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# Cross validation of the Centre for Addiction and Mental Health Inventory of Gambling Situations (CAMH-IGS)

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**Abstract.** A cross-validation of the factor structure of the Centre for Addiction and Mental Health Inventory of Gambling Situations (CAMH-IGS) is described. The CAMH-IGS is based on a cognitive-behavioural approach and is intended for use in treatment planning to help therapists determine the patterns of behaviour, thoughts or feelings which may trigger problematic gambling, with the goal of developing tailored treatment and relapse-prevention approaches for clients. A sample of 994 gamblers was used to cross validate the factor structure of the CAMH-IGS. The results largely replicated the factor structure of the CAMH-IGS but suggest a small number of changes to the scoring of the CAMH-IGS. An exploratory second order factor structure identified two factors: positive and negative emotional states. Significant mean score differences were identified for subscales based on the client's sex and age. Taken together, these findings confirm that each of the CAMH-IGS subscales contributes to the situational risk profile of gambling behavior for clients, and underscore the value of a situational profile in treatment planning.

**Keywords:** Cross-validation, Gambling Situations, Situational Risk, Treatment Planning, Problem Gambling, Gambling Disorder

### Background

This paper describes the cross-validation of the factor structure of the Centre for Addiction and Mental Health Inventory of Gambling Situations (CAMH-IGS) (Littman-Sharp, Turner, & Toneatto, 2009; Turner, Littman-Sharp, Toneatto, Liu, & Ferentzy, 2013). The CAMH-IGS is a 63-item self-report questionnaire designed to facilitate treatment planning for problem gambling. The free on line application produces an individual's profile specifying the types of situations in which a client has gambled excessively over the past year. The CAMH-IGS is similar to previous measures to assess situational risk for substance abusers including the *Inventory of Drinking Situations* (IDS) (Annis, Graham & Davis, 1987; Pashaei, et al., 2013), the *Inventory of Drug Taking Situations* (IDTS) (Turner, Annis & Sklar, 1997), and the Drug Taking Confidence Questionnaire (DTCQ) (Sklar, Annis & Turner, 1997; 1998; Sklar & Turner, 1999; Vasconcelos, et al., 2016). The IDS and IDTS were developed based on the pioneering work of Alan Marlatt and his associates (Marlatt, 1978, 1985, Marlatt & Gordon, 1980) on situational specific relapse risk. Note that originally it was called the Inventory of Gambling Situations (Littman-Sharp, & Turner, 2001), however, another group of authors, Weiss & Petry, (2008; see also Petry, Rash, Blanco, 2010), have already published a similar, but shorter measure using that name IGS. The CAMH-IGS provides a much more detailed examination of a client's risk profile including gambling specific risk triggers.

The purpose of the CAMH-IGS's is to identify high-risk situations for engaging in the behaviour. This information can be used by a therapist to develop individualized treatment plans for those affected by problem gambling. Like the IDS, the CAMH-IGS is based on an approach that views excessive gambling as a pattern of behaviour and cognitions that are learned and can thus be changed (see Annis, 1990; 1982, Annis & Davis, 1989; Annis & Graham, 1988, 1995; Annis, Graham & Davis, 1987, Annis & Martin, 1985; Annis, Schober & Kelly, 1996).

The total score on the CAMH-IGS is substantially correlated with measures of problem gambling,  $r = .78$ ,  $p < .001$ , and indicates a global level of situational susceptibility (Turner, et al., 2013). More importantly, the client's situational risk profile is constructed from the ten subscale scores. Table 1 provides examples of each of the CAMH-IGS 10 subscales. Six of these subscales were derived from earlier research on substance abuse and were used on the IDTS (Turner et al., 1997) and DTCQ (Sklar et al., 1997, 1998; Sklar & Turner, 1999): *Negative Emotions* (derived from the IDTS *unpleasant emotions*), *Conflict with Others*, *Testing Personal Control*, *Pleasant Emotions*, *Social Pressure*, and *Urges and Temptations*. In addition, four subscales were added that measure situations that describe the cycle of gambling behaviour that are not particularly relevant to substance

abuse: initial motivation (e.g., *Need for Excitement, Confidence in Skill*), cognitive entrapment (e.g., *Winning and Chasing*), and gambling in the hope of paying debts (e.g., *Worried about Debts*).

**Table1: Example items from each of the 10 CAMH-IGS subscales.**

Subscale	Example items
<i>Negative Emotions</i>	(07) When I was depressed. (37) When I felt under a lot of stress.
<i>Conflict with Others</i>	(23) When I had an argument with a friend. (32) When there were fights at home
<i>Pleasant Emotions</i>	(04) When I was happy. (16) When I felt confident and relaxed.
<i>Social Pressure</i>	(30) When someone challenged me to a bet. (44) When I was in a social situation and other people were gambling.
<i>Urges and Temptations</i>	(14) When I was in a situation in which I was in the habit of gambling. (22) When I suddenly had an urge to gamble.
<i>Testing Personal Control</i>	(09) When I started to believe that gambling was no longer a problem for me. (47) When I convinced myself that I was a new person and could make a few bets.
<i>Need for Excitement</i>	(05) When I wanted some action. (50) When I began to think how exciting or relaxing a little gambling would be.
<i>Worried about Debts</i>	(08) When I was about to get caught unless I came up with some money fast. (26) When I was afraid of the people to whom I owed money.
<i>Winning and Chasing</i>	(19) When I was winning and wanted to keep on winning. (46) When I needed to win back the money I lost gambling.
<i>Confidence in Skill</i>	(27) When I felt confident about my gambling skills. (57) When I knew it was a “sure thing.”

