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# Can The Great Errors of Surveys Measuring Alcohol Consumption Be Corrected?[?]

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***Abstract***

*Survey research has a history of failures, first documented by Pernanen (1974), in estimating national alcohol consumption. He and later researchers found an underreporting by some 40 to 60 percent when individual responses to interview questions about the drinking of alcoholic beverages are aggregated to national levels established by sales and tax statistics. The use, if any, of surveys in national alcohol statistics is therefore usually restricted to supplement sales and tax statistics with estimates of home made wine and liquor and privately imported volumes.*
*Several methodological tests and experiments on the problem of interviewing about alcohol consumption were included in three Swedish surveys with more than 12.000 interviews. Traditional sources of error were explored such as the effect of question wordings, the answering to achieve social desirability, the forgetting, and the effect of higher or lower sampling ambitions. All had noticeable but smaller effects. Specific problems related to the topic of alcohol rendered larger effects. By including known alcoholics in a sample it was found that two thirds of alcoholics become non-respondents, a fact that may apply to surveys on any topic. Finally this paper discusses how the amount of alcohol intake affects the reporting of alcohol intake; after several drinks the respondents loose count. Only by considering and adjusting for all the factors mentioned can surveys deliver reasonable national statistics on alcohol consumption.*

Numerous publications in sociology, public health, and marketing refer to national statistics on alcohol consumption (for example, Brazeau & Burr 1992, Hukens, Knibbe & Drop 1992, World Drink Trends 1995, Wines and Spirits in the European Community 1993). Such statistics are based on sales or taxation records, not on interview surveys. In the EU nations, they show a doubling of alcohol consumption per capita 1950-75 in the northern countries and a slower rise in southern Europe. After 1975 the drinking of alcoholic beverages declines in southern Europe. In northern Europe it levels off with a slight declining trend in recent years (Smith & Solgaard 1998). See Figure 1.

A seminal paper by Pernanen (1974) disqualifies survey research in national alcohol statistics. When individual responses to interview questions about the drinking of alcoholic beverages are aggregated to national levels established by sales and tax statistics, there is an underreporting not by a few percentage points but by the lion's share. Later reviews (Lemmens, Knibbe & Tan 1987, Kühlhorn 1998) have not changed this judgment.

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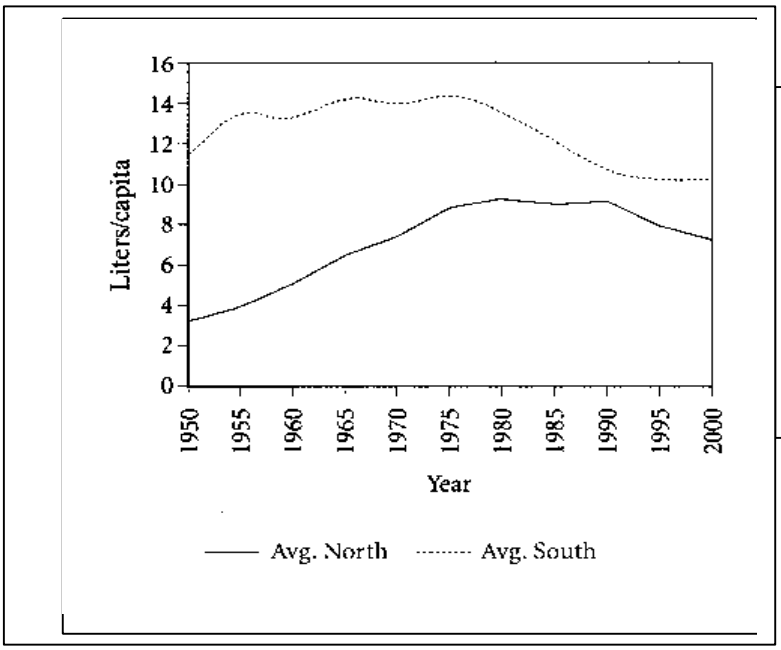
[?] This paper is a part of KALK, a project on Swedish alcohol statistics. Its sponsors are the major Swedish private and public stakeholders in alcoholic beverages: The National Alcohol Board, The National Institute of Public Health, Systembolaget (The Swedish Alcohol Retailing Monopoly), Vin & Sprit Group, and, The Swedish Brewers Association. The Swedish Council of Crime Prevention sponsored some of the special surveys. Eckhart Kühlhorn headed the KALK research team and performed or supervised the statistical calculations and drafted the report in Swedish, *Alkoholkonsumtionen i Sverige under 1990-talet*, OAS and CAN, Stockholm, 2000. The present paper deals only with methodological problems in the uses of interview surveys in alcohol research, not to the use of sales and tax statistics. It also omits the many discussions in the KALK project that relate to specific Swedish problems and controversies. An earlier version which did not include the AFLCAC factor was presented in the seminar "Quality Criteria in Survey Research", June 25-27, 1998 arranged by the World Association of Public Opinion Research (WAPOR) in Cadenabbia, Italy. We are grateful for the comments by this seminar.

