



Drinking among university students with a history of reading difficulties: motivational and personality risk factors for hazardous levels of consumption

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Abstract

An increasing number of students are entering university with reading difficulties—whether they be diagnosed or self-reported. Research demonstrates that university students who self-report a history of reading difficulties (HRD) have lower academic achievement and higher anxiety about academic performance as compared to peers without this history (NRD). Here we study other aspects of HRD students' university experiences, focusing on alcohol consumption. Specifically, we investigated the drinking motives and personality characteristics likely to increase risk of hazardous alcohol consumption among HRD vs. NRD undergraduates. We identified 42 HRD and 54 NRD participants based on responses to a reading history questionnaire. Participants completed questionnaires assessing hazardous drinking, drinking motives, and alcohol-risk personality traits. Both groups reported similarly high levels of hazardous drinking. HRD students reported drinking more to conform with peers, and less to enhance positive moods, than NRD students. HRD students also scored higher in the alcohol personality risk of impulsivity. Our results support a unique pattern of motives and personality risks among HRD students, a pattern that likely puts them at increased risk for sustained hazardous drinking. Clinical implications for preventing problem drinking among HRD undergraduates are considered.

Keywords Conformity drinking · Drinking motives · Enhancement drinking · History of reading difficulties · Impulsivity · Substance abuse · University experience

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In recent years, improved early identification practices as well as accommodation services at the elementary, secondary, and postsecondary levels have made university education more accessible to students with learning disabilities, including those with dyslexia (e.g., Philpott & Fiedorowicz, 2012; Learning Disability Association of Ontario, 2018). Yet, there exists a population who, despite similarly poor word reading skills as students diagnosed with learning disabilities (Deacon et al., 2012), have not necessarily benefited from early identification nor received access to accommodations: university students with a self-reported history of reading difficulties (HRD, Parrila et al., 2007). Evidence suggests that HRD students are at greater risk for academic difficulties and dropout than their peers without this history (NRD; e.g., Bergey et al., 2017). While the current research demonstrates that HRD students are likely to struggle academically (e.g., MacKay et al., 2019; Parrila et al., 2007), we know very little about other key predictors of success at university, such as mental health and substance use. Breaking this trend, a recent study suggested that HRD students experience more academic-specific mental health challenges than their NRD peers (Elgendi et al., 2021). Considering the strong bidirectional relation between mental health difficulties and hazardous alcohol use, particularly among university students (Hudson et al., 2018), we investigated the rates of hazardous drinking and associated motives and personality traits in first year HRD students. Doing so provides novel data toward understanding the myriad of risks experienced by HRD students, as well as how to mitigate them.

Differentiation among history of reading difficulty and learning and reading disabilities

To ensure clarity in our review of the available scientific knowledge, we contextualize our population of interest and other related groups. We differentiate between the terms history of reading difficulty (HRD), learning disability (LD), and reading disability (RD). HRD students are defined by their self-reported difficulties with reading, and thus are not required to have an official diagnosis. This contrasts both LD and RD students who have official diagnoses. RD represents a subtype of LD that has shared and unique features with other LDs, such as a disability in math (e.g., Child et al., 2019; Peterson et al., 2021). Regardless of disability type, all students with diagnosed LD have access to academic accommodations. However, as it is a requirement that one has an official diagnosis to access these accommodations, a key difference between HRD students and those diagnosed with any LD is HRD students lack access to such accommodations. This is concerning: HRD and RD students have similarly poor word reading skills (Deacon et al., 2012) and both groups have substantially poorer reading and spelling skills than NRD students (e.g., Kemp et al., 2009). HRD students are also shown to be slower at answering questions after reading a text than their NRD peers (Hebert et al., 2018). Limited access to accommodations, then, may result in poorer academic performance for HRD students as compared to students who have access to accommodations, a hypothesis that has indirect evidence. While research reliably demonstrates that HRD students have lower GPAs than NRD students (Bergey et al., 2017), there is less consistency in findings as to the academic performance of students with and without diagnosed learning disabilities (e.g., Hen & Goroshit, 2014). Further, students with diagnosed learning disabilities who access accommodations have more contact with faculty and less difficulty completing assignments than students with learning disabilities who do not access accommodations (McGregor et al.,

2016). Access to accommodations may act as a protective factor against poor academic performance. This leads to the possibility that accommodations might also mitigate harms from the adverse consequences of poor academic performance, such as increased substance use and mental health challenges. Unfortunately, unlike their peers with a diagnosed LD, HRD students are not offered the potential protective factor of academic accommodations and therefore may be at an even greater risk for the harms associated with poor academic performance.

Hazardous alcohol use

One decisive predictor of both academic and mental health challenges is hazardous alcohol use. Here, we conceptualize hazardous alcohol use as representing heavier drinking levels, assessed by querying the frequency and quantity of alcohol consumed within a given timeframe (AUDIT-C; Saunders et al., 1993). Critically, there are adverse consequences of hazardous drinking that arise in university and can continue beyond these years, including physical, social, and emotional harms. In a recent study, 55% of Canadian university students who drink reported at least one harm because of their drinking, including blacking out, engaging in unplanned and unprotected sexual activity, and sustaining physical injuries (American College Health Association, 2013). Research also suggests that students' hazardous drinking is linked to lower GPA (e.g., Bolin et al., 2017) and lower levels of employment after university (Bamberger et al., 2018). Further, while some students mature out of hazardous alcohol use, others maintain hazardous drinking beyond university (Bilevicius et al., 2021). Given the serious consequences of hazardous drinking, understanding hazardous drinking patterns among HRD students is crucial.

