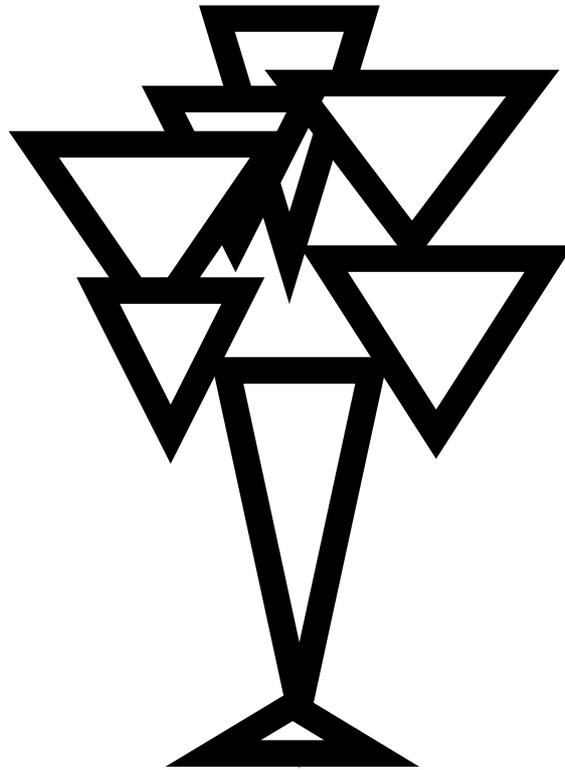


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# Effects of alcohol consumption on health and mortality

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**Holger Theobald**

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Stockholm 2001



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Effects of alcohol consumption on health and mortality  
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## **Abstract**

During the last 25 years, alcohol consumption has become a widely debated issue, especially due to research results, in which the beneficial effects of alcohol on health and mortality have been maintained. Research has primarily focused on two issues: the association between low consumption of alcohol and decreased mortality, mediated through decreased risks for cardiovascular diseases, and the association between wine consumption and health. This thesis deals with both of these issues, as well as the identification of high and low consumers of alcohol, by means of a questionnaire and a health examination. The differential effects of high and low alcohol consumption, as well as the differential effects of diverse alcohol beverages are investigated, using data from National Cause of Death Register, National In-Patient Register and National Cancer Register. Multivariate analysis has been conducted to investigate the effects of alcohol and the influence of confounders. The plausibility of tracing high and low consumers of alcohol, through the use of two questions about alcohol consumption included in a questionnaire has also been investigated. The effects of a single health examination, seen in relation to morbidity and mortality, traced in the proceeding 22-year period have also been studied.

Among the results for 32,185 individuals the discrepancies found between men and women with high and low alcohol consumption are notable. An increased risk ratio was found for cardiovascular morbidity and mortality among men with high alcohol consumption, while for men with low alcohol consumption an increased risk ratio for mortality was found, but no increased risk ratio for morbidity. For women with low alcohol consumption, an increased risk ratio for morbidity and mortality was found. Such an association was not found for women with high alcohol consumption. Moreover, mortality was investigated among 1,828 individuals in relation to the amount and type of alcoholic beverage consumed. Those who consumed wine had a reduced total and cardiovascular mortality, compared to non-drinkers and those who consumed beer or liquor. Risk reduction seems to be confined to those consumers of wine, whose intake was less than 140 grams of alcohol per week and who consumed wine only once a week. Furthermore, ex-drinkers were found to have an increased total and cardiovascular mortality. Self-reported health status was also investigated among 14,950 individuals, as it relates to the amount and type of alcoholic beverage consumed. Those individuals who consumed wine had better self-reported health status than individuals who consumed other types of beverages. Adjustments for confounders, such as smoking, exercise and different psychosocial factors, did not change the results.

The conclusions are drawn that individuals, who formerly have had high consumption of alcohol, but who have reduced their consumption, due to illness, are included in the group classified at the time of the study as low consumers, may serve as an explanation for the findings with low consumers. It is unclear as to which mechanisms are responsible for the observed differences between men and women as regards high alcohol consumption. Moderate consumption of wine has beneficial effects on self-reported health status, when compared to consumption of beer and liquor, and is associated with 50% reduction of risk for cardiovascular mortality. The beneficial effects of wine may be explained by the health promotional ingredients in wine and/or lifestyle factors, associated with wine consumption. Further research is needed to investigate the effects of the ingredients in wine and life style factors on health and mortality. Although identification of high and low consumers, by means of the inclusion of two questions in a questionnaire, was shown to be effective, the results of health screening proved to be less positive. These studies nevertheless indicate that other measures, such as health screening for specific risk groups, might prove to be effective, as regards disease prevention.

Key words: health survey, questionnaire, validity, alcohol drinking, alcoholic beverages, health status, wine, hospitalisation, morbidity, mortality, cardiovascular diseases, neoplasm

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## Abbreviations

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BMI	Body mass index
CHD	Coronary heart disease
CI	Confidence interval
CVD	Cardiovascular disease
HDL	High density lipoprotein
ICD	International Classification of Diseases
LDL	Low density lipoprotein
OR	Odds ratio
REBUS	Rehabiliteringsbehovs undersökningen
RR	Risk ratio
SALLS	The Swedish Annual Level of Living Survey (ULF in Swedish)
ULF	Undersökning av levnadsförhållanden (SALLS in English)
WHO	World Health Organisation

## **List of publications**

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This thesis is based on the following original papers which will be referred to by Roman numerals.

1. Theobald H, Bygren LO, Carstensen J, Hauffman M, Engfeldt P. Effects of an assessment of needs for medical and social services on long-term mortality: a randomized controlled study. *Int J Epidemiol* 1998; 27: 194-198
2. Theobald H, Bygren LO, Carstensen J, Engfeldt P: Validity of two questions on alcohol use in a health survey questionnaire. *Scan J Publ Health*, 1999; 27:73-79
3. Theobald H, Bygren LO, Carstensen J, Engfeldt P: A moderate intake of wine is associated with reduced total mortality and reduced mortality from cardiovascular disease. *J Stud Alcohol* 2000; Sep;61(5):652-6
4. Theobald H, Johansson SE, Engfeldt P: The influence of different types of alcoholic beverages on the self-reported health status. (manuscript)
5. Theobald H, Johansson SE, Bygren LO, Engfeldt P: The effects of alcohol consumption on morbidity and mortality: A 26 year follow-up study. (manuscript)

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## **1. Background**

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Large quantities of alcohol have a detrimental effect on health, influencing the majority of organs (See, for example, Harrison's Principles of Internal Medicine). The effects of alcohol result in increased morbidity and mortality. In contrast, a number of studies exist that indicate that a moderate consumption of alcohol decreases the risk for mortality due to CVD (Poikolainen 1995). Inasmuch as CVD are one of the most common causes of mortality, a moderate consumption of alcohol is associated with decrease of total mortality. The optimal quantity of alcohol, required to acquire positive effects, has not been determined, nor has it been determined whether one specific type of alcoholic beverage is more beneficial than another in order to ensure decreased cardiovascular mortality. In order to answer either of these questions, it would be necessary to conduct large randomized controlled clinical trials. Such measures are not feasible today, as they are not considered to be ethically justifiable. A number of well-executed prospective epidemiological examinations are necessary in order to substantiate the eventual positive effects of moderate alcohol consumption. The Rehabilitation Need Examination (REBUS) from 1969-1970, which is described in detail in section 4.1, is a population study, which was expected to provide answers to some of the questions that exist regarding the positive and negative effects of alcohol on morbidity and mortality. Before we began to study the effects of alcohol on the individuals, who were included in REBUS, we wished to investigate whether or not the general health examinations, which a number of the individuals included in REBUS had undergone, influenced mortality, when compared to the individuals, who had not undergone the general health examinations. This thesis begins, therefore, with a study of the effects on mortality of a single health examination and is followed by a number of studies, in which the effects of alcohol on health, morbidity and mortality, are investigated.