***Figure 1. Consumption of absolute alcohol per capita and year in the North and South of EU 1950-2000.***




**Northern Europe:**

Ireland, Denmark, Finland, Netherlands, UK, Belgium, Luxembourg, Austria, Germany, and, Sweden

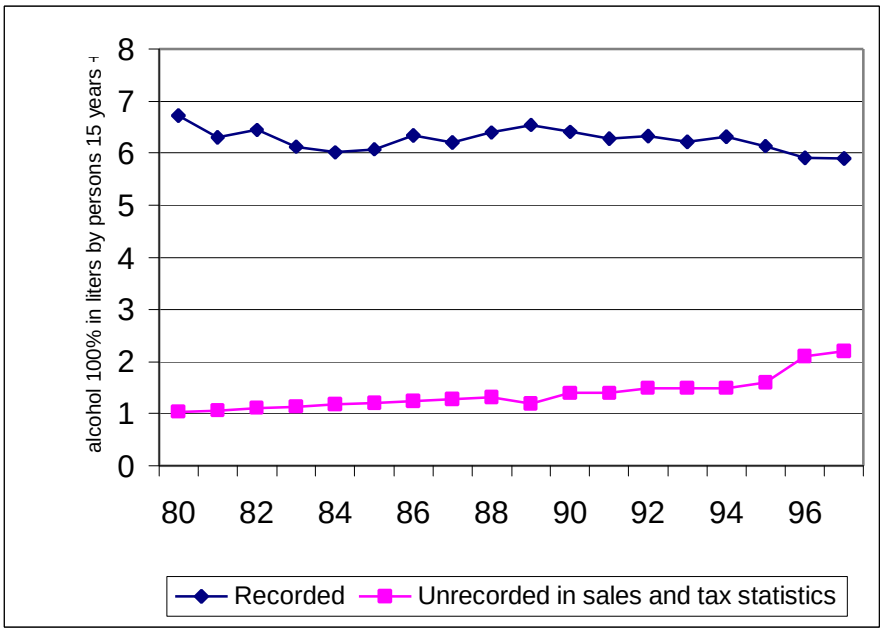
**Southern Europe:**

Greece, Portugal, Italy, Spain, and, France

Source: Smith & Solgaard, 1998, p 82

The World Health Organization has made a virtue of the necessity in this situation by its general but blunt recommendation to member states to pursue policies that reduce the total national level of alcohol intake, i.e. what at present is subject to acceptable statistics (WHO 1980).

***Figure 2. Alcohol consumption in Sweden 1980-97 from recorded sources and from unrecorded sources estimated by interviews.***



## Secondary Analysis

All consumption of alcoholic beverages is not recorded in the sales and tax statistics (Kühlhorn, 1994). Liquor, wine and beer may be homemade, emanate from moonshine factories, be smuggled from countries with less or no tax, or be legally imported as "tax-free". With varying reliability such sources of alcohol can be ascertained by survey research and/or projections from health statistics. In Figure 2 we have added them to the recorded statistics for Sweden by using data from Norström (1997) and a secondary analysis of seven surveys from the period 1989-1990, and 1992-1997.

The volume of alcohol unrecorded in sales and tax statistics is on the rise in Sweden. We do not have comparable statistics for other countries. However, if one could add the unrecorded consumption to the trends in Figure 1 it is less certain that the total consumption would show a decline in recent years. In Sweden, at least, there is rather an advance.

## Our surveys

In a Swedish project named KALK we have explored the frontiers of survey research in the measurement of alcohol consumption. This task has forced us to take a fresh look at several traditional sources of error in survey research such as the effect of question wordings and the effects of non-responses.

**Survey A.** 10.073 telephone interviews with 16-80 years old in a national sample based on random digit dialing (RDD). 365 independent and comparable daily samples were interviewed every day for a whole year from March 1996 through February 1997. GfK Sweden did the fieldwork, which after six recalls had a completion rate of 50.4 per cent. There was no advance notice by mail about these interviews; you cannot write letters to phone numbers. This survey includes tests of various question instruments that have been used in past studies of alcohol consumption.

**Survey B.** 2.303 telephone interviews with 16-80 years old in a high precision unrestricted random probability sample from the population registry. Conducted in April through August 1996 by Statistics Sweden which after 15 recalls had a completion rate of 74.7 per cent. Advance notices by mail were sent to all chosen for interviews. This survey is used to test the effects of reducing non-response rates and includes also a standard measure of symptoms of alcoholism.

**Survey C.** 491 telephone interviews with repeat drunken driving offenders from the official crime registry. Fieldwork in the spring and summer 1996 by Statistics Sweden, which after 15 recalls had a completion rate of 33.6 per cent. Advance notices by mail were sent to all chosen for interviews. The letter indicated that the researchers were aware of the court records of the respondents. There was therefore less incentive among the latter to totally deny their alcohol problem.

Full description of Survey A is found in chapter 2 of our report *Alkoholkonsumtionen i Sverige under 1990-talet*, (Kühlhorn et al., 2000) and of Surveys B and C in Kühlhorn, Leifman, & Borschos (1998).

## Procedures Used to Supplement Sales Statistics with Survey Measures

Our own Survey A is responsible for the measurement for the year 1996 in Diagram 2. At that time the chart of total per capita consumption, recalculated as 100 per cent alcohol, shows a volume of 7.96 liters. We started the calculation of this number with the official tax-registered alcohol sales, and then added from our interview data the homemade, privately imported, and illegally obtained shares. We have not included the amounts consumed by Swedes while abroad, which we estimate to be 1.68 liters pure alcohol per year and capita. Nor have we included the alcohol content of light (often called "non-alcoholic") beer, which is 0.3 liters. But we have included smuggled alcoholic beverages, home produced spirits and wines, and travelers' private imports, be they legal or more than what is legally allowed.

