure 6.6). Again model fit was very good and all standardised factor loadings were very high. Compared with self-reported data, the model fit was better and the factor loadings higher with proxy-reported data. The distribution of predicted factor scores on dysfunction reported by a proxy is shown in Figure 6.8. The distribution is similar to using self-reported data (Figure 6.6).

The models using self-report of acute dysfunction and proxy-report of acute dysfunction were re-fitted using the data from IFS-1 (Figure 6.9). Both models had good fit and very high factor loadings at IFS-1. The standardised factor loadings were similar to those found with the data at IFS-2 suggesting the latent factor was stable over time. The self-report and proxy-report models were very similar to each other at IFS-1 and had similar model fit.

An additional aspect of dysfunction measured at IFS-1 and IFS-2 was reported episodes of zapoi in the past year. Zapoi was not considered as a manifestation of the latent variable shown in Figure 6.5 as the four manifest variables included measure frequency of routine dysfunction whereas zapoi is a marker of sporadic dysfunction. Zapoi was therefore considered separately and used as an observed variable (coded as one or more episodes versus no episodes in the past 12 months).

There were two other acute alcohol-related consequences measured at both IFS-1 and IFS-2: whether men were arrested for drunkenness and whether men were taken to a sobering up station. These were not used as markers of either routine or sporadic dysfunction as these events would be strongly influenced by external factors not related to an individual's drinking i.e. the probability of being arrested if drunk could vary for many reasons unrelated to level of drunkenness such as number of policemen in the area and general tolerance of drunkenness.

**Figure 6.4 Confirmatory factor analysis model of acute alcohol-related dysfunction with standardized factor loadings (95% confidence intervals) of all men interviewed at IFS-2**




[a] CFI Confirmatory Fit Index; TLI Tucker Lewis Index; RMSEA Root Mean Square of Approximation

**Figure 6.5 Distribution of predicted factor scores on acute dysfunction at IFS-2**

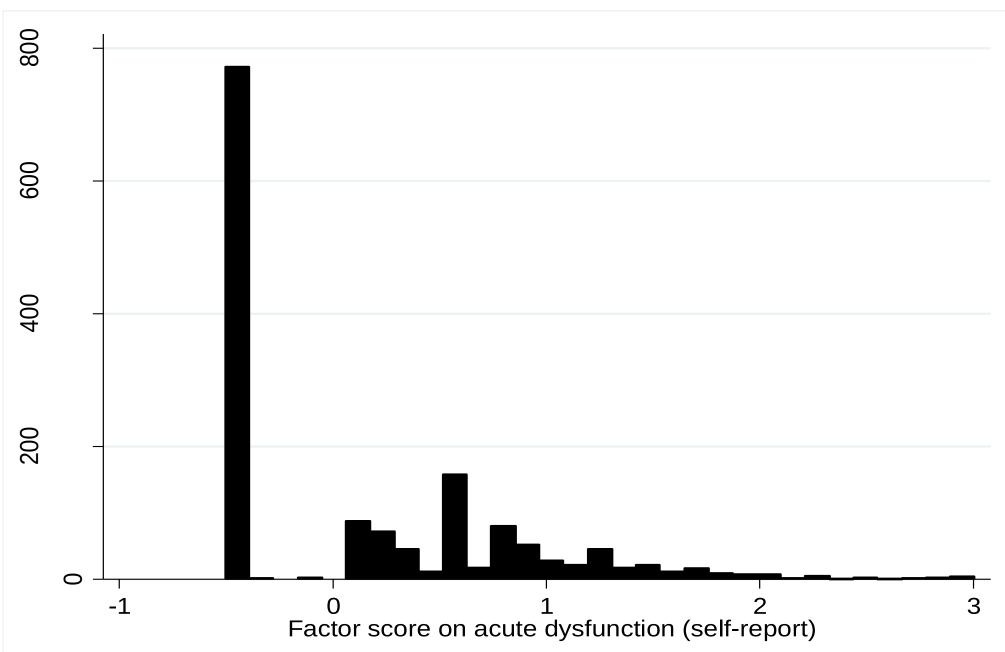
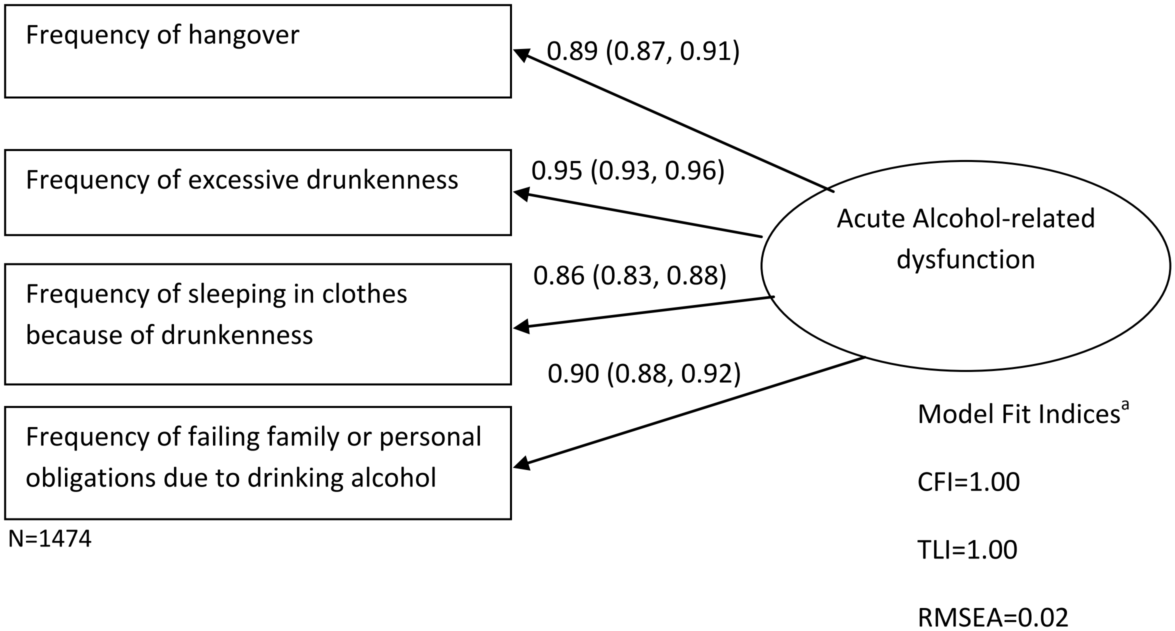


**Figure 6.6 Confirmatory factor analysis model of acute alcohol-related dysfunction with standardized factor loadings (95% confidence intervals) of all men interviewed at IFS-2 using proxy report of observed variables**




[a] CFI Confirmatory Fit Index; TLI Tucker Lewis Index; RMSEA Root Mean Square of Approximation

**Figure 6.7 Distribution of predicted factor scores on acute dysfunction by proxy-report at IFS-2**

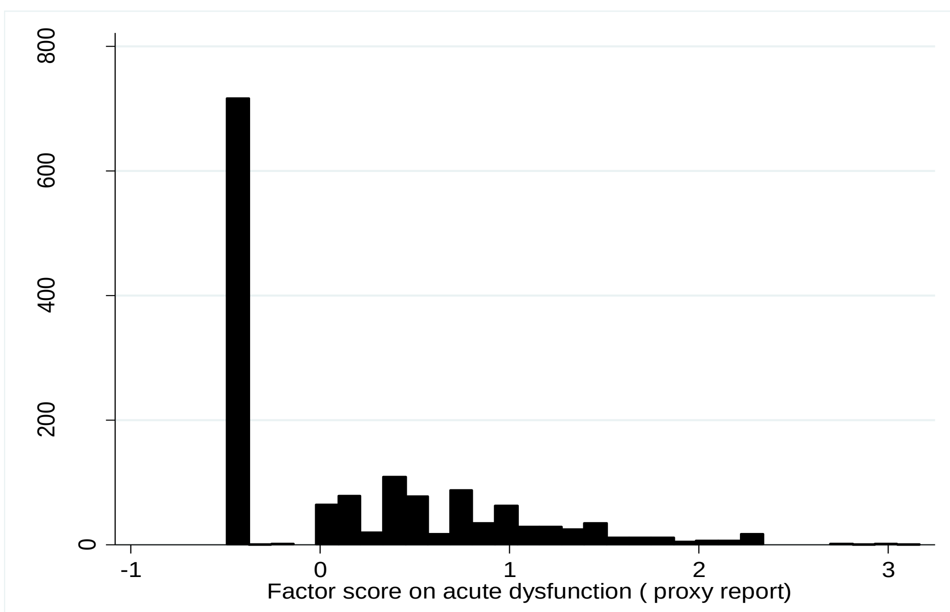
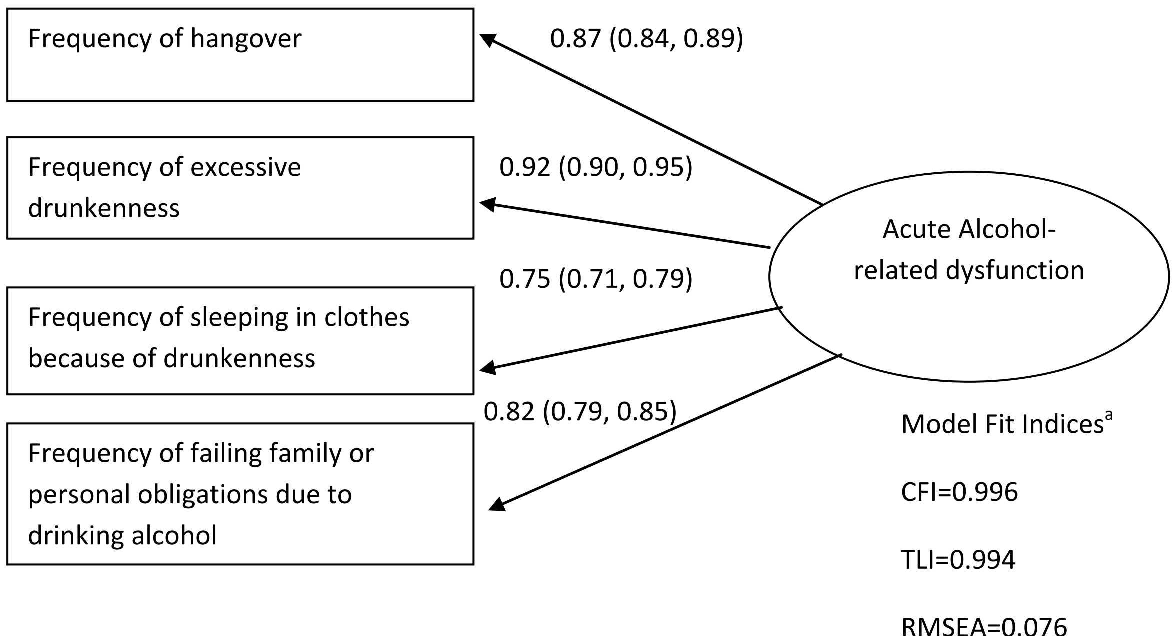
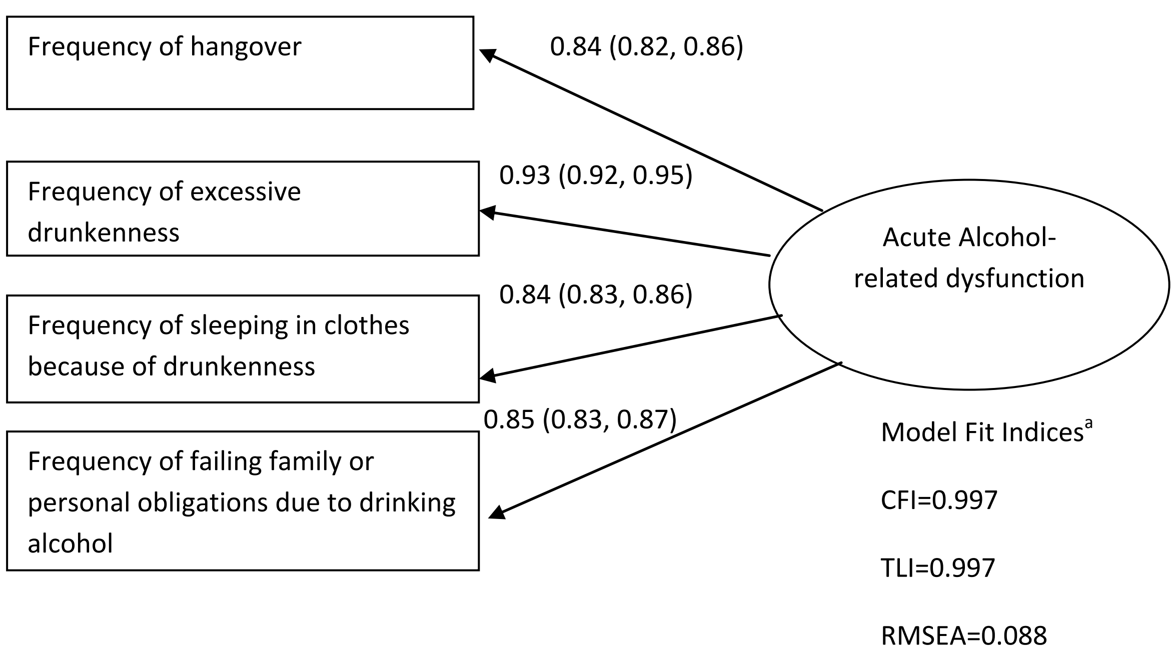


**Figure 6.8 Confirmatory factor analysis models of acute dysfunction with standardized factor loadings (95% CI) for all men interviewed at IFS-1**

**a) Self-report (n=1941)**




**b) Proxy-report (N=2000)**



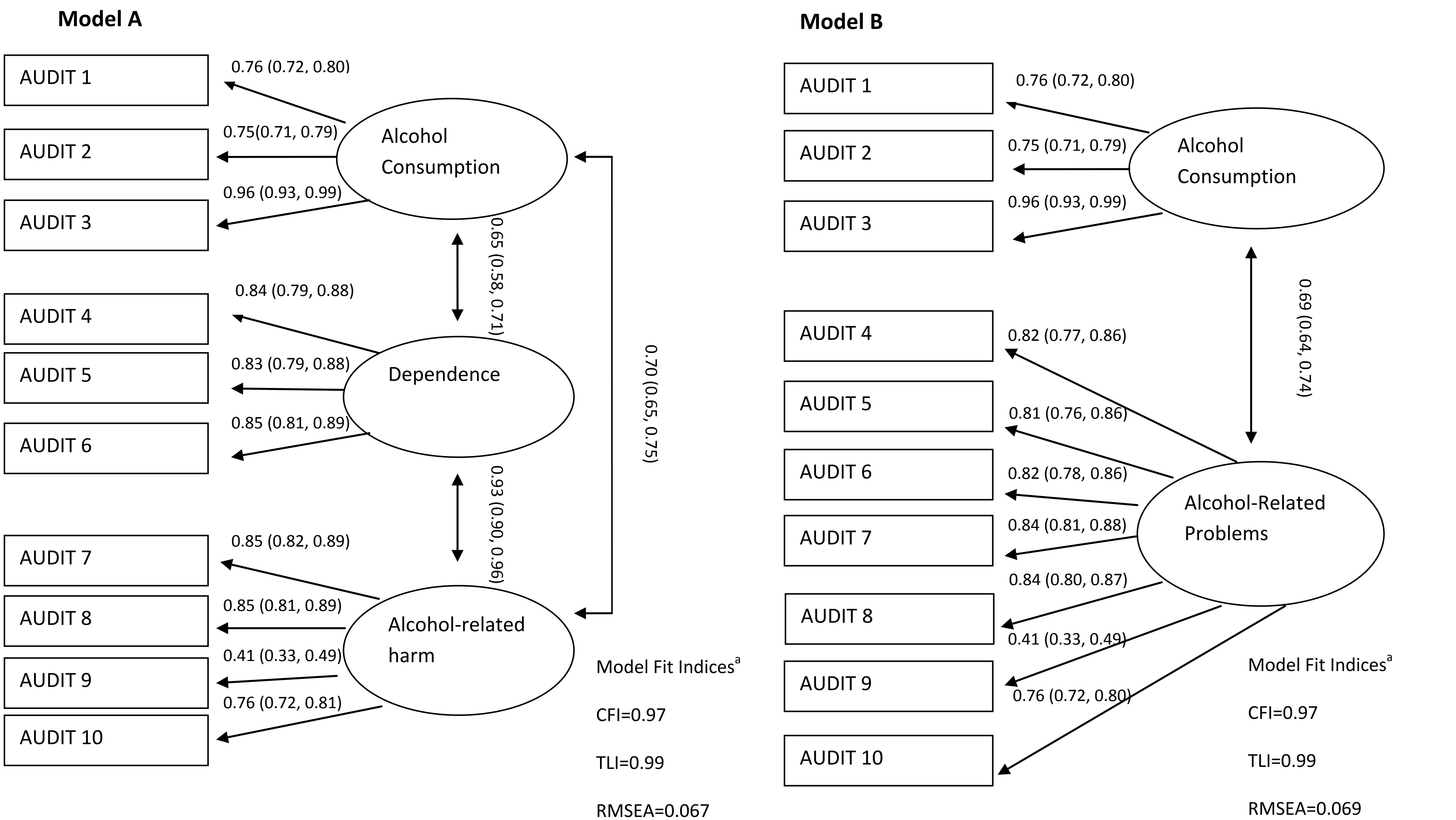

[a] CFI Confirmatory Fit Index; TLI Tucker Lewis Index; RMSEA Root of Mean Square of Approximation

## Latent Dimensions of the Alcohol Use Disorders Identification Test (AUDIT)

The internationally validated AUDIT is designed to measure three domains of alcohol use – alcohol consumption, alcohol-related harm and alcohol dependence(247, 251). A common use of the AUDIT is to sum scores on the ten questions to give a total score out of a maximum score of 40 with a score of 8 or above used as a general cut off point to indicate hazardous or harmful drinking. However, using the AUDIT as a score in this way does not take into account whether an individual scores highly on the alcohol consumption elements (i.e. they are a hazardous drinker because they drink a large volume of alcohol) or on the questions on alcohol-related harm or symptoms of dependence. An alternative use of the AUDIT is to consider the questions as observed variables that are indicators of underlying latent variables which measure the three alcohol domains of interest. Although the AUDIT is designed to measure three dimensions of alcohol use, several general population surveys have suggested that it only measures two distinct dimensions – alcohol consumption and alcohol-related problems (252-254). A two factor structure for the AUDIT has also been found using data from a clinical population in Russia(250) but this has not been assessed in a Russian general population sample.

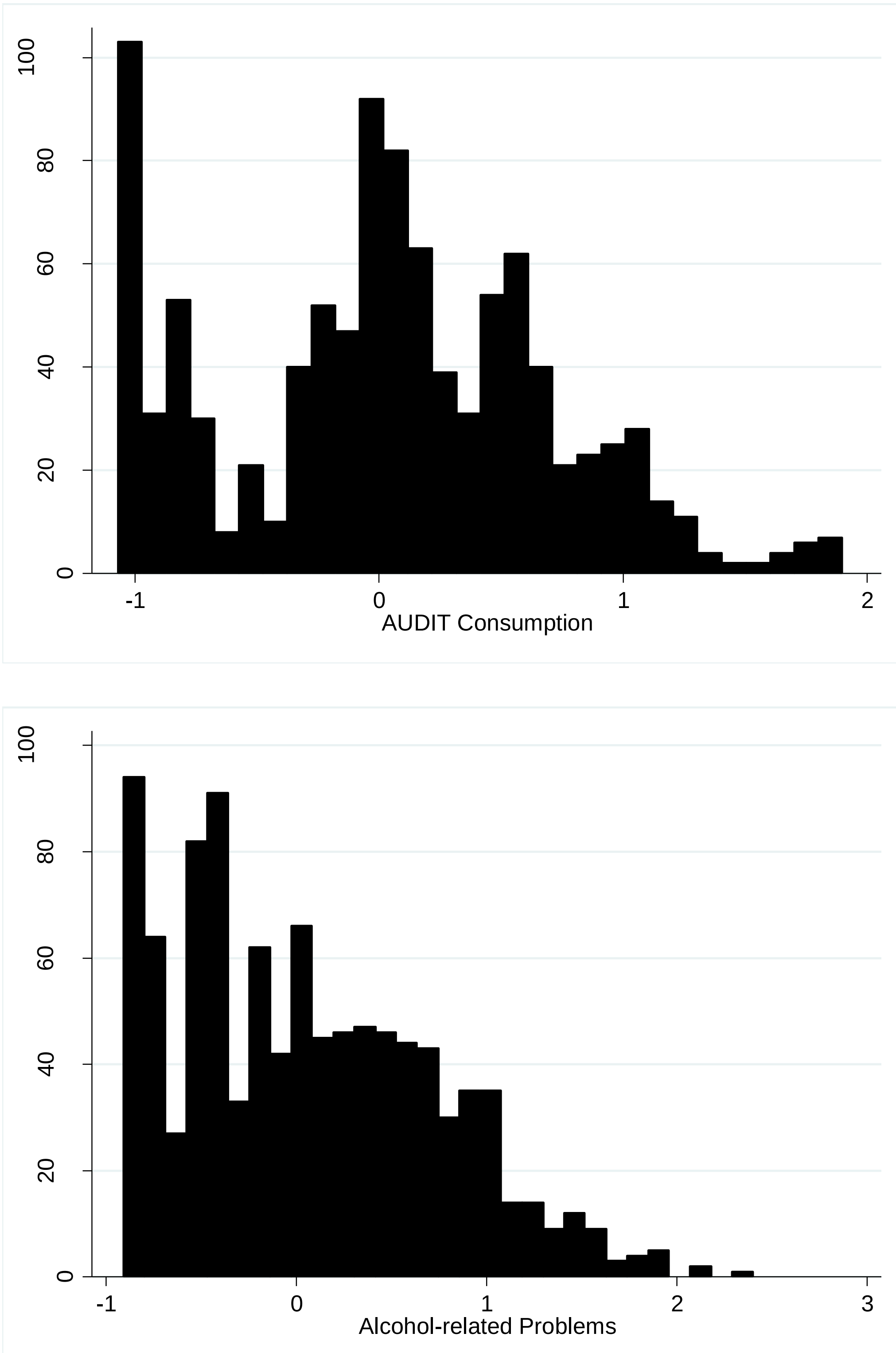
Two possible models were considered for the AUDIT (see Figure 6.10): Model A had three latent factors (alcohol consumption, alcohol-related harm and alcohol dependence) in line with the theoretical structure of the AUDIT while Model B had two latent factors (alcohol consumption and alcohol-related problems) as suggested by previous studies. Both models fitted the data very well. In Model A the factors alcohol-related harm and alcohol dependence were very highly correlated (0.93) suggesting these factors were not distinct from each other. Since there was no obvious additional benefit to having two very highly correlated factors (dependence and alcohol-related harm) over one factor (alcohol-related problems) Model B was selected as the better model on the grounds of parsimony. These models are discussed in more detail in Paper 1. The distributions of predicted factor scores for the two latent factors of the AUDIT (consumption and alcohol-related problems) in men with a complete AUDIT score at IFS-2 are shown in Figure 6.11.

**Figure 6.9 Alternative measurement models of the latent dimensions of the AUDIT with standardised factor loadings (95%CI) fitted on all men with complete AUDIT scores at IFS-2**




[a] CFI Confirmatory Fit Index; TLI Tucker Lewis Index; RMSEA Root Mean Square of Approximation (N=1005)

**Figure 6.10 Distribution of predicted factor scores on latent dimensions of the AUDIT (consumption and alcohol-related problems) in men with complete AUDIT scores at IFS-2**



### 6.1.5 Summary

A latent variable approach has several potential advantages as a method for measuring alcohol use: it allows several highly correlated variables to be used together maximising the information available, reduces measurement error, and is appropriate for the multidimensional nature of alcohol use. This approach to measuring alcohol use may be particularly appropriate for measuring alcohol use in the Izhevsk Family Studies given the large amount of data on alcohol use collected in these studies.

Several key latent dimensions were identified from the IFS interviews: three latent factors of alcohol intake (beer intake, wine intake and spirits intake) and one latent factor of acute alcohol-related dysfunction. The data supported two latent factors of the AUDIT (alcohol consumption and alcohol-related problems). In addition to the latent variables of alcohol use identified there were several observed alcohol use variables which could have important effects on health but which did not appear to be manifestations of any of the latent variables. These were non-beverage alcohol use, drinking patterns (large volumes of spirits without eating any food, drinking alone and drinking before noon) and zapoi. In the following chapters both latent and observed alcohol use variables are used to investigate the association between alcohol use and socio-demographic variables and the effects of alcohol use on employment and cardio-vascular risk factors.

## Section II: Results

# Chapter 7: Socio-demographic Predictors of the Alcohol Use Disorders Identification Test (AUDIT)

## 7.1 Introduction to Paper 1

The main substantive aim of Paper 1 was to investigate the associations between socio-demographic variables such as age and education and the latent dimensions of the AUDIT (see Chapter 6). There are substantial and increasing socio-economic gradients in mortality in Russia but relatively little is known about their determinants including the role of alcohol (44, 45, 272, 273).

The AUDIT has been validated for international use and has been increasingly used in epidemiological surveys worldwide. Compared to the latent variables developed using the IFS interview data (see Chapter 6) the AUDIT could be considered a conventional tool for measuring hazardous alcohol consumption in the general population. However although it has been previously used in Russia (274-277) and has been validated in a clinical sample there (250) it has not been validated for use in epidemiological surveys of the general population. As discussed above (Chapter 4 and Chapter 6) there is some debate about the factor structure of the AUDIT in terms of the number of latent domains of hazardous alcohol use that the AUDIT measures. Again this has been investigated in Russia in a clinical population (250) but not in the general population. Therefore in addition to the substantive aim of investigating the association between hazardous alcohol use and socio-demographic variables, Paper 1 also has two main methodological aims 1) to investigate the factor structure of the AUDIT in a Russian general population sample and 2) to use the detailed interview data on alcohol intake collected at IFS-2 to investigate the validity of AUDIT question 2 – the reported number of drinks consumed on one drinking occasion.

## 7.2 Study sample

The study sample was all men who attended the IFS-2 health check and completed all the AUDIT questions on the self-completed questionnaire.

## 7.3 Exposures

The exposures of interest were age, education, marital status, employment status, level of household amenities and smoking status. All these variables were assessed at the IFS-2 interview.

## 7.4 Outcomes

The outcomes of interest were hazardous alcohol consumption and alcohol-related problems measured by the two latent factors of the AUDIT. The specification of these latent variables is discussed in Chapter 6. AUDIT questions were obtained from the self-completed questionnaire at the IFS-2 health check.

## 7.5 Statistical Methods

The statistical methods used were confirmatory factor analysis (CFA) and structural equation modelling (SEM). These methods are discussed in more detail in Appendix 1.

## 7.6 Findings and Conclusions

The data supported a two factor structure for the AUDIT in Izhevsk – alcohol consumption and alcohol related-problems. These two factors showed different associations with socio-demographic variables. Both latent dimensions decreased with age and were higher in men who were unemployed seeking work compared to men in regular paid employment. However while the alcohol-related problems factor was lower in men with higher education and a higher level of amenities, alcohol consumption did not differ with education and level of amenities.

Compared with the volume of ethanol from spirits (measured in grams of spirits) usually consumed on a drinking occasion reported in the IFS-2 interview, men substantially under-reported the number of drinks they typically consumed in the AUDIT question “how many drinks containing alcohol do you have on a typical day when you are drinking?”. The same level of under-reporting was not seen for beer or wine suggesting that this is a specific problem with the way spirits are purchased and consumed in Russia and a different understanding of what constitutes a “drink” of spirits. These results suggest the AUDIT should be used with caution in Russia especially if used as a self-completed questionnaire.

The findings from this paper support the use of latent variables as measures of alcohol use as separating the AUDIT into two latent dimensions provided more detailed information about the association between alcohol use and socio-demographic variables than the more conventional approach of using the total AUDIT score. However the culturally specific limitation of the AUDIT identified in this paper suggests more research is needed into identifying measures of alcohol use which are appropriate for use in Russia.

## Paper 1: Socio-demographic Predictors of Dimensions of the AUDIT Score in a Population Sample of Working-age Men in Izhevsk, Russia

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# SCREENING AND IDENTIFICATION

## Socio-demographic Predictors of Dimensions of the AUDIT Score in A Population Sample of Working-age Men in Izhevsk, Russia

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**Abstract — Aims:** To investigate the relationship between socio-demographic factors and alcohol drinking patterns identified through a formal analysis of the factor structure of the Alcohol Use Disorders Identification Test (AUDIT) score in a population sample of working-age men in Russia. **Methods:** In 2008–2009, a sample of 1005 men aged 25–59 years living in Izhevsk, Russia were interviewed and information collected about socio-demographic circumstances. Responses to the AUDIT questions were obtained through a self-completed questionnaire. Latent dimensions of the AUDIT score were determined using confirmatory factor analysis and expressed as standard deviation (SD) units. Structural equation modelling was used to estimate the strength of association of these dimensions with socio-demographic variables. **Results:** The AUDIT was found to have a two-factor structure: alcohol consumption and alcohol-related problems. Both dimensions were higher in men who were unemployed seeking work compared with those in regular paid employment. For consumption, there was a difference of 0.59 SDs, (95% confidence interval (CI): 0.23, 0.88) and for alcohol-related problems one of 0.66 SD (95% CI: 0.31, 1.00). Alcohol-related problems were greater among less educated compared with more educated men (*P*-value for trend = 0.05), while consumption was not related to education. Similar results were found for associations with an amenity index based on car ownership and central heating. Neither dimension was associated with marital status. While we found evidence that the consumption component of AUDIT was underestimated, this did not appear to explain the associations of this dimension with socio-demographic factors. **Conclusions:** Education and amenity index, both measures of socio-economic position, were inversely associated with alcohol-related problems but not with consumption. This discordance suggests that self-reported questions on frequency and volume may be less sensitive markers of socio-economic variation in drinking than are questions about dependence and harm. Further investigation of the validity of the consumption component of AUDIT in Russia is warranted as it appears that the concept of a standard 'drink' as used in the instrument is not understood.

## INTRODUCTION

Life expectancy in Russia is extremely low for an industrialized country (Leon *et al.*, 2009). Hazardous alcohol consumption among working-age men is a particularly important contributory factor to this (Leon *et al.*, 2007; Zaridze *et al.*, 2009). However, understanding the determinants of hazardous drinking in Russia has received only limited attention. In an earlier study in Izhevsk, Russia (Tomkins *et al.*, 2007), low educational level, being unemployed and lower levels of household wealth/amenities were all associated with hazardous drinking defined in terms of indicators such as consumption of non-beverage alcohols and being continuously drunk for two or more days. However, daily consumption of spirits was associated with being unemployed but not with education or household amenities. The relationship between socio-economic variables and alcohol use is particularly important in Russia where socio-economic differences in mortality have been increasing (Shkolnikov *et al.*, 1998; Murphy *et al.*, 2006).

The Alcohol Use Disorders Identification Test (AUDIT) was developed as a screening instrument for harmful or hazardous alcohol consumption for use in primary health care settings (Saunders *et al.*, 1993). However, today the AUDIT is also increasingly used in epidemiological studies as a standard measure of hazardous drinking in a population (Coulthard *et al.*, 2002; Mendoza-Sassi and Beria, 2003; Nilssen *et al.*, 2005; Kallmen *et al.*, 2007; Reinert and Allen, 2007).

The AUDIT score was originally designed to cover three conceptual domains of hazardous alcohol use—elevated consumption, alcohol dependence and alcohol-related harm (Saunders *et al.*, 1993; Babor *et al.*, 2001). However, there has been considerable debate over the actual number of domains represented by the AUDIT. Studies in Sweden, Brazil and the UK of general population samples have all suggested a two factor structure with one factor measuring alcohol consumption and one measuring alcohol-related problems(Bergman and Kallmen, 2002; Lima *et al.*, 2005; Shevlin and Smith, 2007). The validity of the AUDIT has recently been investigated in Russia in a sample of 255 tuberculosis patients and found to have high internal consistency and high sensitivity for detecting alcohol use disorders in such a clinical population (Mathew *et al.*, 2010). This study also supported a two factor structure (Mathew *et al.*, 2010). However, the structure has not yet been investigated in a Russian general population sample.

Several recent studies have found that demographic and clinical variables do not show the same relationships with different dimensions of the AUDIT (Shevlin and Smith, 2007; Smith *et al.*, 2010). In this paper, we set out to (i) investigate the factor structure of AUDIT in a population sample in Russia and (ii) investigate the relationship between socio-demographic variables and dimensions of alcohol drinking patterns and consequences as measured by the AUDIT.

## METHODS

The analyses were based on data from the Izhevsk Family Study-2. This was a follow-up study of men who were originally recruited as live population controls for a case–control study (2003–2006) of alcohol and premature mortality among working-age men (Leon *et al.*, 2007). The study was conducted in Izhevsk, an industrial city west of the Ural Mountains, Russia. The original controls were a random sample from a 2002 population list of the city frequency matched by age to the deaths occurring in the city among men aged 25–54 years.

Of the original 2041 live controls, in 2008–2009, we successfully followed up and completed interviewer-administered questionnaires for 1515. The questionnaire collected information on socio-demographic characteristics including educational level, household amenities (access to a car and central heating), marital status and employment status. Questions on alcohol consumption included frequency and usual quantity of spirits, wine and beer consumed on a typical occasion. Smoking status was also ascertained.

All re-interviewed subjects were offered a health check which 1052 men attended. This typically took place 2–3 weeks after the re-interview and involved measurements of height, weight, blood pressure and collection of a blood sample. Levels of the liver enzyme γ-glutamyl transferase (GGT) were measured.

Men attending the health check examination were also given a self-completed questionnaire containing the AUDIT questions (Babor *et al.*, 2001). We adapted the WHO Russian translation of the AUDIT questions in two respects: (i) the 1-year reference period for behaviours and consequences was replaced with a 3-month period. This was done because we were using the same instrument in a 3-month follow-up interview for a subset of the subjects enrolled in a brief intervention trial (Tomkins *et al.*, 2008).This may have affected the total AUDIT score but should not affect the factor structure since the structure of the questions was unaltered. (ii) The first AUDIT question 'how often do you have a drink containing alcohol?' was modified by adding 'including substances not intended to be drunk'. This was done because of the relatively high prevalence of non-beverage alcohol consumption in this population (Gil *et al.*, 2009). The questions used are shown in Table 2. In the main analyses presented in this paper, we focus on the 1005 (66.3%) subjects who had a complete AUDIT score.

In order to determine if there was selection bias in the sample of men included, we investigated whether subjects with a complete AUDIT score differed from those without by comparing the distribution of the characteristics recorded at the interviewer-administered questionnaire for both groups. To study associations among the available variables, we examined the distribution of AUDIT score by age, education, amenity index, marital status, employment and smoking. To provide some element of validation, we also examined the distribution of AUDIT scores by fourths of GGT.

It is acknowledged in the literature that the concept of a standard drink used in the AUDIT questionnaire is potentially problematic, as it may be understood in different ways across cultures (Lemmens, 1994; World Health Organisation, 2000; Gill and Donaghy, 2004). For this reason, as is commonly done, in our study the AUDIT questions were preceded by explicit text stating that a standard drink was defined to be 25 g of vodka, one 330 ml bottle of beer or 150 ml of wine. However, the design of the Izhevsk study provided an unusual opportunity to investigate the sensitivity of the 'drinks' question. This was done by comparing responses to the AUDIT question on number of drinks to responses given in the preceding interviewer-administered questionnaire about the usual quantity of each beverage consumed in explicit categories that are used by Russians in their everyday life (spirits and wine in grams and beer in bottles).

### *Statistical methods*

To determine the factor structure of the AUDIT in a Russian context, we fitted two alternative confirmatory factor analysis (CFA) models estimated using weighted least squares with mean and variance adjustment (Muthèn and Muthèn, 1998–2007; Flora and Curran, 2004). Model 1 specified the three factors the AUDIT was designed to measure—alcohol consumption (loading on Questions 1–3), dependence (loading on Questions 4–6) and alcohol-related harm (loading on Questions 7–10). Model 2 specified two factors—alcohol consumption (loading on Questions 1–3) and alcohol-related problems (loading on Questions 4–10).They were compared using the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI) and the Root Mean Square Error of Approximation (RMSEA). CFI and TLI values >0.95 indicate acceptable model fit (Tabachnik and Fidell, 1996; Streiner, 2006). For the RMSEA, values <0.08 indicate a reasonable fit and values <0.05 indicate a good fit (Streiner, 2006).

We investigated the relationship between socio-demographic variables and both specifications of the AUDIT latent factors model by fitting structural equation models (SEMs) with age, education, marital status employment, amenity index and smoking as explanatory variables (Bollen, 1989). The latent factors were expressed in standard deviation (SD) units.

Analyses were carried out in Stata 11(StataCorp., 2009) and Mplus 5(Muthèn and Muthèn, 1998–2007).

## RESULTS

The number of participants at each stage of the study is shown in Fig. 1. Of the 1515 subjects re-interviewed in 2008–2009, 510 did not fill out the self-completed questionnaire, almost all because they did not take part in the health check examination. There was no evidence of a difference in age ($P = 0.62$), employment ($P = 0.13$), education ($P = 0.57$) or smoking status ($P = 0.44$) between the 1005 subjects for whom complete AUDIT scores were available from the self-completed questionnaire, and the 510 subjects who did not have this information. However, those with complete AUDIT scores were more likely to be married (81.0 vs. 75.7%, $P = 0.04$) and more likely to have both a car (53.9 vs. 46.5%, $P = 0.006$) and central heating (87.7 vs. 80.8%, $P < 0.001$). There was no evidence of a difference in the median total volume of ethanol consumed from beer, wine and spirits based on responses to the interview-administered questionnaire ($P = 0.66$) between men who completed the AUDIT and men who did not.

The mean age of the subjects included was 48.5 years (SD = 8.0). The median AUDIT score was 6 (inter-quartile range 3–12). The frequency distribution of age, GGT, marital status, employment, education, amenity index and smoking status and their corresponding median AUDIT scores are shown in Table 1. Median AUDIT increased across fourths of GGT (test for trend $P < 0.001$).

*Latent dimensions of AUDIT*

The factor loadings and model fit indices for the two proposed CFA models are shown in Table 2. Both fit the data very well. However, factors 2 and 3 in Model 1 were highly correlated ($r = 0.93$) therefore the two factor solution, leading to the two dimensions of alcohol consumption and alcohol-related problems was adopted when relating socio-demographic factors to the AUDIT using an SEM approach.

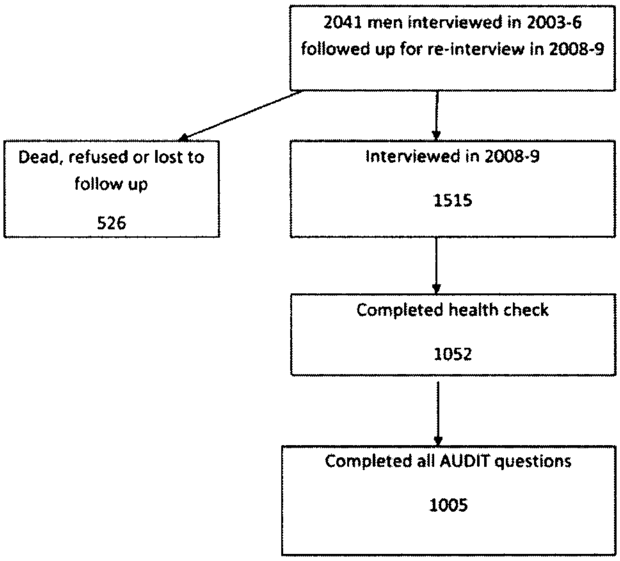


Fig. 1. Flow chart of participants.

*Socio-demographic predictors of dimensions of the AUDIT score*

The associations of age, marital status, employment status, education level and, amenity index with each of the two latent dimensions of the AUDIT (consumption and alcohol-related problems) are shown in Table 3. This reports the regression coefficients estimated using a series of SEMs for two models: adjusted for age alone and then adjusted for all other variables in the table. Age was inversely associated with both AUDIT dimensions. There was little evidence for marital status being related to either AUDIT dimension, although it is notable that in nearly all instances those living in a registered marriage had the lowest levels of both consumption and alcohol-related problems. In contrast, there was strong evidence that men who were unemployed and seeking work had higher levels of both alcohol consumption and alcohol-related problems than men in regular paid employment. The two measures of socio-economic position (education and amenities) showed similar patterns. In the models adjusted for age alone, while neither showed an association with the consumption dimension, both showed an inverse association with alcohol-related problems. Similar patterns were seen for the fully adjusted models, although the effects

Table 1. Distribution of age, GGT, marital status, employment, education, amenity index and smoking status and category-specific median AUDIT score

| Variable | Categories | *n* (%) | Median AUDIT score |
|---|---|---|---|
| Age | 25–29 | 14 (1.4) | 11 |
| | 30–34 | 73 (7.3) | 7 |
| | 35–39 | 91 (9.1) | 7 |
| | 40–44 | 115 (11.4) | 7 |
| | 45–49 | 189 (18.8) | 6 |
| | 50–54 | 246 (24.5) | 6 |
| | 55+ | 277 (27.6) | 6 |
| Fourth of GGT* (u/l) | First fourth (<20) | 255 (26.0) | 4 |
| | Second fourth (20–29.7) | 235 (24.0) | 6 |
| | Third fourth (29.8–45.7) | 236 (24.1) | 7 |
| | Fourth fourth (>45.7) | 255 (26.0) | 9 |
| Marital status* | Living together with a partner in a registered marriage | 813 (80.9) | 6 |
| | Living together with a partner but not in a registered marriage | 93 (9.3) | 7 |
| | Divorced or separated | 54 (5.4) | 7.5 |
| | Widower | 8 (0.8) | 10.5 |
| | Never married | 36 (3.6) | 6 |
| Employment | In regular paid employment | 844 (84.0) | 6 |
| | In irregular paid employment | 47 (4.7) | 8 |
| | Unemployed seeking work | 43 (4.3) | 12 |
| | Unemployed not seeking work | 63 (6.3) | 5 |
| | Other | 8 (0.8) | 4 |
| Education | Incomplete secondary or less | 43 (4.3) | 7 |
| | Secondary | 733 (72.9) | 6 |
| | Higher and incomplete higher | 229 (22.8) | 6 |
| Amenity index | Neither car or central heating | 60 (6.0) | 7.5 |
| | Either car or central heating | 467 (46.5) | 7 |
| | Both car and central heating | 478 (47.6) | 6 |
| Smoking status* | Never smoked | 196 (19.5) | 5 |
| | Ex smoker | 183 (18.2) | 5 |
| | Current smoker | 625 (62.2) | 7 |
| Total | | 1005 (100) | 6 |

*Data missing on GGT for 24 participants, on marital status for 1 participant and on smoking status for 1 participant.

Table 2. Standardized factor loadings (standard errors) for two and three confirmatory factor models of AUDIT[a] and latent factor correlations

| | Model 1 | | | Model 2 | |
|---|---|---|---|---|---|
| Latent dimensions | Alcohol consumption | Dependence | Alcohol-related harm | Alcohol consumption | Alcohol-related problems |
| AUDIT questions | | | | | |
| Q1. How often do you have a drink containing alcohol including substances not intended to be drunk? | 0.76 (0.02) | | | 0.76 (0.02) | |
| Q2. How many drinks (portions) containing alcohol do you have on a typical day when you are drinking? | 0.75 (0.02) | | | 0.75 (0.02) | |
| Q3. How often do you have 6 or more drinks on one occasion? | 0.96 (0.01) | | | 0.96 (0.01) | |
| Q4. How often during the last 3 months have you found you were not able to stop drinking once you had started? | | 0.84 (0.02) | | | 0.82 (0.02) |
| Q5. How often during the last 3 months have you failed to do what was expected of you because of drinking | | 0.83 (0.02) | | | 0.81 (0.02) |
| Q6. How often during the last 3 months have you needed a drink first thing in the morning to get yourself going after a heavy drinking session? | | 0.85 (0.02) | | | 0.82 (0.02) |
| Q7. How often during the last 3 months have you had a feeling of guilt or remorse as a result of your drinking? | | | 0.85 (0.02) | | 0.84 (0.02) |
| Q8. How often during the last 3 months have you been unable to remember what happened the night before because of your drinking? | | | 0.85 (0.02) | | 0.84 (0.02) |
| Q9. Have you or someone else been injured because of your drinking? | | | 0.41 (0.04) | | 0.41 (0.04) |
| Q10. Has a relative, friend, doctor or other health worker been concerned about your drinking or suggested you cut down? | | | 0.76 (0.02) | | 0.76 (0.02) |
| Latent factor correlations | | | | | |
| Factor 1 | 1.00 | | | 1.00 | |
| Factor 2 | 0.65 (0.03) | 1.00 | | 0.69 (0.03) | 1.00 |
| Factor 3 | 0.70 (0.03) | 0.93 (0.02) | 1.00 | | |
| Goodness of fit indices | | | | | |
| CFI | 0.97 | | | 0.97 | |
| TLI | 0.99 | | | 0.99 | |
| RMSEA | 0.067 | | | 0.069 | |

[a]Sample of 1005 men.

were attenuated, and in the case of the amenity index no longer reached statistical significance (test for heterogeneity $P = 0.32$; test for linear trend $P = 0.13$).