## **2. Introduction**

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### **2.1 Health screening**

Preventive measures can be important with regard to the elimination or the avoidance of social and medical problems. Using the natural course of illness as a starting point, treatment undertaken in the early stages of illness is defined as primary prevention. (Measures, which are undertaken in later stages of illness, are defined as secondary prevention.) According to text books, measures undertaken at this stage, when the pathophysiological process has begun, while remaining undetected by patients, as symptoms are not been noticed, are defined as primary prevention. At this stage, blood and urine chemical analyses as well as physical examination, conducted by a physicians, can be undertaken to detect illness. In addition, a conventional health control or screening can be expected to provide information for the early-detection of illness, resulting in valuable insight and large benefits for patients and primary health. In practice health controls serve to provide the information necessary for the renewed treatment of patients, who no longer receive treatment despite their need for care. Prevention of relapse or deterioration at this stage in the natural course of an illness is

often called tertiary prevention. Health examinations can play a role at this stage as well.

When estimating the results of a health examination, the following measures should be taken into consideration: In those cases, where measures were taken to ensure appropriate care, the results can be considered positive for patients. On the other hand, when patients are provided incorrect information, which leaves them with a false sense of security, this may delay examination by a physician, resulting in delay of treatment.

The effects of screening have been the source for many studies, investigations and evaluations. Only a few randomized studies, using control groups, have been undertaken, where mortality has been studied over time. In the American College of Physicians report (Eddy 1991), the results of the 1981 American College of Physicians, the 1989 U.S. Preventive Services Task Force study, the 1979 Canadian Task on the Periodic Health Examination study, and several other North American investigations have been summarized. A consensus exists on the appropriateness of counselling all adults once a year on nutrition, physical activity, sexual activity, dental care, drug addiction, accident prevention and the use of tobacco. According to the studies listed above, high blood pressure health controls should be undertaken every other year, while clinical breast examinations should be given every year after the age of 40, mammography once a year after the age of 50 and cervix smears for both young and older women as well as certain vaccinations should be undertaken on a regular basis, with different intervals.

All too often recommendations, such as those cited above, are not based on the results of randomized controlled studies. Recommendations exist for counselling in the following cases: high blood pressure, clinical breast cancer examinations for women between the ages of 50-59 years of age, syphilis serology for patients with many sexual partners, tuberculosis testing with exposure in the home or in areas of high prevalence, mammography for women in the ages of 50-59 years of age, gonorrhoea smear with many sexual partners, Hepatitis B vaccination for those who are at risk, influenza vaccination for those over the age of 65 years of age, pneumococcal vaccine for sickle-cell anaemia or for patients without a spleen, and for conventional childhood vaccinations. Moreover, counselling is recommended with regard to the use of tobacco in combination with oral contraceptives or when patients have diabetes, high blood pressure, or high cholesterol or have been exposed to asbestos, silicon or uranium. Furthermore, recommendations are made for HIV instruction for high risk groups, and in conjunction with dental treatment and annual dentist consultation. The counselling, recommended by all of the investigations mentioned above, is based on other evidence, for example other types of studies or the opinions of respected authorities.

Expectations were high during past decades with reference to general health controls, that were not related to specific illnesses. Attempts have been made to develop so-called partial health controls, which were termed 'uniphase screening' and combinations of such health controls termed 'multiphase screening'. The same applied to life long health controls, termed 'lifelong surveillance', that were both partial, i.e., directed towards specific illnesses, and directed towards particular groups on the basis of age and gender. General health controls that were not directed towards

a specific illness and were directed exclusively to geographically defined groups, adults only or similarly defined, were positively perceived by the general public, while they were viewed by scepticism by professionals. Only a few large randomized controlled studies have been published, which are described below.

In a multiphasic screening conducted by a health maintenance organization in California, 5,156 persons between the ages of 35-54 years of age participated in annual health controls for a period of 16 years. No differences were found between the intervention and control groups with reference to disability and total mortality. In the intervention group, however, deaths from pre-specified “potentially postponable” causes, i.e., deaths associated with complications of colorectal cancer and hypertension, were 30 percent lower than in the control group (Loring et al 1973, Dales et al 1979, Friedman et al 1986).

In an English randomized controlled study conducted in primary health care with 7,229 persons between the ages of 40-64 years of age, no difference with regard to mortality were found between the case and control group after nine years. The study entailed two screening sessions conducted every third year (South-East London Screening Study Group 1977).

Hence, the results of randomized controlled studies concerning undirected general health screening programmes are inconsistent with regard to their ability to reduce mortality. With regard to screening programmes for specific conditions, such as cancer of the breast and cervix, hypertension and hypercholesterolaemia, the scientific grounds for supporting such screening programmes are much more solid. However, controversy still exist with regard to the value of screening programmes ( Sox 1994).

## **2.2 Alcohol**

Many substances are detrimental to health. While it is clear that consumption of large quantities of alcohol is detrimental to health (Harrison’s Principles of Internal Medicine, Anderson 1995), the issue of the consumption of moderate amounts of alcohol is complex. Reports exist that indicate that the regular consumption of low to moderate amounts of alcohol has beneficial health effects. These studies have primarily pointed out a positive effect on CVD. In a review published by Poikolainen (1995), it was noted that among 29 studies the majority showed a J-formed relation between alcohol consumption and mortality. Non-drinkers had a somewhat higher total mortality rate than persons who had a moderate alcohol consumption. Mortality increased in relation to increases in alcohol consumption. The low mortality found among persons with a low consumption of alcohol is related to decreased CHD, while the high mortality rates among persons who consume large quantities of alcohol is primarily the result of accidents (Anderson 1995), suicide, liver (Norton et al 1987) and gastric diseases (Andreasson et al 1988, Carrao et al 1999, Holman et al 1996). The fact that studies conducted with many different types of populations indicate similar results, i.e., that a low consumption of alcohol decreases the risk for mortality caused by CHD when comparisons are made with non-drinkers, strengthen the plausibility of theories identifying the decreases as the effects of alcohol.

CHD and other CVD are the most common cause of death among both men and women in Sweden. Several studies have shown a relationship between moderate consumption of alcohol and a decreased risk for death as a result of CVD (Poikolainen 1995, Corrao et al 2000). Epidemiological data from Europe, U.S.A, Asia, and Australia have in most cases shown a 20-40 percent decrease in risk for death caused by CVD among persons, who consume alcohol, when compared with those who do not consume alcohol. Persons with moderate alcohol consumption seem to exhibit a larger decrease in risk, when compared with both non-drinkers as well as persons, with large alcohol consumption.

### **2.3 Different studies: ecological, cohort, case control**

Population studies of the effects of alcohol on mortality rates have been conducted with different designs. Certain studies, so-called ecological studies, are based on alcohol sales statistics, where per capita consumption of different types of alcoholic beverages have been determined for different countries or areas, and mortality rates are thereafter compared.

The results are often inconclusive, inasmuch as a few individuals can conceivably be responsible for a large portion of the alcohol consumption. Ecological studies have several limitations. Among others, no correction has been made for confounders, and the possibility exists that the populations studied may be heterogeneous.

Case control and cohort studies are considered to provide more accurate results, due to the fact that the relationship between alcohol consumption and mortality rates is studied in relation to specific individuals. Participants have provided information concerning their alcohol consumption by means of a questionnaire, and mortality rates are recorded for a number of years following collection of questionnaire data. The results of different studies are, however, inconsistent, giving rise to discussions as to whether or not low alcohol consumption can be related to health.

### **2.4 Drinking patterns**

Drinking patterns are considered to be of importance with reference to health. Drinking large quantities of alcohol on one and the same occasion instead of drinking the same amount of alcohol distributed over a longer period of time has different effects on health. For example, individuals with beer binging had higher mortality than individuals who consumed the same amount of beer without binging (Kauhanen et al 1997). In another study it was found that the best results were reached with regard to decreasing the risk for "major coronary events" if one or two drinks were consumed daily five or six days a week (McElduff et al 1997).

