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# The influence of work stress on alcohol-use: A meta-analysis

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**Abstract**

The aim of this study is to investigate with a meta-analysis the association between work stress and alcohol consumption and dependence. The second aim of this study is to discover whether gender affects the association of interest. Database PubMed was used to search for literature that includes information about the association between work stress and alcohol use. Twelve studies were found that met the inclusion criteria. Alcohol consumption was operationalized as drinking at least one glass of alcohol due to work stress until the number of glasses which will fall under alcohol dependence. (i.e., 1-15 glasses a week for women and 1-22 glasses a week for men). Meta-analysis showed that the combined effect size of the association between work stress and alcohol consumption was significant, but very small ($r$ = 0.043, 95 % CI =0.015, 0.072, $p$ = .003). The combined effect size of the association between work stress and alcohol dependence also was significant and small ($r$ = 0.171, 95 % CI = 0.089, 0.250, $p$ < .001). A meta-regression analyses showed that for gender only men significantly moderate the association between work stress and alcohol use. In conclusion, the meta-analysis supports that there is an association between work stress and alcohol consumption and alcohol dependence. Men are more likely to be at risk for alcohol dependence due to work stress. The results should be interpreted with caution because of the limitations of this study, such as high heterogeneity and the small number of studies.

# 1. Introduction

## 1.1. Stress and urbanization

The modern world of 2014 is urbanizing at a rapid pace, causing major changes in human lives daily. Lifestyles, working circumstances, social behaviour and health are all changing (World Health Organization, 2011). With respect to the changes and stresses occurring at the workplace, work stressors for a long time invariably took the form of material factors, such as physical work and working in chemical factories (Siegrist & Rödel, 2006). Since 1990 many more jobs have become emotionally and mentally demanding. There seems to be significant changes with a change in the prevalence of health-adverse work environments from material to emotional and mental stressors (Siegrist & Rödel, 2006). In these days fewer jobs are physical demanding and more are defined by the mental and emotional demands. For example computer-based information processing is becoming a huge part of a lot of jobs and also jobs in the service sector seems to continue to increase. With globalization, pressure at work is increasing significantly and job insecurity is on the increase (Siegrist & Rödel, 2006; Christopherson, Garretsen & Martin, 2008). As a consequence of this urbanisation and the attendant changing working circumstances, stress at work in our modern society is likely to be on the increase. This issue is in an essential one for society, as work stress can have negative consequences.

Much research into work stress and its influence on health and health behaviour has been and is being undertaken. In this study the focus is on the association between work stress and alcohol use. A meta-analysis will be conducted because no systematic research has been undertaken to test the presence and possible strength of such an association. In the next paragraphs the concept of work stress will be further explained, as well as its relation to alcohol use.

## 1.2 Work stress models and health

Work-related stress can be described and measured by two well-known models: the job-demand-control model and the effort-reward-imbalance model (Karasek, 1979; Siegrist, 1996). These two models classify complementary aspects of a working environment using both a stressful and a buffering psychosocial work component (Siegrist & Rödel, 2006).

The *job-demand-control model* focuses on two major work job characteristics or axes: job demands and job control. Job demand describes the social, physical, psychological and administrative facets of the job. These require constant psychological and / or physiological

costs. Job control can be defined as the latitude for decision-making and the freedom to select the most suitable skills for the task (Karasek, 1979; Karasek and Theorell, 1990). If a job entails physical and psychological needs and a worker has insufficient personal resources to respond to its demands and expectations, then this results in job strain. The axis of job strain and high demands are likely to result in stress and also in impaired health. Conversely, a high level of job control has positive health effects (Karasek and Theorell, 1990).

These two characteristics can be combined in a two by two scheme of low versus high demands and low versus high control, and the job-demand-control model consequently describes four job types. A job is an 'active' job when it has high demands and when job control is high. In such cases the skills and level of control of the workers ought to be suitable for the job. Karasek (1979) describes the job as 'passive' if workers have low levels of demand and control. Passive workers may experience mobility problems over time and problems with certain skills. If workers experience low demands, but a high level of control, this can be described as a 'low-strain' job The last job type described in the demand-control-model is the 'high-strain' job. This is characterized by high levels of demand but low levels of control. This type of job has negative health effects as it causes the most stress. This means that the workers' ability to use skills effectively or to rise to meet the high demands remain low (Häusser, Schulz-Hardt & Mojzisch, 2014; Karasek, 1979).