Note: This table was previously published as Table 1 in Turner, et al., (2013) as open access and, repeated here with permission of the author.

Turner et al., (2013) describes convergent and divergent validity information on the subscales. For example, Negative Emotions was correlated with depression,  $r = .34$ ,  $p < .001$ , but Pleasant Emotions was not correlated with depression,  $r = .07$ , ns. In addition, Conflict with Other was negatively correlated with Co-operation, Urges and Temptations was correlated with Impulsiveness,  $r = .31$ ,  $p < .001$ , and Confidence in Skill was correlated with the belief in gambling systems,  $r = .45$ ,  $p < .05$ . In addition, McGrath, Stewart, Klein, and Barrett (2010), report that people who gamble for enhancement scored higher on Pleasant Emotions and low scores on Negative Emotions. In contrast people who reported having coping motives for gambling showed particularly higher scores on Negative Emotions situations. Furthermore, Grubbs and Chapman, (2019) have used IGS profiles to differentiate patients with post-traumatic stress disorder (PTSD) from those who do not have PTSD.

Previous models of situational risk have found that the subscales are correlated with each other and that the correlations between the subscales can be further organized in terms of a second order factor structure (Annis & Graham, 1988; Sklar et al., 1997; Turner et al., 1997). Second order factors explain the correlations between subscales. Second order factor structures are common in personality research (e.g., Cattell, 1996; Patton, Stanford, & Barratt, 1995). The big five personality factors, for example, are second order factors which organize and simplify first order factors (Cattell, 1996). Second order factors can be useful in terms of defining the general type of situation that a person is at risk, whereas the individual subscales define in more detail the exact type of risk. For example, both *Conflict with Others* and *Negative Emotions* are subscales of the CAMH-IGS related to negative emotions, but the subscales define specific issues that should be addressed for an individual (e.g., conflict vs. depression). For the Inventory of Drinking Situations two second order factors were discovered: positive and negative emotional situations (Annis & Graham, 1988). The Inventory of Drug Taking Situations on the other hand, identified three second order factors: positive, negative and urge related situations (Turner et al., 1997). Given the number of subscales that are unique to the CAMH-IGS (e.g., *Confidence in Skill*; *Winning and Chasing*) we have no theoretical preconception of the second order structure for the CAMH-IGS. As such, we will explore the second order structure using exploratory factor analysis methods.

The primary purpose of the current paper was to cross-validate the factor structure of the CAMH-IGS with a large sample and to see if there were any loadings that should be changed. The hypotheses of the present study were that this confirmatory factor analysis will support the factor structure of the CAMH-IGS that was reported by (Turner et al., 2013; Littman-Sharp et al., 2013). In particular, we hypothesized:

- 1) That all 10 factors would be replicated.
- 2) That the correlation matrix of factors would be positive definite.

- 3) That an examination of correlated residuals would not find any evidence of an alternative factor structure.

The paper will also examine the mean differences in subscale scores and explore possible second order factor structures. Based on previous research we hypothesized that:

- 4) Based on Turner et al. (2013) females would score higher on *Negative Emotions* and *Need for Excitement*, but with otherwise males and females would have similar scores.
- 5) That the second order factor structure would indicate either 2 (IDS; Annis & Graham, 1987) or 3 factors (IDTS; Turner et al., 1997).

## Method

### Procedure

This research study was approved by the [removed] research ethics board as protocol # 209/2009 and the anonymous CAMH-IGS data was extracted and provided to us for analysis.

The CAMH-IGS was first made available as an application on the CAMH website in 2009 and more recently available in 2018 as a mobile app. Each time the scale was accessed, the individual was invited to participate in an anonymous research study to evaluate the CAMH-IGS. If they agreed to participate, they were also asked a number of demographic questions including their sex, age category, country of residence, ethnicity, and their self-reported problem gambling status (social gambler, problem gambler, or gambler in recovery). A little more than half (59%) consented to participate in the study.

### The CAMH-IGS

The 63 items of the CAMH-IGS are designed to be general enough that the respondent would likely have experienced or that they could easily imagine themselves experiencing. For each of the items, the clients are asked to indicate how frequently they have gambled heavily in each of 63 situations. The individual would then complete each of the CAMH-IGS questions using a 4-point scale: never (0), rarely (1), often (2), and almost always (3). Subscale scores are the sum of the items, divided by the number of items, then multiplied by 100 to produce a score between 0 and 100.

It is designed to be administered by a therapist and completed by the clients themselves as part of the treatment planning stage of therapy. It can be administered using the online application or printed out and administered in paper-and-pencil format. No names or other identifying information is stored by the online application.

After completing the scale, a report on their high-risk situations was provided on the screen with special emphasis on those scales with the highest scores. This profile can be used during treatment planning, to determine what services the client needs (see Littman-Sharp, Turner, & Toneatto, 2009). It is expected that the client and therapist would discuss

the report as part of treatment planning (e.g., what are a client's high-risk situations).