Several researchers have theorized a link between learning disabilities and alcohol and other substance use (e.g., Cosden, 2001; Jhanjee, 2015); however, we were unable to find literature on alcohol use and HRD students in particular. In the absence of studies on hazardous drinking among HRD students, we turn to the existing, although small (see Cosden, 2001; Palfiova et al., 2016) body of research with students with learning disabilities for ideas as to how learning challenges might be related to levels of hazardous drinking in university. The rationale is that the mental health consequences of learning disabilities—including emotional and social problems and low self-esteem—are also risk factors for increased hazardous alcohol and other substance use (e.g., Jhanjee, 2015). Indeed, select studies point to the possibility that students with learning disabilities are at increased risk of hazardous drinking. For example, Beitchman et al. (2001) found that the presence of learning disabilities at 12 years old represented a threefold risk for developing substance use disorders (including alcohol use disorder) at age 19. Similarly, DuPaul et al. (2017) demonstrated that first-year university students with learning disabilities reported more alcohol use than their peers. Yet, one study with university students with dyslexia found that these students drank less than their peers (Wilcockson et al., 2016). The students with dyslexia in this study, however, were 21–22-year-olds, suggesting they were beyond first year and therefore had found ways to succeed at university, perhaps, in part, by limiting their alcohol use. This sample likely represents a different group than first-year university students, whose successes at university are still unknown. Finally, no differences in rates of alcohol use emerged in a study with 15- and 16-year-olds with and without learning disabilities (McNamara & Willoughby, 2010); that said, this might be too young an age at which to detect differences in alcohol use given restricted access at this age. Overall, then,

studies suggest that higher levels of alcohol use may emerge in university students with than in those without diagnosed learning disabilities. And yet we need to remember the differences in HRD students' university experiences, particularly in terms of their disconnect from services and staff in the face of their academic challenges (e.g., Bergey et al., 2017). These differing experiences might place this population at higher risk for hazardous drinking than students with learning disabilities.

The “why” of hazardous alcohol use: motivational and personality risks

The question of levels of hazardous drinking is undoubtedly an important one; however, an equally important query arises in why HRD students may engage in, or be at risk for, hazardous drinking. Here we turn to extant research on both the motivational and personality risks for hazardous alcohol use among university students (e.g., Grant et al., 2007; Richards et al., 2021). Examining such vulnerability factors is crucial: the motives for drinking as well as alcohol-risk personality traits are related to sustained hazardous alcohol use over time and the associated problems that may emerge (e.g., Bilevicius et al., 2021; Simons et al., 2005). Further, if we are to effectively intervene on hazardous alcohol use among HRD students, clear targets need to be identified; exploring the motives and traits related to alcohol use provides us a useful starting point (Canale et al., 2015; Conrod et al., 2006). Investigating these known predictors of alcohol use, then, not only advises on HRD students' risks for sustained hazardous drinking, but also what we might target to effectively mitigate these risks. As such, we explore the motives for drinking and alcohol-related personality traits among HRD vs. NRD students.

Motivational risks for hazardous alcohol use

Our research into this question builds on a conceptual organization of the various reasons that young people drink alcohol put forward by Cooper (1994; Cooper et al., 2016). She proposed a four-factor drinking motives model with two distinct dimensions of desired outcomes from drinking. The first is external versus internal, referring to whether the individual is trying to change something in their social environment or something within themselves through drinking. The second is positive versus negative reinforcement—whether the individual is trying to add something rewarding or take away something aversive through drinking. Crossing these two dimensions yields four drinking motives: social (external, positive reinforcement; drinking to increase social affiliation), enhancement (internal, positive reinforcement; drinking to increase positive emotions), conformity (external, negative reinforcement; drinking to reduce social censure), and coping (internal, negative reinforcement; drinking to reduce negative emotions). This latter category has since been further sub-divided into conceptually and empirically distinct coping motives—specifically, coping with anxiety and with depression—each with their own antecedents and consequences (e.g., Grant et al., 2007).

This model provides us with a framework to hypothesize the specific reasons that HRD students might drink hazardously, reasons that might differ from those for NRD students. Here, we remember that despite facing more academic challenges as compared to their peers without this history (e.g., Bergey et al., 2017), HRD students are not guaranteed access to academic accommodations. Facing these academic challenges unsupported may be related to the increased mental health challenges documented in the HRD population,

including higher academic anxiety and lower academic self-efficacy as compared to NRD students (Elgendi et al., 2021). The latter is the only study to our knowledge to investigate the mental health of HRD students. Importantly, however, comparable mental health challenges to those seen in HRD students, such as increased anxiety and lower self-esteem, emerge in students with diagnosed learning disabilities (e.g., Klassen et al., 2013; Wilson et al., 2009) and students with a specific reading disability (Francis et al., 2019). This combination of academic and mental health challenges experienced by university students with HRD may be a driving force for them drink to cope with the associated negative feelings. Thus, we explored whether HRD students would drink more to cope with anxiety and depression than their NRD peers.