For estimates of the private import (tax free and other) we asked questions about foreign travels and the amount of alcohol brought home from foreign travels. We asked: *"Have you made any trips abroad during the*

*last two months?"* Those who had made trips were asked: *"Have brought home any alcohol?"* If so, the interviewer proceeded by asking what kind of alcohol and how much.

The main difficulty here was not the questions on alcohol but the questions on travel. Since we interviewed during an entire year (see Survey A below) we could disregard the large seasonal variations. However, those who often are away on foreign trips tend to become non-respondents in sample surveys. Validating our responses against travel statistics we had to increase the number of travelers by a factor of 1.25.

***Table 1. Estimates of the total alcohol consumption in Sweden 1996 by different types of beverages and their sources.***

| | **Liter 100%-alcohol per person 15 and over** | **Volume in milj liters** | **Share (%) of the type of beverage** | **Share (%) of total alcohol consumption** |
|---|---|---|---|---|
| **Hard liquor** | | | | |
| Domestically bought & taxed | 1,5 | 27,15 | 53,1 | 18,2 |
| Privately imported | 0,5 | 10,16 | 19,8 | 6,7 |
| Bought smuggled spirits | 0,2 | 3,90 | 7,7 | 4,6 |
| Moonshine | 0,5 | 10,00 | 19,4 | 6,6 |
| Industrial/medical alcohol | - | 0,07 | 0,0 | 0,0 |
| *Subtotal* | *2,7* | *51,27* | *100,0* | *34,3* |
| **Fortified wine** | | | | |
| Domestically bought & taxed | 0,1 | 5,68 | 58,3 | 1,8 |
| Privately imported | 0,1 | 4,26 | 41,7 | 1,3 |
| *Subtotal* | *0,3* | *9,94* | *100,0* | *3,1* |
| **Table wine** | | | | |
| Domestically bought & taxed | 1,6 | 105,18 | 81,6 | 20,6 |
| Privately imported | 0,2 | 11,39 | 9,0 | 2,2 |
| Home made | 0,2 | 11,40 | 9,5 | 2,4 |
| *Subtotal* | *2,0* | *134,55* | *100,0* | *25,3* |
| **Stronger beer** | | | | |
| Domestically bought & taxed | 1,4 | 182,41 | 81,3 | 17,0 |
| Privately imported | 0,3 | 42,62 | 18,8 | 3,9 |
| Home made [1)] | 0,00 | 0,00 | 0,0 | 0,0 |
| *Subtotal* | *1,66* | *225,10* | *100,0* | *20,8* |
| **Regular beer** | **1,25** | **255,37** | **100,0** | **15,7** |
| **Cider/Alcoholic popdrinks** | **0,08** | **10,72** | **100,0** | **1,0** |
| **Total alcohol** | **7,96** | | | **100,0** |

[1)] 51 000 liters home made beer

For estimates of the consumption of homemade and smuggled alcohol we tried three types of question wordings:

- *How many per cent of the spirits you drink is homemade liquor?/ smuggled liquor?*
- *How many of your last ten glasses of liquor has been homemade?/ smuggled liquor?*
- *How much homemade liquor/smuggled liquor/ did you drink yesterday?*

The first wording is not always reliable. There are different sources of non-registered spirits: moonshine, legal tax-free imports, smuggled spirits from abroad, and laboratory or industrial spirits. People could not always accurately calculate percentages from the various sources of non-registered alcohol and their numbers at times added to over 100.

The second wording involved an easier calculation, but put the occasional consumer in a quandary whether to answer "one glass" or "none". The third wording gave us as researchers the opportunity to do the calculation since we had begun the interview by asking about yesterday's total consumption. We think this gives the best estimate of the share of illegal alcohol, but not its absolute amount.

The gross share of all types of alcohol consumed in Sweden but not taxed in Sweden and therefore not recorded in official statistics is estimated to 25.9 per cent of the total consumption. Table 1 gives details for hard liquor, wines, and beer. The grand total of this table – 7.96 liters pure alcohol consumed per capita by the population 15 years and older – has the advantage that the main share of the consumption estimate is gross

sales and tax statistics and thus not subject to sampling errors. A drawback is that tax statistics are notoriously biased in favor of what produces the lowest taxes for the informants, and may introduce another type of error.

The 7.96 liters pure alcohol per capita will now be used as our *best estimate* to evaluate our different methodological efforts to correct data on total national alcohol consumption obtained by direct questions to the national samples.

## Question Wordings to Tap Total Alcohol Consumption

Researchers have used many types of questions to measure the respondents' alcohol consumption. The types of questions differ in the type and complexity of calculations imposed on the respondents. We test the most common of them – those asking about the frequency of drinking and the quantity, an estimate of total drinking in a typical week for the respondent, or, of the last seven days – and added one of our own, the drinking yesterday. We refer to them as ”Frequency & Quantity”, ”Normal Week”, ”Last Seven Days”, and "Yesterday".

