

Risky drinking of alcohol in Sweden: A randomized population survey comparing web- and paper-based self-reports

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ABSTRACT

AIMS – This study compared data quality and response rates for the Alcohol Use Disorders Identification Test (AUDIT) in a web-based versus in a paper-and-pencil format survey. **SETTING** – Subjects were randomised to one of two parallel samples, one web-based and the other paper-based. Data were collected during 2009. **RESULTS** – The web-based format yielded a lower response rate compared to the paper version (26.2% vs. 53.6%), internal consistency was quite similar (0.82 vs. 0.77), while the mean AUDIT scores were higher in the web-based format for both men and women. **CONCLUSIONS** – Future studies should focus on methods for combining different administration methods in order to maximize response rates.

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Introduction

Starting in 1997, the Alcohol Use Disorders Identification Test – AUDIT (Saunders et al. 1993) – has been used in Sweden in four population studies to investigate alcohol habits in the general population. The psychometric properties of the Swedish version of the test are reported elsewhere (Bergman & Källmén 2002; Sinadinovic et al. 2011). Three population studies (1997, 2001 and 2005) were conducted using the paper version of the test. In 2009, with increasingly higher rates of Internet use in Sweden (Findahl 2008a) the question of whether a web-based questionnaire on the Internet could be used to survey risky

drinking of alcohol in the general population without jeopardizing data quality was investigated.

■ Paper and pencil versus Internet

Mailing paper questionnaires is a tried and true method of collecting data, and one that in our earlier AUDIT population surveys generated quite high response rates, 72–80% (Källmén et al. 2007). However, this method is costly, given the expenses of paper printing, postage, and data entry. The web-based alternative offers savings on return postage and data entry. In addition, using the Internet version of the AUDIT

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also eliminates missing value problems on individual items (Kypri & Gallagher 2003; Miller et al. 2002; Werner 2005).

Prior studies investigating whether administering questionnaires via computer is a viable alternative to paper versions have shown inconsistent results. Some research indicates that individuals report higher substance consumption when computerized questionnaires are used instead of paper. Among adolescents, for example, web questionnaires have been found to lead to higher reporting rates of commonly used substances compared to paper questionnaires (Wang et al. 2005). A study of 4 051 randomly sampled individuals from the general U.S. population showed that respondents to a web survey were far more likely than those interviewed by telephone or mail to report heavy drinking (Link & Mokdad 2005). On the other hand, other studies suggest little or no such differences in reporting. In an older study involving university students, reported frequencies of alcohol and other drug use as well as behaviors resulting from alcohol and drug use were similar across telephone, mail, web and Interactive Voice Responses modes of survey administration (Bason 2000). Among undergraduates, no significant differences in data quality or reported substance use were found when comparing paper and web questionnaires (McCabe et al. 2002). Two other studies among college students reported similar results (Miller et al. 2002; McCabe et al. 2006).

Web-based survey administration has apparent advantages in relation to paper, but collecting data with this method is limited to an Internet-using population (Kypri et al. 2004; Werner 2005). Furthermore, no complete official registry for

e-mail addresses (such as those for home addresses) exists today, making it impossible to easily reach the specific population of Internet users (Werner 2005). Mailing paper invitations to individuals in the sample is still a necessary procedure. Several Swedish and international studies have furthermore reported low response rates for Internet-based surveys (Caetano 2001; Sinadinovic et al. 2011; Werner 2005).

■ Internet use in Sweden

In Sweden, the current rate of Internet access is at least 90% among Swedes 16 years or older and 81% of Swedish adults have Internet access in their own homes. Internet access in Norway and Denmark is on the same level but somewhat lower in Finland (Findahl 2008a). Sweden has a unique position in the world when it comes to Internet use, not only because it is one of the countries with highest share of Internet users in the world but also because Internet use is more widely spread in Swedish society compared to other countries, in terms of age and educational level (Findahl 2007; 2008b). Among younger Swedes 16–25 years old almost all (97%) use the Internet at least once a month; among older Swedes 56–65 years old Internet use is currently as high as 75%. The corresponding figure among individuals 66–75 years old is lower, however, at 51% (Findahl 2008a). Sweden thus has considerable potential for attaining a high response rate in a nationwide web-based survey, at least among individuals 65 and younger.

■ Aims

The aim of this study was to conduct a randomized Swedish population survey of

alcohol habits and risky drinking according to the AUDIT using two methods of administration, paper and web-based and to compare results on three parameters: response rates, internal consistency reliability and raw scores. The comparisons were made for men and women separately.