### **2.5 Biological mechanisms**

A number of studies have shown that alcohol consumption increases the level of high density lipoprotein (HDL) cholesterol in the blood at the same time as low density lipoprotein (LDL) cholesterol levels decrease (Haskell et al 1984). These effects may provide an explanation for the positive effects of alcohol on CHD. However, it is

considered feasible that other factors also contribute to the decrease in risk, for example, a decreased aggregability of blood platelets (Renaud et al 1992) and an increased fibrinolytic activity (Hendriks et al 1994). At the same time, consumption of alcohol seems to be associated with an increase in blood pressure (Marmot et al 1994), which may result in an increase in CVD. This circumstance may serve as an explanation for the association between alcohol consumption and the occurrence of haemorrhagic stroke, which has been found in several studies (Stampfer et al 1988).

## **2.6 Non-drinkers and ex-drinkers**

The association between moderate alcohol consumption and decreased risk for CVD may be related to other factors than the consumption of alcohol itself. The issue of whether or not the somewhat higher mortality and disease rates among non-drinkers, when compared to individuals with a moderate consumption of alcohol, can be explained by the assumption that individuals, who have previously had health problems related to excessive alcohol consumption, are included among non-drinkers, has been discussed. Among teetotallers, the mortality risk has been found to be similar to that which is found among moderate alcohol consumers (Fagrell et al 1999, Wannamethee et al 1997, Shaper 1995).

## **2.7 Confounders: smoking, diet, physical activity and psychosocial factors**

The beneficial effects of alcohol on CVD may be explained by unknown facts working in co-operation with alcohol, so-called confounders, such as life style factors and psychosocial factors.

In certain countries, where large consumption of wine occurs, a diet, which includes large quantities of vegetables, olive oil, etc., contribute to flavonoid and antioxidant intake, which in itself, may have a positive effect on CVD (Das et al 1999). In studies, where an association was established between alcohol consumption and decreased risk for CVD, the results were not influenced, when dietary habits were taken into consideration (Stampfer et al 1988, Rimm et al 1991). Similar results have been found for physical activity (Fuchs et al 1995, Berger et al 1998). In most studies, adjustment has been made for the influence of smoking habits, a major cardiovascular risk factor, which often is linked with drinking habits. In spite of this, moderate alcohol consumption has been found to be beneficial as regards CVD mortality (Poikolainen 1995). Finally, there are a lot of psychosocial factors, which may function as confounders. Adjustment made for social class, education and employment did not significantly influence the beneficial effects of alcohol on mortality (Poikolainen 1995). Hence, no single confounder has been found that may explain the beneficial effects of alcohol.

## **2.8 Type of beverage**

A number of studies have shown that choice of alcoholic beverage may have a health effect, especially with regard to CVD. With regard to choice of alcoholic beverage, the results are inconsistent (Klatsky et al 1997). A number of studies have shown that

wine, especially red wine, has a protective effect on the heart (Klatsky et al 1990, Klatsky et al 1993, Tjønneland et al 1999). This effect may be related to the content of flavonoids and antioxidants in wine (Das et al 1999). The fact that wine, beer and liquor have been reported to have differential health effects can be related to other health promotional factors, that are associated with choice of beverage, such as dietary habits , total alcohol consumption and smoking habits (Tjønneland et al 1999).

In a review of studies conducted since 1965 in this field (Rimm et al 1996), it was found that, even if the majority of the twelve ecological studies that were evaluated showed that wine in particular seemed to decrease the risk for mortality in CVD, the same result was not found, when three case control studies and ten prospective studies were evaluated. The conclusion was drawn that the decrease in risk for mortality in CVD can be related to alcohol itself and that no differences could be found between the different types of alcoholic beverages. Hence, it is still unclear as to whether or not one type of alcoholic beverage may have a more beneficial effect on mortality than does another.

## **2.9 Validity**

The majority of studies conducted on the effects of alcohol are based on self-reported data (Bryan et al 1993, Duffy et al 1992, O'Hare et al 1991, Smith et al 1995) . This data is either collected by means of an approximate estimate of alcohol consumption of different beverages, provided by the persons in question themselves, or by means of reports provided by persons, as to the exact amounts of different alcoholic beverages consumed during the previous days, for example during the last week prior to interview. Using the former data collection method, a source of error may occur, related to the approximation of consumption, which are made in differing manners by different individuals. Using the latter data collection method, it is difficult to ascertain if the consumption reported for the days prior to interview is typical, or if it differs from alcohol consumption seen over a longer period of time.

When the reported alcohol consumption in certain studies is compared to total alcohol sales in a specific area, a discrepancy often occurs, whereby total alcohol sales are found to be twice as large as total self-reported consumption (Fitzgerald et al 1987). In order to accurately identify individuals, whose alcohol consumption entails health risks, different screening instruments have been developed, such as the Alcohol Use Disorders Identification Test, (AUDIT) (Babor et al 1989) and the so-called CAGE questionnaire, which is an acronym for “questions about cutting down on drinking, annoyance at others’ concern about drinking, feeling guilty about drinking, and using alcohol as an eye-opener in the morning” (Allen et al 1995, Bradley et al 1998).

Reports exist that indicate that single questions concerning alcohol consumption, when placed in the context of a questionnaire that focuses on health, exercise, diet and smoking, provide more accurate data on alcohol consumption than that provided by other data collection methods (Fleming et al 1991).

## **2.10 Alcohol consumption over time**

Even if the alcohol consumption pattern found in the majority of longitudinal studies are judged to be relatively stable over time, studies exist which show that the quantities of alcohol consumed can vary somewhat with age, with a maximum level being reached at approximately 25 years of age (Shaper et al 1998). More men than women can at this point in time have large consumption of alcohol, which later seems to decrease with increasing age (Wannamethee et al 1988). One American study has also shown a discrepancy between generations, with the younger generation exhibiting larger alcohol consumption than the older generation had at the same age (Grant 1997).

### **3. Aims**

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- To investigate whether general health examinations influence morbidity and mortality;
- To investigate whether or not two simple questions included in a questionnaire can serve to identify individuals with large and small alcohol consumption;
- To investigate how large and small alcohol consumption influences morbidity and mortality among men and women;
- To investigate the effects of different alcoholic beverages on morbidity and mortality and how these effects are influenced by different so-called confounders.

## 4. Subjects and methods

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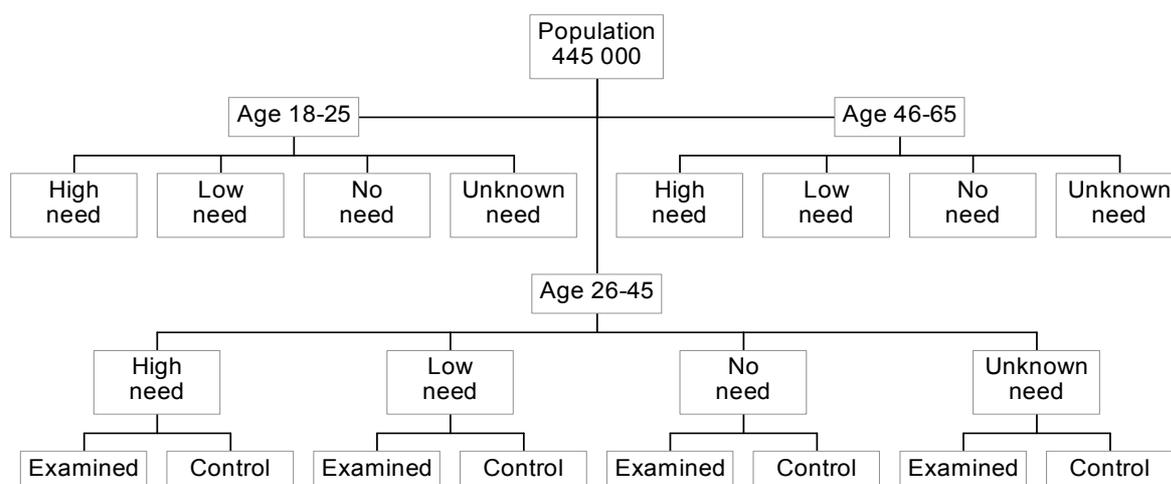
During the period of two years, from 1969 to 1971, a large health examination was undertaken in the Stockholm County Council catchment area, with the primary purpose of investigating the need for care, in the The Need for Rehabilitation Study, called REBUS. Participants in the study were randomly selected from a sample of the residents in the Stockholm County Council catchment area, according to 1969 census. Residents of the city of Stockholm were not included.