The *effort-reward-imbalance model* was created by Siegrist in 1996. It is built on reciprocity, fulfilled tasks, and being reciprocated by acceptable rewards. These rewards can be for example, money, esteem or promotion. The model comprises two dimensions in interaction with each other. The first dimension is a 'high effort' and the other is a 'low reward' dimension. 'High effort' can be divided into external effort such as demands or obligations, and internal effort such as coping mechanisms, e.g. need for control. The 'low reward' dimension is concerned with insufficient monetary return, or too little personal recognition, thus producing the belittlement of a perceived low status. An imbalance can arise when a worker puts in too much effort proportional to the reward. This imbalance may cause a state of emotional distress with a special tendency towards autonomic arousal and associated strain reactions (Siegrist, 1996).

These models have been shown to be valuable, as they predict health problems. Work stress may have a negative influence on somatic and mental health (Tsutsumi et al., 2003). Stress research has shown that job characteristics like psychological job demands and job control can predict somatic illnesses, such as cardio-vascular diseases, musculoskeletal disorders, high blood pressure and fatigue work stress can have negative psychological effects

such as burnouts and poor mental health generally, such as a depression. (Benson & Magraith, 2005; Tsutsumi et al., 2003; Godin, Kittel, Coppieters & Siegrist, 2005; Niedhammer & Chea, 2003; Mallen, Peat, Thomas, Dunn & Croft , 2007). Work stress can lead to over-eating, which can lead to an overweight condition or even obesity (Abel, 1991). Research confirms that job strain causes more weight problems, less physical activity and an increase in smoking and drinking, which are high risk factors for working people. Much less is known about how the various components of these models are associated with health behaviour, such as alcohol consumption (Tsutsumi et al., 2003; Linde et al., 2012). That is why this study is restricted to the high risk behaviour of alcohol consumption associated with work stress. The consequences of alcohol consumption that will be discussed in the following section will explain why there is a need of research into this topic.

### 1.3 Drinking behaviour and the consequences

Alcohol dependence is an unadjusted pattern of alcohol use that leads to clinically significant impairment or distress. Alcohol dependence is showed by tolerance, withdrawal or drinking to relieve withdrawals, incapability to reduce drinking, drinking more or for longer than planned, abandonment of activities, time spent related to drinking or recovering from drinking, and continued use of alcohol despite alcohol-related psychological or physical problems (American Psychiatric Association [APA], 2007).

Alcohol dependence can be associated with negative health. Someone who consumes alcohol on an average level has an increased risk for major chronic diseases and psychiatric conditions. On an average level for men is 5 or more drinks per day standard, for a week this is 15 or more, this can be considered as alcohol dependence for men. For women this is 4 or more standard drinks per day or 8 or more per week, which can be considered as alcohol dependence for women (Cargiulo, 2007). As earlier said alcohol dependence can increase the risk for psychiatric diseases, for example diseases like, major depression, panic attacks, generalized anxiety disorder, personality disorder and suicide. Alcohol dependence can also cause brain damage or diabetes mellitus (Cargiulo, 2007). However, moderate alcohol consumption is cardio-protective (Rehm et al., 2009). Yet, it has also been shown to be causally related to more than sixty diverse health conditions, in most but not all cases detrimentally (Cargiulo, 2007; Rehm et al., 2009).

Another negative consequence of heavy drinking is the economic costs. Consequences of heavy drinking could for example include conflicts with supervisors or falling asleep at work. This will invariably result in lowered productivity and lack of drive

(Ames, Grube & Moore, 1997). In 1992, the total economic cost of alcohol abuse in the United States was an estimated 176 billion dollars, where 28 billion resulted from healthcare expenses. The remaining 148 billion dollars accounted for such factors as premature deaths, impaired productivity, imprisonment and crime. These are admittedly outdated figures, but they nevertheless give an indication of the huge costs of alcohol abuse (Rice, Kelman & Miller, 1991).

Alcohol abuse may lead to a failure to fulfil responsibilities at home, at work or at school or college. Alcohol abuse is the most common mental health problem in the adult population after depression (Kessler, Berglund & Delmer, 2005). Research has been performed on the prevalence of alcohol abuse among a group of 43,093 US adults between the ages of 18 and 65. The group under study included five different races (white, black, native American, Asian and Hispanic) coming from different areas and earning different incomes. The studies show that around 20 percent of the adults over 60 years of age has at some point experienced one or both of these mental health problems (Kessler, et al., 2005; Hasin, Stinson, Ogburn & Grant, 2007). The research shows a prevalence of 4.7% for alcohol abuse. Alcohol dependence has a prevalence of 3.8. When taking alcohol use disorder into account the prevalence is 8.5 %. Alcohol use can be divided into alcohol abuse and alcohol dependence. The prevalence of lifetime Diagnostic and Statistical Manual of Mental Disorders-IV [DSM] is 17.8% for alcohol abuse and 12.5 % for alcohol dependence. The lifetime prevalence in total of any alcohol use disorder is 30.3%. In 2004 global prevalence rates of alcohol use disorders among adults were estimated to range from 0% to 16%. Lifetime alcohol use disorders have a high prevalence in the US population. A study of 15,500 participants in a national longitudinal study of adolescent health confirmed this (World Health Organization [WHO], 2011).

