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16 Drinking to cope during COVID-19 pandemic: The role of external and internal factors in coping
17 motive pathways to alcohol use, solitary drinking, and alcohol problems
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21 Jeffrey D. Wardell, Ph.D.^{1,2,3*} Tyler Kempe, B.A.⁴, Karli K. Rapinda, M.A.⁴,
22 Alanna Single, M.A.⁴, Elena Bilevicius, M.Sc.⁴, Jona R. Frohlich, M.Ed.⁴,
23 Christian S. Hendershot, Ph.D.^{2,3,5,6}, Matthew T. Keough, Ph.D.¹
24
25

26 ¹Department of Psychology, York University, Toronto, Ontario, Canada

27 ²Institute for Mental Health Policy Research and Campbell Family Mental Health Research
28 Institute, Centre for Addiction and Mental Health, Toronto, Ontario, Canada

29 ³Department of Psychiatry, University of Toronto, Toronto, Ontario, Canada

30 ⁴Department of Psychology, University of Manitoba, Winnipeg, Manitoba, Canada

31 ⁵Department of Psychology, University of Toronto, Toronto, Ontario, Canada

32 ⁶Department of Pharmacology and Toxicology, University of Toronto, Toronto, Ontario, Canada
33
34

35 *Correspondence can be addressed to Jeffrey D. Wardell, Department of Psychology, York
36 University, 101 Behavioural Sciences Building, 4700 Keele Street, Toronto, Ontario, Canada,
37 M3J 1P3. jwardell@yorku.ca
38
39

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43

44 **Abstract**

45 **Background:** The COVID-19 pandemic has resulted in massive disruptions to society, to the
46 economy, and to daily life. Some people may turn to alcohol to cope with stress during the
47 pandemic, which may put them at risk for heavy drinking and alcohol-related harms. Research is
48 needed to identify factors that are relevant for coping-motivated drinking during these
49 extraordinary circumstances to inform interventions. This study provides an empirical
50 examination of coping motive pathways to alcohol problems during the early stages of the
51 COVID-19 pandemic. **Methods:** Participants ($N = 320$; 54.6% male; mean age 32 years old)
52 were Canadian adult drinkers who completed an online survey assessing work- and home-related
53 factors, psychological factors, and alcohol-related outcomes over the past 30 days, covering a
54 time period beginning within one month of the initiation of the COVID-19 emergency response.
55 **Results:** The results of a theory-informed path model showed that having at least one child under
56 age 18, greater depression, and lower social connectedness each predicted unique variance in past
57 30-day coping motives, which in turn predicted increased past 30-day alcohol use (controlling for
58 pre-COVID-19 alcohol use reported retrospectively). Income loss was associated with increased
59 alcohol use, and living alone was associated with increased solitary drinking (controlling for pre-
60 COVID-19 levels), but these associations were not mediated by coping motives. Increased
61 alcohol use, increased solitary drinking, and greater coping motives for drinking were all
62 independently associated with past 30-day alcohol problems, and indirect paths to alcohol
63 problems from living with children, depression, social connectedness, income loss, and living
64 alone were all supported. **Conclusions:** Findings provide insight into coping-motivated drinking
65 early in the COVID-19 pandemic and highlight the need for longitudinal research to establish
66 longer-term outcomes of drinking to cope during the pandemic.

67 **Keywords:** Coronavirus, drinking motives, solitary drinking, social distancing, stress

68 **Introduction**

69 The coronavirus disease (COVID-19) outbreak became a global pandemic in March 2020
70 (World Health Organization, 2019). In countries around the world, public health measures to curb
71 the spread of COVID-19 led to sweeping closures of schools, workplaces, businesses, and public
72 spaces, as citizens were encouraged to stay home and physically distance from one another. In
73 Canada, as in other countries, millions of adults faced financial hardship due to lay-offs and
74 reduced work hours, and millions more had to adjust to working from home (Statistics Canada,
75 2020). Given the speed with which this situation unfolded early in the pandemic, the initial
76 adjustment period was likely very stressful for many people. Moreover, fear and uncertainty
77 about the health risks of COVID-19, along with constant media coverage, likely contributed to
78 heightened distress. Indeed, surveys administered in several countries during the early stages of
79 the pandemic found high levels of general distress, anxiety, and depression among the general
80 public (Centers for Disease Control and Prevention, 2020, Centre for Addiction and Mental
81 Health, 2020, Wang et al., 2020). At the same time, closures and physical distancing measures
82 left many people without access to adaptive coping resources such as social support, places of
83 worship, recreational facilities, and counselling services, making research on coping during the
84 pandemic a high priority (see Holmes et al., 2020).