In line with Cooper's (1994, 2016) model, there may also be other motives for HRD students to drink. For instance, Stack-Cutler et al. (2015) showed that HRD students find personal social connections (friends, family, and significant others) more important than institutional connections (e.g., accommodations) to achieve their academic goals. Stack-Cutler et al.'s results underscore the connection HRD students may want and need to feel with their peers to succeed at university. These results were further supported in Stack-Cutler et al.'s (2016) study, wherein perceived social support mediated the relation between number of co-morbid disabilities, including reading difficulties, and life satisfaction in an HRD sample. Such findings can be well understood in the context of research with university students with learning disabilities that demonstrates increased feelings of loneliness and isolation, as well as higher rates of bullying, than their peers (e.g., Heiman & Shemesh, 2019; Rosenstreich et al., 2015). Within Cooper's (1994; Cooper et al., 2016) drinking motives model, we can map the feeling of desire to belong onto an increased risk of conformity-motivated drinking. Thus, these findings point to the possibility that HRD students will be more motivated to drink to conform than their NRD peers.

Personality traits as risks for hazardous alcohol use

In addition to motives for alcohol use, specific personality traits are predictive of hazardous alcohol use. There is a relevant four-factor model of personality traits associated with risk for hazardous drinking (Castellanos-Ryan & Conrod, 2012; Pihl & Peterson, 1995) developed for the general population. The four factors are anxiety sensitivity, or the fear of anxiety-related sensations (Reiss et al., 1986; Taylor, 2020); hopelessness, or a low expectation of desirable events and high expectation for aversive events (Abramson et al., 1989; Baines et al., 2016); sensation seeking, or the desire for novel experiences (Hamdan-Mansour et al., 2018; Zuckerman, 1994); and impulsivity, or the tendency to act without careful forethought (Dawe & Loxton, 2004). The former two traits are considered internalizing traits, while the latter two are externalizing. Importantly, each of these personality traits is predictive of hazardous alcohol use in general samples of university students/emerging adults (e.g., Adams et al., 2012; Schmidt et al., 2007; Stautz & Cooper, 2013).

Integrating evidence across studies allows us to predict the personality traits likely to be endorsed in the HRD sample. Populations with HRD and learning disabilities are at increased risk to experience negative emotions (e.g., Francis et al., 2019; Wilson et al., 2009) and anxiety sensitivity, hopelessness, and impulsivity are related to a greater susceptibility to experiencing such negative emotions (e.g., Huang, 2015; Joiner, 2000; McLaughlin et al., 2007; Olatunji & Wolitzky-Taylor, 2009). Further, research suggests that the alcohol-related personality traits of anxiety sensitivity, hopelessness, and impulsivity are related to negative reinforcement motives for drinking (e.g., Woicik et al., 2009).

As discussed above, we expect our HRD population to endorse negative reinforcement motives for drinking more strongly than their NRD peers. Together, these findings suggest a heightened probability of HRD students endorsing the personality traits of anxiety sensitivity, hopelessness, and/or impulsivity relative to NRD students.

Present study

The three goals of this study were to compare the (a) hazardous drinking levels, (b) drinking motives, and (c) alcohol-risk personality traits between university students with and without a history of reading difficulties. Based on past work, we had three hypotheses aligning with each of our goals. We predicted that:

- 1) HRD students would report higher levels of hazardous drinking than NRD students.
- 2) HRD students would endorse more negative reinforcement motives for drinking (coping with anxiety, coping with depression, and conformity) than NRD students.
- 3) HRD students would endorse greater internalizing (anxiety sensitivity and hopelessness) and impulsive personality traits than NRD students.

Method

Participants

Participants were English-first language first-year university students attending a large public university in Eastern Canada. Participants were recruited through a larger study focusing on mental health and substance use (Caring Campus survey; Stuart et al., 2019). Based on responses from the Adult History Reading Questionnaire—Revised (ARHQ-R) (Parrila et al., 2003, described below), we used previously determined cut-off scores to select a final sample of 96 students: 42 in the HRD group (16.7% male, 80.9% female, and 2.4% other; $M_{\text{age}} = 18.55$ [0.78]) and 54 in the NRD group (18.5% male and 81.5% female; $M_{\text{age}} = 18.71$ [2.24]). The two groups did not differ significantly on any assessed demographic variable, including age, gender distribution, diagnoses, and majors (Table 1). The participants described here come from the same sample as Elgendi et al. (2021), with slight differences in sample characteristics and cell sizes given the different measures and requirements across studies.

Measures

Demographic questionnaire

Participants completed a researcher-developed demographics questionnaire as part of the larger project, prior to being recruited for the current study. We collected information on several demographic components. The variables that were relevant to this study were age, gender, diagnoses of neurodevelopmental and/or mental health diagnoses, and majors.

Table 1 Means and standard errors for demographic variables of the HRD ($N=42$) and NRD ($N=54$) groups

Variable	HRD	NRD	<i>p</i> value
Age (in years)	18.55 (0.12)	18.71 (0.34)	.671
Gender			
Man	7 (16.7%)	10 (18.5%)	.611
Woman	34 (80.9%)	44 (81.5%)	
Other	1 (2.4%)		
LD and/or ADHD Dx			
No	40 (95%)	51 (94%)	.897
Yes	2 (5%)	3 (6%)	.482
Drinker status			
No	10 (23.8%)	11 (20.4%)	.686
Yes	32 (76.2%)	43 (79.6%)	
Hazardous drinker status			.343
No	17 (40.5%)	21 (38.9%)	
Yes	25 (59.5%)	33 (61.1%)	

Reading history

The Adult Reading History Questionnaire-Revised [ARHQ-R] is a three-scale, 24-item questionnaire designed to identify students who self-report a history of reading difficulties (Parrila et al., 2003). Each item is rated on a Likert scale ranging from 0 (disagreement) to 4 (agreement). An example question is “How much difficulty did you have learning to read in elementary school?,” where 0 is *none* and 4 is *a great deal*. The ARHQ-R is an internally consistent measure ($\alpha=0.90$ in Parrila et al., 2007) and has been validated as a measure of reading abilities in undergraduate students (Parrila et al., 2007).