**Frequency & Quantity.** A combined inquiry into frequency and quantity are common in alcohol research. There is a detailed discussion of the wording of such questions in Sudman & Bradburn (1982, pp 65-68). The wordings are particularly appropriate for the person who rarely drinks alcohol. We used the following formulations in our test:

*Do you ever drink hard liquor/wine/ beer?*

If "Yes": *Approximately how often do you drink hard liquor /wine/ beer/?*
*Pretty much every day*
*4-5 times a week*
*2-3 times a week*
*About once a week*
*A couple of times a month*
*About once a month*
*A few times a year*
*Once a year or less*

*About how much do you drink each time that you drink hard liquor?*
*A small drink (corresponding to about 4 cl)*
*A large drink (corresponding to about 6 cl)*
*2 drinks (corresponding to (about 12 cl)*
*3 drinks (corresponding to about 18 cl)*
*4 drinks (corresponding to about 24 cl)*
*5 drinks (corresponding to about 30 cl)*
*About half a bottle (37.5 cl)*
*More than half a bottle*

For wine and beer the response alternatives referred to glasses, cans, or bottles.

A problem with these questions is found in the fact that most people (in Sweden) drink a great deal more on Fridays and Saturdays and therefore have difficulty in giving an average figure for each occasion which they have consumed alcohol. You do get answers, but they may not be accurate. Adding our answers from the frequency and quantity questions to a national total expressed in pure alcohol per year we obtain 2.9 liters, or, only 37 per cent of the best estimate.

**Yesterday.** In all our surveys this question was asked: *"Did you drink any hard liquor /wine/ beer/ yesterday, that is, x-day? If yes: How much hard liquor /wine/beer/ did you drink?"* We converted the answers into pure alcohol. Distribution over the days of the week is shown in Table 2. This pattern of alcohol consumption does not interfere with the normal workweek in industrial society. During the early part of the

twentieth century it was established in Sweden as part of a process of disciplining a work force with a predominantly rural background to a new labor market (Ambjörnson 1988).

***Table 2. Daily rhythm of alcohol intake in Sweden 1996***

| Weekday | Per Cent 16-80 years old who consumed any alcohol | Per Cent of Weekly Consumption |
|---|---|---|
| Sunday | 22.0 | 9 |
| Monday | 17.1 | 6 |
| Tuesday | 21.4 | 10 |
| Wednesday | 17.6 | 9 |
| Thursday | 20.3 | 8 |
| Friday | 39.3 | 25 |
| Saturday | 46.0 | 33 |

*N=10013. Source: Survey A*

The backside of this pattern of alcohol consumption is a concentration of alcohol-related social problems during Friday evening and Saturday. They include public drunkenness, street fights, domestic violence, drunken driving, peak admittance to alcohol clinics, et cetera. Here, however, we will only deal with the problems it gives to a survey researcher.

Our great effort with questions about consumption yesterday asked on a daily basis during a whole year rendered a disappointing result. Adding up our answers to a national total expressed in pure alcohol per year we obtain 3.7 liters, or, 46 per cent of the best estimate.

The Last Seven Days: A difficulty with the "Yesterday" questions lies in the fact that the researcher does not know how he shall calculate the weights of the answers unless he interviews during every day of the year, or unless he has prior knowledge of the seasonal variations in alcohol consumption. We resolved this problem by a filter question:

*How would you best describe your alcohol consumption during the past seven days?*
*More than normal  Normal  Less than normal*

If "normal": Ask the "Yesterday" question and add a similar "The Day Before Yesterday" question. *Did you drink any hard liquor /wine/ beer/ in the past three to seven days?*
*How much did you drink yesterday/the day before yesterday/three/four/five/six/ seven days ago, that is, X-day?*

If "more than normal" or "less than normal": Ask the questions about a Normal Week (see below).

About one-third in our Survey A reported an atypical situation during the last seven days. Adding our answers about the last seven days to a national total expressed in pure alcohol per year we obtain 3.5 liters, or, 44 per cent of the best estimate.

**A Normal Week**. The difficulties are considerable for our respondents to estimate their weekly consumption over a highly varied weekly rhythm. Our questioning about alcoholic beverages during a normal week, therefore, divided the week into more homogenous periods. Keeping in mind the Swedish weekly rhythm of drinking we asked:

*Do you ever drink hard liquor/wine/ beer in a normal week?*

If "Yes": *About how much hard liquor/wine/ beer/ do you drink during a normal week? This may of course vary in the course of the year, but try to give an average amount. You may give your answer in number of /centiliters, or, shots, or, drinks/glasses, or, bottles/glasses, or, bottles, or, cans.*

*How many drinks of hard liquor /glasses of beer/wine/ do you normally drink on **Sundays**?*
*How many drinks of hard liquor /glasses of beer/wine/do you usually drink on a weekday **from Monday to Thursday**?*

*How many drinks of hard liquor /glasses of beer/wine/ do you normally drink on **Fridays**?*
*How many drinks of hard liquor /glasses of beer/wine/ do you normally drink on **Saturdays**?*

If "No": Ask the Frequency and Quantity question. This was done in Survey B, not in the other surveys.

A normal week would exclude the great festivities and carnival weeks, New Year celebrations, et cetera. This might save the respondent from being embarrassed by having to consider intoxicating amounts, but would underestimate his or her total consumption. At any rate, we found that answers are quickly and readily given to this line of questions. There are, however, particular difficulties in estimating the ”normal” if consumption is irregular. As we know, some people have very high consumption periods followed by periods of low or no consumption. Adding our answers from questions in Survey A about a normal week to a national total expressed in pure alcohol per year we obtain 4.5 liters, i.e. 57 per cent of the best estimate. When the results from the supplementary Frequency and Quantity questions were asked in Survey B we could add 0.34 liters bringing the total to 61 per cent of the best estimate.

