

Alcohol disorders in Canada as indicated by the CAGE questionnaire



Evidence

Études

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Abstract

Objective: To describe alcohol disorders in the general Canadian population, using as a standard indicator the CAGE questionnaire (Have you felt you needed to cut down on your drinking? Have you felt annoyed by criticism of your drinking? Have you felt guilty about drinking? Have you felt you needed a drink first thing in the morning [eye-opener]?).

Design: Secondary analysis of data from Canada's Alcohol and Other Drugs Survey (CADS), a national telephone survey conducted in 1994 of a representative sample of 12 155 people aged 15 years or more.

Participants: The CAGE questionnaire was administered to 5894 drinkers who had consumed alcohol in the 12 months before the CADS survey.

Main outcome measures: Respondents with positive (2 or more affirmative responses) and negative results on the CAGE questionnaire were compared as to demographic characteristics, alcohol consumption and harmful consequences of their drinking. Independent predictors of a positive result were identified by means of logistic regression analysis.

Results: A total of 5.8% of CAGE-tested current drinkers had a positive result on the past-year CAGE in 1994. The proportion of respondents reporting alcohol-related problems in one or more areas of their life was 7 times greater among drinkers with a positive result on the CAGE questionnaire than among those with a negative result (66.8% v. 9.5%) ($p < 0.0001$). When all demographic characteristics were controlled for simultaneously, male sex, residence in the Atlantic provinces, Quebec or the Prairies, single/never married or divorced/separated marital status, and low education level were found to be independent risk factors for a positive result on the CAGE questionnaire. About 85% of the respondents with a positive result had not sought help for their drinking. Applying the estimated sensitivity and specificity of the CAGE questionnaire in detecting alcohol dependence, as per criteria of the *Diagnostic and Statistical Manual*, in a general US population, the authors estimated that 4.1% of Canadians had an alcohol dependence in 1994.

Conclusion: The large proportion of current drinkers with a positive result on the CAGE questionnaire who did not seek help for their drinking underscores the need for identification and brief interventions by physicians. Further research is needed to elucidate the underlying reasons for regional differences in CAGE status.

Résumé

Objectif : Décrire les problèmes de l'alcool dans la population générale du Canada en utilisant comme indicateur normalisé le questionnaire CAGE (Au cours les 12 derniers mois: Avez-vous senti le besoin de réduire votre consommation d'alcool? Vous êtes-vous senti irrité parce qu'on vous critiquait au sujet de votre consommation d'alcool? Vous êtes-vous senti coupable à cause de votre consommation d'alcool? Avez-vous senti le besoin de consommer de l'alcool dès votre réveil le matin?)

Conception : Analyse secondaire de données tirées de l'Enquête téléphonique nationale réalisée en 1994 auprès d'un échantillon représentatif de 12 155 personnes âgées de 15 ans ou plus.

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Participants : Le questionnaire CAGE a été administré auprès de 5894 personnes qui avaient consommé de l'alcool dans les 12 mois précédant l'enquête.

Principales mesures des résultats : On a comparé les consommateurs d'alcool dont le questionnaire CAGE était positif (un questionnaire CAGE positif veut qu'au moins 2 des 4 questions du CAGE soient répondues à l'affirmative) avec ceux dont le questionnaire CAGE était négatif, par rapport aux caractéristiques démographiques, la consommation d'alcool et les effets néfastes de la consommation d'alcool. On a identifié des facteurs de risque indépendants d'un questionnaire CAGE positif par moyen d'une analyse de régression logistique.

Résultats : Parmi les consommateurs d'alcool auprès de qui on a administré le questionnaire CAGE, 5,8 % se sont révélés comme ayant un questionnaire CAGE positif. La proportion des répondants avec des problèmes liés à l'alcool dans un ou plusieurs domaines de leur vie était 7 fois plus élevée chez les consommateurs d'alcool avec un questionnaire CAGE positif que chez ceux avec un questionnaire CAGE négatif (66,8 % c. 9,5 %) ($p < 0,0001$). Lorsqu'on a contrôlé simultanément toutes les caractéristiques démographiques, on a constaté 4 facteurs de risque indépendants, soit le sexe masculin, un lieu de résidence dans les provinces de l'Atlantique, au Québec ou dans les Prairies, une situation de famille divorcé ou séparé, célibataire ou jamais marié, et un faible niveau d'éducation formelle. Environ 85 % des consommateurs d'alcool avec un questionnaire CAGE positif ont avoué n'avoir jamais eu recours à un service ou à de l'aide quelconque pour leur consommation d'alcool. Selon la sensibilité et la spécificité estimative du questionnaire CAGE pour la détection de l'alcoolisme parmi une population générale des États-Unis et conformément aux critères du *Diagnostic and Statistical Manual*, on estime qu'en 1994, 4,1 % des résidents du Canada avaient une dépendance à l'égard de l'alcool.

