



Drinking to Cope During COVID-19 Pandemic: The Role of External and Internal Factors in Coping Motive Pathways to Alcohol Use, Solitary Drinking, and Alcohol Problems

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Background: The COVID-19 pandemic has resulted in massive disruptions to society, to the economy, and to daily life. Some people may turn to alcohol to cope with stress during the pandemic, which may put them at risk for heavy drinking and alcohol-related harms. Research is needed to identify factors that are relevant for coping-motivated drinking during these extraordinary circumstances to inform interventions. This study provides an empirical examination of coping motive pathways to alcohol problems during the early stages of the COVID-19 pandemic.

Methods: Participants ($N = 320$; 54.7% male; mean age of 32 years) were Canadian adult drinkers who completed an online survey assessing work- and home-related factors, psychological factors, and alcohol-related outcomes over the past 30 days, covering a time period beginning within 1 month of the initiation of the COVID-19 emergency response.

Results: The results of a theory-informed path model showed that having at least 1 child under the age of 18, greater depression, and lower social connectedness each predicted unique variance in past 30-day coping motives, which in turn predicted increased past 30-day alcohol use (controlling for pre-COVID-19 alcohol use reported retrospectively). Income loss was associated with increased alcohol use, and living alone was associated with increased solitary drinking (controlling for pre-COVID-19 levels), but these associations were not mediated by coping motives. Increased alcohol use, increased solitary drinking, and greater coping motives for drinking were all independently associated with past 30-day alcohol problems, and indirect paths to alcohol problems from having children at home, depression, social connectedness, income loss, and living alone were all supported.

Conclusions: Findings provide insight into coping-motivated drinking early in the COVID-19 pandemic and highlight the need for longitudinal research to establish longer term outcomes of drinking to cope during the pandemic.

Key Words: Coronavirus, Drinking Motives, Solitary Drinking, Social Distancing, Stress.

THE CORONAVIRUS DISEASE (COVID-19) outbreak became a global pandemic in March of 2020 (World Health Organization, 2020). In countries around the world, public health measures to curb the spread of

COVID-19 led to sweeping closures of schools, workplaces, businesses, and public spaces, as citizens were encouraged to stay home and practice physical distancing from one another. In Canada, as in other countries, millions of adults faced financial hardship due to layoffs and reduced work hours, and millions more had to adjust to working from home (Statistics Canada, 2020). Given the speed with which this situation unfolded early in the pandemic, the initial adjustment period was likely very stressful for many people. Moreover, fear and uncertainty about the health risks of COVID-19, along with constant media coverage, likely contributed to heightened distress. Indeed, surveys administered in several countries during the early stages of the pandemic found high levels of general distress, anxiety, and depression among the general public (Centers for Disease Control and Prevention, 2020; Centre for Addiction and Mental Health, 2020; Wang et al., 2020). At the same time, closures and physical distancing measures left many people without access to adaptive coping resources such as social support, places of worship, recreational facilities, and counseling services,

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making research on coping during the pandemic a high priority (see Holmes et al., 2020).

A salient public health concern is that many people will use alcohol to cope during the COVID-19 pandemic. Indeed, several reports from the media and other sources suggest that sales and consumption of alcohol increased in some areas at the beginning of the pandemic (BACtrack, 2020; Benzie, 2020; Carey, 2020). Moreover, a recent survey of adults across Canada found that stress was a major contributing factor among those who reported increasing their alcohol use during the pandemic (Canadian Centre on Substance Use and Addiction, 2020). Rehm et al. (2020) recently predicted that alcohol consumption will increase as a long-term consequence of the pandemic. The authors based this prediction on evidence from previous public health and economic crises, including a comprehensive review by de Goeij et al. (2015), which found that distress caused by the consequences of such crises (job/income loss, social consequences) was associated with increased alcohol consumption.

Motivational theories of alcohol use (Cooper, 1994; Cooper et al., 1995) suggest that individual differences in reasons for drinking are important for understanding the association between distress and alcohol use. While there are various motives for drinking, extensive research shows that individuals who drink for coping reasons in particular are at heightened risk for alcohol problems (Kuntsche et al., 2005; Merrill et al., 2014; Stevenson et al., 2019). Pertinent to the COVID-19 pandemic, distress caused by widespread economic and social stressors may lead some drinkers to use alcohol to cope, and greater coping motives for drinking may in turn lead to escalations in alcohol consumption. Coping motives for drinking could also lead to increased use of alcohol when at home alone due to COVID-19-related closures of bars and restrictions on social gatherings. Solitary drinking is generally viewed as an atypical drinking style, potentially indicating impaired control over alcohol (e.g., Keough et al., 2016; Keough et al., 2015). Research has linked solitary (vs. social) drinking to symptoms of alcohol use disorder, hazardous drinking, elevated anxiety and depression, and coping motives for drinking (for review, see Skrzynski and Creswell, 2020). Thus, coping-motivated drinkers are a vulnerable group that may be at greater risk for both increased alcohol use and solitary drinking during the pandemic and, in turn, increased likelihood of experiencing alcohol-related problems.

