QUANTITATIVE RESEARCH

An adaptation of the Yesterday Method to correct for under-reporting of alcohol consumption and estimate compliance with Canadian low-risk drinking guidelines

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ABSTRACT

OBJECTIVES: To estimate compliance with Canada's Low-Risk Alcohol Drinking Guidelines (LRDG) in different groups of drinkers after adjusting for under-reporting of alcohol use, and to identify which types of beverage are more likely to be consumed when LRDGs are exceeded.

METHOD: Our sample consisted of 43,242 Canadians aged 15 and over who had responded to the Canadian Alcohol and Drug Use Monitoring Survey, 2008–2010. Consumption in excess of LRDG was estimated for subgroups of drinkers after adjustment for under-reporting of consumption. Responses to Beverage-Specific Yesterday questions were used to make age-, gender- and beverage-specific corrections to under-reporting for data from the last 12 months Quantity–Frequency questions. Statistics Canada data on sales of beer, wine and spirits were also incorporated into the adjusted calculations.

RESULTS: After adjustment for under-reporting, non-compliance with weekly LRDG limits to reduce risk of long-term harm increased from 6.8% to 27.3% among drinkers, and from 42.3% to 68.3% with respect to drinks. Non-compliance with daily LRDG limits to reduce risk of short-term harm increased from 16.7% to 38.6% among drinkers, and from 53.3% to 80.5% with respect to drinks. After adjustment, over 92% of total consumption occurred on risky drinking days among underage Canadians and over 91% of consumption reported by young adults took place during risky drinking occasions. Wine was least likely to be drunk in a risky fashion, spirits were the most likely.

CONCLUSION: When corrections for under-reporting are made, most Canadian alcohol consumption occurs on days when national LRDG are exceeded, especially for underage and young adult drinkers.

KEY WORDS: Survey; yesterday drink; alcohol

In November 2011, the Federal, Provincial and Territorial Health Ministers approved Canada's first national low-risk drinking guidelines (LRDG).[1] The guidelines recommend that women do not exceed 10 standard drinks (SDs) per week or 3 in any one day, while men should have no more than 15 per week or 4 in any one day (one Canadian SD = 13.45 g of pure alcohol).[2,3] This paper seeks to address the extent of compliance with these guidelines using national survey data for the three years leading up to their introduction. In particular, we provide estimates of risky drinking both before and after making adjustments using a recently published methodology that corrects for under-reporting in surveys.[4]

In general population surveys, three main methods are used to ask people to report their alcohol intake.[5] The Quantity–Frequency approach (QF) asks only two questions: "How much alcohol do you usually drink?" and "How often do you drink?" The Graduated-Frequency approach (GF) asks how often people drink specified amounts of alcohol in one day, usually starting with large amounts and graduating down to smaller quantities. The Last Seven Day approach (L7D) asks subjects how much alcohol they drank on each of the last seven days. However, per capita consumption estimates derived from self-report surveys usually yield estimates of between 40% and 60% of those derived from official alcohol sales data.[6] Canadian analyses have

found that some national alcohol and addiction surveys have provided even lower estimates when compared to sales data. For example, the QF method yielded 37.0% coverage of alcohol sales data and the L7D approach yielded 31.9% coverage in the 2004 Canadian Addiction Survey.[7] In the 2008–2010 Canadian Alcohol and Drug Use Monitoring Surveys (CADUMS), the coverage rates were just 33.8% and 35.6% for the QF and L7D methods respectively.[4]

One method that yields improved coverage of alcohol sales is the Yesterday Method, first employed in French surveys of alcohol consumption.[8] This approach provides higher overall coverage of sales,[4] particularly when the method is combined with empirically based estimates of drink size and beverage strength.[9] For example, when using this approach the 2004 Australian National Drug Strategy Health Survey (NDSHS) accounted for

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79.1% of the sales data while the QF and GF approaches yielded only 50.5% and 52.4% coverage of sales respectively.[9]

The Yesterday approach was used in the CADUMS from 2008 to 2010; several questions asked subjects to report the number of drinks of beer, wine, spirits, wine cooler and spirit cooler they had yesterday.[10–12] Respondents were provided with definitions of a "drink" for each beverage type, i.e., Canadian standard drink sizes. We refer to this as the Beverage-Specific Yesterday (BSY) approach. We recently described a new methodology that involves combining information from the BSY with official sales data to correct for differential under-reporting by different population groups using the CADUMS.[4] Our approach revealed that men and women tend to underestimate their consumption to a similar degree, however, young people and low volume drinkers tend to under-report to a greater extent than older and high volume drinkers. In the current study, we apply these adjustments for under-reporting and use them to develop corrected estimates of compliance with Canada's new national LRDGs.