### Participants

A total of 1759 used the CAMH-IGS application between September 2009 and July 2019. Of them, 113 indicated that they were testing the application leaving 1646 people who completed the CAMH-IGS for assessment. A total of 994 people clicked "yes" on the consent for a response rate of 60.4%. Of those who consented to participate, 61.2% were male, 29.2% were female, and 9.7% did not answer this question. The ages ranged from under 18 (0.5%) to over 65 (4.5%) with the mode falling within the 36 to 45 age group (22.6%). The majority of participants were from Canada (57.0%) with large numbers from Australia (14.7%) and the United States (10.2%) and small numbers from 22 other countries making up the balance. Additional demographic information is provided in Table 2. People were also asked to classify themselves in terms of gambling severity where 4.0% considered themselves a social gambler, 20.7% considered themselves having a moderate problem, 32.5% considered themselves to be a severe problem gambler, 11.1% indicated that they had recovered, and 31.7% did not complete this question.

**Table 2: Demographic characteristics of the respondents**

Sex	Male	61.2%
	Female	29.2%
	Not stated	9.7%
Self-categorization	Social	4.0%
	Moderate	20.7%
	Severe	32.5%
	Former Problem Gambler	11.1%
	Not stated	31.7%
Ethnicity	European / Caucasian	45.4%
	East Asian	5.6%
	Middle East	5.2%
	South Asian	4.8%
	South East Asian	4.5%
	Black/African	3.3%
	Aboriginal	2.2%
	Other	3.4%
	Mixed	7.4%
	Not stated	32.9%
Age	25 and under	9.9%
	26 to 35	20.0%
	36 to 45	22.6%
	46 to 55	18.2%

	56 to 65	13.7%
	over 65	4.5%
	Not Stated	11.1%
Country	Canada	57.0%
	Australia	14.7%
	USA	10.2%
	Asia	1.7%
	Europe	1.5%
	Other	0.9%
	Africa	0.8%
	Not stated	12.6%

Note: For ethnicity, mixed identify means they endorsed either “mixed” or endorsed more than one ethnicity.

### Analysis

To test the factor structure of the CAMH-IGS, we performed a confirmatory factor analysis using LISREL 10 (Jöreskog & Sörbom, 2018). The analysis was estimated using a Pearson correlation matrix and maximum likelihood estimates, which is appropriate given the sample size (Rigdon and Ferguson, 1991). The re-specification search was conducted manually. At each step, we examined the modification index scores and altered the model, one parameter at a time to identify the optimal model.

Additional analyses were conducted comparing the scales across demographic categories including sex, age, and country using SPSS. An exploratory factor analysis was conducted using SPSS on the subscales to determine if the CAMH-IGS had a second order factor structure (see Turner et al., 1998).

### Results

The results of the confirmatory factor analysis are presented in Table 3. The matrix was stable and positive definite. The baseline model had a *Chi-square* (1718) of 6666.4 and the ratio of *Chi-square* to degrees of freedom was 3.88. The *Root Mean Squared Residual (RMR)* for the initial model was .056, indicating that the residuals for the model were small (Byrne 1989; Jöreskog & Sörbom, 1988, 1993; March et al., 1988; Marsh & Hocevar, 1985). The *Goodness of fit index (GFI)* was .81, the *Comparative fit index (CFI)* = .84, and *Non-Normed Fit Index (NNFI)* was .83, suggesting that most of the variance in the data was accounted for by the model (Byrne 1989; March et al., 1988; Turner, 1996). These fit indices were not optimal, but this expected given the large number of items and large sample size because correlations between items as small as  $r = .10$  are highly significant (Byrne 1989; Long, 1983; March et al., 1988; Turner, 1996).

A re-specification search was then conducted within the CFA framework to explore whether a model better fitting the data could be

identified based on the modification indices. The re-specification search model was conducted until the parameters reached correlations less than .2 or loadings less than .4. The results from the re-specified models are presented in Table 3. An examination of the lambda matrix identified one loading that was not significant (step 2: item 53, “When I couldn’t think about anything but gambling” on Negative Emotions set to 0) and one large lambda as indicated by the modification index (step 3: item 54 “When I felt under a lot of pressure from family members” on the *Conflict with Others* subscale set free). The change at step 3 resulted in item 54 on the *Negative Emotions* subscale dropping to non-significance and was then set to zero in step 4.

Further examination of the re-specification search revealed that item 39 “When I was worried about my debts” could be set free to vary (i.e., not zero) on the *Winning and Chasing* subscale, which would result in a loading of .47. However, because this item would not conceptually add to the *Winning and Chasing* subscale, and because the item would still load on *Worried about Debts* subscale which it is better suited for, it was not added.

We continued the re-specification search for 3 more steps, but the changes were minor, and Step 4 was selected as the most appropriate model. An examination of the residuals and the modification index found no evidence of an alternative model for the data. Adding additional small cross loadings would only improve the fit by a small amount and would not substantively improve the measure. Adding additional parameters to the measurement model should only be done if they make theoretical sense (Byrne, 1989; Marsh, et al., 1988).

In summary, the hypotheses related to the confirmatory factor analysis were supported. All 10 factors were replicated and the correlation matrix of factors was stable and positive definite. No correlations between factors approached 1.0 and therefore there was no need to combine factors. In addition, we ran an automatic re-specification search, and although there were some additional small cross loadings, at no point was a factor or variable left without any unique variance of its own. In other words, all factors survived the automatic re-specification search. In addition, the small number of correlated residuals that we set free did not suggest any evidence of new factor or of an alternative factor structure. The CFA analysis did not find any evidence of unnecessary factors or evidence of additional factors that could be added to the model.