Several external and internal factors associated with distress during the initial stages of the COVID-19 pandemic could be especially important for predicting drinking to cope. For example, the direct impacts of public health measures on aspects of work and home life may be relevant, given that both work and family stress have been previously linked to drinking to cope (e.g., Frone, 1999; Lambe et al., 2015). In particular, working from home during the pandemic appears to be associated with greater anxiety (Centre for Addiction and Mental Health, 2020), perhaps because this requires

greater adjustment of daily routines and could result in a clash between home and work life. Similarly, not working at all (e.g., layoff, leave of absence, prior unemployment) could be stressful due to difficulty finding work or experiencing lost productivity during a time of economic crisis. In addition, there is evidence from several studies of past economic crises (such as the 2007 economic downturns in the United States and Europe) that income loss specifically (rather than reduced work hours more generally) leads to psychological distress, which then leads to alcohol use and problems (see de Goeij et al., 2015). With respect to home-related factors, having children at home has been associated with increased anxiety early in the COVID-19 pandemic (Centre for Addiction and Mental Health, 2020), likely because school and day care closures have placed additional demands on parents. Also, individuals living alone may have restricted access to social support in the context of stay-at-home recommendations and may experience greater distress as a result. Indeed, both parenting stress (Pelham and Lang, 1999) and low social support (Hasin and Grant, 2015; Peirce et al., 2000) have been previously associated with alcohol consumption.

In addition, individual differences in internal distress during the pandemic could be uniquely associated with greater coping motives for drinking. For example, as depression has been linked with coping motives (e.g., Holahan et al., 2003; Kenney et al., 2015; Orui et al., 2020), individuals experiencing depressed mood during the pandemic may be at greater risk for drinking to cope. Anxiety is also strongly associated with drinking to cope (Allan et al., 2015; DeMartini and Carey, 2011). A specific form of anxiety that may be highly relevant during a pandemic is health anxiety (i.e., worry about becoming ill; Asmundson and Taylor, 2020). Perhaps individuals with greater levels of health anxiety could be at greater risk for drinking to cope with their worry about contracting COVID-19. Finally, in the context of physical distancing measures, feeling socially disconnected could be a relevant predictor of drinking to cope, as research shows that loneliness and social disconnection are associated with greater alcohol use (Arpin et al., 2015; Bonin et al., 2000; Sherry et al., 2012).

The Present Study

It is important to understand coping-motivated drinking during the COVID-19 pandemic in order to inform alcohol intervention strategies. We evaluated a theory-based model of associations among relevant external and internal factors, individual differences in coping motives, changes in alcohol consumption and solitary drinking, and associated alcohol-related problems. We surveyed adult drinkers across Canada who reported on their alcohol use, alcohol problems, and coping motives for drinking over the past 30 days, covering a time period beginning less than a month after the pandemic was declared and emergency public health measures began to go into effect. These public health measures were similar across Canada and included federal, provincial, and local

orders that closed schools and nonessential businesses, banned public gatherings, and encouraged people to stay home and practice physical distancing (see OHS Canada, 2020). We forwarded the following hypotheses (see Fig. 1 for the hypothesized model):

1. Working from home, not working (i.e., job loss, leave of absence, continuation of prior unemployment), income loss, living with at least 1 child under the age of 18, living alone, social disconnection, health anxiety, and depression would all be associated with greater coping motives for drinking early in the pandemic.
2. Coping motives, in turn, would predict both increased alcohol consumption and increased solitary drinking (controlling for retrospectively reported prepandemic levels), both of which, in turn, would be associated with greater alcohol-related problems.
3. Coping motives would mediate the link between the stressors listed in hypothesis 1 and alcohol-related problems via 2 specific pathways: 1) coping motives to increased alcohol consumption and 2) coping motives to increased solitary drinking.
4. Some variables would also have direct relationships with alcohol outcomes. Specifically, living alone and social disconnection would have direct links with increased solitary drinking, as these factors may predict solitary drinking merely as a function of more time spent alone. Further, as income losses could motivate individuals to *decrease* their alcohol use to save money (de Goeij et al., 2015; Rehm et al., 2020), we expected that decreased income would have a negative direct path to alcohol consumption independent of the indirect path through coping motives. Also, coping motives would have a direct association with alcohol problems, consistent with past research (e.g., Merrill et al., 2014), so that all indirect paths via coping motives would be only partially mediated by alcohol use and solitary drinking.

Given that several demographic factors have been previously associated with alcohol use and problems, we included sex, age, race/ethnicity, and income as covariates in our model. Although some research suggests that men may be more likely to use alcohol to cope with economic stressors than women (Brown and Richman, 2012; de Goeij et al., 2015), there is also evidence that women are more likely to engage in stress-related drinking than men (see Peltier et al., 2019). Given the unprecedented impacts of the COVID-19 pandemic, it is currently unclear how various demographic groups will respond differently to stressors in this unique context. Thus, we did not forward specific hypotheses about the role of demographics.

MATERIALS AND METHODS

Participants and Procedure

Participants were recruited via Prolific, an online crowdsourcing platform for workers to complete surveys. Prolific was designed

explicitly for individuals to complete surveys, and the participant pool tends not to be as overstudied as those on other platforms (Palan and Schitter, 2018; Peer et al., 2017). Research using similar crowdsourcing platforms (i.e., Amazon's Mechanical Turk) demonstrates that addiction measures, including those that capture alcohol use, can be reliably and validly administered using crowdsourcing methods (see Kim and Hodgins, 2017). Using participant information previously collected by Prolific, we recruited adults residing in Canada who identified as alcohol users and had a history of high-quality responses on the platform (average approval rating was 99.4% in this sample). We also included 4 attention check items (see Prolific Team, 2020) as a further quality control measure. Consistent with Prolific's guidelines (Prolific Team, 2020), participants' data were automatically rejected from the study if they failed 2 or more attention check items and had a very fast completion time (defined as under 20 minutes in this study). Two participants were removed from the study based on these criteria. Of the remaining 400 participants who completed the survey, none failed more than 1 attention check. Only participants who reported drinking alcohol in the past 30 days and who had complete data on all predictors of interest were included in the present analyses. The current sample included 320 participants (54.7% male; 72% White) with a mean age of 31.99 years ($SD = 9.24$). See Table 1 for additional sample information.