The specific aims of this study are: to estimate degree of noncompliance with Canada's LRDG in different groups of drinkers after adjusting for degree of under-reporting, and to identify which types of beverage are more likely to be consumed when LRDGs are exceeded.[2]

METHOD

Survey sampling

Initiated in April 2008 by Health Canada, the CADUMS was a near continuous survey on alcohol and other substance use among Canadians.[10–12] The survey was derived from the 2004 Canadian Addiction Survey which contained questions on substance use and associated harms.[13] The CADUMS used random digit dialing to obtain a stratified sample across all 10 provinces with equal representation of subjects each month. It is based on a two-stage (telephone household, respondent) random sample stratified by province. The survey covers population aged ≥15 years in the 10 provinces, excluding permanent residents of institutions, people living in households without a telephone and people who only have cell phones. The sample size was 16,674 in 2008, 13,082 in 2009 and 13,615 in 2010, representing an estimated 25,957,435 Canadians aged 15 years and older.

Measures estimating extent of under-reporting alcohol consumption

Table 1 presents the questions used to estimate alcohol consumption in the CADUMS. The QF approach was used to estimate per capita litres of pure alcohol consumption by multiplying the typical number of standard drinks (SDs) reported consumed per day (1 SD = 17.05 mL pure alcohol) and the number of drinking days in the past year. The BSY method was used to estimate population per capita alcohol consumption from the total number of SDs reported consumed "yesterday" across the whole sample. Weights were added for the day of the week that interviews were conducted to get equal representation of these in the estimates. The extent of under-reporting was estimated by comparing the QF and BSY estimates with official sales data. In the following discussion, partial adjustment means adjusting the consumption estimated by the QF to the level of the BSY estimates. To obtain full adjustment, we used official sales data to further uplift the partially adjusted consumption levels.

Table 1. Questions and answer options for alcohol consumption in the 2008–2010 Canadian Alcohol and Drug Use Monitoring Surveys

Method	Question	Answer options
1) QF – quantity–frequency approach	How often did you drink alcoholic beverages during the past 12 months?	…Less than once a month …Once a month …2 to 3 times a month …Once a week …2 to 3 times a week …4 to 6 times a week …Every day …Never
	During the past 12 months, on those days when you drank, how many drinks did you usually have?	…number of drinks in a typical day
2) L7D – last seven day approach	Starting with yesterday, that is <> and including up to 4 AM this morning, how many drinks did you have?	…Number of drinks yesterday, day before yesterday…
3) BSY – beverage-specific yesterday approach	How many regular bottles of beer did you drink yesterday, including up to 4 AM this morning? (Include light beer but not dealcoholized beer)	…Number of drinks for beer yesterday
	How many glasses of wine did you drink yesterday, including up to 4 AM this morning? (142 mL or 5 oz. glass of wine, including ciders and sparkling wines)	…Number of drinks for wine yesterday
	How many drinks of cocktails, spirits or hard liquor did you drink yesterday, including up to 4 AM this morning? (Straight or mixed drink with one and a half ounces (43 mL) of hard liquor)	…Number of drinks for spirits yesterday
	How many regular bottles of wine cooler did you drink yesterday, including up to 4 AM this morning? (A regular bottle (341 mL or 12 ounce) of cooler, but not dealcoholized cooler)	…Number of drinks for wine cooler yesterday
	How many regular bottles of spirit cooler did you drink yesterday, including up to 4 AM this morning? (A regular bottle (341 mL or 12 oz.) of cooler, but not dealcoholized cooler)	…Number of drinks for spirit cooler yesterday

Table 2. Estimated proportions of per capita consumption from different alcoholic beverage types (litres of ethanol/person/year) based on either weighted Beverage-Specific Yesterday (BSY) responses or official Statistics Canada estimates based on sales data