**1.4 Drinking behaviour in association with gender**

Men are more likely to drink alcohol excessively than women. Excessive drinking is associated with significant increases in short-term risks to health and safety (Naimi et al., 2003; Nolen-Hoeksma, 2004). In a study alcohol drinking was measured under men, it seems that in a month around 63 % of adult men reported alcohol use. In this same time period men (24 %) were two times more likely to heavy drink than women. Per year, women average about 2.7 heavy drinking episodes per year, while men per year average about 12.5 heavy drinking episodes (Naimi et al., 2003). An estimating is that at some point in life about 8 % of women will meet criteria for alcohol dependence and that 17 % of men will meet criteria for

alcohol dependence. Disorder of alcohol abuse over 12-monhts is larger among men (Hasin, et al., 2007). It was found that men may be at a higher risk for alcohol disorders (Haberstick et al., 2014). Studies show men drink more alcohol and are more at risk for alcohol, dependence and abuse. It is not known whether the association between work-stress exposure and alcohol use is different between the genders. Therefore research is also needed to discover whether gender affects association between work stress and drinking behaviour.

Research shows that a substantial portion of the population suffers either from alcohol dependence or alcohol abuse (Hasin, et al., 2007). This in association with work stress could be alarming. In conclusion, work stress might lead to alcohol consumption which can have negative health consequences (Cooper et al, 1992). In the next paragraph the research on this link will be discussed.

### 1.5 Research on work stress and drinking behaviour

Given the huge burden associated with alcohol consumption, and the rise of stress at the workplace in recent years, the aim of this study is to pool the information from different articles to discover if there is any association between work stress and alcohol use. There has been much research undertaken on this topic already. Some of the larger studies that have been undertaken will be shortly discussed.

In a large study by Hiro, Kawakami, Tanaka, & Nakamura (2007) the association between work stress and heavy drinking was investigated among 25,104 Japanese male workers in different age groups. Alcohol use was considered as heavy drinking if a woman drinks 15-35 glasses a week and if a man drinks 22-50 glasses a week. They found that some occupational stressors were indeed related to heavy drinking behaviour. This association however varied among different age groups. For those of 18-29 and also those of 50-72 years of age, heavy drinking was associated with the occupational stressor ‘low support from the supervisor’. For the 30-39 year age group the occupational stressors of intra-group conflict, low job control and high cognitive demands were related to heavy drinking. For the final age group, those from 40-49 years, heavy drinking was associated with under-used abilities, quantitative workloads and the physical environment (Hiro, Kawakami, Tanaka, & Nakamura, 2007). Other research also found an association between work stress and alcohol consumption. In a cross-sectional analysis a high prevalence of drinking associated with high psychological demands was discovered. And in a prospective study the results show that there is a high risk factor for alcohol dependence for men with higher work stress (Tsutsumi et al., 2003; Head, Stansfeld & Siegrist, 2004).

In a study with 2,902 participants the relationship between job strain and alcohol abuse was examined. The participants were from the US and were 50 years of age or older. Job strain was measured by Karasek's job-demand-control model (Karasek, 1979). Alcohol abuse was measured using two dichotomous measures. The first was moderate drinking, which is an average of two or more drinks per day for men and one or more drinks per day for women. The second measure was heavy drinking, or five or more drinks on a single occurrence. Both moderate and heavy drinking were found to be unrelated to job strain (Mezuk, Bohnert, Ratliff & Zivin, 2011). Other research also did not show results of an association between work stress and alcohol consumption (Goston, Caiaffa, de Souza Andrade & Vlahov, 2013; Lallukka et al., 2008). To conclude, there seems to be different associations between work stress and alcohol-induced behaviour across different studies. Some research has found an association between work stress and alcohol-induced behaviour, but by no any means all of them. A meta-analysis on the association between work stress and alcohol consumption is therefore needed.

### 1.6 The current study

This study will focus on calculating the aggregate association between work stress and alcohol-use. Work stress in the studies is measured directly and indirectly. Direct measurement means that a questionnaire has been provided with questions related directly to the experience of work stress. Indirect measurement means that components of the job-demand-control model and the effort reward imbalance model have been assessed, which do not directly ask participants whether they feel stressed (Karasek, 1979; Siegrist, 1996).