Conclusion : La proportion importante des consommateurs d'alcool avec un questionnaire CAGE positif et qui n'ont jamais eu recours à un service ou à de l'aide quelconque pour leur consommation d'alcool met en évidence le rôle essentiel des médecins pour dépister les problèmes de l'alcool et d'accomplir des interventions brèves. Des recherches plus poussées s'imposent pour préciser les raisons fondamentales par rapport aux différences régionales mises en évidence par le questionnaire CAGE.

The impact of alcohol consumption on society is considerable. In 1992 in Canada the economic cost of alcohol use was estimated at more than \$7.5 billion, representing 40.8% of the total costs of substance abuse and 1.1% of the Gross Domestic Product.¹ Of the 6701 deaths resulting from alcohol consumption that year, 14.3% were from alcoholic cirrhosis.¹ Also in 1992, 16.6% of hospital separations due to alcohol-related illness resulted from alcohol dependence syndrome.¹ Clearly, problem drinking and alcohol dependence are important health issues in Canada.

The CAGE questionnaire, introduced by Ewing and Rouse in 1970,² is recognized as a simple tool to screen for alcohol dependence. CAGE is an mnemonic for the following questions: Have you felt you needed to cut down on your drinking? Have you felt annoyed by criticism of your drinking? Have you felt guilty about drinking? Have you felt you needed a drink first thing in the morning (eye-opener)? The first published evidence of the validity of the CAGE questionnaire showed a cut

point of 2 or more positive responses to these questions to be a sensitive detector of alcoholism.^{2,3} Since then, the validity, sensitivity and specificity of the CAGE questionnaire as a screening tool have been assessed in hospital, general practice and general populations.⁴⁻¹⁰ Based on a cut point of 2 affirmative responses, the sensitivity of the CAGE questionnaire in clinical populations is about 84% to 91% and its specificity about 77% to 96%.²⁻⁸ The sensitivity and specificity of the questionnaire to detect alcohol dependence, as per criteria of the DSM-III-R (*Diagnostic and Statistical Manual of Mental Disorders*, 3rd edition, revised),¹¹ in relation to alcohol consumption in the previous year (past-year CAGE) were estimated in a general US population at 74.6% and 91.6% respectively.⁶

In Canada a national survey conducted in 1994 on the use of alcohol and other drugs¹² included the past-year CAGE in the questionnaire. We carried out a study to describe alcohol disorders in the general Canadian population, using the CAGE questionnaire as a standard indicator.



Methods

Our study was a secondary analysis of data from Canada's Alcohol and Other Drugs Survey (CADS), a national telephone survey conducted in October 1994.¹² The sampling frame was Canadians aged 15 years or more, speaking either English or French, residing in 1 of the 10 provinces and not being a full-time resident of an institution. For sampling, each of the 10 provinces was divided into geographic areas. The sample was selected by means of random digit dialling sampling methods. One person randomly selected in each household participated in an interview. The unweighted sample size was 12 155, representing a response rate of 75.6%. The effective sample size resulting from the multistage sampling was 10 530. The methods are described in full elsewhere.¹²

In the CADS instrument the CAGE questions were asked in relation to the respondents' experience in the 12 months before the survey. In the current study a cut point of 2 or more affirmative responses to the CAGE questions was deemed to be a positive result.