**Table 3: Confirmatory factor analysis results and re-specification search for the CAMH-IGS**

Step	Item	Parameter change	df	Chi-square	Delta		RMR	GFI	NFI	NNFI	CFI
					Chi-square	ratio					
1	Baseline	--	1718	6666.4	--	3.88	0.056	0.80	0.80	0.83	0.84
2	drop 3 from NE	0.03	1719	6667.1	-0.7	3.88	0.056	0.80	0.80	0.83	0.84
3	add 54 to CO	0.716	1718	6426.3	240.8	3.74	0.055	0.81	0.81	0.84	0.85
4	drop 54 from NE	-0.02	1719	6426.6	-0.3	3.74	0.054	0.81	0.81	0.84	0.85
5	add 39 to WC	0.47	1718	6249.6	177.0	3.64	0.053	0.81	0.81	0.85	0.86
6	add 29 to SP	0.37	1717	6138.2	111.4	3.57	0.052	0.82	0.82	0.85	0.86
7	add residual correlation for 58 & 44	0.20	1716	6030.7	107.5	3.51	0.052	0.82	0.82	0.85	0.86
8	add 31 to SP	0.32	1715	5926.2	104.6	3.46	0.050	0.82	0.82	0.86	0.87

Note: df = Degrees of Freedom; RMR = Root Mean Residual; GFI = Goodness of fit index; NFI = Normed fit Index; NNFI = Non-normed fit Index; CFI = Comparative Fit Index

### Reliability and subscale scores

Scales were computed based on the results of the confirmatory factor analysis with small revisions to the *Negative Emotions* and *Conflict with Others* subscales. The reliability and the variance explained for the first eigenvalue for each subscale are provided in Table 4. The reliability estimates for each of the subscales ranged from .79 to .87, indicating acceptable levels of internal consistency. The reliability of the *Negative Emotions* subscale was .90 in the original model and was .90 for the revised model. The reliability of the *Conflict with Others* subscale increased slightly from .85 to .87. All items on all scales for both the original and revised scales had substantial item total correlations.

We then conducted an exploratory factor analysis for each subscale to determine if each subscale was unifactorial. For all 10 subscales, only one eigenvalue was greater than 1.0 and the first eigenvalue for all 10 subscales accounted for roughly 50% of the variance and covariance between the items. These numbers indicate that all of the scales were unifactorial and have very good psychometric properties.

**Table 4: The reliability scores for each of the CAMH-IGS subscales, and the variance accounted for by the first factor for each subscale.**

Subscale	Alpha	% for first Eigenvalue
Negative Emotions	0.90	59.6
Conflict with Others	0.87	53.0
Urges and Temptations	0.87	48.6
Testing Personal Control	0.80	45.6
Pleasant Emotions	0.80	55.5
Social Pressure	0.83	50.7
Need for Excitement	0.79	49.6
Worried about Debts	0.80	55.4
Winning and Chasing	0.83	55.2
Confidence in Skill	0.80	56.1

We also computed the rank of each subscale for the original and revised scale to determine if these changes would have any substantive differences to the interpretation of a person's profile. For the revised *Negative Emotions* subscale, 98.5% of the scores were within 1 or 2 ranks of the original scale. For *Conflict with Others* subscale, 98.5% of the scores were within 1 or 2 ranks the original scale. Other subscales were within 2 ranks 100% of the time. These findings demonstrate that the interpretation of a client's profiles would be nearly identical using the original scoring scheme (e.g., Littman-Sharp et al., 2009) or the slightly revised scoring scheme presented in this paper.

### Second order factor analysis

As shown in Table 5, the correlations between the subscales ranged from a low of  $r = .26$  between *Pleasant Emotions* and *Negative Emotions* to a high of  $r = .77$  between *Need for Excitement* and *Urges and Temptations*.

We conducted an exploratory factor analysis with the subscale total scores to determine the factor structure of the subscales (a second order factor analysis). We used exploratory analysis methods because we had no preconception about the possible factor structure of the CAMH-IGS. The component structure for the revised scales was examined (see Table 6). Two eigenvalues were greater than 1.0 which accounted for 58.5% and 11.1% of the variance. Note the same pattern was found for the original scales as well. Varimax rotation was performed, and the results reveal that one factor was

centred on *Pleasant Emotions, Need for Excitement, Confidence in Skill, and Social Pressure*. The second factor was centred on *Negative Emotion, Conflict with Others, and Worried about Debts*. The remaining three scales, *Winning and Chasing, Urges and Temptations, and Testing Personal Control* had substantial loadings (>.5) on both factors. An oblique rotation produced the same factor structure. The factor structure is shown in Table 6. Including a third factor in the analysis did not improve the second order factor structure.