### 4.1 Selection procedure (REBUS)

32,185 individuals received a postal questionnaire (see appendix), which included 30 questions dealing with social, somatic and psychological functioning capacity or illness. The individuals were randomly selected in the ages of 18-65 years of age. Selection was stratified into three age groups, i.e., 18-25, 26-45 and 46-65 years of age, in the following proportions: 3:2:1.

A second stratification was made on the basis of data obtained from registers containing information regarding hospitalization, sick leave, the questionnaire answers (after categorisation into large, moderate or normal levels of expected care need) and non-response. After a second random selection of individuals from each strata, 3,064 individuals comprised the group, which as meant to be the health examination group. The randomizing and stratification procedures are shown schematically in Figure 1 below.

**Figure 1. Flowchart of the randomization and stratification procedure in REBUS.**



In addition to age, weighing of the selection was also made on the basis of care need, to ensure that individuals in the lower age groups and those with higher expected level of care need were overrepresented.

The study was conducted in four equally large steps, which each included its own randomly selected population. The comprehensiveness of the studies distinguished the steps from one another, with, for example, psychiatric interviews on alcohol consumption included in three of the steps and data concerning smoking habits included in two of the steps.

The cases were examined at a hospital in order to assess the need for social and medical services. The examination entailed a comprehensive health examination, which especially focused on individuals' social, physical and psychological functioning capacity as well as on their illnesses. Participants were examined by social workers, physicians and psychiatrists. The examination included interviews (divided into somatic, psychiatric and social parts), tests to determine physical and mental performance capacity, ophthalmological examination, dental examination, blood tests as well as psychological tests. The entire examination took a whole day. This examination can be considered to be a comprehensive general health examination with regard to functioning. The purpose was to map the somatic, psychiatric and social need for care and measures. The results of the study have been published in several theses and in reports (Bygren 1974, Bygren 1980, Hauffman 1974, Björk 1977, Jonsson et al 1977, Halldin 1984).

This comprehensive register with detailed information on somatic and social factors, collected over 25 years ago, can be considered to be invaluable. Hence, the register has potential for supplying answers to a long list of questions concerning health and illness.

#### **4.1.1 Follow-up**

A follow-up of persons included in the REBUS study was conducted by means of the National Cause of Death Register, National In-Patient Register and National Cancer Register.

##### **4.1.1.1 National Cause of Death Register**

The National Cause of Death Register includes all deaths that have occurred in Sweden by date of death as well as cause of death, according to the cause of death certificate issued by a physician. The greatest source of error in the Register is related to physician's diagnosis and cause of death report. International studies have shown that the reliability varies with regard to the age of the deceased and the certified cause of death. Cause of death data are therefore more reliable for those who die at a young age than it is for the elderly deceased. By the same premise, data on violent deaths and illnesses with a dramatic course are more reliable than data on chronic illnesses. In both of the former cases, an autopsy is as a rule required to determine if cause of death is accidental or not, while in the latter cases only approximately 40 percent of the certificates of death are based on the results of autopsies. Quality studies have

shown that drop-out amounts to 0.4 percent and coding error amounts to 0.4 percent with regard to diagnoses, made in accordance with International Classification of Diseases (ICD) on chapter level, and with 2.2 percent on a 3-digit diagnosis level. During the period that encompasses the seventeen years between 1969 and 1986, classification was made in accordance with ICD8, and during the period that encompasses the nine year 1987-1996 the classification which was used was in accordance with ICD9 (The National Board of Health and Welfare, <http://www.sos.se/epc/dors/dodsreg.htm>).

#### **4.1.1.2 National In-Patient Register**

The National In-Patient Register encompasses data on all hospital care given in Sweden, including duration of hospitalisation and diagnoses as they have been reported by hospital authorities. The collection of data in the National In-Patient Register was begun successively, starting with Stockholm and Uppsala at the end of the 1960s. The routines for registration and collection of data for the whole of Sweden were completed by the middle of the 1970s. Since 1972, the number of missing cases have amounted to 5 percent, while the number of missing cases of all registered occurrences of care in the Stockholm County Council catchment area have amounted since 1974 to 2 percent. In over 99 percent of all of the occurrences of care, the main diagnoses have been reported. Validity studies conducted, using the Register data from 1986 and 1990, have shown that the percentage of incorrectly reported diagnoses according to the ICD on chapter level, amounted to between 4 and 6 percent, and on a 3-digit diagnosis level, amounted to between 12 and 13 percent (The National Board of Health and Welfare, <http://www.sos.se/epc/par/index.htm>).

#### **4.1.1.3 National Cancer Register**

The National Cancer Register includes data on cancer tumours, which are subject to obligatory reporting procedures, dating from the end of the 1950s and onwards. According to one study published in 1984 (Mattsson 1984), missing cases in the National Cancer Register amount to approximately 4 percent. 98 percent of all of the cases are morphologically determined. Coding is undertaken in accordance with ICD7 classification, a fact which explains why the same classification was used in the REBUS follow-up study.

#### **4.1.2 Non-participants**

Out of the 32,186 individuals to whom were sent a postal questionnaire, 32, 183 individuals have been traced in the registers. Of the three drop-outs from the address registers, data for two individuals are not identifiable (de-coded), and one individual has been excluded, inasmuch as this individual has previously participated in an earlier step. Missing cases due to emigration are considered to be negligible. The questionnaire response rate was 87 percent (28,001 individuals). All individuals were followed until the end of 1996. As regards mortality, it was found that the relative death rates in response groups and the non-response groups were similar for CVD, CHD and accidents/ poisoning. Mortality, due to gastrointestinal diseases was

significantly increased in the non-response group, with the relative risk ratio (RR) for men being 2.2 and for women being 2.7. As regards occurrence of hospitalisation for CVD, it was found that women in the non-response group exhibited decreased RR (0.8). For men in the non-response group, no such difference was found, when they were compared to men in the response group. Occurrence of hospitalisation for CHD and accidents/poisoning did not differ between response and non-response groups. However, the RR for both sexes of occurrence of hospitalisation for gastrointestinal diseases was significantly lower (0.9). The RR for cancer was also lower for those included in the non-response group (0.9). Out of the 3,064 individuals who were asked to participate in an examination, 2,578 persons participated (84 percent).

## **4.2 The Swedish Annual Level of Living Survey (ULF/SALLS)**

“Undersökningen om levnadsförhållanden”, ULF, is referred to in English as “The Swedish Annual Level of Living Survey” with the acronym SALLS.

### **4.2.1 The study population**

The study population has been randomly selected from the entire Swedish population between the ages of 16 to 84 years of age. In the 1996-1997 study, 14,950 individuals were included in the randomized selection, undertaken by Statistics Sweden.