Current drinking was defined as having consumed alcohol in the 12 months before the CADS survey. The CAGE questionnaire was administered to all current drinkers whose drinking frequency was at least once per month or who usually consumed at least 3 drinks on the days they had a drink. This minimum drinking frequency and quantity excluded 21.3% of all current drinkers and resulted in a weighted sample size of 5994. Also excluded were the 0.6% of current drinkers to whom the CAGE questionnaire was administered who did not respond to 1 or more of the CAGE questions and the 1.1% of respondents with "not stated" on 1 or more predictor variables. The final weighted-analysis sample size was 5894.

The CADS inquired about harmful consequences occurring in the 12 months before the survey arising from the respondent's own use of alcohol, involving problems in the following 8 areas: spouse or partner; physical health; outlook on life; friendships; finances; home life; work, studies or employment; and children. The data were summarized as proportions of respondents reporting each specific problem and the proportion reporting problems in one or more areas. Group comparisons were performed with the use of the χ^2 statistic.

Sociodemographic variables and alcohol consumption variables were considered as potential predictor variables. The sociodemographic variables included sex, age, region, language spoken at home, marital status, education and income adequacy (based on household income and the number of household members). The alcohol consumption variables were the number of occasions on which the respondent drank 5 or more drinks at one sitting in the previous 12 months, and the drinking pattern. The former vari-

able included 5 categories: the top decile (12 occasions or more), the remainder of the top quartile (3 to 11 occasions), the second quartile (1 or 2 occasions), the third and fourth quartiles (no occasions) and not stated. Drinking pattern comprised 4 categories of drinkers based on the reported drinking frequency (at least once a week or not) and usual number of drinks (at least 5 or not).

To account for the multiple statistical tests being performed, statistical significance was set at $p < 0.01$. We conducted hierarchical logistic regression analyses to examine the combined effects of the sets of predictor variables as well as their independent effects after controlling for all the other predictors in the model. Model 1 included the sociodemographic variables. For model 2 the alcohol consumption variables were added to the variables in model 1. To verify for possible interaction, we calculated the independent combined effects of 2 variables of interest and the interaction between them. No interaction was found at the $p < 0.01$ level, and, therefore, interaction terms were not included in the multivariate models. We used the Hosmer-Lemeshow χ^2 statistic to determine the overall goodness-of-fit of the models.¹³ All predictors were categorical, producing statistics on the effect of each predictor category relative to a base category. We analysed the data using the Statistical Package for the Social Sciences (release 4.0 for SUN 4, SPSS Inc., Chicago) and Biomedical Data Programs statistical software (BMDP LR; 1990 version for SUN/UNIX, BMDP Statistical Software Inc., Los Angeles).

Results

In 1994, 73.7% of Canadians were current drinkers. The CAGE questionnaire was administered to a subset of current drinkers based on a minimum drinking frequency and quantity, representing 78.7% of all current drinkers. Table 1 shows the demographic characteristics of all current drinkers and of the subset who were given the CAGE questionnaire. With the exception of sex, the subset of current drinkers was similar to the overall group of current drinkers in demographic characteristics. The larger proportion of male respondents in the subset was related to the exclusion of some light, infrequent drinkers, a pattern that is more prevalent among female drinkers than among male drinkers (60.2% v. 35.4%) ($p < 0.001$).

About 5.8% of the CAGE-tested current drinkers responded affirmatively to at least 2 of the questions. If this proportion held true among untested current drinkers, 4.3% ($5.8\% \times 73.7\%$) of Canadians would respond affirmatively to at least 2 CAGE questions. The most conservative point estimate of the proportion of Canadians responding affirmatively to 2 or more CAGE questions (assuming none of the untested current drinkers would have re-

**Table 1: Characteristics of 7441 current drinkers in Canada and a subset of 5894 current drinkers to whom the CAGE questionnaire* was administered**