We hypothesize (H1) that work stress is positively associated with alcohol consumption. We also hypothesize (H2) that work stress is associated with alcohol dependence. The third aim of this study is to discover whether gender affects the proposed association between work stress and drinking behaviour. Men are at a higher risk of suffering from some form of alcohol disorder (Hasin, et al., 2007; Haberstick et al., 2014). The third hypothesis (H3) will therefore be that stress is more strongly associated with alcohol consumption and dependence in men than women.

## 2. Method

### 2.1 Literature search

This meta-analyses formed part of a larger meta-analysis on the association between

work stress and health. A literature search was performed using the PubMed database from December 1928 through April 2014. Nearly all medically important publications of the last few years can be found in the database PubMed. The literature search through PubMed incorporated one search strategy. We formed search terms by combining text words indicating work (work OR job OR occupational) AND stress (stress OR distress OR strain OR burn-out))) AND health (mental health OR physical health OR physical OR mental complaints OR mortality complaints). We searched the PubMed database for peer-reviewed and English-language articles. The articles were scanned by title and abstract. Based on the information in there we decided to include or exclude the article.

**2.2 Codebook: criteria for inclusion and classification**

After the literature search we designed a codebook containing the criteria a study had to meet to be included in the meta-analysis. Category A described a reason for exclusion or uncertainty after a full text review. Articles were excluded if the searched relation did not fit with the scope of our research, the article was a review/meta-analysis/perspective or there was no full text available. Category B and C were to classify the outcome and the predictors of the articles. There were different outcomes (category B): psychological, medical, physical/health complaints, physiological, behaviour and economic. Category C: the predictors were experienced work stress, work characteristics, interpersonal work stress and otherwise not known. The dependent variable was alcohol behaviour. With this codebook we could search for articles which included all kind of predictors of work stress and behaviour, likely encompassing most studies on work stress, alcohol consumption, and dependence.

**2.3 Data extraction**

After the process of exclusion, inclusion and classification the extraction of data was started. From the selected articles the following data were collected: the sample size, mean age/range, percentage of females, distribution of ethnicity, occupation, blue or white collar workers, the type of study, means and standard deviations, test statistics and effect sizes. Through reading the articles carefully it was ascertained whether the researched associations were within the scope of our research. If not the case the article was excluded from our database.

**2.4 Data analyses**

To conduct the statistical analyses we used the Comprehensive Meta-Analysis

Software, version 2 (Borenstein, Hedges, Higgins, & Rothstein, 2005). For every association we pooled the independent variable work stress into negative factors of work stress, like demands, effort reward imbalance, burn-out, overtime work, strain, and exhaustion. Because there were too little studies we did not include positive factors for work stress in the analyses, such as supports and satisfaction.

We operationalized the dependent variable as alcohol dependence and alcohol consumption. Alcohol consumption was in turn operationalized as drinking at least one glass of alcohol due to work stress until the number of glasses which will fall under alcohol dependence. This is 1-15 glasses a week for women and 1-22 glasses a week for men (van Laar et al., 2013). For alcohol dependence we used the criteria following the DSM-IV (APA, 2007). The criteria are: a tolerance for alcohol, abstinence, drinking more alcohol than planned, the continued desire or a few successful attempts to reduce the drinking of alcohol, losing time to get alcohol, influence on social life, and still drinking even if it has an influence on mental or physical health. A score of 0 indicated no alcohol dependence and a score of 1 indicated alcohol dependence (APA, 2007). We also used the criteria from the National Drug Monitor, to determine how many glasses we see as defining alcohol dependence. Following their criteria alcohol use is considered excessive if a woman drinks 15-35 glasses a week and if a man drinks 22-50 glasses a week, considering every glass contains approximately 10 grams of pure alcohol (van Laar et al., 2013).

For every association between work stress and alcohol we calculated the effect size (correlation coefficient r) with 95 % confidence intervals. By calculating $I^2$, which indicates if heterogeneity is present or not, the heterogeneity was examined. We statistically tested heterogeneity by examining the Q statistic. Up to 25 % I-squared is considered as low heterogeneity, between 25-50 % the heterogeneity is considered moderate and 50 % and above is considered high heterogeneity (Higgings & Thompson, 2002). By way of a funnel plots analysis we explored if there was any publication bias. Using the Egger's test it can be revealed whether the funnel plot is symmetric or not and whether the funnel plot indicates the absence or existence of a significant publication bias (Egger, Smith, Schneider & Minder, 1997).

## 3. Results

### 3.1 Descriptive statistics

The search in the database PubMed yielded a total of 8,711 articles. Figure 1 presents a flow chart detailing the different steps involved in searching for relevant studies. These

articles were scanned by reading the title and abstract. After this screening, 1,342 articles remained. This number was limited to 479 articles through screening as prescribed by the designed codebook. The scope was further narrowed to 194 articles for the larger meta-analysis on the association between work stress and health. Within these articles the search was specified for the association between work stress and alcohol use (12 articles).