### **4.2.2 Selection procedure**

The study has been conducted annually since 1979. Interviews, conducted at home, are the main instrument. Non-response is followed up by means of telephone interviews. The average duration of an interview is approximately 70 minutes. Between 12,000 and 13,000 individuals are interviewed during a two-year period. Data from different registers, i.e., different kinds of income, pensions, taxes, housing subsidy, social welfare subsidy, student loans, etc., are collected to complement the ULF/SALLS interviews (Statistics Sweden 1996).

### **4.2.3 Non-participants**

Missing cases amounted in 1999 to 21.4 percent, while in 1997 missing cases amounted to 22.2 percent. Out of these numbers, 15.2 percent refused to participate in the study, 1.9 percent were prohibited from participation due to illness and 3.6 percent could not be found. In addition, partial non-response of varying sizes was recorded for different questions on the questionnaire. In another part of ULF/SALLS, conducted in 1987-1991 with a similar design and response rate as in this study and including 40,078 individuals from the same population, the following relative death rates (diseases related to excessive alcohol consumption, i.e., somatic and psychiatric diseases and accidents caused by alcohol) were observed in a follow-up conducted after five years: participants 1.00 (reference), decliners 1.41 (with a 95 percent confidence interval (CI) of 0.87-2.28), individuals with diseases 3.78 (CI 1.80-7.93) and individuals who could not be found 5.34 (CI 3.10-9.21).

## **5. Statistical analysis**

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In the longitudinal studies, analyses of morbidity and mortality have been calculated, using multivariate analysis (Cox regression, Cox 1972) including the effects and interactions of the variables. (Study I, III, V). Crude and adjusted death risk ratios (RR) were computed for various risk factor exposures, with 95% confidence intervals (CI). The PROC PHREG commando in SAS statistical package has been used. All known and possible confounders have been taken into consideration. Analyses, regarding the relationship between self-rated health and alcohol consumption, were performed using logistic regression (Study IV). Crude and adjusted odds ratios (OR) with 95% confidence intervals (CI) were estimated. The PROC LOGISTIC commando in SAS statistical package has been implemented, facilitating correction for possible confounders.

## 6. Study I

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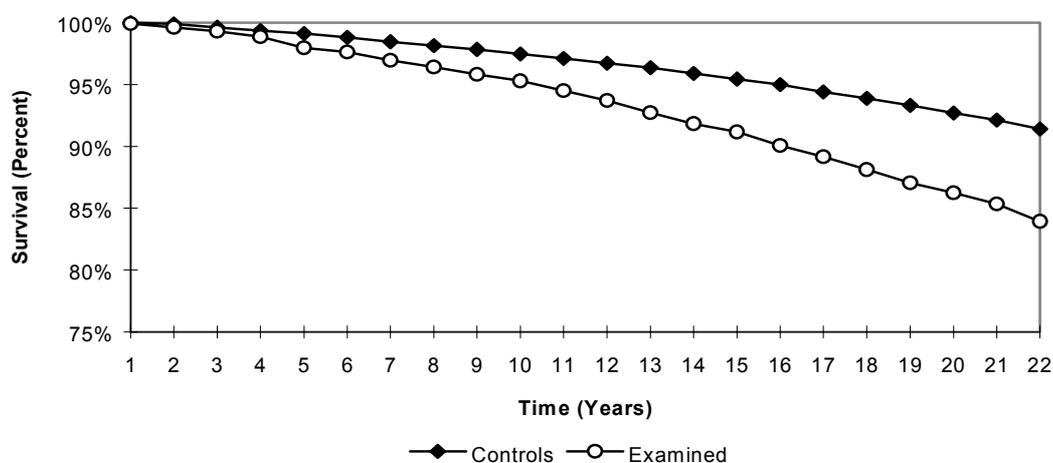
Title:

Effects of an Assessment of Needs for Medical and Social Services on Long-Term Mortality: A randomized controlled study.

### 6.1 Subjects and methods

In this study, the effects of a health examination on mortality were investigated. Mortality rates for 3,064 individuals who participated in a health examination 1969-1970 were followed-up in the National Cause of Death Register until 1990. The 29,122 individuals who only received a short postal questionnaire constituted the control group. Calculations were made using multivariate analysis (Cox regression model), in order to ensure that the results could be corrected for the stratifying variables, i.e., age group, expected level of need, and gender. Total mortality and mortality in CVD, cancer as well as accidents, poisoning and unidentified causes of death were analysed.

**Figure 2. Survival curves for the study population and the control group**



### 6.2 Results

Mortality in the study population was higher than in the control group (See Figure 2.) When correction was made for age and level of need, no differences were found between the groups.

### 6.3 Comments

The study shows that a single general health examination without intervention did not have any effect on mortality during the 20 years following the health examination.

This finding challenges the justification used for general health examinations as a means to influence mortality rates. On the basis of this finding, it is proposed that measures be taken with regard to specific groups at risk of increased mortality, that efforts be made to find risk factors that can be influenced, and that these measures can be combined with an intervention.

## **7. Study II**

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Title:

Validity of Two Questions on Alcohol Use in a Health Survey  
Questionnaire

### **7.1 Subjects and methods**

The purpose of this study is to judge the validity of the two questions concerning alcohol consumption posed in a postal questionnaire which was distributed to 32,186 individuals in the REBUS study. A subsample of 1,645 individuals, who answered the questionnaire, underwent a psychiatric interview dealing with alcohol consumption. The consumed quantities of alcohol were calculated by multiplying quantity by frequency for each alcoholic beverage, in accordance with the information provided in the psychiatric interview, while at the same time the alcoholic content of each beverage was taken into consideration. In this manner alcohol consumption, specified in grams per week, was calculated. Alcohol intake specified in grams of alcohol consumed daily was calculated, according to the following standards:

- Consumption of beer, two (33 centilitre) bottles or less = 10 grams alcohol, 2.5 (33 centilitre) bottles = 40 grams, >five (33 centilitre) bottles = 60 grams;
- Consumption of wine, <1/2 (75 centilitre) bottle = 18 grams, 1/2 -1 (75 centilitre) bottle = 54 grams, > 1 (75 centilitre) bottle = 72 grams;
- Consumption of liquor, <18 centilitres = 30 grams, 18-37.5 centilitres = 94 grams, 37.5-75 centilitres = 188 grams, >75 centilitres = 250 grams.

Alcoholic content was then multiplied by the following drinking frequencies, i.e., 1, 2.5, 5 and 7 times a week, in order to calculate the weekly consumption of alcohol. For those individuals who replied that they drank a certain beverage less often than once a week, consumption quantity was for the beverage in question was calculated with 0 grams.

Those who drank more than 140 grams of alcohol per week were identified as having a high consumption of alcohol, while those individuals who drank less than 50 grams of alcohol per week were identified as having a low consumption of alcohol. The limit of 50 grams per week was set in accordance with a toxicological evaluation, that shows that the consumption of less than 50 grams of alcohol per week can be considered to be non-toxic (Rydberg et al 1974). The limit for high consumption of alcohol was set at 140 grams of alcohol per week in accordance with recommendations made by Swedish National Food Administration (Livsmedelsverket) (Sandström et al 1996). High consumers and low consumers of alcohol were identified by the postal questionnaires, and then the results were

compared with the results of the psychiatric interviews. The two questions concerning alcohol included in the postal questionnaire were the following: "Do you use alcohol?" and "Do you drink at least a half a bottle of liquor or a couple of bottles of wine a week?" (see appendix). Both of these questions were to be answered with one of the following alternatives: often, sometimes or never. The answers provided to the two questions concerning alcohol in the postal questionnaire were combined so that those individuals who answered that they had the lowest alcohol consumption in response to both of the questions were classified as low consumers. Those individuals who indicated that they often used alcohol have been classified as high consumers. After consideration was given to the sensitivity and specificity of different combinations of questionnaire answers, those individuals who indicated that they sometimes use alcohol in combination with the reply that they often or sometimes drink a half a bottle of liquor or a couple of bottles of wine per week were classified as high consumers. The remaining individuals were classified as moderate consumers of alcohol.