Data collection took place between April 30, 2020, and May 4, 2020.¹ As most of the questions were keyed to the past 30 days (see "Measures" section for specific time frames), participants reported on a 30-day period beginning soon after a state of emergency was declared and public health measures went into effect in their area (which occurred between March 12 and March 27, depending on location; OHS Canada, 2020). Further, participants were asked to report their alcohol use and solitary drinking for both the past 30 days and the 30 days prior to the COVID-19 emergency (see Measures). Participants were compensated approximately CAD\$13 (converted from GBP currency). The Office of Research Ethics at York University approved all procedures.

Measures

Demographics. Participants reported their sex, race/ethnicity, income, and the number of individuals they lived with. Participants also reported their relationship status, parental status, age range of children (if applicable), and whether their children live with them (full- or part-time).

Impacts of COVID-19 on Work and Income. Participants were asked whether they had a full-time or part-time job or were a full-time or part-time student before the COVID-19 pandemic began, and how their income and work hours had been affected by the pandemic. The item assessing income changes read "How has your personal income coming directly from your employer been affected by the COVID-19 emergency?" with response options ranging from *It has increased (e.g., due to overtime, increased business) to 100%—I have lost all my income due to the COVID-19 situation* (see Table 1). The item assessing impact on work hours read, "How has the number of hours you work per week at your paid job(s) been affected overall by the COVID-19 emergency?" with several possible response options (see Table 1). Also, participants who were working were asked whether they were working primarily from home (no/yes).

¹The initial survey did not include the alcohol problems measure (Short Inventory of Problems), which was subsequently administered to the same participants between May 12, 2020, and May 16, 2020.

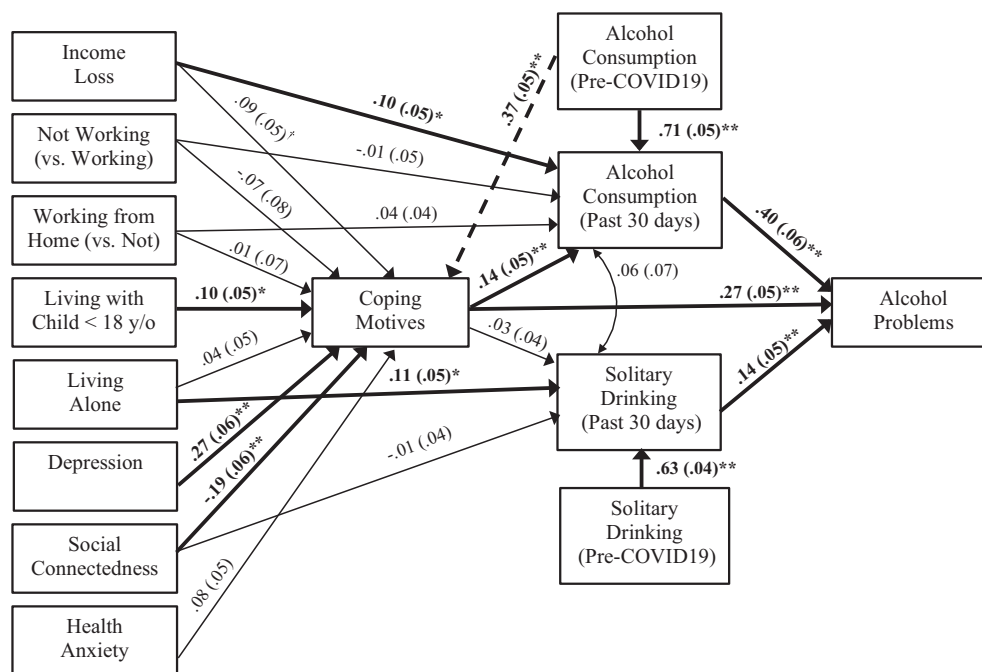


Fig. 1. Final model of coping motive pathways to alcohol use, solitary drinking, and alcohol problems early in the COVID-19 pandemic. All hypothesized paths are shown (**solid arrows**), with **bolded arrows** denoting statistically significant paths. **Dashed arrow** represents a nonhypothesized path that was added to the model post hoc based on the modification index. Sex, race/ethnicity, age, and annual income were included as covariates in the model but are not depicted in the figure (see “Results” section for findings related to these covariates). Standardized estimates are shown with standard errors in parentheses. y/o = years old. $^\dagger p < 0.10$, $*p < 0.05$, $**p < 0.001$.

Depression. The Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001; 9 items; $\alpha = 0.84$) measured depression severity over the last 30 days using a 4-point scale (0 = *Not at all* to 3 = *Nearly Every Day*). Responses to all items were summed to obtain a total depression score. Research supports the reliability and validity of the PHQ-9, with scores on the total scale corresponding to differing levels of depression severity (5 to 9 = Mild; 10 to 14 = Moderate; 15 to 19 = Moderately Severe; 20+ = Severe; Kroenke et al., 2001).