Smoking was strongly associated with both dimensions of the AUDIT after adjusting for age and the socio-economic variables (test for heterogeneity $P < 0.001$ for both alcohol consumption and alcohol-related problems).The alcohol consumption dimension was greatest in men who were current smokers (0.36 SD increase relative to men who had never smoked, 95% confidence interval (CI) 0.19, 0.54). The alcohol-related problems dimension was also highest in men who were current smokers (0.50 SD increase relative to men who had never smoked, 95% CI 0.30, 0.70) but was also higher in ex-smokers (0.27 SD increase relative to men who had never smoked 95% CI 0.03, 0.52).

We checked whether the patterns observed above with the socio-demographic variables were similar if we used a three factor structure. Splitting the alcohol-related problems dimension into two dimensions (alcohol dependence and alcohol-related harm) did not lead to substantively different results to using the combined alcohol-related problems dimension.

### *Sensitivity of the AUDIT*

We compared the number of drinks reported in AUDIT Question 2 (obtained from the self-completed questionnaire) with the usual quantity of beer, wine and spirits reported in the interviewer-administered questionnaire (Table 4). For spirits, the number of drinks reported in AUDIT Question 2 was much lower than the equivalent number reported in the interviewer-administered questionnaire. The same level of discrepancy was not found for wine or beer (data not shown). To examine whether this discrepancy may influence the results, we calculated a 'corrected' AUDIT score by replacing responses to Question 2 in the AUDIT questionnaire with the equivalent number of drinks using the interviewer-administered questionnaire on usual quantity of spirits, except for subjects who never drank spirits according to the interviewer-administered questionnaire (for whom the original score was left unchanged). As a result, the distribution of this 'corrected' score was shifted upward, with a median of 7 (inter-quartile range 4–13) instead of 6 (inter-quartile range 3–12) found with the original score. Using this 'corrected' version, however, did not change the factor structure of the AUDIT, or substantively change the relationship found between the AUDIT dimensions and age, education, marital status employment, amenity index and smoking.

## DISCUSSION

The AUDIT questionnaire has not been used very much in either clinical or epidemiological studies of alcohol problems in Russia, despite the fact that heavy and hazardous drinking is relatively common there (Popova *et al.*, 2007). Our paper is the first to investigate whether the AUDIT was best

Table 3. The relationship between age, marital status, employment, education and amenity index and the two latent factors of the AUDIT (consumption and alcohol-related problems)[a]

| Latent variables | | Consumption | | Alcohol-related problems | |
|---|---|---|---|---|---|
| Predictors | | Age-adjusted coefficient (95% CI) | Fully adjusted coefficient[b] (95% CI) | Age-adjusted coefficient (95% CI) | Fully adjusted coefficient[b] (95% CI) |
| Age (5-year groups) | 25–29 | 0.69 (0.13, 1.25) | 0.68 (0.11, 1.24) | 0.57 (−0.04, 1.17) | 0.52 (−0.08, 1.13) |
| | 30–34 | 0.27 (−0.01, 0.54) | 0.23 (−0.06, 0.51) | 0.36 (0.07, 0.66) | 0.37 (0.06, 0.68) |
| | 35–39 | 0.13 (−0.12, 0.38) | 0.12 (−0.13, 0.38) | 0.26 (−0.01, 0.54) | 0.29 (−0.02, 0.57) |
| | 40–44 | 0.10 (−0.14, 0.33) | 0.08 (−0.16, 0.31) | 0.28 (0.03, 0.53) | 0.31 (0.05, 0.57) |
| | 45–49 | −0.09 (−0.29, 0.11) | −0.10 (−0.30, 0.10) | 0.14 (−0.08, 0.36) | 0.18 (−0.04, 0.40) |
| | 50–54 | 0.01 (−0.17, 0.19) | 0.02 (−0.17, 0.20) | 0.05 (−0.15, 0.26) | 0.10 (−0.11,0.30) |
| | 55–59 | Reference | Reference | Reference | Reference |
| | Linear trend | $P = 0.01$ | $P = 0.03$ | $P = 0.001$ | $P = 0.001$ |
| Marital status | Living together with a partner in a registered marriage | Reference | Reference | Reference | Reference |
| | Living together with a partner but not in a registered marriage | 0.04 (−0.19, 0.27) | −0.02 (−0.25, 0.21) | 0.28 (0.04, 0.53) | 0.19 (−0.06 , 0.43) |
| | Divorced or separated | 0.23 (−0.07, 0.52) | 0.21 (−0.09, 0.50) | 0.18 (−0.14, 0.50) | 0.08 (−0.25, 0.40) |
| | Widower | 0.20 (−0.55, 0.96) | 0.11 (−0.64, 0.86) | 0.33 (−0.49, 1.14) | 0.13 (−0.68, 0.95) |
| | Never married | 0.03 (−0.33, 0.37) | 0.10 (−0.27, 0.46) | 0.08 (−0.31, 0.47) | 0.09 (−0.30, 0.48) |
| | Test for heterogeneity | $P = 0.64$ | $P = 0.70$ | $P = 0.17$ | $P = 0.66$ |
| Employment | In regular paid employment | Reference | Reference | Reference | Reference |
| | In irregular paid employment | 0.07 (−0.24, 0.38) | 0.03 (−0.29, 0.35) | 0.20 (−0.13, 0.53) | 0.11 (−0.23, 0.44) |
| | Unemployed seeking work | 0.59 (0.27, 0.92) | 0.59 (0.26, 0.91) | 0.73 (0.39, 1.07) | 0.66 (0.31, 1.00) |
| | Unemployed not seeking work | −0.26 (−0.53, 0.01) | −0.27 (−0.55, −0.01) | −0.06 (−0.37, 0.25) | −0.11 (−0.43, 0.20) |
| | Other | −0.44 (−1.18, 0.31) | −0.47 (−1.21, 0.28) | −0.36 (−1.25, 0.52) | −0.34 (−1.21, 0.54) |
| | Test for heterogeneity | $P < 0.001$ | $P = 0.001$ | $P < 0.001$ | $P = 0.003$ |
| Education | Incomplete secondary or less | 0.03 (−0.29, 0.36) | 0.09 (−0.24, 0.42) | 0.11 (−0.24, 0.47) | 0.13 (−0.23, 0.49) |
| | Secondary | Reference | Reference | Reference | Reference |
| | Higher and incomplete higher | −0.01 (−0.16, 0.15) | −0.01 (−0.18, 0.15) | −0.21 (−0.39, −0.04) | −0.17 (−0.35, 0.02) |
| | Test for heterogeneity | $P = 0.97$ | $P = 0.85$ | $P = 0.06$ | $P = 0.14$ |
| | Linear trend | $P = 0.86$ | $P = 0.67$ | $P = 0.01$ | $P = 0.05$ |
| Amenity index | Neither car or central heating | 0.14 (−0.15, 0.42) | 0.11 (−0.17, 0.40) | 0.28 (−0.03, 0.59) | 0.18 (−0.13, 0.50) |
| | Either car or central heating | −0.06 (−0.19, 0.08) | −0.08 (−0.22, 0.06 | 0.17 (0.02, 0.32) | 0.10 (−0.05, 0.26) |
| | Both car and central heating | Reference | Reference | Reference | Reference |
| | Test for heterogeneity | $P = 0.39$ | $P = 0.30$ | $P = 0.04$ | $P = 0.32$ |
| | Linear trend | $P = 0.95$ | $P = 0.81$ | $P = 0.01$ | $P = 0.13$ |

[a]Sample of 1005 men.
[b]Mutually adjusted for age, marital status, employment, education and amenity index.

Table 4. Usual quantity of spirits reported in interview compared with number of typical drinks reported (AUDIT Question 2)

| | Number of drinks on a typical drinking day (from AUDIT Question 2)[b] | | | | |
|---|---|---|---|---|---|
| Usual quantity of spirits[a] (corresponding drinks by AUDIT criteria)[c] | 1–2 *n* (%) | 3–4 *n* (%) | 5–6 *n* (%) | 7–9 *n* (%) | 10+ *n* (%) |
| Never drinks spirits | 53 (20.5) | 24 (7.9) | 7 (5.1) | 1 (1.4) | 2 (2.1) |
| Up to 50 g (1–2 drinks) | 17 (6.6) | 5 (1.7) | 1 (0.7) | 0 (0.0) | 1 (1.0) |
| 50–100 g (3–4 drinks) | **35 (13.5)** | 31 (10.3) | 10 (7.2) | 3 (4.0) | 3 (3.1) |
| 100–200 g (5–8 drinks) | **69 (26.6)** | **96 (31.8)** | 49 (35.5) | 19 (25.3) | 14 (14.6) |
| 200–300 g (9–12 drinks) | **61 (23.6)** | **101 (33.4)** | **45 (32.6)** | 35 (46.7) | 31 (32.3) |
| 300–400 g (13–16 drinks) | **9 (3.5)** | **19 (6.3)** | **10 (7.2)** | **5 (6.7)** | 12 (12.5) |
| 400g–500 g (17–20 drinks) | **13 (5.0)** | **26 (8.6)** | **15 (10.9)** | **10 (13.3)** | 28 (29.2) |
| More than 500 g (20+ drinks) | **2 (0.8)** | **0 (0.0)** | **1 (0.7)** | **2 (2.7)** | 5 (5.2) |
| Total | 259 (100) | 302 (100) | 138 (100) | 75 (100) | 96 (100) |
| Underreporting of drinks for AUDIT Question 2 | **189 (73.0)** | **242 (80.1)** | **71 (51.4)** | **17 (22.7)** | 0 (0.0) |

Bold text indicates drinks assumed under estimated in AUDIT question.
[a]Quantity of spirits was measured using grams of spirits not grams of pure ethanol.
[b]Not answered by men who say they never drink alcohol in AUDIT Question 1 ($n = 131$).
[c]Data missing on usual quantity of spirits for four participants.

represented by two or three latent dimensions in a general population sample in Russia. We found that in our study population of working-age men living in a typical medium-sized Russian city, a two-dimension model provided the best fit with these dimensions corresponding to consumption and alcohol-related problems. This is consistent with what has been found in a group of tuberculosis patients in Russia (Mathew *et al.*, 2010) and in other general population samples elsewhere (Bergman and Kallmen, 2002; Lima *et al.*, 2005; Shevlin and Smith, 2007).

The strongest and most consistent associations we observed were for employment status, with those who were unemployed but seeking work having high scores for consumption and alcohol-related problems relative to those in employment. The only other study of AUDIT dimensions in relation to employment we have found was from the UK. This reported an association with employment status measured by economic activity and inactivity and the alcohol-related problems domain of the AUDIT but not the consumption domain (Smith *et al.*, 2010). However, studies using other measures of alcohol consumption patterns have shown higher levels of both alcohol consumption and problem drinking in men who are unemployed (Lee *et al.*, 1990; Montgomery *et al.*, 1998; Bobak *et al.*, 1999; Halme *et al.*, 2008; Virtanen *et al.*, 2008). Moreover, our results are consistent with analyses of a previous survey of the Izhevsk population which found a strong association between unemployment and other markers of hazardous drinking such as frequent hangover, drinking spirits daily and continuous drunkenness lasting two or more days (Tomkins *et al.*, 2007). The cross-sectional nature of our study does not allow us to disentangle the direction of causality underlying these associations. It is conceivable that unemployment may result in the onset of problem drinking (Claussen, 1999) or vice versa, (Kriegbaum *et al.*, 2010) although both pathways could be operating simultaneously.

In contrast to employment status, marital status showed no evidence of an association with either AUDIT dimension in this study. This is striking as there is evidence that not being married is associated with drinking problems both in Russia (Stack and Bankowski, 1994; Vannoy *et al.*, 1999) and in other populations (Temple *et al.*, 1991; Helasoja *et al.*, 2007; Halme *et al.*, 2008). In addition, recent analyses of the original Izhevsk case–control study found that being married was associated with the lowest relative risk of death from both alcohol-related causes of death as well as all other causes of death combined (Pridemore *et al.*, 2010). There are a number of potential explanations for this negative finding. First, there is the play of chance, with only 54 men included who were divorced or separated. Secondly, our cross-sectional analyses may have been subject to selection bias as men who were not married were less likely to take part in the health check examination and complete the AUDIT questionnaire. This could dilute any association of alcohol consumption with marital status. However, it may also be that neither dimension of the AUDIT score is picking up those aspects of drinking behaviour that may be associated with serious relationship problems. We have not found any other investigations of marital status in relation to the AUDIT score in the literature. The link between marital status and AUDIT scores and other measures of problem drinking thus deserves further attention.

We analysed two measures of socio-economic position: education and an amenity index. While there was good evidence of an association of both with the dimension of alcohol-related problems, there was only weak evidence of an association with the consumption dimension. These results are parallel to findings from a previous survey in Izhevsk. This identified a strong association between both education and amenity index with hazardous drinking behaviours such as continuous drunkenness lasting two or more days and frequent hangover but not daily consumption of spirits (Tomkins *et al.*, 2007). Our findings for education also parallel those from a population-based study in Arkhangelsk, Russia which did not find an association between educational level and the AUDIT sub-score based on the first three AUDIT questions (the consumption dimension) (Nilssen *et al.*, 2005). The relationship between AUDIT Questions 4–10 (the alcohol-related problems dimension) was not investigated in the Arkhangelsk study, although interestingly this study failed to find an association of the total AUDIT score with education. These findings are intriguing and deserve further investigation. It may be that while on average usual frequency and amount of alcohol consumed does not vary very much by educational level in Russia, the pattern of consumption does. However, what is clear is that in the Russian setting, at least, when using the AUDIT as an epidemiological outcome (as distinct from a clinical screening tool), it is important to look separately at associations with the two latent dimensions of consumption and alcohol-related problems. Using the total AUDIT score may obscure more complex relationships with socio-demographic and behavioural factors. This conclusion parallels that from other recent research that also emphasizes the need to look separately at multiple dimensions of the AUDIT when investigating issues of aetiology (Smith *et al.*, 2010).

Aside from these substantive findings, unlike many studies using the AUDIT questionnaire, we were able to investigate an aspect of the validity of this instrument. We have concluded that there may be considerable misclassification in the response given to AUDIT Question 2 about the typical number of drinks. This is likely to be due to cultural understanding of what a 'drink' or 'portion' of spirits represents. While a 'drink' as used in the AUDIT is intended to refer to the equivalent of 10–12 g of ethanol, some Russian respondents appear to have interpreted 'a drink' of vodka as referring to a large glass containing 200 g or more of spirits (80 g ethanol). The same level of misclassification was not observed for wine and beer.

Some element of misclassification of number of drinks is to be expected and previous studies have shown that people commonly underestimate their drink sizes compared with a 'standard' drink (Lemmens, 1994; Kaskutas and Graves, 2000; Gill and Donaghy, 2004). However, the high level of underestimation of drinks compared with measurement of spirits in grams indicates that there may be specific problems with AUDIT Question 2 in the Russian context, related to the way spirits are purchased and consumed. Our results suggest caution when using the AUDIT in Russia. Our study has some general limitations. While Izhevsk has a typical demographic profile for a medium-sized Russian city, our findings cannot be automatically generalized to Russia as a whole. Moreover, the initial sample required that proxy informants should be living in the same house as the men therefore our study population excludes those living alone in 2003–2006. To this extent, we have probably underestimated the prevalence of hazardous drinking, as those living alone are likely to include a disproportionate number of men with serious drinking problems, although such men also tend to be excluded from other population surveys.

In summary, education and amenity index, both measures of socio-economic position, were inversely associated with the alcohol-related problems dimension of the AUDIT but not with the consumption dimension. This discordance suggests that self-reported questions on frequency and volume may be less sensitive markers of socio-economic variation in hazardous drinking than are questions about dependence and harm. Further investigation of the validity of the consumption component of AUDIT in Russia is warranted as it appears that the concept of a standard 'drink' as used in the instrument is not understood. Further research should examine whether problems could be overcome either by using AUDIT face to face or giving more guidance on the meaning of the word 'drink'.

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# Chapter 8: Acute Alcohol-related Dysfunction and Education

## 8.1 Introduction to Paper 2

In Paper 2 the relationship between the different latent variables described in Chapter 6 and observed aspects of alcohol use was investigated by determining what aspects of alcohol consumption (latent beverage alcohol intake, observed non-beverage alcohol use and drinking patterns) predicted acute alcohol-related dysfunction (latent routine dysfunction and zapoi).

In Paper 1 education was found to be associated with alcohol-related problems but not with alcohol consumption. Therefore the association between alcohol use and education was examined further in Paper 2 by investigating the association between education and alcohol-related dysfunctional behaviours such as hangover and drunkenness and whether this association could be explained by different aspects of alcohol consumption (intake of beverage alcohol, non-beverage alcohol use and drinking patterns). In contrast to Paper 1 where AUDIT scores were calculated for both drinkers and non-drinkers the analyses in Paper 2 were restricted to drinkers since the outcome of interest acute alcohol-related dysfunction can only be experienced among those who drink alcohol.

## 8.2 Study Sample

The study sample was all men who reported drinking alcohol in the past 12 months at IFS-1.

## 8.3 Exposures

The exposures of interest were alcohol intake and drinking patterns for the first aim and educational level for the second aim.

Alcohol intake was measured by three latent factors of beverage alcohol intake – beer intake, wine intake and spirit intake (see Chapter 6) and by observed non-beverage alcohol use (categorised as yes/no). Drinking pattern was measured by three observed variables – drinking large volumes of spirits without eating any food, drinking alone and drinking before noon.

Education was categorised as incomplete secondary or lower, secondary and higher.

## 8.4 Outcomes

The outcome of interest was acute alcohol-related dysfunction. This was measured in two ways 1) routine dysfunction  measured by the latent variable of acute alcohol-related dysfunction (see Chapter 6) and 2) sporadic dysfunction measured by one or more reported episodes of zapoi.

## 8.5 Statistical Methods

The statistical method used to investigate the relationship between the exposures and outcomes was Structural Equation Modelling (SEM). This is discussed in more detail in Appendix 1.

## 8.6 Findings and Conclusions

The three latent factors of beverage alcohol intake (beer intake, wine intake and spirit intake) all independently predicted the latent factor of acute alcohol-related dysfunction with spirit intake being the strongest predictor. Non-beverage alcohol use and drinking patterns (drinking spirits without food, drinking alone and drinking before noon) were also strong independent predictors of the latent factor of acute alcohol-related dysfunction. There was strong evidence of a negative association between acute alcohol-related dysfunction and education which was only partly explained by alcohol intake and drinking patterns. The findings for routine acute alcohol-related dysfunction (measured by a latent variables) were very similar to the findings for sporadic dysfunction i.e. zapoi.

The findings from this paper show that there is a strong relationship between the different observed and latent alcohol use variables outlined in Chapter 6. However the fact that the strong association between the latent factor of acute alcohol-related dysfunction and education could not be explained by detailed information on alcohol intake and drinking patterns suggests that this is an important dimension of alcohol use distinct from these more conventional measures.

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Version - 22 Aug 2011

# Paper 2: Alcohol-related dysfunction in working-age men in Izhevsk, Russia: An application of Structural Equation Models to study the association with education

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Running head: Alcohol-related dysfunction and education in Russia

ABSTRACT

**Background:** Acute alcohol-related dysfunctional behaviours, such as hangover, are predictive of poor health and mortality. Although much is known about the association of education with alcohol consumption, little is known about its association with these dysfunctional behaviours.

**Methods:** The study population was 1705 male drinkers aged 25-54 years resident in the city of Izhevsk, Russia who participated in a cross-sectional survey (2003-6). Structural equation modelling was used to examine the relationships between education, beverage and non-beverage alcohol intake, drinking patterns, and acute alcohol-related dysfunction score among these drinkers.

**Results:** Dysfunction was related to all other drinking variables, with the strongest predictors being spirit intake, non-beverage alcohol consumption and drinking patterns. There was a strong relationship between education and acute dysfunction which was not explained by adjusting for alcohol intake and drinking patterns (mean adjusted dysfunction score 0.35 SD (95% CI 0.10, 0.61) lower in men with higher versus secondary education).

**Conclusions:** Although by definition one or more aspects of alcohol consumption should explain the educational differences in alcohol-related dysfunction, detailed information on drinking only partly accounted for the observed patterns. Thus beyond their intrinsic interest, these results illustrate the challenges in constructing statistical models that convincingly identify the pathways that link educational differences to health-related outcomes.

Hazardous alcohol consumption is a major cause of low life expectancy in Russia and an important public health concern particularly in men.(1, 3, 6, 9, 10, 15) Drinking in Russia is characterised by episodic consumption of very large volumes of ethanol particularly from spirits.(3, 34, 39, 278) Whilst spirits remain the dominant beverage type, consumption of beer has been increasing especially in younger people. Russian alcohol use also includes a high prevalence of distinctive hazardous drinking behaviours such as zapoi (two or more days of continuous drunkenness where a person is withdrawn from normal social life) and consumption of non-beverage alcohol i.e. manufactured ethanol-based liquids not intended for drinking (e.g. eau de cologne and medicinal tinctures).(1, 29) Mortality in Russia shows a strong inverse gradient with education but relatively little work has been done to understand the factors - including alcohol consumption- that comprise the mechanism underlying this association.(44, 45, 272, 273)

Consumption of alcohol has many negative consequences both chronic and acute. The most immediate consequence of heavy alcohol use is intoxication or drunkenness often closely followed by hangover. Frequency of the acute consequences of heavy drinking can and have been used as proxy measures of episodes of heavy drinking (2, 92, 152, 270, 271) but are also negative outcomes in themselves. For example hangover is unpleasant and may have negative consequences economically due to lost productivity, absenteeism and work-related accidents as well as increased risk of injury.(141, 145-147, 169) These immediate consequences of alcohol consumption may be described as acute behavioural dysfunctions from alcohol.

Other consequences of alcohol consumption such as alcohol-related violence have also been shown to be closely associated with acute alcohol-related behavioural dysfunction. Frequency of drunkenness has been found to be a strong predictor of social problems, alcohol dependence and alcohol-related harm.(92)Frequency of intoxication, hangover and passing out because of drunkenness have been shown to be strongly predictive of subjective health, alcohol-related hospital admissions and death even after adjustment for average weekly intake of alcohol.(270, 271)

Acute alcohol-related behavioural dysfunction can be seen as on the causal pathway between alcohol intake (frequency and quantity of alcohol consumed) and more distal outcomes possibly related to alcohol use such as relationship breakdown or unemployment. Therefore a good measure of acute alcohol-related dysfunction could be a useful tool for understanding the relationship between alcohol consumption and alcohol-related problems and as a predictor of more distal adverse outcomes due to alcohol. Beyond this, these acute dysfunctions could also be important indicators of a pattern of drinking that has serious health consequences.

The aims of the analyses reported here were 1) to investigate what aspects of alcohol consumption (alcohol intake and drinking pattern) are most strongly associated with acute alcohol-related behavioural dysfunctions, such as hangover and drunkenness and 2) to investigate the relationship between educational level and acute alcohol-related dysfunction and how far this relationship is mediated through different aspects of alcohol consumption among drinkers.

## MATERIALS AND METHODS

### Study sample

This study used data from the Izhevsk Family Study 1 (IFS-1). This study included a cross-sectional survey conducted between 2003 and 2006 of 1941 men aged 25- 54 selected from the 2002 population register of the city of Izhevsk. Most of these men had originally been selected as live controls in a case-control study of the relationship between hazardous drinking and premature mortality (1) which involved them being frequency matched by age to cases (deceased men aged 25-54 years resident in Izhevsk). This paper focused only on the live men who had consumed alcohol in the past year (1,705/1,941 men) as by definition only drinkers can be at risk of acute alcohol-related dysfunction.

### Outcome variables

The outcome of interest was acute alcohol-related behavioural dysfunction in the previous year and was defined in terms of either: (i) *routine dysfunction:* measured as a latent variable manifested by self-reported behaviours following alcohol consumption. These were: frequency of excessive drunkenness (*peripivayet*– to get completely drunk), hangover, sleeping in clothes because of drunkenness and failing to fulfil family or personal obligations because of drinking alcohol. There were seven response categories for these questions: never or almost never, less than once a month, once a month, several times a month, once a week, several times a week and every day, or (ii) *sporadic dysfunction*: at least one episode of *zapoi* (defined as a period of continuous drunkenness of several days or more during which a person does not work and is withdrawn from normal life).

**Exposure variables**

Self-reported beverage and non-beverage alcohol intake and drinking pattern in the year preceding the interview were the main exposure variables in the first analyses and educational level in the second.

Beverage alcohol intake was quantified from questions on frequency of beer, wine, and spirit consumption, and on their usual and maximum quantity per drinking occasion (in explicit categories used by Russians in everyday life: beer in bottles and wine and spirits in grams). It was defined in terms of three latent factors representing beer, wine and spirits intake. The available information was obtained from questions on frequency of consumption (with 7 categories: never or almost never, a few times per year, 1-3 times a month, once or twice a week, three or four times a week, nearly every day, and every day or more often) and questions on usual and maximum quantity (converted into litres of pure ethanol consumed per occasion using the mid-point of each category so that the same unit of measurement was used for beer, wine and spirits). More specifically the three latent factor scores for beverage alcohol intake were each defined in terms of: intake by usual volume of ethanol consumed, maximum volume of ethanol consumed, and frequency of consumption. Self-reported consumption of non-beverage alcohol in the past year (e.g. eau de cologne) was coded as a binary variable: yes or no.

The information on drinking patterns was derived from questions on whether: (i) men ever drank large quantities of spirits without also eating some food at the same sitting (coded as never, sometimes or always); (ii) they ever drank alone (coded as never, sometimes or often), and (iii) whether they ever drank before noon (coded as never, occasionally and frequently). The three indicators of drinking pattern were not highly correlated and therefore were not taken to be manifestations of a common latent dimension.

Educational level was the exposure for the second aim. It was coded in three categories: incomplete secondary or lower, secondary and higher or incomplete higher. It is worth noting that the category of secondary education is a heterogenous group including men with complete secondary education and specialised secondary education and those who attended professional schools and therefore this categorisation may not have captured all the variability in educational level in the sample. However since the categorisation used should be sufficient for investigating general trends in overall level of education which could be comparable with other study populations.

**Statistical analyses**

Structural equation models were used to study the association among these variables and each outcome (routine acute behavioural dysfunction and *zapoi*), according to the conceptual model shown in Figure 1. This approach to modelling has several advantages in particular the inclusion of latent variables that allow extraction of essential information from the raw data and reduce measurement error, naturally under some distributional and functional assumptions. Note that Figure 1 does not include a direct relationship between education and acute alcohol-related behavioural dysfunction. This was because associations between education and the two measures of dysfunction were assumed necessarily to be mediated by alcohol intake and/or patterns of drinking, since alcohol must first be consumed in order to experience its acute consequences.

Estimation was by Weighted Least squares with mean and variance adjusted (WMSLV) which is appropriate for the categorical nature of the outcome variables. Model fit was assessed using the Comparative Fit Index (CFI), the Tucker Lewis Index (TLI) and the Root Mean Square of Approximation (RMSEA). CFI and TLI values greater than 0.95 indicate good model fit with a minimum of 0.90 indicating acceptable fit.(267, 268) For the RMSEA values greater than 0.10 indicates a bad fit, while less than 0.08 indicates a reasonable fit and values less than 0.05 indicate a good fit.(268)

Distinct structural equation models for either routine or sporadic acute dysfunction were fitted to address the two aims. All included adjustment for age and measurement models for the observed alcohol intake and dysfunction variables used for the specification of latent variables (264).To investigate what aspects of alcohol intake were most strongly associated with acute alcohol-related behavioural dysfunction, we fitted models which included only the outcome (either routine or sporadic dysfunction), the three latent alcohol intake variables, non-beverage alcohol use and the indicators of drinking pattern.

To investigate the role of educational level in influencing dysfunction, we started by fitting models where education was allowed to directly influence each of the outcomes (routine or sporadic dysfunction), while controlling only for the effect of age. Then we sequentially adjusted for the three latent variables of intake of beverage alcohol (beer, wine and spirits), and the indicators of non-beverage alcohol consumption and drinking patterns (drinking large volumes of spirits without eating, drinking alone and drinking before noon).

**Missing data**

There was a small amount of missing data for most of the questions on alcohol with the largest amount of missing data affecting the question on the failure to fulfil family or personal obligations (Table 1). The estimation procedure WLSMV allowed the inclusion of incomplete records which would not bias the estimates on the assumption that data were missing completely at random (269). Comparative analyses were carried out restricting the data to men with complete data for all variables.

Analyses were carried out in Stata 11 (StataCorp, Texas)(279) and Mplus 5 (Muthén & Muthén, Los Angeles)(269).

**Ethics Statement**

The Izhevsk Family Study 1 was approved by the Ethics committees of the London School of Hygiene and Izhevsk Medical Academy. Verbal consent was obtained from all participants and documented by interviewers on the cover page of the questionnaire and entered in the database. Verbal consent was obtained rather than written consent due to awareness of local cultural issues concerning fear of signing official documents. This method of consent was approved by the Ethics committees of the London School of Hygiene and Izhevsk Medical Academy.

RESULTS

Of the 1,941 men interviewed in 2003-6, 1,705 (87.8 %) reported that they had consumed alcohol in the past year. Drinkers were more likely to have higher level education than non-drinkers (15.7% non-drinkers had higher education vs 23.4% drinkers, P=0.007). Among drinkers the distribution by educational level was: 89 men (5.2%) had incomplete secondary level education or lower, 1217 (71.4%) men had a secondary level education and 399 (23.4%) had a higher or incomplete higher level of education. The distribution of the sample by alcohol consumption variables and acute dysfunctional behaviours is shown in Table 1.

Missingness due to item non-response on alcohol intake and acute alcohol-related dysfunction was found to be closely associated with answers to other questions on alcohol use at the same survey. For example the question with the largest amount of missing data was frequency of failing to fulfil family or personal obligations due to drinking (missing for 42 men).This variable was more likely to be missing in men who reported more frequently sleeping in their clothes because of drunkenness ($P<0.001$). Restricting the analyses to men with complete data did not alter the results.

### Intake of beverage alcohol (latent variables)

The measurement model used to deal with measurement error in beverage alcohol intake is shown in Figure 2. For each beverage type (beer, wine and spirits) the highest factor loading was seen for the maximum volume of ethanol consumed on one drinking occasion.

### Routine acute alcohol-related dysfunction (latent variable)

The measurement model used to define acute alcohol-related dysfunction is shown in Figure 3 with factor loadings and model fit indices. All four manifest variables were strongly associated with the underlying latent factor.

### Aim 1: Associations of alcohol intake and drinking patterns with acute alcohol-related dysfunction

The estimated associations between alcohol intake and drinking patterns and the latent factor of routine acute alcohol-related dysfunction are shown in Table 2. Intake of beer, wine and spirits summarised by their respective latent variables were associated with acute dysfunction after mutual adjustment for the other drinking variables although spirit intake showed a stronger association than intake of beer or wine. Non-beverage alcohol use was strongly associated even after controlling for intake of all three types of beverage alcohol and drinking patterns, as were drinking spirits without eating and drinking before noon although drinking alone no longer maintained significance. Mutually adjusting for all the drinking variables resulted in substantial attenuation of the estimated coefficients suggesting that all the drinking variables are highly correlated.

The equivalent results for sporadic acute behavioural dysfunction, i.e. *zapoi*, are shown in Table 3. After mutual adjustment, non-beverage alcohol use showed the strongest association out of the measures of alcohol intake while only spirit intake among the latent variables of alcohol intake maintained significance. All three drinking patterns predicted zapoi, but drinking before noon showed a particularly strong association. As with routine dysfunction, odds ratios adjusted for the effect of all alcohol variables were substantially reduced compared to the age adjusted estimates.

**Aim 2: Association of education with types of alcohol consumed**

Table 4 shows the association of the latent factors of beverage alcohol intake with educational level. Spirit intake was lower in men with higher education compared to secondary education. There was no evidence of a difference in beer or wine intake by education. There was strong evidence that non-beverage alcohol use was associated with education as compared to men with secondary level education, odds of non-beverage alcohol use were higher in men with incomplete secondary education (age adjusted odds ratio 3.06 95% CI 1.75, 5.36) and lower in men with higher education (age adjusted odds ratio 0.38 (95% CI 0.20, 0.69).

**Education and acute alcohol-related dysfunction**

The estimated associations between education and the routine dysfunction latent factor controlled for different measures of alcohol intake and drinking pattern are shown in Table 5. Adjustments were carried out to separate the pathways through which education may influence dysfunction assuming that there was no unmeasured confounding between each of these mediators and the outcome. Estimates are expressed as regression coefficients of top and bottom category of education versus the middle category (secondary education).

There was a strong age-adjusted association between education and routine dysfunction with men with higher education having lower levels of the latent factor compared to men with secondary education (Model 1). This association reduced on additionally adjusting for intake of beverage alcohol (Model 2), non-beverage alcohol use (Model 3) or for drinking patterns (Model 4), with the exception of drinking alone (Model 5). Although there was no statistical evidence of a difference in dysfunction between men with incomplete secondary and secondary education controlling for non-beverage alcohol reduced the estimated coefficient substantially. Controlling for all possible pathways related to alcohol consumption and drinking behaviour did not explain why men with higher education were protected relative to those with secondary education (Model 6).

The same analyses were carried out for sporadic dysfunction i.e. *zapoi* (Table 6). There was a strong age-adjusted association between education and zapoi. As in the analyses of routine dysfunction (Table 5) there was evidence of a protective effect of higher education. This association was reduced but not completely explained by adjusting for beverage alcohol intake, non-beverage alcohol use and drinking patterns (Model 6).

DISCUSSION

In this study beverage alcohol intake, particularly spirit intake, non-beverage alcohol use, and drinking patterns (drinking spirits without eating, drinking alone and drinking before noon) were found to be strongly associated with two measures of acute alcohol-related dysfunction: a latent variable measuring routine dysfunction and *zapoi*, a measure of sporadic dysfunction. Educational level was strongly associated with both of these measures of dysfunction. The association between education and alcohol-related dysfunction was only partly explained by beverage alcohol intake, drinking non-beverage alcohol and two aspects of reported drinking pattern (drinking spirits without eating and drinking before noon) as while any increased risk of dysfunction associated with being in the lowest educational category relative to the middle educational group was largely accounted for by these dimensions of alcohol drinking pattern, the protective effect of higher education was not.

Acute alcohol-related dysfunction is an important aspect of harm from alcohol. Frequency of hangover, excessive drunkenness, sleeping in clothes because of drunkenness and failing to fulfil family or personal obligations due to drinking alcohol were used as indicators of an underlying latent variable measuring frequent acute alcohol-related dysfunction. All four observed variables were strong manifestations (i.e. had similarly large factor loadings) of this factor at both surveys. Several previous studies have used measures of the acute consequences of alcohol consumption such as hangover and drunkenness as proxy markers of heavy drinking.(2, 92, 152) Hangover, drunkenness and passing out from alcohol have all been found to be strong predictors of more long term harm from alcohol such as self-reported health, hospitalization and death.(270, 271) However we are not aware of any other studies which have used a principled approach to combine several markers of the acute negative consequences of alcohol consumption into one measure and then used this to identify its predictors. We have also separated routine and sporadic dysfunction and found that they had similar predictors.

Previous studies in other parts of Russia that have looked at hazardous or problematic drinking found that the prevalence of heavy drinking (≥160g of ethanol per week), binge drinking, drinking twice a week and mean intake of ethanol per drinking occasion were lower in more educated compared to less educated men although mean alcohol intake in the past week showed an inconsistent association with education.(41, 42) Analyses of Alcohol Use Disorders Identification Test (AUDIT) scores measured in the Izhevsk Family Study 2 ( a follow-up study of men interviewed at IFS-1) found that more educated men had lower levels of alcohol-related problems but the same levels of alcohol consumption.(280)

The most intriguing aspect of our results is that the associations between education and acute alcohol-related dysfunction were only partly explained by consumption of beverage alcohol intake, non-beverage alcohol and pattern of drinking such as consuming spirits without food. Given that by definition alcohol-related dysfunction must ultimately be the result of alcohol drinking behaviour, there are only a limited number of potential explanations for these results.

The first and most obvious explanation is that our exposure and outcome measures are subject to measurement error. All information on alcohol consumption and its consequences was self-reported and thus it is likely that there was some measurement error of alcohol intake resulting in residual confounding. If this were the case it would suggest that conventional questions on frequency and volume of ethanol alone are not sensitive enough measures of heavy alcohol intake in this population since they were not sufficient to explain the association between acute alcohol-related dysfunction and education.

Aside from measurement error, it may be that we have failed to capture some important mediator-outcome confounders as well as other aspects of alcohol use that are correlated with education. For example there may be differences in the toxicological profile of what is consumed by educational group independent of volume or frequency of consumption. Thus men in higher educational groups may consume purer sources of alcohol and be less likely to experience dysfunction. Education may also be related to aspects of individual susceptibility to alcohol such as nutritional status, physical and mental health, and supportive familial and social relationships. These factors may further explain the relationship between education and acute alcohol-related dysfunction.

Non-beverage alcohol use was a strong predictor of both routine and sporadic dysfunction, independent of intake of beer, wine and spirits and drinking patterns. Future studies on alcohol consumption in Russia should include measures of non-beverage alcohol use as well as intake of beer, wine and spirits. Spirit intake was more strongly associated with acute alcohol-related dysfunction than beer or wine intake. However these results reflect levels of consumption of these beverage types amongst working-age men in Izhevsk and may not be generalisable to other populations where the proportion of ethanol consumed from spirits is lower.

There are some general limitations to the study overall. Firstly men who were living alone in 2003-2006 were excluded from the sample. Also the possibility of bias induced by unmeasured confounders cannot be discounted. To this extent, generalizing our findings to the population as a whole has to be done with caution and suitable caveats. It is also important to note that no attempt has been made here to explain the more distal pathways by which education may lead to higher levels of either alcohol consumption or alcohol-related dysfunction for example through influences on employment and income. Although these factors are likely to be on the causal pathway between education and acute alcohol-related dysfunction it was not possible to examine these relationships using the cross-sectional data used in these analyses since the relationship between drinking and employment is extremely likely to be bi-directional.

In conclusion we have identified several predictors of routine and sporadic acute alcohol-related dysfunction in a sample of working-age men in Izhevsk, Russia: beverage alcohol intake particularly intake of spirits, consumption of non-beverage alcohol, drinking spirits without food, drinking alone, drinking before noon and education. The association between education and acute alcohol-related dysfunction was only partly explained by beverage alcohol intake, non-beverage alcohol consumption, drinking large quantities of spirits without food and drinking before noon. This suggests more information is needed to identify men at risk of harm from alcohol than can be identified from conventional questions on quantity and frequency of consumption. Measures of acute alcohol-related dysfunctional behaviour could be useful epidemiological tools in future research on more distal alcohol-related harm.

Finally, from a more methodological perspective, these results illustrate the challenge in constructing statistical models that convincingly identify the pathways that link educational differences to health-related behaviours and outcomes, even when the universe of potential explanatory pathways is by definition restricted, as is the case with alcohol-related dysfunction.