Following on past work with this population (e.g., Elgendy et al., 2021; MacKay et al., 2019), we used the 8 items from the elementary subscale to generate a proportion score and identify first-year university students who self-reported as having a history of reading difficulties (see Appendix for these questions). The proportion score was calculated by dividing each participant’s score by the maximum score of 32. Proportion scores ranged from 0 to 1, with higher values reflecting a more substantial history of reading difficulties. Consistent with prior work (e.g., Parrila et al., 2007), we used the following cut-off scores for group classification: participants with proportion scores equal to or less than 0.25 were assigned to the NRD group, and participants with proportion scores equal to or greater than 0.37 were assigned to the HRD group. The mid-range group was excluded from the sample.

Hazardous drinking

Hazardous drinking was assessed using the Alcohol Use Disorder Identification Test—Consumption scale (AUDIT-C), a 3-item scale from the AUDIT assessing drinking habits (Saunders et al., 1993). Specifically, the AUDIT-C queries the frequency of drinking, frequency of binge-drinking, and quantity of drinks consumed per episode. Each item is rated on a Likert scale of 0 (*very infrequent drinking* or *minimal drinks*)–4 (*very frequent drinking* or *many drinks*). The total score from the AUDIT-C is calculated by summing the

scores from the 3 items; this produces a score of 0–12, with higher values reflecting more hazardous drinking. The AUDIT-C has good concurrent and discriminant validity (Bohn et al., 1995). In our sample, the AUDIT-C had an acceptable reliability of $\alpha=0.771$.

We also used the AUDIT-C to categorize our sample into hazardous and non-hazardous drinkers. Specifically, we used an AUDIT-C score of 5 as our criterion: a score of greater than and equal to 5 indicated hazardous drinking, while a score of less than 5 indicated non-hazardous drinking. This cut-off score demonstrates strong sensitivity and specificity in separating university students who do and do not drink hazardously (Dawson et al., 2005).

To divide our sample into drinkers and non-drinkers, we used the item “How often do you have a standard drink containing alcohol?.” Those who responded *never* were classified as non-drinkers; all other participants were classified as drinkers. Only the drinkers were administered the measure of drinking motives.

Drinking motives

Motives for drinking were assessed using the Modified Drinking Motives Questionnaire—Revised (M-DMQ-R; Grant et al., 2007), a 23-item self-report questionnaire on which participants report how often in the past term they used alcohol for a particular reason. Each item is rated on a 5-point Likert scale ranging from 1 (*almost never/never*) to 5 (*almost always/always*).

Five subscales are scored for this measure, representing conceptually and empirically distinct motivations for drinking: social, enhancement, conformity, coping with anxiety, and coping with depression. Higher subscale scores reflect greater endorsement of a particular motive. These subscales have good internal consistency, test–retest reliability, and factorial validity in undergraduates (e.g., Grant et al., 2007). In our sample, these subscales had acceptable to good reliabilities ranging from $\alpha=0.659^1$ (coping with anxiety) to 0.869 (social).

We also combined these five subscales into two higher order scales of positive and negative reinforcement motives for drinking. Specifically, enhancement and social motives were combined to form the positive reinforcement scale, while conformity, coping with anxiety, and coping with depression were combined to form the negative reinforcement scale. The alpha reliabilities of these higher-order scales in our sample were acceptable to good at $\alpha=0.855$ and 0.781, respectively.

Alcohol-risk personality traits

To assess personality traits predictive of hazardous drinking, we administered the Substance Use Risk Profile Scale (SURPS; Woicik et al., 2009). This is a 23-item self-report measure that assesses four personality traits shown to be predictive of different patterns of hazardous and/or problematic drinking: hopelessness (7 items), anxiety sensitivity (5 items), impulsivity (5 items), and sensation seeking (6 items). All items are rated on a 4-point Likert scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). Several items are reverse scored. Higher subscale scores indicate more endorsement of a given

¹ While .70 is typically considered the cut-off for acceptable internal consistency, some (e.g., Loewenthal & Lewis, 2020) argue that .60 should be treated as an acceptable cut-off for shorter scales (e.g., 10 items or less) given that more items generally translate into higher internal consistency values.