85 A salient concern is that many people will use alcohol to cope during the COVID-19
86 pandemic. Indeed, several reports from the media and other sources suggest that sales and
87 consumption of alcohol have increased in some areas since the start of the pandemic (BACTrack,
88 2020, Benzie, 2020, Carey, 2020). Moreover, a recent survey of adults across Canada found that
89 stress was a major contributing factor among those who reported increasing their alcohol use
90 during the pandemic (Canadian Centre on Substance Use and Addiction, 2020). Rehm et al.
91 (2020) recently predicted that alcohol consumption will increase as a long-term consequence of

92 the pandemic. The authors based this prediction on evidence from previous public health and
93 economic crises, including a comprehensive review by de Goeij et al. (2015), which found that
94 distress caused by the consequences of such crises (job/income loss, social consequences) was
95 associated with increased alcohol consumption.

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

112 Several external and internal factors associated with distress during the initial stages of
113 the COVID-19 pandemic could be especially important for predicting drinking to cope. For
114 example, the direct impacts of public health measures on aspects of work and home life may be
115 relevant, given that both work and family stress have been previously linked to drinking to cope

116 (e.g., Frone, 1999, Lambe et al., 2015). In particular, working from home during the pandemic
117 appears to be associated with greater anxiety (Centre for Addiction and Mental Health, 2020),
118 perhaps because this requires a greater adjustment in daily routines and could result in a clash
119 between home and work life. Similarly, not working at all (e.g., layoff, leave of absence, prior
120 unemployment) could be stressful due to difficulty finding work or experiencing lost productivity
121 during a time of economic crisis. In addition, there is evidence from several studies of past
122 economic crises (such as the 2007 economic downturns in the U.S. and Europe) that income loss
123 specifically (rather than reduced work hours more generally) leads to psychological distress that
124 then leads to alcohol use and problems (see de Goeij et al., 2015). With respect to home-related
125 factors, having children at home has been associated with increased anxiety early in the COVID-
126 19 pandemic (Centre for Addiction and Mental Health, 2020), likely because school and daycare
127 closures have placed additional demands on parents. Also, individuals living alone may have
128 restricted access to social support in the context of stay at home recommendations and may
129 experience greater distress as a result. Indeed, both parenting stress (Pelham Jr and Lang, 1999)
130 and low social support (Hasin and Grant, 2015, Peirce et al., 2000) have been previously
131 associated with alcohol consumption.

132 In addition, individual differences in internal distress during the pandemic could be
133 uniquely associated with greater coping motives for drinking. For example, as depression has
134 been linked with coping motives (e.g., Kenney et al., 2015, Holahan et al., 2003, Orui et al.,
135 2020), individuals experiencing depressed mood during the pandemic may be at greater risk for
136 drinking to cope. Anxiety is also strongly associated with drinking to cope (DeMartini and Carey,
137 2011, Allan et al., 2015). A specific form of anxiety that may be highly relevant during a
138 pandemic is health anxiety (i.e., worry about becoming ill; Asmundson and Taylor, 2020).
139 Perhaps individuals with greater levels of health anxiety could be at greater risk for drinking to

140 cope with their worry about contracting COVID-19. Finally, in the context of physical distancing
141 measures, feeling socially disconnected could be a relevant predictor of drinking to cope, as
142 research shows that loneliness and social disconnection is associated with greater alcohol use
143 (Arpin et al., 2015, Bonin et al., 2000, Sherry et al., 2012).

144 **The Present Study**

145 It is important to understand coping-motivated drinking during the COVID-19 pandemic
146 in order to inform alcohol intervention strategies. We evaluated a theory-based model of
147 associations among relevant external and internal factors, individual differences in coping
148 motives, changes in alcohol consumption and solitary drinking, and associated alcohol-related
149 problems. We surveyed adult drinkers across Canada who reported on their alcohol use, alcohol
150 problems, and coping motives for drinking over the past 30 days, covering a time period
151 beginning less than a month after the pandemic was declared and emergency public health
152 measures began to go into effect. These public health measures were similar across Canada and
153 included federal, provincial, and local orders that closed schools and non-essential businesses,
154 banned public gatherings, and encouraged people to stay home and practice physical distancing
155 (see OHS Canada, 2020). We forwarded the following hypotheses (see Figure 1 for hypothesized
156 model):

- 157 1. Working from home, not working (i.e., job loss, leave of absence, continuation of prior
158 unemployment), income loss, living with at least one child under age 18, living alone,
159 social disconnection, health anxiety, and depression would all be associated with greater
160 coping motives for drinking early in the pandemic.
- 161 2. Coping motives, in turn, would predict both increased alcohol consumption and increased
162 solitary drinking (controlling for retrospectively reported pre-pandemic levels), both of
163 which, in turn, would be associated with greater alcohol-related problems.