REFERENCES: See end of Thesis

**Figure 1: Hypothesized Relationships between Variables Measured at the Izhevsk Family Study 1**

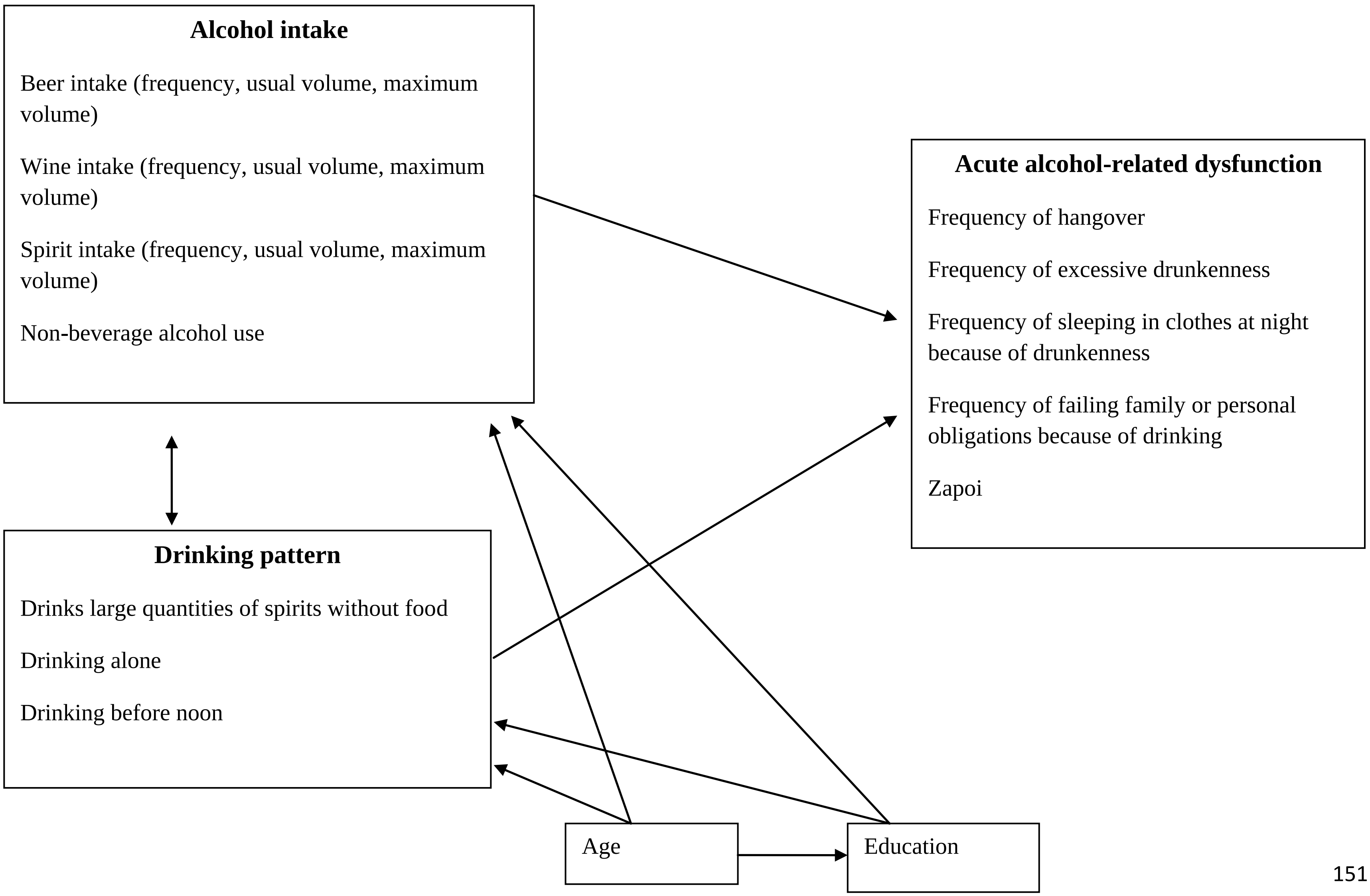


**Table 1.Distribution of self-reported alcohol intake and indicators of acute alcohol-related dysfunction in men who had consumed alcohol in the past 12 months**

| | | IFS-1 (% or SD) | |
|---|---|---|---|
| Frequency of drinking beer | Never drinks beer | 269 | (15.8) |
| (Missing=1) | A few times per year | 148 | (8.7) |
| | 1-3 times per month | 434 | (25.5) |
| | 1-2 times/week | 578 | (33.9) |
| | 3-4 times/week | 164 | (9.6) |
| | Almost daily | 90 | (5.3) |
| | Daily | 21 | (1.2) |
| Mean usual volume of ethanol per occasion from beer in beer drinkers (mls of ethanol) (Missing=8) | | 44.5 | (25.8) |
| Mean maximum volume of ethanol per occasion from beer in beer drinkers (mls of ethanol) (Missing=20) | | 74.3 | (42.2) |
| Frequency of drinking wine | Never drinks wine | 1047 | (61.4) |
| (Missing=6) | A few times per year | 347 | (20.4) |
| | 1-3 times per month | 205 | (12.0) |
| | 1-2 times/week | 84 | (4.9) |
| | 3-4 times/week | 16 | (0.9) |
| | Almost daily | 6 | (0.4) |
| | Daily | 0 | (0.0) |
| Mean usual volume of ethanol per occasion from wine in wine drinkers (mls of ethanol) (Missing=6) | | 46.2 | (33.4) |
| Mean maximum volume of ethanol per occasion from wine in wine drinkers (mls of ethanol) (Missing=12) | | 73.1 | (46.3) |
| Frequency of drinking spirits | Never drinks spirits | 132 | (7.7) |
| (Missing=2) | A few times per year | 370 | (21.7) |
| | 1-3 times per month | 667 | (39.1) |
| | 1-2 times/week | 427 | (25.0) |
| | 3-4 times/week | 65 | (3.8) |
| | Almost daily | 36 | (2.1) |
| | Daily | 6 | (0.4) |
| Mean usual volume of ethanol per occasion from spirits in spirit drinkers (mls of ethanol) (Missing=6) | | 118.2 | (63.5) |
| Mean maximum volume of ethanol per occasion from spirits in spirit drinkers (mls of ethanol) (Missing=23) | | 188.9 | (84.3) |
| Frequency of hangover | Never | 885 | (51.9) |
| (Missing=17) | Less than once a month | 387 | (22.7) |
| | Once a month | 243 | (14.3) |
| | Several times a month | 90 | (5.3) |
| | Once a week | 46 | (2.7) |
| | Several times a week | 26 | (1.5) |
| | Every day | 11 | (0.7) |
| Frequency of excessive drunkenness | Never | 886 | (52.0) |
| (Missing=17) | Less than once a month | 450 | (26.4) |
| | Once a month | 227 | (13.3) |
| | Several times a month | 55 | (3.2) |
| | Once a week | 45 | (2.6) |
| | Several times a week | 16 | (0.9) |
| | Every day | 9 | (0.5) |

| | | IFS-1 | (% or SD) |
|---|---|---|---|
| Frequency of sleeping in clothes because of drunkenness | Never | 1417 | (83.1) |
| (Missing=8) | Less than once a month | 153 | (9.0) |
| | Once a month | 74 | (4.3) |
| | Several times a month | 23 | (1.4) |
| | Once a week | 15 | (0.9) |
| | Several times a week | 11 | (0.7) |
| | Every day | 4 | (0.2) |
| Frequency of failing to fulfil family or personal obligations | Never | 1357 | (79.6) |
| because of drinking | Less than once a month | 141 | (8.3) |
| (Missing=42) | Once a month | 99 | (5.8) |
| | Several times a month | 34 | (2.0) |
| | Once a week | 14 | (0.8) |
| | Several times a week | 12 | (0.7) |
| | Every day | 6 | (0.4) |
| Went on zapoi in the past year | No | 1570 | (92.1) |
| (Missing=4) | Yes | 131 | (7.7) |
| Drinks large quantities of spirits without also eating some | Never/Rarely | 1449 | (85.0) |
| Food | Sometimes | 235 | (13.8) |
| (Missing=1) | Always | 20 | (1.2) |
| Ever drinks alone | Never | 888 | (52.1) |
| (Missing=1) | Sometimes | 727 | (42.6) |
| | Often | 89 | (5.2) |
| Ever drinks before noon | Never | 1177 | (69.0) |
| (Missing=2) | Occasionally | 501 | (29.4) |
| | Frequently | 25 | (1.5) |
| Total | | 1705 | (100) |

**Figure 2.Measurement models of Beverage Alcohol Intake with standardized factor loadings (95% confidence intervals) for 1,705 drinkers in the Izhevsk Family Study 1**

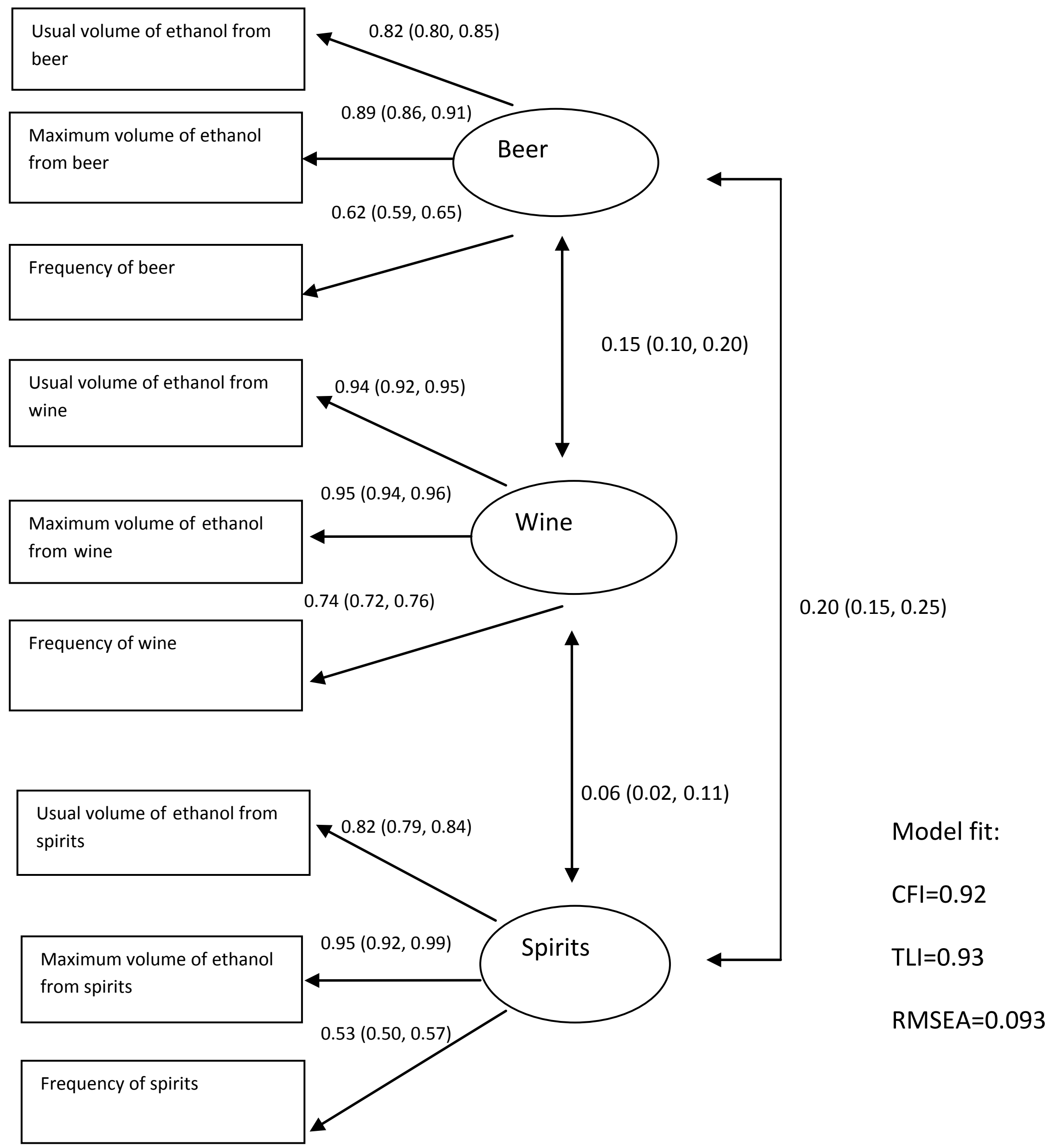


**Figure 3.Measurement models of acute alcohol-related dysfunction with standardized factor loadings (95% confidence intervals) for 1,705 drinkers in the Izhevsk Family Study 1**

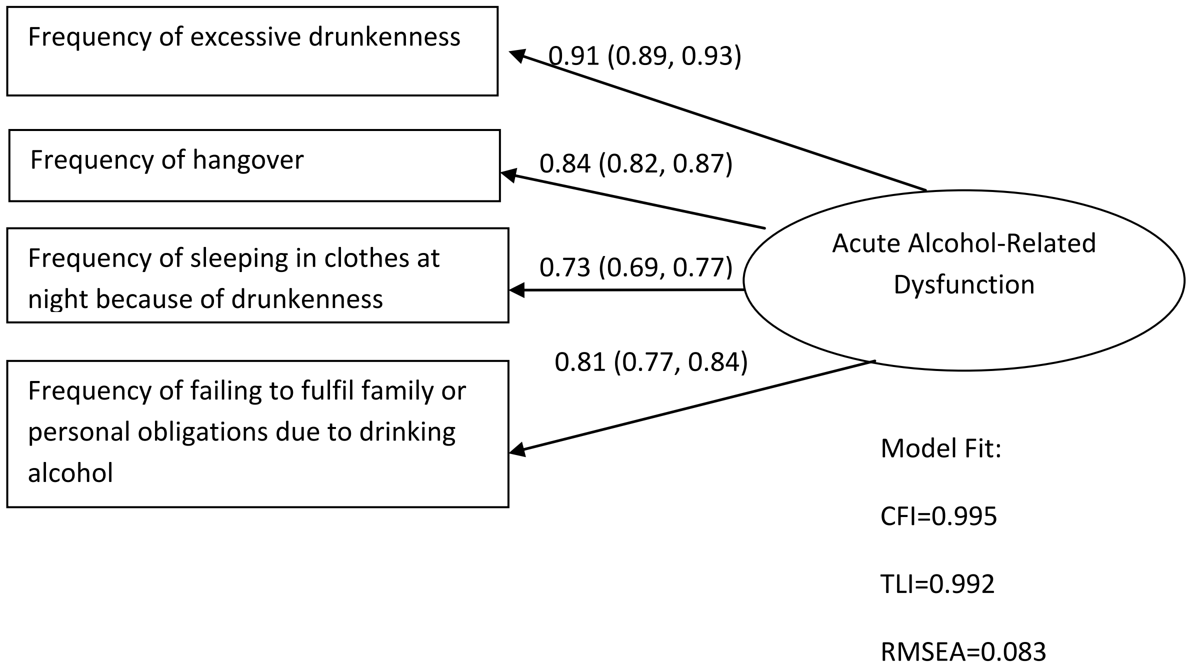


**Table 2.Relationship between latent intake of beer, wine, and spirits, non-beverage alcohol use and drinking patterns and latent routine dysfunction among 1,705 drinkers in the Izhevsk Family Study 1**

| Predictors | | Latent factor of Acute Alcohol-related Dysfunction | | | |
|---|---|---|---|---|---|
| | | Adjusted for age | | Adjusted for age and all other variables[b] | |
| | | Coefficient[a] | 95% CI | Coefficient[a] | 95% CI |
| Drinks non-beverage alcohol | | 1.66 | 1.46, 1.85 | 0.97 | 0.74, 1.20 |
| Beer intake (latent) | | 4.54 | 1.38, 7.70 | 0.16 | 0.08, 0.23 |
| Wine intake (latent) | | -0.30 | -0.81, 0.21 | 0.25 | 0.17, 0.33 |
| Spirit intake (latent) | | 1.05 | 0.93, 1.18 | 0.75 | 0.65, 0.85 |
| Drinks large volumes of spirits without eating | Sometimes | 1.32 | 1.16, 1.48 | 0.68 | 0.49, 0.87 |
| | Always | 1.93 | 1.47, 2.38 | 0.77 | 0.21, 1.33 |
| Drinks alone | Sometimes | 0.50 | 0.38, 0.61 | 0.11 | -0.07, 0.29 |
| | Often | 0.93 | 0.70, 1.16 | 0.29 | -0.01, 0.58 |
| Drinks before noon | Occasionally | 1.09 | 0.96, 1.22 | 0.51 | 0.36, 0.67 |
| | Frequently | 2.92 | 2.56, 3.28 | 0.91 | 0.49, 1.34 |

[a] Coefficients represent standard deviation (SD) change in continuous latent factor of acute alcohol-related dysfunction for 1 SD change in latent alcohol intake variable or SD difference in latent factor of acute alcohol-related dysfunction in non-beverage alcohol drinkers compared to men who do not drink non-beverage alcohol, or in men who drink large volumes of sprits without eating, drink alone or drink before noon compared to men who never do so. All estimates are adjusted for age.

[b] Mutually adjusted for beer intake, wine intake, spirit intake, non-beverage alcohol use, spirits without food, drinking alone and drinking before noon

**Table 3.Relationship between latent intake of beer, wine, spirits, non-beverage alcohol use and drinking patterns and sporadic dysfunction (zapoi) in 1,705 drinkers in the Izhevsk Family Study 1**

| Predictors | | Zapoi[a] | | | |
|---|---|---|---|---|---|
| | | Adjusted for age | | Adjusted for age and all other variables[c] | |
| | | Odds ratio[b] | 95% CI | Odds ratio[b] | 95% CI |
| Non-beverage alcohol use | | 17.35 | 11.32, 26.59 | 5.96 | 3.43, 10.37 |
| Beer intake (latent) | | 1.53 | 1.25, 1.87 | 1.24 | 0.98, 1.57 |
| Wine intake (latent) | | 1.50 | 1.28, 1.75 | 1.00 | 0.83, 1.20 |
| Spirit intake (latent) | | 3.03 | 2.39, 3.85 | 1.56 | 1.20, 2.02 |
| Drinks large volumes of spirits without eating | Sometimes | 11.38 | 7.68, 16.84 | 3.78 | 2.36, 6.07 |
| | Always | 25.76 | 10.28, 64.52 | 3.46 | 0.95, 12.58 |
| Drinks alone | Sometimes | 2.97 | 1.97, 4.49 | 1.60 | 0.95, 2.69 |
| | Often | 8.25 | 4.57, 14.91 | 2.25 | 1.02, 4.96 |
| Drinks before noon | Occasionally | 9.36 | 6.00, 14.60 | 3.84 | 2.26, 6.54 |
| | Frequently | 112.59 | 43.29, 292.83 | 8.61 | 2.72, 27.27 |

[a] Zapoi is a binary outcome

[b] Odds ratios are for odds of zapoi per one standard deviation change in latent alcohol intake factors or in non-beverage alcohol drinkers compared to men who do not drink non-beverage alcohol or in men who drink large volumes of sprits without eating, drink alone or drink before noon compared to men who never do so. All estimates are adjusted for age.

[c] Mutually adjusted for beer intake, wine intake, spirit intake, non-beverage alcohol use, drinking spirits without food, drinking alone and drinking before noon

**Table 4.Relationship between education and beverage alcohol intake among 1,705 drinkers in the Izhevsk Family Study 1**

| Alcohol intake variable at IFS-1 | Education | | | | |
|---|---|---|---|---|---|
| | Incomplete secondary | | Higher | | Test for trend |
| | Age adjusted coefficient [a] | 95% CI | Age adjusted coefficient [a] | 95% CI | |
| Beer intake (latent) | 0.08 | -0.16, 0.32 | -0.04 | -0.17, 0.09 | P=0.40 |
| Wine intake(latent) | 0.01 | -0.22, 0.24 | 0.10 | -0.04, 0.24 | P=0.21 |
| Spirit intake (latent) | -0.11 | -0.33, 0.11 | -0.32 | -0.45, -0.19 | P<0.001 |

[a] Coefficients for latent factor models represent standard deviation difference in latent factor compared to reference category of men in secondary education.

**Table 5.Relationship between education and latent routine dysfunction adjusted for age, and sequentially for alcohol intake and drinking patterns in 1,705 drinkers in the Izhevsk Family Study 1**

| | Education | | | |
|---|---|---|---|---|
| | Incomplete secondary | | Higher | |
| | Coefficient for dysfunction[a] | 95% CI | Coefficient for dysfunction[a] | 95% CI |
| Model 1: age | 0.26 | -1.33, 1.85 | -0.50 | -0.70, -0.29 |
| Model 2: model 1 + beer intake wine intake and spirit intake | 0.44 | -0.88, 1.77 | -0.42 | -0.80, -0.05 |
| Model 3: model 1 + non-beverage alcohol use | 0.09 | -1.43, 1.61 | -0.46 | -0.62, -0.31 |
| Model 4: Model 1 +drinking spirits without food, drinking alone and drinking before noon | 0.17 | -1.03, 1.37 | -0.37 | -0.55, -0.19 |
| Model 5: Model 1 + drinking alone | 0.28 | 0.03, 0.53 | -0.51 | -0.67, -0.36 |
| Model 6:Fully adjusted model[b] | 0.27 | -0.88, 1.42 | -0.35 | -0.61, -0.10 |

[a] Coefficients represent standard deviation difference in continuous latent factor of acute alcohol-related dysfunction in relation to men with secondary education

[b] Fully adjusted model: age + latent factor of beer intake+ latent factor of wine intake+ latent factor of spirits intake +non-beverage alcohol use+ drinking spirits without food + drinking alone + drinking before noon

**Table 6.Relationship between education and sporadic dysfunction (zapoi) adjusted for age, and sequentially for alcohol intake and drinking pattern in 1,705 drinkers in the Izhevsk Family Study 1**

| | Education | | | |
|---|---|---|---|---|
| | Incomplete secondary | | Higher | |
| | Odds ratio[a] | 95% CI | Odds ratio[a] | 95% CI |
| Model 1: age | 1.57 | 0.83, 2.99 | 0.28 | 0.15, 0.52 |
| Model 2: model 1 + beer intake wine intake and spirit intake | 1.65 | 0.80, 3.38 | 0.35 | 0.18, 0.67 |
| Model 3: model 1 +non-beverage alcohol use | 0.91 | 0.34, 1.90 | 0.33 | 0.17, 0.64 |
| Model 4: Model 1 + drinking spirits without food, drinking alone and drinking before noon | 1.18 | 0.54, 2.58 | 0.44 | 0.22, 0.87 |
| Model 5: Model 1 + drinking alone | 1.53 | 0.79, 2.96 | 0.28 | 0.15, 0.54 |
| Model 6:Fully adjusted model[b] | 0.96 | 0.40, 2.31 | 0.46 | 0.22, 0.95 |

[a] The reference category for odds ratios is men with secondary education

[b] Fully adjusted model: age + latent factor of beer intake + latent factor of wine intake + latent factor of spirit intake + non-beverage alcohol use + drinking spirits without food + drinking alone + drinking before noon

# Chapter 9: Alcohol use and Employment Status

## 9.1 Introduction

Loss of employment can have many negative effects including poverty, marginalization, and adverse mental and physical health outcomes (281, 282). Unemployment and job instability are predictors of male mortality in Russia(283).

Globally there is strong evidence that alcohol consumption is associated with unemployment. Many cross-sectional studies have found evidence both that alcohol intake is higher in unemployed men (46, 284-287)and that the unemployed have a more hazardous drinking pattern(284, 288, 289).This association has also been found in Russia(46, 280). However the relationship between alcohol and unemployment is complex as while hazardous or problem drinking may increase the risk of becoming unemployed, unemployment is also a risk factor for hazardous consumption. Longitudinal study designs have found evidence both that alcohol use is a predictor of unemployment (290-292)but also that unemployment leads to increased alcohol consumption (241, 293-297). In the Russian Longitudinal Monitoring Survey of the Higher School of Economics (RLMS-HSE) daily alcohol consumption in 2002 was a predictor of job loss in 2003 (291). Alcohol consumption is also associated with decreased productivity, increased sickness absence(298-304), and increased risk of work place accidents(305)although conversely moderate consumption of alcohol is associated with earning higher wages(306-308).

Pathways from alcohol consumption to unemployment may be through chronic effects on health which  make it difficult or impossible to remain in the work force but also through the acute consequences of alcohol such as hangover and drunkenness which can directly affect an individual’s ability to function in the workplace since heavy drinking the previous evening is associated with decreased physical and cognitive functioning the next day(174). Therefore in addition to amount of alcohol consumed, alcohol-related dysfunction may be particularly important for any effect of alcohol use on employment status. Acute alcohol-related dysfunction may be a mediator of the relationship between alcohol intake and employment since for the same intake of ethanol two men may differ in their vulnerability to dysfunction and therefore the impact of their drinking on their work life.

The majority of longitudinal studies investigating alcohol use as a predictor of employment, including the only study carried out in Russia(291), have investigated only volume of ethanol as a predictor of employment status(290). Only one study used a measure of acute dysfunction. Liira (1999) et al found self-reported drunkenness once a week or more predicted employment status in Scandinavian construction workers but not forest workers(292). It is unlikely that drunkenness once a week or more adequately captured men's drinking patterns or experience of acute dysfunction. In addition this study did not measure amount of ethanol consumed so could not investigate the relationship between volume of ethanol, acute dysfunction and employment. The effects of acute dysfunction on employment have not been investigated. In addition there are no studies which have investigated the effects of zapoi and non-beverage alcohol consumption on employment.

The aims of this analysis were to investigate the effects of different aspects of alcohol use (volume of ethanol, non-beverage alcohol use and alcohol-related dysfunction) on employment status in working-age men in Izhevsk, Russia using longitudinal data.

The objectives of the analysis were

1) To investigate whether volume of ethanol , non-beverage alcohol use and alcohol-related dysfunction measured by observed variables and latent variables at IFS-1 predicted employment status at IFS-2
2) To investigate the relationship between alcohol intake (volume of ethanol from beverage alcohol and non-beverage alcohol use), alcohol-related dysfunction and employment and whether dysfunction is a mediator of the relationship between alcohol intake and employment
3) To compare the results of analyses using an observed measure of acute alcohol-related dysfunction to predict employment status with the results of analyses using a latent variable to measure acute alcohol-related dysfunction

## 9.2 Methods

### 9.2.1 Study sample

In order to look at the association between alcohol use and employment status longitudinally the study sample for these analyses was men with both proxy and self-reported data available at IFS-1 who were in regular paid employment at IFS-1 and who were also followed-up and re-interviewed at IFS-2.

### 9.2.2 Outcome

Employment in Russia may include casual non-permanent jobs or payment in goods including food and alcohol rather than money. Enforced unpaid leave and wage arrears (not being paid on time) are also common(283). Job instability as well as unemployment has been shown to be associated with poorer health and mortality in Russia (283, 309). The question on employment status at IFS-2 had five categories: in regular paid employment, in irregular paid employment, unemployed seeking work, unemployed not seeking work and other. Since regular paid employment is the most secure form of employment the outcome of interest was defined as whether men were in regular paid employment or not at IFS-2. This was measured by self-reported employment status (in regular paid employment or not) at the IFS-2 interview. Men in irregular employment were included in the same category as men who were unemployed as “not in regular paid employment” since as discussed above job instability as well as unemployment is associated with poorer health and the transition from regular paid employment at IFS-1 to irregular paid employment at IFS-2 is a negative change in employment status.

### 9.2.3 Exposures

#### 9.2.3.1 Alcohol intake

The two measures of alcohol intake used were total volume of beverage alcohol in litres per year and non-beverage alcohol use.

The distribution of total volume of beverage alcohol was skewed to the right (see Figure 5.1) therefore it was used either as a categorical variable or the log total volume of beverage alcohol was used. Total volume of ethanol from beverage alcohol in litres per year was calculated from questions on the usual volume of beer, wine and spirits per drinking occasion and the frequency of drinking beer, wine and spirits. Questions on the usual volume of beer, wine and spirits were asked in categories that would be used by Russians in everyday life (beer in bottles, wine and spirits in grams) and converted into litres of ethanol using the mid-point of each category. Questions on the frequency of consuming beer, wine and spirits had seven categories: every day or more often, nearly every day, three or four times a week, once or twice a week, one to three times a month, a few times per year and never or almost never. Latent variables were not used as measures of alcohol intake as the data did not support an overall latent factor of beverage alcohol intake (see Section 6.4.1) and the exposure of interest for this analysis was overall amount of beverage alcohol consumed rather than beer, wine and spirit intake individually.

Non-beverage alcohol consumption was used as a binary variable (drinks non-beverage alcohol or does not drink non-beverage alcohol).

#### 9.2.3.2 Alcohol-related dysfunction

Alcohol-related dysfunction was divided into three types: routine dysfunction, frequent dysfunction and sporadic dysfunction. Sporadic dysfunction was measured by one or more episodes of zapoi[2] in the past 12 months. Routine and frequent dysfunction were measured by reported frequency of four acute alcohol-related dysfunctional behaviours: hangover, excessive drunkenness, sleeping in clothes because of drunkenness and failing to fulfil family or personal obligations because of drinking. As well as using these variables separately information on all four behaviours were combined using two different methods: i) a binary observed measure of frequent acute dysfunction categorizing men as dysfunctional drinkers if they reported twice weekly or more frequency of hangover and/or excessive drunkenness and/or sleeping in clothes because of drunkenness and/or failing family or personal obligations due to

[2] Zapoi was defined as a period of continuous drunkenness of several days or more during which a person does not work and is withdrawn from normal life

drinking alcohol and ii) a latent continuous variable of routine acute alcohol-related dysfunction manifested by frequency of the same four observed dysfunctional behaviours. The measurement model for this variable is shown in Figure 6.7.. Predicted scores on the underlying latent variable (factor scores) were used to create an ordered categorical measure of dysfunction with seven categories dividing men with any level of dysfunction into fifths of dysfunction score. t Non-drinkers and drinkers with no dysfunction were treated as separate categories. Fifths of factors score were chosen a priori as this should provide a reasonable number of categories to assess whether there was evidence for a linear trend in odds of ceasing to be in regular employment with dysfunction. Note that these categories were not intended to correspond to particular levels of dysfunction and it is not possible to say precisely how men in the third fifth for example differ from those in the second fifth in terms of their dysfunctional behaviour beyond saying they have a higher score on the underlying factor. Since both non-drinkers and non-dysfunctional drinkers would have a factor score equivalent to zero, non-drinkers were separated from non-dysfunctional drinkers using observed self-report of drinking status. Note that the category of non-dysfunctional drinker created using the latent variable is a smaller group than defined using the binary observed variable since for the binary variable men who experienced dysfunctional behaviours less than twice a week are coded as non-dysfunctional drinkers whereas with the latent variable only men who never experience any of the four dysfunctions are coded as non-dysfunctional drinkers.

#### 9.2.3.3 Proxy versus self-report

All alcohol variables measured at IFS-1 were reported both by the man himself and by a proxy- respondent living in the same household. Many of the questions, for example frequency of sleeping in clothes at night because of drunkenness were on behaviours directly observable by a proxy. Since proxy respondents would have less reason to underestimate prevalence of drinking patterns and dysfunctional behaviours (e.g. because of social desirability) it was considered that proxy response on these variables would be more accurate than self-report. This assumption was supported by the fact that proxies reported more frequent occurrence of dysfunctional behaviours than index men at both IFS-1 and IFS-2 (see Chapter 5). Therefore proxy reports of non-beverage alcohol consumption, zapoi and frequency of acute dysfunctional behaviours were used in the analyses. Self-reported data was used to calculate volume of ethanol as it would be very difficult for a proxy to accurately estimate volume of ethanol consumed. This assumption was supported by the high level of missing data on proxy-report of usual and maximum volume of beer, wine and spirits consumed on one occasion (see Chapter 5). Since there is no gold standard measure of alcohol consumption available it is not possible to know who is the most accurate informant. Studies investigating agreement between proxy and self-report have generally found good levels of agreement for directly observable drinking behaviours, global pattern of drinking and frequency of consumption but less agreement for more subjective behaviours and amount of ethanol consumed(196, 197, 199), therefore the assumption that proxies would provide reasonable information on directly observable behaviours but not overall amount of ethanol consumed seems to be supported by the existing literature on the reliability of proxy-reported data on alcohol use.

### 9.2.4 Potential confounding variables at IFS-1

Potential confounders were measured using self-report of variables at IFS-1. Age was coded into five year intervals and used as a continuous variable. Education was coded into three categories: incomplete secondary or lower, complete secondary and higher/incomplete higher. Marital status was coded into five categories: living with a spouse in a registered marriage, living with a spouse but not in a registered marriage, divorced, widower and never married. Level of amenities was coded into three categories: men with neither a car nor central heating, men with either a car or central heating, and men with both a car and central heating. Smoking status was coded as never smoked, ex-smoker or current smoker.

The IFS-1 and IFS-2 interviews contained several questions on health status: whether the participant was registered as disabled, always had a cough in the morning in recent months, became breathless climbing stairs in recent months, had difficulty walking 1 km in recent months, and had had difficulties with activities of daily living (e.g. shopping, washing and getting dressed) in recent months. All these variables were coded as binary variables. Men who reported one or more of these problems were classed as having health problems.

Age, marital status, education, smoking status and an amenity index based on whether participants owned a car or had central heating were considered as potential confounders and adjusted for in all analyses. Age, marital status, education and level of amenities were considered as confounders since they were likely to independently be associated with both alcohol use and employment status. Smoking status was considered a potential confounder since alcohol use and smoking are strongly associated and smoking may independently lead to loss of employment through its effects on health. Health status was also considered as a potential confounder since health status could independently affect both drinking and employment. However since health problems may also be on the causal pathway between alcohol and employment models are presented with and without adjustment for health status.

### 9.2.5 Statistical analyses

The analysis of alcohol use as a predictor of employment status has two main parts: A simple analysis using only observed alcohol variables and a more complex analysis involving the latent variable acute alcohol-related dysfunction. This was done in order to assess whether using the more complex approach provided additional information to a simpler analysis using more conventional alcohol measures and methods of analysis. Logistic regression was used for the first approach and structural equation modelling(263) for the more complex approach. Structural equation modelling is described in more detail in Appendix 1.

#### 9.2.5.1 Observed alcohol variables at IFS-1 and employment status at IFS-2

For the first approach the association between observed alcohol variables at IFS-1 (total volume of beverage alcohol, non-beverage alcohol use, zapoi, frequency of hangover, excessive drunkenness, sleeping in clothes because of drunkenness, failing family or personal obligations due to drinking alcohol and the binary variable frequent acute alcohol-related dysfunction) and whether men were in regular paid employment at IFS-2 was assessed using logistic regression. Separate age-adjusted logistic regression models were fitted for each observed alcohol variable and then additionally adjusted for the other potential confounding variables described above.

#### 9.2.5.2 Latent acute alcohol-related dysfunction at IFS-1 and employment status at IFS-2

The relationship between the latent variable frequent acute alcohol-related dysfunction at IFS-1 and employment status was assessed in two ways: i) logistic regression was used to estimate the odds of employment at IFS-2 by fifths of dysfunction factor scores at IFS-1 compared to drinkers with no dysfunction and ii) structural equation models were fitted estimating the effect of the latent variable at IFS-1 (used as a continuous variable) on employment status at IFS-2. As with the analysis for observed alcohol use variables models were first adjusted for age and then additionally adjusted for other potential confounders.

#### 9.2.5.3 Inter-relationship between alcohol intake, acute alcohol-related dysfunction and employment status

The inter-relationship between alcohol intake and acute alcohol-related dysfunction at IFS-1 and employment status at IFS-2 was investigated by fitting the structural equation model shown in Figure 9.1. This model was used to estimate both the direct effects of alcohol intake variables (log volume of ethanol and non-beverage alcohol use) at IFS-1 on employment status at IFS-2 and their indirect effects via acute alcohol-related dysfunction (latent factor of routine acute alcohol-related dysfunction and zapoi). Probit regression was used for these analyses in order to separate direct and indirect effects of the alcohol intake variables since the outcome (employment status) was binary, under the assumption of no unmeasured confounders(310). Probit regression is an analysis method for modelling binary outcome variables using an inverse cumulative standard normal distribution function (311). Probit regression is described in more detail in Appendix 1.

#### 9.2.5.4 Sensitivity analysis: Relationship between volume of ethanol and employment excluding men who drink non-beverage alcohol

The analyses for volume of beverage alcohol were repeated excluding men if either they or their proxy reported they drank non-beverage alcohol or data on non-beverage alcohol use was missing. The purpose of this analysis was to determine if excluding non-beverage alcohol drinkers (for whom the total volume of beverage alcohol is known to be inaccurate) altered the results since including non-beverage alcohol drinkers may have resulted in bias as men who drink non-beverage alcohol may drink comparatively low volumes of beverage alcohol but in reality drink a large volume of ethanol per year (which would not be measured by questions on consumption of beer, wine and spirits) and therefore including non-beverage alcohol drinkers may have obscured the true relationship between total volume of ethanol and unemployment.

#### 9.2.5.5 Missing Data

All analyses were restricted to men with employment status measured at IFS-2 excluding those in regular employment who were lost to follow up between IFS-1 and IFS-2. Missing data due to item non-response at IFS-1 was dealt with in different ways for the two analysis methods. Logistic regression analyses were restricted to complete case analysis. Structural equation models were estimated using WMSLV and an analysis method equivalent to pairwise present analysis was used for missing data(269). Predictors of loss to follow up, item non-response and the possible implications of missing data for these analyses are discussed in more detail in Chapter 5.

## 9.3 Results

There were 1502 men in regular paid employment at IFS-1 for whom both self and proxy-reported data was available at IFS-1. Of these men 1143 (76.1%) were re-interviewed at IFS-2. The baseline characteristics of these 1143 men by employment status at IFS-2 are shown in Table 9.1. At IFS-2 115/1143 men (10.1%) were no longer in regular paid employment. Men no longer in regular employment at IFS-2 were more likely to be older and less likely to be married, have higher education and own both a car and central heating at IFS-1.

The relationship of alcohol consumption and dysfunction at IFS-1 with employment status at IFS-2 is shown in Table 9.2. The relationship between each alcohol variable and employment in Table 9.2 is shown adjusted for age (Model 1), adjusted for age, socio-demographic variables and smoking (Model 2) and additionally adjusted for health problems (Model 3). These analyses were carried out separately for each alcohol variable and were not mutually adjusted for the effects of the other alcohol use variables.

### 9.3.1 Relationship between alcohol intake (observed) and employment

The relationship between alcohol intake and employment is shown in the top third of Table 9.2.There was no evidence that the total volume of ethanol from beverage alcohol influenced employment status. In contrast there was good evidence that drinkers who drank non-beverage alcohol were more likely to have ceased regular paid employment at IFS-2 than drinkers who drank only beverage alcohol even after adjusting for socio-demographic factors and health problems.

### 9.3.2 Relationship between alcohol-related dysfunction and employment

#### 9.3.2.1 Observed variables

The relationship between observed alcohol-related dysfunction variables and employment is shown in the middle third of Table 9.2. After adjusting for socio-demographic confounders (Model 2) there was strong evidence that men who had been on zapoi in the previous year of the IFS-1 survey had over three times higher odds of having ceased regular paid employment at IFS-2.

There was strong evidence of a linear trend in odds of no longer being in regular employment with more frequent proxy-report of each of the four dysfunctional behaviours (hangover, excessive drunkenness, sleeping in clothes because of drunkenness and failing family or personal obligations because of drinking). There was good evidence that proxy-report of hangover, excessive drunkenness and sleeping in clothes at night because of drunkenness every day were associated with higher odds of no longer being in regular employment compared to men who never experienced these behaviours. However there was also evidence that odds of no longer being in regular employment at IFS-2 were higher among men who experienced hangover or excessive drunkenness once a month and several times a month and sleeping in clothes because of drunkenness once a month compared to never experiencing these behaviours. Frequent dysfunctional drinkers (proxy-report of any of the four dysfunctions twice or more per week) had slightly higher odds of having ceased regular paid employment at IFS-2 than drinkers who did not frequently experience dysfunction but this was not statistically significant.

Additionally adjusting for health problems (Model 3) reduced the estimated odds ratios slightly but did not substantively alter the results.

#### 9.3.2.2 Latent variable of acute alcohol-related dysfunction

The relationship between the latent factor of acute alcohol-related dysfunction and employment is shown in the bottom third of Table 9.2. After adjusting for confounders (Model 2) there was strong evidence that drinkers in the fourth and fifth fifths of latent dysfunction had over twice the odds of being unemployed at IFS-2 than drinkers with no dysfunction. When the latent factor of acute alcohol-related dysfunction was used as a continuous variable the odds of no longer being in regular paid employment increased by 51% (95 % CI: 20%-89%) for every standard deviation unit increase in dysfunction score. Additional adjustment for health problems (Model 3) had very little impact on the association between acute alcohol-related dysfunction and employment suggesting that the association of alcohol and employment was not mainly mediated through any negative effect on health.

### 9.3.3 The inter-relationship between alcohol intake, alcohol-related dysfunction and employment

The relationship between alcohol intake (total volume of ethanol from beverage alcohol and non-beverage alcohol use) and alcohol-related dysfunction (latent factor of routine acute alcohol-related dysfunction and zapoi) with employment is shown in Figure 9.1 and Table 9.3. All results are shown with adjustment for health problems. Direct and indirect effects of non-beverage alcohol and volume of ethanol from beverage alcohol use are shown in Table 9.3, the latter obtained by multiplying the point estimates of the effect of these variables on zapoi and acute alcohol-related dysfunction by the effect of the dysfunction variables on employment. There was strong evidence that both zapoi and the latent factor of acute alcohol-related dysfunction directly influenced employment status at IFS-2. Non-beverage alcohol use had strong indirect effects on employment via both zapoi and acute alcohol-related dysfunction but there was no evidence that non-beverage alcohol use had a direct effect on employment status once total volume of ethanol from beverage alcohol, zapoi and acute alcohol-related dysfunction were included in the model. Total volume of ethanol had no indirect effect via zapoi but there was strong evidence of a small indirect effect via the latent factor of acute alcohol-related dysfunction. There was also weak evidence that total volume of ethanol from beverage alcohol had a small direct effect on employment once non-beverage alcohol use, zapoi and acute alcohol-related dysfunction were included in the model in the opposite direction to the effect of the other alcohol variables (i.e. the predicted probability of ceasing to be in regular paid employment decreased as total volume of ethanol increased).

### 9.3.4 Sensitivity Analysis: Relationship between beverage alcohol intake and employment excluding non-beverage alcohol drinkers

The estimated effects of volume of ethanol from beverage alcohol excluding non-beverage alcohol drinkers and sequentially adjusted for confounders are shown in Table 9.4. The results are similar to those from analyses including non-beverage alcohol drinkers (Table 9.2). There was no evidence that employment status at IFS-2 was influenced by volume of beverage alcohol at IFS-1.

## 9.4 Discussion

### 9.4.1 Substantive findings

Drinking non-beverage alcohol, going on zapoi and routine acute alcohol-related dysfunction (latent) in the previous 12 months all predicted no longer being in regular employment at follow up. Volume of ethanol was associated with an increase in the predicted probability of no longer being in regular paid employment via the latent factor of acute alcohol-related dysfunction. However once the pathway from total volume of ethanol to employment via acute alcohol-related dysfunction was controlled for, there was very weak evidence that the predicted probability of ceasing to be in regular paid employment decreased as total volume of beverage alcohol increased. Both zapoi and the latent factor of acute alcohol-related dysfunction were mediators of the relationship between non-beverage alcohol use and employment.

The findings for total volume of beverage alcohol are in contrast to analyses of the Russian Longitudinal Monitoring Survey (RLMS) which found that higher average daily consumption of alcohol increased the probability of job loss a year later (291). There are some differences between the two studies: the RLMS asks questions on the frequency of consumption of all alcohol and usual daily consumption of beer, wine, spirits and home-made liquor (which was not measured at IFS-1) in the past 30 days. The authors used a measure of daily alcohol intake calculated from this data but do not explain how this was calculated. In addition the outcome of interest was specifically whether men were fired and therefore at follow-up only men who were no longer employed but still participating in the work force were of interest (i.e. men who were in irregular employment or unemployed but not seeking work were not included as “unemployed” ). It is unclear if these differences would be sufficient to explain the discrepancy in the results of the two studies.  Average daily consumption of beverage alcohol was also found to predict unemployment four years later among construction workers in Southern Finland (290). Volume of ethanol in the Izhevsk Family Studies had indirect effects on employment via acute alcohol-related dysfunction but also once this pathway was controlled for there was very weak evidence of a direct effect of total volume of beverage alcohol in the opposite direction (decrease in the predicated probability of no longer being in regular paid employment as total volume of beverage alcohol increased). The reasons for the direct effect of total volume of ethanol in the opposite direction to that expected from previous studies are unclear. The direct effect was only of borderline significance and may have been a result of over adjusting for other highly correlated alcohol variables. It may also be due to effects of unmeasured confounding between acute dysfunction and employment. However it may also be that consuming a large volume of alcohol does convey some advantages in the work place for example through increased social interaction but these are counteracted by the much stronger negative impact of alcohol-related dysfunction. This would be in keeping with findings from other studies that drinkers, at least those who drink moderately, earn higher wages than non-drinkers (306-308, 312). It is worth noting that both the direct and indirect effects of total volume of ethanol were very small in comparison to the effects of zapoi and frequent acute alcohol-related dysfunction. The RLMS study had a larger sample size (n=4173) than IFS-2 but the effect size found for average daily consumption of alcohol was also very small (probit regression coefficient 0.0003 increase in probability of being fired per gram of alcohol per week)(291). Although beverage alcohol intake is likely to be an underestimate of total alcohol intake in the IFS due to other sources of ethanol such as samogon and non-beverage alcohol excluding men who drank non-beverage alcohol did not substantially alter the results.

There are likely to be several potential moderators of the association between alcohol use and employment status such as income, receipt of pensions, occupation and additional household demographic factors such as whether men are supporting children or other relatives. Some of these variables such as income were not measured in the IFS studies and could not be assessed. There was also limited power to assess interactions even when some information was available i.e. on occupation due to the relatively small numbers of men who became unemployed between the two surveys. The fact that potential mediators of this relationship were not included should be taken into account when interpreting findings from this study. These factors should be included in future work on the association between alcohol use and employment.

All data on alcohol use were obtained from self- or proxy-report and therefore subject to measurement error. Using proxy report of drinking behaviour may be more accurate than self-reported data since proxies have less reason to under-report socially unacceptable behaviours. However proxy report is not reliable for certain aspects of alcohol use such as volume of ethanol consumed per occasion and therefore could not be used for measuring alcohol intake. Self-reported alcohol intake is very likely to be affected by measurement error since when asked about usual frequency and volume of consumption participants are likely to report their mode rather than mean consumption, ignoring less frequent heavy drinking episodes (53). Dysfunctional drinking behaviours such as hangover and sleeping in clothes because of drunkenness may be easier to report accurately than volume of alcohol consumed, especially for proxy respondents. However they also represent a more hazardous drinking pattern. The strong association between alcohol-related dysfunction and employment compared to the small effects of volume of ethanol which were mainly via dysfunction seems to suggest that, when considering effects on employment, whether alcohol leads to dysfunctional behaviour is more important than the overall amount consumed. This was supported by the finding that the effects of non-beverage alcohol use were completely mediated via alcohol-related dysfunction.

### 9.4.2 Comparison between simple analyses using only observed variables and more complex analysis using the latent factor of acute alcohol-related dysfunction

There was strong evidence of a linear trend in odds of no longer being in regular paid employment at IFS-2 with proxy-reported frequency of four observed dysfunctional behaviours: hangover, excessive drunkenness, sleeping in clothes because of drunkenness and failing family or personal obligations due to drinking alcohol. However there were very small numbers in some of the frequency categories (e.g. only three men with proxy-report of sleeping in their clothes everyday) which limits the use of each variable on its own, for example there was evidence of raised odds of ceasing to be in regular paid employment at IFS-2 in men who experience hangover and excessive drunkenness once a month, several times a month and every day compared to men who never experienced these dysfunctions but no evidence of higher odds in men who experience them one or more times per week. It is unclear if this is because men who experience dysfunction monthly are at higher risk of losing their job or if this is a question of power since monthly dysfunction was more commonly reported than weekly dysfunction. Combining information from all four variables therefore has the advantage of increasing power as well as being more efficient (using one variable rather than four). Therefore combining information on all four observed dysfunctions into an overall dysfunction variable rather than using each variable separately seems reasonable. Two methods of combining data on all four observed variables were used – a simple approach using a binary variable and a more complex approach using a latent variable.

The results of the more complex analysis are different to the findings of the simpler analysis. The latent variable of routine acute dysfunction was manifested by the same four observed variables used to create the binary frequent dysfunction variable, however only the latent factor of acute dysfunction showed a strong relationship with employment status. This may be for several reasons. Firstly with the latent variable approach all available information on the observed dysfunctional behaviours could be made use of without recategorization. The cut point of twice weekly or more for the binary variable was chosen a priori as a likely indicator of high levels of dysfunction and because this cut-point had been used for some of these behaviours in previous analyses of the Izhevsk Family Studies (1, 2, 313). However it may not have been sensitive enough since in the analysis using the latent dysfunction factor men in both the fourth and fifth quintiles of dysfunction had higher odds of no longer being in regular employment at IFS-2 than drinkers with no dysfunction. In addition when the relationship between frequency of each of the dysfunctional variables and employment was analysed separately there was evidence that men who experienced some of the dysfunctions once a month or several times a month had higher odds of ceasing regular employment compared to men who never experience them. An advantage of the latent variable approach  was that there was no need to use a cut-off point such as twice weekly or more to determine whether men experienced a dysfunctional behaviour such as hangover or not, but could use all the available information on the frequency of dysfunction. Using the latent variable also took into account whether men experienced dysfunction on more than one of the four manifest variables, whereas men experiencing all four dysfunctional behaviours would be classed the same way as  men experiencing only one of the dysfunctional behaviours with the binary variable.

Another advantage of using a latent variable was that it was possible to look for a dose-response relationship between dysfunction and employment since the latent variable is continuous. The simpler analysis only separated men into dysfunctional and non-dysfunctional drinkers, however dysfunctional behaviour is more likely to be on a spectrum. There was strong evidence to suggest a linear relationship between the latent factor of acute dysfunction and employment. This supported the strong evidence of a linear trend found between each of the observed dysfunctional variables and employment. This could not be investigated using the binary variable.

In addition to the advantages of using a latent variable to measure dysfunction, there were also advantages to using structural equation modelling to jointly investigate the relationship between alcohol intake, alcohol-related dysfunction and employment. Using structural equation modelling it was possible to separate the direct and indirect effects of the alcohol intake variables on employment under the assumption of no unmeasured confounding(310), although a limitation was that this could only be done using probit regression. This showed that the effects of non-beverage alcohol were mediated through alcohol-related dysfunction (both through zapoi and through the latent factor of acute dysfunction).Total volume of beverage alcohol had small indirect effect via the latent factor of acute alcohol-relate dysfunction and once this pathway was controlled for there was weak evidence of a direct effect of total volume of ethanol in the opposite direction. This could not have been shown in an analysis using only logistic regression.