Methods

■ The AUDIT questionnaire

The AUDIT questionnaire is recommended by the World Health Organisation (WHO) and is used internationally to screen for problem drinking among the general population. Internal reliability, factor structure and norm data for the Swedish version of the test have been described earlier by Bergman and Källmén (2002). Although the AUDIT was constructed as a screening instrument for hazardous and harmful alcohol habits in primary care patients, it can also be used to screen for alcohol-related social and health problems, as well as dependency (Selin 2006). For these reasons we considered it appropriate to use the AUDIT to estimate changes in alcohol use in the Swedish population. The AUDIT was constructed with the ambition that it would be useful in countries with differing alcohol habits and cultures. For AUDIT respondents, a drink is defined as 12 grams of 100% alcohol. This quantity is exemplified on the form for various types of drinks (e.g. beer, wine or spirits). Various cut-off points for hazardous or harmful habits have been suggested. For the purposes of the present study, the cut-off for hazardous or harmful alcohol habits among men was set at the recommended 8 points (Saunders et al. 1993) and the cut-off for women was set at 6 points as suggested by Bergman and

Källmén (2003). A higher cut-off level, 16 for men (and possibly 14 for women), has been used to identify more severe alcohol-related problems. This higher cut-off was suggested by Babor et al. (2001) but has not yet been well established.

■ Procedure

Two random samples of 1250 individuals each were drawn from the same national register (DAFA-SPAR) over all Swedish individuals having a registered address. The samples were evenly divided between men and women. A direct marketing company, PAR AB, performed the data collection.

Participants in one sample were allocated to an electronic, web-based response group and those from the other sample were allocated to a paper-and-pen response group. All potential respondents were between 17 and 71 years old and were geographically distributed in the whole of Sweden. Two reminders were sent, three and six weeks after the main mailing.

Subjects allocated to the paper response group were sent an envelope containing an introductory letter, the AUDIT questionnaire with a reference code and a stamped return envelope. Subjects allocated to the web response group received a postcard with the same introductory text, an URL-link and a log-in code to the electronic version of the questionnaire. PAR AB handled the distribution of the paper questionnaires and postcards.

The study was authorized by the Karolinska Institutet Ethical Review Board (Dnr 2009/120–31).

■ Samples and respondents

Ten persons allocated to the paper response group and 18 from the web-based

response group had changed their address without registering a new one; these were excluded from the sample, leaving 1240 individuals in the paper response group, and 1232 individuals in the web-based response group. After the first mailing, 314 individuals (25%) responded to the AUDIT paper version and 167 (13%) responded to the web-based version. Following the first reminder, the total number of responses was 483 (39%) in the paper group and 230 (18%) in the web-based group. After the second reminder the final number of responses for the paper version was 663 (53.6%), 276 men and 344 women (43 did not disclose their gender). For the web-based version of the AUDIT, the final number of responses was 324 (26.2%), 140 men and 184 women. The overall response rate for both response modes, was 40% (987 out of 2472). In the paper response group, 104 individuals (15.6%) chose to reveal their identity in order to receive a voucher worth 50 SEK, and in the electronic response group, 98 individuals (30.2%) did the same.

■ Statistics

All data analyses were conducted using Statistical Package for Social Sciences (SPSS) software. Age groups were handled according to a previous study (Bergman & Källmén 2002) which indicated that alcohol habits at the population level were fairly stable among individuals 28 to 60 years of age. For this reason, study participants for all analyses were grouped by age into three groups: 17–27 years, 28–60 years and 61–71 years.

Response rates for the two questionnaire modes were compared using a χ^2 -test. Cronbach's alpha coefficients were used to

calculate the internal consistency, i.e., the degree to which all items assess one single construct. The differences in AUDIT scores between the response modes (paper/electronic) were tested separately for men and women using a univariate analysis of covariance, controlling for age.

Results

■ Paper versus Web-based response rates

There was a significant effect of administration mode on the number of recruited respondents ($\chi^2_1 = 202.7$; $df=1$; $p < 0.001$). The response rate was lower than expected for the electronic version (26.2%) and higher than expected for the paper version (53.6%). As in our earlier studies with the AUDIT, the proportion of women responding in both administration modes was higher than the proportion of responding men.

■ Internal consistency reliability

The internal consistencies of the AUDIT (Cronbach's alpha) were high for both the paper and web-based versions (see Table 1). Most of the differences in consistency between paper-and-pen and web-based versions were small, with overlapping confidence intervals. However, the confidence intervals show that the Cronbach's alpha coefficient for women in the paper response group was significantly lower than that for women in the web-based response group.