Social Connectedness. The Social Connectedness Scale-Revised (Lee et al., 2001; 20 items; $\alpha = 0.94$) assessed feelings of interpersonal closeness and connectedness (e.g., “I feel close to people”) in the last 30 days using a 6-point scale (1 = *Strongly Disagree* to 6 = *Strongly Agree*). Items were summed to obtain a total score. Low scores are thought to reflect social disconnection and negative appraisals of one’s social relationships (Lee et al., 2001).

Health Anxiety. The Illness Attitudes Scales (Kellner, 1987; 27 items, $\alpha = 0.87$) assessed attitudes, beliefs, and behaviors related to health anxiety using a 5-point scale (0 = *No* to 4 = *Most of the time*). We used the standard version of the measure, which does not ask participants to respond to items based on a specific time frame, and so, scores represent trait-like health anxiety. The Illness Attitudes Scales have high validity, reliability, and sensitivity (Sirri et al., 2008). A total score was obtained by summing all items, with a score of 47 or higher indicating severe health anxiety (Hedman et al., 2015).

Coping Motives. The Coping Motives Scale of the Drinking Motives Questionnaire-Revised Short Form (Kuntsche and Kuntsche, 2009; 3 items; $\alpha = 0.85$) assessed how often participants drank in order to cope with negative affect over the last 30 days (1 = *Never*; 2 = *Sometimes*; 3 = *Always*). Items were summed to obtain a total coping motives score.

Alcohol Consumption. Participants were asked to report their alcohol consumption both with reference to the “past 30 days” and with reference to the “one month period prior to when the COVID-19 emergency was declared in your area.” For both time frames, participants reported how frequently they consumed an alcoholic beverage (0 = *Never* to 7 = *Every Day*)² and the typical quantity of alcohol they consumed on drinking occasions (0 = *1 drink* to 10 = *25 or more drinks*), using modified items from the National Institute on Alcohol Abuse and Alcoholism’s recommended alcohol questions. The product of these 2 items comprised a Quantity by Frequency (QF) index (an indicator of total alcohol consumption) for both 30-day time frames.

Solitary Drinking. To measure frequency of solitary drinking, participants responded to the following question with reference to both the past 30 days and the 1-month period prior to when the COVID-19 emergency was declared in their area: “When you drank alcohol, how much of that time was spent drinking while you were by yourself relative to when socializing with other people either in-person or virtually (e.g., voice/video chat such as Skype, Facetime, Zoom, etc.)?” Given that many people began using virtual means of socializing during the pandemic, the definition of social drinking included both in-person and virtual social contexts in order to avoid participant confusion. Participants used a scale ranging from

²The alcohol frequency item included a response option that read “less than once a month.” As participants were asked to report their alcohol use with reference to 30-day time frames (i.e., past 30 and 30 days prior to the COVID-19 emergency), participants who chose this response option were assumed to be reporting low-frequency drinking rather than abstinence (as they did not choose the “never” response option). Accordingly, to aid interpretation of the means of the frequency items, these participants were assigned a value of “1” to equate them with those who endorsed the “once a month” response option.

Table 1. Sample Characteristics and Descriptive Statistics for Work-Related and Home-Related Variables

	<i>n</i>	%		<i>n</i>	%
<i>Province</i>			<i>Pre-COVID-19 Employment Status</i>		
Ontario	162	50.6	Unemployed or nonworking student	46	14.4
British Columbia	46	14.4	Part-time employed	73	22.8
Alberta	38	11.9	Full-time employed	201	62.8
Quebec	30	9.4			
Other	44	13.8	<i>Impacts of COVID-19 on Work</i>		
<i>Race/Ethnicity (check all that apply)^a</i>			Laid off and not working any hours	69	21.6
White	231	72.2	Paid/unpaid leave	17	5.3
East Asian, South-East Asian, Pacific Islander	47	14.7	Quit job	7	2.2
Black	17	5.3	Reduced hours	62	19.4
South Asian	15	4.7	No change in hours	139	43.4
Hispanic, Latino	13	4.1	Increased hours	26	8.1
Other	17	5.3	Currently working from home	151	47.2
<i>Student status</i>			<i>Income Change due to COVID-19^b</i>		
Nonstudent	244	76.3	Reduced 100%	62	19.4
Part-time student	31	9.7	Reduced 51 to 99%	15	4.7
Full-time student	45	14.1	Reduced 10 to 50%	33	10.3
<i>Relationship status</i>			Reduced by up to 10%	24	7.5
Single (never married or divorced)	115	36.0	No change	176	55.0
Common-law/married/long-term relationship	205	64.0	Increased income	10	3.1
<i>Annual household income</i>			<i>Home variables</i>		
Less than \$20,000	26	8.1	No children	229	71.6
\$20,000 to \$39,999	40	12.5	Has child(ren) under the age of 18 at home	81	25.3
\$40,000 to \$59,999	42	13.1	Has child(ren) over 18 and/or not at home	10	3.1
\$60,000 to \$79,999	43	13.4			
\$80,000 to \$99,999	60	18.8	Lives alone	40	12.5
\$100,000 to \$149,999	73	22.8			
Over \$150,000	36	11.3			

^aParticipants were counted in all categories they endorsed; *n* = 215 participants identified only as White.