## Who Shall Do the Calculations: the Researcher or the Respondents?

There are at least two schools of thought about questionnaire construction aimed at gross statistics:

The first view: In a survey interview the respondents give the facts, and the researcher calculates the distributions of these facts. This is the rule of thumb in a "positivist tradition" of social research. The survey interview is here usually seen as a series of stimuli and responses. Survey respondents should only be asked to provide raw material for the researchers’ calculations. If the respondents are asked to do calculations one expects uncontrollable errors and lack of uniformity. The errors occurring in this approach lie mainly with the respondents whose memory and perception thus should be checked and double-checked. The few conceivable errors of the researcher are only arithmetic and can be corrected without new fieldwork. The questionnaires we have called "Frequency and Quantity", "Yesterday" and "Last Seven Days" are written in this tradition.

The second view: A survey interview is a structured conversation in which the respondents give their considered judgments, and the researcher shall understand and summarize these judgments. The researchers in this more "humanistic tradition" accept that respondents are ready, willing and able to enter a conversation with the interviewer and give his or her estimates also of complex situations. It is understood that such estimates are formulated in terms of the respondents' personal values and the opinion climate in the circles where they move. The survey interview in this approach is often seen as a process of mutual symbolic interactions between interviewer and interviewee, not as a stimulus-response situation.

The line of questioning we have called "The Normal Week" comes nearer this approach than the others. Every respondent may here define what is normal for him or her, given his or her values and social circles, and the interviewer and interviewee together fill this self-chosen conception of a normal week with counts of shots of liquor, glasses of wine, or cans/bottles of beer. The errors in this approach lie mainly in misunderstandings and cannot be corrected without new fieldwork.

All question-types showed gross underestimation. Table 3 summarizes the story. The message from Pernanen (1974) is still true: straightforwardly analyzed surveys account for 40 to 60 per cent of the actual alcohol consumption. But some lines of questioning may be better than others. To most statisticians and economists it may come as a counter-intuitive conclusion that the strict questions in ”Frequency and Quantity” perform so poorly, recording only 37 per cent of the consumption.

***Table 3. Mean per capita consumption and share of total national consumption of alcohol per year (liters 100% alcohol among the population 15 years and older) in Sweden 1996 according to various question wordings***

| Question Type | Number of respondents | Consumption in liters per capita of 100% alcohol | Share of total alcohol consumption recorded by the scale |
|---|---|---|---|
| *Survey A* | | | |
| Frequency & Quantity | 2008 | 2.90 | 36.4% |
| Yesterday | 10073 | 3.70 | 46.4% |
| The Last Seven Days + Normal Week | 1993 | 3.54 | 44.4% |
| A Normal Week | 4045 | 4.52 | 56.7% |
| *Survey B* | | | |
| Yesterday | 2303 | 3.64 | 45.7% |
| Normal Week + Frequency & Quantity | 2303 | 4.86 | 61.0% |

The consumption a "Normal Week", in spite of the several problems we noted with this line of questioning, gives the highest estimate with regard to national consumption: it records 57 per cent of the total consumption. When the ”Normal Week” line of questioning is supplemented by the ”Frequency and Quantity” questions addressed to those who say that they do not drink in a normal week, we can record 61 per cent of the total national consumption by interviews. A "humanistic" question supplemented by a "positivistic" one thus gave the nearest estimate.

Using the line of questioning we have called "Yesterday" we find that the underreporting is significantly greater for hard liquor that for wine and beer. This is consistent with the notion that an element of social desirability appears in answers to survey questions.

## Correcting for the Forgetting Over Time

We asked everybody " Did you drink any hard liquor /wine/ beer/ *yesterday*, that is, x-day?" and "Did you drink any hard liquor /wine/ beer/ *the day before yesterday*, that is, x-day?" The same type of question was asked for each day during the week preceding the interview in a subsample of the Survey A comprising 1.267 interviews split in equivalent daily samples with respondents who had reported that their alcohol consumption had been normal during the previous week. If the answers were entirely accurate the difference between the days after recall would be no larger than random sampling variations. However, the workings of memory in answering this type of question causes the quantity of alcohol consumed to decrease from day to day, counting from the day of the interview. The results after recalculation in pure alcohol intake are found in Table 4¤.

The decline in recall of alcohol consumption already starts after one day. There is a rapid decline in the level reported for the day before an interview. This fact raised our hopes that one could formulate questions in survey research on alcohol to avoid or reduce the underreporting. Encouragement came from studies of memory and mismemory in surveys of health events (hospitalizations, miscarriages, taking blood pressures) and of political events (registration, voting); some of them are summarized in Tanur 1992, part 3). However, as we have seen in Table 3, the criterion validity of the straight questions about consumption yesterday and the day before yesterday is not impressive.

The accumulated decline in memory of alcohol consumption during a week is 21 per cent. We can apply this to our weekly measures, i.e. Last Seven Days and Normal Week, as a correction factor. In Survey A "Last Seven Days" questions then render 4.3 liters, or 54 per cent of the best estimate, and ""Normal Week" questions render 5.5 liters, i.e. 69 per cent of the best estimate. In Survey B where we have "Normal Week" questions supplemented by the ”Frequency and Quantity” questions to those who say that they do not drink in a normal week we achieve 5.9 liters and 74 per cent of the best estimate.