## **7.2 Results**

The study showed good agreement as regards the identification of high consumers and low consumers of alcohol with the aid of the two methods of identification, i.e., the postal questionnaire and the psychiatric interview, respectively. Using the psychiatric interview as a reference method, the postal questionnaire had a sensitivity of 69 percent and a specificity of 87 percent for identification of high consumers of alcohol. The postal questionnaire had a sensitivity of 34 percent and a specificity of 93 percent for identification of low consumers of alcohol.

## **7.3 Comments**

The two questions concerning alcohol in the postal questionnaire had a relatively high specificity for identification of high consumers and low consumers of alcohol. Hence, it should be possible to study the effects of alcohol in those individuals who answered the questionnaire, but had not be examined by a psychiatrist.

## **8. Study III**

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Title:

A Moderate Intake of Wine is Associated with Reduced Total Mortality and Reduced Mortality from Cardiovascular Disease.

### **8.1 Subjects and methods**

The effects of alcohol consumption on mortality were investigated in this study. On the one hand, the association between total quantity of alcohol consumed and mortality was investigated. On the other hand, the choice of alcoholic beverage, such as wine, beer and liquor, was studied with regard to mortality. The quantity of alcohol, gram per week for each alcoholic beverage was calculated on the basis of

information provided during the psychiatric interview. The mortality was follow-up in the National Cause of Death Register. In addition, non-drinkers and ex-drinkers could be identified. A multivariate statistical model was constructed, using Cox regression, in which those individuals who drank wine, beer or liquor at least one time per week were classified as consumers of the beverage in question.

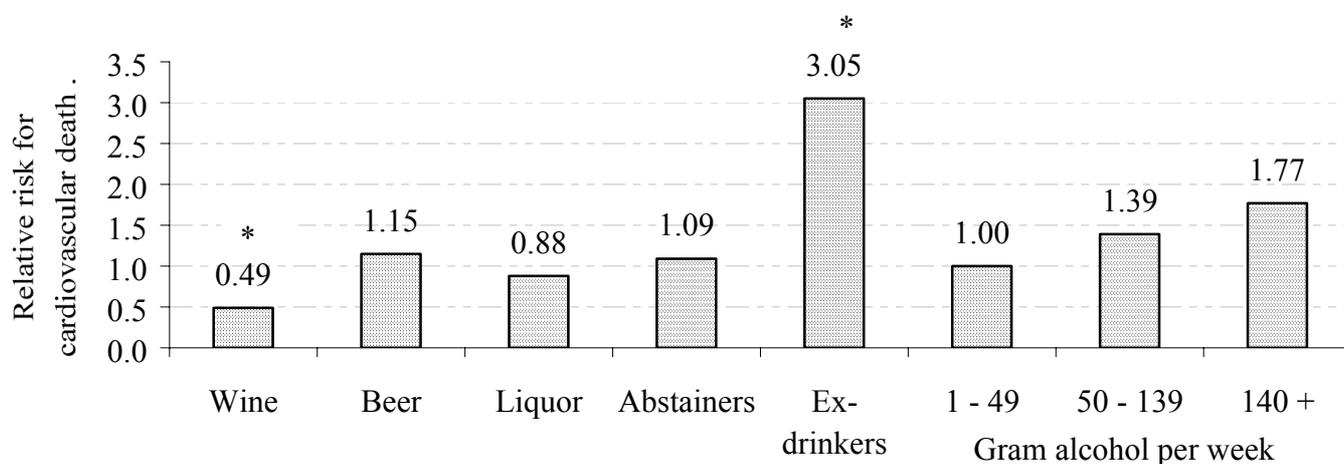
The same persons could be classified as consumers of several beverages. No interaction was found between the different alcoholic beverages. The model was corrected for total alcohol consumption, age group, gender and expected level of needs.

## 8.2 Results

The study showed that consumers of wine had a reduced total mortality risk (RR=0.49; CI 0.37-0.9) and cardiovascular mortality (RR= of 0.58; CI= 0.40-0.84). (See Figure 4.) The increased risk for mortality that was noticed among non-drinkers, when compared to low consumers, disappeared when a subgroup among non-drinkers, i.e., those who had indicated in the psychiatric interview that they had not always been non-drinkers, were separated from the other non-drinkers. These ex-drinkers had a RR = 2.64 ( CI = 1.56-4.49) for total mortality and a RR = 3.05 ( CI = 1.37-6.77) for cardiovascular mortality. (See Figure 3.) When adjustment was made for Body Mass Index (BMI), social group, membership in a non-profit organisation or number of siblings, the results remained unchanged.

Moreover, only low consumers and moderate consumers of wine (less than 140 grams per week) exhibited this risk reduction. (See Table 1 below.) When frequency of wine consumption was studied, it was shown that only those who drank wine at the most one time per week, who exhibited a risk reduction as regards total and cardiovascular mortality.

**Figure 3.** Mortality in CVD associated with consumption of wine, beer and liquor, when the total alcohol consumption, gender, age and expected level of needs are taken into consideration (n=117)



**Table 1.** Relative mortality risk ratio associated with wine consumption

Amount consumed	n	Total mortality	Cardiovascular mortality
1 – 49 grams	190	0.54 (CI; 0.40-0.84)	0.57 (CI; 0.27-1.20)
50 – 139 grams	185	0.59 (CI;0.35-0.98)	0.41 (CI; 0.16-1.06)
> 140 grams	10	1.51 (CI;0.46-4.97)	1.49 (CI; 0.19-11.74)

### 8.3 Comment

The study shows that consumption of wine seems to be associated with a 50% reduction of total and cardiovascular mortality. The fact that a risk decrease for mortality, irrespective of cause of death, is found can partially be explained by the circumstance that a large portion of the total mortality can be associated with cardiovascular causes of death. The study also indicates that a high consumption of alcohol is detrimental for health. Low consumption of wine seems to be associated with the largest risk reduction. The fact that the effect was most obvious among those individuals, who seldom drank wine (once a week), seems to indicate that other factors than the substances contained in wine may serve to explain the positive effect, for example, life style factors.

## 9. Study IV

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Title:

The Influence of Different Types of Alcoholic Beverages on the Self-reported Health Status

### 9.1 Subjects and methods

In this study the association between alcohol consumption and self-rated health was investigated, using ULF/SALLS data from 1996-1997. Self-rated health has in other studies been shown to be correlated to morbidity and mortality (Mossey et al 1982, Kaplan et al 1983, Idler 1990, Johansson et al 1999). Consideration was taken in this study to age, gender, smoking habits, total alcohol consumption, education, occupation and exercise. Calculations were made, using a multivariate logistic regression model. In the model the total alcohol consumption per week was calculated by multiplying the quantity of alcohol consumed during the previous week with the alcoholic content of the diverse beverages consumed. The questionnaire is included in the appendix. The alcoholic content of a glass of beer (with 2.8 weight% alcohol) was set at five grams, while a bottle (33 centilitres) of beer with the same alcoholic content was set at 10 grams and a can (50 centilitres) of beer with the same alcoholic content was set at 14 grams. A bottle (33 centilitres) of strong beer (with 4.5 weight% alcohol) was set at 15 grams, while a can (45 centilitres) of strong beer with the same alcoholic content was set at 20 grams and a bottle (75 centilitres) of strong beer with the same alcoholic content was set at 34 grams alcohol. One centilitre wine (with 12 vol% alcohol) was estimated to contain 0.96 grams of alcohol, while a glass of wine (with the same alcoholic content) was estimated to contain 9.6 grams of alcohol. A half a bottle (37.5 centilitres) of wine (12 vol% alcohol) was estimated to contain 36

grams of alcohol and a whole bottle (75 centilitres) of wine (with the same alcoholic content) was estimated to contain 72 grams of alcohol. One centilitre of strong wine (with an alcoholic content of 20 vol%) was considered to be equivalent to 1.6 grams of alcohol, while a glass (10 centilitres) of strong wine (with the same alcoholic content) was considered the equivalent to 16 grams of alcohol. One centilitre of liquor (40 vol% of alcohol) was set at 3.33 grams of alcohol. As regard those individuals who indicated that their ordinary alcohol consumption was lower/ substantially lower or higher/ substantially higher than that during the previous week, normal weekly alcohol consumption was calculated instead by multiplying frequency (number of times per week/ month the last year) with the normal consumption per time. When calculations were undertaken to determine the number of days per week of alcohol consumption, the following scale was used:

- for the answer “Nearly every day” the equivalent of 6.5 days was set;
- for the answer “4-5 days a week” the equivalent of 4.5 days was set;
- for the answer “2-3 days a week” the equivalent of 2.5 days was set;
- for the answer “once a week” the equivalent of 1 day was set;
- for the answer “2-3 days a month” the equivalent of 0.625 days was set;
- for the answer “once a month” the equivalent of 0.25 days was set;
- for the answer “1-6 times a year” the equivalent of 0.0825 was set;
- for the answer “ more seldom” the equivalent of 0.00192 days was set.