^bResponse options for the item assessing income change due to COVID-19 included the following: It has increased (e.g., due to overtime, increased business), it was not affected at all, reduced by up to 10%, reduced by 10 to 25%, reduced by 25 to 50%, reduced by 51 to 75%, reduced by more than 75%, 100%—I have lost my income due to the COVID-19 situation. Some responses were combined in the table for ease of presentation.

0 = 100% by yourself to 10 = 100% with other people. Responses were reverse-coded so that higher values represented a greater percentage of solitary versus social drinking time.³

Consequences of Alcohol Use. The Short Inventory of Problems (15 items, $\alpha = 0.70$), a subset of items from the Drinker Inventory of Consequences (Miller et al., 1995), assessed alcohol-related problems over the past 30 days. Participants rated each item on a 4-point scale (0 = *Not at All/Never* to 3 = *Very Much/Daily or Almost Daily*), and items were summed to create a total alcohol problems index.

Data Analysis

Descriptive Analyses. Prior to analyses, extreme outliers (i.e., greater than 3.29 standard deviations from the mean and clearly disconnected from the rest of the distribution; Tabachnick and Fidell, 2007) were re-coded to 1 unit greater than the next most extreme value to reduce their potential for exerting an undue influence on parameter estimates. This resulted in recoding 1 outlier on the

health anxiety variable, 5 outliers on both the pre-COVID-19 and past 30-day alcohol use variables, and 3 outliers on the alcohol problems variable. Next, we conducted descriptive analyses on the variables in our hypothesized model. Paired-samples *t*-tests also were conducted to examine whether there were any mean-level differences in alcohol use and solitary drinking between the 30 days prior to the COVID-19 emergency and the past 30 days.

Mediation Model. To examine our hypotheses, we specified a path model using observed variables in Mplus v. 7.4 (Muthén and Muthén, 2012). Most continuous variables reasonably approximated normal distributions, with a few of the alcohol-related variables showing slight deviations from normality (all skewness values <1.91, all kurtosis values <3.03). The robust maximum likelihood estimator (MLR) was used to accommodate violations of the normality assumption. Some participants (*n* = 25) were missing data on the alcohol problems variable due to a technical issue with the survey. These participants were retained in the analysis through the use of the MLR estimator.

The hypothesized path model is depicted in Fig. 1. Independent variables included home- and work-related variables, depression, social connectedness, and health anxiety. For home-related variables, our model included: (i) a dichotomous indicator for living alone (vs. living with others), and (ii) a dichotomous indicator for having at least 1 child under the age of 18 living at home (vs. not). To examine work status, we included the dichotomous indicator “not currently working” based on the item assessing the impact of

³Four participants in the sample reported that they had not consumed alcohol in the 30 days prior to the COVID-19 emergency. In order to retain them in the analysis, they were assigned a value of “0” for the pre-COVID solitary drinking variable to reflect an absence of solitary drinking behavior during that time period.

Table 2. Means and Standard Deviations for Health Anxiety, Depression, Social Connectedness, and Alcohol-Related Variables

	M		SD				
Health anxiety	34.08		13.19				
Depression	7.57		5.29				
Social connectedness	79.59		16.95				
Alcohol problems	3.31		4.89				
Coping drinking motives	1.55		0.56				

	30 days prior to the COVID-19 emergency		Past 30 days (during the COVID-19 emergency)		<i>t</i>	df	<i>d</i>
	<i>M</i>	SD	<i>M</i>	SD			
Alcohol frequency ^a	3.21	1.75	3.48	1.87	-4.12**	319	0.23
Alcohol quantity ^b	2.39	1.52	2.25	1.41	2.49*,a	319	0.14
QF Index	8.15	7.67	8.34	7.75	-0.67	319	0.04
Solitary drinking ^c	3.38	3.49	4.62	4.00	-7.33**	319	0.41

^aResponse options ranged from *Never* (coded 0) to *Every Day* (coded 7). Observed means fall between the anchors for *Once a week* (coded 3) and *Twice a week* (coded 4).

^bResponse options ranged from *1 drink* (coded 1) to *25 or more drinks* (coded 10). Observed means fall between the anchors for *2 drinks* (coded 2) and *3 to 4 drinks* (coded 3).

^cResponse options ranged from *100% with other people* (coded 0) to *100% by yourself* (coded 10). Observed means fall between the anchors for *30% by yourself, 70% with other people* (coded 3) and *50% by yourself, 50% with other people* (coded 5).

p < 0.05, ***p* < 0.01.

the pandemic on work status (1 = laid off, on leave, quit job; 0 = still working). Participants who reported being unemployed prior to the COVID-19 emergency and also reported no increases in work hours during the pandemic were coded as not currently working. A dichotomous indicator for “working from home” (1 = yes; 0 = not working from home/not currently working) was also included. Given that the item assessing change in income due to COVID-19 was skewed and bimodal (see Table 1), we created a binary indicator for “income loss” (1 = decrease in income; 0 = no change/increase in income).

To evaluate our hypotheses, the independent variables were specified as simultaneous predictors of past 30-day coping motives for drinking, which in turn was specified as a predictor of both past 30-day alcohol use (QF index) and past 30-day solitary drinking. The residuals for the alcohol use and solitary drinking variables were allowed to freely covary. In addition, reports of alcohol consumption and solitary drinking in the 30 days prior to the COVID-19 emergency were included as covariates (see Fig. 1), so that coping motives predicted *relative changes* in alcohol use and solitary drinking in the past 30 days.