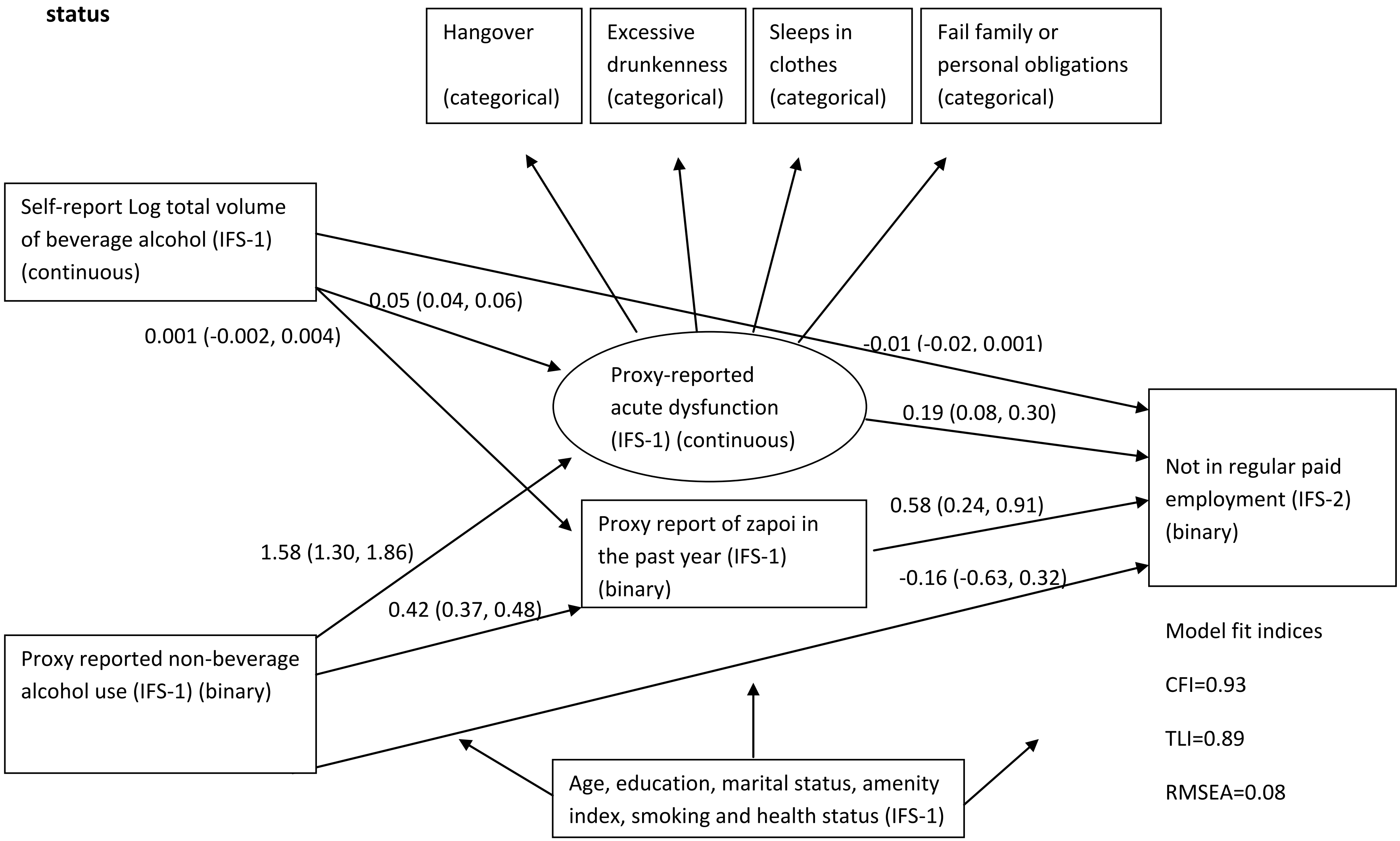
The purpose of using more complex methods (latent variables, structural equation modelling) over simpler methods (observed variables, logistic regression) was to provide more information about the relationship between alcohol use and employment. Using a latent variable to measure acute dysfunction did provide more information on the relationship between dysfunction and employment than only using observed alcohol variables: 1) When considering the effects of four dysfunctional behaviours on employment (hangover, excessive drunkenness, sleeping in clothes because of drunkenness and failing family or personal obligations because of drinking) a latent variable manifested by these four observed variables showed a much stronger association with future employment status than a binary variable categorizing men as dysfunctional or non-dysfunctional based on high frequency of any of the four behaviours 2) latent acute dysfunction showed a dose-response relationship with employment 3) the relationship between dysfunction and employment appeared to be linear and this simplifies the parameterization of the model with a continuous exposure, 4) acute dysfunction was a mediator of the relationship between alcohol intake (volume of ethanol from beverage alcohol and non-beverage alcohol use) and employment and 5) volume of ethanol had an indirect effect on employment via acute alcohol-related dysfunction and with weak evidence of a direct effect in the opposite direction once this pathway was accounted for.

### 9.4.3 Conclusions

In conclusion several aspects of drinking behaviour influenced employment status in working-age men in Izhevsk, Russia: Drinking non-beverage alcohol, zapoi and a latent variable measuring routine acute alcohol-related dysfunction. There was strong evidence that total volume of ethanol from beverage alcohol had a small indirect effect on employment via routine acute alcohol-related dysfunction and weak evidence of a direct effect in the opposite direction to the other alcohol variables after accounting for mediation via acute alcohol-related dysfunction. Both zapoi and the latent factor of acute alcohol-related dysfunction were mediators of the effects of non-beverage alcohol on employment.

The results of a more complex analysis using latent variables and structural equation modelling provided additional information to those of a simpler analysis using only observed variables and logistic regression. Using a latent variable to measure acute dysfunction within a structural equation modelling framework provided additional insight into the relationship between alcohol use and employment.

**Figure 9.1 Structural equation model of the relationship between alcohol intake (volume of ethanol from beverage alcohol and non-beverage alcohol use), acute alcohol-related dysfunction (latent factor of acute dysfunction and zapoi) and employment status**




*Estimated linear regression and probit regression coefficients (95% CI) reported for main relationships (N=1107)

## Table 9.1 Baseline characteristics of men in regular paid employment at IFS-1 by employment status at IFS-2

| Characteristic at IFS-1 | | N | (%) | Number no longer in regular paid employment at IFS-2 (row %) | |
|---|---|---|---|---|---|
| Age | 25-29 | 77 | (6.7) | 10 | (13.0) |
| | 30-34 | 101 | (8.8) | 5 | (5.0) |
| | 35-39 | 104 | (9.1) | 8 | (7.7) |
| | 40-44 | 192 | (16.8) | 9 | (4.7) |
| | 45-50 | 272 | (23.8) | 24 | (8.8) |
| | 50-54 | 390 | (34.1) | 57 | (14.6) |
| | 55+ | 7 | (0.6) | 2 | (28.6) |
| Marital status | Living with spouse in registered marriage | 942 | (82.4) | 91 | (9.7) |
| | Living with spouse not in registered marriage | 109 | (9.5) | 14 | (12.8) |
| | Divorced | 36 | (3.2) | 4 | (11.1) |
| | Widower | 6 | (0.5) | 2 | (33.3) |
| | Never married | 50 | (4.4) | 4 | (8.0) |
| Education | Incomplete secondary | 56 | (4.9) | 9 | (16.1) |
| | Secondary | 820 | (71.7) | 92 | (11.2) |
| | Higher | 267 | (23.4) | 14 | (5.2) |
| Amenity index | Neither car nor central heating | 67 | (5.9) | 10 | (14.9) |
| | Car or central heating | 584 | (51.1) | 67 | (11.5) |
| | Car and central heating | 492 | (43.0) | 38 | (7.7) |
| Smoking Status (Missing=1) | Never smoked | 227 | (15.2) | 22 | (9.7) |
| | Ex-smoker | 174 | (35.1) | 12 | (6.9) |
| | Current smoker | 741 | (64.9) | 81 | (10.9) |
| Registered Disabled | No | 1117 | (97.7) | 109 | (9.8) |
| | Yes | 26 | (2.3) | 6 | (23.1) |
| Breathless climbing stairs in recent months (missing=4) | No | 1057 | (92.5) | 100 | (9.5) |
| | Yes | 82 | (7.2) | 15 | (18.3) |
| Difficulty walking 1 km in recent months (missing=4) | No | 1069 | (93.5) | 103 | (9.6) |
| | Yes | 70 | (6.1) | 12 | (17.1) |
| Problems with activities of daily living | No | 1139 | (99.7) | 115 | (10.1) |
| | Yes | 4 | (0.4) | 0 | (0.0) |
| Always had a morning cough in recent months (Missing=2) | No | 707 | (62.0) | 66 | (9.3) |
| | Yes | 434 | (38.0) | 49 | (11.3) |
| Any health problem[a] (missing=9) | No | 646 | (56.5) | 57 | (8.8) |
| | Yes | 488 | (42.7) | 58 | (11.9) |
| Total volume of ethanol from beverage alcohol in litres per year (missing=14) | >0-2 Litres | 196 | (17.4) | 58 | (9.2) |
| | 2-4 Litres | 243 | (21.5) | 19 | (7.8) |
| | 5-9 Litres | 269 | (23.8) | 32 | (11.9) |
| | 10-19 Litres | 171 | (15.2) | 17 | (9.9) |
| | 20+ Litres | 104 | (9.2) | 12 | (11.5) |
| Proxy report of drinking non-beverage alcohol (missing=13) | Non-drinker | 145 | (12.8) | 12 | (8.3) |
| | No | 922 | (81.6) | 86 | (9.3) |
| | Yes | 63 | (5.6) | 15 | (23.8) |
| Proxy report of zapoi in the past year | Non-drinker | 145 | (12.7) | 12 | (8.3) |
| | No | 924 | (80.8) | 83 | (9.0) |
| | Yes | 74 | (6.5) | 20 | (27.0) |
| Proxy-report of hangover (missing=35) | Never | 670 | (60.5) | 50 | (7.5) |
| | Less than once a month | 218 | (19.1) | 18 | (8.3) |
| | Once a month | 114 | (10.0) | 20 | (17.5) |
| | Several times a month | 57 | (5.0) | 14 | (24.6) |
| | Once a week | 27 | (2.4) | 4 | (14.8) |
| | Several times a week | 16 | (1.4) | 0 | (0.0) |
| | Everyday | 6 | (0.5) | 3 | (50.0) |

| | | N | ( %) | Number no longer in regular paid employment at IFS-2 (Row %) | |
|---|---|---|---|---|---|
| Proxy-report of excessive drunkenness (missing=17) | Never | 618 | (54.1) | 49 | (7.9) |
| | Less than once a month | 255 | (22.3) | 19 | (7.5) |
| | Once a month | 131 | (11.5) | 25 | (19.1) |
| | Several times a month | 57 | (5.0) | 12 | (21.1) |
| | Once a week | 36 | (3.1) | 3 | (8.3) |
| | Several times a week | 20 | (1.7) | 3 | (15.0) |
| | Everyday | 9 | (0.8) | 3 | (33.3) |
| Proxy-report of sleeping in clothes at night because of drunkenness (missing=6) | Never | 934 | (81.7) | 75 | (8.0) |
| | Less than once a month | 87 | (7.6) | 12 | (13.8) |
| | Once a month | 58 | (5.1) | 14 | (24.1) |
| | Several times a month | 23 | (2.0) | 5 | (21.7) |
| | Once a week | 13 | (1.1) | 2 | (15.4) |
| | Several times a week | 19 | (1.7) | 5 | (26.3) |
| | Everyday | 3 | (0.3) | 2 | (66.7) |
| Proxy-report of failing family or personal obligations because of drinking (missing=19) | Never | 901 | (78.8) | 81 | (9.0) |
| | Less than once a month | 76 | (6.6) | 6 | (7.9) |
| | Once a month | 65 | (5.7) | 10 | (15.4) |
| | Several times a month | 39 | (3.4) | 7 | (18.0) |
| | Once a week | 25 | (2.2) | 4 | (16.0) |
| | Several times a week | 13 | (1.1) | 3 | (23.1) |
| | Everyday | 5 | (0.4) | 2 | (40.0) |
| Proxy reported frequent dysfunctional behaviour (observed) (missing=41) | Non-drinker | 145 | (13.2) | 12 | (8.3) |
| | Drinker- no frequent dysfunctional behaviour | 903 | (81.9) | 86 | (9.5) |
| | Frequent dysfunctional drinker | 54 | (4.9) | 10 | (18.5) |
| Proxy report of Acute alcohol-related dysfunction (latent) (missing=7)[b] | Non-drinker | 145 | (12.7) | 12 | (8.3) |
| | Drinker- no dysfunction | 386 | (33.9) | 28 | (7.3) |
| | First quintile of dysfunction | 137 | (12.0) | 13 | (9.5) |
| | Second quintile of dysfunction | 125 | (11.0) | 6 | (4.8) |
| | Third quintile of dysfunction | 102 | (9.0) | 11 | (10.8) |
| | Fourth quintile of dysfunction | 128 | (11.3) | 23 | (18.0) |
| | Fifth quintile of dysfunction | 115 | (10.1) | 22 | (19.1) |
| Total | | 1143 | (100) | 115 | (10.1) |

[a] Registered disabled and/or breathless climbing stairs and/or difficulty walking 1 km and/or always has a cough in the morning and/or problems with activities of daily living

[b] Data missing for all 4 manifest variables: hangover, excessive drunkenness, sleeping in clothes because of drunkenness and failing family and personal obligations because of drinking

## Table 9.2 Association between alcohol variables at IFS-1 and not being in regular paid employment at IFS-2 among men who were in regular paid employment at IFS-1

| Alcohol Use at IFS-1 (N=1143) | | Model 1 [b,g] | | Model 2 [c,g] | | Model 3 [d,g] | |
|---|---|---|---|---|---|---|---|
| | | Odds ratio (95%CI) | P value | Odds ratio (95%CI) | P value | Odds ratio (95%CI) | P value |
| Total volume of ethanol from beverage alcohol in litres per year (missing=14) | Non-drinker | 0.98 (0.46, 2.08) | Test for linear trend P=0.19 | 0.94 (0.44, 2.02) | Test for linear trend P=0.33 | 0.92 (0.43, 1.97) | Test for linear trend P=0.36 |
| | >0-2 Litres | 1.00 (ref) | | 1.00 (ref) | | 1.00 (ref) | |
| | 2-4 Litres | 0.86 (0.44, 1.69) | | 0.88 (0.45, 1.75) | | 0.86 (0.44, 1.71) | |
| | 5-9 Litres | 1.40 (0.76, 2.59) | | 1.40 (0.75, 2.60) | | 1.37 (0.74, 2.55) | |
| | 10-19 Litres | 1.18 (0.59, 2.39) | | 1.10 (0.54, 2.24) | | 1.08 (0.53, 2.19) | |
| | 20+ Litres | 1.43 (0.65, 3.10) | | 1.22 (0.55, 2.70) | | 1.17 (0.52, 2.61) | |
| | Log total volume of ethanol (continuous) | 1.07 (0.96, 1.20) | Test for linear trend p=0.22 | 1.06 (0.95, 1.19) | Test for linear trend p=0.30 | 1.06 (0.95, 1.19) | Test for linear trend p=0.32 |
| Proxy-report of non-beverage alcohol use (missing=13) | Non-drinker | 0.85 (0.45, 1.60) | Test for heterogeneity p=0.006 | 0.83 (0.43, 1.57) | Test for heterogeneity P=0.03 | 0.82 (0.43, 1.57) | Test for heterogeneity p=0.04 |
| | No | 1.00 (ref) | | 1.00 | | 1.00 (ref) | |
| | Yes | 2.88 (1.55, 5.38) | | 2.37 (1.24, 4.52) | | 2.30 (1.21, 4.40) | |
| Proxy-report of zapoi | Non-drinker | 0.89 (0.47, 1.67) | Test for heterogeneity P<0.001 | 0.86 (0.45, 1.65) | Test for heterogeneity P=0.001 | 0.86 (0.45, 1.64) | Test for heterogeneity P=0.001 |
| | No | 1.00 (ref) | | 1.00 (ref) | | 1.00 (ref) | |
| | Yes | 3.65 (2.08, 6.42) | | 3.10 (1.73, 5.53) | | 3.08 (1.71, 5.55) | |
| Proxy-report of Hangover (missing=35) | Never | 1.00 (ref) | Test for linear trend P<0.001 | 1.00 | Test for linear trend P<0.001 | 1.00 (ref) | Test for linear trend p=0.001 |
| | Less than once a month | 1.22 (0.69, 2.14) | | 1.14 (0.65, 2.04) | | 1.14 (0.65, 2.03) | |
| | Once a month | 2.82 (1.60, 4.98) | | 2.65 (1.48, 4.74) | | 2.67 (1.49, 4.78) | |
| | Several times a month | 4.15 (2.12, 8.14) | | 3.70 (1.83, 7.48) | | 3.77 (1.85, 7.68) | |
| | Once a week | 2.22 (0.74, 6.71) | | 2.10 (0.68, 6.45) | | 2.05 (0.67, 6.31) | |
| | Several times a week | perfect prediction | | perfect prediction | | (perfect prediction) | |
| | Every day | 13.17 (2.53, 68.54) | | 9.03 (1.59, 51.49) | | 8.82 (1.55, 50.24) | |
| Proxy-report of Excessive drunkenness (missing=17) | Never | 1.00 (ref) | Test for linear trend P<0.001 | 1.00 (ref) | Test for linear trend P=0.002 | 1.00 (ref) | Test for linear trend P=0.003 |
| | Less than once a month | 0.97 (0.56, 1.69) | | 0.93 (0.53, 1.62) | | 0.92 (0.53, 1.61) | |
| | Once a month | 2.80 (1.65, 4.74) | | 2.52 (1.46, 4.34) | | 2.54 (1.47, 4.37) | |
| | Several times a month | 3.07 (1.52, 6.21) | | 2.76 (1.34, 5.70) | | 2.84 (1.37, 5.90) | |
| | Once a week | 1.03 (0.31, 7.01) | | 0.97 (0.28, 3.35) | | 0.95 (0.27, 3.27) | |
| | Several times a week | 1.98 (0.56, 7.01) | | 1.53 (0.42, 5.59) | | 1.45 (0.39, 5.37) | |
| | Every day | 5.89 (1.42, 24.46) | | 5.13 (1.15, 22.94) | | 5.07 (1.13, 22.70) | |
| Proxy-report of sleeping in clothes because of drunkenness (missing=6) | Never | 1.00 (ref) | Test for linear trend P<0.001 | 1.00 (ref) | Test for linear trend P<0.001 | 1.00 (ref) | Test for linear trend P<0.001 |
| | Less than once a month | 1.90 (0.99, 3.67) | | 1.83 (0.94, 3.57) | | 1.87 (0.96, 3.65) | |
| | Once a month | 3.75 (1.95, 7.18) | | 3.33 (1.72, 6.47) | | 3.45 (1.77, 6.75) | |
| | Several times a month | 2.81 (1.01, 7.83) | | 2.60 (0.92, 7.38) | | 2.54 (0.89, 7.22) | |
| | Once a week | 2.12 (0.46, 9.82) | | 1.84 (0.39, 8.65) | | 1.81 (0.38, 8.54) | |
| | Several times a week | 3.80 (1.33, 10.90) | | 2.81 (0.90, 8.76) | | 2.74 (0.87, 8.60) | |
| | Every day | 19.21 (1.71, 215.37) | | 20.89 (1.77, 246.87) | | 20.73 (1.76, 244.97) | |

| Alcohol Use at IFS-1 (N=1143) | | Model 1 [b,g] | | | Model 2 [c,g] | | | Model 3 [d,g] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Odds ratio (95%CI) | | P value | Odds ratio (95%CI) | | P value | Odds ratio (95% CI) | | P value |
| Proxy-report of failing family or personal obligations because of drinking (missing=19) | Never | 1.00(ref) | | Test for linear trend P=0.001 | 1.00 (ref) | | Test for linear trend p=0.006 | | | Test for linear trend P=0.007 |
| | Less than once a month | 0.85 | (0.36, 2.02) | | 0.83 | (0.35, 1.99) | | 0.82 | (0.34, 1.96) | |
| | Once a month | 1.80 | (0.88, 3.68) | | 1.55 | (0.75, 3.22) | | 1.60 | (0.77, 3.34) | |
| | Several times a month | 2.30 | (0.98, 5.40) | | 2.17 | (0.90, 5.23) | | 2.23 | (0.92, 5.39) | |
| | Once a week | 1.89 | (0.63, 5.67) | | 1.98 | (0.65, 6.05) | | 1.91 | (0.62, 5.85) | |
| | Several times a week | 2.86 | (0.77, 10.68) | | 2.24 | (0.57, 8.81) | | 2.15 | (0.55, 8.50) | |
| | Every day | 7.05 | (1.15, 43.18) | | 6.76 | (0.96, 47.50) | | 6.46 | (0.91, 45.69) | |
| Proxy-report of frequent acute alcohol-related dysfunction (observed)[a] (missing=41) | Non-drinker | 0.84 | (0.44, 1.57) | Test for heterogeneity P=0.15 | 0.81 | (0.43, 1.54) | Test for heterogeneity P=0.35 | 0.81 | (0.42, 1.54) | Test for heterogeneity P=0.39 |
| | Drinker- no frequent dysfunctional behaviour | 1.00 (ref) | | | 1.00 (ref) | | | 1.00 (ref) | | |
| | Frequent dysfunctional drinker | 2.02 | (0.98, 4.17) | | 1.64 | (0.76, 3.52) | | 1.58 | (0.73, 3.42) | |
| Fifths of proxy-report of Acute Alcohol-related dysfunction (latent) (missing=7**)** | Non-drinker[e] | 1.15 | (0.57, 2.33) | Test for linear trend p<0.001<br><br>Departure from linear trend P=0.22 | 1.07 | (0.52, 2.20) | Test for linear trend P<0.001<br><br>Departure from linear trend P=0.32 | 1.07 | (0.52, 2.19) | Test for linear trend P<0.001<br><br>Departure from linear trend P=0.31 |
| | Drinker- no dysfunction[e] | 1.00 (ref) | | | 1.00 (ref) | | | 1.00 (ref) | | |
| | First fifth of dysfunction | 1.38 | (0.69, 2.76) | | 1.28 | (0.64, 2.58) | | 1.29 | (0.64, 2.59) | |
| | Second fifth of dysfunction | 0.70 | (0.28, 1.72) | | 0.67 | (0.27, 1.67) | | 0.66 | (0.26, 1.65) | |
| | Third fifth of dysfunction | 1.61 | (0.77, 3.36) | | 1.50 | (0.71, 3.17) | | 1.50 | (0.71, 3.17) | |
| | Fourth fifth of dysfunction | 2.89 | (1.59, 5.25) | | 2.54 | (1.38, 4.74) | | 2.57 | (1.38, 4.78) | |
| | Fifth fifth of dysfunction | 3.01 | (1.65, 5.52) | | 2.77 | (1.40, 4.95) | | 2.64 | (1.40, 4.99) | |
| Proxy-report of acute alcohol-related dysfunction (latent)[f] | | 1.60 | (1.29, 1.99) | Test for linear trend P<0.001 | 1.51 | (1.21, 1.89) | Test for linear trend P<0.001 | 1.50 | (1.20, 1.88) | Test for linear trend P<0.001 |

[a] Dysfunctional drinking defined as twice weekly or more hangover and/or excessive drunkenness and/or sleeping in clothes because of drunkenness and/or failing family or personal obligations because of drinking

[b] Model 1: Adjusted for age

[c] Model 2: Model 1 + education + marital status + level of amenities + smoking status

[d] Model 3: Model 2 + health problems

[e] Both non-drinkers and drinkers with no dysfunction have a dysfunction score of zero but are distinguished here using the observed variable self-reported drinking status

[f] Odds ratio refers to the increase in odds of no longer being employed at IFS-2 per standard deviation increase in the latent factor of acute alcohol-related dysfunction at IFS-1

[g] Models are separate for each alcohol variable (i.e. not mutually adjusted for effects of the other alcohol variables)

**Table 9.3 Alcohol-related dysfunction (zapoi and latent factor of acute alcohol-related dysfunction) as mediators of the relationship between alcohol intake (volume of ethanol from beverage alcohol and non-beverage alcohol use) at IFS-1 and employment at IFS-2**

| Alcohol variable at IFS-1 N=1107 | Employment at IFS-2 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Direct | | | Indirect via acute alcohol-relate dysfunction | | | Indirect via zapoi | | |
| | Probit coefficient (95% CI) | | P value | Probit coefficient (95% CI) | | P value | Probit coefficient (95% CI) | | P value |
| Self-reported log total volume of ethanol from beverage alcohol | -0.01 | (-0.02, 0.002) | 0.07 | 0.01 | (0.002, 0.02) | 0.002 | 0.001 | (-0.001, 0.002) | 0.54 |
| Proxy reported non-beverage alcohol use | -0.16 | (-0.63, 0.32) | 0.52 | 0.30 | (0.11, 0.48) | 0.002 | 0.25 | (0.10, 0.39) | 0.001 |
| Proxy report of zapoi | 0.58 | (0.24, 0.91) | 0.001 | - | | | - | | |
| Proxy reported acute alcohol-related dysfunction (latent) | 0.19 | (0.08, 0.30) | 0.001 | - | | | - | | |
| Model Fit Indices: | | | | | | | | | |
| CFI | 0.93 | | | | | | | | |
| TLI | 0.89 | | | | | | | | |
| RMSEA | 0.08 | | | | | | | | |

[a] All models adjusted for age, education, marital status, level of amenities, smoking status and health problems at IFS-1

**Table 9.4 Association between beverage alcohol intake at IFS-1 and not being in regular paid employment at IFS-2 among men who were in regular paid employment at IFS-1 and did not drink non-beverage alcohol at IFS-1**

| N=1053 | | Odds ratio for not being in regular paid employment at IFS-2 (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Model 1[a] | | Test for linear trend | Model 3[b] | | Test for linear trend |
| Total volume of ethanol from beverage alcohol in litres per year (missing=14) | Non-drinker | 0.93 | (0.43, 2.01) | P=0.18 | 0.87 | (0.39, 1.91) | P=0.25 |
| | >0-2 Litres | 1.00 (ref) | | | 1.00 (ref) | | |
| | 2-4 Litres | 0.73 | (0.35, 1.51) | | 0.74 | (0.36,1.54) | |
| | 5-9 Litres | 1.24 | (0.65, 2.37) | | 1.20 | (0.63, 2.32) | |
| | 10-19 Litres | 1.31 | (0.64, 2.68) | | 1.19 | (0.58, 2.46) | |
| | 20+ Litres | 1.35 | (0.64, 3.19) | | 1.24 | (0.51, 3.00) | |
| | Log total volume of ethanol (continuous) | 1.08 | (0.97, 1.22) | P=0.24 | 1.07 | (0.95, 1.21) | P=0.27 |

[a] Model 1: Adjusted for age

[b] Model 3: Model 1 +education + marital status + level of amenities + smoking status +health problems at IFS-1

# Chapter 10: Association between Latent dimensions of Alcohol Use and Cardiovascular Risk Factors

## 10.1 Introduction

The male mortality rate from cardiovascular disease in Russia is one of the highest in the world (772 deaths per 100, 000 of the population in 2008)(11). Circulatory diseases accounted for one third of deaths among cases in the IFS-1 case-control study(313) and for 52% of deaths among men followed up in a prospective study in Arkhangelsk in the North west of Russia(314). Despite this high cardiovascular mortality rate, cardiovascular disease risk calculated using the Framingham risk score and Norwegian myocardial risk score (both of which use conventional risk factors for cardiovascular disease such as blood pressure, total cholesterol and smoking status) was lower in Arkhangelsk than in Norway, where cardiovascular disease is lower, suggesting there are other major causes of high cardiovascular mortality in Russia(315) including hazardous alcohol consumption(9, 313, 316). Cardiovascular disease mortality in Russia has shown substantial fluctuations over time since the mid-1980s, particularly in those of working-age consistent with fluctuations in mortality from alcohol poisoning and per capita alcohol consumption(313). Analysis of the case-control data from IFS-1 showed that hazardous drinking was associated with increased mortality from cardiovascular disease (except from myocardial infarction) with a particularly strong relationship with cardiomyopathy (313). Analysis of another large case-control study investigating mortality and alcohol consumption in three cities in Western Siberia showed a strong relationship between alcohol intake and mortality from acute ischaemic heart disease other than myocardial infarction(9).

Many studies have found a J-shaped or U-shaped relationship between alcohol intake and cardiovascular disease, particularly ischaemic heart disease, with lower risk in light/moderate drinkers (approximately 1-3 drinks per day) compared to both abstainers and heavier drinkers (121, 123, 317, 318). However studies which consider markers of drinking pattern such as “binge” drinking or heavy irregular drinking have shown any cardio-protective effect of alcohol appears to be modified by drinking pattern with increased risk with episodic heavy drinking (128, 317-319). Therefore although moderate alcohol consumption may be cardio-protective, the strong association between alcohol and cardiovascular mortality found in Izhevsk may be related to high levels of hazardous drinking patterns such as the episodic consumption of very large volumes of spirits.

Alcohol consumption has previously been found to increase blood pressure (104, 121, 317, 320-322) and to have many effects on lipid balance such as increased levels of high density lipoprotein (HDL) and the main protein component of HDL, Apolipoprotein A1 (Apo A1)(121-123, 317, 323-325). Changes in HDL and Apo A1 have been suggested as one of the main reasons for any cardio-protective effect of moderate alcohol consumption (121, 123, 325, 326). However while HDL shows a strong association with cardiovascular disease, and has traditionally been considered cardio-protective recent studies using Mendelian randomisation suggest that the association between HDL and cardiovascular disease may not be due to a causal relationship (327-329).There is some limited evidence that effects of alcohol consumption on lipid profile are modified by drinking pattern with no increases in HDL levels following binge drinking while at least in animals binge drinking is associated with increases in low density lipoproteins (LDL) and its main protein component Apolipoprotein B (Apo B), which are associated with a worse cardiovascular disease risk profile (128, 131, 132).

Despite evidence that alcohol consumption is an important cause of high cardiovascular disease mortality in Russia, little has been done to investigate the effects of the very hazardous drinking pattern found in Russia on traditional cardiovascular risk factors. A cross-sectional survey of 282 men in Novosibirsk (Russia), Krakow (Poland) and Karvina (Czech Republic) found that both volume of ethanol and frequency of binge drinking (>100g of ethanol per drinking occasion) were associated with increased HDL levels but showed no association with LDL while both HDL and LDL were raised among frequent binge drinkers who also drank a large volume of ethanol per year(330). A cross-sectional study in Arkhangelsk, Russia found that raised gamma glutamyl transferase (GGT) was associated with higher blood pressure, cholesterol, triglycerides, LDL, Apo A1 and Apo B but not with HDL (274). There was also a strong positive association between Apo A1 and both self-reported frequency of drinking alcohol and usual volume of beer and spirits per week even adjusting for GGT and other factors predicting Apo A1 while Apo B was associated only with GGT and usual volume of beer per week(323). With the exception of the association with Apo A1 and Apo B, GGT was the only measure of alcohol consumption used in this study. However, GGT can be raised for many reasons apart from alcohol consumption including other factors which may affect blood pressure and lipid profile such as smoking and body mass index which were not adjusted for in this study (208, 211, 212). In the absence of confirmation with other markers of alcohol use it is not certain that the relationships found between GGT and cardiovascular risk factors in Arkhangelsk were due to alcohol intake or to other factors affecting GGT. More research is needed on the association between alcohol use and cardiovascular risk factors in Russia using more detailed information on alcohol use.

The aims of this analysis were to investigate the cross-sectional association between alcohol use and cardiovascular risk factors in working-age men in Izhevsk Russia.

The objectives were:

1) To investigate the association between the latent factors of beverage alcohol intake(beer intake, wine intake, spirit intake) with serum lipid levels and hypertension at IFS-2 and whether there were differences in these associations by the type of beverage consumed
2) To investigate the association of the latent factors of acute alcohol-related dysfunction with serum lipid levels and hypertension at IFS-2
3) To investigate whether any of the four latent factors (beer intake, wine intake, spirit intake and acute alcohol-related dysfunction) showed independent associations with cardiovascular risk factors, in particular whether acute alcohol-related dysfunction showed any associations with cardiovascular risk factors which could not be explained by alcohol intake
4) To investigate how the association between cardiovascular disease risk factors and latent factors of alcohol use compared to the association between cardiovascular disease risk factors and alcohol biomarkers (GGT and CDT)

## 10.2 Methods

### 10.2.1 Study Sample

The study sample for these analyses was men who attended the IFS-2 health check.

### 10.2.2 Outcomes

The outcomes of interest were serum lipoprotein levels and hypertension.

Serum lipoprotein levels were obtained from blood samples obtained at the IFS-2 health check. Variables considered as outcomes of interest were High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Apo-protein A1 (Apo A1), Apo-protein B (Apo B) and total cholesterol. Lipoprotein and apolipoprotein assays were conducted in Moscow by the commercial diagnostics laboratory Lytech using an Architect i2000 analyser. LDL was estimated using the Friedwald equation. All variables were measured in millimoles per litre and used as continuous variables. Higher levels of HDL and its main protein component Apo A1 are associated with lower cardiovascular risk, whilst higher levels of LDL and its main protein component Apo B are associated with higher cardiovascular risk(331). The ratio of LDL to HDL and the ratio of Apo A1 to Apo B are also strongly associated with cardiovascular risk, with a lower value for both associated with a lower risk of cardiovascular disease (331, 332). Therefore these were also considered as outcomes of interest.

Hypertension was assessed using the mean of the second and third blood pressure measurements from the IFS-2 health check. Seated blood pressure was measured three times using Omron (705 IT) electronic sphygmomanometers. These were checked at the start and end of the study fieldwork and found to be correctly calibrated. Men were categorized as hypertensive if they had a mean systolic blood pressure greater than 139 mm hg or a mean diastolic blood pressure greater than 89 mm hg or they were prescribed anti-hypertensive medication which was assessed from the medical history taken at the health check.

### 10.2.3 Exposures

The exposure of interest was alcohol use at IFS-2 measured by the three latent factors of beverage alcohol intake (beer, wine and spirit intake), the latent factor of routine acute alcohol-related dysfunction and the alcohol biomarkers carbohydrate deficient transferrin (CDT) and gamma glutamyl transferase (GGT).

The latent alcohol variables were derived from interview questions at IFS-2. The specification of the latent variables is discussed in detail in Chapter 6. Latent variables were used in two ways: i) as continuous latent variables in structural equation models and ii) as categorical variables derived from predicted scores on the latent factor (factors scores). For the three beverage alcohol intake factors men who consumed that beverage type were split into fifths using quintiles of factor scores. Men with a zero score were divided into non-drinkers and men who were drinkers but did not drink that beverage type using observed self-report of frequency of consumption. Men with any level of dysfunction were divided in to fifths using factor scores on dysfunction while men with no dysfunction were divided into drinkers with no dysfunction and non-drinkers using observed variables on self-reported drinking status.

In these analyses proxy-reported data was used for dysfunction as proxies were considered less likely to under-report dysfunctional behaviours than the index men however self-reported data was used for alcohol intake since it would be very difficult for proxies to accurately report volume of ethanol consumed per occasion.

Alcohol biomarkers (GGT and CDT) were obtained from the blood sample taken at the IFS-2 health check. Assays of GGT were conducted at The Republican Blood Transfusion Centre in Izhevsk using the kinetic colorimetric method(333). CDT was measured by the Moscow-based diagnostics company Galen using the SEBIA Capillarys 2 multicapillary analyser(334).Log GGT and log CDT were used since the distribution of both GGT and CDT was skewed to the right (See Chapter 5).

### 10.2.4 Confounding variables

Potential confounders measured at the IFS-2 interview were age, education, marital status, level of amenities, smoking and regular physical activity. Age was measured in five year intervals and used as a continuous variable. Education was coded into three categories: incomplete secondary or lower, complete secondary and higher/incomplete higher. Marital status was coded as living with a spouse in a registered marriage or unmarried. Level of amenities was coded into three categories: men with neither a car nor central heating, men with either a car or central heating, or men with both a car and central heating. Employment status was coded as in regular paid employment or not. Smoking was coded as never smoked, ex-smoker, 1-10 cigarettes per day, 11-20 cigarettes per day, or more than 20 cigarettes per day. Regular physical activity was defined as exercising several times a week during leisure time or usually walking or cycling for more than 30 minutes per day or having a job involving a lot or physical activity. Regular physical activity was used as a binary variable (yes/no).

Potential confounders measured at the IFS-2 health check were Body Mass Index (BMI) measured in Kg/metres$^2$. Height was measured using SECA Leicester portable height measures. Weight was measured using Tanita HS-1632 weighing scales. Both height and weight were measured three times and BMI calculated using the mean of these measurements. BMI was categorized as underweight (<20), normal weight (20-24), overweight (25-29), obese (30-34) and severely obese (≥35). Use of lipid lowering drugs was also considered as a potential confounder, however, only 9 men reported using them and therefore this was not included in the final model.

All these variables were considered as confounders as they may influence cardiovascular risk but also be independently associated with alcohol consumption. This includes use of medications since this could be related to health consciousness which may also influence alcohol consumption.

### 10.2.5 Statistical Analysis

Separate structural equation models were fitted to investigate the relationship between each outcome (HDL, LDL, LDL to HDL ratio, Apo A1, Apo B, Apo B to Apo A1 ratio, total cholesterol, and hypertension) and each of the four latent alcohol variables (beer intake, wine intake, spirit intake and acute alcohol-related dysfunction). All models included adjustment for age and measurement models specifying the four latent variables. Models were then additionally adjusted for socio-demographic variables, smoking status, BMI and regular physical activity. Finally all models were mutually adjusted for the four latent alcohol variables to investigate whether these variables showed an association with cardiovascular risk factors independent of each other. Of particular interest was whether the acute dysfunction variable (taken as a measure of an extreme drinking pattern) showed an association with cardiovascular risk independent of beer, wine and spirit intake.

To provide some measure of validity to the latent variables the analyses were repeated using log GGT and log CDT as exposure variables. First models were fitted adjusting for age, then potential confounders and then finally adjusting for the four latent alcohol use variables. The aims of these analyses were i) to investigate whether the associations with cardiovascular risk factors differed when biomarkers were used rather than data obtained by interview and ii) to investigate whether self/proxy reported data on alcohol use accounted for any associations seen between alcohol biomarkers and cardiovascular risk factors. In analyses using log GGT men with markers of hepatitis B or hepatitis C infection were excluded as GGT was likely to be raised due to the infection rather than because of alcohol consumption.

In order to investigate whether there was a U or J-shaped relationship with the latent alcohol variables and each of the cardiovascular risk factors, fifths of factor scores were used as categorical variables in linear regression models for continuous outcomes and logistic regression models for binary outcomes and adjusted for potential confounders. The same analyses were repeated using fifths of GGT and CDT. Fifths were selected a priori as giving a reasonable number of categories with which to assess whether there was non-linearity.

### 10.2.6 Sensitivity Analysis: Association of latent factors of acute alcohol-related dysfunction with lipid levels and hypertension excluding non-beverage alcohol drinkers

Among men who drink non-beverage alcohol the three latent factors of beverage alcohol intake (beer, wine and spirit intake) do not completely capture overall consumption of ethanol. Any association of acute alcohol-related dysfunction with lipid levels and hypertension not explained by controlling for beer, wine and spirit intake may therefore be due to consumption of non-beverage alcohol rather than an independent effect of acute dysfunction per se. For these reasons the analyses for acute alcohol-related dysfunction were repeated excluding men if they or their proxy-respondent reported that they drank non-beverage alcohol or if data on non-beverage alcohol use was missing.

### 10.2.7 Missing Data

Complete case analysis was used for logistic regression models. Structural equation models were estimated using WMSLV and an analysis method equivalent to pairwise present analysis was used for missing data(269). Predictors of loss to follow up, item non-response and the possible implications of missing data are discussed in more detail in Chapter 5.

## 10.3 Results

There were 1052 men who attended the IFS-2 health check, however only 1004 of these men also had a blood test and due to logistical problems in the laboratories analysing the blood samples not all the samples have been analysed therefore there is some missing data for each of the outcomes and exposures which were assessed by blood sample. Proxy-reported data was available for 978 (93%) of men who attended the health check. The distribution of serum lipid levels by fifths of factors scores on the four latent alcohol variables and fifths of GGT and CDT are shown in Table 10.1. The prevalence of hypertension by these alcohol variables is shown in Table 10.2. The distribution of potential confounders in the sample is shown in Table 10.3.

The relationship between fifths of factor score for each latent variable, fifths of the two alcohol biomarkers and each of the outcomes is shown in Appendix 2. Since there was no evidence of a U- or J-shaped relationship between any of the outcome variables and the four latent dimensions of alcohol use only the results from the structural equation models are presented here.

The relationship between each outcome and each latent variable is shown adjusted for age (model 1), additionally adjusted for socio-demographic variables, smoking, physical activity, and body mass index (model 2) and mutually adjusted for the four latent alcohol use variables (model 3).

**10.3.1 Relationship between Latent factors of alcohol use and serum lipoprotein profile**

The estimated associations between the four latent factors of alcohol use and serum lipid levels are shown in Table 10.4.

After adjusting for potential confounders (model 2) there was strong evidence of a positive association between HDL levels and all four latent variables. After mutually adjusting for the other latent alcohol variables (model 3) beer intake, wine intake and spirit intake, but not acute dysfunction, remained independently associated with HDL although with substantially diminished effect sizes, with the strongest association being seen for spirit intake. The results for Apo A1 were very similar to those for HDL.

After adjusting for potential confounders (model 2), there was strong evidence of an inverse trend in LDL with all four latent factors. After mutual adjustment for all four latent variables (model 3), there was some evidence of an inverse trend in LDL with acute dysfunction but not beer, wine or spirit intake. A similar pattern of results was seen for Apo B as for LDL.

After adjusting for confounders (model 2), there was strong evidence of an inverse relationship between both the LDL: HDL ratio and all four latent variables. After mutual adjustment (model 3) there was strong evidence of an inverse trend in the LDL: HDL ratio with spirit intake and good evidence of an inverse trend with beer and wine intake. The pattern of results for the Apo B: Apo A1 ratio was similar to the LDL: HDL ratio except that

that there was evidence of a negative trend with wine intake, spirit intake and acute alcohol-related dysfunction after adjusting for all four latent factors. For both LDL: HDL ratio and Apo B: Apo A1 ratio effect sizes were substantially reduced on mutually adjusting for all four latent factors.

There was some evidence of a positive association between total cholesterol and beer intake after adjusting for potential confounders (model 2) which remained after adjusting for the other three alcohol use factors (model 3). There was no evidence of an association between total cholesterol and either wine intake, spirit intake or acute dysfunction.

For all outcomes except total cholesterol the estimated effect size for the latent factor of acute alcohol-related dysfunction was very similar to the latent factors of beer and spirit intake. After adjusting for beer, wine and spirit intake the latent factor of acute dysfunction remained inversely associated with LDL and Apo B although beer, wine and spirit intake did not.

### 10.3.2 Relationship between alcohol biomarkers and serum lipoprotein profile

The estimated associations of serum lipids with log GGT and log CDT  are shown in Table 10.5.

After adjusting for potential confounders (model 2) there was strong evidence of a positive association between log GGT and HDL, Apo A1, Apo B and total cholesterol. There was strong evidence of a negative association between log GGT and the LDL: HDL ratio and the Apo B: Apo A1 ratio. There was no evidence of an association between log GGT and LDL.  Adjusting for the four latent factors explained the association between log GGT and Apo B: Apo A1 ratio and reduced the estimated association between GGT and HDL, LDL:HDL ratio and Apo A1, however the estimated association between GGT and Apo B and total cholesterol remained the same and LDL became positively associated with GGT.

After adjusting for potential confounders (model 2) there was strong evidence of a positive association of log CDT with HDL and Apo A and strong evidence of a negative association of log CDT with LDL, Apo B, LDL: HDL Ratio and Apo B: Apo A1 ratio. These associations remained even after adjusting for beer intake, wine intake, spirit intake and acute alcohol-related dysfunction although with the exception of Apo B the estimated coefficient was reduced. There was some evidence of a positive association between Log CDT and total cholesterol which was removed by controlling for the latent variables of alcohol use.

### 10.3.3 Association of latent factors of alcohol use and alcohol biomarkers with hypertension

The estimated associations between the latent factors of alcohol use, alcohol biomarkers and hypertension are shown in Table 10.6. After adjusting for potential confounders the latent factors of beer intake, spirit intake and acute alcohol-related dysfunction were associated with higher odds of hypertension. There was no evidence of an association between wine intake and hypertension. Only acute alcohol-related dysfunction remained independently associated with hypertension after mutual adjustment for all four latent factors of alcohol use.

Both log GGT and log CDT showed a strong positive association with hypertension. This was reduced but not completely explained by adjusting for the four latent factors of alcohol use.