A logistic regression statistical model was constructed in which those individuals, who had provided information as regards their consumption of wine, beer and liquor, were included and calculated to be consumers of the beverage(s) in question. The same persons were included as consumers of several beverages, if they had indicated that their consumption included diverse beverages. No interaction between the beverages could be found. Self-reported health was considered to be poor for those individuals, who reported that their health status was poor or very poor. Teetotallers and ex-drinkers could not be identified by means of the questionnaire. Individuals were categorised into the consumer groups that were used in the regression model, by means of the calculated total alcohol consumption per week, allowing for the separation of individuals with increased risk for self-reported poor health in the analysis.

## **9.2 Results**

Wine consumption was associated with improved health (self-reported). The results were corrected for age group, gender and total alcohol consumption. When smoking, BMI, education and exercise were taken into consideration, the results remained the same. Other beverages showed no significant differences. It was also observed that individuals who engaged regularly in physical activity had better health (self-reported) than wine consumers.

## **9.3 Comments**

The study shows that wine consumption is associated with better health (self-reported). This finding is in agreement with the findings in Study III, Grønbaek et al

1999 and Poikolainen et al 1999. Rather than assuming that better health (self-reported) is associated with the substances contained in wine, other explanations can be offered to clarify this finding. One such explanation is that favourable life style factors are associated with wine consumption. In this study, however, no such life style factors could be traced.

## **10. Study V**

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### **Title:**

The Effects of Alcohol Consumption on Morbidity and Mortality:  
A 26-year follow-up Study

### **10.1 Subjects and methods**

The effects of alcohol consumption on morbidity, mortality and the occurrence of cancer were investigated, when morbidity was defined as occurrence of hospitalisation. By means of an evaluation of the answers to the postal questionnaires employed, low consumers and high consumers of alcohol could be identified among the 32,186 individuals who had received the questionnaire in 1969 (Study II). These persons were then followed-up, by tracing their occurrence in the National Cause of Death Register, The National Cancer Register and the National In-Patient Register, up to and including 1996. As regards calculations of morbidity, those individuals were excluded, who had become ill prior to 1971, that is, before all of the stages of the questionnaire survey were complete. Calculations were made, using multivariate analysis (Cox regression model). The results were corrected for age groups (10-year intervals), and calculations were made separately for women and men, except as regards cancer, when the analysis was corrected for gender. No data as regards smoking habits were available.

### **10.2 Results**

The study shows an increased risk of total mortality and morbidity for high consumers of alcohol. Mortality in gastrointestinal diseases as well as accidents and poisoning were also high among those individuals. Women, who are high consumers of alcohol, were found to have 2.5 greater risk for hospitalisation for infertility examinations than women who are included in the low consumers of alcohol. The risk for oesophagus, ventricle and pancreas cancer was higher for high consumers of alcohol. For high consumption women, there was not increased risk for breast cancer. An increased risk ratio for cardiovascular morbidity and mortality among men with high alcohol consumption. An increased risk ratio for mortality was found for men with low alcohol consumption, but no increased risk ratio for morbidity. Although an increased risk ratio for morbidity and mortality for women with low alcohol consumption was found, no such association was found for women with high alcohol consumption.

### 10.3 Comments

The study confirms that high alcohol consumption seems to be associated with increased mortality and morbidity in, among other illnesses, gastrointestinal and cancer diseases (Corrao et al 1999, Thun et al 1997). A severe limitation of this study is that analyses could not be corrected for smoking habits. Moreover, teetotallers and ex-drinkers could not be identified in the study. High consumption of alcohol is associated with increased cardiovascular morbidity and mortality in men, but not in women. Among women low alcohol consumption is associated with increased cardiovascular morbidity and mortality. Among men low alcohol consumption is associated with increased mortality, but not with increased morbidity. One explanation for the findings as regards low consumers of alcohol may be the occurrence of illness, which, in turn, has led to reduced alcohol intake (Wannamethee et al 1997, Shaper 1995). The mechanism, which operate behind the observed differences between men and women as regards high alcohol consumption, are unclear.

## 11. Discussion

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The association between alcohol consumption and health risks is confirmed by the results of this 26-year follow-up study of morbidity and mortality, using the data from the REBUS study. The analysis of self-reported health in the ULF/SALLS study from 1996-1997 indicates the same results. The follow-up of the 28,001 individuals in the REBUS study shows that cause of death and hospitalisation diagnosis are in agreement, which would seem to indicate a causal relationship between alcohol consumption and the diseases responsible for morbidity and mortality. The fact that the study population represents a random sample of the Swedish population and that the response rate was high and non-response rate was low would seem to strengthen the results.

The choice of control group is considered to be an importance aspect of this study. In many studies, ex-drinkers have been included in the non-drinker group. It has been shown in this study, as in other studies, that ex-drinkers have an increased risk for total and cardiovascular mortality, when compared to non-drinkers and moderate consumers of alcohol. Moreover, the non-drinker group consists of relatively few individuals. In this study, the large group of moderate consumers has been used as the control group. When ex-drinkers were isolated from the non-drinkers, the U-formed relationship between consumed quantity of alcohol and cardiovascular mortality disappeared. This finding can be interpreted to mean that the prospective cardio-protective effect of alcohol is limited, implying that other life style factors, such as exercise and diet, are of greater importance for health. This interpretation would dispute the advisability of generally making recommendation to the general public regarding the regular consumption of small quantities of alcohol for health promotional purposes, as has been discussed in other countries.

Previous studies have also shown that, even if drinking patterns are fairly stable, change occurs over time. Many studies have shown that younger persons have higher consumption than persons who are 40-60 years of age. Few individuals increase their

alcohol consumption as they grow older. Among those between the ages of 40-60 years old may be included individuals who have been high consumers of alcohol in their youth, but who have decreased their consumption as they grow older, perhaps due to the health risks involved or, but not necessarily, due to alcohol-related illness. This may serve as an explanation for the U-formed relationship between alcohol consumption and mortality found in many studies. In this study, it has not been possible to take changed alcohol consumption patterns over time into consideration, inasmuch as the study is based on one single data collection. The protective association between moderate alcohol consumption and risk for CHD seems with probability to be mediated by the effects on blood lipids (Haskell et al 1984) and the fibrinolytic system (Hendriks et al 1994). Fifty percent of the beneficial effects of alcohol are probably mediated through HDL cholesterol (Langer et al 1992). Experimental studies have also shown that alcohol could have antioxidative effects on smooth muscle tissue (Reinke et al 1996). Other studies have shown increased insulin sensitivity as a result of alcohol intake (Kiechl et al 1996). All of these factors have positive effects on the atherosclerotic process, which is the pathophysiological process behind CVD. Moreover, other health effects seen to be related to alcohol consumption, such as stress relief, distress relief as well as appetite stimulation for elderly, could also be seen to influence health and well-being (Roberts et al 1995).