Next, past 30-day alcohol use, solitary drinking, and coping motives all were specified as predictors of total alcohol problems in the past 30 days. In addition, the hypothesized model included a direct path from living alone to past 30-day solitary drinking and from income loss to past 30-day alcohol use. With respect to the latter, we also controlled for the direct associations of the work status variables (working from home, not working) in order to isolate the variance in alcohol use that could be attributed specifically to income losses from other work-related factors. Finally, demographic variables (age, sex, race/ethnicity, annual income) were included as covariates by regressing all dependent variables (coping motives, alcohol use, solitary drinking, alcohol problems) on each of the demographic variables. As two-thirds of the sample ($n = 215$) identified only as White, a binary indicator was used for race/ethnicity (White only vs. non-White/mixed race/Hispanic or Latino).

We used the following criteria as an indication of good model fit: root mean square error of approximation (RMSEA) < 0.06, comparative fit index (CFI) > 0.95, and standardized root mean square residual (SRMR) < 0.05 (Hu and Bentler, 1999). In the event that

the model did not fit the data well, we planned to examine modification indices for potential sources of misfit and respecify the model if indicated. Given the post hoc nature of this process, we only respecified the model based on modification indices >10 that made conceptual sense within our theoretical framework. Once the final model was specified, bootstrapping (with 10,000 samples) was used to estimate bias-corrected confidence intervals (CI) for hypothesized indirect paths.

RESULTS

Descriptive Statistics

Table 1 shows descriptive data for categorical variables, and Table 2 contains means and standard deviations for continuous variables. On average, participants reported living with 1.96 (SD = 1.39) other people, with approximately 13% indicating that they lived alone. Of the participants who indicated that they had children under the age of 18 living with them, the average age of the youngest child was 5.72 years (SD = 4.93). More than half of the participants reported a change in work hours during the pandemic, and a large portion of the sample reported that they were currently working from home (see Table 1). The majority (55%) reported no change in personal employment income since the COVID-19 emergency was declared. Still, a sizable portion (19%) reported losing 100% of their personal income. As shown in Table 2, the average score on the PHQ-9 was 7.57, representing mild-to-moderate depression in the past 30 days, with 2.5% of the sample scoring above the cutoff for severe depression. Further 17% of the sample scored at or above the cutoff for severe health anxiety (i.e., 47) on the Illness Attitudes Scales.

Table 2 also shows descriptive statistics for alcohol use and solitary drinking in the 30 days prior to the COVID-19

emergency and in the past 30 days, along with paired-samples *t*-tests for differences between these 2 reference periods. Average drinking frequency was slightly higher, and average drinking quantity was slightly lower, for the past 30 days versus the 30 days prior to the COVID-19 emergency. Consequently, the mean QF score, an index of total alcohol consumption, did not differ significantly between the pre-COVID and past 30-day reference periods (see Table 2). In contrast, there was a statistically significant increase in solitary drinking reported for the past 30 days relative to the 30 days prior to the COVID-19 emergency. Inspection of means in Table 2 suggests that percentage of solitary versus social drinking time increased from an average of 30 to 40% to an average of 40 to 50%. Finally, the total score on the Short Inventory of Problems suggests low levels of past 30-day alcohol problems in the sample, although total scores ranged from 0 to 21, indicating variability across participants.

Mediation Model

Model Results. The initial hypothesized model did not fit the data well, adjusted $\chi^2(25) = 112.44$, $p < 0.001$, RMSEA = 0.105, CFI = 0.882 SRMR = 0.042. Inspection of modification indices revealed that the greatest improvement in model fit could be achieved by estimating the path from pre-COVID alcohol use to past 30-day coping motives (MI = 55.13). As this made sense conceptually, we respecified the model to include this path. The modified model fit the data well, adjusted $\chi^2(24) = 51.20$, $p = 0.001$, RMSEA = 0.060, CFI = 0.963, SRMR = 0.026, and was used as the final model, with no further modification indices meeting our criteria for consideration.

Direct Paths. Path coefficients for the final model are shown in Fig. 1. With respect to home- and work-related variables, only having a child under the age of 18 living at home was associated with greater coping motives for drinking. As hypothesized, both greater depression and lower social connectedness were associated with greater coping motives, although health anxiety did not show the expected association with coping motives. Coping motives, in turn, were associated with increased alcohol consumption in the past 30 days (controlling for pre-COVID alcohol consumption). Contrary to expectations, coping motives were not associated with increased solitary drinking in the past 30 days after covarying for pre-COVID solitary drinking. Both increased alcohol consumption and increased solitary drinking in the past 30 days had the hypothesized positive associations with past 30-day alcohol problems. The hypothesized direct association between coping motives and alcohol problems was also significant.

Although the hypothesized association between COVID-related income loss and coping motives only approached statistical significance ($p = 0.087$), income loss did have a significant, direct association with past 30-day alcohol

Table 3. Estimates and Confidence Intervals for Supported Hypothesized Indirect Pathways to Alcohol Problems

Indirect pathway	Standardized estimate	95% CI ^a
Income Loss → ALC Use → ALC Problems	0.039	[0.005, 0.081]
Child < 18 y/o → COP → ALC Use → ALC Problems	0.006	[0.001, 0.016]
Child < 18 y/o → COP → ALC Problems	0.028	[0.005, 0.061]
Living Alone → SOL Drinking → ALC Problems	0.015	[0.002, 0.039]
Depression → COP → ALC Use → ALC Problems	0.014	[0.005, 0.032]
Depression → COP → ALC Problems	0.073	[0.036, 0.124]
Social CON → COP → ALC Use → ALC Problems	-0.010	[-0.024, -0.003]
Social CON → COP → ALC Problems	-0.051	[-0.096, -0.022]

Only hypothesized indirect paths that were supported (i.e., 95% CI does not contain zero) are shown. All other hypothesized indirect paths in the model were not supported (i.e., 95% CI contains zero).