Beverage	Statistics Canada L ethanol/year†	Statistics Canada % of total L	BSY CADUMS L ethanol/year	CADUMS BSY % of total L	% BSY/Statistics Canada
Beer	4.20	51.22	2.14 (±0.18)	53.53	50.98
Wine	1.80	21.95	1.11 (±0.07)	27.74	61.65
Spirits	2.20	26.83	0.75 (±0.11)	18.73	34.06
Total	8.20	100.00	4.00 (±0.24)	100.00	48.78

† Annual litres per youth/adult aged 15+ for years 2008, 2009 and 2010.[20]

Methods used to correct for under-reporting in age–gender groups

Information from both the QF and BSY methods were employed to estimate adjustments for under-reporting within each age–gender category using methods described in greater detail elsewhere.[4] First, a correction factor for frequency (F) of drinking days was developed for each age–gender group by comparing observed numbers of respondents reporting drinking the day before with the expected numbers based on responses to the QF. The F adjustment used the number of drinkers in each QF frequency category who reported drinking the day before the interview to estimate a more accurate conversion factor. Specifically, the proportion of drinkers in each frequency category who drank "yesterday" was multiplied by 365. This procedure assumes that respondents a) can remember if they drank the previous day and b) were truthful about this in the interview. Consistent with other studies,[14] there was substantial under-reporting of frequency among individuals reporting less frequent consumption on the QF, with 2 to 3 times more individuals reporting consumption the day before the interview than would be predicted by their responses on the QF. The only exception was for individuals reporting consumption "every day", for whom an actual average drinking frequency of nearer six days a week was found. The correction factors for frequency for men and women respectively were 20.43 and 16.72 for less than once a month, 41.79 and 32.76 for once a month, 82.93 and 72.71 for 2–3 times per month, 115.29 and 107.70 for once per week, 181.42 and 169.91 for 2–3 times a week, 271.95 and 259.01 for 4–6 times a week and 319.85 and 306.34 for every day. Second, unique correction factors were calculated for typical quantities reported by respondents according to specific age–gender categories. The quantity or Q adjustment was conducted in two steps. First, we calculated mean numbers of standard drinks consumed "yesterday" separately for men and women within each QF frequency category and compared this with mean "quantity" calculated directly from BSY responses. It was assumed that the BSY would provide a more accurate estimate of mean quantity consumed on a drinking day within these broad categories of drinkers. The second adjustment to Q involved calculating "uplift" correction factors for each age and gender group based on i) the extent of under-reporting of each major beverage class, i.e., beer, wine and spirits estimated from BSY versus sales data, and ii) the proportions of each beverage that made up consumption on a typical day for each age and gender group based on the BSY questions. This adjustment, therefore, took account of different degrees of under-reporting of each of the main beverages (beer, wine and spirits) in comparison with

official Statistics Canada sales data (see Table 2) and also the different pattern of preferences for each beverage type for individuals of different age and gender based on their BSY responses. This resulted in upwards adjustments for quantity (Q) ranging from 48.9% for 45 to 64 year old women to 56.1% for 15 to 18 year old women (other adjustment factors for men and women were between this range).[4]

Measures of compliance with Low Risk Drinking Guidelines

Extent of non-compliance with the LRDG was estimated both with and without the above adjustment for under-reporting, both for "risky drinkers" (i.e., those not complying with LRDG) and "risky drinks" (i.e., drinks consumed on days when LRDG were exceeded). Risky drinking most relevant to chronic diseases or other long-term health harm was defined as having 16 or more drinks per week for men and 11 or more drinks per week for women.[2] The percentages of drinkers exceeding these limits in a typical week were calculated from the last 12 months QF questions (i.e., typical quantity per day times typical number of drinking days per week). "Risky" drinks for chronic health harms were counted as all those consumed by these "risky drinkers". Risky drinking for acute or short-term health harms is defined in Canada as five or more drinks in one day for men and four or more for women.[2] All drinkers who reported these levels as typical for drinking days in the QF were deemed "risky drinkers" for acute harm. The proportion of drinks consumed on days when these limits were exceeded was calculated directly from the BSY questions. All drinks consumed on such days were counted as "risky" for acute harm. The QF method is typically used to estimate individual drinking patterns over the past year but suffers from substantial under-reporting. The BSY cannot be used to measure individual consumption patterns over time, but can estimate beverage preferences, typical drinking quantities and typical frequencies more accurately for subgroups of drinkers. The QF approach was used to estimate compliance with LRDG both before and after adjustment for under-reporting once the more accurate data from the BSY questions and official sales data were factored in to the estimates. We present both partially and fully adjusted estimates of LRDG compliance for different age and gender groups. Partial adjustment uses estimates of typical drinking quantity (Q) and frequency (F) for population subgroups based on BSY responses. Full adjustment incorporates additional Q uplift factors to match official Statistics Canada data on age 15+ per capita sales of beer, wine and spirits.[4] The latter calculation first required estimates of the proportion of pure alcohol consumed as beer, wine and spirits for each age–gender subgroup calculated from the BSY responses.