Not only quantity of alcohol, but also choice of alcoholic beverage may change over time. Sales data imply that wine consumption may have increased during the period of time. This may mean that a number of the individuals, who did not drink wine at the time of the study, do drink wine at present, but that these individuals are nevertheless classified as non-consumers of wine. The fact that the analysis shows an association between wine consumption and cardiovascular mortality would seem to strengthen the argument that other life style factors, that were in 1969 associated with wine consumption, can explain the findings to a certain extent. A possible explanation for the association between wine consumption and decreased cardiovascular mortality has been suggested, relating the association to flavonoids and other antioxidants, contained in wine.

The study of effects of alcohol consumption on mortality as well as on self-reported health shows that risk reduction is associated with low consumption or moderate consumption, when compared with the results for high consumers and non-drinkers. In the REBUS study, it was possible to isolate ex-drinkers from the non-drinker group, showing that non-drinkers and moderate drinkers had approximately the same risks for cardiovascular and total mortality. In the REBUS study as well as in the ULF/SALLS study, a 50% reduced risk for total and cardiovascular mortality as well as poor health (self-reported) could be shown for wine consumers. In the REBUS study, individuals who drank wine once a week had a larger risk decrease than those individuals who consumed wine more often, even after correction was made for total alcohol intake. In the ULF/SALLS study, an association between alcohol consumption and improved health (self-reported) was found exclusively for wine consumption, but not for consumers of strong wine. Confounders including life style factors are considered to provide possible explanations for these results.

## 12. Conclusions

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- A single general health examination does not influence mortality, measured 22 years after the examination.
- It is possible to identify high and low consumers of alcohol by means of simple questions included in a survey questionnaire.
- High alcohol consumption (>140 grams per week) is associated with increased mortality and morbidity.
- No beneficial effects of low consumption of alcohol on mortality and morbidity in cardiovascular disease could be confirmed in this study.
- Wine consumption equivalent to ½ a bottle wine per week is associated with a 50% reduction of total and cardiovascular mortality.
- It is unclear as to whether or not a causal relationship exists between wine consumption and decreased mortality. Confounders such as life style factors may provide an explanation for the results.

### **13. Sammanfattning på Svenska**

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Det är välkänt att hög alkohol konsumtion medför en ökad sjuklighet och dödlighet. I flera epidemiologiska studier har man påvisat ett J-format samband mellan alkohol konsumtionens storlek och mortalitet, både nykterister och högkonsumenter har en ökad mortalitet jämfört med de som har en måttlig konsumtion. Eftersom död orsakad av kardiovaskulära orsaker är den vanligaste dödsorsaken innebär detta att måttlig alkoholkonsumtion också minskar den totala dödligheten. Den optimala mängden alkohol som man bör intaga för att uppnå dessa positiva effekter är ej helt klarlagd, man vet inte heller om någon speciell alkoholdryck har företräde framför de andra vad gäller att minska kardiovaskulär mortalitet. Eftersom randomiserade kontrollerade studier ej är etiskt möjliga att genomföra är man hänvisad till välgjorda epidemiologiska undersökningar för att besvara dessa frågeställningar.

Syftet med avhandlingsarbetet är att i två stora svenska epidemiologiska undersökningar ytterligare belysa betydelsen av alkohol konsumtionen för hälsa och mortalitet. Bland annat avsåg vi att undersöka betydelsen av alkoholkonsumtionens storlek på hälsa och mortalitet, om de tre alkoholhaltiga dryckerna vin öl och sprit skiljer sig åt vad gäller effekter på hälsan och mortalitet och vilken betydelse konfounders kan ha i sammanhanget.

Rehabiliteringsbehovsundersökningen (REBUS) var en stor hälsoundersökning som genomfördes 1969-70 där en enkät sändes till ett slumpmässigt urval av 32185 personer i Stockholms län. Enkäten innehöll 30 allmänna frågor om hälsa och alkoholvanor. 3064 personer kallades också till en undersökning. Uppföljning av dödlighet och sjuklighet skedde sedan i dödsorsaksregister, patientregister och cancerregister. I det första arbetet analyserades om hälsokontrollen hade några effekter på dödligheten. Efter justering för stratifieringsvariablerna kunde ingen skillnad i mortalitet påvisas mellan den hälsoundersökta gruppen jämfört med kontrollgruppen som enbart besvarat en enkät. Beräkningarna genomfördes med multipel regressions analys.

I arbete II validerades de svar individerna gett i postenkäten mot de svar man gav vid intervjun med psykiater vad gäller alkoholkonsumtionen. Vi fann att det var möjligt att identifiera såväl hög som låg konsumenter av alkohol med hög sensitivitet och specificitet med postenkäten.

I arbete III studerades mortaliteten för drygt 1800 individer med avseende på vilken typ av alkohol haltig dryck som konsumerades. Vi fann att individer som konsumerade vin hade en halverad total och kardiovaskulär dödlighet jämfört med de som drack öl och starksprit. Resultaten justerades för åldersklass, kön, total alkohol konsumtion och stratifieringsvariabeln förväntat vårdbehov. Justering för socialgrupp och rökning förändrade inte resultaten. Vi fann också att de som blivit nykterister senare i livet hade högre mortalitet jämfört med de som alltid varit nykterster.

Den andra stora epidemiologiska undersökningen som analyserades var undersökningen av levnadsförhållanden (ULF) som genomfördes 1996-1997. I denna undersökning intervjuades ca 11000 slumpmässigt utvalda personer i Sverige om sina levnadsförhållanden, en rad frågor om alkoholkonsumtion ingick i intervjun. I arbete

IV undersöktes hur alkoholkonsumtionen påverkade den självskattade hälsan. Självskattad hälsa har i andra studier visat sig vara väl korrelerad till sjuklighet och dödlighet. Vi fann att individer som drack vin hade en bättre självskattad hälsa än de som drack öl, starköl, starkvin och starksprit. Resultaten justerades för ålder och total alkoholkonsumtion. Personer med en måttlig alkoholkonsumtion hade en bättre självskattad hälsa än de som var högkonsumenter eller inte drack alkohol. Ingen skillnad mellan könen påvisades. Justering för rökning, body mass index, utbildning, yrkesgrupp och motionsvanor ändrade inte resultaten

I den sista delen av avhandlingsprojektet, arbete V, undersöktes alkohol konsumtionens betydelse för morbiditet och mortalitet under 26 år för ca 30 000 personerna i REBUS. För männen noterades en ökad mortalitet och morbiditet i kardiovaskulära sjukdomar för högkonsumenter, för lågkonsumenter sågs en ökad mortalitet men ej morbiditet. För kvinnor fann vi en ökad morbiditet och mortalitet för lågkonsumenter men ej för högkonsumenter. Gastrointestinala sjukdomar och cancer var ökad hos högkonsumenterna, både hos män och kvinnor.

Avhandlingen har visat att hög alkohol konsumtion är associerad med ökad sjuklighet, dödlighet och självskattad ohälsa. Redan etablerad sjuklighet kan vara en förklaring till ökningen av dödlighet och sjuklighet samt sämre självskattad hälsa bland lågkonsumenter av alkohol. Detta skulle också kunna förklara skillnaden i dödlighet mellan dem som blivit nykterister senare i livet jämfört med dem som alltid varit nykterister. Måttlig konsumtion av vin tycks vara associerat med lägre mortalitet och bättre självskattad hälsa jämfört med konsumtion av öl och starksprit. Orsakerna till detta är oklara men att effekten var tydligast bland personer som drack vin sällan (1 gång/vecka) talar för att det kan finnas andra förklaringar till den positiva effekten än ämnen i vinet, t. ex. livsstilsfaktorer.

## 14. Acknowledgements

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