- 164 3. Coping motives would mediate the link between the stressors listed in hypothesis 1 and
165 alcohol-related problems via two specific pathways: coping motives to increased alcohol
166 consumption and coping motives to increased solitary drinking.
- 167 4. Some variables would also have direct relationships with alcohol outcomes. Specifically,
168 living alone and social disconnection would have direct links with increased solitary
169 drinking, as these factors may predict solitary drinking merely as a function of more time
170 spent alone. Further, as income losses could motivate individuals to *decrease* their alcohol
171 use to save money (de Goeij et al., 2015, Rehm et al., 2020), decreased income would have
172 a negative direct path to alcohol consumption independent of the indirect path through
173 coping motives. Also, coping motives would have a direct association with alcohol
174 problems, consistent with past research (e.g., Merrill et al., 2014), so that all indirect paths
175 via coping motives would be only partially mediated by alcohol use and solitary drinking.

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

184 **Method**

185 **Participants and Procedure**

186 Participants were recruited via Prolific, an online crowdsourcing platform for workers to
187 complete surveys. Prolific was designed explicitly for individuals to complete surveys, and the

188 participant pool tends not to be as over-studied as those on other platforms (Palan and Schitter,
189 2018, Peer et al., 2017). Research using similar crowdsourcing platforms (i.e., Amazon's
190 Mechanical Turk) demonstrates that addiction measures, including those that capture alcohol use,
191 can be reliably and validly administered using crowdsourcing methods (see Kim & Hodgins,
192 2017). Using participant information previously collected by Prolific, we recruited adults
193 residing in Canada who identified as alcohol users and had a history of high quality responses on
194 the platform (average approval rating was 99.4% in this sample). We also included 4 attention
195 check items (see Prolific Team, 2020) as a further quality control measure. Consistent with
196 Prolific's guidelines (Prolific Team, 2020), participants' data were automatically rejected from
197 the study if they failed 2 or more attention check items and had a very fast completion time
198 (defined as under 20 minutes in this study). Two participants were removed from the study based
199 on these criteria. Of the remaining 400 participants who completed the survey, none failed more
200 than one attention check. Only participants who reported drinking alcohol in the past 30 days and
201 who had complete data on all predictors of interest were included in the present analyses. The
202 current sample included 320 participants (54.6% male; 72% White) with a mean age of 31.99
203 years ($SD=9.24$). See Table 1 for additional sample information.

204 Data collection took place between April 30 and May 4, 2020¹. As most of the questions
205 were keyed to the past 30 days (see Measures for specific timeframes), participants reported on a
206 30-day period beginning soon after a state of emergency was declared and public health measures
207 went into effect in their area (which occurred between March 12 and March 27, depending on
208 location; OHS Canada, 2020). Further, participants were asked to report their alcohol use and
209 solitary drinking for both the past 30 days as well as the 30 days prior to the COVID-19
210 emergency (see Measures). Participants were compensated approximately CAD\$13 (converted
211 from GBP currency). The Office of Research Ethics at York University approved all procedures.

212 **Measures**

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

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

226 **Depression.** The Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001; 9-items;
227 $\alpha=.84$) measured depression severity over the last 30 days using a 4-point scale (0 = *Not at all* to
228 3 = *Nearly Every Day*). Responses to all items were summed to obtain a total depression score.
229 Research supports the reliability and validity of the PHQ-9, with scores on the total scale
230 corresponding to differing levels of depression severity (5-9 = Mild, 10-14 = Moderate, 15-19 =
231 Moderately Severe, 20+ = Severe; Kroenke et al., 2001).

232 **Social Connectedness.** The Social Connectedness Scale-Revised (Lee et al., 2001; 20
233 items; $\alpha = .94$) assessed feelings of interpersonal closeness and connectedness (e.g., “I feel close
234 to people”) in the last 30 days using a 6-point scale (1= *Strongly Disagree* to 6 = *Strongly Agree*).

235 Low scores are thought to reflect social disconnection and negative appraisals of one's social
236 relationships (Lee et al., 2001).

237 **Health Anxiety.** The Illness Attitudes Scales (Kellner, 1987; 27 items, $\alpha = .87$) assessed
238 attitudes, beliefs, and behaviours related to health anxiety using a 5-point scale (0 = *No* to 4 =
239 *Most of the time*). We used the standard version of the measure, which does not ask participants
240 to respond to items based on a specific time frame, and so scores represent trait-like health
241 anxiety. The Illness Attitudes Scales have high validity, reliability, and sensitivity (Sirri et al.,
242 2008). A total score was obtained by summing all items, with a score of 47 or higher indicating
243 severe health anxiety (Hedman et al., 2015).