**Table 5. Correlations between subscales in the CAMH-IGS.**

	NE	CO	UT	TPC	PE	SP	NEX	WD	WC	CS
Negative Emotions (NE)	1									
Conflict with Others (CO)	0.76	1								
Urges and Temptations (UT)	0.65	0.57	1							
Testing Personal Control (TPC)	0.56	0.62	0.66	1						
Pleasant Emotions (PE)	0.26	0.33	0.55	0.54	1					
Social Pressure (SP)	0.33	0.47	0.48	0.51	0.54	1				
Need for Excitement (NEX)	0.51	0.48	0.77	0.62	0.66	0.63	1			
Worried about Debts (WD)	0.44	0.57	0.49	0.54	0.33	0.41	0.4	1		
Winning and Chasing (WC)	0.51	0.49	0.72	0.61	0.47	0.39	0.67	0.56	1	
Confidence in Skill (CS)	0.35	0.43	0.62	0.67	0.56	0.49	0.61	0.51	0.68	1

**Table 6: Second order factor structure with varimax rotation for the revised CAMH-IGS subscales**

	Component	
	1	2
Pleasant Emotions	<b>0.86</b>	0.07
Need for Excitement	<b>0.80</b>	0.36
Confidence in Skill	<b>0.75</b>	0.33
Social Pressure	<b>0.70</b>	0.24
Urges and Temptations	<b>0.63</b>	<b>0.59</b>
Winning and Chasing	<b>0.61</b>	<b>0.53</b>
Testing Personal Control	<b>0.60</b>	<b>0.58</b>
Negative Emotions	0.15	<b>0.88</b>
Conflict with Others	0.22	<b>0.87</b>
Worried about Debts	0.34	<b>0.64</b>

Note: Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization.

### Scale Means

Mean scores are presented in Table 7 for the revised scales. It is of note that the highest overall subscale mean score on the CAMH-IGS was for the *Winning and Chasing* subscale ( $M = 66.7, D = SD = 23.7$ ). This was followed by the *Urges and Temptations* ( $M = 60.3, D = SD = 22.3$ ), *Need for Excitement* ( $M = 59.6, D = SD = 22.3$ ) and *Negative Emotions* ( $M = 54.5, D = SD = 26.6$ ) subscales, respectively.

Insert Table 7 about here

Table 7 also provides mean scores for the subscales stratified for males and females. Moderate size sex differences were found on four scales: *Negative Emotions*,  $t(898) = -4.8, p < .001$ , *Social Pressure*,  $t(898) = 5.3, p < .001$ , *Confidence in Skill*,  $t(898) = 5.2, p < .001$ , and *Pleasant Emotions*,  $t(898) = 4.1, p < .001$ . Females scored higher than males on *Negative Emotions*, while males scored higher than females on *Social Pressure*, *Confidence in Skill*, and *Pleasant Emotions*. There was also a very small difference for *Worried about Debts*,  $t(896) = 2.3, p < .05$  with males scoring slightly higher than females ( $d = -.16$ ). As shown in Table 5, the effect sizes for these sex differences were small to moderate (from .16 to .37)

The mean scores by age group are shown in Figure 1. Age was tested excluding those under 18 because the sample was too small. Significant age effects were found for several of the subscales including *Negative Emotions*,  $F(5, 878) = 5.2, p < .001$ , *Conflict with Others*,  $F(5, 878) = 4.1,$

$p < .01$ , *Testing Personal Control*,  $F(5, 878) = 2.5$ ,  $p < .05$ , *Pleasant Emotions*,  $F(5, 878) = 2.5$ ,  $p < .05$ , *Social Pressure*,  $F(5, 878) = 16.4$ ,  $p < .001$ , *Worried about Debts*,  $F(5, 878) = 8.4$ ,  $p < .001$ , *Winning and Chasing*,  $F(5, 878) = 3.9$ ,  $p < .01$ , and *Confidence in Skills*,  $F(5, 878) = 8.0$ ,  $p < .001$ . Due to the large number of pairwise comparisons, we tested contrasts of each age group against the mean of the remaining groups using an alpha of .005 (see Table 8). As shown in Figure 1 *Social Pressure*, *Pleasant Emotions*, and *Confidence in Skill* peak for those 25 and under and decreased with increasing age. In contrast, *Negative Emotions*, *Worried about Debts*, *Conflict with Others*, and *Winning and Chasing* were highest for people between 36 and 45. The oldest age group had significantly lower scores than the average of the other groups for *Negative Emotions*, *Testing Personal Control*, *Social Pressure*, *Worried about Debts*, and *Confidence in Skill*. Figure 1 provides a graphical depiction of the differences by age group for each of the subscales.

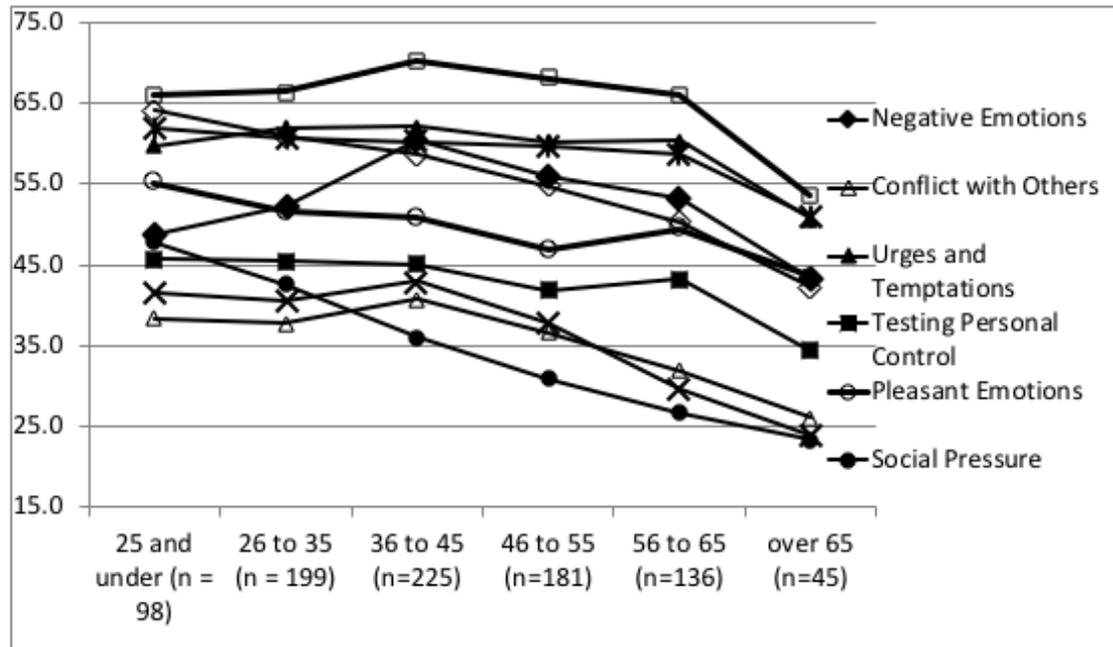
**Table 8:**  
**Age groups and CAMH-IGS subscale mean scores using revised scores.**