### 10.3.4 Comparison of results found using latent factors and those using alcohol biomarkers

The associations found with lipid levels were very similar for all four of the latent variables and for log CDT. With all these variables there was a positive trend in HDL and Apo A1 and a negative trend in LDL, Apo B and the ratio of LDL: HDL and Apo B: Apo A1. The association with cholesterol was inconsistent with some evidence of a positive association for beer intake and log CDT but no evidence of an association with wine intake, spirit intake or acute dysfunction.

Log GGT showed a slightly different pattern of results to the other alcohol variables. Log GGT also showed a strong positive association with HDL and Apo A1 and a negative association with LDL: HDL ratio and Apo B: Apo A1 ratio but a positive trend with Apo B, in contrast to the negative association found with the other five variables, and a positive association with LDL after adjusting for the four latent alcohol factors. There was strong evidence of a positive trend in total cholesterol with log GGT.

Similarly to beer intake, spirit intake and acute dysfunction, both log GGT and log CDT were positively associated with hypertension.

Additionally adjusting for the four latent factors of alcohol use did not explain the association between alcohol biomarkers and cardiovascular risk factors.

### 10.3.5 Association of Acute Alcohol-related dysfunction with lipid profile and hypertension excluding non-beverage alcohol drinkers

The associations of the latent factor of acute alcohol-related dysfunction with lipid levels and hypertension excluding non-beverage alcohol drinkers are shown in Table 10.7. The pattern of results after adjusting for potential confounders (Model 2) were similar to those for all men (Table 10.4) although with some reduction in the estimated coefficients and weaker evidence of an association of acute alcohol-related dysfunction with LDL, Apo A1 and Apo B when non-beverage alcohol drinkers were excluded suggesting that non-beverage alcohol consumption does contribute to the associations seen between acute alcohol-related dysfunction and cardiovascular risk factors. Additionally adjusting for the latent factors of beer intake, wine intake and spirit intake (Model 3) explained the association of acute alcohol-related dysfunction with HDL, Apo A1 and LDL but even among men who did not drink non-beverage alcohol adjusting for beverage alcohol intake did not explain the associations of acute alcohol-related dysfunction with Apo B and hypertension.

## 10.4 Discussion

### 10.4.1 Substantive Findings

Beverage alcohol intake (beer, wine and spirits) and acute alcohol-related dysfunction were all associated with similar changes in lipid profile with increases in HDL and Apo A1 and decreases in LDL and Apo B as all four latent variables increased. Similar changes were seen with the alcohol biomarker CDT. These changes were in line with a more cardio-vascular favourable lipid profile with heavier alcohol consumption, although beer intake, log CDT and log GGT were also associated with higher total cholesterol and log GGT was positively associated with Apo B. In contrast there was strong evidence of higher levels of hypertension with increased levels of beer intake, spirit intake, acute alcohol-related dysfunction, log GGT and log CDT. The associations of acute dysfunction with HDL and Apo A1 were explained by controlling for beverage alcohol intake whereas the associations with LDL, Apo B and hypertension were not.

A cross-sectional study in Arkhangelsk, Russia found that after adjusting for age, raised GGT was associated with higher blood pressure, cholesterol, LDL, Apo A1 and Apo B but not with HDL (274). Similar associations were found between GGT and cardiovascular risk factors in Izhevsk except that higher GGT was associated with higher HDL but not LDL. However in Izhevsk there were several differences in results using GGT to the results of five other measures of alcohol use including another alcohol biomarker CDT. While all measures showed similar associations with HDL and Apo A1, GGT showed a positive association with Apo B whereas all the other alcohol measures were inversely associated with it. The other measures of alcohol use were also inversely associated with LDL whereas GGT was not. Although beer intake and CDT showed some evidence of a positive association, GGT showed a much stronger association with total cholesterol than any of the other measures of alcohol use. For most outcomes in the Arkhangelsk study GGT was used as the only measure of alcohol consumption and the only confounder adjusted for was age. However in more depth analysis of factors associated with Apo A1 and Apo B in Arkhangelsk both higher self-reported alcohol consumption (measured by frequency of drinking any alcohol and volume of beer and vodka consumed per week) and GGT were independently associated with higher levels of Apo A1 but only volume of beer per week and GGT were associated with raised Apo B(323).

GGT is not a very specific measure of alcohol use as it can be raised for many reasons other than alcohol including age, obesity, smoking , use of certain medications such as anticonvulsants and non-steroidal anti-inflammatories, non-alcoholic liver disease and in certain other medical conditions such as diabetes (196, 204, 208, 211-214).  The main reason that alcohol biomarkers were used was to provide validation of the results using self- and proxy-report of alcohol consumption, however it seems unlikely that the differences in findings for GGT compared to the latent factors are due to measurement error in self-reported alcohol intake as the findings for CDT which is more specific for alcohol (although it can also be raised with certain types of liver damage such as primary biliary cirrhosis (223))were more consistent with the latent factors which were measured using self- and proxy-report of alcohol consumption and its acute consequences than with those for GGT. There is some evidence that GGT may be associated with risk of cardiovascular disease independent of alcohol as GGT has previously been found to predict risk of coronary heart disease and stroke in both drinkers and non-drinkers(218). Differences in associations with GGT compared to CDT and the latent factors of alcohol use in Izhevsk also indicate that GGT may be associated with cardiovascular health independent of alcohol consumption. Overall the results suggest caution is needed when using GGT as a measure of alcohol consumption to investigate the association between alcohol consumption and cardiovascular risk factors as any associations found may be due to factors other than alcohol.

Several previous studies have found that moderate alcohol consumption is associated with increased HDL and Apo A1 (121, 123, 324, 325). A cross-sectional study including men from Novosibirsk, Russia as well as Krakow (Poland) and Karvina (Czech Republic) found that higher HDL levels were associated both with large volumes of total ethanol per year and with frequent binge drinking(330). There is also a large volume of evidence supporting a relationship between alcohol consumption and hypertension (104, 121, 317, 320-322).There is less evidence from previous studies to support an association between LDL/ Apo B and alcohol consumption as findings from previous studies have been inconsistent with some finding no evidence of an association(317, 324) but others suggesting either a positive association (121, 330, 335) or a negative association(325). The survey including 136 men from Novosibirsk, Russia as well as 146 men from cities in Poland and the Czech Republic found no evidence of an association with LDL with total volume of ethanol per year and frequency of binge drinking but good evidence that LDL levels were higher among frequent binge drinkers who also drank a large volume of ethanol per year(330). Alcohol consumption in this study was measured by a graduated-frequency questionnaire asking about consumption of all alcohol in the past year. It is unclear why results from this study with respect to the association between LDL and alcohol consumption were different to Izhevsk although it is worth noting this study had a much smaller sample size. A recent meta-analysis of experimental studies investigating the effects of moderate consumption on LDL found no overall effect of alcohol consumption on LDL(324) whereas animal studies have also shown increases in LDL with binge drinking(132). The finding of strong evidence of an inverse relationship with alcohol and LDL and Apo B at IFS-2, especially for acute dysfunction, is surprising. It seems unlikely that this association was due to measurement error as the same effect was seen using self-reported data on alcohol intake, proxy-reported data on frequency of alcohol-related dysfunction and an alcohol biomarker CDT. Some of this effect may be related to differences in diet and nutritional status correlated with drinking, however since most studies have looked only at the effects of moderate alcohol consumption on LDL and Apo B this relationship may require further investigation in very heavy drinking populations.

Overall the findings showed that alcohol consumption among men was associated with a lipid profile traditionally associated with good cardiovascular health even among the heaviest drinkers (higher HDL/Apo A1 and lower LDL/Apo B with increased consumption). Given the high mortality rate from cardiovascular disease in Russia and the strong association between hazardous alcohol consumption and cardiovascular disease that has been found there this seems surprising although any cardio-protective effects of alcohol on lipid levels may be counteracted by increases in blood pressure particularly among men who drink large volumes of beer and spirits. Some recent studies using Mendelian randomization suggest that the association between low HDL and ischaemic heart disease is not a causal relationship (327-329) therefore the increased HDL levels found with increasing alcohol consumption may not be cardio-protective as previously thought. Previous studies in Russia have found that traditional cardiovascular risk factors such as blood pressure and lipid levels do not explain the extremely high level of cardiovascular mortality in Russia (315, 336). Any contribution of hazardous alcohol consumption may therefore be at least partly through other mechanisms such as direct toxic effects on heart muscle leading to arrhythmias and cardiomyopathy. However this alternative explanation of the link between alcohol and cardiovascular disease cannot be resolved in this study as data on cardiovascular disease mortality is not available.

### 10.4.2 Discussion of different measures of alcohol use

The main advantage of using the three latent variables of beverage alcohol intake was that it was then possible to investigate whether beverage type had an impact on cardiovascular risk factors. In contrast to using the observed volume of ethanol consumed from each beverage type, the latent factors made use of pattern of drinking by beverage type by including maximum volume consumed as well as usual volume and frequency reflecting that the three beverage types are consumed in different ways and may therefore have different effects on cardiovascular disease risk beyond the total volume of ethanol consumed. The results for all lipoproteins were very similar for all three latent beverage alcohol intake factors, with the exception of the positive association seen with beer intake and total cholesterol but not with wine or spirit intake. This suggests that any association found were due to consumption of ethanol rather than other factors related to beverage type such as congeners or polyphenols. In contrast only beer and spirit intake were associated with hypertension although whether this is due to differences in the effects of beverage type or the drinking pattern associated with each beverage type (i.e. heavy episodic consumption of spirits and beer compared to more moderate consumption of wine) is unclear although the strong association seen with hypertension and acute dysfunction and log CDT suggests that the hazardous drinking pattern associated particularly with the consumption of spirits in Izhevsk is likely to be an important factor.

It is important to note that using a latent variable approach to measure alcohol intake also had several disadvantages: 1) Using three variables to measure alcohol intake was more cumbersome than using one observed measure of volume of ethanol 2) it was difficult to relate differences in score on the latent factors to volume of ethanol consumed as the latent variables do not have units and therefore it was not possible to determine from this analysis the level of consumption that is associated for example with increases in blood pressure and 3) combining data on frequency and volume per occasion in one measure meant it was not possible to separate out effects of sporadic and regular heavy drinking which may have different effects on both lipid profile and blood pressure.

In contrast to the previous chapters where the latent factor of acute alcohol-related dysfunction has been used as a measure of acute dysfunction following drinking, here it was used more as a measure of an extreme drinking pattern as with the exception of hangover which may have distinct physiological effects it seems unlikely that dysfunctional behaviour would affect cardiovascular risk factors other than through the high volume of alcohol needed to experience these acute consequences. Acute dysfunction showed associations with HDL, Apo A1, LDL and Apo B very similar to the three latent factors of beverage alcohol intake and a strong association with hypertension similar to beer and spirit intake. The associations with HDL and Apo A1 were explained by beverage alcohol intake and the association with LDL was explained by beverage alcohol use when non-beverage alcohol drinkers were excluded, however acute dysfunction still remained associated with Apo B and hypertension even after adjusting for beer, wine, spirit intake and excluding non-beverage alcohol drinkers suggesting that the pattern of drinking represented by this dimension (frequent dysfunctional drinking) may have some effects on cardiovascular health over and above amount of ethanol consumed.

The associations of log GGT and log CDT with cardiovascular risk factors were not explained by controlling for beer intake, wine intake, spirit intake or acute alcohol-related dysfunction. Although, especially for GGT which can be raised for many reasons, this may indicate that these associations are related to factors other than alcohol it may also indicate that the alcohol biomarkers particularly CDT provide additional information on alcohol consumption beyond even the detailed information collected in the IFS-2 interview. The relationship between alcohol biomarkers and alcohol consumption is complex as many factors such as age, gender and smoking have been found to affect the volume of ethanol consumed needed to raise biomarkers and the rate of increase (209, 214, 222). While alcohol biomarkers have limitations they also have substantial strengths in that they are objective measures and less subject to the measurement error and bias affecting self-reported (and proxy-reported) data on alcohol consumption. In this study several measures of alcohol use from different sources (self-reported alcohol intake, proxy-reported dysfunction and CDT) showed similar associations with cardiovascular risk factors which strengthens the evidence in favour of these being true associations.

There are several limitations to the study. Only 69% of men interviewed at IFS-2 attended the health check and only 66% also had a blood test. Since there were some differences between men who attended the health check and those who did not this may be a source of selection bias (See Chapter 5).There was also additional missing data on several of the outcome measures and exposures assessed by the blood test although since this data is missing due to logistical problems at the laboratories these values should be missing completely at random and therefore this should not have introduced bias(259). Overall however the results may not be generalisable to the whole study population. Another limitation is the possibility of confounding. Although several variables were controlled for in the model there may have been other unmeasured confounders such as diet and there may be some residual confounding due to measurement error in some of the confounders that were controlled for such as physical activity which was not very accurately measured or the categorization of education which may not have accounted for all variability in educational level. However, while there may be other unmeasured aspects of lifestyle, behaviour and socio-economic circumstances which are correlated with alcohol consumption and cardiovascular risk, the strong finding of an association between alcohol consumption and blood pressure seems to be universal and independent of contextual factors(121, 320, 337). Finally it was only possible to study cross-sectional associations since the cardiovascular risk factors were only measured at one time-point. Ideally it would be better to study the effects of changes in alcohol consumption on cardiovascular risk factors within individuals, however this could not be assessed given the study design of the Izhevsk Family Studies.

### 10.4.3 Conclusions

Overall alcohol consumption, including dysfunctional drinking, was associated with a traditionally cardio-protective lipid profile with increases in HDL and Apo A1 but decreases in LDL and Apo B as level of alcohol consumption increased. In contrast the prevalence of hypertension increased with alcohol consumption in particular frequent dysfunctional drinking. These findings were consistent across several measures of alcohol use although there were some differences between GGT and the other five measures used. Hazardous drinking may contribute to high cardiovascular disease in Russia through effects on blood pressure but does not seem to through its effects on lipids.

## Table 10.1 Distribution of serum lipids by latent factors of alcohol use and alcohol biomarkers at IFS-2

| Alcohol Variables | | N | Mean HDL in mmols/l (SD) n=976 | | Mean LDL in mmols/l (SD) n=958 | | Mean Apo A1 in mmols/l(SD) n=971 | | Mean Apo B in mmols/l (SD) n= 972 | | Mean total Cholesterol in mmols/l (SD) n=976 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All men | | 1052 | 1.43 | (0.45) | 3.27 | (0.88) | 1.47 | (0.32) | 0.89 | (0.26) | 5.41 | (1.02) |
| Non-drinkers | | 138 | 1.21 | (0.24) | 3.40 | (0.81) | 1.27 | (0.20) | 0.92 | (0.24) | 5.30 | (0.95) |
| Beer intake (latent) | Non beer drinker | 184 | 1.36 | (0.48) | 3.20 | (0.89) | 1.41 | (0.35) | 0.88 | (0.26) | 5.34 | (1.00) |
| | 1st fifth | 144 | 1.46 | (0.45) | 3.22 | (0.78) | 1.49 | (0.31) | 0.87 | (0.24) | 5.39 | (0.97) |
| | 2nd fifth | 147 | 1.46 | (0.44) | 3.35 | (0.78) | 1.50 | (0.30) | 0.90 | (0.23) | 5.53 | (0.88) |
| | 3rd fifth | 152 | 1.45 | (0.38) | 3.32 | (0.83) | 1.50 | (0.29) | 0.91 | (0.25) | 5.47 | (0.99) |
| | 4th fifth | 143 | 1.58 | (0.45) | 3.31 | (1.15) | 1.59 | (0.30) | 0.91 | (0.30) | 5.64 | (1.24) |
| | 5th fifth | 144 | 1.51 | (0.52) | 3.07 | (0.85) | 1.53 | (0.36) | 0.85 | (0.26) | 5.35 | (0.99) |
| Wine intake (latent) | Non wine drinker | 593 | 1.47 | (0.46) | 3.26 | (0.93) | 1.51 | (0.33) | 0.89 | (0.26) | 5.47 | (1.05) |
| | 1st fifth | 70 | 1.39 | (0.38) | 3.34 | (0.87) | 1.44 | (0.27) | 0.89 | (0.24) | 5.40 | (1.01) |
| | 2nd fifth | 66 | 1.35 | (0.43) | 3.27 | (0.67) | 1.41 | (0.25) | 0.90 | (0.22) | 5.35 | (0.77) |
| | 3rd fifth | 67 | 1.35 | (0.31) | 3.22 | (0.72) | 1.43 | (0.23) | 0.90 | (0.22) | 5.33 | (0.89) |
| | 4th fifth | 60 | 1.51 | (0.41) | 3.20 | (0.94) | 1.52 | (0.27) | 0.87 | (0.29) | 5.41 | (1.07) |
| | 5th fifth | 58 | 1.71 | (0.68) | 3.05 | (0.81) | 1.67 | (0.42) | 0.81 | (0.26) | 5.60 | (1.01) |
| Spirit intake (latent) | Non spirits drinker | 67 | 1.37 | (0.34) | 3.21 | (0.79) | 1.44 | (0.24) | 0.86 | (0.23) | 5.29 | (0.89) |
| | 1st fifth | 168 | 1.35 | (0.34) | 3.29 | (0.94) | 1.41 | (0.27) | 0.89 | (0.25) | 5.35 | (1.11) |
| | 2nd fifth | 178 | 1.46 | (0.44) | 3.23 | (0.90) | 1.51 | (0.32) | 0.88 | (0.25) | 5.39 | (0.99) |
| | 3rd fifth | 171 | 1.47 | (0.40) | 3.39 | (0.93) | 1.52 | (0.29) | 0.93 | (0.27) | 5.61 | (1.04) |
| | 4th fifth | 168 | 1.49 | (0.48) | 3.22 | (0.87) | 1.52 | (0.33) | 0.90 | (0.26) | 5.52 | (1.03) |
| | 5th fifth | 162 | 1.58 | (0.62) | 3.09 | (0.83) | 1.57 | (0.40) | 0.84 | (0.25) | 5.40 | (0.94) |
| Proxy-report of Acute dysfunction (latent) N=980 | Non-dysfunctional drinker | 332 | 1.37 | (0.36) | 3.35 | (0.92) | 1.43 | (0.27) | 0.92 | (0.26) | 5.45 | (1.07) |
| | 1st fifth of dysfunction | 89 | 1.41 | (0.40) | 3.30 | (0.80) | 1.45 | (0.29) | 0.91 | (0.25) | 5.42 | (0.98) |
| | 2nd fifth of dysfunction | 111 | 1.43 | (0.41) | 3.35 | (0.93) | 1.51 | (0.33) | 0.93 | (0.26) | 5.57 | (1.09) |
| | 3rd fifth of dysfunction | 110 | 1.44 | (0.51) | 3.09 | (0.86) | 1.49 | (0.34) | 0.86 | (0.25) | 5.35 | (1.00) |
| | 4th fifth of dysfunction | 101 | 1.57 | (0.48) | 3.23 | (0.97) | 1.57 | (0.32) | 0.88 | (0.26) | 5.46 | (1.05) |
| | 5th fifth of dysfunction | 99 | 1.76 | (0.65) | 2.93 | (0.80) | 1.67 | (0.43) | 0.75 | (0.24) | 5.24 | (0.97) |
| GGT [a] (u/l) N=949 | 1st fifth (<18.9) | 198 | 1.33 | (0.31) | 3.17 | (0.79) | 1.37 | (0.25) | 0.82 | (0.22) | 5.07 | (0.89) |
| | 2nd fifth (18.9-24.4) | 178 | 1.41 | (0.37) | 3.31 | (0.91) | 1.43 | (0.26) | 0.88 | (0.24) | 5.31 | (0.97) |
| | 3rd fifth (24.5-34.4) | 191 | 1.36 | (0.41) | 3.24 | (0.77) | 1.43 | (0.29) | 0.90 | (0.22) | 5.34 | (0.89) |
| | 4th fifth (34.5-52.6) | 190 | 1.40 | (0.40) | 3.39 | (0.83) | 1.48 | (0.29) | 0.96 | (0.25) | 5.64 | (0.95) |
| | 5th fifth (>52.6) | 192 | 1.65 | (0.64) | 3.31 | (1.11) | 1.65 | (0.41) | 0.93 | (0.32) | 5.81 | (1.17) |
| CDT (%) N=997 | 1st fifth (<0.6) | 97 | 1.27 | (0.29) | 3.20 | (0.68) | 1.32 | (0.23) | 0.85 | (0.22) | 5.12 | (0.91) |
| | 2nd fifth (0.6-0.7) | 194 | 1.25 | (0.26) | 3.40 | (0.78) | 1.33 | (0.22) | 0.93 | (0.22) | 5.39 | (0.88) |
| | 3rd fifth (0.8-1.0) | 251 | 1.26 | (0.28) | 3.37 | (0.84) | 1.37 | (0.22) | 0.95 | (0.25) | 5.46 | (1.03) |
| | 4th fifth (1.1-2.1) | 249 | 1.42 | (0.34) | 3.35 | (0.87) | 1.50 | (0.28) | 0.92 | (0.24) | 5.51 | (1.01) |
| | 5th fifth (>2.1) | 206 | 1.88 | (0.57) | 2.96 | (1.03) | 1.77 | (0.37) | 0.76 | (0.27) | 5.38 | (1.14) |

[a] Excluding men with hepatitis B or hepatitis C infection

**Table 10.2 Prevalence of hypertension by latent factors of alcohol use and alcohol biomarkers at IFS-2**

| Alcohol Variables | | Hypertensive (%) | |
|---|---|---|---|
| All men | | 653/1047 | (62.4) |
| Non-drinkers | | 67/135 | (49.6) |
| Beer intake (latent) | Non- beer drinker | 120/184 | (65.2) |
| | 1st fifth | 96/144 | (66.7) |
| | 2nd fifth | 98/146 | (67.1) |
| | 3rd fifth | 95/152 | (62.5) |
| | 4th fifth | 97/142 | (68.3) |
| | 5th fifth | 80/144 | (55.6) |
| Wine intake (latent) | Non-wine drinker | 392/591 | (66.3) |
| | 1st fifth | 42/70 | (60.0) |
| | 2nd fifth | 37/66 | (56.1) |
| | 3rd fifth | 36/67 | (53.7) |
| | 4th fifth | 37/60 | (61.7) |
| | 5th fifth | 42/58 | (72.4) |
| Spirit intake (latent) | Non-spirits drinker | 40/67 | (59.7) |
| | 1st fifth | 103/168 | (61.3) |
| | 2nd fifth | 117/176 | (66.5) |
| | 3rd fifth | 112/171 | (65.5) |
| | 4th fifth | 119/168 | (70.8) |
| | 5th fifth | 95/162 | (58.6) |
| Proxy-report of Acute dysfunction (latent) N=980 | Non-dysfunctional drinker | 212/331 | (64.1) |
| | 1st fifth of dysfunction | 58/89 | (65.2) |
| | 2nd fifth of dysfunction | 75/111 | (67.6) |
| | 3rd fifth of dysfunction | 63/110 | (57.3) |
| | 4th fifth of dysfunction | 69/101 | (68.3) |
| | 5th fifth of dysfunction | 72/99 | (72.7) |
| GGT[a] (u/l) N=949 | 1st fifth (<19) | 91/217 | (41.9) |
| | 2nd fifth (19-24) | 103/189 | (54.5) |
| | 3rd fifth (25-34) | 130/199 | (65.3) |
| | 4th fifth (35-52) | 146/206 | (70.9) |
| | 5th fifth (>52) | 164/210 | (78.1) |
| CDT (%) N=997 | 1st fifth (<0.6) | 54/97 | (55.7) |
| | 2nd fifth (0.6-0.7) | 103/192 | (53.7) |
| | 3rd fifth (0.8-1.0) | 154/251 | (61.4) |
| | 4th fifth (1.1-2.2) | 164/249 | (65.9) |
| | 5th fifth (>2.2) | 140/206 | (68.0) |

[a] Excluding men with hepatitis B or hepatitis C infection

**Table 10.3 Distribution of potential confounding variables among men who attended the IFS-2 Health Check**

| | | N | (%) |
|---|---|---|---|
| Age (years) | <30 | 16 | (1.5) |
| | 30-34 | 76 | (7.2) |
| | 35-39 | 98 | (9.3) |
| | 40-44 | 120 | (11.4) |
| | 45-49 | 202 | (19.2) |
| | 50-54 | 261 | (24.8) |
| | ≥55 | 279 | (26.5) |
| Education | Incomplete secondary | 48 | (4.6) |
| | Secondary | 771 | (73.3) |
| | Higher | 233 | (22.2) |
| Marital Status (Missing=1) | Living with a spouse in a registered marriage | 849 | (80.7) |
| Level of amenities | No car or central heating | 66 | (6.3) |
| | Car or central heating | 488 | (46.4) |
| | Car and central heating | 498 | (47.3) |
| Employment Status | In regular paid employment | 877 | (83.4) |
| Takes Regular physical activity (Missing=2) | Yes | 989 | (94.0) |
| Smoking (Missing=1) | Never smoked | 202 | (19.2) |
| | Ex-smoker | 192 | (18.3) |
| | 1-10 cigarettes per day | 119 | (11.3) |
| | 11-20 cigarettes per day | 409 | (38.9) |
| | >20 cigarettes per day | 129 | (12.3) |
| Body Mass Index ($Kg/m^2$) (Missing=8) | <20 | 59 | (5.6) |
| | 20-24 | 376 | (35.7) |
| | 25-29 | 416 | (39.5) |
| | 30-34 | 153 | (14.5) |
| | ≥35 | 40 | (3.8) |
| Uses lipid lowering drugs | Yes | 9 | (0.9) |
| Total | | 1052 | (100) |

**Table 10.4 Relationship between serum lipid levels and latent factors of beer intake, wine intake, spirit intake and acute alcohol-related dysfunction**

| N=1052 | | Beer intake | | | Wine intake | | | Spirit intake | | | Proxy-reported acute alcohol-related dysfunction | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Coefficient[d] (95% CI) | | P-value | Coefficient[d] (95% CI) | | P-value | Coefficient[d] (95% CI) | | P-value | Coefficient[d] (95% CI) | | P-value |
| HDL (mmol/l) | Model 1[a] | 0.20 | (0.17, 0.23) | <0.001 | 0.05 | (0.01, 0.10) | 0.02 | 0.17 | (0.15, 0.20) | <0.001 | 0.16 | (0.14, 0.19) | <0.001 |
| | Model 2[b] | 0.19 | (0.15, 0.22) | <0.001 | 0.11 | (0.06, 0.16) | <0.001 | 0.18 | (0.15, 0.20) | <0.001 | 0.16 | (0.13, 0.19) | <0.001 |
| | Model 3[c] | 0.05 | (0.02, 0.09) | 0.003 | 0.04 | (0.01, 0.06) | 0.002 | 0.12 | (0.07, 0.16) | <0.001 | 0.01 | (-0.04, 0.05) | 0.82 |
| LDL (mmol/l) | Model 1[a] | -0.11 | (-0.18, -0.04) | 0.002 | -0.10 | (-0.17, -0.03) | 0.006 | -0.12 | (-0.18, -0.06) | <0.001 | -0.14 | (-0.20, -0.08) | <0.001 |
| | Model 2[b] | -0.08 | (-0.15, -0.02) | 0.01 | -0.10 | (-0.18, -0.03) | 0.006 | -0.11 | (-0.17, -0.05) | 0.001 | -0.12 | (-0.19, -0.06) | <0.001 |
| | Model 3[c] | 0.07 | (-0.01, 0.15) | 0.10 | -0.05 | (-0.13, 0.03) | 0.19 | -0.05 | (-0.16, 0.05) | 0.35 | -0.10 | (-0.20, -0.002) | 0.05 |
| LDL: HDL Ratio | Model 1[a] | -0.37 | (-0.44, -0.30) | <0.001 | -0.24 | (-0.31, -0.16) | <0.001 | -0.32 | (-0.38, -0.26) | <0.001 | -0.32 | (-0.38, -0.26) | <0.001 |
| | Model 2[b] | -0.34 | (-0.41, -0.27) | <0.001 | -0.22 | (-0.32, -0.13) | <0.001 | -0.32 | (-0.38, -0.26) | <0.001 | -0.31 | (-0.37, -0.25) | <0.001 |
| | Model 3[c] | -0.08 | (-0.15, -0.01) | 0.03 | -0.08 | (-0.15, -0.01) | 0.03 | -0.17 | (-0.25, -0.08) | <0.001 | -0.08 | (-0.18, 0.01) | 0.09 |
| Apo A1 (mmol/l) | Model 1[a] | 0.15 | (0.12, 0.17) | <0.001 | 0.03 | (-0.01, 0.06) | 0.14 | 0.13 | (0.11, 0.15) | <0.001 | 0.12 | (0.10, 0.14) | <0.001 |
| | Model 2[b] | 0.15 | (0.12, 0.17) | <0.001 | 0.08 | (0.04, 0.12) | <0.001 | 0.13 | (0.11, 0.16) | <0.001 | 0.12 | (0.10, 0.14) | <0.001 |
| | Model 3[c] | 0.05 | (0.03, 0.08) | <0.001 | 0.03 | (0.01, 0.05) | 0.01 | 0.09 | (0.06, 0.13) | <0.001 | -0.01 | (-0.04, 0.03) | 0.67 |
| Apo B (mmol/l) | Model 1[a] | -0.03 | (-0.05, -0.01) | 0.001 | -0.03 | (-0.05, -0.01) | 0.002 | -0.04 | (-0.05, -0.02) | <0.001 | -0.05 | (-0.06, -0.03) | <0.001 |
| | Model 2[b] | -0.03 | (-0.05, -0.01) | 0.004 | -0.03 | (-0.05, -0.02) | <0.001 | -0.03 | (-0.05, -0.01) | <0.001 | -0.04 | (-0.06, -0.02) | <0.001 |
| | Model 3[c] | 0.02 | (-0.003, 0.04) | 0.10 | -0.02 | (-0.04, 0.001) | 0.07 | -0.004 | (-0.03, 0.02) | 0.80 | -0.04 | (-0.07, -0.01) | 0.003 |
| Apo B: Apo A1 Ratio | Model 1[a] | -0.08 | (-0.10, -0.06) | <0.001 | -0.06 | (-0.08, -0.04) | <0.001 | -0.07 | (-0.09, -0.05) | <0.001 | -0.07 | (-0.09, -0.06) | <0.001 |
| | Model 2[b] | -0.08 | (-0.09, -0.06) | <0.001 | -0.06 | (-0.08, -0.04) | <0.001 | -0.07 | (-0.09, -0.06) | <0.001 | -0.07 | (-0.09, -0.05) | <0.001 |
| | Model 3[c] | -0.01 | (-0.03, 0.01) | 0.18 | -0.02 | (-0.04, -0.004) | 0.01 | -0.03 | (-0.06, -0.01) | 0.003 | -0.02 | (-0.05, 0.00) | 0.05 |
| Total cholesterol (mmol/l) | Model 1[a] | 0.08 | (-0.00, 0.16) | 0.06 | 0.01 | (-0.07, 0.09) | 0.81 | 0.05 | (-0.02, 0.12) | 0.18 | 0.01 | (-0.06, 0.09) | 0.72 |
| | Model 2[b] | 0.10 | (0.02, 0.19) | 0.01 | 0.02 | (-0.07, 0.11) | 0.64 | 0.07 | (-0.004, 0.14) | 0.06 | 0.05 | (-0.03, 0.12) | 0.25 |
| | Model 3[c] | 0.13 | (0.03, 0.23) | 0.01 | -0.01 | (-0.10, 0.07) | 0.75 | 0.07 | (-0.05, 0.19) | 0.24 | -0.10 | (-0.22, 0.02) | 0.11 |

[a]Model 1: Adjusted for age

[b]Model 2: Model 1 + education + marital status + smoking + level of amenities + employment status + regular physical activity + body mass index

[c]Model 3: Model 2 + latent factor of beer + latent factor of wine + latent factor of spirits + latent factor of acute dysfunction (proxy-report)

[d] Coefficients refer to change in lipid component in mmols/litre for 1 standard deviation change in the latent factor

**Table 10.5 Relationship between lipid levels and alcohol biomarkers (GGT and CDT)**

| Lipid Levels | | Log GGT[e] (n=949) | | | Log CDT (n=997) | | |
|---|---|---|---|---|---|---|---|
| | | Coefficient (95% CI) | | P value | Coefficient (95% CI) | | P value |
| HDL (mmol/l) | Model 1[a] | 0.17 | (0.14, 0.20) | <0.001 | 0.33 | (0.31, 0.35) | <0.001 |
| | Model 2[b] | 0.20 | (0.18, 0.23) | <0.001 | 0.31 | (0.29, 0.33) | <0.001 |
| | Model 3[c] | 0.15 | (0.12, 0.18) | <0.001 | 0.28 | (0.26, 0.31) | <0.001 |
| LDL (mmol/l) | Model 1[a] | 0.07 | (0.01, 0.13) | 0.03 | -0.20 | (-0.27, -0.14) | <0.001 |
| | Model 2[b] | 0.04 | (-0.02, 0.11) | 0.20 | -0.16 | (-0.23, -0.08) | <0.001 |
| | Model 3[c] | 0.09 | (0.03, 0.15) | 0.004 | -0.13 | (-0.20, -0.07) | <0.001 |
| LDL: HDL Ratio | Model 1[a] | -0.12 | (-0.19, -0.04) | 0.002 | -0.52 | (-0.60, -0.45) | <0.001 |
| | Model 2[b] | -0.19 | (-0.26, -0.11) | <0.001 | -0.47 | (-0.54, -0.40) | <0.001 |
| | Model 3[c] | -0.08 | (-0.14, -0.01) | 0.02 | -0.39 | (-0.45, -0.34) | <0.001 |
| Apo A1 (mmol/l) | Model 1[a] | 0.14 | (0.12, 0.16) | <0.001 | 0.22 | (0.21, 0.24) | <0.001 |
| | Model 2[b] | 0.16 | (0.14, 0.19) | <0.001 | 0.22 | (0.20, 0.24) | <0.001 |
| | Model 3[c] | 0.12 | (0.10, 0.15) | <0.001 | 0.19 | (0.17, 0.21) | <0.001 |
| Apo B (mmol/l) | Model 1[a] | 0.04 | (0.03, 0.06) | <0.001 | -0.08 | (-0.10, -0.06) | <0.001 |
| | Model 2[b] | 0.03 | (0.01, 0.05) | 0.004 | -0.06 | (-0.08, -0.04) | <0.001 |
| | Model 3[c] | 0.04 | (0.03, 0.06) | <0.001 | -0.06 | (-0.08, -0.04) | <0.001 |
| Apo B: Apo A1 Ratio | Model 1[a] | -0.01 | (-0.03, 0.01) | 0.27 | -0.13 | (-0.14, -0.11) | <0.001 |
| | Model 2[b] | -0.03 | (-0.05, -0.01) | 0.001 | -0.11 | (-0.13, -0.09) | <0.001 |
| | Model 3[c] | -0.004 | (-0.02, 0.01) | 0.63 | -0.10 | (-0.11, -0.08) | <0.001 |
| Total cholesterol (mmol/l) | Model 1[a] | 0.37 | (0.26, 0.42) | <0.001 | 0.03 | (-0.05, 0.10) | 0.53 |
| | Model 2[b] | 0.35 | (0.27, 0.43) | <0.001 | 0.10 | (0.01, 0.18) | 0.02 |
| | Model 3[c] | 0.36 | (0.29, 0.43) | <0.001 | 0.07 | (-0.03, 0.16) | 0.17 |

[a]Model 1: Adjusted for age

[b]Model 2: Model 1 + education + marital status + smoking + level of amenities + employment status + regular physical activity + Body Mass Index

[c]Model 3: Model 2 + latent factor of beer intake + latent factor of wine intake + latent factor of spirit intake + latent factor of proxy reported acute behaviour dysfunction

[e] Analyses for GGT excludes men with hepatitis B or C infection

**Table 10.6 Association between hypertension and the latent factors of beer intake, wine intake and spirit intake, acute alcohol-related dysfunction and alcohol biomarkers (GGT and CDT)**

| N=1052 | Hypertension | | | | | |
|---|---|---|---|---|---|---|
| | Model 1 | | Model 2 | | Model 3 | |
| | Odds ratio[e] | 95% CI | Odds ratio[e] | 95% CI | Odds ratio[e] | 95% CI |
| Beer Intake | 1.22 | 1.04, 1.44 | 1.24 | 1.05, 1.47 | 1.01 | 0.86, 1.20 |
| Wine Intake | 1.09 | 0.91, 1.31 | 1.04 | 0.87, 1.25 | 0.98 | 0.85, 1.13 |
| Spirit intake | 1.28 | 1.10, 1.49 | 1.27 | 1.08, 1.49 | 0.95 | 0.78, 1.16 |
| Acute Alcohol-related dysfunction (proxy-reported) | 1.33 | 1.12, 1.65 | 1.33 | 1.14, 1.56 | 1.38 | 1.10, 1.73 |
| Log GGT[d] (N=949) | 2.41 | 1.91, 3.04 | 2.26 | 1.79, 2.87 | 2.08 | 1.63, 2.65 |
| Log CDT (N=997) | 1.40 | 1.17, 1.68 | 1.74 | 1.43, 2.13 | 1.66 | 1.33, 2.06 |

[a] Model 1: Adjusted for age

[b] Model 2: Model 1 + education+ level of amenities + marital status + employment status + smoking + physical activity + body mass index

[c] Model 3: Model 2 + mutual adjustment for the four latent factors of alcohol use ( latent factor of beer intake, latent factor of wine intake , latent factor of spirit intake and latent factor of proxy-reported acute behaviour dysfunction). Models are not mutually adjusted for log GGT or log CDT

[d] Analyses for GGT excludes men with hepatitis B or hepatitis C infection

[e] Odds ratios refer to increase in odds of having hypertension per standard deviation unit increase in the latent factor or per log unit increase in GGT/CDT

**Table 10.7 Relationship between lipid levels and latent factors of beer intake, wine intake, spirit intake and proxy-reported acute alcohol-related dysfunction excluding non-beverage alcohol drinkers**

| N=890 | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coefficient (95% CI) | | P value | Coefficient (95% CI) | | P value | Coefficient (95% CI) | | P value |
| HDL (mmol/l) | 0.13 | (0.10, 0.16) | <0.001 | 0.13 | (0.10, 0.16) | <0.001 | 0.03 | (-0.02, 0.07) | 0.24 |
| LDL (mmol/l) | -0.10 | (-0.17, -0.03) | 0.008 | -0.09 | (-0.16, -0.02) | 0.02 | -0.09 | (-0.19, 0.01) | 0.08 |
| LDL: HDL Ratio | -0.27 | (-0.34, -0.20) | <0.001 | -0.27 | (-0.34, -0.20) | <0.001 | -0.10 | (-0.19, 0.002) | 0.06 |
| Apo A1 (mmol/l) | 0.11 | (0.09, 0.13) | <0.001 | 0.14 | (-0.001, 0.27) | 0.05 | 0.02 | (-0.02, 0.05) | 0.39 |
| Apo B (mmol/l) | -0.03 | (-0.05, -0.01) | 0.01 | -0.02 | (-0.04, -0.004) | 0.02 | -0.03 | (-0.06, -0.004) | 0.03 |
| Apo B: Apo A1 Ratio | -0.06 | (-0.08, -0.04) | <0.001 | -0.06 | (-0.08, -0.04) | <0.001 | -0.03 | (-0.05, -0.001) | 0.04 |
| Total cholesterol (mmol/l) | 0.05 | (-0.03, 0.14) | 0.21 | 0.07 | (-0.02, 0.15) | 0.11 | -0.05 | (-0.17, 0.07) | 0.38 |
| | Odds ratio (95% CI) | | P value | Odds ratio (95% CI) | | P value | Odds ratio (95% CI) | | P value |
| Hypertension | 1.36 | (1.14,1.63) | 0.001 | 1.44 | (1.18, 1.75) | <0.001 | 1.40 | (1.10, 1.78) | 0.006 |

[a]Model 1: Adjusted for age

[b]Model 2: Model 1 + education + marital status + smoking + level of amenities + employment status + regular physical activity + body mass index

[c]Model 3: Model 2 + latent factor of beer + latent factor of wine + latent factor of spirits

[d] Coefficients refer to change in lipid component in mmols/litre for 1 standard deviation change in the latent factor of acute alcohol-related dysfunction

[e] Odds ratios refer to increase in odds of having hypertension per standard deviation unit increase in the latent factor of acute alcohol-related dysfunction

## Section III: Discussion

# Chapter 11: Discussion and Concluding Comments

Given the strong link between hazardous alcohol consumption and high male mortality in Russia, the main aim of this thesis was to improve understanding of the relationship between alcohol use and health and socio-economic circumstances among working-age men in Izhevsk, Russia. However an important objective in achieving this was to make best use of the available data on alcohol use and therefore a substantial part of the thesis was devoted to considering different methods of measuring alcohol consumption and to identifying key latent dimensions of alcohol use.

## 11.1 Key findings

### 11.1.1 Main substantive findings on Alcohol Use in Russia

- Total volume of beverage alcohol intake and use of non-beverage alcohols were both prospectively related to subsequent employment status. Almost all of these effects were mediated through the impact of alcohol on acute dysfunction (Chapter 9).
- Alcohol consumption was associated with a traditionally cardio-protective lipid profile (higher HDL and lower LDL with increasing consumption) but increased hypertension with frequent heavy consumption (Chapter 10).
- Less educated men had higher levels of alcohol-related problems as measured using the AUDIT even when account was taken of the level of alcohol consumption (Paper 1).
- The risk of acute alcohol-related dysfunction increased with decreasing level of education. However, this appeared to be only partly explained by alcohol intake and drinking patterns which suggests socio-economic factors such as education may be related to vulnerability to alcohol (Paper 2).
- The type of alcohol consumed in particular non-beverage versus beverage alcohol was an important factor in the effects of alcohol consumption on health and social dysfunction (Paper 2, Chapter 9, and Chapter 10).

### 11.1.2 Main Methodological Findings

- Using latent variables to measure beverage alcohol intake provided information on differences between beer, wine and spirit intake in their associations with socio-demographic variables and health which would not have been identified using the more conventional observed measure total volume of ethanol from beverage alcohol per year (Paper 2, Chapter 10).
- The latent alcohol intake variables had advantages over a conventional measure of volume of ethanol in including additional information on the maximum volume of ethanol consumed per occasion but were limited by the fact they could not be used to separate out any different effects of frequency of drinking and volume consumed per occasion (Chapter 6, Chapter 10).
- A latent variable approach to measuring acute alcohol-related dysfunction had several advantages over more conventional approaches to measuring dysfunction such as using each observed dysfunction variable separately or combining information on high frequency of dysfunctional behaviours to create a binary observed variable (Chapter 9).
- The latent factor of routine acute alcohol-related dysfunction showed different associations with socio-economic factors than measures of alcohol intake but similar associations with cardiovascular disease risk factors (Paper 2, Chapter 9, Chapter 10) suggesting this latent variable could have a particularly useful role in understanding the impact of alcohol use on outcomes related to behaviour such as marital breakdown, violence and accidents.

## 11.2 Main Substantive findings on Alcohol Use in Russia

A key finding from this thesis was that while volume of ethanol had no substantive effect on employment status, acute alcohol-related dysfunction was a strong predictor of whether men remained in regular paid employment. Although many studies have found a strong cross-sectional association between alcohol use and employment (46, 284-289) very few other studies have looked at this longitudinally including only one other study from Russia(291). This was the first study to look at the effects of acute alcohol-related dysfunction on employment status and to show that the effects of alcohol intake on employment including the consumption of non-beverage alcohol were mediated through dysfunctional behaviour rather than through effects on health.

Another key finding was that high alcohol consumption was associated with a traditionally cardio-protective lipid profile, not just in terms of higher HDL and Apo A1 which has been shown previously (317, 330)but also lower LDL and Apo B. This finding was consistent across several different measures of alcohol consumption including the alcohol biomarker CDT. Given the high level of mortality from cardio-vascular disease in Russia(11) and the strong association found there in previous studies between hazardous alcohol consumption and cardiovascular mortality (9, 313) this is important as it shows that this association is not due to detrimental effects of alcohol on lipid levels and therefore future research should concentrate on other potential mechanisms for this association.

One of the main objectives of the thesis was to investigate the association between alcohol use and socio-economic factors. A key finding was that men with lower levels of education were at higher risk of experiencing acute alcohol-related dysfunction even taking into account alcohol intake and drinking patterns. The findings on the relationship between education and alcohol use were consistent using both the latent variables of alcohol use developed in the thesis and the more conventional latent dimensions of the AUDIT score. Although an educational gradient in alcohol use has been found previously in Russia (41, 42) this was the first study to show educational differences in dysfunction and alcohol-related problems distinct from differences in alcohol consumption.

## 11.3 Methodological Approaches to Measuring Alcohol Use

In the absence of a gold standard for measuring alcohol use an important objective of this thesis was to investigate whether more sophisticated analytical methods could provide additional information on the relationship of alcohol use with health and socio-economic circumstances beyond that obtained using more conventional approaches, in particular whether latent variables could provide information beyond only observed measures of alcohol use. Overall four latent factors of alcohol use were identified: three alcohol intake factors (beer intake, wine intake and spirits intake) and one factor of routine acute alcohol-related dysfunction. Latent factors of beverage alcohol intake differed in their utility to the latent factor of dysfunction so these two types of latent variable are discussed separately.