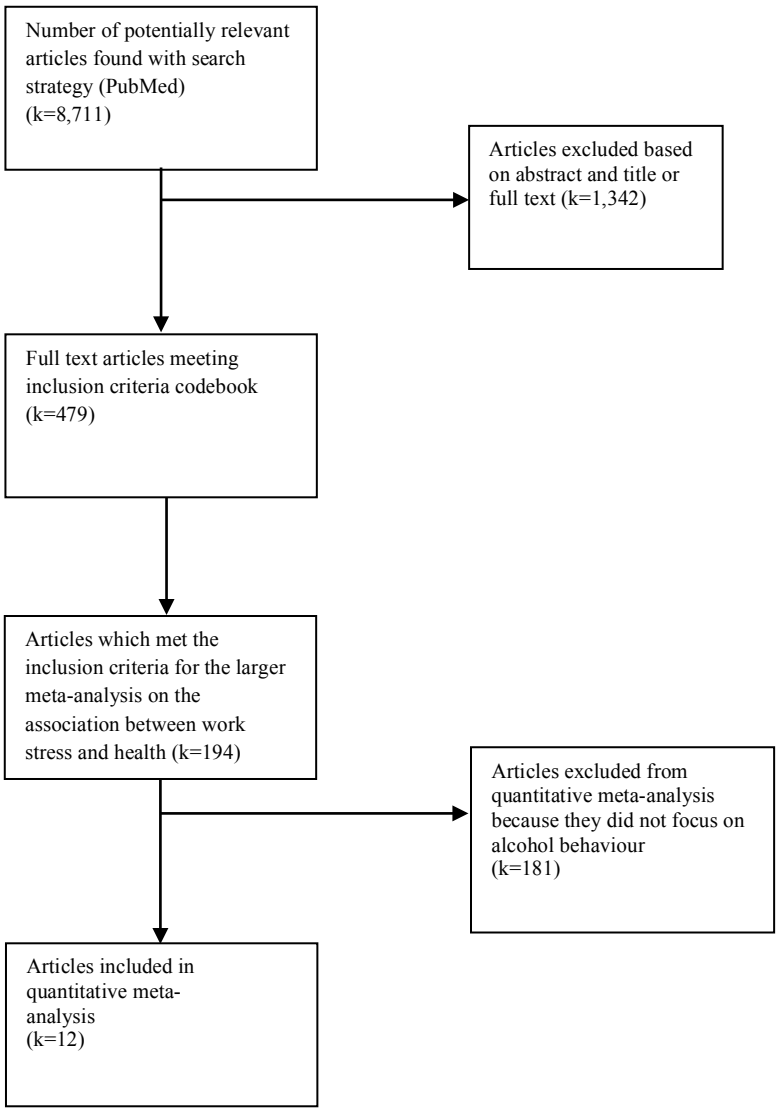


*Figure 1.* Flow chart of selection of the articles

Twelve studies met all the inclusion criteria and were included in the meta-analysis. The characteristics of the twelve studies are presented in Table 1. Eleven studies provided information about the gender characteristics of the population that was studied, which is important for measuring the moderator. Alcohol use was measured by different instruments,

but all the instruments in the studies checked the gram or glasses of alcohol so this could categorized the behaviour into alcohol consumption and alcohol dependence.

*Table 1.*Studies eligible for quantitative meta-analysis of research on work stress and alcohol use