	25 and under (n = 98)		26 to 35 (n = 199)		36 to 45 (n=225)		46 to 55 (n=181)		56 to 65 (n=136)		over 65 (n=45)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Negative Emotions	48.9	26.8	52.2	26.0	60.4*	26.3	56.1	27.4	53.2	26.2	43.4+	24.5
Conflict with Others	38.4	24.5	37.8	24.7	40.8*	23.8	36.6	26.3	31.8	23.7	26.1	23.9
Urges and Temptations	59.8	23.9	62.1	21.8	62.2	22.1	60.2	22.6	60.4	21.9	50.7	23.0
Testing Personal Control	45.8	22.8	45.5	23.0	45.1	21.8	41.8	22.7	43.4	22.0	34.4+	19.2
Pleasant Emotions	55.2*	23.9	51.6	23.8	50.8	23.1	46.9	23.9	49.5	24.1	43.6	21.2
Social Pressure	47.8*	24.9	42.6*	25.6	36.0	24.9	31.0	21.8	26.7+	20.5	23.4+	19.9
Need for Excitement	62.0	24.2	60.6	22.3	60.3	22.7	59.7	22.7	58.7	21.3	51.0	20.2
Worried about Debts	41.6	25.0	40.7	24.4	43.0*	26.5	37.9	25.9	29.6+	24.0	23.9+	23.9
Winning and Chasing	66.2	25.1	66.5	22.9	70.2	24.3	68.2	23.7	66.1	22.3	53.7+	23.3
Confidence in Skill	64.1*	27.2	60.9*	24.7	58.7	25.2	54.7	25.7	50.3	24.7	42.2+	23.6

Note: \* indicates the mean is significantly higher than the average of all other groups; + indicates the mean is significantly lower than the average of all other groups. In all cases  $p < .005$  to correct for alpha inflation due to multiple comparisons.

Figure 1

Age and CAMH-IGS scores.



As shown in Table 9, of the people who completed the CAMH-IGS, 40 classified themselves as social gamblers, 206 classified themselves as moderate problem gamblers, 323 classified themselves as severe problem gamblers, and 110 classified themselves as former problem gamblers. These figures should be treated with caution as we did not ask the participants to complete any formal measure of problem severity and these classifications were self-identified. Nonetheless, the scores on the subscales were strongly related to the self-identified category. Not surprisingly, severe problem gamblers scored significantly higher than social all subscales and higher than moderate problem gamblers on subscales except for *Need for Excitement* (using an alpha of .005 to correct for multiple comparisons). Former and severe gamblers did not differ on most scales, except for *Social Pressure* and *Pleasant Emotions* where people who endorsed former problem gambler scored higher.

**Table 9: Self categorization of participants based on revised scoring.**

	<i>N</i>		<i>NE</i>	<i>CO</i>	<i>UT</i>	<i>TPC</i>	<i>PE</i>	<i>SP</i>	<i>NEX</i>	<i>WD</i>	<i>WC</i>	<i>CS</i>
Social	40	M	30.5	25.2	39.2	26.8	36.7	32.5	38.8	24.2	41.0	35.5
		SD	31.6	28.9	29.1	24.1	28.1	27.3	27.7	26.5	31.5	27.2
Moderate	206	M	49.1	31.9	56.1	41.0	47.6	30.6	57.5	31.4	62.7	52.3
		SD	26.0	23.3	19.4	21.2	22.4	21.1	19.9	22.2	21.7	24.9
Severe Problem	323	M	62.5	43.7	67.5	48.2	51.8	36.4	63.7	44.4	74.1	60.4
		SD	23.4	23.5	19.0	21.0	22.9	23.6	21.0	26.2	20.7	24.9
Former Problem	110	M	52.1	35.3	60.1	43.7	56.4	47.9	62.7	42.1	63.7	59.9
		SD	23.8	22.8	21.7	21.2	21.8	25.4	20.9	24.4	22.4	23.8

Note: *NE* = Negative Emotions; *CO* = Conflict with Others; *UT* = Urges and Temptations; *TPC* = Testing Personal Control; *PE* =