244 **Coping Motives.** The Coping Motives scale of the Drinking Motives Questionnaire
245 Revised Short Form (Kuntsche and Kuntsche, 2009; 3 items; $\alpha = .85$) assessed how often
246 participants drank in order to cope with negative affect over the last 30 days (1 = *Never*, 2 =
247 *Sometimes*, 3 = *Always*).

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

256 **Solitary Drinking.** To measure frequency of solitary drinking, participants responded to
257 the following question with reference to both the past 30 days and the one-month period prior to
258 when the COVID-19 emergency was declared in their area: "When you drank alcohol, how much

259 of that time was spent drinking while you were by yourself relative to when socializing with
260 other people either in-person or virtually (e.g., voice/video chat such as Skype, Facetime, Zoom,
261 etc.)?” Given that many people began using virtual means of socializing during the pandemic, the
262 definition of social drinking included both in-person and virtual social contexts in order to avoid
263 participant confusion. Participants used a scale ranging from 0 = *100% by yourself* to 10 = *100%*
264 *with other people*. Responses were reverse coded so that higher values represented a greater
265 percentage of solitary vs. social drinking time.³

266 **Consequences of Alcohol Use.** The Short Inventory of Problems (15 items, $\alpha=.70$), a
267 subset of items from the Drinker Inventory of Consequences (Miller et al., 1995), assessed
268 alcohol-related problems over the past 30 days. Participants rated each item on a 4-point scale (0
269 = *Not at All/Never* to 3 = *Very Much/Daily or Almost Daily*), and items were summed to create a
270 total alcohol problems index.

271 **Data Analysis**

272 **Descriptive Analyses**

273 Prior to analyses, extreme outliers (i.e., greater than 3.29 standard deviations from the
274 mean and clearly disconnected from the rest of the distribution; Tabachnick and Fidell, 2007)
275 were recoded to 1 unit greater than the next most extreme value to reduce their potential for
276 exerting an undue influence on parameter estimates. This resulted in recoding 1 outlier on the
277 health anxiety variable, 5 outliers on both the pre-COVID-19 and past 30 day alcohol use
278 variables, and 3 outliers on the alcohol problems variable. Next, we conducted descriptive
279 analyses on the variables in our hypothesized model. Paired samples t-tests also were conducted
280 to examine whether there were any mean-level differences in alcohol use and solitary drinking
281 between the 30-days prior to the COVID-19 emergency and the past 30 days.

282

283 Mediation Model

284 To examine our hypotheses, we specified a path model using observed variables in Mplus
285 v. 7.4 (Muthén and Muthén, 2012). Most continuous variables reasonably approximated normal
286 distributions, with a few of the alcohol-related variables showing slight deviations from
287 normality (all skewness values < 1.96, all kurtosis values < 4.57). The robust maximum
288 likelihood estimator (MLR) was used to accommodate violations of the normality assumption.
289 Some participants ($n=25$) were missing data on the alcohol problems variable due to a technical
290 issue with the survey. These participants were retained in the analysis through the use of MLR
291 estimator.

292 The hypothesized path model is depicted in Figure 1. Independent variables included
293 home- and work-related variables, depression, social connectedness, and health anxiety. For
294 home-related variables, our model included: (a) a dichotomous indicator for living alone (vs.
295 living with others), and (b) a dichotomous indicator for having at least one child under the age of
296 18 living at home (vs. not). To examine work status, we included the dichotomous indicator “not
297 currently working” based on the item assessing the impact of the pandemic on work status
298 (1=laid off, on leave, quit job; 0=still working). Participants who reported being unemployed
299 prior to the COVID-19 emergency and reported no increases in work hours during the pandemic
300 were also coded as not currently working. A dichotomous indicator for “working from home”
301 (1=yes; 0=not working from home/not currently working) was also included. Given that the item
302 assessing change in income due to COVID-19 was skewed and bimodal (see Table 1), we created
303 a binary indicator for “income loss” (1=decrease in income, 0=no change/increase in income).

304 To evaluate our hypotheses, the independent variables were specified as simultaneous
305 predictors of past 30-day coping motives for drinking, which in turn was specified as a predictor
306 of both past 30-day alcohol use (QF index) and past 30-day solitary drinking. The residuals for

307 the alcohol use and solitary drinking variables were allowed to freely covary. In addition, reports
308 of alcohol consumption and solitary drinking in the 30 days prior to the COVID-19 emergency
309 were included as covariates (see Figure 1), so that coping motives predicted *relative changes* in
310 alcohol use and solitary drinking in the past 30 days.