| First author, year | N | Mean age | Female % | Predictors | Outcome | Work stress measure | Alcohol consumption measure |
|---|---|---|---|---|---|---|---|
| Ahola, 2006 | 3,276 | 45 | 48 | Burn-out | Alcohol dependence | The Maslach Burnout Inventory | Standardized Composite International Diagnostic Interview (CIDI) |
| Cunradi, 2009 | 1,231 | 46.5 | 16.6 | Burn-out | Alcohol consumption | The Maslach Burnout Inventory | Self-administered questionnaire |
| Goston, 2013 | 893 | 40.2 | 69.1 | Job strain | Alcohol consumption | The Brazilian's short version of the psychological and control demand scale Theorell's version | ''Do you drink alcohol?'' treated as a dichotomous variable |
| Head, 2004 | 10,308 | 45 | 31 | Effort-reward imbalance | Alcohol dependence | Karasek Job Content Questionnaire | CAGE questionnaire |
| Hiro, 2007 | 17,501 | 44.5 | Unknown | Job demands | Alcohol dependence | Generic Job Stress Questionnaire | Weekly alcohol consumption of >275 g, |
| Lallukka, 2008 | 2,881 | 52 | 80 | Overtime work | Alcohol dependence | Karasek Job ontent Questionnaire | Consumption of cut-off point more than 200g for men and 140g for women of pure alcohol per week |
| László, 2010 | 676 | 54.9 | 22 | Job strain | Alcohol consumption | The Swedish Demand-Control Questionnaire | Average daily alcohol intake was measured |
| Marchand, 2008 | 10,155 | 40 | 100 | Job demands | Alcohol dependence | Karasek Job Content Questionnaire | Participants indicated the number of drinks they had during the week on each day |
| Mezuk, 2011 | 2,909 | 60.4 | 53.5 | Job strain | Alcohol consumption | Karasek Job Content Questionnaire | Participants were asked about their typical alcohol consumption measured in units in the past few months |
| Michélsen, 2002 | 367 | 50 | 51.8 | Overtime work | Alcohol dependence | Questionnaire considering conditions at work | Question-naire items concerning average weekly alcohol consumption |
| Peterson, 2007 | 3,719 | 47 | 82 | Exhaustion | Alcohol consumption | OLBI | AUDIT |
| Tsutsumi, 2003 | 6,759 | 49.5 | 52.1 | Job strain | Alcohol consumption, alcohol dependence | Psychological job demands and job control scales | The average total amount of alcohol consumed was calculated in grams per day |

### 3.2 The association between work stress and alcohol consumption

The relation between work stress and alcohol consumption was first examined. I hypothesized that work stress would be positively associated with alcohol consumption. A forest plot shows the statistics in Figure 2. Aggregated over 6 studies which included alcohol consumption which is 1-15 glasses a week for women and 1-22 glasses a week for men (van

Laar et al., 2013). The studies together had 19,642 participants. The combined effect size of the association between work stress and alcohol consumption was significant, but small ($r$ = 0.043, 95 % CI [0.015, 0.072], $p$ = .003). Taking a closer look at the studies they all have a very small effect. For all the studies the effect on alcohol consumption is smaller than 0,1. We checked for heterogeneity across studies and found it to be high (Q = 13.61 $I^2$ = 63.27, $p$ < 0.0001).

| First author, year | Outcome | Statistics | | | | Point estimate and 95% CI |
|---|---|---|---|---|---|---|
| | | Point estimate | Lower limit | Upper limit | P-value | |
| Cunradi, 2009 | Consumption | 0.076 | 0.020 | 0.131 | 0.008 | |
| Goston, 2013 | Consumption | -0.064 | -0.129 | 0.002 | 0.057 | |
| Laszlo, 2010 | Consumption | 0.075 | -0.001 | 0.149 | 0.052 | |
| Mezuk, 2011 | Consumption | 0.065 | 0.029 | 0.101 | 0.000 | |
| Peterson, 2007 | Consumption | 0.040 | 0.008 | 0.072 | 0.015 | |
| Tsutsumi, 2003 | Consumption | 0.048 | 0.024 | 0.072 | 0.000 | |
| Combined | | 0.043 | 0.015 | 0.072 | 0.003 | |

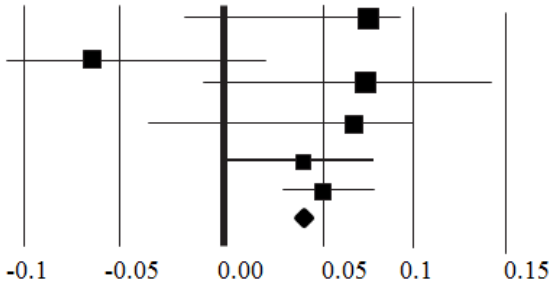


*Figure 2.* Forest plot on the association between work stress and alcohol consumption

### 3.3 The association between work stress and alcohol dependence

I hypothesized that work stress is associated with alcohol dependence. There is a case of alcohol dependence if a woman drinks 15-35 glasses a week and if a man drinks 22-50 glasses a week, taking into account that every glass contains approximately 10 grams of pure alcohol (van Laar et al., 2013). Seven studies met the criteria. Indeed, the overall effect size of the association between work stress and alcohol dependence is significant ($r$ = 0.171, 95 % CI [0.089, 0.250] , $p$ < .001). The combined effect size for the predictors was significant. Looking more closely into the studies they all have an effect. Effort reward imbalance has the strongest effect (r = 0.251). Burn-out has a small effect (r = -0.194). The effect of overtime work is also small (r = 0.124). All the other predictors' effects are smaller than 0,1. For the association between work stress and alcohol dependence the heterogeneity was high (Q = 787.51 $I^2$ = 98.86, $p$ < .0001).