***Table 4. Memory of drinking during past week based on items in the scale "Last Seven Days".***

| Time laps between interviewing and consumption | Consumption reported in percent of first day after recall Total Survey A N=10073 | Sub-sample with normal consumption during past week N=1267 | Forgotten share of consumption |
|---|---|---|---|
| One day | 100% | 100% | 0% |
| Two days | 89% | 81% | 11% |
| Three days | | 85% | 15% |
| Four days | | 65% | 35% |
| Five days | | 74% | 26% |
| Six days | | 78% | 22% |
| Seven days | | 62% | 38% |
| *Accumulated forgotten share of consumption during a week* | | | *21%* |

One can, of course, discuss the accuracy of our base line of 100 per cent after one day. In reality, the figure for one day after recall may also have distortions, particularly among the heavy consumers who may suffer from hangovers.

## The Effect of High Intake: Loosing Counts

It is a common observation that a high intake of alcohol reduces the precision of actions and of mental operations. One dilemma of alcohol research by survey methods is that the reporting of alcohol intake is affected by the alcohol intake.

In Survey B we included the so-called AUDIT scale (Saunders, Aasland, Babor, De La Fuente, J. & Grant 1993) that is designed to identify persons in the risk zones of alcoholism. We have different aims and use here only three of the 12 questions in the AUDIT-scale that relate to the problem of loosing counts on occasions of drinking.

***A1.*** *How often do you have six or more drinks on one occasion? Never (1), Less than monthly (2), Monthly (3), Weekly (4), Daily or almost daily, (4)*
***A2.*** *How often during the last year have you found that you were not able to stop drinking once you had started? Never (1), Less than monthly (2), Monthly (3), Weekly (3), Daily or almost daily, (3)*
***A3.*** *How often during the last year have you been unable to remember what happened the night before because you had been drinking? Never (1), Less than monthly (2), Monthly (3), Weekly (3), Daily or almost daily, (3)*

These questions form the basis of what we call an Adjustment Factor for Loosing Count of Alcohol Consumption (AFLCAC).

The share of respondents who answer with the higher response alternatives is very small. We therefore combine the response "Daily" with the response "Weekly" in Question A1 and the responses "Daily", "Weekly" and "Monthly" in Questions A2 and A3 to yield top cells with more than 1 percent of the total. Resulting weights are shown in the parentheses.

The respondents who answer ”Never” on all three questions (52.4% in Survey B) do not need any adjustment and receive an AFLCAC = 1.0. The others are adjusted by the formula:

AFLCAC = 1.0 + log(A2+A3)

AFLCAC is designed to restore the pure alcohol content in the number of drinks that the respondents who answered other than "never" on all above questions are assumed to have lost count of in the interview. The formula needs an experimental validation before it can be considered an acceptable approximation. Table 5 shows that AFLAG is related to age and sex in roughly the same way as is heavier drinking. In Survey B we obtain an adjustment of 0.84 liters per year and capita calculated as 100%-alcohol per year, i.e. an adjustment of 14.4 per cent of the raw value. Adding this amount to the 5.9 adjusted liters in the highest estimate in the previous section we get 7.9 liter, or 99 per cent of the best estimate of the national total.

***Table 5. Adjustment Factor for Loosing Count of Alcohol Consumption (AFLCAC) in age and sex groups in Survey B.***

| Age | Male | Female |
|---|---|---|
| 16-25 | 1.35 | 1.24 |
| 26-35 | 1.28 | 1.14 |
| 36-45 | 1.24 | 1.11 |
| 46-55 | 1.20 | 1.07 |
| 56-65 | 1.16 | 1.04 |
| 66-75 | 1.08 | 1.02 |
| 76-80 | 1.03 | 1.00 |
| | N=1951 | |

## The Effects of Non-Response: Coping With the Alcoholic and Near-Alcoholic

Sample surveys consist of at least two strata: respondents and non-respondents. Non-response introduces distortions if a variable measured has a different distribution in the non-response stratum than in the responding stratum.

The non-response stratum can be divided into at least two sub-strata: the accessible and the non-accessible for an interview. When we sample the stratum of non-respondents for a follow-up study, the new respondents from the follow-up belong to the accessible sub-stratum. In Survey A we made a follow-up of the non-respondents with 264 interviews. Their answers were weighted into the respondents' answers in all tabulations. The differences between the accessible non-respondents and the respondents were very small, so small that they could have been neglected without any change in our conclusions.

Survey A is a typical market research sample, with a completion rate of 50.4 per cent. Survey B is a high quality government survey. The Survey B reached many more from the accessible non-respondent stratum than Survey A. Survey B had advance notices by mail sent to all chosen for interviews, and 15 recalls were made before the interviewers were allowed to give up. The completion rate is 74.7 per cent.

Our estimates of alcohol consumption were, however, only marginally affected by reducing the non-response from some 50 percent to 25 per cent. Survey A and Survey B show only small differences. In other words, the accessible non-respondents in a standard market research sample do not differ from the respondents in the high-quality government survey.

## Alcoholism

In Survey C of the repeatedly drunken drivers, we have a concentration of alcoholics, near-alcoholics, and persons with alcohol problems and/or repeated alcohol irresponsibility. The sample may be more representative of male than female alcoholics.