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

322 We used the following criteria as an indication of good model fit: Root Mean Square
323 Error of Approximation (RMSEA) < .06, Comparative Fit Index (CFI) > .95, and Standardized
324 Root Mean Square Residual (SRMR) < .05 (Hu and Bentler, 1999). In the event that the model
325 did not fit the data well, we planned to examine modification indices for potential sources of
326 misfit and re-specify the model if indicated. Given the posthoc nature of this process, we only re-
327 specified the model based on modification indices > 10 that made conceptual sense within our
328 theoretical framework. Once the final model was specified, bootstrapping (with 10,000 samples)
329 was used to estimate bias-corrected confidence intervals (CI) for hypothesized indirect paths.

330

Results

331

332 Descriptive Statistics

333 Table 1 shows descriptive data for categorical variables, and Table 2 contains means and
334 standard deviations for continuous variables. On average, participants reported living with 1.96
335 ($SD=1.39$) other people, with approximately 13% indicating that they lived alone. Of the
336 participants who indicated that they had children under the age of 18 living with them, the
337 average age of the youngest child was 5.71 years old ($SD=4.93$). More than half of participants
338 reported a change in work hours during the pandemic, and a large portion of the sample reported
339 that they were currently working from home (see Table 1). The majority (55%) reported no
340 change in personal employment income since the COVID-19 emergency was declared. Still, a
341 sizable portion (19%) reported losing 100% of their personal income. As shown in Table 2, the
342 average score on the PHQ-9 was 7.57, representing mild-to-moderate depression in the past 30
343 days, with 2.5% of the sample scoring above the cut off for severe depression. Further 17% of the
344 sample scored at or above the cut off for severe health anxiety (i.e., 47) on the Illness Attitudes
345 Scales.

346 Table 2 also shows descriptive statistics for alcohol use and solitary drinking in the 30
347 days prior to the COVID-19 emergency and in the past 30 days, along with paired samples *t*-tests
348 for differences between these two reference periods. Average drinking frequency was slightly
349 higher, and average drinking quantity was slightly lower, for the past 30 days vs. the 30 days
350 prior to the COVID-19 emergency. Consequently, the mean QF score, an index of total alcohol
351 consumption, did not differ significantly between the pre-COVID and past 30-day reference
352 periods (see Table 2). In contrast, there was a statistically significant increase in solitary drinking
353 reported for the past 30 days relative to the 30 days prior to the COVID-19 emergency.
354 Inspection of means in Table 2 suggests that percentage of solitary vs. social drinking time

355 increased from an average of 30-40% to an average of 40-50%. Finally, the total score on the
356 Short Inventory of Problems suggests low levels of past 30-day alcohol problems in the sample,
357 although total scores ranged from 0 to 21, indicating variability across participants.

358 **Mediation Model**

359 **Model Results.** The initial hypothesized model did not fit the data well, adjusted
360 $\chi^2(25)=112.44, p<.001, RMSEA=.105, CFI=.882 SRMR=.042$. Inspection of modification
361 indices revealed that the greatest improvement in model fit could be achieved by estimating the
362 path from pre-COVID alcohol use to past 30-day coping motives (MI=55.13). As this made sense
363 conceptually, we re-specified the model to include this path. The modified model fit the data
364 well, adjusted $\chi^2(24)=51.20, p=.001, RMSEA=.060, CFI=.963, SRMR=.026$, and was used as the
365 final model, with no further modification indices meeting our criteria for consideration.

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

377 Although the hypothesized association between COVID-related income loss and coping
378 motives only approached statistical significance ($p=.087$), income loss did have a significant,

403 anxiety, and depression in the general public (Centers for Disease Control and Prevention, 2020,
404 Centre for Addiction and Mental Health, 2020, Wang et al., 2020), it is likely that many people
405 will use alcohol to cope with distress during the pandemic (see Canadian Centre of Substance
406 Use and Addiction, 2020; Rehm et al., 2020). The goal of this study was to provide an empirical
407 examination of coping-motivated pathways to alcohol use and problems during the early stages
408 of the pandemic, in order to help inform targeted interventions.