Table 2 Means and standard deviations for each outcome variable

Variables	Group		Cohen's <i>d</i>	<i>p</i> value
	HRD (<i>n</i> = 42)	NRD (<i>n</i> = 54)		
	Mean (SD)	Mean (SD)		
Hazardous drinking	5.00 (3.41)	4.98 (3.41)	0.01	.490
Positive reinforcement motives	18.44 (5.86)	19.14 (6.33)	0.11	.313
Enhancement	6.63 (3.14)	9.07 (3.17)	0.77*	.001
Social	10.03 (3.71)	10.07 (3.60)	0.01	.482
Negative reinforcement motives	23.40 (8.37)	18.19 (8.10)	0.63*	.004
Conformity	7.28 (3.88)	5.26 (2.79)	0.60*	.005
Coping with anxiety	7.72 (3.03)	6.91 (3.18)	0.26	.135
Coping with depression	6.78 (3.35)	6.02 (3.38)	0.23	.169
Personality traits				
Hopelessness	13.86 (3.82)	14.46 (4.22)	0.15	.253
Anxiety sensitivity	12.50 (3.24)	12.61 (3.09)	0.03	.232
Sensation seeking	16.45 (3.44)	15.98 (3.57)	0.13	.259
Impulsivity	9.12 (1.78)	8.35 (2.41)	0.36*	.044

Note. The *ns* for the drinking motives include only those who were drinkers: HRD (*n* = 32), NRD (*n* = 43). * indicates a significant group difference. Boldface indicates significant group difference after Benjamini–Hochberg correction for multiplicity testing

personality trait. This measure has been shown to have concurrent, discriminant, and incremental validity (Woicik et al., 2009). In our sample, the subscale internal consistencies were all good, ranging from $\alpha = 0.834$ (sensation seeking) to 0.899 (hopelessness).

Procedure

All students entering first year as an undergraduate at a large Eastern Canadian university were invited to participate in a large online screening offered through the university's electronic research participation system, SONA, that determines participants' eligibilities for various studies in the psychology and neuroscience department. As a part of this screening, students completed the ARHQ-R. We calculated the proportion scores for all students who completed the ARHQ-R and recruited those who had a score of 0.25 or below or 0.37 or above to complete the larger survey that contained the AUDIT-C, M-DMQ-R, and SURPS. This survey was from the Caring Campus project (Stuart et al., 2019) and was completed in the fall or winter of the students' first year. Participants were compensated in the form of gift cards or course credit or could donate the cash value to support mental health activities on campus.

Results

The means, standard deviations, and correlations of our outcome measures are reported in Tables 2 and 3, respectively. We conducted *t*-tests for each of our primary hypotheses. Because we made a priori directional predictions for each of our hypotheses, we

Table 3 Correlations among our outcome measures, with HRD ($n=42$) below the diagonal and NRD ($n=54$) above the diagonal

	1	2	3	4	5	6	7	8	9	10	11	12
1. Pos. reinforcement	1	.940	.946	.532	.377	.602	.389	.676	.183	-.048	.421	.217
2. Enhancement	.844	1	.778	.487	.263	.617	.363	.594	.151	-.070	.392	.205
3. Social	.882	.695	1	.516	.443	.521	.370	.666	.193	-.022	.401	.205
4. Neg. reinforcement	.454	.486	.138	1	.764	.884	.921	.348	.409	.069	.340	.137
5. Conformity	.322	.202	.245	.414	1	.458	.551	.265	.191	-.071	.260	-.300
6. Coping with anx	.670	.701	.494	.640	.088	1	.793	.357	.365	.157	.275	.338
7. Coping with dep	.464	.406	.205	.788	.295	.582	1	.280	.479	.079	.337	.269
8. Haz. drinking	-.026	.113	.092	.194	-.057	.189	.232	1	.273	.042	.299	.331
9. Hopelessness	-.387	-.454	-.443	.039	.165	.049	-.219	.009	1	.078	-.098	.308
10. AS	.183	.079	.128	.303	.143	.289	.041	-.342	.344	1	-.258	.329
11. SS	.078	.071	.030	.053	-.339	-.198	.315	.226	-.061	-.039	1	.153
12. Impulsivity	-.228	.024	-.297	.191	.206	.117	.138	.108	.372	.112	-.128	1

Note. Significant correlations are indicated by boldface font. AS, anxiety sensitivity; SS, sensation seeking. For the drinking motive subscales, the *ns* were HRD ($n=32$) and NRD ($n=43$)

used one-tailed tests of significance. Further, after reporting effects based on traditional significance levels, we report effects correcting for multiplicity testing using the Benjamini–Hochberg false discovery rate (Benjamini & Hochberg, 1995). Our data met the assumptions required for *t*-tests (Tabachnick & Fidell, 2007). Because not all participants were drinkers, the analysis for our second hypothesis, which required participants to endorse drinking, was conducted with a subset of the entire sample.² There were 75 students in total who were drinkers: 32 in the HRD group and 43 in the NRD group.

We also conducted power analyses to determine the magnitude of effect we could detect as significant with our sample size. For an analysis with 96 participants, alpha set at 0.05, and power set at 0.80, an effect size of at least $d=0.28$ would emerge as significant. For an analysis with 75 participants and the same criteria as above, we required an effect of $d=0.33$ to find significant between-group differences. All effect sizes, reported as Cohen's *d*, are shown in Table 2.

Hypothesis 1: HRD students will report more hazardous drinking than NRD students

The *t*-tests revealed no significant differences between HRD and NRD students on hazardous drinking ($t(94)=0.026, p=0.490$; Table 2; see³ for supplementary analyses).

Hypothesis 2: HRD students will endorse more negative drinking motives than NRD students

We then determined whether students with and without HRD differed on positive and negative reinforcement motives for drinking. The HRD group endorsed significantly greater negative reinforcement drinking motives ($t(73)=2.721, p=0.004$) than the NRD group, a difference which survived the Benjamini–Hochberg correction. There was no group difference on positive reinforcement motives for drinking ($t(73)=0.490, p=0.313$).