ALC, alcohol; CON, connectedness; COP, coping motives; SOL, solitary; y/o, years old.

^aBias-corrected confidence intervals based on 10,000 bootstrapped samples.

consumption (Fig. 1). However, the direct association was in the positive direction, contrary to the hypothesized negative association. Work status indicators (working from home, not working) were not uniquely associated with alcohol consumption. Living alone was associated directly with increased solitary drinking in the past 30 days as hypothesized, but social connectedness was not.

Though not depicted in Fig. 1, the demographic covariates showed some interesting associations. Male ($\beta = 0.12$, $SE = 0.04$, $p = 0.003$) and non-White participants ($\beta = 0.14$, $SE = 0.04$, $p = 0.001$) reported greater increases in solitary drinking relative to female and White participants, respectively. Age was negatively associated with alcohol problems ($\beta = -0.20$, $SE = 0.05$, $p < 0.001$). Annual household income was not associated with any outcomes, and no demographic covariates were significantly associated with increased alcohol consumption or coping motives (all $ps > 0.05$).

Specific Indirect Pathways. Estimates and CI for the indirect associations are shown in Table 3. With respect to the hypothesized indirect pathways, living with a child under the age of 18, greater depression, and lower social connectedness were all indirectly associated with alcohol problems via 2 pathways: one going sequentially through both coping motives and alcohol use and the other going directly through coping motives. The hypothesized indirect path from living alone to alcohol problems was mediated by increased solitary drinking (but not by coping motives). Income loss was indirectly associated with greater alcohol problems through increased alcohol use, but not through coping motives

(contrary to expectations). None of the other hypothesized indirect pathways were supported (Table 3).

DISCUSSION

Public health measures enacted during the initial stages of the COVID-19 pandemic resulted in abrupt, drastic changes to daily life and have had enormous economic and social impacts around the world. Because this has been associated with elevated levels of distress, anxiety, and depression in the general public (Centers for Disease Control and Prevention, 2020; Centre for Addiction and Mental Health, 2020; Wang et al., 2020), it is likely that many people will use alcohol to cope with distress during the pandemic (see Canadian Centre on Substance Use and Addiction, 2020; Rehm et al., 2020). The goal of this study was to provide an empirical examination of coping-motivated pathways to alcohol use and problems during the early stages of the pandemic, in order to help inform targeted interventions.

In our path model, we found that individual differences in coping motives for drinking were associated with both alcohol consumption and alcohol problems reported for the past 30 days, a time period that closely followed the onset of emergency public health measures across Canada. Although we cannot determine whether coping motives and alcohol problems changed relative to preemergency levels, we did control for retrospectively reported alcohol consumption during the 30 days prior to the initiation of emergency public health measures. Findings suggest that, although significant variance in coping motives could be explained by preemergency levels of alcohol use, coping motives were still associated with *increased* alcohol consumption in the past 30 days relative to preemergency levels. Increased alcohol consumption, in turn, was associated with greater alcohol problems, partially mediating the link between coping motives and alcohol problems. These findings are consistent with the large literature linking coping motives to heavier alcohol consumption and alcohol-related harms (Cooper et al., 2016; Kuntsche et al., 2005), and provide evidence that coping motives for drinking were associated with increased alcohol consumption early in the COVID-19 pandemic. Thus, coping motives may be an important point of intervention to curb the increases in alcohol use and associated harms that are expected to result from the pandemic over the long run (Rehm et al., 2020).

We examined several hypothesized coping motive pathways to alcohol use and problems from various factors that were thought to be relevant for drinking to cope early in the pandemic. First, we found that greater depressive symptoms and lower social connectedness were associated with greater coping motives, which in turn mediated their associations with increased alcohol consumption and greater alcohol problems. These findings are consistent with the large body of prior research supporting the role of depressive symptoms and feelings related to social disconnection (e.g., loneliness) in coping pathways to drinking (Arpin et al., 2015; Cooper

et al., 2016; Sadava and Thompson, 1986). Given that depression appears to have increased since the onset of the COVID-19 pandemic (Centers for Disease Control and Prevention, 2020; Centre for Addiction and Mental Health, 2020) and that ongoing physical distancing measures are likely to contribute to further social disconnection, these findings highlight the importance of addressing coping-motivated drinking among depressed and socially disconnected individuals. In contrast, we did not observe the hypothesized association between health anxiety and drinking to cope. This finding could be related to the fact that we focused on general, trait-like health anxiety rather than COVID-specific, state increases in health anxiety symptoms. Further, our sample had a relatively young average age, and less than 65,000 cases of COVID-19 had been confirmed across Canada by the time of the survey (Government of Canada, 2020a), perhaps making the health risks less salient to participants in this study. Research in regions harder-hit by COVID-19 will be necessary to fully examine the role of health anxiety in coping-motivated drinking.