409 In our path model, we found that individual differences in coping motives for drinking
410 were associated with both alcohol consumption and alcohol problems reported for the past 30
411 days, a time period that closely followed the onset of emergency public health measures across
412 Canada. Although we cannot determine if coping motives and alcohol problems changed relative
413 to pre-emergency levels, we did control for retrospectively reported alcohol consumption during
414 the 30 days prior to the initiation of emergency public health measures. Findings suggest that,
415 although significant variance in coping motives could be explained by pre-emergency levels of
416 alcohol use, coping motives were still associated with *increased* alcohol consumption in the past
417 30 days relative to pre-emergency levels. Increased alcohol consumption, in turn, was associated
418 with greater alcohol problems, partially mediating the link between coping motives and alcohol
419 problems. The findings are consistent with the large literature linking coping motives to heavier
420 alcohol consumption and alcohol-related harms (Kuntsche et al., 2005, Cooper et al., 2016), and
421 provide evidence that coping motives for drinking were associated with increased alcohol
422 consumption early in the COVID-19 pandemic. Thus coping motives may be an important point
423 of intervention to curb the increase in alcohol use and associated harms that are expected to result
424 from the pandemic over the long run (Rehm et al., 2020).

425 We examined several hypothesized coping motive pathways to alcohol use and problems
426 from various factors that were thought to be relevant for drinking to cope early in the pandemic.

427 First, we found that greater depressive symptoms and lower social connectedness were associated
428 with greater coping motives, which in turn mediated their associations with increased alcohol
429 consumption and greater alcohol problems. These findings are consistent with the large body of
430 prior research supporting the role of depressive symptoms and feelings related to social
431 disconnection (e.g., loneliness) in coping pathways to drinking (Arpin et al., 2015, Cooper et al.,
432 2016, Sadava and Thompson, 1986). Given that depression appears to have increased since the
433 onset of the COVID-19 pandemic (Centers for Disease Control, 2020, Centre for Addiction and
434 Mental Health, 2020), and that ongoing physical distancing measures are likely to contribute to
435 further social disconnection, these findings highlight the importance of addressing coping-
436 motivated drinking among depressed and socially disconnected individuals. In contrast, we did
437 not observe the hypothesized association between health anxiety and drinking to cope. This
438 finding could be related to the fact that we focused on general, trait-like health anxiety rather than
439 COVID-specific, state increases in health anxiety symptoms. Further, our sample had a relatively
440 young average age, and less than 65,000 cases of COVID-19 had been confirmed across Canada
441 by the time of the survey (Government of Canada, 2020), perhaps making the health risks less
442 salient to participants in this study. Research in regions harder-hit by COVID-19 will be
443 necessary to fully examine the role of health anxiety in coping-motivated drinking.

444 With respect to the hypothesized work- and home-related stressors, only having a child
445 under the age of 18 living at home was uniquely associated with coping motives for drinking.
446 Given that daycares and schools across Canada were closed during the early stages of the
447 pandemic, parents may have experienced increased stress (e.g., due to increased childcare
448 demands, conflicting obligations to children and work, etc.), which could have increased their
449 likelihood of using alcohol as a coping strategy. Indeed, a recent Canadian study that found that
450 parents with children under age 18 reported higher levels of anxiety early in the pandemic

451 (Centre for Addiction and Mental Health, 2020). The finding that living with children under 18
452 was associated indirectly with alcohol problems via greater coping motives and increased alcohol
453 use is also consistent with prior research showing an association between parenting stress and
454 alcohol consumption (Pelham Jr and Lang, 1999). Our findings suggest that future research on
455 coping during the COVID-19 pandemic should focus on the unique needs of parents.

456 Although the hypothesized association between income loss and coping motives only
457 approached statistical significance, income loss was directly associated with greater alcohol
458 consumption. Although we hypothesized a negative direct association based on the assumption
459 that individuals may reduce their alcohol consumption as a cost-savings measure (Rehm et al.,
460 2020, de Goeij et al., 2015), we instead observed a positive association in our sample. Perhaps
461 because our sample had a relatively high median annual income (\$80,000 - \$100,000), and relief
462 funding was provided by the Canadian government to millions of individuals claiming lost
463 income (Government of Canada, 2020), most participants who reported income losses likely did
464 not have to resort to immediate cost-savings measures such as reducing their drinking. Moreover,
465 the negative effect of income loss on alcohol consumption may have been offset by a shift to less
466 costly drinking behaviour (de Goeij et al., 2015, Rehm et al., 2020), such as shifting to drinking
467 at home when bars and other venues were closed by public health orders. Still, these
468 considerations do not explain the observed positive association between income loss and
469 increased drinking that was not mediated by coping motives. Further, this association does not
470 appear to be an artefact of less time spent working as we controlled for work status (including
471 non-working status) in our model. Thus, the mechanisms that may explain the observed link
472 between income loss and alcohol consumption require further exploration in future research.