Statistical analysis

The entire pooled sample across the three years is included in our analysis to maximize statistical power.[15] The estimates are based on the weighted sample and the expansion weights are recalculated and were rescaled to the sample size.[15] Multivariate logistic regression analysis was performed to examine the differences in percent of risky drinkers among specified age and sex groups, and z-tests were used to examine the differences in percent of risky drinks among age and sex groups.[16] Statistical analyses were completed using SAS SURVEYMEANS, SURVEYFREQ, SURVEYLOGISTIC and TABULATE procedures because these procedures analyze sample survey data taking into account the sample design effect.[17]

RESULTS

Per capita alcohol consumption estimate using the Yesterday Method

Table 2 presents per capita alcohol consumption by types of beverage and percentage of beer, wine and spirits estimated from the surveys compared to sales data. Per capita consumption of beer (including wine and spirit coolers), wine and spirits estimated using the BSY approach was substantially lower than recorded sales data. Reported spirits consumption in the surveys was 0.75 L, which accounted for only 34% of official spirits sales. The reporting of beer and wine consumption was more accurate in the surveys, however, covering 51% and 62% of official sales respectively. The per capita consumption estimates from sales data were outside the 95% CIs for the survey estimates, indicating significant under-reporting of all beverage types.

Risky drinkers and "risky drinks" for chronic harm

Table 3 presents the estimates of the percentage of both risky drinkers (those exceeding LRDGs) and risky drinks (drinks consumed on days and weeks when LRDGs were exceeded) for chronic harm using the QF method, i.e., exceeding or in excess of the weekly LRDG limits. Without any adjustments for

under-reporting, 6.8% of drinkers exceeded the weekly LRDG and, collectively, contributed 42.3% of total alcohol consumption. After the final uplift adjustments for under-reporting of alcohol consumption (i.e., uplifting self-reported consumption of each beverage type to sales data reflecting gender- and age-specific beverage preferences), it was estimated that 27.3% of Canadian drinkers exceed the weekly LRDG limits, between them accounting for 68.3% of total Canadian alcohol consumption. Wald chi-square tests in multivariate logistic regression of risky drinkers showed a significantly higher percent of risky drinkers, either unadjusted or adjusted with F values and/or Q uplift factors among those aged 18/19–24 years than among other age groups ($p < 0.001$); and a significantly higher percent among men than women ($p < 0.001$). Z-tests also suggested a significantly higher percent of risky drinks among those aged 18/19–24 than among the other four age groups ($p < 0.001$); a significantly higher percent among those aged 15–17/18 than among those aged 25 years or older ($p < 0.001$); and a significantly higher percent among men than women ($p < 0.001$).

Risky drinkers and risky drinks for acute harm

Table 4 presents estimated percentages of risky drinkers and risky drinks for acute harm for the three major categories of beverage. Before adjusting for under-reporting, just over half of all alcohol consumed (53.3%) was estimated to have been consumed on a day when LRDGs for avoiding acute harm were exceeded and 16.7% of drinkers regularly exceeded these limits. After full adjustment for under-reporting, it was estimated that 38.6% of all Canadian drinkers exceeded the daily LRDG limits (i.e., 3 for women and 4 for men) on a typical drinking day, collectively accounting for 80.5% of all alcohol consumed. Despite the higher thresholds for men, there were more male risky drinkers than female (40.1% versus 37%). Across all age groups, spirits were more likely to be consumed on risky drinking days (92.1% of all spirit consumption), than beer (83% of all beer consumption) or wine (60.6% of all wine consumption).