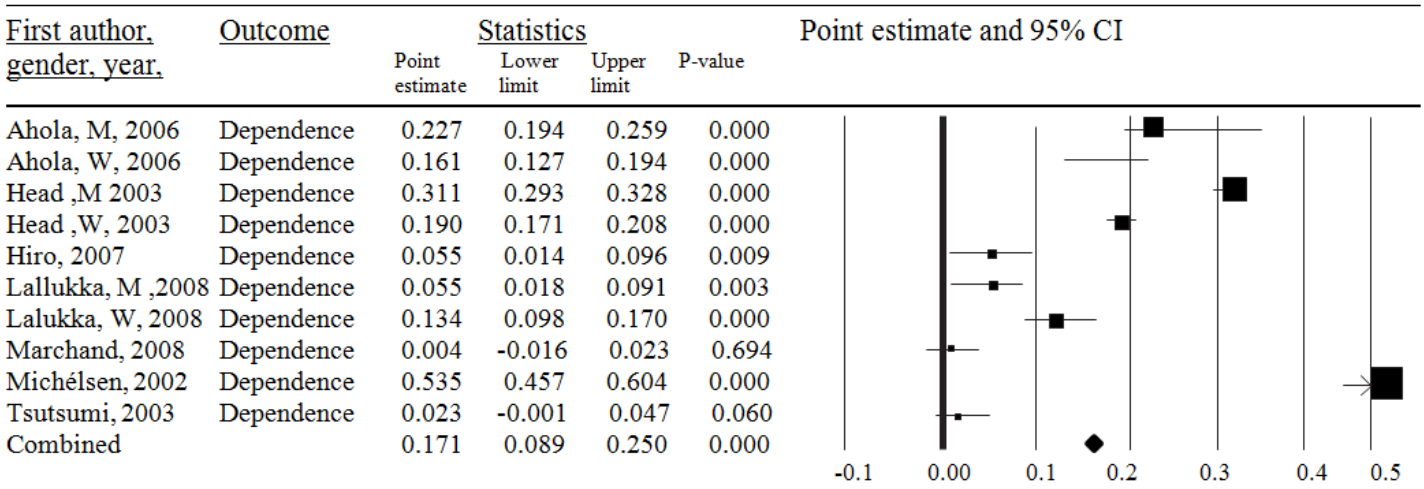


*Figure 3*. Forest plot on the association between work stress and alcohol dependence
*Note M: subsample consisting of men; W: subsample consisting of women*

### 3.4 Gender differences with regard to the association between work stress and alcohol consumption and dependence

A meta-regression was done to check for the moderator gender. For the association between work stress and alcohol consumption and female as moderator there seems to be a negative slope ($\beta$ = -0,00076, $p < .001$). For men as moderator there seems to be a positive slope ($\beta$ = 0,00076 $p < .001$). For the association between work stress and alcohol dependence and female as moderator there seems to be a negative slope which is significant for the association between work stress and dependence ($\beta$ = -0.00344, $p < .001$). For men as moderator the slope seems positive ($\beta$ = 0.00343, $p$ <.001).

### 3.5 Publication bias

By using the funnel plot across the 12 independent samples possible publication bias was explored. The Egger's test did not indicate significant publication bias, with an Egger's regression intercept of −1.6938 ($p$ = 0.7453). Thus, there was no strong evidence of publication bias in this meta-analysis.

## 4. Discussion

### 4.1 General discussion

Earlier research shows different associations between work stress and drinking behaviour across different studies. Some research has found an association between work stress and drinking behaviour, but by no means all of them (Goston et al., 2013; Head et al.,

2004; Hiro et al., 2007; Lallukka et al., 2008; Mezuk et al., 2011; Tsutsumi et al., 2003). A meta-analysis of the association between work stress and alcohol behaviour was therefore needed. The association between work stress and alcohol consumption was explored, as well as the association between work stress and alcohol dependence. Gender was added to the model to test its moderator effects on both the association of work stress and alcohol consumption, or the association of work stress and alcohol dependence

First, the association between work stress and alcohol consumption was examined. It was hypothesized that work stress is positively associated with alcohol consumption, and the results did support this. There seems to be an effect between work stress and alcohol consumption, although this effect seems to be small (Cohen, 1988). It was further hypothesized that work stress is associated with alcohol dependence . The results supported this hypothesis as well. According to the criteria set forth by Cohen (1988), the association between work stress and alcohol dependence is small. The third hypothesis was that work stress is more strongly associated with alcohol consumption and dependence in men than in women. This hypothesis was confirmed. Work stress is more strongly associated with alcohol consumption in men as compared to women.