Pleasant Emotions; *SP* = Social Pressure; *NEX* = Need for Excitement; *WD* = Worried about Debts; *WC* = Winning and Chasing; *CS* =

Confidence in Skill;

### Discussion

The purpose of the current study was to cross-validate the factor structure of the CAMH-IGS. Consistent with our expectations, we were able to mostly replicate the 10-factor structure of the CAMH-IGS reported by Turner et al. (2013) with only 3 minor changes to the factor loading matrix (hypothesis 1). The model tested was found to be positive definite (hypothesis 2). An examination of the residuals did not find any evidence of an alternative factor structure (hypothesis 3). Only a small number of changes in the factor matrix were indicated in the analysis. These changes did not impact the reliability of *Negative Emotions* subscale and resulted in a slight improvement in the reliability for *Conflict with Others* subscale. Additional changes could be made by adding more cross loadings, but we determined that these would not be clinically useful.

We also hypothesized that there would be sex differences in the CAMH-IGS, as previous research reported that females higher on the *Negative Emotions* and *Need for Excitement* subscales (Turner, et al., 2013). The current study examined sex differences in the CAMH-IGS subscales with a larger sample size and found that four subscales had small to moderate sex differences: *Negative Emotions*, *Pleasant Emotions*, *Social Pressure*, and *Confidence in Skill*. The sex differences in the *Negative Emotions* subscale replicated previous findings from the CAMH-IGS (Turner et al, 2013), and is also consistent with previous work with the IDTS (Annis, Turner, & Sklar, 1996) and DTCQ (Sklar, et al., 1998). This finding indicates that females were more likely to report engaging in an addictive behaviour to escape negative emotions. However, the sex difference for *Need for Excitement* subscale was not replicated. The higher scores for males on *Confidence in Skill* subscale was consistent with previous research

demonstrating that male gamblers tend to be more interested in skill or strategy-oriented games (Stevens, & Young, 2010; Wood, & Williams, 2011; Potenza, Steinberg, McLaughlin, Wu, Rounsaville, & O'Malley, 2001). Potenza et al. (2001) reported that among helpline callers, men were more likely to report problems with “strategic” gambling activities. In addition, Wood and Williams (2011) reported that games of skill were preferred by men whereas women were more likely to engage in online bingo. The higher means for men of *Pleasant Emotions and Social Pressure* subscales suggest that men are more likely to lose control over gambling when they are happy or when socializing. Given the significant differences in risk profiles between males and females, gender specific treatment programs may be advisable.

We were also interested in exploring the presence of second order factor structures, and the results revealed a 2-factor model with a positive affect situations factor and a negative affect situations factor. This two-factor model is consistent with previous analysis of the Inventory of Drinking Situations (Annis & Graham, 1988); however, we did not find evidence of a separate urges factor as was reported for the Inventory of Drug Taking Situations (Turner et al., 1997). Rather, *Urges and Temptations* and *Testing Personal Control* subscales loaded on both factors, suggesting that they are neither fully positive nor fully negative, but common to both positive and negative emotional states. It is important to point out that when we use the term “positive emotional situations” we are referring to positive reinforcement (Marlatt & Gordon, 1980). Positive in this context does not mean that the situation is low risk or that gambling when happy is better than gambling when unhappy. In fact, for some people it means that when they are in a positive mood situation (*Pleasant Emotions, Need for Excitement*) they are more likely to lose control and gamble excessively than when they may be in a negative emotional situation. Consistent with the IDTS (Turner et al., 1997), negative emotional situations were more often a trigger for females than male, but for the CAMH-IGS, positive emotional situations were more often a trigger for males than females.

Although not intended as a measure of problem severity, the results regarding self-categorization suggest that the CAMH-IGS can differentiate people who classify themselves as social, moderate or severe gamblers. The results for former problem gamblers suggest that they were still at high-risk, especially when it comes to *Social Pressure* and *Pleasant Emotions*. Interestingly, some people who considered themselves to be social gamblers also had substantial scores on some of the scales.

The analysis also revealed an interesting subscale difference between the CAMH-IGS and the Inventory of Drug Taking Situations (IDTS; Annis, Turner, et al., 1996). For example, for the CAMH-IGS, *Winning and Chasing* was the most frequently endorsed scale with a mean of 66.7, suggesting that the most critical factor driving a gambling problem is the belief that one is due for a win and chasing their losses. This was true for both males and females. This contrasts with the IDTS for alcohol,

(Annis, Turner, et al., 1996) where the highest scores were for *Unpleasant Emotions* (the equivalent of *Negative Emotions* in the CAMH-IGS) for both males and females. For cocaine, the highest score for females was *Unpleasant Emotions*, but for males the highest score was for *Urges and Temptations* followed by *Unpleasant Emotions* (Annis, Turner et al., 1996). For the CAMH-IGS, *Negative Emotion* had the second highest average score for females. However, for males, four other CAMH-IGS subscales, *Need for Excitement*, *Confidence in Skill*, *Pleasant Emotions* and *Urges and Temptations* also had higher average scores than *Negative Emotions*. The differences between the IDTS and CAMH-IGS illustrate that different addictive behaviors serve different psychological needs and are triggered by different situations.