Table 3. Weighted estimates of % risky drinkers and "risky drinks" for long-term harm as per Canada's Low-Risk Alcohol Drinking Guidelines by age and sex using unadjusted and adjusted estimates from QF from the 2008–2010 CADUMS

Age and sex	Number of drinkers	% Risky drinkers /All drinkers (±95% CI)			% Risky drinks/All drinks (±95% CI)		
		Non-adjusted	Partially adjusted†	Fully adjusted‡	Non-adjusted	Partially adjusted†	Fully adjusted‡
Age, years§							
15–17/18	1486	5.96 (±3.16)	10.66 (±3.63)	25.62 (±4.62)	***50.68 (±1.46)	***63.36 (±1.41)	***75.38 (±0.61)
18/19–24	3154	***10.86 (±2.21)	***19.92 (±2.76)	***41.32 (±3.42)	***54.79 (±0.70)	***68.93 (±0.65)	***80.90 (±0.30)
25–44	9113	5.39 (±0.90)	9.19 (±1.16)	26.74 (±1.68)	37.29 (±0.45)	46.17 (±0.46)	66.68 (±0.25)
45–64	12,272	6.88 (±0.85)	7.90 (±0.90)	25.76 (±1.41)	41.08 (±0.44)	42.71 (±0.44)	65.21 (±0.26)
65+	5782	7.53 (±1.31)	6.87 (±1.22)	22.31 (±1.96)	41.83 (±0.71)	38.16 (±0.70)	60.32 (±0.46)
Sex							
Male	13,855	***8.87 (±0.91)	***12.66 (±1.08)	***29.80 (±1.42)	***45.57 (±0.32)	***51.84 (±0.32)	***69.50 (±0.18)
Female	17,952	4.75 (±0.61)	6.60 (±0.74)	24.81 (±1.21)	35.04 (±0.45)	38.79 (±0.46)	65.80 (±0.26)
Total	31,807	6.84 (±0.56)	9.68 (±0.66)	27.34 (±0.94)	42.25 (±0.26)	47.72 (±0.27)	68.28 (±0.15)

† The QF estimates were adjusted with revised Q and F values estimated from typical BSY responses for each age and gender group.
‡ QF estimates were further adjusted with Q uplift factors calculated for each age and gender group based on typical beverage preferences and under-reporting of beverage-specific consumption by BSY method compared with sales data.
§ Underage drinking varied by province = 15–17 years in Alberta, Manitoba and Quebec, 15-18 elsewhere in Canada.
Wald chi-square test or z-test: ***$p < 0.001$.

Table 4. Weighted estimates of the percentage of drinks consumed on risky drinking days by types of beverage for short-term harm regarding Canada's Low-Risk Alcohol Drinking Guidelines in five age groups, men and women in Canada, 2008–2010

Age and sex	% Risky drinkers (±95% CI)†	% Risky drinks (±95% CI)‡			
		Total	Beer	Wine	Spirit
Based on the yesterday drinks					
Age, years§					
15–17/18	34.47 (±4.97)	*74.47 (±2.74)	***65.60 (±4.60)	6.15 (±8.96)	***90.42 (±2.67)
18/19–24	***41.44 (±3.44)	***80.05 (±1.22)	***81.45 (±1.47)	***62.26 (±5.58)	***81.20 (±2.26)
25–44	17.65 (±1.35)	55.29 (±0.97)	54.85 (±1.28)	32.75 (±2.15)	73.43 (±1.76)
45–64	10.08 (±0.99)	45.74 (±1.00)	49.65 (±1.50)	26.66 (±1.61)	62.36 (±1.97)
65+	4.99 (±1.03)	28.03 (±1.30)	33.16 (±2.80)	13.69 (±2.01)	39.19 (±3.12)
Sex					
Male	***18.79 (±1.23)	***55.30 (±0.70)	*57.63 (±0.90)	25.95 (±1.58)	67.79 (±1.32)
Female	14.46 (±1.05)	48.66 (±1.08)	54.01 (±1.91)	***29.38 (±1.58)	67.82 (±1.84)
Total	16.66 (±0.61)	53.33 (±0.59)	56.97 (±0.81)	27.73 (±1.12)	67.80 (±1.07)
Uplifted with Q to the level of sales					
Age, years§					
15–17/18	45.00 (±5.27)	***92.38 (±1.21)	***92.02 (±1.83)	16.85 (±12.97)	***95.20 (±1.34)
18/19–24	***59.86 (±3.40)	***91.27 (±0.60)	***90.67 (±0.77)	***79.06 (±3.28)	***95.66 (±0.81)
25–44	39.11 (±1.85)	82.14 (±0.52)	83.80 (±0.66)	62.19 (±1.56)	92.86 (±0.71)
45–64	35.10 (±1.55)	78.02 (±0.58)	79.92 (±0.84)	63.46 (±1.23)	92.25 (±0.75)
65+	27.01 (±2.11)	65.56 (±0.96)	68.65 (±1.93)	46.68 (±2.05)	83.94 (±1.62)
Sex					
Male	***40.14 (±1.54)	***82.22 (±0.37)	**83.39 (±1.62)	***61.58 (±1.23)	91.79 (±0.53)
Female	36.97 (±1.35)	76.62 (±0.64)	81.36 (±1.05)	59.76 (±1.19)	*92.73 (±0.70)
Total	38.58 (±1.02)	80.54 (±0.32)	83.02 (±0.43)	60.64 (±0.86)	92.11 (±0.43)