Characteristic	Group; % of respondents	
	All current drinkers	Drinkers given CAGE questionnaire
Sex		
Male	53.2	58.0
Female	46.8	42.0
Age, yr		
15-17	4.8	4.8
18-19	3.4	3.6
20-24	10.4	11.1
25-34	23.9	24.1
35-44	22.4	22.6
45-54	15.5	15.3
55-64	9.4	9.2
≥ 65	10.0	9.3
Region		
Atlantic	8.4	8.2
Quebec	26.7	27.8
Ontario	34.3	34.2
Prairies	17.1	16.7
British Columbia	13.4	13.0
Language		
English	68.0	67.6
French	24.0	25.0
Other/not stated	8.0	7.3
Marital status		
Married/common-law	60.2	59.1
Single/never married	29.1	30.5
Widowed	3.9	3.3
Divorced/separated	6.8	7.1
Education level		
Less than secondary	21.8	21.1
Secondary	25.0	24.6
Some postsecondary	31.6	32.3
University degree	18.1	18.8
Not stated	3.6	3.2
Income adequacy		
Low	14.5	13.5
Middle	37.2	37.2
High	14.6	15.8
Not stated	33.7	33.4
Drinking pattern		
Light, infrequent	47.1	33.5
Light, frequent	40.7	51.1
Heavy, infrequent	4.7	5.9
Heavy, frequent	7.6	9.5
No. of occasions with ≥ 5 drinks at 1 sitting		
≥ 12	10.4	13.0
3-11	16.1	20.0
1-2	17.1	19.4
0	52.5	43.0
Not stated	3.9	4.6

*See the introductory section.

sponded affirmatively to at least 2 questions) is 3.4% (5.8% × 78.7% × 73.7%). Using the reported values for the sensitivity (74.6%) and specificity (91.6%) of the CAGE questionnaire to detect alcohol dependence,⁶ as per DSM-III-R criteria, we estimated the prevalence of alcohol dependence in the Canadian population in 1994 to be 4.1%.

Table 2 shows the prevalence of alcohol-related harmful consequences due to the respondent's own use of alcohol. As expected, the proportions of current drinkers who reported problems were higher among those given the CAGE questionnaire than among all current drinkers, both for specific problems and for problems in one or more areas. Overall, 10.5% of current drinkers and 12.9% of CAGE-tested current drinkers reported problems in one or more areas. The problems most commonly reported by the overall group of current drinkers were physical health problems and financial problems.

The proportion of respondents reporting problems in one or more areas was 7 times greater among drinkers with a positive result on the CAGE questionnaire than among those with a negative result (66.8% v. 9.5%) ($p < 0.0001$). The proportion of respondents reporting problems in each specific area was significantly greater among drinkers with a positive result on the CAGE questionnaire than among those with a negative result ($p < 0.0001$).

Table 3 shows a gradient in the proportions of current drinkers with a positive result on the CAGE questionnaire according to alcohol consumption pattern, increasing from 1.5% among light, infrequent drinkers to 22.7% among heavy, frequent drinkers.

Table 3 also shows the bivariate comparisons and independent risk factors for a positive result on the CAGE questionnaire. When all the demographic characteristics were controlled for simultaneously (model 1), male sex, region, marital status and education level were found to be independent risk factors for a positive result. Male drinkers were 1.72 times more likely than female drinkers to have a positive result. The odds of having a positive result were more than 2-fold greater for residents of the Atlantic provinces, Quebec and the Prairie provinces compared with residents of Ontario, for single/never married and divorced/separated people compared with married people, and for people with less than secondary school education compared with those with a university degree.

When we compared male and female drinkers who had the same drinking pattern and other demographic characteristics, male drinkers were not significantly more likely to have a positive result on the CAGE questionnaire than female drinkers (model 2, Table 3). Similarly, in this model, people with less than secondary school education were not significantly more likely to have a positive result than those with a university degree.



The CADS inquired about attempts at reducing alcohol consumption. Overall, 22.2% of current regular drinkers reported having tried to reduce their alcohol consumption. Drinkers with a positive result on the CAGE questionnaire were about 4 times more likely to have tried to reduce their alcohol consumption than drinkers with a negative result (74.7% v. 18.9%) ($p < 0.0001$).

Finally, the CADS inquired about seeking help or treatment to deal with problem drinking. About 1.5% of all CAGE-tested current drinkers reported having sought some help, with a significantly larger proportion among those with a positive result on the questionnaire than among those with a negative result (14.5% v. < 1%) ($p < 0.0001$).

Discussion

The CAGE questionnaire is a well-known practical tool with good psychometric properties used to screen for alcohol disorders. We used it as a standard indicator of alcohol disorders in the general Canadian population. The value of the CAGE questionnaire applied to general populations still needs to be clarified.