Follow-up comparisons between HRD and NRD groups on the five individual drinking motive subscales revealed significant differences between HRD and NRD students on the subscales of conformity and enhancement motives. Specifically, HRD students reported more drinking for conformity motives than NRD students ($t(73)=2.633, p=0.005$), consistent with our hypothesis. Conversely and unexpectedly, HRD students endorsed less drinking for enhancement motives than NRD students ($t(73)=-3.315, p<0.001$). Each of these comparisons survived the Benjamini–Hochberg correction ($ps<0.05$).

² Only drinkers can report on their motivations for drinking.

³ Given our unexpected nonsignificant finding on hazardous drinking between HRD and NRD students, we ran follow-up analyses on proportions of drinkers and hazardous drinkers in each group. Chi-square analyses revealed no differences in the proportions of drinkers ($\chi^2(1)=.164, p=.686$) nor the proportion of hazardous drinkers ($\chi^2(1)=.025, p=.875$) across the HRD and NRD groups. Further, even if we examine only the drinkers, the HRD and NRD groups did not differ in the proportion who were hazardous drinkers, $\chi^2(1)=.020, p=.888$.

Hypothesis 3: HRD students will endorse greater internalizing and impulsive personality traits than NRD students

The *t*-tests revealed that HRD students scored significantly higher on impulsivity than NRD students ($t(94) = 1.726, p = 0.044$), consistent with our hypothesis. When this group difference was evaluated following the application of the Benjamini–Hochberg correction, it did not meet the recommended level ($p = 0.06$). There were no other significant differences on levels of alcohol-risk personality traits between the HRD and NRD samples.

Discussion

Our goal of our preliminary study was to provide an initial examination of the patterns of hazardous alcohol use, drinking motives, and alcohol-risk personality traits, of a specific and vulnerable population of university students—namely, those who self-report a history of reading difficulties. In contrast to our initial speculation, we found no differences in hazardous drinking or in drinking to cope between HRD and NRD students. However, we did find that HRD students were more likely to endorse negative reinforcement motives for drinking generally, and higher levels of conformity motivated drinking specifically, than their NRD counterparts. We also found that HRD students reported higher levels of impulsive personality traits than their NRD peers. And unexpectedly, our results demonstrated lower levels of enhancement motivated drinking among HRD than NRD students. These results sketch an initial pattern of the motives and personality risk factors for HRD students' drinking in university, data that we think will be useful in informing the design of supports.

Hazardous alcohol use

Despite finding differences between the drinking motives and personality risk factors of HRD and NRD students, our results showed no significant between-group differences on rates of hazardous drinking, which converges with evidence of no differences between adolescents with and without learning disabilities on their rates of alcohol use (e.g., McNamara & Willoughby, 2010). However, our finding does not support our hypothesis, nor does it align with some past studies demonstrating that individuals with learning disabilities drink more than their peers (e.g., Beitchman et al., 2001; DuPaul et al., 2017).

It also diverges from studies that find lower rates of alcohol use among university students with dyslexia as compared to students without this diagnosis (Wilcockson et al., 2016). As this latter study investigated dyslexia specifically, their sample likely mirrors ours more closely than the general learning disabilities population. That said, their sample's average age was 21 to 22 years old, suggesting that they were upper-year students with dyslexia who were able to continue to meet the demands of university while having a diagnosed learning disability; this is likely a different population than our first year HRD students. The fact that we did not find that HRD status protected against alcohol use, as Wilcockson and colleagues did with dyslexia, could certainly reflect a difference between the alcohol use of the HRD and dyslexia populations. It could also reflect a difference between students with learning challenges who have and have not learned to accommodate

for their difficulties. Such contrasting findings in studies of students with a diagnosed learning disability versus those with HRD further stress the relevance of investigating the HRD population independently.

One way to understand this absence of group difference on hazardous drinking is to appreciate that rates of hazardous drinking in both groups were remarkably high. Roughly 60% of each group met AUDIT-C cut-offs for hazardous drinking, rates comparable to those reported in other work with university students (e.g., Narain et al., 2018). With HRD students, then, we have a group of students who face additional risk factors as compared to NRD students, such as academic difficulties, dropout, and increased mental health challenges (Elgendi et al., 2021), and yet appear to be just as likely to drink hazardously as their peers. There are two ways to interpret this pattern. First, it can be considered positive that HRD students have similar rates of hazardous drinking to NRD students despite the fact the former group may be under more duress, potentially indicating adaptive coping with their heightened academic and/or mental health difficulties. Alternatively, the high level of hazardous drinking in spite of these challenges may be considered concerning; keeping their drinking to reasonable levels might be even more important for HRD than NRD students, given the former students' greater obstacles to success in university. This becomes particularly relevant as we consider the increasing and intensive demands of university beyond first year, including graduate or professional programs, as well as heightened requirements and expectations in the workforce. Both interpretations reinforce the importance of understanding the long-term consequences of the drinking habits of HRD students. Their broader challenges may maintain or escalate risky drinking over time, in contrast to other students whom we know tend to drop their level of drinking across the university years and beyond (Bilevicius et al., 2021).