† Risky drinking for acute harms consisted for men of having 5 or more drinks and for women 4 or more drinks in a typical day in past year (QF approach).
‡ Risky drinks overall and by beverages for acute harms consisted of the alcohol consumed "yesterday". Self-reported consumption yesterday was uplifted to the level of recorded alcohol sales in Canada (8.2 L in 2008, 2009 and 2010).
§ Underage drinking varied by province = 15-17 years old in Alberta, Manitoba and Quebec, 15-18 elsewhere in Canada.
Wald chi-square test or z-test: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

DISCUSSION

This study explored and made adjustment for the extensive under-reporting of alcohol consumption in the CADUMS. Self-report surveys are commonly used to assess levels of risky drinking, especially since the advent of the first national drinking guidelines in Canada introduced in late 2011.[2] The ability to make corrections for under-reporting was made possible in the CADUMS by the inclusion of questions about whether or not respondents consumed any alcohol the day before the interview. A newly published methodology has shown that the information in this Yesterday method can be used to correct for under-reporting in both drinking frequencies and drinking quantities.[4] Furthermore, the different degrees of under-reporting of beer, wine and spirits compared with sales data and the different preferences among population subgroups for these beverage types, can be used to further uplift estimates based on self-reported consumption.[4] After applying corrections for under-reporting, estimated non-compliance with weekly LRDG limits increased from 6.8% to 27.3% among drinkers, and from 42.3% to 68.3% with respect to drinks; and drinking above the daily LRDG limits increased from 16.7% to 38.6% among drinkers, and from 53.3% to 80.5% with respect to drinks. It should be noted that the 4 drinks per day limit for men and the 3 drinks per day limit for women is recommended "on occasion" with the usual daily limit set one drink lower for both sexes (3 for men and 2 for women).

After correcting for under-reporting in CADUMS, we estimated the proportion of all alcohol consumed by different subgroups of drinkers that took place on days or weeks when LRDG were exceeded. This proportion was especially high among young people, being over 92% (acute harm) and 75% (chronic harm) for those under legal drinking age and over 91% (acute harm) and 80% (chronic harm) for adults aged 18/19 to 24 years compared with 80.5% (acute harm) and 68.3% (chronic harm) for the population as a whole.

Our study found that young people aged 15–24 had a significantly higher rate of drinking risky drinks for both chronic and acute harms compared to other age groups, particularly seniors. Further, beer and spirits were most likely to be drunk on risky drinking days among young people. Thus government pricing and taxation policies for controlling consumption and harm might usefully be targeted towards beer and spirits for which the highest costs are incurred and toward younger drinkers who tend to prefer these categories of beverages. Australian research employing the Yesterday method has also identified spirits and regular strength beer as being the beverages most likely to be consumed on risky drinking occasions.[9] This research also found that lower strength beer (<3.8% by volume) was the least likely to be drunk when LRDGs are exceeded, suggesting that encouraging consumption of lower strength beverages may be an effective approach for reducing alcohol-related harm and costs.