In addition, these numbers reinforced the notion proposed by Marlatt and Gordon (1980) that in order to understand an individual's gambling we need to take into account both negative emotional issues and positive emotional states as triggers for an addictive behaviour. Furthermore, the results for *Winning and Chasing* and *Confidence in Skill* also underscore the importance of the problem of erroneous beliefs that many gamblers have. The basic purpose of computing a situational profile of one's clients is that one type of treatment does not fit all. The results confirm that like alcohol and drugs, some people are triggered to use by being in a bad mood whereas others are triggered by being in a good mood, and other people are triggered by a variety of other situations (e.g., winning, skill, debt, urges). The results overall are consistent with the cognitive-behavioural view, that an addiction is driven by positive emotional situations that positively reinforce the gambling behavior and negative emotional situations that reinforce escape learning or negative reinforcement (see Annis & Graham, 1995; Marlatt, 1985; Marlatt & Gordon, 1980).

There were two different patterns of results in terms of age. For *Negative Emotions*, *Winning and Chasing*, and *Conflict with Others*, the highest scores were for people 36 to 45. On the other hand, for *Social Pressure* and *Confidence in Skill* the highest score was for those 18 to 25, and scores decreased with age. This suggests that social pressure and skill mattered more to younger adults and less to older adults. Similar findings were reported by Annis et al., (1987) which found that that older respondents had lower mean scores on the IDS subscales than the younger respondents. Furthermore, Annis, Turner, et al., (1996) reported that Social Pressure scores were lower for older adults. The findings for the *Confidence in Skill* subscale were consistent with previous studies that younger players are more likely to seek out games with skill components (Odlaug, Marsh, Kim, & Grant, 2011). In a sample of 440 problem gamblers, Odlaug et al., (2011) found that strategic gamblers had a significantly younger age of onset of gambling activities. Another interesting feature of the pattern with age was that older adults (65+) had the lowest scores on nearly all of the subscales. The findings of larger scores on *Social Pressure* by the

Australians can also at least partially be explained by age of the clients as the Australian clients were significantly younger than the clients from Canada, and the United States. Relative to the younger participants, the older adults may be less vulnerable to *Social Pressure*, *Confidence in Skill*, and *Negative Emotion*, they are still vulnerable to *Urges and Temptations*, *Pleasant Emotion*, *Social Pressure*, and a *Need for Excitement*. It would appear that when in a good mood, older adults (55+) are as much at risk as any other age group.

### **Limitations**

One limitation of the current study was only 60% of the people who completed the questionnaire consented to have their data used for research purposes. This means that the participants did not feel coerced into participating, but it also means that the response rate has to be taken into account when interpreting the results. Furthermore, the background questions were not required to be completed and thus some of the questions had missing values.

A further limitation was that the CAMH-IGS was a self-report scale, and thus the scale required honesty on the part of the client for accuracy. Generally speaking, it is in the client's best interest to be honest about their situational risk, otherwise the clinician may suggest resources and treatment modalities that are not relevant for the particular client. To encourage honesty, it is recommended to make it clear to the client that this scale is designed for their benefit and to help them and their therapist breakdown situational risk in order to focus on key issues.

### **Conclusion**

The results showed that the CAMH-IGS subscales were stable and highly reliable and each subscale accounted for some unique aspect of the situational risk profile for the gambling behaviour of clients. The confirmatory factor analysis found no major contradictions to the factor structure and there was no evidence of any additional factors in the scale. We did however find 3 modifications and a slightly revised CAMH-IGS. Analysis showed that these revisions have very little effect on the CAMH-IGS interpretations, but the reliability of Conflict with Others increased slightly. The CAMH-IGS can be used by clinicians to understand the situational risk profile of their clients and assist in clinical planning such as determining which groups would be most appropriate for the particular client. For example, a client who scored high on *Need for Excitement* might need help with alternative activities (e.g., exercise, new hobbies) whereas a person who scores high on *Negative Emotions* may need help with depression or anxiety. A person who scores high on *Confidence in Skill* or *Winning and Chasing* might need help with erroneous beliefs and a person who scores high on *Conflict with Others* might benefit from couples counselling or conflict resolution.

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**Potential Conflicts of Interest**

None of the authors declare any conflict of interest. Dr. Turner has received funding from the Ontario Ministry of Health and Long-Term Care, The Ontario Problem Gambling Research Centre, the National Center for Responsible Gambling (NCRG), and from Ontario Lottery and Gaming (OLG). In all cases, the contract included guarantees of independence and intellectual property rights for the researcher and the funders made no attempt to influence the study at any point. Turner has also acted as a consultant on gambling problems for various government and legal entities, reviewed grant applications and articles for publication, and developed treatment and prevention materials for problem gambling.

In terms of non-financial conflicts, Turner is also the Editor of the Journal of Gambling Issues. In addition, Turner has reviewed grant applications and articles for publication, and helped develop treatment and prevention materials for problem gambling.

All other authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

**Availability of data and material**

Data will be made available upon request pending REB approval.

**Code availability**

Not applicable

**Author's contributions**

SH lead the effort to put the CAMH-IGS on the CAMH web site. NT ran the study, analysed the data and wrote the first draft. JS, SH, TEM, SC, and MvdM helped write and revise the text.

**Ethics approval**

The research study was approved by the CAMH research ethics board as protocol #209/2009. All participants read and electronically signed an informed consent form by clicking yes (or no). The website allowed them to use the CAMH-IGS for assessment whether they clicked yes or no. All data was collected anonymously.

### Consent to participate

All participants read and had the opportunity to consent or not consent. Consent for publication: All participants were informed in the consent form that the result might be published.

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