Since the landmark studies by Ewing² and Mayfield and colleagues,³ studies in general and clinical populations have labelled what the CAGE questionnaire detects as alcoholism, alcohol dependence, alcohol abuse, problem drinking, at-risk drinking, excessive drinking, heavy drinking and harmful drinking.²⁻¹⁰ The confusion about what the questionnaire detects arises from the various moral, pragmatic, pathophysiologic and psychologic tenets held about the nature of alcohol disorders. This unresolved debate has led to nomenclature ranging from ambiguous and imprecisely and inconsistently defined terms in everyday clinical usage to specific diagnoses

based on the explicit criteria of disease classification systems.

We debated how to refer to the alcohol disorder detected by the CAGE questionnaire in this general Canadian population survey. In the only Canadian study on the psychometric properties of the CAGE questionnaire applied to the general population, Smart and associates¹⁴ validated the lifetime CAGE against alcohol consumption and concluded that the questionnaire was useful in survey application as a means of measuring a dimension of alcohol problems in the general population.

In the end, we believe that the CAGE questionnaire when applied to the general population is a pragmatic indicator of problem drinking of major clinical concern, including possible physical dependence on alcohol. In our study 85% of current drinkers with a positive result on the questionnaire had not sought help for their drinking. Although some people with alcohol problems are expected to achieve recovery without formal treatment,¹⁵ this large proportion underscores the need for physicians to identify problem drinkers and implement brief interventions. Despite the usefulness of the CAGE questionnaire in a busy medical setting, only a minority of Canadian family physicians appear to be familiar with this screening test.¹⁶

Chan and collaborators⁶ estimated the ability of the past-year CAGE to detect alcohol dependence, as per DSM-III-R criteria, in a general US population. False positivity was found to be greatest among light drinkers, and the estimated positive predictive value of the CAGE questionnaire was 68%. The positive predictive value in our study would be expected to be greater because the questionnaire design excluded a proportion of light, infrequent drinkers. Applying Chan and collaborators' estimates of sensitivity and specificity to our results, we esti-

Table 2: Proportion of current drinkers reporting specific alcohol-related harmful consequences* in the 12 months before the survey, according to CAGE status

Problem area	Group; % of respondents			
	Overall <i>n</i> = 7441	Given CAGE questionnaire <i>n</i> = 5894	CAGE negative <i>n</i> = 5554	CAGE positive <i>n</i> = 340
Spouse/partner	2.4	3.0	1.5	53.6†
Physical health	6.2	7.7	5.3	47.4†
Outlook on life	2.7	3.3	1.4	32.6†
Friendships	3.4	4.1	2.3	32.4†
Finances	4.0	5.0	3.4	29.3†
Home life	2.0	2.5	1.1	26.2†
Work/studies/employment	1.7	2.1	1.2	17.3†
Children	1.3	1.7	‡	‡
One or more areas	10.5	12.9	9.5	66.8†

*The categories of harmful consequences are not mutually exclusive.

† $p < 0.0001$.

‡Not reliable owing to high sampling variability.

Table 3: Unadjusted bivariate and adjusted multivariate models for a positive result of the CAGE questionnaire among current drinkers