Motivational risks predictive of hazardous alcohol use

The pattern of group differences in drinking motives—that HRD students drink more to conform and less for enhancement than their NRD peers—further highlights the need to take the overall findings seriously. While conformity drinking motives are linked to alcohol-related problems (e.g., Kuntsche et al., 2008), enhancement motives are more related to hazardous alcohol use, like the outcome tapped on the AUDIT-C used herein (e.g., Kuntsche et al., 2008; Merrill et al., 2014), and are very commonly endorsed among university students (e.g., see review by Cooper et al., 2016). This suggests that HRD students are less likely than other students to drink for a relatively normative reason—“the buzz”—in their first year of university. Rather, HRD students appear to follow a drinking pattern that is very focused on drinking for negative reinforcement reasons, particularly to fit in with peers. Given this pattern of motives, it may be that HRD students would show more harms related to their alcohol use, such as sustaining an injury, missing classes and/or exams, and fighting with peers, than would NRD students. Certainly, such harms from their alcohol use might compound HRD students' academic challenges (e.g., Bergey et al., 2017), exacerbating the difficulties related to their reading difficulties. Future research could investigate this possibility with a longitudinal design and a validated measure of alcohol-related problems for undergraduates, such as the Young Adult Alcohol Consequences Questionnaire (YAACQ; Read et al., 2006).

HRD students' greater endorsement of drinking to conform than their NRD peers may have arisen because HRD students feel isolated from their peers—like “outsiders”—and thus drink to reduce feelings of social censure. Importantly, alcohol has been found to act

as a facilitator of emotional connectivity and social bonding in university students (e.g., Sayette et al., 2012). Relatedly, HRD students report placing more value in personal social connections (e.g., friends, family, significant others) than institutional social connections (e.g., accommodations) in helping them achieve their academic goals (e.g., Stack-Cutler et al., 2015), underscoring the importance this population places in peer-level social connections. Research with university students with learning disabilities demonstrates that increased social support mitigates the otherwise heightened risk of bullying this population faces (Heiman & Shemesh, 2019). While students with learning disabilities are not an identical population to HRD students, such a finding offers a potential explanation for why HRD students put such value in peer-level social connections and thus demonstrate elevated motivation to drink to conform with their peers.

We did not expect HRD students to report similar levels of coping with anxiety drinking motives to NRD students, given that students with diagnosed learning disabilities report more anxiety than their peers (e.g., Klassen et al., 2013) and those with a history of reading difficulties report higher levels of academic anxiety than their peers (e.g., Elgendi et al., 2021). However, a nuance of past research is that HRD students endorsed higher rates of academic anxiety than NRD students, but not general anxiety (Elgendi et al., 2021). It is possible that, had we measured motives involving drinking to cope specifically with academic-related anxiety, we may have found higher endorsement of drinking to cope by HRD than NRD students. This is a step that can be taken in future research. It is also possible that this difference would emerge as a significant effect with a larger sample, as we were underpowered to detect a smaller effect than $d=0.33$ as significant with the drinkers in the current study.

Personality traits predictive of hazardous alcohol use

The finding that HRD students endorsed more impulsive traits than their peers should not be taken lightly: impulsivity is a strong predictor of hazardous alcohol use over time (Krank et al., 2011), including beyond university (Bilevicius et al., 2021). Impulsivity is also a risk factor for increased harms from drinking (e.g., Jones et al., 2014). This stresses the importance of following HRD students longitudinally to determine if a history of reading difficulties is related to an increased risk of problems arising from drinking in later years of university or beyond. We can also understand this group difference in the context of the high co-morbidity between reading difficulties and attentional deficits (e.g., Wadsworth et al., 2015). For example, there is considerable co-morbidity between learning disabilities and ADHD, of which impulsivity is a hallmark symptom; some estimates suggest that individuals with a diagnosed learning disability are seven times more likely to be diagnosed with ADHD than those without a learning disability (DuPaul et al., 2013). Further, there is a vast literature documenting the relation between ADHD symptoms and increased substance use (Charach et al., 2011; Fuller-Thomson et al., 2021), again highlighting the importance of taking our finding seriously. Yet, the group difference in impulsivity observed here should be considered preliminary since it did not withstand multiplicity testing; it should be replicated in future studies to determine if it is robust. Exploring this finding in future studies would also allow us to examine how specific this effect is to students with HRD or if it emerges because of potential overlap between HRD and ADHD.

Given that we found stronger endorsement for negative reinforcement drinking motives, including conformity, in our HRD than NRD sample, we were surprised that HRD and NRD students reported similar levels of the internalizing personality traits of anxiety

sensitivity and hopelessness, both of which are related to general negative reinforcement motives for drinking as well as conformity specifically (e.g., Comeau et al., 2001; Woicik et al., 2009). As with the absence of higher levels of coping drinking motives in HRD students, this result may be related to the fact that the increased anxiety previously observed in HRD students has been shown to be academic specific (Elgendi et al., 2021), reducing the likelihood that it is related to more pervasive internalizing personality traits. Overall, the personality traits related to hazardous drinking and its associated problems merit further investigation in the HRD population. For instance, future research could divide the HRD sample by alcohol-risk personality traits and determine if this interaction leads to different motives and risk level for hazardous alcohol use.