■ AUDIT scores

Both men ($F_{1,369} = 6.30$; $p=0.013$) and women ($F_{1,471} = 4.11$; $p= 0.043$) scored significantly higher on the electronic version of the AUDIT than on the paper version,

Table 1. Internal consistency (Cronbach alpha) for the two modes of data collection of the AUDIT (paper vs electronic)

	Electronic	95% CI	Paper	95% CI
All respondents	0.82 (N=324)	+0.04	0.77 (N=525)	+0.04
Males	0.78 (N=140)	+0.07	0.82 (N=239)	+0.05
Females	0.85 (N=184)	+0.05	0.67 (N=294)	+0.05

even when controlling for age (see Table 2). The mean differences between web-based and paper versions were about 20% higher than the pooled standard deviation for both men and women. This means that although the difference was statistically significant the practical significance of the difference is moderate.

Discussion

This article concerned the impact of the administration mode of the AUDIT on response rates, data quality (internal consistency) and coverage rates (scoring on AUDIT). The data suggest differences in all these three domains. First, distributing the AUDIT by paper yielded a response rate that was about twice as high as for the web-based questionnaire. Second, internal consistency was comparable for the two administration modes among men while for women the web-based questionnaire yielded a higher internal consistency than the paper version. Finally, both men and women scored significantly higher on the AUDIT when they responded using the

web-based questionnaire. This difference remained when controlling for age in the analysis. Below we discuss these results, first referring specifically to the internal consistency measures and the scoring differences, and concluding with the response rate differences in relation to internal consistency and scoring issues.

The high internal consistencies suggest that AUDIT is a coherent scale in both administration modes. The relatively low Cronbach's alpha for women in the paper version was unexpected and contradicts earlier results. The significant differences in scores for the electronic version of the AUDIT compared to the paper version appear at first sight to support the hypothesis that web-based self-reporting is more honest than paper reporting, in line with the previously cited research in this direction (Link & Mokdad 2005; Wright et al. 1998).

Regarding the significant difference in AUDIT scores between the paper and web-based versions, we believe it may be connected with the non-respondents. Respondents in the web-based group may

Table 2. Mean and standard deviation of the total AUDIT score for paper and electronic version. The size of differences of the two presentation modes is expressed in standard deviations

Gender	Response mode	n	Mean	Standard deviation	Size of differences
Men	Electronic	140	5.80	4.77	0.25
	Paper	239	4.73	4.20	
Women	Electronic	184	4.12	4.29	0.21
	Paper	294	3.39	2.59	

not have been representative of the population. While we were able to control for age by using age as a covariate, we did not collect any data on other confounding factors such as personality traits or computer competence. Personality traits such as extraversion and conscientiousness may be associated with heavy alcohol drinking. Computer competence may have been low in view of the 10 to 15 study participants who called us and asked how to log in.

Persons with the highest alcohol consumption are known to have a higher proportion of multiple problems, including unstable living conditions. This group is more difficult to reach with a questionnaire. If non-respondents drink more, a lower response rate would give a lower level of reported problems. However, the web-based questionnaire yielded higher levels of reported problems despite a much lower response rate, in comparison to the paper version of the AUDIT. A future research challenge would be to evaluate the concurrent validity of reported alcohol-related problems (AUDIT) in population surveys.

To conclude, response rates according to the present study do not indicate that conditions are currently suitable for administering surveys on alcohol-related problems via the Internet, even in a general population with very high Internet access and using random sampling from the general population. One procedure that might increase coverage of problems as well as yield satisfactory data quality would be to offer a mixed-mode administration procedure where respondents

choose their mode of data administration. Mixed mode administration in the form of initial web-based survey followed by a mailed paper survey for non-respondents has been successful with college students (McCabe et al. 2006; Werner 2005). A recent study comparing web-based and automated telephony (IVR) modes yielded higher response rates when respondents were given a choice of response mode (Sinadinovic et al. 2011).

The degree to which the results in this study generalize to other cultural settings and populations is an open question. However, Internet use in the Nordic countries is approximately equal. The results in this study point to an advantage for paper-and-pen surveys but further studies should be conducted in other populations and with various data collection procedures. To some extent, matters such as data skills, confidence in the data collectors and computer availability vary over time and should always be taken into account when collecting these kinds of data. Our conclusion is that web-based questionnaires can currently replace paper and pen-questionnaires to a certain extent. However, as long as computer skills and interest are unevenly distributed, and no official registry of e-mail addresses exists, the response rate for web-based questionnaires will be lower than on traditional questionnaires. Research in the near future could focus on methods for combining different administration modes in various subgroups.

Declaration of interest None.