The response rate of Survey C was 33.6 percent using the same thorough methods and the same interviewers as in Survey B that rendered a response rate of 74.7 per cent. Persons with alcohol problems are thus grossly underrepresented with normal survey procedures. They are over-represented among the non-accessible non-respondents. Since they do drink copiously — among male alcoholics about a bottle of hard liquor a day and much more beer than the average person drinks — they account for a significant amount of the underreporting of alcohol consumption in surveys of the public.

In our Survey C, each respondent was told that we had found his name among convicted drunken drivers. In this particular case, the fact that the respondent knows that the interviewer has advance information of his problems probably improved the accuracy of the answers. In the ideal case, the interviewers of a sample of alcoholics should be specialists on alcoholism whom the respondents discover that they cannot fool.

From various studies (Spak 1996, Öjesjö 1983) we estimate the prevalence of alcoholics in Sweden to about 5.5 per cent of the adult males and 0.5 per cent of the females. We impute their consumption in our normal Surveys, A and B. Only 67.3 per cent should, however, be imputed. The rest, 33.6 per cent, as we saw in Survey C, belong to the response stratum, i.e. represent those who had already been interviewed in the

normal samples. This operation adds 0.37 liters to the national per capita consumption, calculated as pure alcohol per year giving us a total consumption of 8.32 liter of pure alcohol. This amount compares well to the best estimate of 7.96 liters obtained by supplementing sales statistics with information from interviews about non-registered alcohol excluding consumption abroad.

## Can The Great Errors of Surveys Measuring Alcohol Consumption Be Corrected?

We have examined the merits of survey research in the study of alcohol consumption. If the aim of a research solely is to establish the total alcohol consumption and its components in a nation we recommend a procedure that add from interview data the homemade, privately imported, and illegally obtained shares to the official tax-registered alcohol sales. The result of this use of interview surveys are illustrated in Table 1 which shows that the Swedes in 1996 on the average consumed 7.96 liter of pure alcohol in the form of liquor, beer wine, etc. By this approach we cannot reveal the consumption in various subgroups of the population, only the national average. However, as shown above in Table 1, we can report separately on the various types of alcoholic beverages and whether they have been obtained by legal or illegal sources. This approach has the advantage that the main share of the consumption estimate is tax and sales statistics and thus not subject to sampling errors.

The straightforward use of interview surveys to measure alcohol consumption among the public and its subgroups results in underreporting, not by a few percentage points as is the case in studies of tobacco smoking, but by the lion's share. Four ways to reduce underreporting have been illustrated here.

1. Using a humanistic rather than a positivistic approach to question wording, and avoiding questions that require difficult calculations on part of the respondents. For surveys that need to roughly record alcohol consumption more in passing with the smallest number of questions we recommend the line of questioning called "Normal Week". For general-purpose surveys of high quality we also recommend the line of questioning we called "Last Seven Days ". ”Frequency and Quantity” questions might be given only to those who say that they do not drink during a normal week or the last seven days.

2. Adjusting for the lapses of memory between the day of interviewing and the period of consumption mentioned in the questions. To establish the correction factor one needs to use the line of questioning we called "The Last Seven Days".

3. Adjusting for the tendency of respondents to loose count of the number of drinks consumed on occasions of heavier drinking. For this purpose four questions from AUDIT can be used. The specific adjustment formula (AFLCAC) we have proposed need, however, validation before it can be generally recommended.

4. Adjusting for the heavy drinkers among non-accessible non-respondents in surveys of the public, in plain words, the alcoholics. A special sample of known alcoholics, preferable interviewed by specialists on alcoholism, can supplement a general survey of the public. We used for this purpose a sample of repeatedly convicted drunken drivers.

Our final table summarizes the results from the main questionnaires and adjustments made when using only interview surveys, and no sales statistics, in our attempts to measure alcohol consumption. The resulting figure of 8.32 liter pure alcohol per capita and year in Table 6 is very close to the national total estimate from adjusted sales statistics of 7.96 liter in Table 1. The latter estimate excludes explicitly consumption abroad (1.68 liters), a fact that may account for the remaining discrepancy.

A survey data bank with this degree of accuracy can thus be established. Thereby the usual tracking of consumer goods by survey analysis in the subgroups of society – age, sex, marital status, education, region, life styles, etc. – can be carried out with good accuracy also for alcoholic beverages. Target groups more specific than the whole nation proposed by WHO can be established. Survey researchers will be able to accurately track the alcohol consumption in these target groups for educational, medical, legislative, and commercial purposes.

***Table 6. The mean consumption of alcohol in Sweden in 1996 in liters per capita of 100% alcohol as revealed by adjusted and imputed interview surveys. Summary.***

| | Liter 100%-alcohol per person 15-80 | Accumulated share of best estimate |
|---|---|---|
| Interviews with the general population age 15-80 Survey A using questionnaire Frequency & Quantity | 2.90 | |
| Interviews with the general population age 15-80 Survey A using questionnaire Normal Week | 4.52 | |
| **Interviews with the general population age 15-80 Survey B using questionnaire Normal Week + questionnaire Frequency & Quantity to those who do not drink in a normal week** | **5.88** | **61.0%** |
| Adjustment of above for the accumulated forgotten amount of consumption during a week based on Survey A | 1.23 | 89,3% |
| Adjustment Factor for Loosing Count of Alcohol Consumption (AFLCAC) based on Survey B | 0.84 | 99.8% |
| Imputing non-accessible non-respondents with alcohol problems from Survey C | 0.37 | 104.5% |
| **Total** | **8.32** | |

## *References*


*Alcoholic Beverages and European Society.* (1993). Amsterdam: The Amsterdam Group.