### 11.3.1 Beverage Alcohol Intake

In order to decide if using latent variables added anything of value to the analysis it is necessary to consider what the alternative analysis strategy would have been if the analysis had been confined only to observed variables. The three latent factors of beverage alcohol intake (beer intake, wine intake and spirit intake) are most analogous to the conventional measure volume of ethanol from beverage alcohol consumed per year.

Compared to volume of ethanol, the main strength of the measurement model for beverage alcohol intake was that it could be used to study the different effects of the three main beverage types, taking account not just of the volume of ethanol consumed from each beverage type but also associated drinking pattern. The strong effect of spirit intake compared to wine or beer intake on acute alcohol-related dysfunction (Paper 2) suggests this is due not just to the higher proportion of volume of ethanol coming from spirit consumption overall but also the propensity for spirits to be consumed in very large volumes per occasion compared to average consumption of beer and wine. The differences found between the three beverage types in their associations with acute alcohol-related dysfunction (Paper 2), education (Paper 2) and cardiovascular risk factors (Chapter 10) are key findings which could not have been identified using only total volume of ethanol.

Maximum volume of ethanol consumed per drinking occasion had the highest factor loading for all three latent variables which shows it was an important aspect of the latent factors of beverage alcohol intake (see Chapter 6). For obvious reasons this variable was not used in calculating the observed variable total volume of ethanol from beverage alcohol per year and therefore results between the latent and observed variables are not directly comparable.  Despite this it seemed important to include maximum volume as when answering questions on usual volume per occasion respondents are more likely to report modal rather than mean consumption ignoring less frequent heavy drinking occasions. Including maximum volume per occasion to some extent addresses this by including information on heavier drinking occasions. Additionally the high factor loading for maximum volume of ethanol shows this variable is strongly associated with the underlying latent factor and has better discrimination for separating men in terms of their alcohol intake than frequency and usual volume alone. The ability to include additional information on maximum volume, which is already commonly included in surveys measuring alcohol use, was a strength of using latent variables to measure beverage alcohol intake.

An important limitation of the beverage alcohol intake (latent) model developed in the thesis was that it could not be used to separate out effects of frequency of drinking from effects of large volumes per occasion. Conceptually a model with a “frequency” factor and a “volume per occasion” factor is appealing but surprisingly was not supported by the data. In many circumstances the different components of the latent factors (i.e. frequency of consumption, usual volume per occasion and maximum volume per occasion) are likely to be of interest in themselves and therefore combining information on all these measures may obscure important differences in the effects of volume compared to frequency.

Since a latent factor does not have any units a more general limitation to using latent factors to measure alcohol intake it that it is difficult to interpret how this relates in absolute terms to amount of ethanol consumed i.e. how much ethanol does a man with a high spirit intake score actually consume? How much of a problem this is depends on the nature of the question being asked. The role of latent variables in making public health recommendations on safe drinking levels is limited since for example while the importance of maximum volume shows the need to provide recommendations on the maximum amount of alcohol that can be safely consumed it is not clear what these recommendations should be. However latent variables can be appropriately used for ranking levels of consumption and therefore have a potential role in increasing understanding of aetiology.

Although the model of beverage alcohol intake has some limitations and did not have an advantage over total volume of ethanol in terms of data reduction, developing this model raised interesting questions about differences in drinking pattern by type of beverage and how this related to socio-demographic variables such as education. It would be interesting to investigate how this model and its association with socio-demographic variables might differ in a population with different drinking patterns such as a higher proportion of alcohol intake from beer or wine compared to spirits.

### 11.3.2 Routine Acute alcohol-related dysfunction

The second type of latent variable developed in the thesis was manifested by several acute consequences of alcohol consumption (frequency of hangover, excessive drunkenness, sleeping in clothes because of drunkenness and failing family or personal obligations due to drinking) and was labelled "routine acute alcohol-related dysfunction" as all these behaviours could be considered as types of alcohol-related dysfunction. There are two main areas of importance to be discussed in relation to this variable: 1) Did using a latent variable to measure dysfunction add anything compared to simpler analyses using only observed variables? and 2) how useful is it to measure acute dysfunction?

In contrast to measuring alcohol intake, using a latent variable to measure alcohol-related dysfunction had several obvious advantages over using the individual observed categorical variables on frequency of individual types of dysfunctions. Firstly from the point of data reduction using one latent variable of dysfunction was superior to using the four observed variables separately. However, instead of using a latent variable, information on all four variables could have been combined to form an observed binary measure of dysfunction using a pre-determined cut-point (e.g. twice weekly or more often) to define dysfunction. This approach was used to investigate acute dysfunction as a predictor of employment and the results compared to those using the latent variable of acute alcohol-related dysfunction (Chapter 9). Compared with the binary observed measure of dysfunction the latent variable had several advantages. The latent variable made use of information on the frequency of all four behaviours and since the itwas continuous it better represented the probable nature of dysfunction as a spectrum. The latent variable was a much stronger predictor of employment status than the binary measure even though both variables were derived from the same four observed variables. Overall using a latent variable to measure acute alcohol-related dysfunction seemed an appropriate use of the data and to provide more information than using only observed variables.

The latent variable acute alcohol-related dysfunction showed strong associations with education (Paper 2) and cardiovascular risk factors (Chapter 10) and predicted future employment status independent of volume of ethanol consumed (Chapter 9). Therefore it seems to be an important aspect of alcohol use and worth measuring in addition to consumption. However it is important to be clear what this latent variable is actually measuring. By calling this variable the latent factor of acute alcohol-related dysfunction it has been labelled a measure of harm from alcohol (an outcome variable). This label was used since all the observed variables manifested by the latent variable are consequences of alcohol consumption and can only occur after alcohol is consumed.

This latent variable could also be perceived as a measure of an extreme drinking pattern since the acute consequences of alcohol consumption can also be used as proxy measures of very heavy drinking occasions. However if acute dysfunction is only a measure of a hazardous drinking pattern in terms of frequent consumption of large volumes of ethanol, and alcohol consumption is measured accurately in terms of alcohol intake and drinking pattern, then alcohol consumption should explain entirely any relationship between dysfunction and more distal outcome variables. This was not found to be the case with respect to the association with education and acute alcohol-related dysfunction which was not explained by beverage or non-beverage alcohol intake or drinking patterns (Paper 2).

Conversely if the latent acute dysfunction variable is a measure of alcohol-related harm it might be expected to show independent effects beyond alcohol intake for outcomes related to behaviour but not for outcomes related to the physiological effects of ethanol such as lipid levels. In contrast to the findings for education, the relationship with acute dysfunction and serum lipids with the exception of Apo B was explained by either beverage or non-beverage alcohol intake (Chapter 10). The relationship between acute dysfunction and employment (an outcome likely to be related to behavioural effects of alcohol) was very different to the relationship between volume of ethanol and employment (Chapter 9) whereas the associations between acute dysfunction and cardiovascular risk factors (outcomes more likely to be related to the physiological effects of ethanol) were very similar to the relationships between latent beverage alcohol intake factors and cardiovascular risk factors (Chapter 10). This seems to suggest that although a measure of dysfunction is naturally strongly associated with amount of ethanol consumed and could be used as a proxy measure of heavy drinking, it can be used, in conjunction with measures of alcohol intake, as a measure of the immediate impact of heavy drinking on an individual. This latent variable could therefore be very useful in investigating the impact of alcohol use on outcomes related to behaviour such as marital breakdown, violence and accidents.

**Measures of dysfunction in Other Studies**

Dysfunctional behaviours such as drunkenness have frequently been used as proxy measures of heavy alcohol consumption (92, 152, 270, 271) and as predictors of more distal harm from alcohol(270, 271) however considering several measures of dysfunction as manifestations of a latent variable is a novel approach.

Khan et al (2002) in their typology of alcohol use included three dimensions: alcohol use, alcohol-related problems and alcohol dependence, with alcohol use influencing both alcohol-related problems and dependence(241). The dimension of alcohol-related problems developed by Khan et al could be considered similar to the dimension of acute alcohol-related dysfunction measured in Izhevsk however there are some important differences between these two dimensions. The dimension of alcohol-related problems developed by Khan et al was manifested by a mixture of drinking pattern, symptoms of alcohol dependence and more distal consequences of alcohol consumption. Similarly the AUDIT dimension of alcohol-related problems which might also be considered analogous to the latent factor of acute alcohol-related dysfunction contains a mixture of acute consequences of alcohol consumption (such as being unable to remember what happened the night before because of drinking) but also symptoms of alcohol dependence (such as being unable to stop drinking once started). The latent variable acute alcohol-related dysfunction only includes acute consequences of consumption and therefore is more an indicator of very heavy drinking leading to short term dysfunction rather than alcohol dependence (although the two are likely to be inter-related).

Another difference to the dimension of alcohol-related problems developed by Khan et al and many other scales of alcohol-related problems as, with the exception of the question on failing to fulfil family or personal obligation due drinking, it only includes consequences which are necessarily caused by alcohol such as hangover and drunkenness and therefore should be less affected by whether people attribute their problems to alcohol or not. Also unlike many alcohol-related social problem scales only consequences of alcohol which could be experienced by any drinker were included as many alcohol-related problems may not be applicable to the whole population of drinkers (for example problems at work are not applicable to those who are currently unemployed) and therefore could underestimate the true impact of alcohol consumption in the population.

### 11.3.3 Structural equation modelling

Another innovative methodological approach was the use of structural equation modelling (SEM) to investigate the relationship between the latent dimensions of alcohol use and observed aspects of alcohol consumption, socio-demographic variables and cardiovascular risk factors.

A major advantage to using structural equation modelling for investigating the relationship between different aspects of alcohol use and health and socio-economic circumstances was that it could be used to investigate mediation and separate out both direct and indirect effects of variables under the assumption of no unmeasured confounding(310). This was important when investigating the inter-relationship between alcohol intake, alcohol-related dysfunction and employment in Chapter 9. It would not have been possible to investigate dysfunction as a mediator of this relationship using a more conventional analysis approach such as logistic regression.

## 11.4 Recommendations for measuring alcohol use

The Izhevsk Family Studies included a large variety of alcohol measures. However not all studies will be able to include as many measures of alcohol use. The results of this thesis strongly suggest that measures of acute alcohol-related dysfunction such as hangover and drunkenness provide important additional information beyond measures of quantity and frequency of consumption particularly when the outcome of interest is related to behaviour and should be included in surveys measuring alcohol use. If information on frequency of several dysfunctional behaviours is collected these can be used to identify an underlying latent variable of acute alcohol-related dysfunction which could be an extremely useful tool in epidemiological research in particular since structural equation modelling can then be used to explore the complex relationship between alcohol consumption, alcohol-related dysfunction and more distal alcohol-related problems. These findings with regard to acute alcohol-related dysfunction are relevant to studies worldwide, not just to those in Russia. Further work is needed exploring the use of latent variables to measure acute alcohol-related dysfunction in other populations and in women as well as men. Future work could involve investigating the relationship between acute dysfunction and many other outcomes. Some suggested outcomes where alcohol-related dysfunction may be an important factor include marital dysfunction, mental health problems and alcohol-related violence and injuries.

More specific to Russia surveys should include questions on non-beverage alcohol consumption since this had effects on acute alcohol-related dysfunction and employment independent of total volume of beverage alcohol.

## 11.5 Concluding Comments

Very few studies have used factor analysis to identify latent dimensions of alcohol use in a general population survey. This has never been done previously in Russia.

Hazardous alcohol consumption among working-age men in Izhevsk, Russia strongly influenced employment status and risk factors for cardio-vascular disease. Measures of non-beverage alcohol use and acute dysfunction from alcohol (both routine and sporadic) provided information on the impact of alcohol beyond measures of beverage volume and frequency. While the role of latent variables to measure alcohol intake had certain limitations, a latent variable approach had many advantages as a method for measuring acute alcohol-related dysfunction.

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# Appendix 1: Statistical Methods

## Variance, Covariance and Correlation

Variance is a measure of the variation in an observed variable (i.e. how far values are from the mean of the variable).

**Equation 1: Formula for calculating variance(338)**

$$\frac{\sum(\boldsymbol{x_i} - \overline{\boldsymbol{x}})^2}{\boldsymbol{n} - \mathbf{1}}$$

Where $\bar{x}$ = mean of X

Covariance is an unstandardized measure of how two variables change together, or the association between two variables. The units of measurement for the covariance of two variables X and Y are the units of X multiplied by the units of Y.

**Equation 2: Formula for calculating covariance(338)**

$$\frac{\sum(\boldsymbol{x_i} - \overline{\boldsymbol{x}})(\boldsymbol{y_i} - \overline{\boldsymbol{y}})}{\boldsymbol{n} - \mathbf{1}}$$

Covariance can be used to calculate correlation, which is a standardized measure of the association between two variables. The most commonly used measure of correlation is Pearson's correlation coefficient. This is used to measure the amount of linear correlation between two continuous variables. It can take any value from -1 (perfect negative correlation) to 1 (perfect positive correlation) with zero meaning no linear relationship between the two variables although there may be still be a curvilinear relationship.

Other measures of correlation include Spearman's Rank coefficient (a non-parametric measure of correlation), polychoric correlation (a measure of the correlation between two theoretically normally distributed continuous variables from two observed ordered categorical variables) and tetrachoric correlation (a type of polychoric correlation where the observed variables are binary)(339, 340).

## Factor Analysis

Variance in a set of related observed variables is made up of three types of variance: common or shared variance, unique variance and error variance. Factor analysis is statistical technique which uses the common variance between observed variables to find underlying latent variables known as factors(261, 262, 341). These factors may also be referred to as latent dimensions since the underlying latent variable is assumed to be continuous and normally distributed.  Factor analysis can be used for data reduction as a large number of observed variables can be reduced to a smaller number of latent factors(267, 342). It can also be used to identify underlying mechanisms explaining the correlation between observed variables. Factor analysis unlike principal components analysis uses only the common variance to extract factors and therefore another use of factor analysis is to reduce measurement error.

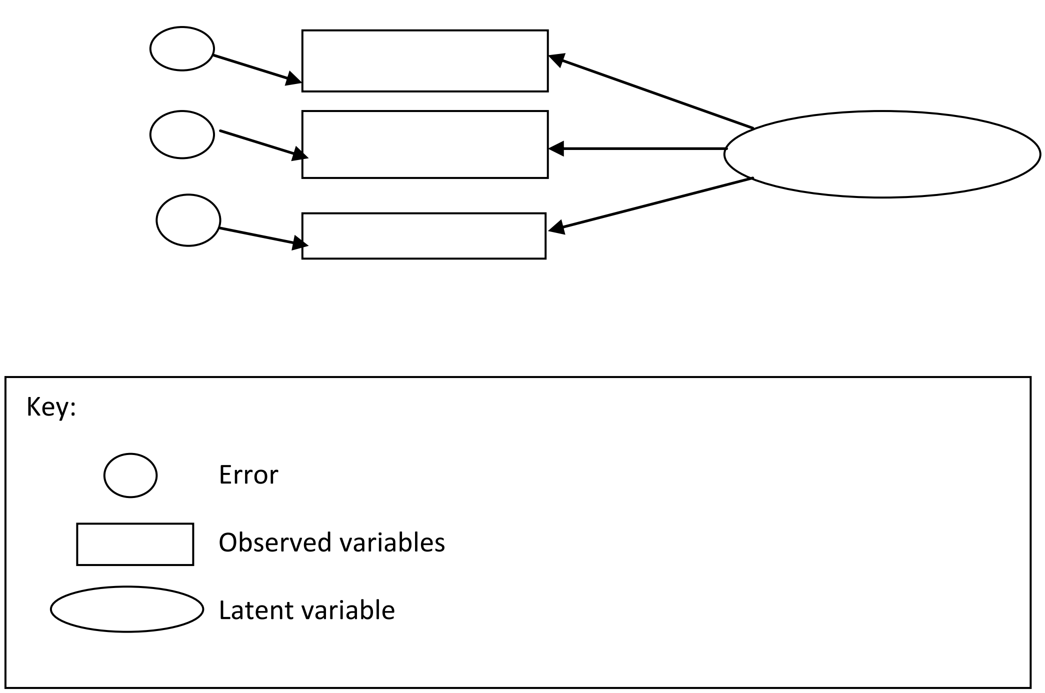
Factor analysis can be used with observed categorical data with the assumption that the underlying latent variable for the observed categories is a normally distributed continuous variable. Other model assumptions for factor analysis are multivariate normality of all underlying constructs and that the relationship between latent and observed variables is linear. Data are suitable for factor analysis if there are no outliers since these have a greater influence on the factor solution than other variables; there is reasonable correlation between observed variables; and the sample size is adequate(267, 341). The sample size needed for finding replicable factors will depend on how many observed variables load on each factor and how strongly variables are related to the latent factors, however guidelines for adequate sample size are either at least 300 subjects or 10 subjects per observed variable(267, 342).

## Confirmatory factor analysis

Factor analysis can be either exploratory or confirmatory. Explanatory factor analysis (EFA) is used in the early stages to decide which observed variables correlate together and how many factors should be selected to explain the observed data. Confirmatory factor analysis (CFA) is used to test the fit of an already specified model(263). Pre-existing knowledge is used to specify a priori both the number of factors and the observed variables that are indicators of each factor(264).

When representing a confirmatory factor model with a diagram rectangles are used to represent observed variables and oblongs to represent latent variables. Arrows point from the latent variables to the observed variables which are indicators of the latent variable. The arrows point from the latent variables to the observed variables and not the other way round because of the underlying theory that the underlying latent variable accounts for the correlation between the observed variables (268)

**Diagrammatic representation of a confirmatory factor analysis model**



Factor loadings give a measure of how strongly observed variables are related to an underlying latent factor. The larger the factor loading is, the stronger the relationship between the observed variable and the latent factor. Comrey and Lee (1992) suggest standardized factor loadings for over 0.71 are excellent, over 0.63 are very good, over 0.55 are good, over 0.45 are fair and over 0.32 are poor(261). In general factor loadings below 0.3 or even 0.4 are considered to show there is no relationship between the observed variable and the latent factor(261, 267). However these are only guidelines and the size of factor loadings is influenced by correlation between factors and sample homogeneity so if a sample is homogeneous with respect to observed variables a lower cut off for the interpretation of factor loadings should be used(261, 267).

Confirmatory factor analysis models can be hierarchical. A first order confirmatory factor analysis model is one where all latent variables are measured directly by observed variables. A second order confirmatory factor analysis model contains at least one latent factor which is not directly measured by any observed variables but is measured by several first order factors which are correlated with each other. This second order factor is presumed to have direct casual effects on the first order factors (264). A confirmatory factor model which includes a second order factor will always have the same fit as the model without the second order factor.

Following factor analysis, factor scores can be created which are variables indicating an individual's placement on a latent factor(343).Factor scores are estimates of the scores subjects would have received on this latent factor if it was observable (267). There are various methods of calculating factor scores(343). The method used by Mplus and therefore in the thesis is the regression method(344). However caution should be used as factor scores are only estimates and each method of calculating them has drawbacks. The regression method is biased as relationships between variables due to chance inflate the correlation between factor scores and the underlying factor(261, 267).

## Structural Equation Modelling

Structural equation modelling (SEM) is a broad family of statistical techniques which can be used to examine the relationship between one or more dependent (or endogenous) variables and one or more independent (or exogenous) variables where variables can be latent or observed(263, 267). A structural equation model has two parts: the measurement model and the structural model (269). The measurement model is the part of a SEM model that relates observed variables to latent variables. The structural model is the part of a SEM which specifies the hypothesized relationship between variables. Confirmatory factor analysis is a special case within the broad family of structural equation modelling which can be used for the measurement model. Like confirmatory factor analysis, SEMs use covariance between variables, although means can also be analysed (264).The goals of structural equation modelling are 1) to understand patterns of covariance between observed variables and 2) to find a model which explains as much of the variance in observed variables as possible(345).

SEMs should be specified using a priori knowledge of the supposed relationship between variables(264). Specification of the model including which variables are related to each other and the direction of effects is an important first step in structural equation modelling which should be based on existing knowledge or theory rather than statistical fit. However SEMs do not have to be used purely for confirmatory purposes. They can also be used to test alternate models or to modify hypotheses if data do not fit a proposed model(264).

SEM is a flexible technique with several potential advantages over more conventional regression models: 1) it allows the inclusion of latent as well as observed variables, 2) it explicitly estimates measurement error and 3) it can be used to separate direct and indirect effects of variables under the assumption of no unmeasured confounders(310, 346).

## Model Fit Indices

There are several methods of assessing model fit for confirmatory factor analysis and structural equation models. None of the model fit indices available are perfect and it is advisable not to rely heavily on one measure of model fit but to use a variety of fit indices as estimates of global model fit. Below is a summary of the model fit indices used in the thesis.

**Comparative Fit Index (CFI):** This is a measure of how well the specified model fits compared to the null model (no correlation between variables). It can take a value between 0 and 1.Conventionally values over 0.90 indicate acceptable fit and greater than 0.95 indicate the model fits well (267, 268).

**Equation 3: Calculation of the Comparative Fit Index(347)**

$$\boldsymbol{CFI = 1 - \frac{\left({\chi^2}_{H_0} - df_{H_0}\right)}{\left({\chi^2}_{b} - df_{b}\right)}}$$

Where $df_b$ is degrees of freedom of baseline model (null model) and $df_{H0}$ is the degrees of freedom of the hypothesized model.

**Tucker Lewis Index (TLI):** Like the Comparative fit index this is a measure of how well the specified model fits compared to the null model. It can take a value between 0 and 1. Values over 0.90 indicate acceptable fit and greater than 0.95 indicate the model fits well (267, 268, 347). Model fit is often underestimated if sample size is small (less than 100)(347).

**Equation 4: Calculation of the Tucker Lewis Index (347)**

$$\boldsymbol{TLI = \frac{({\chi^2}_b/df_b) - ({\chi^2}_{H_0}/df_{H_0})}{({\chi^2}_b/df_b) - 1}}$$

**Root Mean Square of Approximation (RMSEA):** The RMSEA is an error of approximation index- a measure of whether the data deviate from the model. A RMSEA of <0.05 indicates good model fit, <0.08 indicates acceptable model fit and >0.1 suggests the model fits poorly (268, 347).

**Equation 5: Calculation of the Root Mean Square of Approximation(264, 348)**

$$\boldsymbol{RMSEA} = \sqrt{\frac{\boldsymbol{max}\,(\boldsymbol{\chi^2}_{\boldsymbol{H0}} - \boldsymbol{df}_{\boldsymbol{Ho},}\boldsymbol{0})}{\boldsymbol{df}_{\boldsymbol{H0}}(\boldsymbol{N}-\boldsymbol{1})}}$$

## Estimation Methods for factor analysis and structural equation models

The main estimation method used in the thesis was Weighted Least Squares with Mean and Variance Adjusted (WLSMV). This is part of a family of methods known as weighted least squares (WLS). These are estimation methods which do not assume multivariate normality and are therefore more appropriate for categorical data (263-266). Generally Maximum likelihood (ML) estimation is the most commonly used estimation method for factor analysis and structural equation models however ML estimation assumes multivariate normality and therefore may not be valid when variables are categorical. ML estimation was used in the thesis to calculate odds ratios for binary outcomes where appropriate since WLSMV estimates probit coefficients for binary outcomes which are harder to interpret.

**Interpretation of estimates**

Parameter estimates from structural equation models may be unstandardized or standardised. The unstandardized estimate is the effect of 1 unit change in X (exposure) on Y (outcome) in units of Y. The fully standardized estimate is the effect of 1 SD change in

X on Y in SD units of Y. It is also possible to only standardise by X or only standardise by Y, i.e. the X standardized estimate is the effect of 1 SD increase in X on Y in units of Y.

## Probit regression

Probit regression is an analysis method for modelling binary outcomes using an inverse cumulative standard normal distribution function(311). A major assumption of a probit model is that although there are only two possible responses for the observed outcome there is an underlying continuous latent variable with an S-shaped distribution (cumulative standard normal distribution) which determines the probability of observing a particular outcome. Probit regression coefficients are estimates of the change in z-score or probit index on the underlying latent variable for one unit change in the explanatory variable. Probit coefficients can then be converted into the predicted probabilities of experiencing the outcome. However since the underlying latent variable is S-shaped and not linear, the impact of 1 unit change in z-score is not equivalent to the same change in predicted probability of observing a particular outcome at all places along the latent variable. Probit regression models usually produces equivalent results in terms of predicted probabilities to logistic regression models but probit regression coefficients are harder to interpret than log odds ratios.

## Missing Data

Missing data is a problem as it is a source of selection bias and also reduces sample size. Methods for dealing with missing data depend on the probable missingness mechanism. There are three broad classes of missingness mechanism: missing completely at random (MCAR), missing at random (MAR) and missing not at random (MNAR)(259). Missing completely at random means missingness is unrelated to any variables involved in the analysis. Missing at random means missing observations can be explained by other non missing observations and therefore conditional on what is observed, data is missing at random. Missing not at random means the reason for missing observations depends on the missing observations themselves and therefore even given the observed data the data is not missing at random. It is never possible to know for certain the true missingness mechanism. In reality MCAR is usually extremely unlikely.

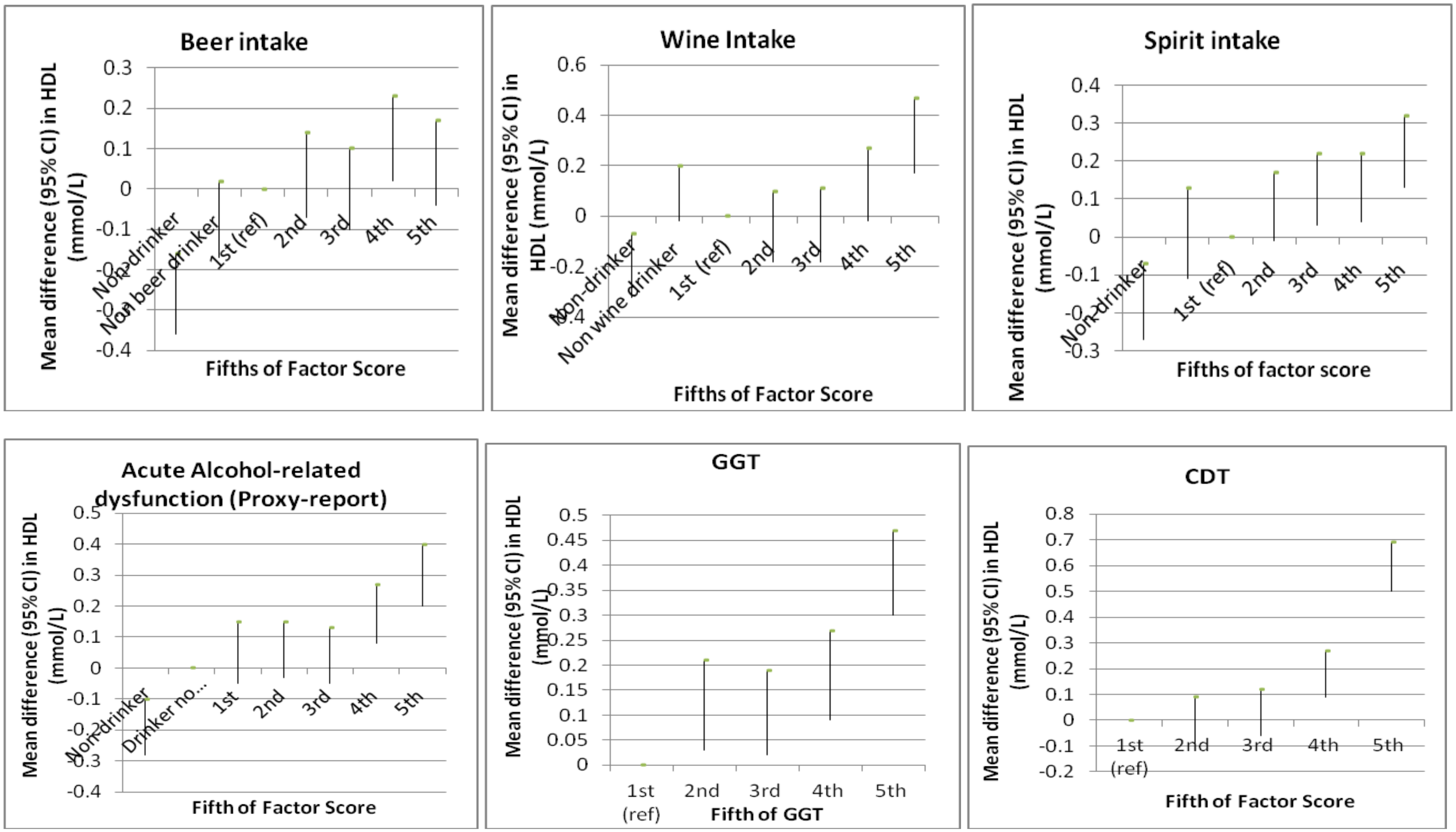
The method for dealing with missing data in structural equation models using Mplus depends on the model estimation method:

When the estimator is WMSLV missing data is handled using a pairwise present approach when no covariates are present and as a function of observed covariates when they are(269, 349). In a pairwise present analysis all available data is used for the estimation of each correlation and therefore the sample size can vary for each correlation. A pairwise present approach is valid when the missingness mechanism is MCAR but may be biased when missing data are MAR or NMAR.

When the estimator is Maximum likelihood missing data is estimated via the Expectation-Maximization (EM) algorithm. In contrast to WMSLV, maximum likelihood estimation is appropriate when the missingness mechanism is MAR as well as MCAR(269).

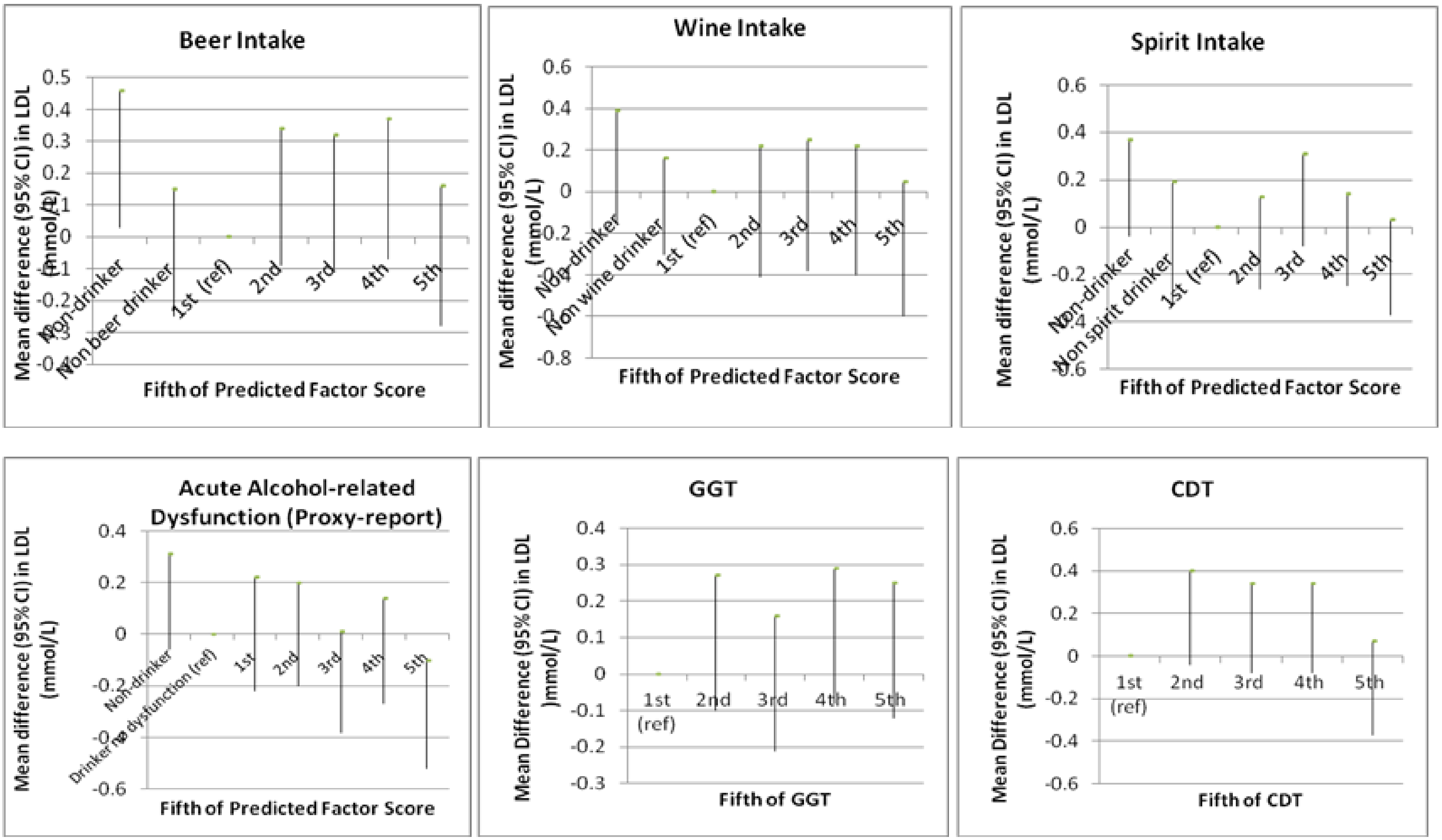
# Appendix 2: Relationship of fifths of factor scores for latent alcohol variables and fifths of alcohol biomarkers with Cardiovascular Risk Factors

**Figure 1: Relationship between latent alcohol use variables, alcohol biomarkers and high density lipoprotein (HDL) at IFS-2**



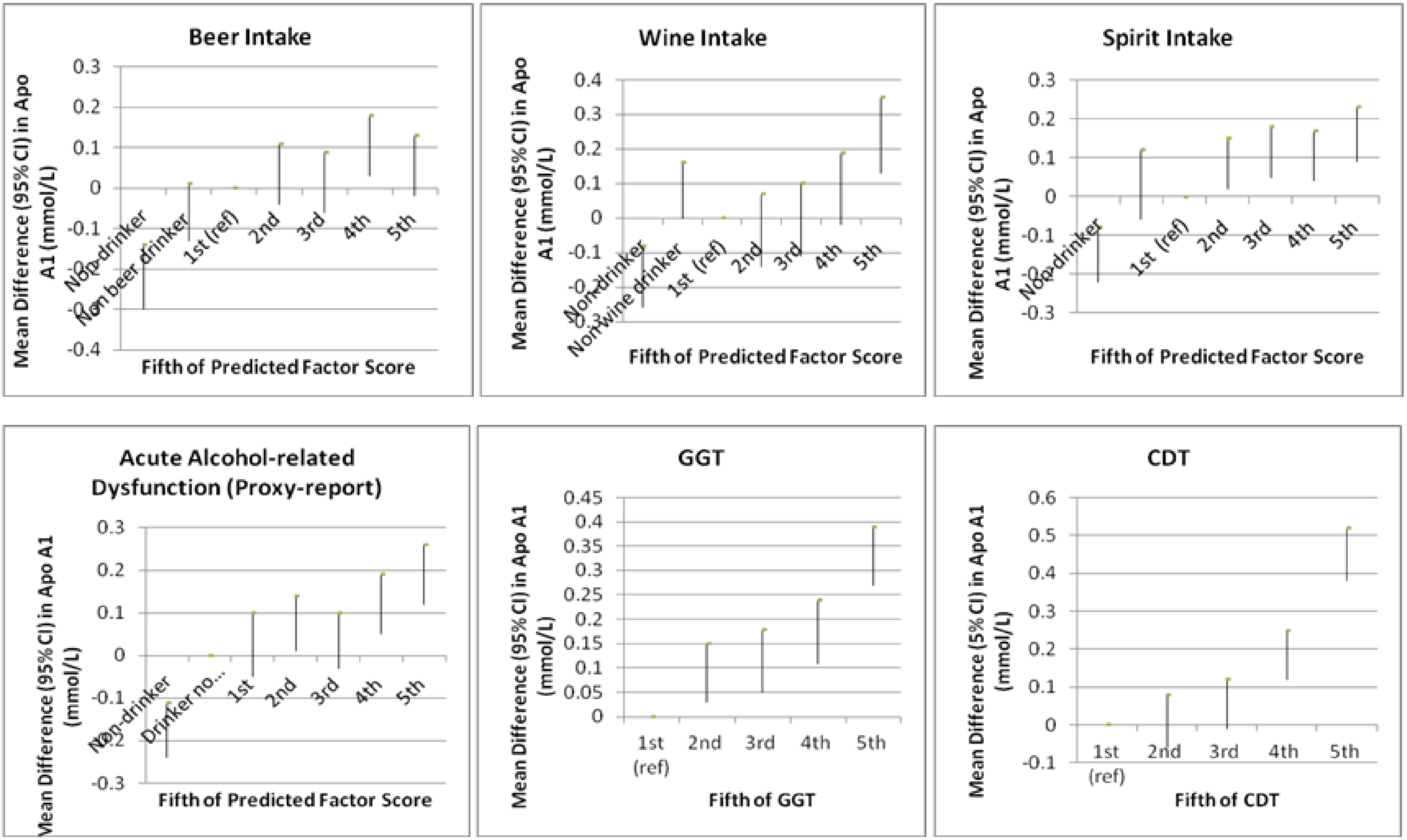

*Adjusted for age, education, marital status, employment, physical activity, level of amenities, smoking and Body Mass Index

**Figure 2: Relationship between latent alcohol use variables, alcohol biomarkers and low density lipoprotein at IFS-2**



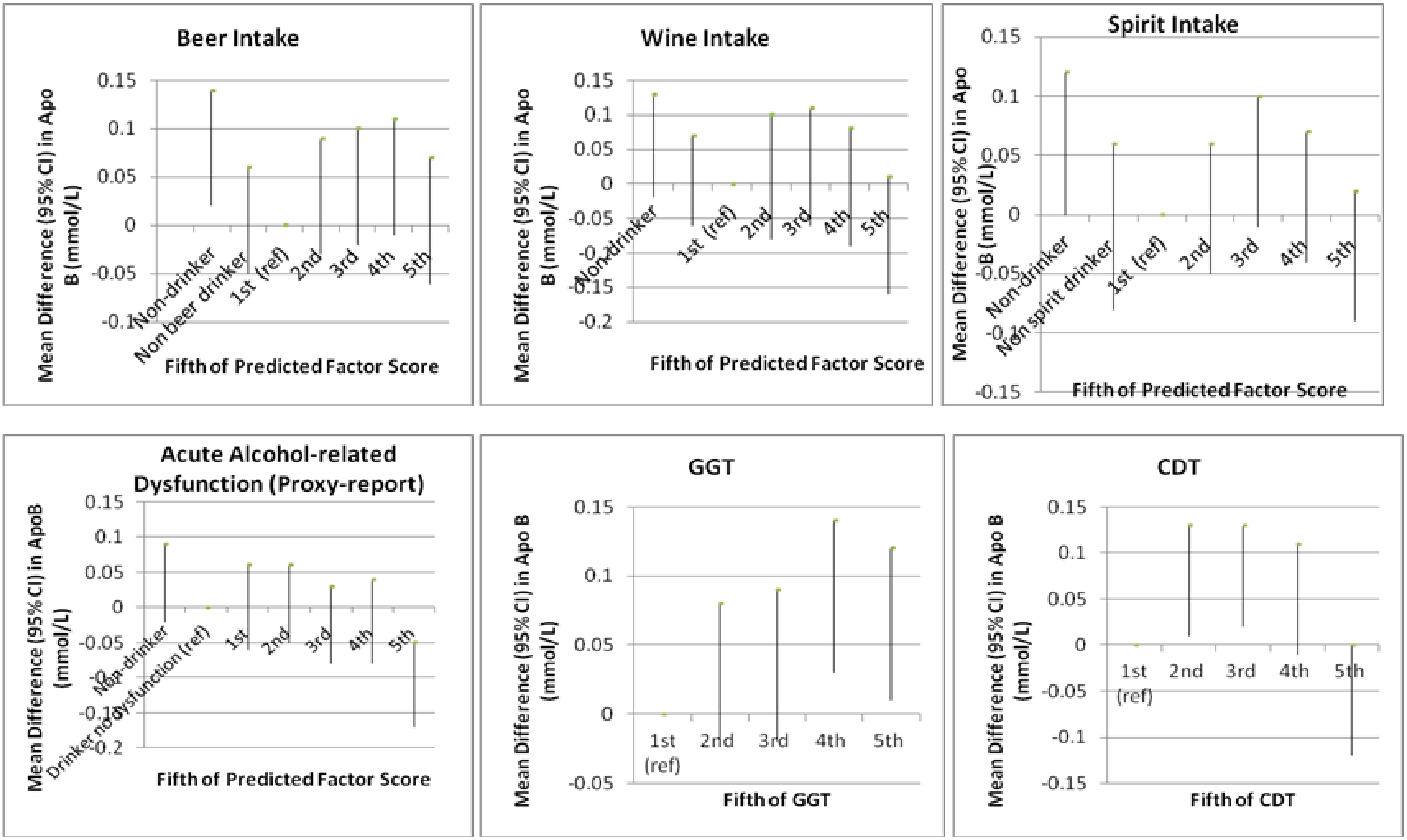

*Adjusted for age, education, marital status, employment, physical activity, level of amenities, smoking and Body Mass Index

**Figure 3: Relationship between latent alcohol use variables, alcohol biomarkers and apo-lipoprotein A1 (Apo A1) at IFS-2**



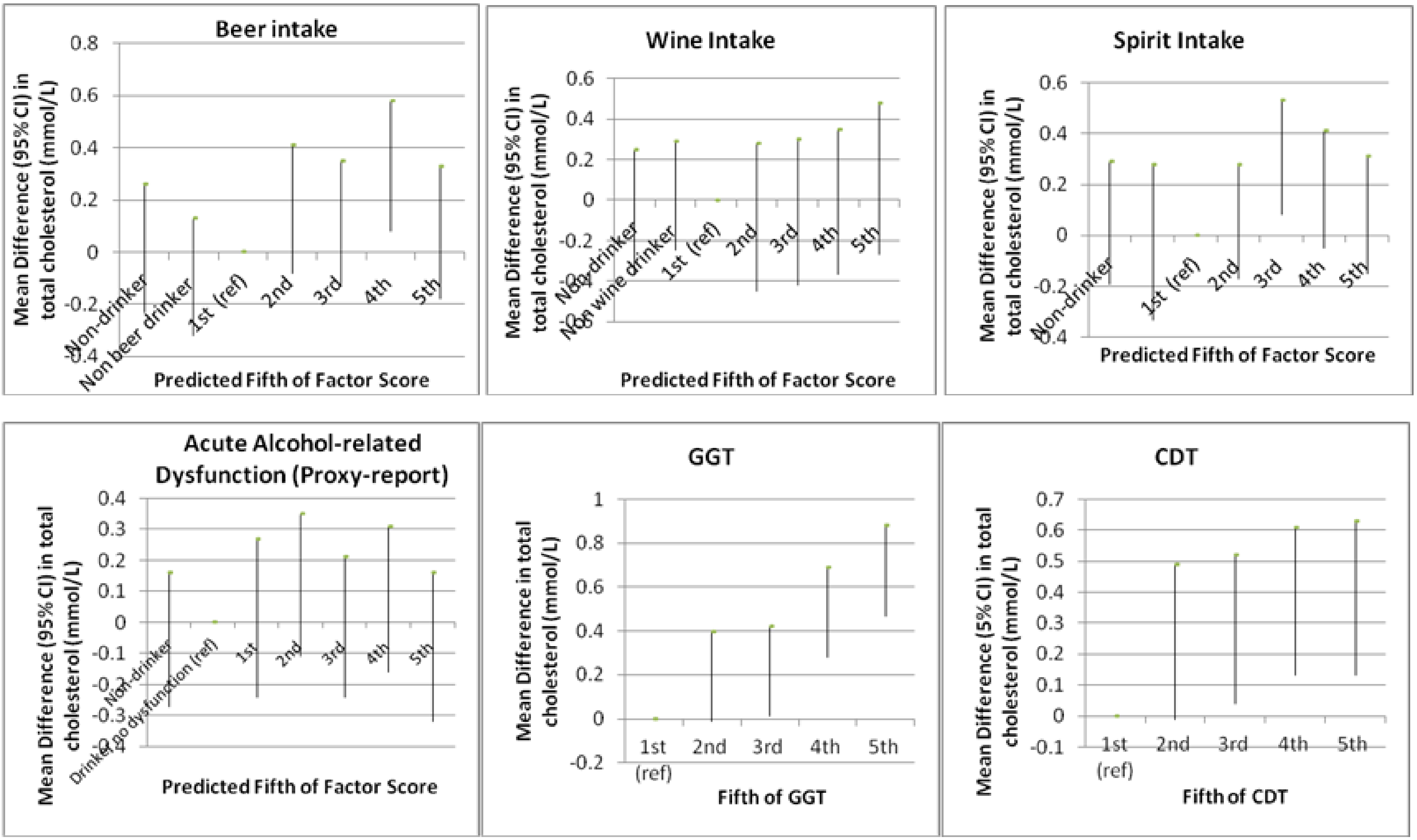

*Adjusted for age, education, marital status, employment, physical activity, level of amenities, smoking and Body Mass Index

**Figure 4: Relationship between latent alcohol use variables, alcohol biomarkers and apo-lipoprotein B (Apo B) at IFS-2**



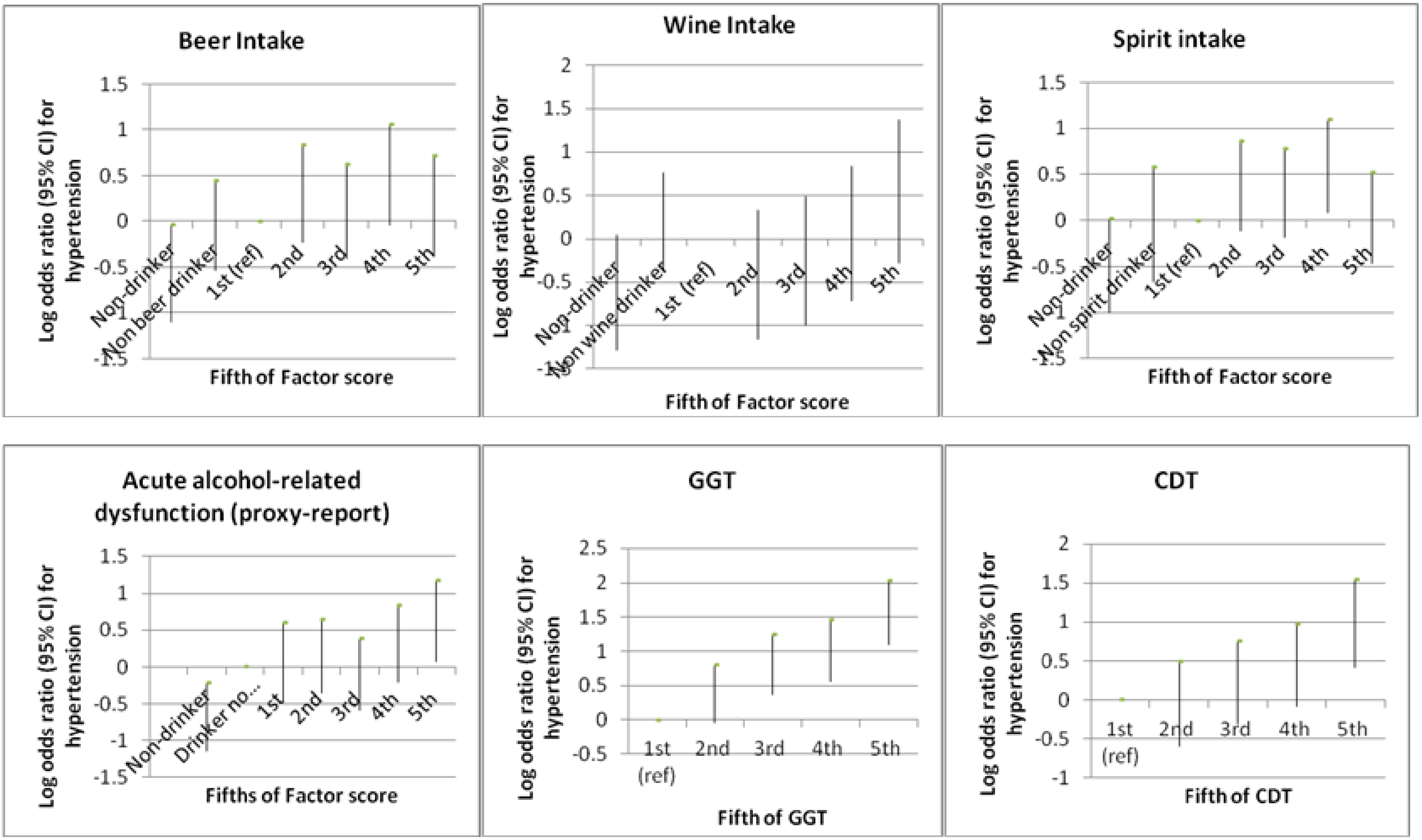

*Adjusted for age, education, marital status, employment, physical activity, level of amenities, smoking and Body Mass Index

**Figure 5: Relationship between latent alcohol use variables, alcohol biomarkers and total cholesterol at IFS-2**




*Adjusted for age, education, marital status, employment, physical activity, level of amenities, smoking and Body Mass Index

**Figure 6: Relationship between latent alcohol use variables, alcohol biomarkers and hypertension at IFS-2**




*Adjusted for age, education, marital status, employment, physical activity, level of amenities, smoking, and Body Mass Index

# Appendix 3: English versions of IFS Questionnaires

# A: IFS-1 Index Questionnaire

**Izhevsk Family Study**
**Control questionnaire**
**Cover Sheet: to be completed by the interviewer**

| | |
|---|---|
| Subject number | ☐☐☐☐☐☐ |
| Date of interview | DD ☐☐ MM ☐☐ YYYY ☐☐☐☐ |
| Interviewer first name | ........................................................ |
| Interviewer last name | ........................................................ |
| Interviewer code | ☐☐☐☐ |
| Time started | ☐☐ : ☐☐ |
| Time ended | ☐☐ : ☐☐ |

**Having read the information sheet, are you willing to be interviewed and for the information collected to be used for the purposes of this scientific study?**

| | |
|---|---|
| Has respondent read the study information sheets? | Yes ☐ |
| Has respondent given verbal consent? | Yes ☐ |

Instructions to interviewer:

Some questions ask about the behaviour of *the subject* during the past year (G11, some questions in section L). For these questions, please disregard any changes in behaviour that occurred in the last few months due to ill health.