We could confirm the hypothesis that work stress is positively associated with alcohol consumption. As mentioned above, there were contrary results for the association between work stress and alcohol behaviour (Goston et al., 2013; Head et al., 2004; Hiro et al., 2007; Lallukka et al., 2008; Mezuk et al., 2011; Tsutsumi et al., 2003). It should be taken into account that if there is one study with a negative effect, this could have a big influence on the overall effect size of the study. This because of the small size of the study. This study is the first to exam for more specific categories of alcohol consumption. One of the reasons almost no association was found, could be that the association between work stress and alcohol dependence is stronger when only alcohol dependence is taken as an outcome and alcohol consumption is not included. In the studies all alcohol behaviour was categorized as alcohol consumption, but in this study the category alcohol behaviour was divided in 2 subcategories: alcohol consumption and dependence.

The hypothesis that work stress is associated with alcohol dependence can be confirmed although the effect is small (Cohen, 1988). Alcohol dependence is defined following the criteria from the National Drug Monitor regarding alcohol use. There is a case of alcohol dependence if a woman drinks 15-35 glasses a week and if a man drinks 22-50 glasses a week, taking into account that every glass contains approximately 10 grams of pure alcohol. The consequences of an alcohol dependence on society are huge, so this result has to

be taken seriously. Alcohol dependence brings a higher risk for psychiatric conditions (Cargiulo, 2007). Alcohol dependence can also cause brain damage and diabetes mellitus (Rehm et al., 2009). Another negative consequence of alcohol dependence could be high economic costs, because of conflicts with supervisors, falling asleep at work, lowered productivity, and lack of drive (Ames et al., 1997). In any case it also results in high healthcare costs because of premature deaths and others costs like, imprisonment, and crime (Rice, Kelman, & Miller, 1991).

Meta-regression analyses showed for gender there were significant effects on men in the association between work stress and alcohol consumption and dependence. This result is in line with earlier research. Men are two times more likely to binge drink than woman during the same time period and it was found that men are at higher risk for alcohol disorders (Naimi et al., 2003; Haberstick et al., 2014). This concludes that men are more likely to drink alcohol when stressed at work than women which is relevant to our research on the association between work stress and alcohol behaviour.

Since 1990 many more jobs have become emotionally and mentally demanding. There seem to be significant changes with a change in the prevalence of health-adverse work environments from material to emotional and mental stressors, which results in more work stress (Siegrist & Rödel, 2006). People who are experiencing work stress can choose behavioural decisions or habits to deal with these work stressors (Lynch, Kaplan, Cohen, Tuomilehto & Salonen, 1996). One of the mechanisms to cope with this work stress could be alcohol use. The results of this meta-analysis show that indeed there is an association between work stress and alcohol use and that this could be one of the mechanisms to deal with this stress.

### 4.2 Limitations

There are a few limitations in the meta-analysis which warrant discussion. First, heterogeneity was high across the studies. This counts especially for the association between work stress and alcohol consumption. This should be taken into account when interpreting the results. Second, the focus was only on papers published in English. Results from studies in other languages were not included. With this there is a risk not all the studies were included about the association between work stress and alcohol use which could have had an influence on the results of the study. Third, the measurement of work stress and alcohol behaviour could be a problem. Different studies used different measurements for work stress and alcohol behaviour. We tried to pool it as much as possible but the chance is that this can cause a

misrepresentation of what they really measured. Fourth, work stress could be measured directly and indirectly. In this study the studies measured work stress only indirectly. It is unknown what the association would be of direct measured work stress and alcohol consumption or dependence. The third and fourth reason could also explain why the test for heterogeneity was significant.

### 4.3 Strengths

Although our study has limitations, it also contains strengths. This was one of the first studies which gave a systematic overview of alcohol-use in association with work stress. Especially alcohol dependence can have a lot of negative consequences such as economic costs and health problems. That is why research into this topic is important. A meta-analysis is a good method to get a huge number of studies and participants in one study and to summarize their results without too much effort (Walker, Hernandez, Kattan, 2008). In combining the different studies a high power can be generated due to the possibility of making more statements with more security. Small effects normally disappear, however, they become apparent in meta-analyses.

### 4.4 Conclusion

In conclusion, the meta-analysis supports that there is an association between alcohol consumption and alcohol dependence. Men are more likely to be at risk for alcohol dependence because of work stress. The results should be interpreted with caution because of the limitations of this study, such as high heterogeneity and the limited number of studies in this meta-analysis. Further research is needed, for instance research which focuses on the difference between alcohol consumption which has less negative consequences and alcohol dependence which has more negative consequences in association with work stress. Also moderators which could have an influence on the high heterogeneity should be studied more extensively, for instance age, type of work like blue or white collar workers, ethnicity and social economic status of the worker.

## 5. References

References marked with an asterisk indicate studies included in the meta-analysis


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