With respect to the hypothesized work- and home-related stressors, only having a child under the age of 18 living at home was uniquely associated with coping motives for drinking. Given that day cares and schools across Canada were closed during the early stages of the pandemic, parents may have experienced increased stress (e.g., due to increased childcare demands and conflicting obligations to children and work), which could have increased their likelihood of using alcohol as a coping strategy. Indeed, a recent Canadian study found that parents with children under the age of 18 reported higher levels of anxiety early in the pandemic (Centre for Addiction and Mental Health, 2020). The finding that living with children under the age of 18 was associated indirectly with alcohol problems via greater coping motives and increased alcohol use is also consistent with prior research showing an association between parenting stress and alcohol consumption (Pelham and Lang, 1999). Our findings suggest that future research on coping during the COVID-19 pandemic should focus on the unique needs of parents.

Although the hypothesized association between income loss and coping motives only approached statistical significance, income loss was directly associated with greater alcohol consumption. Although we hypothesized a negative direct association based on the assumption that individuals may reduce their alcohol consumption as a cost-savings measure (de Goeij et al., 2015; Rehm et al., 2020), we instead observed a positive association in our sample. Perhaps because our sample had a relatively high median annual income (\$80,000 to \$100,000), and relief funding was provided by the Canadian government to millions of individuals claiming lost income (Government of Canada, 2020b), most participants who reported income losses likely did not have to resort to immediate cost-savings measures such as reducing their drinking. Moreover, the negative effect of income loss on alcohol consumption may have been offset by a shift to less costly drinking behavior (de Goeij et al., 2015; Rehm

et al., 2020), such as shifting to drinking at home when bars and other venues were closed by public health orders. Still, these considerations do not explain the observed positive association between income loss and increased drinking that was not mediated by coping motives. Further, this association does not appear to be an artifact of less time spent working as we controlled for work status (including nonworking status) in our model. Thus, the mechanisms that may explain the observed link between income loss and alcohol consumption require further exploration in future research.

In addition, although living alone was not associated with coping motives and coping motives were not associated with solitary drinking, living alone was associated directly with increased solitary drinking as hypothesized (although social disconnection was not). These findings suggest that observed increases in solitary drinking early in the pandemic may have had more to do with situational factors than with coping processes—that is, closures and stay-at-home guidelines may have led drinkers to shift their drinking to the home, which meant drinking alone a greater proportion of the time, especially among those who reported living alone. Importantly, increased solitary drinking was still associated with unique variance in alcohol problems over and above increased alcohol use and coping motives. This finding aligns with the literature suggesting that solitary drinking is an important marker of alcohol-related risk (Skrzynski and Creswell, 2020), and suggests that solitary drinking in the context of COVID-19-related public health measures (especially the risks for those who live alone) requires further research attention.

Although we did not have specific hypotheses about the role of demographic factors in our model, it is worth noting that we did not observe associations between demographic covariates (sex, race/ethnicity, age, annual income) and coping motives or changes in alcohol consumption early in the pandemic. Although Rehm et al. (2020) predicted that men will show greater increases in alcohol use as a result of the pandemic, they hypothesized that the coping pathway underlying this sex difference would only begin to emerge after the economic and social consequences of the pandemic accumulate over time. However, we did find that men and non-White participants reported greater increases in solitary drinking (relative to women and White-only participants, respectively), as well as an association between age and alcohol problems. These associations were not mediated by coping motives. Additional research with larger and more diverse samples will be necessary to further elucidate the mechanisms underlying demographic differences in alcohol outcomes during the COVID-19 pandemic.

This study had several limitations that must be considered. Foremost among these is the cross-sectional nature of the data, which precludes examination of temporal relationships among variables. Although specification of our path model was guided by theory and previous research, we cannot rule out alternative models of the directional associations among the variables. Though we were able to model changes in

alcohol consumption and solitary drinking relative to pre-pandemic levels, pre-pandemic drinking was reported retrospectively, making it prone to recall bias. We also did not have data on pre-pandemic alcohol problems, further adding to this limitation. Longitudinal research, which is currently planned with this sample, will be important for establishing the directionality of associations in this model and for examining the longer term alcohol outcomes associated with coping-motivated drinking during the pandemic.

In addition, as our study relied on a modest-sized sample of convenience recruited from an online survey platform, we must be careful not to generalize our findings to the population. It will be important to replicate the findings reported here in larger and more diverse samples, including those with a better representation of low-income individuals, clinical populations, minority groups, and other vulnerable individuals. Further, although our model included a large set of predictors likely to be relevant for drinking to cope during the pandemic, it is by no means an exhaustive model of all relevant risk factors. Also, while coping motives were most relevant to our conceptual framework, other drinking motives (e.g., enhancement, social) are no doubt important for understanding pathways to alcohol outcomes during the pandemic. Given our modest sample size, we were not able to test a more complex model that included simultaneous pathways through all types of drinking motives. Larger samples will be needed for future research aiming to examine a broader motivational model of alcohol use during the pandemic.

In conclusion, the findings improve our understanding of coping-motivated drinking in the context of the extreme public health measures that were enacted early in the pandemic, which will be informative if a second wave of COVID-19 (or indeed a new public health crisis) requires a similar emergency response in the future. As the public health measures that were in place across Canada and much of the world when the data were collected have gradually started to be lifted at the time of this writing, it will be important to track how the relevance of the factors examined here changes as the pandemic response shifts over time. The findings may inform coping skills interventions that can be targeted toward individuals at risk for drinking to cope during the COVID-19 pandemic.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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