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REFERENCES

- Babor, T. & Higgings-Biddle, J. & Saunders, J. & Monteiro, M. (2001): AUDIT, the Alcohol Use Disorders Identification Test: Guidelines for use in primary care. Geneva: WHO
- Bason, J. (2000): Comparison of telephone mail, web, and IVR surveys of drug and alcohol use among university of Georgia students. Paper presented at the American Associations of Public Opinion Research
- Bergman, H. & Källmén, H. (2002): Alcohol use among Swedes and a psychometric evaluation of the Alcohol Use Disorders Identification Test (AUDIT). *Alcohol and Alcoholism* 37: 245–251
- Bergman, H. & Källmén, H. (2003): Svenska kvinnor har fått mer riskfyllda och skadliga alkoholvanor. Undersökning av förändringar i svenskarnas alkoholvanor åren 1997–2001. (Swedish women show more hazardous and harmful alcohol habits. Investigation of changes in Swede's alcohol habits during the period 1997–2001). *Läkartidningen* 100: 1028–1035
- Caetano, R. (2001): Non-response in alcohol and drug surveys: a research topic in need of further attention. *Addiction* 96: 1541–1545
- Findahl, O. (2007): Sverige i Europa (Sweden in Europe). Hudiksvall: World Internet Institute
- Findahl, O. (2008a): Svenskarna och internet 2007 (The Swedes and Internet 2007). Hudiksvall: World Internet Institute
- Findahl, O. (2008b): Internet i ett internationellt perspektiv – Del 2. Sverige i världen (Internet in an international perspective – Part 2. Sweden in the world). Hudiksvall: World Internet Institute
- Kypri, K. & Gallagher, S. (2003): Incentives to increase participation in an Internet survey of alcohol use: a controlled experiment. *Alcohol & Alcoholism* 38: 437–441
- Kypri, K. & Stephenson, S. & Langley, J. (2004): Assessment of Nonresponse Bias in an Internet Survey of Alcohol Use. *Alcoholism: Clinical and Experimental Research* 28: 630–634
- Källmén, H. & Wennberg, P. & Berman, A.H. & Bergman, H. (2007): Alcohol habits in Sweden during 1997–2005, as measured with the AUDIT. *Nordic Journal of Psychiatry* 61: 466–470
- Link, M. & Mokdad, A. (2005): Effects of survey mode on self-reports of adult alcohol consumption: Comparison of web, mail and telephone approaches. *Journal of Studies on Alcohol* 66: 239–245
- McCabe, S. & Boyd, C. & Couper, M. & Crawford, S. & D'Arcy, H. (2002): Mode effects for collecting alcohol and other drug use data: Web and U.S. mail. *Journal of Studies on Alcohol* 63: 755–761
- McCabe, S. E. & Diez, A. & Boyd, C.J. & Nelson, T.F. & Weitzman, E.R. (2006): Comparing web and mail responses in a mixed mode survey in college alcohol use research. *Addictive behaviors* 31: 1619–1627
- Miller, E. T. & Neal, D. J. & Roberts, L. J. &

- Baer, J. S. & Cressler, S. O. & Metrik, J. & et.al (2002): Test-retest reliability of alcohol measures: is there a difference between Internet-based assessment and traditional methods? *Psychology of Addictive Behaviors* 16: 56–63
- Saunders, J.B. & Aasland, O.G. & Babor, T.F. & De La Fuente, J.R. & Grant, M. (1993): Development of Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption – II. *Addiction* 88: 791–804
- Selin, K. H. (2006): Alcohol Use Disorders Identification Test (AUDIT): What does it screen for? Performance of the AUDIT against four different criteria in a Swedish population sample. *Substance use & Misuse* 41: 1181–1189
- Sinadinovic, K. & Wennberg, P. & Berman, A.H. (2011): Population screening of risky alcohol and drug use via Internet and Interactive Voice Response (IVR): A feasibility and psychometric study in a random sample. *Drug and Alcohol Dependence* 114 (1): 55–60
- Wang, Y. C. & Lee, C. M. & Lew-Ting, C. Y. & Hsiao, C. K. & Chen, D. R. & Chen, W. J. (2005): Survey of substance use among high school students in Taipei: Web-based questionnaire versus paper-and-pencil questionnaire. *Journal of Adolescent Health* 37: 289–295
- Werner, P. (2005): On the Cost-Efficiency of Probability Sampling Based Mail Surveys with a Web Response Option. Linköping: University of Linköping
- Wright, D. L. & Aquilino, W. S. & Supple, A. I. (1998): A comparison of computer-assisted and paper-and-pencil self-administered questionnaires in a survey on smoking, alcohol, and other drug use. *Public Opinion Quarterly* 62: 331–353.