Ambjörnsson, R. (1988), *Den skötsamme arbetaren: idéer och ideal i ett norrländskt sågverkssamhälle 1880-1930*, Stockholm: Carlsson.

Björkman, N-M. (1979), *Social önskvärdhet som felkälla i frågeundersökningar. En jämförelse mellan två datainsamlingsmetoder*, Stockholm.

Brazeau, R., & Burr, N. (1992). *International survey: Alcoholic beverage taxation and control policies* (8th ed.). Ottawa: Brewers Association of Canada.

Cutler, S. F., Wallace, P. G. & Haines, A. P. (1988), "Assessing alcohol consumption in general practice patients – a comparison between questionnaire and interview." (Findings of the Medical Research Council's general practice research frame work study on lifestyle and health), *Alcohol and Alcoholism*, vol. 23, No 6, pp. 441-450.

Davis, P., & Walsh, D. (1983). *Alcohol problems and alcohol control in Europe*, New York: Gardner Press.

Hukens, C.L.H., Knibbe, R.A., & Drop, M.J. (1992). "Alcohol consumption in the European community: Uniformity and diversity in national drinking patterns." Paper presented at the 18th Annual Alcohol Epidemiology Symposium, Toronto, Canada.

Jansson, C-G. (1990), "Retrospective data, undesirable behaviour, and the logitudinal perspective" in Magnusson, D. & Bergman, L. D.(ed), *Data quality in longitudinal Research*, Cambridge, Cambridge University Press.

Kühlhorn, E. (1994), *Statistikförd och icke-statistikförd alkohol*. Bilaga 8 i SOU 1994:25, Socialdepartementet.

Kühlhorn, E (1998), "Problem och nya grepp i kartläggningar av alkoholkonsumtionen och alkoholskadorna" in Kühlhorn, E. & Björ, J., *Svenska alkoholvanor i förändring*. Sober förlag.

Kühlhorn, E. & Leifman, H. (1993), "Alcohol Surveys with High and Low Coverage Rate: A comparative analysis of survey strategies in the alcohol field", *Journal of Studies on Alcohol*, vol. 54, pp. 542-554.

Kühlhom, E. (2000) *Alkoholkonsumtionen i Sverige under 1990-talet.* CAN, Stockholm

Kühlhorn, E., Leifman, H. & Borschos, B. (1998) *Kartläggning av sociala förhållanden i socialt marginaliserade grupper.* BRÅ, Stockholm.

Lemmens, P., Knibbe, R.A. & Tan, F. (1987), "Weekly recall and diary estimates of alcohol consumption in a general population survey", *Journal of Studies on Alcohol*, vol 49, pp.131-135.

Marshall, M. (Ed.). (1979). *Beliefs, behaviors and alcoholic beverages: A cross-cultural survey*, Ann Arbor, MI: University of Michigan Press.

Midanik, L. (1982), "The validity of self-reported alcohol consumption and alcohol problems: A literature review", *British Journal of Addiction*, vol 77, pp. 357-382.

Norström, T. (1997), "Alkoholkonsumtionens mörkertal i Sverige 1960-1994", *Nordisk Alkohol- och narkotikatidskrift*, vol. 14, nr. 2, pp 65-73.

Pernanen K. (1974) "Validity of survey data on alcohol use" in: Gibbins, R.J., Israel, Y., Kalant, H., Popham, R.E., Schmidt, W and Smart, R. G.. (Eds) *Research Advances in Alcohol and Drug Problems*, Vol. 1, New York: John Wiley & Sons, Inc., 1974, pp 355-374.

Pittman, D.I., & White, H. R. (Eds.). (1991). *Society, culture and drinking patterns revisited*, New Brunswick, NJ: Rutgers University.

Sabroe, K.E. (1994). *Alcohol in society*, Aarhus: Aarhus University Press.

Saunders, J.B., Aasland, O.G., Babor, T.F., De La Fuente, J. & Grant, M. (1993) Development of the Alcohol Use Disorders Identification Test (AUDIT). WHO Collaborative project on early detection of persons with harmful alcohol consumption - ll, *Addiction*, 88, 791-804.

Smith, D E. & Solgaard, H.S. (1998). "Global trends in European Alcoholic drinks consumption", *Marketing and Research Today*, vol 27, no 2, pp. 80-85.

Spak, F (1996) *Women and alcohol in Göteborg: an epidemiological study of female alcoholism and alcohol related problems*. The Department of Social Medicine, Göteborg University, Vasa Hospital and the department of Psychiatry, Karolinska Institutet, Huddinge University Hospital, Göteborg

Sudman, S. & Bradburn, N.M. (1982) *Asking questions.* Jossey-Bass Publishers, San Francisco, Washington, London.

Tanur, Judith M. editor (1992) *Questions about questions.* Russel Sage Foundation, New York.

WHO (1980), *Problems related to alcohol consumption*. Report of a World health organization Expert Committee. Technical Report Series 650. Geneva, WHO, 1980.

*Wines and Spirits in the European Community.* (1993). Brussels: Club de Bruxelles.

*World Drink Trends.* (1995). Oxford, England: NTC Publications Ltd.

Öjesjö, L (1983) *An Epidemiological Investigation of Alcoholism in a total Population; the Lundby Study*. Institutionen för Social- och Rättspsykiatri, Lunds universitet, Lund