Some limitations of our analysis should be kept in mind. Purchasing and consumption are not the same phenomenon, as other sources of alcohol consumption such as home production and goods purchased outside Canada are possible.[5] Second, it is important to acknowledge the low response rates in the CADUMS (43.5% in 2008, 44.7% in 2009 and 44.3% in 2010) – especially for younger people with cellphones, an increasing problem with population surveys in developed countries.[7,9,18,19] Since younger and heavier drinkers may be more likely to be

excluded from the survey,[19] the estimates of drinks consumed on risky drinking days are likely to be conservative.

CONCLUSION

In summary, after applying systematic corrections for under-reporting, there were substantial increases in estimates of the proportion of the Canadian population at risk for both long- and short-term harm from their drinking. Further, it was estimated that the great majority of alcohol consumption occurs on days and weeks when national low risk drinking guidelines are exceeded. We recommend inclusion of the detailed Yesterday method in future national alcohol surveys (as was done in the Australian NDSHS surveys) so that more accurate empirical estimates of patterns of risky alcohol consumption can be obtained from Canadians. We caution, however, that these adjustments for under-reporting may only be appropriate at the aggregate level and cannot be applied reliably to individual survey responses.

REFERENCES

1. Canadian Centre on Substance Abuse. Canada's Low-Risk Alcohol Drinking Guidelines. Ottawa, ON: CCSA, 2011. Available at: http://www.ccsa.ca/Resource%20Library/2012-Canada-Low-Risk-Alcohol-Drinking-Guidelines-Brochure-en.pdf (Accessed May 14, 2014).
2. Butt P, Beirness D, Gliksman L, Paradis C, Stockwell T. Alcohol and health in Canada: A summary of evidence and guidelines for low-risk drinking. Ottawa: CCSA, 2011. Available at: http://www.ccsa.ca/2011%20CCSA%20Documents/2011-Summary-of-Evidence-and-Guidelines-for-Low-Risk%20Drinking-en.pdf (Accessed September 18, 2012).
3. Stockwell T, Butt P, Beirness D, Gliksman L, Paradis C. The basis for Canada's new low-risk drinking guidelines: A relative risk approach to estimating hazardous levels and patterns of alcohol use. *Drug Alcohol Rev* 2012;31:126–34. PMID: 21954872. doi: 10.1111/j.1465-3362.2011.00342.x.
4. Stockwell T, Zhao JH, Macdonald S. Who under-reports their alcohol consumption in telephone surveys and by how much? An application of the 'yesterday method' in a national Canadian substance use survey. *Addiction* 2014;109:1657–66. PMID: 24825591. doi: 10.1111/add.12609.
5. Stockwell T, Chikritzhs T. International guide for monitoring alcohol consumption and related harm. Geneva, Switzerland: World Health Organization, 2000. Available at: http://whqlibdoc.who.int/hq/2000/who_msd_msb_00.4.pdf (Accessed April 27, 2011).
6. Pernanan K. Validity of survey data on alcohol use. In: Gibbins RJ, Israel Y, Kalant H, Popham RE, Schmidt W, Smart RG (Eds.), *Research Advances in Alcohol and Drug Problems*. New York, NY: Wiley and Sons,1974;355-74.
7. Stockwell T, Zhao JH, Thomas G. Should alcohol policies aim to reduce total alcohol consumption? New analyses of Canadian drinking patterns. *Addict Res Theory* 2009;17:135–51.
8. Knibbe RA, Bloomfield K. Alcohol consumption estimates in surveys in Europe: Comparability and sensitivity for gender differences. *Subst Abus* 2001;22:23–38. PMID: 12466667.
9. Stockwell T, Zhao J, Chikritzhs T, Greenfield TK. What did you drink yesterday? Public health relevance of a recent recall method used in the 2004 Australian National Drug Strategy Household Survey. *Addiction* 2008;103:919–28. PMID: 18482414. doi: 10.1111/j.1360-0443.2008.02219.x.
10. Health Canada. Canadian Alcohol and Drug Use Monitoring Survey 2008: Microdata User Guide. Ottawa: Health Canada, 2009. Available at: http://prod.library.utoronto.ca/datalib/codebooks/cstdli/cadums/2008/cadums-technical-guide-2008-final-eng.pdf (Accessed December 14, 2010).
11. Health Canada. Canadian alcohol and drug use monitoring survey 2009: Microdata user guide. Ottawa: Health Canada, 2010. Available at: http://datalib.chass.utoronto.ca/codebooks/cstdli/cadums/2009/cadums%20final%20technical%20guide%202009%20-en.pdf (Accessed March 29, 2011).
12. Health Canada. Canadian alcohol and drug use monitoring survey 2010: Microdata user guide. Ottawa: Health Canada, 2011. Available at: odesi.ca/documentation/CADUMS/2010/cadums_2010_gid_eng.pdf (Accessed June 18, 2013).
13. Canadian Centre on Substance Abuse. Canadian Addiction Survey 2004: Microdata eGuide. Ottawa: CCSA, 2005.
14. Ye Y, Bond JC, Cherpitel CJ, Borges G, Monteiro M, Vallance K. Evaluating recall bias in a case-crossover design estimating risk of injury related to alcohol: Data from six countries. *Drug Alcohol Rev* 2013;32:512–18. PMID: 23574580. doi: 10.1111/dar.12042.
15. Thomas S, Wannell B. Combining cycles of the Canadian Community Health Survey. *Health Reports* 2009;20(1):35–38.
16. Pagano M, Gauvreau K. *Principles of Biostatistics* (2nd ed.). Pacific Grove, CA: Duxbury, 2000.
17. SAS Institute. SAS/STAT 9.3 user's guide. Cary, NC: SAS Institute Inc., 2011.
18. Caetano R. Non-response in alcohol and drug surveys: A research topic in need of further attention. *Addiction* 2001;96:1541–45. PMID: 11784451.
19. Zhao JH, Stockwell T, MacDonald S. Non-response bias in alcohol and drug population surveys. *Drug Alcohol Rev* 2009;28:648–57. PMID: 19930019. doi: 10.1111/j.1465-3362.2009.00077.x.
20. Statistics Canada. Table 183-0019 - Volume of sales of alcoholic beverages in litres of absolute alcohol and per capita 15 years and over, fiscal years ended March 31, annual. Ottawa: Statistics Canada, 2014. Available at: http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.pgm (Accessed August 25, 2014).