Practical implications, limitations, and conclusion

Our data paint a preliminary picture of the pattern of motives and personality risk factors that lead HRD students to drink in university, a pattern that differs from that of their peers without this history. The unique pattern of motives and personality risks in HRD students highlights the potential of our data to inform how to best support HRD students in a university setting. For example, the fact that HRD students are more likely to drink to conform than NRD students underscores the importance of this population forming and maintaining social connections while in university. Participating in non-alcoholic events that still allow social connections to develop, such as movie nights or midnight breakfasts (e.g., The Alcohol Prevention Compass), may increase social connections independent of alcohol and reduce alcohol use (e.g., Patrick et al., 2010). Further, participating in interventions designed to build social skills has demonstrated effectiveness on reducing hazardous drinking (e.g., Stigler et al., 2011). One intervention study with university students suggests that training cognitive and behavioral techniques targeting specific drinking motives, including conformity, results in decreased hazardous alcohol use (Canale et al., 2015). Similarly, targeting the impulsivity of HRD students could help to decrease their risk of developing problematic alcohol use and suffering negative consequences of alcohol (e.g., Jones et al., 2014; Krank et al., 2011). The PreVenture program has demonstrated effectiveness in supporting adolescents at high risk for alcohol and other substance misuse to manage risky personality traits, including impulsivity (e.g., Conrod et al., 2006; Newton et al., 2020). These interventions may also prove helpful with HRD students in a university setting.

While this study provides a useful first glance at the alcohol risks of HRD students, it is not without limitations. First, our ability to explore more fine-grained questions, such as how each reading group differs by drinker profile, was limited by our small sample size. Similarly, our study examined only university students in their first year. Given that there may be systematic differences between university students and other postsecondary students, our results may not generalize to all postsecondary groups (e.g., community college students). Further, with the demands of university increasing through the undergraduate years, we may find that HRD students begin to struggle more than NRD students, leading to a higher chance of academic difficulty, mental health challenges, and hazardous and/or problematic alcohol use. As a result, it would be beneficial to study this population throughout their undergraduate degree. Such a longitudinal design would also address the fact that our data were cross-sectional and thus we cannot establish the directionality or causality of our demonstrated effects. Further, we only studied alcohol-related factors; there is substantial literature demonstrating the high prevalence of misuse of other substances, such as cannabis and prescription drugs, on university

campuses (e.g., Silvestri et al., 2015). To better contextualize the experiences HRD students may have in university, it would be important to also study potential group differences in the misuse of these substances as well as HRD students' motives to use such substances. Finally, we were underpowered to detect effect sizes smaller than $d=0.28$ in the full sample or smaller than $d=0.33$ in the drinker subsample; this likely precluded detection of smaller group differences that may nonetheless be meaningful (e.g., on coping with anxiety motives).

The results of this study add to the existing body of literature that highlights the importance of investigating university students with a history of reading difficulties; here we extended beyond their academic performance to other aspects of their university experience. We found differences in drinking motives and in an alcohol-risk personality trait in university students with, compared to those without, a self-reported history of reading difficulties. Most critically, we found that HRD students reported higher levels of negative reinforcement motives for drinking and impulsivity, known predictors of problematic alcohol use (Cooper et al., 2016; Krank et al., 2011). A more fine-grained analysis of drinking motives revealed higher conformity motives and lower enhancement motives among HRD students, suggesting a very specific pattern of drinking to fit in with peers. Overall, these findings offer a foundation for understanding the alcohol use patterns and risks of HRD students and the related set of challenges they may face. Future research needs to build upon this foundation to best support the HRD population in university—an environment in which we know they may face more challenges than their peers.

Appendix. Eight questions from the elementary subscale of the ARHQ-R

Please read each of the following questions and choose the response that best describes you. Please choose only one response per question.

1. How much difficulty did you have learning to read in elementary school?
 1. None
 2. Not much
 3. Some
 4. Quite a bit
 5. A great deal
2. How much extra help did you need when learning to read in elementary school?
 1. No help
 2. Help from friends
 3. Help from teachers/parents
 4. Tutors or special class for one year
 5. Tutors or special class for 2 or more years.
3. How would you compare your reading skill to that of others in your elementary classes?
 1. Clearly above average
 2. Somewhat above average
 3. Average
 4. Somewhat below average
 5. Clearly below average
4. Which of the following most nearly describes your attitude toward reading as a child?
 1. Very positive
 2. Somewhat positive
 3. Neutral

4. Somewhat negative
5. Very negative
5. When you were in elementary school, how much reading did you do for pleasure?
 1. A great deal
 2. Quite a bit
 3. Some
 4. Not much
 5. None
6. How would you compare your reading speed in elementary school with that of your classmates?
 1. Clearly above average
 2. Somewhat above average
 3. Average
 4. Somewhat below average
 5. Clearly below average
7. How much difficulty did you have learning to spell in elementary school?
 1. None
 2. Not much
 3. Some
 4. Quite a bit
 5. A great deal
8. When you were in elementary school, how many books did you read for pleasure each year?
 1. More than 10
 2. 6 to 10
 3. 3 to 5
 4. 1 to 2
 5. None

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Code availability Not applicable.

Declarations

Ethics approval This project has ongoing ethics approval from Dalhousie University REB (Coping in University; 2017–4084).

Consent to participate All participants signed a consent form prior to participating in this study.

Consent for publication All participants who agreed to participate also agreed to anonymized publication of their aggregated data.

Conflict of interest The authors declare no competing interests.

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