473 In addition, although living alone was not associated with coping motives and coping
474 motives were not associated with solitary drinking, living alone was associated directly with

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

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

497 This study had several limitations that must be considered. Foremost among these is the
498 cross-sectional nature of the data, which precludes examination of temporal relationships among

499 variables. Although specification of our path model was guided by theory and previous research,
500 we cannot rule out alternative models of the directional associations among the variables.
501 Although we were able to model changes in alcohol consumption and solitary drinking relative to
502 pre-pandemic levels, pre-pandemic drinking was reported retrospectively, making it prone to
503 recall bias. We also did not have data on pre-pandemic alcohol problems, further adding to this
504 limitation. Longitudinal research, which is currently planned with this sample, will be important
505 for establishing the directionality of associations in this model and for examining the longer term
506 alcohol outcomes associated with coping-motivated drinking during the pandemic.

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

519 In conclusion, the findings improve our understanding of coping-motivated drinking in
520 the context of the extreme public health measures that were enacted early in the pandemic, which
521 will be informative if a second wave of COVID-19 (or indeed a new public health crisis) requires
522 a similar emergency response in the future. As the public health measures that were in place

523 across Canada and much of the world when the data were collected have gradually started to be
524 lifted at the time of this writing, it will be important to track how the relevance of the factors
525 examined here changes as the pandemic response shifts over time. The findings may inform
526 coping skills interventions that can be targeted toward individuals at risk for drinking to cope
527 during the COVID-19 pandemic.

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Notes

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

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-days 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 chose 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.

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 behaviour during that time period.

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732 **Figure Legend**

733 **Figure 1.** Final model of coping motive pathways to alcohol use, solitary drinking, and alcohol

734 problems early in the COVID-19 pandemic. All hypothesized paths are shown (solid arrows),

735 with bolded arrows denoting statistically significant paths. Dashed arrow represents a non-

736 hypothesized path that was added to the model post hoc based on the modification index. Sex,

737 race/ethnicity, age, and annual income were included as covariates in the model but are not

738 depicted in the figure (see Results for findings related to these covariates). Standardized estimates

739 are shown with standard errors in parentheses. y/o = years old. †p < .10, *p < .05, **p < .001.

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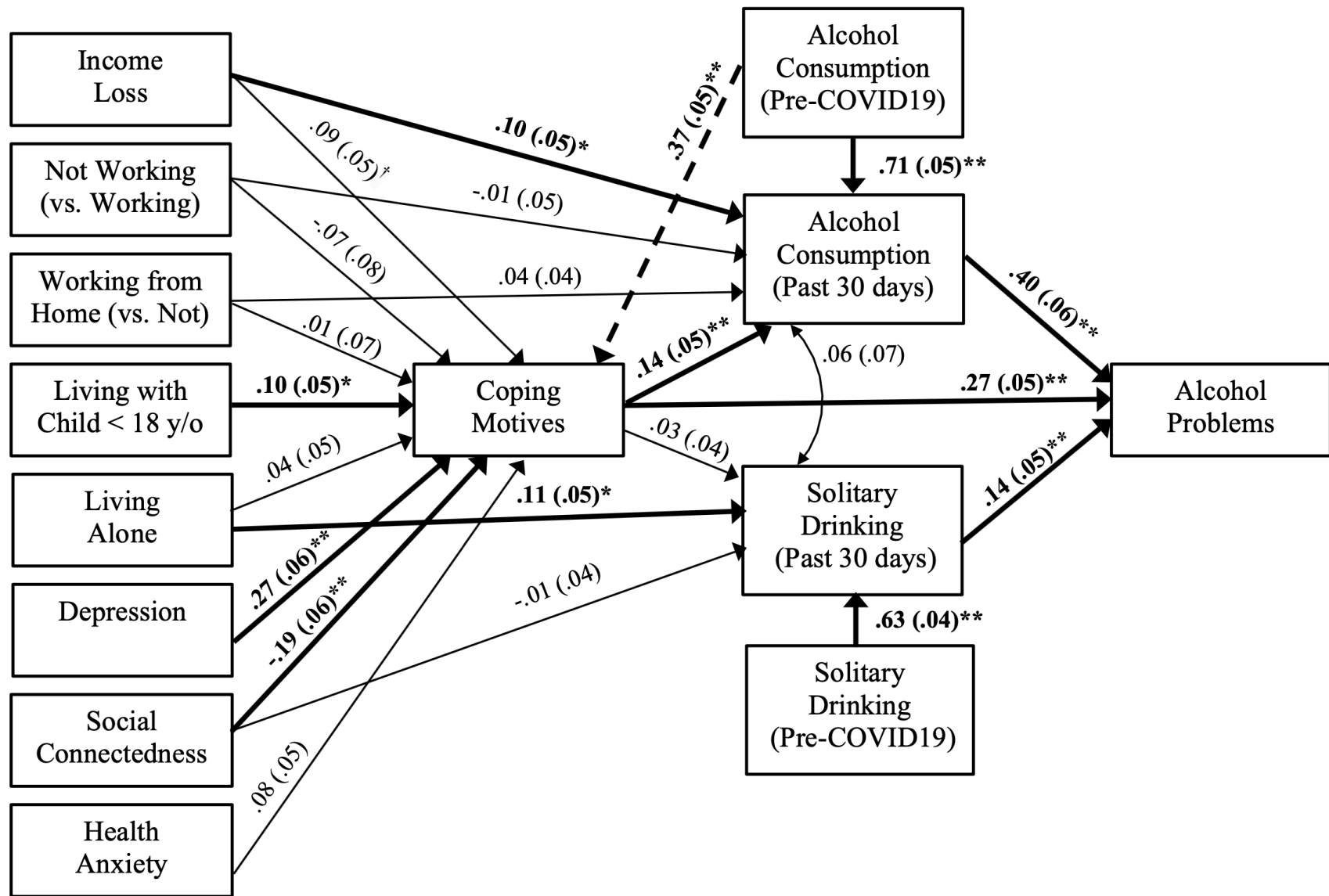