RÉSUMÉ

OBJECTIFS : Estimer le respect des Directives de consommation d'alcool à faible risque du Canada (DCFR) au sein de divers groupes de buveurs après avoir tenu compte de la sous-déclaration de la consommation d'alcool et déterminer quels types de boissons sont les plus susceptibles d'être consommées lorsque les DCFR sont dépassées.

MÉTHODE : Notre échantillon était composé de 43 242 Canadiens âgés de 15 ans et plus qui ont répondu à l'Enquête de surveillance canadienne de la consommation d'alcool et de drogues, 2008–2010. On a estimé la consommation dépassant les DCFR après ajustement de la sous-déclaration de la consommation des sous-groupes de buveurs. Les réponses aux questions Propre à une boisson-Hier ont servi à corriger la sous-déclaration liée à l'âge, au genre et à la boisson particulière des données des 12 derniers mois des questions Quantité-Fréquence. Les données de Statistique Canada sur la vente de bière, de vin et de spiritueux ont également été incorporées aux calculs ajustés.

RÉSULTATS : Après avoir tenu compte de la sous-déclaration, la non-conformité aux limites hebdomadaires des DCFR pour réduire le risque de dommage à long terme est passée de 6,8 % à 27,3 % parmi les buveurs et de 42,3 % à 68,3 % quant aux consommations alcooliques. La non-conformité aux limites quotidiennes des DCFR pour réduire le risque de dommage à court terme est passée de 16,7 % à 38,6 % parmi les buveurs et de 53,3 % à 80,5 % quant aux consommations alcooliques. Après ajustement, plus de 92 % de la consommation totale s'est produite les jours de consommation d'alcool risqués chez les mineurs canadiens et plus de 91 % de la consommation déclarée des jeunes adultes s'est produite lors d'occasions risquées de consommer. Le vin était la boisson la moins susceptible d'être consommée et les spiritueux, les plus susceptibles de l'être.

CONCLUSION : Une fois les corrections apportées pour tenir compte de la sous-déclaration, la consommation d'alcool de la plupart des Canadiens se produit les jours pendant lesquels les DCFR nationales sont dépassées, en particulier chez les buveurs mineurs et chez les jeunes adultes.

MOTS CLÉS : enquête; consommation d'alcool d'hier; alcool