Characteristic	No. of respondents in weighted sample	Weighted %	Unadjusted odds ratio	Adjusted odds ratio	
				Model 1	Model 2
Sex					
Male	3416	7.0	1.72†	1.72†	0.87
Female	2478	4.2	1.00	1.00	1.00
Age, yr					
15–17	285	7.9	1.34	0.67	0.64
18–19	210	7.3	1.23	0.73	0.56
20–24	654	8.9	1.53	1.07	0.83
25–34	1420	5.7	0.95	0.88	0.77
35–44	1334	6.0	1.00	1.00	1.00
45–54	901	5.8	0.96	0.96	1.16
55–64	542	4.0	0.65	0.62	0.87
≥ 65	549	1.9	0.30†	0.32*	0.62
Region					
Atlantic	484	7.6	2.34†	2.09†	1.71
Quebec	1641	7.1	2.17†	2.90†	2.61†
Ontario	2016	3.4	1.00	1.00	1.00
Prairies	984	7.6	2.34†	2.17†	1.93†
British Columbia	769	5.8	1.75*	1.64	1.39
Language					
English	3986	5.7	1.00	1.00	1.00
French	1475	6.6	1.17	0.62	0.64
Other/not stated	432	3.5	0.60	0.70	1.17
Marital status					
Married/common-law	3482	4.0	1.00	1.00	1.00
Single/never married	1795	8.6	2.26†	2.09†	1.56*
Widowed	196	2.1	0.51	0.94	0.91
Divorced/separated	421	10.1	2.70†	2.60†	2.07†
Education level					
Less than secondary	1244	8.1	1.96†	2.01†	1.43
Secondary	1449	5.4	1.27	1.29	0.95
Some postsecondary	1901	5.8	1.37	1.22	0.99
University degree	1108	4.3	1.00	1.00	1.00
Not stated	191	2.4	0.55	1.00	0.50
Income adequacy					
Low	799	8.4	1.52*	1.24	1.12
Middle	2193	5.7	1.00	1.00	1.00
High	932	6.0	1.06	1.16	1.08
Not stated	1970	4.7	0.82	0.91	0.95
Drinking pattern					
Light, infrequent	1974	1.5	1.00	NA‡	1.00
Light, frequent	3011	5.3	3.68†		2.78†
Heavy, infrequent	346	7.1	5.02†		2.20*
Heavy, frequent	563	22.7	19.28†		6.36†
No. of occasions with ≥ 5 drinks at 1 sitting					
≥ 12	765	19.8	18.74†	NA	8.06†
3–11	1179	7.3	5.98†		4.13†
1–2	1142	4.7	3.74†		3.10†
0	2537	1.3	1.00		1.00
Not stated	270	6.0	4.85†		3.28†

 * $p < 0.01$.

 † $p < 0.001$.

‡NA = not applicable.



mated that 4.1% of Canadians had an alcohol dependence in 1994. Our estimate is approximately twice that based on the Jellinek formula¹⁷ and the number of deaths from cirrhosis in Canada in 1990. The latter method, considered a crude estimate, yielded a prevalence of alcohol dependence of 1800 per 100 000 population in 1990.¹⁸

We found that, compared with residents of Ontario, residents of several other regions of the country had a higher risk of having an alcohol disorder, as judged by the CAGE questionnaire. This finding is compatible with previous reports of a lower prevalence of alcohol-related problems in Ontario than in other parts of Canada.¹⁹ The variable sensitivity of the CAGE questionnaire in different ethnic groups⁷ may contribute to observed regional differences in CAGE status. Alternatively, alcohol prevention efforts in Ontario may be more effective than those in other regions of Canada. Further research is needed to elucidate the underlying reasons for observed regional differences.

In this study we computed 2 multivariate models. Model 1, which included only demographic variables, showed low education level to be independently predictive of a positive result on the CAGE questionnaire. Our finding is in agreement with the results of a longitudinal study involving a large general population sample conducted by Crum and coworkers.²⁰ Those authors found that people who did not complete high school were 6.34 times more likely to abuse alcohol or show alcohol dependence than were people with a college degree. Model 1 in our study also showed that male drinkers were more likely than female drinkers to have a positive result on the CAGE questionnaire. A possible explanation is that the CAGE questionnaire is a less sensitive indicator among women than among men.^{6,7} Alternatively, men may be more likely than women to have a positive result because they consume more alcohol than women.¹²

Our model 2, which included intermediate variables, indicated the extent to which alcohol consumption explained the relation between the independent variables and a positive result on the CAGE questionnaire. Thus, model 2 showed that if male and female drinkers consume the same amount of alcohol, they are equally likely to have alcohol disorders, as judged by the CAGE questionnaire. This finding is compatible with previous reports of the lack of an association between sex and the number of alcohol-related problems after controlling for alcohol consumption.^{19,21}

In conclusion, applying the estimated sensitivity and specificity of the CAGE questionnaire to detect alcohol dependence, as per DSM-III-R criteria, in a general US population,⁶ we estimate that 4.1% of Canadians had an alcohol dependence in 1994. The large proportion of current drinkers with a positive result on the question-

naire who had not sought help for their drinking problem underscores the importance of screening and brief interventions by physicians.

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