Figure 1. See legend on previous page.

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

	<u><i>n</i></u>	<u><i>%</i></u>		<u><i>n</i></u>	<u><i>%</i></u>
<u>Province</u>			<u>PreCOVID-19 Employment Status</u>		
Ontario	162	50.6%	Unemployed or non-working 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%	<u>Impacts of COVID-19 on Work</u>		
Other	44	13.8%	Laid off and not working any hours	69	21.6%
<u>Race/Ethnicity (check all that apply)^a</u>			Paid/unpaid leave	17	5.3%
White	231	72.2%	Quit job	7	2.2%
East Asian, South-East Asian, Pacific Islander	47	14.7%	Reduced hours	62	19.4%
Black	17	5.3%	No change in hours	139	43.4%
South Asian	15	4.7%	Increased hours	26	8.1%
Hispanic, Latino	13	4.1%	<u>Income Change due to COVID-19^b</u>		
Other	17	5.3%	Currently working from home	151	47.2%
<u>Student Status</u>			Reduced 100%	62	19.4%
Non-student	244	76.3%	Reduced 51-99%	15	4.7%
Part-time student	31	9.7%	Reduced 10-50%	33	10.3%
Full-time student	45	14.1%	Reduced by up to 10%	24	7.5%
<u>Relationship Status</u>			No change	176	55.0%
Single (never married or divorced)	115	36.0%	Increased income	10	3.1%
Common-law / married / long-term relationship	205	64.0%	<u>Home Variables</u>		
<u>Annual Household Income</u>			No children	229	71.6%
Less than \$20,000	26	8.1%	Has child(ren) under age 18 at home	81	25.3%
\$20,000 - \$39,999	40	12.5%	Has child(ren) over 18 and/or not at home	10	3.1%
\$40,000 - \$59,999	42	13.1%	<u>Lives Alone</u>		
\$60,000 - \$79,999	43	13.4%	Lives Alone	40	12.5%
\$80,000 - \$99,999	60	18.8%			
\$100,000 - \$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: it has increased (e.g., due to overtime, increased business), it was not affected at all, reduced by up to 10%, reduced by 10-25%, reduced by 25-50%, reduced by 51-75%, 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.

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

	<i>M</i>	<i>SD</i>					
Health Anxiety	34.08	13.19					
Depression	7.57	5.29					
Social Connectedness	79.59	16.95					
Total 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>	<i>df</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
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*	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

Notes.

^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 *Three to four 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).

* $p < .05$, ** $p < .01$.

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 Prob	.039	[.005, .081]
Child < 18 y/o → COP → ALC Use → ALC Prob	.006	[.001, .016]
Child < 18 y/o → COP → ALC Prob	.028	[.005, .061]
Living Alone → SOL Drinking → ALC Prob	.015	[.002, .039]
Depression → COP → ALC Use → ALC Prob	.014	[.005, .032]
Depression → COP → ALC Prob	.073	[.036, .124]
Social Connectedness → COP → ALC Use → ALC Prob	-.010	[-.024, -.003]
Social Connectedness → COP → ALC Prob	-.051	[-.096, -.022]

Notes. 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, COP = Coping Motives, SOL = Solitary, y/o = years old.

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