How to fill in this questionnaire:

- where there are numbers, circle one or more as indicated for each specific question
- where there are lines, fill in with text
- where there are small boxes, fill in with figures and leading zeros if necessary. E.g. 'ten' would be:

| | | |
|---|---|---|
| 0 | 1 | 0 |

Different fonts will be used to help you distinguish between different types of phrases:

**Questions, to be read out to the respondent, will be written like this.**
Instructions, to be read out to the respondent, will be written like this.
*Instructions for you, the interviewer, will be written like this. These should not be read out.*

## Questionnaire: control

*This questionnaire deliberately starts with section E, question E9 (E1 – E8 are deliberately excluded).*

I would like to begin by asking you some questions about yourself

**E9. How old are you?**

☐☐☐ years
97 difficult to answer
98 refuse to answer

**E10. What is your date of birth?**

DD☐☐ MM☐☐ YYYY☐☐
97 difficult to answer
98 refuse to answer

**E11. What is your nationality?**

*Please circle the single most appropriate answer.*
1 Russian
2 Urdmurt
3 Tatar
4 Other (specify) .................... .................... .................... .................... .................... ....................
97 difficult to answer
98 refuse to answer

**E12. Please could you tell me the region in which you were born?**

*Please circle the single most appropriate answer.*
1 Izhevsk ⇨**go to** E14
2 Other part of Udmurtia
3 A different oblast of Russia
4 A part of the former Soviet Union outside Russia
5 Outside the former Soviet Union
97 difficult to answer ⇨***go to** E14*
98 refuse to answer ⇨***go to** E14*

**E13. Was the place you were born in an urban or a rural area?**

*Please circle the single most appropriate answer.*
1 urban
2 rural
97 difficult to answer
98 refuse to answer

**E14. How long have you continuously lived in Izhevsk?**

*Please circle the single most appropriate answer.*

1 less than 6 months
2 6 months - 1 year
3 more than 1 year but less than 5 years
4 more than 5 years but less than 10 years
5 over 10 years but not my whole life
6 since birth (excluding army and temporary periods away of up to 5 years)
97 difficult to answer
98 refuse to answer

**E15. What is your current marital status? Are you:**

*Please circle the single most appropriate answer.*

1 Living together with a spouse in a registered marriage
2 Living together with a spouse but not in a registered marriage
3 Divorced or separated
4 Widower
5 Never married
97 difficult to answer
98 refuse to answer

*The next section is Section B*

I would like to ask you your views about the area you live in

**B1. What is your view of the general state of this neighbourhood as a place to live?**

*Please circle the single most appropriate answer.*
1 very good
2 good
3 fair
4 poor
5 very poor
97 difficult to answer
98 refuse to answer

**B2. Please select the phrase from the following five choices that best describes the people in your neighbourhood.**

*Please circle the single most appropriate answer.*
1 Everyone is friendly towards each other
2 Most of them are friendly towards each other
3 Some of them are friendly towards each other
4 A few of them are friendly towards each other
5 No one is friendly towards each other
97 difficult to answer
98 refuse to answer

**B3. With regard to level of crime, how do you see this neighbourhood?**

*Please circle the single most appropriate answer.*
1 there is a high level of crime
2 there is a moderate level of crime
3 there is a low level of crime
97 difficult to answer
98 refuse to answer

Now a few questions about whether you or any other member of your household have been a victim of crime

**B4. Please indicate which, if any, of the following crimes have affected this residence or things belonging to members of the household during the past year**
*Multiple responses are permitted. Please circle all that apply.*
1 a car or other vehicle was stolen
2 something was stolen out of a car
3 a vehicle was damaged or destroyed by vandals or people out to steal
4 someone got into this residence without permission and stole something
5 someone got into this residence without permission and caused damage
6 someone attempted to get into this residence without permission
7 something was stolen from outside the residence (from garage, dacha, etc)
8 deliberate damage was done to this residence or anything outside it that belonged to someone in this household
9 other (specify) ........................................................................................................................
10 none of the above
97 difficult to answer
98 refuse to answer

*Question B5 is deliberately excluded*

**B6. I now want to ask you which, if any, of the following crimes were committed against you personally during the past year**

*Multiple responses are permitted. Please circle all that apply.*

1 something you were carrying was stolen out of his hands or from his pockets, bag or case
2 something was stolen from a cloakroom, office or car or anywhere else you left it
3 something of yours was deliberately damaged or tampered with
4 someone physically assaulted you
5 someone threatened to physically assault you
6 you were sexually interfered with, assaulted or attacked by someone you knew or a stranger
7 other (specify) ..........................................................................................................................
8 none of the above
97 difficult to answer
98 refuse to answer

**B7. I now want to ask you which, if any, of the following crimes were committed against any other member of this household during the past year**

*Multiple responses are permitted. Please circle all that apply.*

1 something they were carrying was stolen out of his hands or from his pockets, bag or case
2 something was stolen from a cloakroom, office or car or anywhere else they left it
3 something of theirs was deliberately damaged or tampered with
4 someone physically assaulted them
5 someone threatened to physically assault them
6 they were sexually interfered with, assaulted or attacked by someone they knew or a stranger
7 other (specify) ..........................................................................................................................
8 none of the above
9 not applicable
97 difficult to answer
98 refuse to answer

C4 I am now going to ask you some questions about the structure of your household

*Interviewer! This table excludes the respondent and the deceased*
*Interviewer! Where options are given, please circle the appropriate response*

| First name | Relation-ship to you | Sex | Age (yrs) | education | Contributes to household income? |
|---|---|---|---|---|---|
| ........................ | | M F | | | |
| ........................ | | M F | | | |
| ........................ | | M F | | | |
| ........................ | | M F | | | |
| ........................ | | M F | | | |
| ........................ | | M F | | | |
| ........................ | | M F | | | |
| ........................ | | M F | | | |

☐ Please tick this box if the respondent refuses to complete this table

**Relationship codes:**
1 spouse or partner
2 parent
3 brother
4 sister
5 daughter
6 daughter in law
7 son
8 son in law
9 grandchild
10 other relatives
11 unrelated lodger/friend
97 difficult to answer

**Education codes:**
1 incomplete secondary
2 complete secondary
3 professional school
4 specialised secondary
5 incomplete higher
6 higher
9 not applicable
97 difficult to answer
98 refuse to answer

**Contribution to income codes:**
1 Yes
2 No
97 difficult to answer
98 refuse to answer

I would now like to ask you some questions about your home

**C5. What type of dwelling is it?**

*Please circle the single most appropriate answer.*

1 hostel
2 shared/communal flat
3 flat, sole use
4 part of shared house
5 house, sole use
6 other (specify) ........ ..........................................................................................
97 difficult to answer
98 refuse to answer

**C6 What type of building is it?**

*Please circle the single most appropriate answer.*

1 wooden house
2 brick house
3 house built from concrete blocks
4 other (specify) ........ ..........................................................................................
97 difficult to answer
98 refuse to answer

**C7. Who is the owner of your dwelling?**

*Please circle the single most appropriate answer.*

1 a member or members of the household / flat privatized
2 the state or municipality / flat unprivatized )
3 someone who does not live in the house (specify) ............................................... )
4 other (specify) ........................................................................................... ) ⇨ ***go to** C9*
97 difficult to answer ⇨ ***go to** C9*
98 refuse to answer ⇨ ***go to** C9*

**C8. How did a member or members of your household come to own your dwelling?**

*Please circle the single most appropriate answer.*

1 built it entirely or partially themselves
2 purchased it
3 obtained it through privitisation free of charge
4 inherited it or obtained it as a gift
5 exchanged it with a different household without adding money
6 exchanged it with a different household and added some of own money
7 other (specify) ..........................................................................................................................
97 difficult to answer
98 refuse to answer

**C9. How many rooms, excluding kitchen and bathroom, are there in your dwelling in total?**

|__|__| rooms
97 difficult to answer
98 refuse to answer

<u>The following questions relate to the economic situation of this household</u>

**C13. Which of the following properties does your household entirely or partly use or own in addition to this home?**

*Multiple responses are permitted. Please circle all that apply.*

1 summer dacha or garden house
2 all-season dacha or countryside house
3 another house in city
4 another flat or room in city
5 workshop or place for personal enterprise
6 shop or kiosk for street trade
7 other (specify) ........................................................................................................................
8 none
97 difficult to answer
98 refuse to answer

**C14. Which of the following things did his household own?**

*Multiple responses are permitted. Please circle all that apply.*

1 a car
2 a motorcycle
3 livestock
5 modern television
6 video
7 videocamera
8 computer
9 modern washing machine
10 microwave
11 telephone
12 hifi
13 fridge
14 none
97 difficult to answer
98 refuse to answer

**C15. On what kind of income did this household rely during the past year?**
*Interviewer! Show the respondent card No. C15*

*Multiple responses are permitted. Please circle all that apply.*
1 regular salaries
2 occasional salaries
3 income/revenue from business or individual labour
4 income/revenue from agriculture
5 income from bank interest or dividends
6 age pensions
7 invalidity pensions
8 welfare: social benefits (including social privileges)
9 welfare: child benefit
10 scholarships
11 help of relatives
12 other
13 none
97 difficult to answer
98 refuse to answer

**C16. Have you contributed to the household income in the past few months?**

*Please circle the single most appropriate answer.*
1 yes
2 no
97 difficult to answer
98 refuse to answer

**C17. What proportion of the household's monthly income was normally spent on food during the past year?**

*Please circle the single most appropriate answer.*
1 less than half of the household's income
2 about half of the household's income
3 more than half of the household's income
97 difficult to answer
98 refuse to answer

**C18. Which of the phrases below best describes this household's financial situation during the past year?**
*Interviewer! Show the respondent card No. C18*

*Please circle the single most appropriate answer.*
1 We were sometimes unable to purchase basic necessities (food, communal services, essential clothing or inexpensive medicine)
2 We were able to purchase basic necessities, but not expensive goods for long-term use
3 We were occasionally able to purchase expensive goods for long-term use
4 We were able to purchase expensive goods for long-term use, but not things like houses, flats or expensive cars
5 We were able to purchase expensive goods for long-term use such as houses, flats or expensive cars
97 difficult to answer
98 refuse to answer

I would now like to ask you a few questions about your parents

*Interviewer! Do not ask D1-D3 if you already know that the mother is alive, but complete D1:*

**D1. Is your mother alive?**

*Please circle the single most appropriate answer.*

1 yes ⇨ ***go to** D4.*

2 no

97 difficult to answer ⇨ ***go to** D4.*

98 refuse to answer ⇨ ***go to** D4.*

**D2. When did your mother die?**

*Please circle the single most appropriate answer.*

1 within the last year

2 1 - 5 years ago

3 6 - 10 years ago

4 more than 10 years ago

97 difficult to answer

98 refuse to answer

**D3. How old was your mother when she died?**

|_|_|_| years

97 difficult to answer

98 refuse to answer

*Interviewer! Do not ask the D4-D6 if you already know that the father is alive, but complete D4:*

**D4. Is your father alive?**

*Please circle the single most appropriate answer.*

1 yes ⇨ ***go to** F1*

2 no

97 difficult to answer ⇨ ***go to** F1*

98 refuse to answer ⇨ ***go to** F1*

**D5. When did your father die?**

*Please circle the single most appropriate answer.*

1 within the last year

2 1 - 5 years ago

3 6 - 10 years ago

4 more than 10 years ago

97 difficult to answer

98 refuse to answer

**D6. How old was your father when he died?**

|_|_|_| years

97 difficult to answer

98 refuse to answer

*The next section is section F*

I would now like to ask you about your education and occupation

**F1. What is your level of education?**

*Please circle the single most appropriate answer.*

1 incomplete secondary
2 complete secondary
3 professional school
4 specialised secondary
5 incomplete higher
6 higher
97 difficult to answer
98 refuse to answer

**F2. If you have any professional qualifications, please specify what they are.**

*Please answer in your own words.*

1 ..........
..........
..........
..........
..........
..........

97 difficult to answer
98 refuse to answer

**F3. Are you currently in regular paid employment?**

*Please circle the single most appropriate answer.*

1 yes ⇨**go to** F7
2 no
97 difficult to answer
98 refuse to answer

**F4. Are you...**

*Please circle all answers which apply*

1 in irregular paid work
2 unemployed, seeking work
3 student ⇨***go to** F6*
4 retired, except for retirement due to invalidity ⇨***go to** F6*
5 retired due to invalidity ⇨***go to** F6*
6 unemployed, not seeking work
9 other (specify) ..........
97 difficult to answer
98 refuse to answer

**F5. What was the main reason for ceasing regular paid employment?**

*Please circle the single most appropriate answer.*

1 could not find a job after finishing education
2 was made redundant
3 a temporary job ended
4 was fired
5 gave up voluntarily due to unsatisfactory work salary/work conditions
6 gave up work because of ill health
8 gave up my job for other reasons (specify) ..........................................................................
97 difficult to answer
98 refuse to answer

**F6. How long ago did you cease regular paid employment?**

*Please circle the single most appropriate answer.*

1 have never been in regular paid employment ⇨ ***go to** F11*
2 within the week before death
3 more than 1 week but less than 1 month ago
4 more than 1 month but less than 6 months ago
5 more than 6 months but less than 1 year ago
6 over 1 year ago )
97 difficult to answer ) ⇨ ***go to** F11*
98 refuse to answer )

<u>I would now like to ask you some questions about your main regular employment over the past year</u>

**F7. What was your main occupation during the past year?**

*Please answer in your own words.*

1 ..........................................................................
..........................................................................
..........................................................................

97 difficult to answer
98 refuse to answer

**F8. What was your main occupational status during the past year?**

*Please circle the single most appropriate answer.*

1 Senior oficial or office top manager
2 Manager of department of branch office
3 Production and operation department manager
4 Physical and engineering science associate professional
5 Life science and health associate professional
6 Office clerk without higher education
7 Skilled workeer
8 Unskilled worker
9 Entrepreneur
10 Other
97 difficult to answer
98 refuse to answer

*Interviewer! If there are any discrepancies between the respondent's occupational status and education, select the response for A15 according to occupational status. For example, a nurse with higher education is marked as 'office clerk without higher education', point '6, and a primary school teacher with secondary special education is marked as 'life science and health associate professional', point '5', etc. '*

**F9. What type of firm or organisation have you mainly worked for during the past year?**

*Please circle the single most appropriate answer.*

1 State/local enterprise/authority
2 Cooperative/employee owned firm
3 A private company
4 Joint state and private ownership
5 Other (specify) ..................................................................................................................
97 difficult to answer
98 refuse to answer

**F10. In what branch of industry have you mainly worked during the past year?**

*Please circle the single most appropriate answer.*

1 civil service
2 education, culture and media
3 banks or other financial institutions
4 healthcare or social services
5 service industry
6 agriculture
7 industry, construction
8 transport, communications
9 military/police
10 other (specify) ..................................................................................................................
97 difficult to answer
98 refuse to answer

**F11. Do you have any sources of income (if you are in regular paid employment, exclude earnings from your main workplace)?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer )⇨ ***go to** F13*
98 refuse to answer )

**F12. What are these sources of extra income?**

*Multiple responses are permitted. Please circle all that apply.*

1 Pension (any kind)
2 Occasional/irregular work
3 Social benefits (any kind)
4 Private enterprise
5 Other (specify) ........................................................................................................................
97 difficult to answer
98 refuse to answer

**F13. Does your family produce agricultural products from a plot of land of which they have use?**

*Please circle the single most appropriate answer.*

1 does not have a plot of land
2 yes
3 no
97 difficult to answer
98 refuse to answer

**F14. Are you/were you ever in the army?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer )⇨ ***go to** F17*
98 refuse to answer )

**F15. What is/was your rank in the army?**

*Please circle the single most appropriate answer.*

1 soldier
2 sergeant
3 praporshyik
4 officer
97 difficult to answer
98 refuse to answer

**F16. Did you ever serve in a zone of conflict?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

**F17. Have you ever been in any kind of prison?**

*Please circle the single most appropriate answer.*

1 yes, during the previous year
2 yes, between 1 - 5 years ago
3 yes, more than 5 years ago
4 no, never
97 difficult to answer
98 refuse to answer

I would now like to ask you some further questions about your life during the past 5 years

**G1 - G8: Did he experience any of the following events in the last 5 years? If so, when?**

| | no | yes, in past 12 months | yes, 1-2 years ago | yes, 2-5 years ago | Difficult to answer | Refuse to answer |
|---|---|---|---|---|---|---|
| G1 serious illness of wife/partner | 1 | 2 | 3 | 4 | 97 | 98 |
| G2 serious illness of other close family member or friend | 1 | 2 | 3 | 4 | 97 | 98 |
| G3 death of wife/partner | 1 | 2 | 3 | 4 | 97 | 98 |
| G4 death of other close family member or friend | 1 | 2 | 3 | 4 | 97 | 98 |
| G5 divorce/separation from wife/partner | 1 | 2 | 3 | 4 | 97 | 98 |
| G6 serious financial problems | 1 | 2 | 3 | 4 | 97 | 98 |
| G7 other serious problems involving family or friends | 1 | 2 | 3 | 4 | 97 | 98 |
| G8 serious work or employment-related problems | 1 | 2 | 3 | 4 | 97 | 98 |

**G9. What were his relations with his family?**

*Please circle the single most appropriate answer.*

1 harmonious, peaceful
2 occasional quarrels and conflicts
3 frequent quarrels and conflicts
97 difficult to answer
98 refuse to answer

**G10. Do you confide in family members or friends about personal matters?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer ) ⇨ **go to** J1.
98 refuse to answer )

**G11. How often do you have contact with the people in which you confide?**

*Please circle the single most appropriate answer.*

1 every day
2 every week
3 every month
4 less than once a month
97 difficult to answer
98 refuse to answer

*Section H is deliberately excluded. The next section is Section J.*

I would now like to ask you about any diseases or disabilities that you have or had

**J1. Do you have any doctor diagnosed diseases which have serious long-term consequences for health?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer ) ⇨ **go to** J3
98 refuse to answer )

**J2. What is/are the disease(s)?**

*Multiple responses are permitted. Please circle all that apply.*

1 cancer
2 heart disease
3 hypertension/high blood pressure
4 diabetes
5 tuberculosis
6 hepatitis
7 other infectious and parasitic diseases and their consequences
8 stroke (cerebovascular disease)
9 alcohol dependency
10 depression
11 other psychiatric conditions
12 diseases of bones, joints, vertebras and musculo-skeletal system
13 diseases of kidney
14 other diseases of genito-urinary system
15 diseases of stomach, intestine and other digestive organs
16 other (specify) ..........................................................................................................
97 difficult to answer
98 refuse to answer

**J3. During the past year, were you ever hospitalised?**

*Please circle the single most appropriate answer.*

1 yes, once
2 yes, more than once
3 no )
97 difficult to answer )⇨ ***go to** J5*
98 refuse to answer )

**J4. What was the reason for being hospitalised? (describe all occurrances)**

*Please answer in your own words.*

1
..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................

97 difficult to answer
98 refuse to answer

**J5. When did you last visit a polyclinic?**

*Please circle the single most appropriate answer.*

1 within the last few days
2 1 week ago
3 more than 1 week but less than 1 month ago
4 more than 1 month but less than 6 months ago
5 more than 6 months but less than 1 year ago
6 over 1 year ago
97 difficult to answer
98 refuse to answer

**J6. Where is your medical card?**

*Please answer in your own words.*

1 ..........

97 difficult to answer
98 refuse to answer

**J7. Please give the name and address of the polyclinic you currently attend.**

*Please answer in your own words.*

1 ..........

97 difficult to answer
98 refuse to answer

**J8. If you are registered disabled, how long ago were you registered?**

*Please circle the single most appropriate answer.*

1 not applicable ⇨ ***go to** K1*
2 within the last 6 months
3 between 6 and 12 months ago
4 between 1 and 5 years ago
5 between 5 and 10 years ago
6 over 10 years ago but not his whole life
7 have always been disabled
97 difficult to answer
98 refuse to answer

**J9. What was the reason for being registered disabled?**

*Please circle the single most appropriate answer.*

1 disabled from birth
2 disabled from war
3 disabled due to disease
4 disabled due to occupational disease
5 disabled due to involvement in Chernobyl clear-up
6 disabled due to an accident at work
7 disabled due to other accidents
97 difficult to answer
98 refuse to answer

**J10. What is the nature of the disability? (please include the level of invalidity in your description)**

*Please answer in your own words.*

1 ...................................................................................................

...................................................................................................

...................................................................................................

...................................................................................................

...................................................................................................

...................................................................................................

97 difficult to answer
98 refuse to answer

I would now like to ask you some questions about your health during the past year

**K1. Have you broken any bones during the past year?**

*Please circle the single most appropriate answer.*
1 yes
2 no
97 difficult to answer
98 refuse to answer

**K2. In recent months, have you coughed when getting up in the morning?**

*Please circle the single most appropriate answer.*
1 always
2 sometimes
3 rarely
4 never
97 difficult to answer
98 refuse to answer

**K3. In recent months, could you climb up a flight of stairs without becoming breathless?**

*Please circle the single most appropriate answer.*
1 yes, easily
2 yes, with some difficulty
3 no - too difficult
97 difficult to answer
98 refuse to answer

**K4. In recent months, how difficult was it for you to walk about 1km?**

*Please circle the single most appropriate answer.*
1 not at all difficult
2 slightly difficult
3 very difficult/impossible
97 difficult to answer
98 refuse to answer

**K5. Have you lost a significant amount of weight during the past year?**

*Please circle the single most appropriate answer.*
1 yes
2 no
97 difficult to answer
98 refuse to answer

**K6. In recent months, have you been able to carry out your daily activities, such as shopping, washing or dressing, which a totally health person can manage without difficulty?**

*Please circle the single most appropriate answer.*
1 yes
2 no, not during the past month
3 no, not during the past 6 months
4 no, not for over 6 months
97 difficult to answer
98 refuse to answer

**K7. In recent months, did you do physical exercise in your leisure time?**

*Please circle the single most appropriate answer.*

1 yes, several times a week or more
2 yes, sometimes, but less than several times a week
3 never )
97 difficult to answer ) ⇨ **go to** K9
98 refuse to answer )

**K8. What kind of exercise?**

*Please answer in your own words.*

1 ..............................................................................

97 difficult to answer
98 refuse to answer

**K9. Do you usually walk or cycle for more than 30 minutes per day?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

**K10. Do you have a job that involves regular physical activity?**

*Please circle the single most appropriate answer.*

1 yes, a lot of physical activity
2 yes, moderate physical activity
3 no, not much/no physical acitvity
4 not applicable
97 difficult to answer
98 refuse to answer

**K11 How tall are you? Please answer as accurately as you can.**

☐☐☐ cm

97 difficult to answer
98 refuse to answer

I am now going to ask you a series of questions regarding drinking of alcohol. These questions are about the past year, unless otherwise specified

**L1-L4. For each type of drink listed in the left hand column, please indicate how often each is usually drunk**

| | every day or more often | nearly every day | three or four times a week | once or twice a week | 1-3 times a month | a few times per year | never or almost never | difficult to answer | refuse to answer |
|---|---|---|---|---|---|---|---|---|---|
| L1 beer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 98 | 99 |
| L2 wine | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 98 | 99 |
| L3 spirits | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 98 | 99 |
| L4 alcoholic substances NOT intended to be drunk | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 98 | 99 |

*Interviewer! If the respondent answered '7', '98' or '99' to* ***ALL*** *of the previous four questions, skip to L35*

**L5-L8. For each type of drink listed in the left hand column, please indicate on which day of the week each is usually drunk**

| | only at the weekend | only on weekdays | any day | every day | only on holidays/ celebration | never or almost never | difficult to answer | refuse to answer |
|---|---|---|---|---|---|---|---|---|
| L5 beer | 1 | 2 | 3 | 4 | 5 | 6 | 98 | 99 |
| L6 wine | 1 | 2 | 3 | 4 | 5 | 6 | 98 | 99 |
| L7 spirits | 1 | 2 | 3 | 4 | 5 | 6 | 98 | 99 |
| L8 alcoholic substances NOT intended to be drunk | 1 | 2 | 3 | 4 | 5 | 6 | 98 | 99 |

**L9. How much beer do you usually drink on one occasion? ('occasion' means a single continuous period of drinking)**

*Please circle the single most appropriate answer.*

1 never drinks beer
2 1 bottle or less
3 2-4 bottles
4 5-6 bottles
5 more than 6 bottles
97 difficult to answer
98 refuse to answer

**L10. How much wine do you usually drink on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks wine
2 up to 200g
3 between 200 - 400g
4 between 400 - 600g
5 between 600 - 1000g
6 more than 1 litre
97 difficult to answer
98 refuse to answer

**L11. What quantity of spirits, such as vodka or other strong drinks, do you usually drink on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks spirits
2 between 50 – 100g
3 between 100 - 200g
4 between 200 - 300g
5 between 300 - 400g
6 between 400 - 500g
7 more than 500g
97 difficult to answer
98 refuse to answer

**L12. What is the maximum quantity of beer ever drunk on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks beer
2 1 bottle or less
3 2-4 bottles
4 5-6 bottles
5 more than 6 bottles
97 difficult to answer
98 refuse to answer

**L13. What is the maximum quantity of wine ever drunk on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks wine
2 up to 200g
3 between 200 - 400g
4 between 400 - 600g
5 between 600 - 1000g
6 more than 1 litre
97 difficult to answer
98 refuse to answer

**L14. What is the maximum quantity of spirits ever drunk on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks spirits
2 between 50 – 100g
3 between 100 - 200g
4 between 200 - 300g
5 between 300 - 400g
6 between 400 - 500g
7 more than 500g
97 difficult to answer
98 refuse to answer

**L15. Do you ever drink spirits together with either beer or wine at the same sitting?**

*Please circle the single most appropriate answer.*

1 yes, often
2 yes, sometimes
3 no, never
97 difficult to answer
98 refuse to answer

**L16. Do you ever drink large quantities of spirits without also eating some food at the same sitting?**

*Please circle the single most appropriate answer.*

1 always
2 sometimes
3 rarely/never
97 difficult to answer
98 refuse to answer

**L17. How often do you become excessively drunk?**

*Please circle the single most appropriate answer.*

1 every day
2 several times a week
3 once a week
4 several times a month
5 once a month
6 less than once a month
7 never or almost never
97 difficult to answer
98 refuse to answer

**L18. Do you ever drink alcohol before noon?**

*Please circle the single most appropriate answer.*

1 no
2 yes, occasionally
3 yes, frequently
97 difficult to answer
98 refuse to answer

**L19. How often do you have a hangover?**

*Please circle the single most appropriate answer.*

1 every day
2 several times a week
3 about once a week
4 several times a month
5 about once a month
6 less than once a month
7 never or almost never
97 difficult to answer
98 refuse to answer

**L20. How often do you fail to fulfil your work obligations due to drinking alcohol?**

*Please circle the single most appropriate answer.*

1 every day
2 several times a week
3 about once a week
4 several times a month
5 about once a month
6 less than once a month
7 never
8 not applicable
97 difficult to answer
98 refuse to answer

**L21. How often do you fail to fulfil your family or personal obligations due to drinking alcohol?**

*Please circle the single most appropriate answer.*

1 every day
2 several times a week
3 about once a week
4 several times a month
5 about once a month
6 less than once a month
7 never
97 difficult to answer
98 refuse to answer

**L22. Do you ever go to sleep at night with your clothes on because of being drunk?**

*Please circle the single most appropriate answer.*

1 every day
2 several times a week
3 about once a week
4 several times a month
5 about once a month
6 less than once a month
7 never or almost never
97 difficult to answer
98 refuse to answer

**L23. Do you ever drink alone?**

*Please circle the single most appropriate answer.*

1 yes, often
2 yes, sometimes
3 no, never
97 difficult to answer
98 refuse to answer

**L24. Do you usually drink alcohol at home or in other places?**

*Please circle the single most appropriate answer.*

1 usually at home
2 sometimes at home, sometimes elsewhere
3 usually elsewhere
97 difficult to answer
98 refuse to answer

<u>I would now like to ask you about episodes of 'zapoi' in your life. By 'zapoi', I mean a continuous drunkeness of several days or more during which the person does not work and is withdrawn from normal life</u>

**L25. Have you had one or more episodes of zapoi in the past <u>year</u>?**

*Please circle the single most appropriate answer.*

1 yes, often
2 yes, sometimes
3 no, never )
97 difficult to answer ) ⇨**go to** L32
98 refuse to answer )

**L26. Have you had one or more episodes of zapoi in the past <u>month</u>?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer ) ⇨**go to** L32
98 refuse to answer )

**L27. Have you had one or more episodes of zapoi in the past week?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer ) ⇨ **go to** L32
98 refuse to answer )

**L28. During your most recent episode of heavy drinking, what was the maximum quantity of beer drunk?**

*Please circle the single most appropriate answer.*

1 none
2 1 bottle or less
3 2-4 bottles
4 5-6 bottles
5 more than 6 bottles
6 drank beer, but not sure of the quantity
97 difficult to answer
98 refuse to answer

**L29. During your most recent episode of heavy drinking, what was the maximum quantity of wine drunk?**

*Please circle the single most appropriate answer.*

1 none
2 up to 200g
3 between 200 - 400g
4 between 400 - 600g
5 between 600 - 1000g
6 more than 1 litre
7 drank wine, but not sure of the quantity
97 difficult to answer
98 refuse to answer

**L30. During your most recent episode of heavy drinking, what was the maximum quantity of spirits drunk?**

*Please circle the single most appropriate answer.*

1 none
2 between 50 – 100g
3 between 100 - 200g
4 between 200 - 300g
5 between 300 - 400g
6 between 400 - 500g
7 more than 500g
8 drank spirits, but not sure of the quantity
97 difficult to answer
98 refuse to answer

**L31. During your most recent episode of zapoi, did you drink any other alcoholic substances other than those intended as drinks?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

**L32. Have you been arrested because you were drunk during the past year?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

**L33. Are you currently drinking more than, less than, or about the same as you were one year ago?**

*Please circle the single most appropriate answer.*

1 more than a year ago
2 about the same as a year ago
3 less than a year ago
97 difficult to answer
98 refuse to answer

**L34. Are you currently drinking more than, less than, or about the same as you were one month ago?**

*Please circle the single most appropriate answer.*

1 more than a month ago
2 about the same as a month ago
3 less than a month ago
97 difficult to answer
98 refuse to answer

**L35. Was there ever any period in your life when you drank heavily other than during the past 12 months?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

**L36. Have you ever had help or advice from a doctor, narcologist, social worker or some other professional for an alcohol problem?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer ) ⇨ ***go to** L38*
98 refuse to answer )

**L37. Did you get such help or advice in the past 12 months?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

**L38. Have you ever been taken to a sobering-up centre?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer )⇨ ***go to** M1*
98 refuse to answer )

**L39. Was this during the past 12 months?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

I will now ask you some questions concerning your smoking habits

**M1. Are you a current smoker?**

*Please circle the single most appropriate answer.*

1 never a smoker ⇨ **go to** M6
2 no, ex-smoker
3 yes, a current-smoker ⇨ **go to** M3
97 difficult to answer ⇨ **go to** M6
98 refuse to answer ⇨ **go to** M6

**M2. How many years ago did you stop smoking regularly?**

*Please circle the single most appropriate answer.*

1 less than one year ago
2 more than 1 year but less than 5 years ago
3 more than 5 years but less than 10 years ago
4 more than 10 years ago
97 difficult to answer
98 refuse to answer

**M3. What do/did you smoke most often?**

*Please circle the single most appropriate answer.*

1 papyrosi
2 filtered cigarettes
3 unfiltered cigarettes
4 other (specify) ..............................................................................................
97 difficult to answer
98 refuse to answer

**M4. When you smoke/smoked, how many per day is/was usual?**

*Please circle the single most appropriate answer.*

1 1-5 per day
2 6-10 per day
3 11-20 per day
4 more than 20 per day
97 difficult to answer
98 refuse to answer

**M5. How old were you when you started smoking regularly?**

*Please circle the single most appropriate answer.*

1 <10 years old
2 10-19 years old
3 20-29 years old
4 >30 years old
97 difficult to answer
98 refuse to answer

**M6. Have his parents ever smoked?**

*Please circle the single most appropriate answer.*

1 yes, father only
2 yes, mother only
3 yes, both parents
4 no, neither
97 difficult to answer
98 refuse to answer

**<u>Thank you for your time in helping us with this study</u>**

The final question is about the circumstances of the interview

**X1 Was the proxy respondent present in the same room or within earshot at any point during your interview?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

*The following questions are answered only by you as an interviewer and are not to be read out:*

**X2** *How would you judge the reliability of the answers from this interview?*

1 satisfactory
2 not entirely satisfactory. For example, a moderate level of non-response by *the subject*, or perhaps small interruptions affected the quality of the responses
3 poor. For example, a high level of non-response by *the subject*, or perhaps many/constant interruptions affected the quality of the responses.

**X3** *Were there any other people present in the same room while the interview was taking place?*

1 yes
2 no ⇨ ***go to** X5*

**X4.** *Please provide details of other people present during the interview, including their relationship to respondent:*

1 ............................................................
............................................................
............................................................

**X5.** *Were there any interruptions to the interview?*

1 yes
2 no ⇨ ***go to** X7*

**X6.** *Please provide details of interruptions, including their duration:*

1 ............................................................
............................................................
............................................................

**X7.** *Any other comments, including indication of questions that were particularly hard to answer*

1 ............................................................
............................................................
............................................................

**End of questionnaire**

# B: IFS-2 Index Questionnaire

## Izhevsk Family Study
## Participant questionnaire
## Cover Sheet: to be completed by the interviewer

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject number | | | | | | | | | | | | | | | | | | |
| Date of previous interview | | | | MM | | | YYYY | | | | | | | | | | | |
| Date of previous interview | DD | | | MM | | | YYYY | | | | | | | | | | | |

Interviewer first name ....................................................................................

Interviewer last name ....................................................................................

Interviewer code | | |

Time started | | | : | | |

Time ended | | | : | | |

**<u>Having read the information sheet, are you willing to be interviewed and for the information collected to be used for the purposes of this scientific study?</u>**

Has respondent read the study information sheets? | Yes | |

Has respondent given verbal consent? | Yes | |

Instructions to interviewer:

Some questions ask about the behaviour of *the subject* during the past year. For these questions, please disregard any changes in behaviour that occurred in the last few months due to ill health.

How to fill in this questionnaire:

- where there are numbers, circle one or more as indicated for each specific question
- where there are lines, fill in with text
- where there are small boxes, fill in with figures and leading zeros if necessary. E.g. 'ten' would be:

| | | |
|---|---|---|
| 0 | 1 | 0 |

Different fonts will be used to help you distinguish between different types of phrases:

**Questions, to be read out to the respondent, will be written like this.**
Instructions, to be read out to the respondent, will be written like this.
*Instructions for you, the interviewer, will be written like this.* ***These should not be read out.***

<u>**Questionnaire: participant**</u>

**A0 Did you respond to the previous questionnaire on mm/yy?**

1 yes
2 no
97 difficult to answer
98 refuse to answer

*Interviewer! If the informant is not the same person as last time, do not read out the following comment.*

I would like to begin by reminding you that we interviewed you on [date]. Some of the questions we ask may be the same or similar as those we asked last time, but this is deliberate. Thank you for agreeing to respond

*This questionnaire deliberately skips to section E, question E9 (E1 – E8 are deliberately excluded).*

I would like to begin by asking you some questions about yourself

**E9. How old are you?**

☐☐☐ Years
97 difficult to answer
98 refuse to answer

**E10. What is your date of birth?**

DD☐☐ MM☐☐ YYYY☐☐
97 difficult to answer
98 refuse to answer

**E11. What is your nationality?**

*Please circle the single most appropriate answer.*
1 Russian
2 Udmurt
3 Tatar
4 Other (specify) .................... .................... .................... .................... .................... ....................
97 difficult to answer
98 refuse to answer

**E12. Please could you tell me the region in which you were born?**

*Please circle the single most appropriate answer.*
1 Izhevsk ⇨**go to** E14
2 Other part of Udmurtia
3 A different oblast of Russia
4 A part of the former Soviet Union outside Russia
5 Outside the former Soviet Union
97 difficult to answer ⇨***go to** E14*
98 refuse to answer ⇨***go to** E14*

**E13. Was the place you were born in an urban or a rural area?**

*Please circle the single most appropriate answer.*
1 urban
2 Rural
97 difficult to answer
98 refuse to answer

**E14. How long have you continuously lived in Izhevsk?**

*Please circle the single most appropriate answer.*
1 up to 6 months
2 more than 6, up to 12 months
3 more than 1, up to 5 years
4 more than 5, up to 10 years
5 more than 10 years, but not your whole life
6 since birth (excluding army and temporary periods away of up to 5 years)
97 difficult to answer
98 refuse to answer

**E15. What is your current marital status? Are you:**

*Please circle the single most appropriate answer.*
1 Living together with a spouse/partner in a registered marriage
2 Living together with a spouse/partner but not in a registered marriage
3 Divorced or separated )
4 Widower ) ⇨***go to*** *E16*
5 Never married )
97 difficult to answer )
98 refuse to answer )

**E15b How long have you lived with your current spouse/partner?**
*Please circle the single most appropriate answer.*

1 up to 2 years
2 more than 2, up to 5 years
3 more than 6 years
97 difficult to answer
98 refuse to answer

**E16. How many children do you have?**

*Please circle the single most appropriate answer.*
1 0
2 1
3 2
4 3
5 4 or more
97 difficult to answer
98 refuse to answer

*The next section is Section B*

I would like to ask you your views about the area you live in

**B1. What is your view of the general state of this neighbourhood as a place to live?**

*Please circle the single most appropriate answer.*

1 very good
2 good
3 fair
4 poor
5 very poor
97 difficult to answer
98 refuse to answer

**B2. Please select the phrase from the following five choices that best describes the people in your neighbourhood.**

*Please circle the single most appropriate answer.*

1 Everyone is friendly towards each other
2 Most of them are friendly towards each other
3 Some of them are friendly towards each other
4 A few of them are friendly towards each other
5 No one is friendly towards each other
97 difficult to answer
98 refuse to answer

**B3. With regard to level of crime, how do you see this neighbourhood?**

*Please circle the single most appropriate answer.*

1 there is a high level of crime
2 there is a moderate level of crime
3 there is a low level of crime
97 difficult to answer
98 refuse to answer

*B4-B7 are excluded from this questionnaire*

I would now like to ask you some additional questions about the people who live in your household

**C0a.** **Is this the same address you were living in at the time of the last interview (mm/yy)**

*Please circle the single most appropriate answer.*

1 Yes ⇨**go to** C1
2 No
97 difficult to answer ⇨**go to** C1
98 refuse to answer ⇨**go to** C1

**C0b.** **When did you move to the current address?**

*Please circle the single most appropriate answer.*

1 Up to 6 months ago
2 More than 6, up to 12 months ago
3 More than 1, up to 2 years ago
4 More than 2 years ago
97 difficult to answer
98 refuse to answer

**C1.** **How many people currently live in his household?**

☐☐ People
97 difficult to answer
98 refuse to answer

*Questions C2 and C3 are deliberately excluded*

**C4. I am now going to ask you some questions about the structure of your household**

*Interviewer! This table excludes the respondent and the deceased*
*Interviewer! Where options are given, please circle the appropriate response*

| Relationship to you | Sex | Age (yrs) | education | Contributes to household income? |
|---|---|---|---|---|
| | M F | | | |
| | M F | | | |
| | M F | | | |
| | M F | | | |
| | M F | | | |
| | M F | | | |
| | M F | | | |
| | M F | | | |

Please tick this box if the respondent refuses to complete this table ☐

**Relationship codes:**
1 spouse or partner
2 parent
3 brother
4 sister
5 daughter
6 daughter in law
7 son
8 son in law
9 grandchild
10 other relatives
11 unrelated lodger/friend
97 difficult to answer
98 refuse to answer

**Education codes:**
1 incomplete secondary
2 complete secondary
3 professional school
4 specialised secondary
5 incomplete higher
6 higher
9 not applicable
97 difficult to answer
98 refuse to answer

**Contribution to income codes:**
1 Yes
2 No
97 difficult to answer
98 refuse to answer

**Codes for age**
997 difficult to answer
998 refuse to answer

I would now like to ask you some questions about your home

**C5. What type of dwelling is it?**

*Please circle the single most appropriate answer.*

1 Hostel
2 shared/communal flat
3 flat, sole use
4 part of shared house
5 house, sole use
6 Other (specify) ........
...........................................................................................
97 difficult to answer
98 refuse to answer

**C6 What type of building is it?**

*Please circle the single most appropriate answer.*

1 wooden house
2 brick house
3 house built from concrete blocks
4 Other (specify) ........
...........................................................................................
97 difficult to answer
98 refuse to answer

**C7. Who is the owner of your dwelling?**

*Please circle the single most appropriate answer.*

1 a member or members of the household / flat privatized
2 the state or municipality / flat unprivatized
3 someone who does not live in the house (specify)
4 Other (specify)
97 difficult to answer
98 refuse to answer

**C8.** This question is deliberately excluded

**C9. How many rooms, excluding kitchen and bathroom, are there in your dwelling in total?**

☐☐ Rooms
97 difficult to answer
98 refuse to answer

**C10. How many rooms are used for sleeping in your dwelling. Please include rooms that also have other functions.**

☐☐ Rooms
97 difficult to answer
98 refuse to answer

C11 This question is deliberately excluded

**C12. Which of the following amenities does your household have access to?**

*Multiple responses are permitted. Please circle all that apply.*

1 comfortable toilet, connected with running water and sewerage system
2 hot water supplied
3 cold water supplied
4 central heating
5 gas or electric oven
6 telephone
7 Electricity
97 difficult to answer
98 refuse to answer

The following questions relate to the economic situation of this household

**C13. Which of the following properties does your household entirely or partly use or own in addition to this home?**

*Multiple responses are permitted. Please circle all that apply.*

1 summer dacha or garden house
2 all-season dacha or countryside house
3 another house in city
4 another flat or room in city
5 workshop or place for personal enterprise
6 shop or kiosk for street trade
7 other (specify)
8 .......................................................................................................................................

None
97 difficult to answer
98 refuse to answer

**C14. Which of the following things does this household own?**

*Multiple responses are permitted. Please circle all that apply.*

1 a car
2 a motorcycle
3 livestock
5 modern television
6 video or DVD
7 videocamera
8 computer
9 modern washing machine
10 microwave
11 telephone
12 hifi
13 fridge
14 None
97 difficult to answer
98 refuse to answer

**C15. On what kind of income did this household rely during the past year?**
***Interviewer! Show the respondent card No. C15***

*Multiple responses are permitted. Please circle all that apply.*

1 regular salaries
2 occasional salaries
3 income/revenue from business or individual labour
4 income/revenue from agriculture
5 income from bank interest or dividends
6 Old-age pensions
7 invalidity pensions
8 welfare: social benefits (including social privileges)
9 welfare: child benefit
10 scholarships
11 help of relatives
12 other
13 none
97 difficult to answer
98 refuse to answer

**C16. Have you contributed to the household income in the past few months?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

**C17. What proportion of the household's monthly income was normally spent on food during the past year?**

*Please circle the single most appropriate answer.*

1 less than half of the household's income
2 about half of the household's income
3 more than half of the household's income
97 difficult to answer
98 refuse to answer

<u>C18</u> <u>This question is deliberately excluded</u>

I would now like to ask you a few questions about your parents

***Interviewer! Do not ask D1-D3 if you already know that the mother is alive, but complete D1:***

**D1. Is your mother alive?**

*Please circle the single most appropriate answer.*

1 yes ⇨***go to** D4.*
2 no
97 difficult to answer ⇨***go to** D4.*
98 refuse to answer ⇨***go to** D4.*

**D2. When did your mother die?**

*Please circle the single most appropriate answer.*

1 up to 1 year ago
2 more than 1, up to 5 years ago
3 more than 5, up to 10 years ago
4 more than 10 years ago
97 difficult to answer
98 refuse to answer

**D3. How old was your mother when she died?**

☐☐☐ years
97 difficult to answer
98 refuse to answer

***Interviewer! Do not ask D4-D6 if you already know that the father is alive, but complete D4:***

**D4. Is your father alive?**

*Please circle the single most appropriate answer.*

1 yes ⇨***go to** D7*
2 No
97 difficult to answer ⇨***go to** D7*
98 refuse to answer ⇨***go to** D7*

**D5. When did your father die?**

*Please circle the single most appropriate answer.*

1 up to 1 year ago
2 more than 1, up to 5 years ago
3 more than 5, up to 10 years ago
4 more than 10 years ago
97 difficult to answer
98 refuse to answer

**D6. How old was your father when he died?**

| | | | Years

97 difficult to answer
98 refuse to answer

**D7. Who mainly brought you up?**

*Multiple responses permitted. Please circle all responses which apply*

1 Both parents together
2 mother
3 father
4 Other adult relatives
5 Other adults (not relatives)
6 Care home/childrens' home
7 Other (please specify) ……………………………………………………………………………………..
97 difficult to answer
98 refuse to answer

*The next section is section F*

I would now like to ask you about your education and occupation

**F1. What is your level of education?**

*Please circle the single most appropriate answer.*

1 incomplete secondary
2 complete secondary
3 professional school
4 specialised secondary
5 incomplete higher
6 Higher
97 difficult to answer
98 refuse to answer

**F2. If you have any professional qualifications, please specify what they are.**

*Please answer in your own words.*

1 ..............................................................................................................................
..............................................................................................................................
..............................................................................................................................
.....................................................
..............................................................................................................................
.........................................................................................
..............................................................................................................................
.........................................................................................
..............................................................................................................................
.........................................................................................

97 difficult to answer
98 refuse to answer

**F4 Are you…**

*Please circle all answers which apply*

1 Full time student
2 Retired, except for retirement due to invalidity
3 Retired due to invalidity Other (specify) …………………………………………..
5 None of the above
97 difficult to answer
98 refuse to answer

**F3a Are you…**

*Please circle all answers which apply*

1 In regular paid work ⇨***go to*** *F7*
2 In irregular paid work
3 Unemployed, seeking work
4 Unemployed, not seeking work
7 Other (please specify)…………………………………………
97 difficult to answer
98 refuse to answer

**F5. What was the main reason for ceasing regular paid employment?**

*Please circle the single most appropriate answer.*

1 could not find a job after finishing education
2 was made redundant
3 a temporary job ended
4 was fired
5 gave up voluntarily due to unsatisfactory work salary/work conditions
6 gave up work because of ill health
8 gave up my job for other reasons (specify) ...........................................................................................
9 have never been in regular paid employment
97 difficult to answer
98 refuse to answer

**F6. How long ago did you cease regular paid employment?**

*Please circle the single most appropriate answer.*

1 have never been in regular paid employment ⇨***go to*** *F11*
2 within the past week
3 more than 1, up to 4 weeks ago
4 more than 1, up to 6 months ago
5 more than 6, up to 12 months ago
6 more than 1 year ago
97 difficult to answer )⇨***go to*** *F11*
98 refuse to answer )

<u>I would now like to ask you some questions about your main regular employment over the past year or in the last period that you were working.</u>

**F7. What was your main occupation during the past year, or in the last period that you were working?**

*Please answer in your own words.*

1 ..........................................................................................................................

...........................................................................................

..........................................................................................................................

...........................................................................................

97 difficult to answer
98 refuse to answer

**F8. What was your main occupational status during the past year or in the last period that you were working?**

*Please circle the single most appropriate answer.*

1 Senior official or office top manager
2 Manager of department of branch office
3 Production and operation department manager
4 Physical and engineering science associate professional
5 Life science and health associate professional
6 Office clerk without higher education
7 Skilled worker
8 Unskilled worker
9 Entrepreneur
10 Other
97 difficult to answer
98 refuse to answer

***Interviewer! If there are any discrepancies between the respondent's occupational status and education, select the response for F8 according to occupational status, regardless of any qualifications***

**F9. What type of firm or organisation have you mainly worked for during the past year?**

*Please circle the single most appropriate answer.*

1 State/local enterprise/authority
2 Cooperative/employee owned firm
3 A private company
4 Joint state and private ownership
5 Other (specify) .............................................................................................................................
97 difficult to answer
98 refuse to answer

**F10. In what branch of industry have you mainly worked during the past year?**

*Please circle the single most appropriate answer.*

1 civil service
2 education, culture and media
3 banks or other financial institutions
4 healthcare or social services
5 service industry
6 agriculture
7 industry, construction
8 transport, communications
9 military/police
10 other (specify) .............................................................................................................................
97 difficult to answer
98 refuse to answer

**F11. Other than earnings from regular paid employment, do you currently have any other sources of income?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer ) *go to* *F13*
98 refuse to answer )

**F12. What are these sources of extra income?**

*Multiple responses are permitted. Please circle all that apply.*

1 Pension (any kind)
2 Occasional/irregular work
3 Social benefits (any kind)
4 Private enterprise
5 Other (specify) .........................................................................................................................

97 difficult to answer
98 refuse to answer

**F13. Does your family produce agricultural products from a plot of land of which they have use?**

*Please circle the single most appropriate answer.*

1 does not have a plot of land
2 yes
3 No
97 difficult to answer
98 refuse to answer

**F14. Are you/were you ever in the army?**

*Please circle the single most appropriate answer.*

1 yes
2 no )
97 difficult to answer ) *go to* *F17*
98 refuse to answer )

**F15. What is/was your rank in the army?**

*Please circle the single most appropriate answer.*

1 soldier
2 sergeant
3 praporshyik
4 Officer
97 difficult to answer
98 refuse to answer

**F16. Did you ever serve in a zone of conflict?**

*Please circle the single most appropriate answer.*

1 yes
2 No
97 difficult to answer
98 refuse to answer

**F17. Have you ever been in any kind of prison?**

*Please circle the single most appropriate answer.*

1 yes, during the previous year
2 yes, between 1 and 5 years ago
3 yes, more than 5 years ago
4 no, never
97 difficult to answer
98 refuse to answer

**F18 Were you involved in the Chernobyl clean up?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

I would now like to ask you some further questions about your life during the past 5 years

**G1 - G8: Did you experience any of the following events in the last 5 years? If so, when?**

| | no | yes, in past 12 months | yes, 1-2 years ago | yes, 2-5 years ago | Difficult to answer | Refuse to answer |
|---|---|---|---|---|---|---|
| G1 serious illness of wife/partner | 1 | 2 | 3 | 4 | 97 | 98 |
| G2 serious illness of other close family member or friend | 1 | 2 | 3 | 4 | 97 | 98 |
| G3 death of wife/partner | 1 | 2 | 3 | 4 | 97 | 98 |
| G4 death of other close family member or friend | 1 | 2 | 3 | 4 | 97 | 98 |
| G5 divorce/separation from wife/partner | 1 | 2 | 3 | 4 | 97 | 98 |
| G6 serious financial problems | 1 | 2 | 3 | 4 | 97 | 98 |
| G7 other serious problems involving family or friends | 1 | 2 | 3 | 4 | 97 | 98 |
| G8 serious work or employment-related problems | 1 | 2 | 3 | 4 | 97 | 98 |

**G9. What are your relations with your family?**

*Please circle the single most appropriate answer.*
1 harmonious, peaceful
2 occasional quarrels and conflicts
3 frequent quarrels and conflicts
97 difficult to answer
98 refuse to answer

**G10 a Do you have any close friends?**

*Please circle the single most appropriate answer.*
1 Yes
2 No ⇨ ***go to*** *G10*
97 difficult to answer⇨ ***go to*** *G10*
98 refuse to answer ⇨ ***go to*** *G10*

**G10 b. Who are they?**

*Please circle all responses that apply.*
1 Friends of childhood or youth
2 Friends who work with you
3 Friends you know through your hobbies
4 Neighbours
5 Other (specify)…………………………………………………………………………………………..
97 difficult to answer
98 refuse to answer

**G10. Do you confide in anybody about personal matters?**

***Please circle the single most appropriate answer.***
1 yes
2 no )
97 difficult to answer ) ⇨ **go to** G12
98 refuse to answer )

**G11. How often do you have contact with the people in which you confide?**

*Please circle the single most appropriate answer.*
1 every day
2 every week
3 every month
4 less than once a month
5 less than once a year
97 difficult to answer
98 refuse to answer

**G12. Have you had any physical fights in the past year?**
*Please circle the single most appropriate answer.*
1 Yes, frequently
2 Yes, occasionally
3 No ⇨ ***go to** the next section (skipping G13)*
97 difficult to answer ***go to** the next section (skipping G13)*
98 refuse to answer ***go to** the next section (skipping G13)*

**G13. Who were these with?**
*Please circle all answers that apply.*
1 Family members
2 Friends
3 Other
97 difficult to answer
98 refuse to answer

Section H is deliberately excluded. The next section is Section J.

**J1. This question is deliberately omitted**

**J2. This question is deliberately omitted**

**J3. During the past year, were you ever hospitalised?**

*Please circle the single most appropriate answer.*

1 yes, once
2 yes, more than once
3 no )
97 difficult to answer ) ⇨ ***go to*** *J5*a
98 refuse to answer )

**J3a. If yes, was this in the past three months?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

**J4. What was the reason for being hospitalised in the past year? (describe all occurrences)**

*Please answer in your own words.*

1
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......................................................................................................
..........................................................................................................................
......................................................................................................

97 difficult to answer
98 refuse to answer

**How many times have you had contact with medical services (e.g. polyclinic or doctor) during the past 3 months because of ill health (excluding inpatient)?**

**J5a**

*Please circle the single most appropriate answer.*

| | |
|---|---|
| 1 | 0 |
| 2 | 1 |
| 3 | 2-4 |
| 4 | 5 or more |
| 97 | difficult to answer |
| 98 | refuse to answer |

**J5b. During the last month, were they any days when you missed work because you felt unwell?**

*Please circle the single most appropriate answer.*

| | |
|---|---|
| 1 | Yes |
| 2 | No ⇨ ***go to*** *J8* |
| 3 | Do not work ⇨ ***go to*** *J8* |
| 97 | difficult to answer ⇨ ***go to*** *J8* |
| 98 | refuse to answer ⇨ ***go to*** *J8* |

**J5c If yes, approximately how many days?**

| | |
|---|---|
| ☐☐ | days |
| 97 | difficult to answer |
| 98 | refuse to answer |

J6 This question is deliberately excluded

J7 This question is deliberately excluded

**J8. If you are registered disabled, how long ago were you registered?**

*Please circle the single most appropriate answer.*

| | |
|---|---|
| 1 | not registered disabled ⇨ ***go to*** *J11* |
| 2 | up to 6 months ago |
| 3 | more than 6, up to 12 months ago |
| 4 | more than 1, up to 5 years ago |
| 5 | more than 5, up to 10 years ago |
| 6 | more than 10 years ago but not my whole life |
| 7 | have always been disabled |
| 97 | difficult to answer |
| 98 | refuse to answer |

**What was the reason for being registered disabled?**

**J9.**

*Please circle the single most appropriate answer.*

1 disabled from birth
2 disabled from war
3 disabled due to disease
4 disabled due to occupational disease
5 disabled due to involvement in Chernobyl clear-up
6 disabled due to an accident at work
7 disabled due to other accidents
97 difficult to answer
98 refuse to answer

**J10. What is the class of the disability?**

*Please circle the single most appropriate answer.*

1 Class 1
2 Class 2
3 Class 3
97 difficult to answer
98 refuse to answer

**J11. During the past year have there been persistent large changes in your circumstances and/or behaviour (diet, exercise, drinking, smoking) that have occurred because of ill health or disability?**

***Please circle the single most appropriate answer.***

1 yes
2 no ⇨***go to*** *section K*
97 difficult to answer ) ⇨***go to*** *section K*
98 refuse to answer )

**J12. When did this change occur?**

***Please circle the single most appropriate answer.***

1 over past 3 months
2 4-6 months ago
3 over 6 months ago
97 difficult to answer
98 refuse to answer

**J13. Please briefly describe the causes of these changes and its consequences on your circumstances and/or behaviour**

***Please answer in your own words.***

1 ..........................................................................................................................................

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97 difficult to answer

98 refuse to answer

I would now like to ask you some questions about your health during the past year

**K1. Have you broken any bones during the past year?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

**K2. In recent months, have you coughed when getting up in the morning?**

*Please circle the single most appropriate answer.*

1 always
2 sometimes
3 rarely
4 Never
97 difficult to answer
98 refuse to answer

**K3. In recent months, could you climb up a flight of stairs without becoming breathless?**

*Please circle the single most appropriate answer.*

1 yes, easily
2 yes, with some difficulty
3 no - too difficult
97 difficult to answer
98 refuse to answer

**K4. In recent months, how difficult was it for you to walk about 1km?**

*Please circle the single most appropriate answer.*

1 not at all difficult
2 slightly difficult
3 very difficult/impossible
97 difficult to answer
98 refuse to answer

**K5. Have you lost a significant amount of weight during the past year?**

*Please circle the single most appropriate answer.*

1 yes
2 No
97 difficult to answer
98 refuse to answer

**K6.** **In recent months, have you been able to carry out your daily activities, such as shopping, washing or dressing, which a totally health person can manage without difficulty?**

*Please circle the single most appropriate answer.*

1 yes
2 no, not during the past month
3 no, not during the past 6 months
4 no, not for over 6 months
97 difficult to answer
98 refuse to answer

**K7.** **In recent months, did you do physical exercise in your leisure time?**

*Please circle the single most appropriate answer.*

1 yes, several times a week or more
2 yes, sometimes, but less than several times a week
3 never )
97 difficult to answer ) ⇨**go to** K9
98 refuse to answer )

**K8.** **What kind of exercise?**

*Please answer in your own words.*

1 ............................................................................................................................................................
..........................................................
............................................................................................................................................................
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97 difficult to answer
98 refuse to answer

**K9.** **Do you usually walk or cycle for more than 30 minutes per day?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

**K10 Do you have a job that involves regular physical activity?**
**.**

*Please circle the single most appropriate answer.*

1 yes, a lot of physical activity
2 yes, moderate physical activity
3 no, not much/no physical acitvity
4 not applicable
97 difficult to answer
98 refuse to answer

<u>K11</u> **<u>This question is deliberately excluded</u>**

I am now going to ask you a series of questions regarding drinking of alcohol. These questions are about the past year, unless otherwise specified

Surrogates are mentioned in the following questions. These are substances not intended for drinking, including eau de colognes and medicinal tinctures as well as other things. They may be found in shops, chemists and kiosks.

**For each type of drink listed in the left hand column, please indicate how often each is usually drunk**

| | | every day or more often | nearly every day | three or four times a week | once or twice a week | 1-3 times a month | a few times per year | never or almost never | difficult to answer | refuse to answer |
|---|---|---|---|---|---|---|---|---|---|---|
| L0 | alcohol (beer, wine, spirits or anything else containing alcohol) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 97 | 98 |
| L1 | beer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 97 | 98 |
| L2 | wine | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 97 | 98 |
| L3 | spirits | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 97 | 98 |
| L4 | surrogates | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 97 | 98 |
| L0b | homemade samogon | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 97 | 98 |
| L0c | homemade wine, braga | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 97 | 98 |
| L0d | alcoholic cocktails (premixed bottles) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 97 | 98 |

*Interviewer! If the respondent answered '7', '98' or '99' to* ***ALL*** *of the previous questions in this section, skip to L0i*

**For each type of drink listed in the left hand column, please indicate on which day of the week each is usually drunk**

| | | only at the weekend | only on holidays/ celebration | on no particular day | never/almost never | difficult to answer | refuse to answer |
|---|---|---|---|---|---|---|---|
| L0e | alcohol (beer, wine, spirits or anything else containing alcohol) | 1 | 2 | 3 | 4 | 97 | 98 |
| L5 | beer | 1 | 2 | 3 | 4 | 97 | 98 |
| L6 | wine | 1 | 2 | 3 | 4 | 97 | 98 |
| L7 | spirits | 1 | 2 | 3 | 4 | 97 | 98 |
| L8 | surrogates | 1 | 2 | 3 | 4 | 97 | 98 |
| L0f | homemade samogon | 1 | 2 | 3 | 4 | 97 | 98 |
| L0g | homemade wine, braga | 1 | 2 | 3 | 4 | 97 | 98 |
| L0h | alcoholic cocktails (premixed bottles) | 1 | 2 | 3 | 4 | 97 | 98 |

***Interviewer! Skip to L9***

**L0i. Have you ever drunk alcohol in your life other than on a few occasions?**

*Please circle the single most appropriate answer.*

1 Yes ⇨ ***go to*** *L35a*
2 No ⇨ ***go to*** *L46*
97 difficult to answer ⇨ ***go to*** *L46*
98 refuse to answer ⇨ ***go to*** *L46*

**L9. How much beer do you usually drink on one occasion? ('occasion' means a single continuous period of drinking)**

*Please circle the single most appropriate answer.*

1 never drinks beer
2 1 bottle (0.5l) or less
3 2-4 bottles (0.5l)
4 5-6 bottles (0.5l)
5 more than 6 bottles(0.5l)
97 difficult to answer
98 refuse to answer

**L10. How much wine do you usually drink on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks wine
2 up to 200g
3 between 200 - 400g
4 between 400 - 600g
5 between 600 - 1000g
6 more than 1 litre
97 difficult to answer
98 refuse to answer

**L11. What quantity of spirits, such as vodka or other strong drinks, do you usually drink on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks spirits
2 Up to 50g
3 between 50 – 100g
4 between 100 - 200g
5 between 200 - 300g
6 between 300 - 400g
7 between 400 - 500g
8 more than 500g
97 difficult to answer
98 refuse to answe

**L12. What is the maximum quantity of beer ever drunk on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks beer
2 1 bottle (0.5l) or less
3 2-4 bottles (0.5l)
4 5-6 bottles (0.5l)
5 more than 6 bottles (0.5l)
97 difficult to answer
98 refuse to answer

**L13. What is the maximum quantity of wine ever drunk on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks wine
2 up to 200g
3 between 200 - 400g
4 between 400 - 600g
5 between 600 - 1000g
6 more than 1 litre
97 difficult to answer
98 refuse to answer

**L14. What is the maximum quantity of spirits ever drunk on one occasion?**

*Please circle the single most appropriate answer.*

1 never drinks spirits
2 up to 50g
3 between 50 – 100g
4 between 100 - 200g
5 between 200 - 300g
6 between 300 - 400g
7 between 400 - 500g
8 more than 500g
97 difficult to answer
98 refuse to answer

**L15. Do you ever drink spirits together with either beer or wine at the same sitting?**

*Please circle the single most appropriate answer.*

1 yes, often
2 yes, sometimes
3 no, never
97 difficult to answer
98 refuse to answer

**L16. Do you ever drink large quantities of spirits without also eating some food at the same sitting?**

*Please circle the single most appropriate answer.*

1 always
2 sometimes
3 rarely/never
97 difficult to answer
98 refuse to answer

**L17. How often do you become excessively drunk?**

*Please circle the single most appropriate answer.*

1 every day
2 several times a week
3 once a week
4 several times a month
5 once a month
6 less than once a month
7 never or almost never
97 difficult to answer
98 refuse to answer

**L18. Do you ever drink alcohol before noon?**

*Please circle the single most appropriate answer.*

1 No
2 yes, occasionally
3 yes, frequently
97 difficult to answer
98 refuse to answer

**L19. How often do you have a hangover?**

*Please circle the single most appropriate answer.*

1 every day
2 several times a week
3 about once a week
4 several times a month
5 about once a month
6 less than once a month
7 never or almost never
97 difficult to answer
98 refuse to answer

<u>L20 This question is deliberately omitted</u>

**L20a. During the last month, were they any days when you missed work because you felt unwell due to alcohol?**

*Please circle the single most appropriate answer.*

1 Yes
2 No ⇨ ***go to** L21*
3 Do not work ⇨ ***go to** L21*
97 difficult to answer ⇨ ***go to** L21*
98 refuse to answer ⇨ ***go to** L21*

**L20b If yes, how many days?**

☐☐ days
97 difficult to answer
98 refuse to answer

**L21. How often do you fail to fulfil your family or personal obligations due to drinking alcohol?**

1 every day
2 several times a week
3 about once a week
4 several times a month
5 about once a month
6 less than once a month
7 Never
97 difficult to answer
98 refuse to answer

**L22. Do you ever go to sleep at night with your clothes on because of being drunk?**

*Please circle the single most appropriate answer.*

1 every day
2 several times a week
3 about once a week
4 several times a month
5 about once a month
6 less than once a month
7 never or almost never
97 difficult to answer
98 refuse to answer

**L23. Do you ever drink alone?**

*Please circle the single most appropriate answer.*

1 yes, often
2 yes, sometimes
3 no, never
97 difficult to answer
98 refuse to answer

**L24. Do you usually drink alcohol at home or in other places?**

*Please circle the single most appropriate answer.*

1 usually at home
2 sometimes at home, sometimes elsewhere
3 usually elsewhere
97 difficult to answer
98 refuse to answer

**L24a With whom do you usually drink?**

*Multiple responses are permitted.*

**1** with the members of your household
**2** with other relatives
**3** with friends who work with you
**4** with neighbours
**5** with friends from childhood (youth)
**6** with friends you know through your hobbies
**7** a variety of people
**8** usually drinks alone
**9** other
97 difficult to answer
98 refuse to answer

I would now like to ask you about episodes of 'zapoi' in your life. By 'zapoi', I mean a period of continuous drunkeness of several days or more during which the person does not work and is withdrawn from normal life

**L25. Have you had one or more episodes of zapoi in the past year?**

*Please circle the single most appropriate answer.*

1 yes, often had episodes of zapoi
2 yes, sometimes had episodes of zapoi
3 no, never )
97 difficult to answer ) ⇨**go to** L32
98 refuse to answer )

**L26.** **Have you had one or more episodes of zapoi in the past <u>month</u>?**

*Please circle the single most appropriate answer.*

1 Yes
2 no )
97 difficult to answer ) ⇨ **go to** L27b
98 refuse to answer )

**L27.** **Have you had one or more episodes of zapoi in the past <u>week</u>?**

*Please circle the single most appropriate answer.*

1 yes
2 no
97 difficult to answer
98 refuse to answer

**L27b.** **How long does a typical episode last?**

*Please circle the single most appropriate answer.*

1 2 days
2 3 days
3 4 or more days
97 difficult to answer
98 refuse to answer

**L27c.** **How many episodes have you had in the past year?**

*Please circle the single most appropriate answer.*

1 1
2 2-4
3 5-9
4 10 or more
97 difficult to answer
98 refuse to answer

**L28.** **This question is deliberately omitted**

**L29.** **This question is deliberately omitted**

**L30.** **This question is deliberately omitted**

**L31.** **During your most recent episode of zapoi, did you drink surrogates (any alcoholic substances other than those intended for drinking)?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

**L32.** **Have you been arrested because you were drunk during the past year?**

*Please circle the single most appropriate answer.*

1 yes
2 No
97 difficult to answer
98 refuse to answer

**L33. Are you currently drinking more than, less than, or about the same as you were one year ago?**

*Please circle the single most appropriate answer.*
1 more than a year ago ⇨**go to** L35a
2 about the same as a year ago ⇨**go to** L35a
3 less than a year ago
97 difficult to answer ⇨**go to** L35a
98 refuse to answer ⇨**go to** L35

**L33b. Is this because of…**

*Multiple responses are permitted. Please circle all that apply.*
1 I was afraid of losing my job
2 Advised by doctor to stop
3 After treatment for alcohol problems
4 Felt too ill to drink
5 Pressure from or influence of my family or friends
6 Financial reasons
7 I decided I don't want to drink alcohol any more for other health-/illness-related reasons (please specify)…………………………………………..
8 I decided I don't want to drink alcohol any more for other non health-/illness-related reasons (please specify)…………………..................................
97 difficult to answer
98 refuse to answer

**L34. This question is deliberately omitted**

**L35a Have you drunk <u>any</u> alcohol in the past month?**

*Multiple responses are permitted. Please circle all that apply.*
1 Yes ⇨ go to L35
2 No
97 difficult to answer ⇨ go to L35
98 refuse to answer ⇨ go to L35

**L35b When did you stop drinking alcohol?**

*Please circle the single most appropriate answer.*
1 up to 6 months ago
2 more than 6, up to 12 months ago
3 more than 1, up to 5 years ago
4 more than 5 years ago
97 difficult to answer
98 refuse to answer

**L35c Why did you stop drinking alcohol?**

*Please circle the single most appropriate answer.*

1 I was afraid of losing my job
2 Advised by doctor to stop
3 After treatment for alcohol problems
4 Felt too ill to drink
5 Pressure from or influence of my family or friends
6 Financial reasons
7 I decided I don't want to drink alcohol any more for other health-/illness-related reasons (please specify)…………………………………………..
8 I decided I don't want to drink alcohol any more for other non health-/illness-related reasons (please specify)…………………..................................
97 difficult to answer
98 refuse to answer

**L35. Was there ever any period in your life when you drank heavily other than during the past 12 months?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

**L36. Have you ever had help or advice from a doctor, narcologist, social worker or some other professional for an alcohol problem?**

*Please circle the single most appropriate answer.*

1 Yes
2 no )
97 difficult to answer ) ⇨ ***go to** L38*
98 refuse to answer )

**L37. Did you get such help or advice in the past 12 months?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

**L37b. Have you ever attended the Narcology Dispensary?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

**L38. Have you ever been taken to a sobering-up centre?**

*Please circle the single most appropriate answer.*

1 Yes
2 No )
97 difficult to answer ) ⇨ ***go to** L41*
98 refuse to answer )

**L39. Was this during the past 12 months?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

**L40. This question is deliberately omitted**

**L41 How long, in minutes, does it take to get to the nearest place that one can buy beverages?**

*Please circle the single most appropriate answer.*

1 <5 minutes
2 5-10 minutes
3 10-30 minutes
4 >30 minutes
97 Difficult to answer
98 refuse to answer

**L44 Have you ever been admitted to hospital/clinic because of alcohol poisoning ?**

*Please circle the single most appropriate answer.*

1 Yes
2 No ⇨ ***go to** L46*
97 Difficult to answer ⇨ ***go to** L46*
98 refuse to answer ⇨ ***go to** L46*

**L45 What had you drunk?**

…………………………………………………………………………………….
97 Difficult to answer
98 refuse to answer

**L46 Did your father go on zapoi when you were growing up?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 Difficult to answer
98 refuse to answer

**L47 Did your father drink surrogates when you were growing up?**
*Please circle the single most appropriate answer.*

1 Yes
2 No
97 Difficult to answer
98 refuse to answer

**L48 Does anyone in your household apart from you go on zapoi?**
*Please circle the single most appropriate answer.*

1 Yes
2 No
97 Difficult to answer
98 refuse to answer

**L49 Does anyone in your household apart from you drink surrogates?**
*Please circle the single most appropriate answer.*

1 Yes
2 No
97 Difficult to answer
98 refuse to answer

Interviewer: ask the following questions to men who drink surrogates a few times per year or more often

**S1 What is the main reason that you drink surrogates?**

*Please circle the single most appropriate answer.*

1 Taste
2 Psychological /physical effect
3 Ease of purchase
4 Price
5 Other reasons. Please specify …………………………………………………………..
97 difficult to answer
98 refuse to answer

**S2 When did you start consuming surrogates?**

*Please circle the single most appropriate answer.*

1 within the past month
2 within past 6 months
3 within the last year
4 more than a year ago
97 difficult to answer
98 refuse to answer

**S3 What surrogates do you drink?**

*Interviewer! Please show respondent card S3.*

*Select all possible answers*

1 Yason
2 Troyar
3 Composition
4 Troynoy or any other cologne or perfume (write what exactly he consumes))
____________________________________________
5 Infusion of juniper
6 Infusion of hawthorn
7 Pepper tincture
8 Other types of spirituous infusions (what exactly)_____________________
9 Spirits (technical, medical or other)
10 Windows cleaning liquid, other cleaners
11 Other types of liquids containing spirits (which exactly?)
________________________________________________________
97 difficult to answer
98 refuse to answer

**S4 Do you ever drink surrogates at home?**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

**S5 Where do you usually buy surrogates?**

*Please circle the single most appropriate answer.*

1 Kiosk
2 Pharmacy
3 Market
4 Other shop
97 difficult to answer
98 refuse to answer

**S6 How long, in minutes, does it take you to get to the nearest place that you buy surrogates?**

*Please circle the single most appropriate answer.*

1 <5 minutes
2 5-10 minutes
3 10-30 minutes
4 >30 minutes
97 difficult to answer
98 refuse to answer

**S7 When you drink surrogates, how many bottles do you usually drink per day?**

*(write down what the respondent answers)*

________bottles
97 difficult to answer
98 refuse to answer

**S8 When you drink surrogates, how much in mls do you usually drink per day? (not diluted)**

*(write down what the respondent answers)*

________mls
97 difficult to answer
98 refuse to answer

**S9 This question is deliberately omitted**

**S10 What best describes your drinking behaviour before you started using surrogates?**

*Please circle the single most appropriate answer.*

1 drank beverages, but not very much
2 drank beverages a lot but had no zapoi
3 drank a lot and went on zapoi
97 difficult to answer
98 refuse to answer

I will now ask you some questions concerning your smoking habits

**M1. Are you a current smoker?**

*Please circle the single most appropriate answer.*
1 never a smoker ⇨ **go to** M6
2 no, ex-smoker
3 yes, a current-smoker ⇨ **go to** M3
97 Difficult to answer ⇨ **go to** M6
98 refuse to answer ⇨ **go to** M6

**M2. How many years ago did you stop smoking regularly?**

*Please circle the single most appropriate answer.*
1 up to 1 year ago
2 more than 1, up to 5 years ago
3 more than 5, up to 10 years ago
4 more than 10 years ago
97 difficult to answer
98 refuse to answer

**M3. What do/did you smoke most often?**

*Please circle the single most appropriate answer.*
1 papyrosi
2 filtered cigarettes
3 unfiltered cigarettes
4 other (specify) ..........................................................................................................................
97 difficult to answer
98 refuse to answer

**M4. When you smoke/smoked, how many per day is/was usual?**

*Please circle the single most appropriate answer.*
1 up to 10
2 more than 10, up to 20
3 more than 20
97 difficult to answer
98 refuse to answer

**M5. How old were you when you started smoking regularly?**

*(open questions)*
☐☐ Years
97 difficult to answer
98 refuse to answer

**M6. Have his parents ever smoked?**

*Please circle the single most appropriate answer.*
1 yes, father only
2 yes, mother only
3 yes, both parents
4 no, neither
97 difficult to answer
98 refuse to answer

<u>We previously interviewed you on dd/mm. We are aware that we have repeated some questions; this is because we would like to be absolutely clear on some of the things that may have changed since we that time. We would be grateful if you would also answer the following questions which ask specifically about changes which may have ocurred.</u>

<u>Interviewer! If this respondent was not previously interviewed, please ask about changes since the proxy was interviewed in the last study.</u>

**N1 Have any new people joined or left your household since the last interview.**

*Please circle the single most appropriate answer.*

1 Yes
2 No
97 difficult to answer
98 refuse to answer

**N2 Has there been any change in your employment status since the last interview?**
*Please circle the single most appropriate answer.*

1 Yes
2 No ⇨ **go to** N4
97 difficult to answer ⇨ **go to** N4
98 refuse to answer ⇨ **go to** N4

**N3 If yes, please describe**

**………………………………………………………………………………………………………………**

**N4 Has there been any change in your marital status since the last interview?**
*Please circle the single most appropriate answer.*

1 Yes
2 No ⇨ **go to** N6
97 difficult to answer ⇨ **go to** N6
98 refuse to answer ⇨ **go to** N6

**N5 If yes, please describe**

**………………………………………………………………………………………………………………**

**N6 Has there been any change in your drinking behaviour since the last interview?**
*Please circle the single most appropriate answer.*

1 I was an abstainer, now I drink alcohol
2 I did drink alcohol, now I am an abstainer
3 I did drink alcohol, now I drink surrogates too
4 I did drink surrogates, now I only drink alcholic drinks and no surrogates
5 No change
6 Other (specify) …………………………………………………..
97 difficult to answer
98 refuse to answer

Section W: Consent

We may wish to recontact you in the future for further collaboration in research. This may involve reinterview, or other questionning.

**W1 Do you agree that we may recontact you in this way?**

*Please circle the single most appropriate answer.*

1 yes
2 No
97 difficult to answer
98 refuse to answer

Interviewer! Give the respondent the information sheet for the health exam and give them time to read it before asking for consent.

W2 Interviewer! Mark if the respondent gives their consent for recontact for the health exam

*Please circle the single most appropriate answer.*

1 yes
2 No⇨ **go to** X1
97 difficult to answer
98 refuse to answer

**W3 Do you have any request about the location, date and time of the health check?**

……………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………
………………………………………………….

97 difficult to answer
98 refuse to answer

**Thank you for your time in helping us with this study**

Section X: The final questions are about the circumstances of the interview

***The following questions are answered only by you as an interviewer and are not to be read out:***

***X1*** ***Was the proxy respondent present in the same room or within earshot at any point during your interview?***

*Please circle the single most appropriate answer.*

1 yes
2 No

**X2** ***How would you judge the reliability of the answers from this interview?***

1 satisfactory
2 not entirely satisfactory. For example, a moderate level of non-response by *the subject*, or perhaps small interruptions affected the quality of the responses
3 poor. For example, a high level of non-response by *the subject*, or perhaps many/constant interruptions affected the quality of the responses.

**X3** ***Were there any other people present in the same room while the interview was taking place?***

1 yes
2 no ⇨***go to*** *X5*

**X4.** ***Please provide details of other people present during the interview, including their relationship to respondent:***

1

....................................................................................................................................

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....................................................................................................................................

..........

....................................................................................................................................

...........................................................................

**X5.** ***Were there any interruptions to the interview?***

1 yes
2 no ⇨***go to*** *X7*

**X6.** ***Please provide details of interruptions, including their duration:***

1

..........................................................................................................................................

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**X7.** ***Any other comments, including indication of questions that were particularly hard to answer***

1

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**<u>End of questionnaire</u>**

## C: Self-Completed Questionnaire

### Self-reported health and behaviour questionnaire

BARCODE

label

ID of subject | | | | | | |

Although you may feel that some of the following questions may not apply to you, please would you answer all of the following questions.

Example of answering questions with several numbered answers:

**17.** Because of my drinking, I have not eaten properly

| | |
|---|---|
| Never | 0 |
| Once or a few times | 1 |
| Once or twice a week | 2 |
| Daily or almost daily | 3 |

**This information will help us to get the better idea of how you feel and how well you are able to do your usual activities. Answer every question by placing a check mark on the line in front of the appropriate answer. If you are unsure about how to answer a question, please give the best answer you can and make a written comment beside your answer.**

**1. In general, would you say your health is:**

| | |
|---|---|
| Excellent | 1 |
| Very good | 2 |
| Good | 3 |
| Fair | 4 |
| Poor | 5 |

**The following two questions are about activities you might do during a typical day.**

2. **Does YOUR HEALTH NOW LIMIT YOU in these activities? If so, how much? MODERATE ACTIVITIES, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf:**

| | |
|---|---|
| Yes, limited a lot | 1 |
| Yes, limited a little | 2 |
| No, not limited at all | 3 |

3. **Does YOUR HEALTH NOW LIMIT YOU in these activities? If so, how much? Climbing SEVERAL flights of stairs:**

| | |
|---|---|
| Yes, limited a lot | 1 |
| Yes, limited a little | 2 |
| No, not limited at all | 3 |

**During the PAST 4 WEEKS have you had any of the following problems with your work or other regular activities AS A RESULT OF YOUR PHYSICAL HEALTH?**

4. **ACCOMPLISHED LESS than you would like:**

| | |
|---|---|
| All of the time | 1 |
| Most of the time | 2 |
| Some of the time | 3 |
| A little of the time | 4 |
| None of the time | 5 |

5. **Were limited in the KIND of work or other activities:**

| | |
|---|---|
| All of the time | 1 |
| Most of the time | 2 |
| Some of the time | 3 |
| A little of the time | 4 |
| None of the time | 5 |

**During the PAST 4 WEEKS, were you limited in the kind of work you do or other regular activities AS A RESULT OF ANY EMOTIONAL PROBLEMS (such as feeling depressed or anxious)?**

**6. ACCOMPLISHED LESS than you would like:**

All of the time 1
Most of the time 2
Some of the time 3
A little of the time 4
None of the time 5

**7. Didn't do work or other activities as CAREFULLY as usual:**

All of the time 1
Most of the time 2
Some of the time 3
A little of the time 4
None of the time 5

**8. During the PAST 4 WEEKS, how much did PAIN interfere with your normal work (including both work outside the home and housework)?**

Not at all 1
A little bit 2
Moderately 3
Quite a bit 4
Extremely 5

**The next three questions are about how you feel and how things have been DURING THE PAST 4 WEEKS. For each question, please give the one answer that comes closest to the way you have been feeling.**

**9. How much of the time during the PAST 4 WEEKS –**

**Have you felt calm and peaceful?**

All of the time 1
Most of the time 2
Some of the time 3
A little of the time 4
None of the time 5

**10. How much of the time during the PAST 4 WEEKS –**

**Did you have a lot of energy?**

| | |
|---|---|
| All of the time | 1 |
| Most of the time | 2 |
| Some of the time | 3 |
| A little of the time | 4 |
| None of the time | 5 |

**11. How much of the time during the PAST 4 WEEKS –**

**Have you felt downhearted and blue?**

| | |
|---|---|
| All of the time | 1 |
| Most of the time | 2 |
| Some of the time | 3 |
| A little of the time | 4 |
| None of the time | 5 |

**12. During the PAST 4 WEEKS, how much of the time has your PHYSICAL HEALTH OR EMOTIONAL PROBLEMS interfered with your social activities (like visiting with friends, relatives, etc.)?**

| | |
|---|---|
| All of the time | 1 |
| Most of the time | 2 |
| Some of the time | 3 |
| A little of the time | 4 |
| None of the time | 5 |

**Where questions ask about 'drinks', these are referring to an average portion, e.g. 25g of vodka, one 330ml bottle of beer or 150 mls of wine**

| | | Never (skip to q 21,22) | Monthly or less | 2-4 times per month | 2-3 times per week | 4 or more times per week |
|---|---|---|---|---|---|---|
| **13.** | **How often do you have a drink containing alcohol, including substances not intended to be drunk** | 1 | 2 | 3 | 4 | 5 |

**14.** **How many drinks (portions) containing alcohol do you have on a typical day when you are drinking?**
*Please circle the single most appropriate answer.*

0 1 or 2
1 3 or 4
2 5 or 6
3 7 to 9
4 10 or more

**15.** **How often do you have 6 or more drinks on one occasion?**
*Please circle the single most appropriate answer.*

0 Never
1 Less than monthly
2 Monthly
3 Weekly
4 Daily or almost daily

| | | Never | Less than monthly | Monthly | Weekly | Daily or almost daily |
|---|---|---|---|---|---|---|
| **16.** | **How often during the last 3 months have you found that you were not able to stop drinking once you had started?** | 1 | 2 | 3 | 4 | 5 |
| **17.** | **How often during the last 3 months have you failed to do what was normally expected of you because of drinking?** | 1 | 2 | 3 | 4 | 5 |
| **18.** | **How often during the last 3 months have you needed a drink first thing in the morning to get yourself going after a heavy drinking session?** | 1 | 2 | 3 | 4 | 5 |
| **19.** | **How often during the last 3 months have you had a feeling of guilt or remorse as a result of your drinking?** | 1 | 2 | 3 | 4 | 5 |
| **20.** | **How often during the last 3 months have you been unable to remember what happened the night before because of your drinking?** | 1 | 2 | 3 | 4 | 5 |

**21.** **Have you or someone else been injured because of your drinking?**

*Please circle the single most appropriate answer.*

1 No

2 Yes, but not in the last year

3 Yes, during the last year

**22.** **Has a relative, friend, doctor or other health worker been concerned about your drinking or suggested you cut down?**

*Please circle the single most appropriate answer.*

1 No

2 Yes, but not in the last year

3 Yes, during the last year

**23. Have you drunk any alcohol in the past 3 months**

1 Yes -> Please continue with the next question, 24.

2 No -> Thank you for your participation. Please end here.

**Think about your drinking in the last 3 months and answer each question ticking the closest answer to how you see yourself.**

**24. Do you find yourself thinking about when you will next be able to drink?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

**25. Is drinking more important than anything else you might do during the day?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

**26. Do you feel that your need for drink is too strong to control?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

**27. Do you plan your days around getting and drinking alcohol?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

**28. Do you drink in a particular way in order to increase the effect it gives you?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

**29.** **Do you drink morning, afternoon and evening?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

**30.** **Do you feel you have to carry on drinking once you have started?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

**31.** **Is getting the effect you want more important than the particular type of alcohol you use?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

**32.** **Do you want to drink more when the effect starts to wear off?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

**33.** **Do you find it difficult to cope with life without alcohol?**

| | |
|---|---|
| Never | 0 |
| Sometimes | 1 |
| Often | 2 |
| Nearly always | 3 |

***Thank you for answering questions!***