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Evaluation of Psychometric Properties of the Inventory of Gambling Motives, Attitudes and Behaviors among Chinese Adolescents

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Abstract Given the high prevalence of adolescent gambling involvement and disorder, this study adapted the revised version of the Inventory of Gambling Motives, Attitudes and Behaviors to an adolescent version (GMAB-A) with a cross-sectional survey of 809 Chinese high school students (41.6 % females, M_{age}=16.86, SD_{age}=1.36) in Macao, China. Confirmatory factor analyses generally supported the original factor structure. The GMAB-A consisted of six, four, and four factors in the motivational, attitudinal, and behavioral domains respectively after refinement. The factor scores were correlated with the criterion variables such as disordered gambling symptoms in the expected directions, and their reliabilities were satisfying. Our findings also suggest that the attitudinal subscales are applicable to non-gamblers. In addition to its application on research, the GMAB-A can be used as an enquiring tool for gambling cognitions and behaviors and thus facilitate devising intervention programs for adolescent gambling disorder.

Keywords Gambling · Measurement · Attitudes · Motives · Chinese

Adolescent gambling has been increasingly recognized as a global problem that is signified as high participation, higher pathological prevalence than adults, and highly dangerous to individual development (Blinn-Pike et al. 2010; Wu and Lau 2014). Because of their cognitive and psychosocial immaturity, younger people are more prone to disordered gambling than adults (American Psychiatric Association 2013). A higher past-year prevalence of disordered gambling as 1.8–10.9 % has been reported among adolescents in both western and Chinese communities (Ariyabuddhiphongs 2013; Chiu and Woo 2012; Ho et al. 2012; Splevins et al. 2010; Molde et al. 2009) compared to that of the general population as 0.2–0.3 % (American Psychiatric Association 2013). These alarming numbers strike us with a series of increased risks associated with adolescent gambling, including substance abuse, suicide ideation and attempts, delinquency and crimes, disrupted family relationships, poorer academic records (see Blinn-Pike et al. 2010 for a review). In a city with high accessibility to

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gambling like Macao, youth gambling problem is a major concern as the past-year gambling participation among youth was higher than 40 % (Fong and Ng 2010; Su and Wong 2007).

On the contrary of the severe adolescent gambling problem, the studies of adolescent gambling is still in infancy period compared to studies of other adolescent addictions and adult gambling (Blinn-Pike et al. 2010). Published scientific research on adolescent gambling in Chinese context is particularly scarce although the gambling involvement and problems have been documented to be common (Fong and Ng 2010; Ho et al. 2012; Su and Wong 2007; Wong 2010). The latest review on adolescent gambling advocated on developing and validating specialized scales to assess adolescent gambling and problem (Blinn-Pike et al. 2010). This calling urges us to examine the applicability of an assessment tool of gambling cognitions and behaviors, the Inventory of Gambling Motives, Attitudes and Behaviors (GMAB), in adolescents, which was developed and validated among Chinese community adult dwellers (Tao et al. 2011; Wu et al. 2012).

The GMAB is constructed and validated as an indigenous scale with the agenda of identifying gambling motives, attitudes, and behaviors for Chinese gamblers (Tao et al. 2011). Unlike most of the existing gambling scales, it has reached non- and sub-clinical gamblers, provided a multiple perspectives of assessing individual gambling, and seized the cultural traits of Chinese gamblers. In the revised version of the GMAB (i.e. GMAB-R), the researchers assessed the motives from six facets (i.e., *self-worth*, *monetary gains*, *sensation seeking*, *boredom alleviation*, *learning*, and *socialization*), the attitudes from four facets (i.e., *fate and luck*, *negative gambling consequences*, *techniques*, and *superstition*), and the behaviors from five facets (i.e., *impaired control*, *gambling involvement*, *arousal reaction*, *superstitious behavior*, and *controlled gambling*) for the purpose of generating a comprehensive and sensitive measurement of Chinese gambling cognitions and behaviors (Wu et al. 2012). The satisfying psychometric properties of the GMAB-R and some of its subscales have been well demonstrated in randomly sampled Chinese adult gamblers (Wu et al. 2012; Wu et al. 2013). Further validations across different demographic backgrounds, however, are warranted.

Empirical studies have reported similar cognitions and behaviors of adolescent gamblers that were captured by the GMAB-R and suggested its application potentials to adolescents. Similar to adult gamblers, youth gamblers reported irrational control beliefs such as game manipulation ability (Moore and Ohtsuka 1999), attitudes towards luck, technique and negative consequences (Derevensky et al. 1996; Wong and Tsang 2012), and motives including monetary gains (Calado et al. 2014; Gillespie et al. 2007; Moore and Ohtsuka 1999; Wong and Tsang 2012; Wickwire et al. 2010), self-worth (Moore and Ohtsuka 1999; Burger et al. 2006), excitement seeking, boredom alleviation, socialization (Gillespie et al. 2007; Rahman et al. 2012), and learning (Burger et al. 2006). Typical gambling behaviors such as chasing, frequent gambling intentions and behaviors were also discovered among adolescent gamblers (Ariyabuddhiphongs 2013; Su and Wong 2007). However, empirical evidence for the efficacy of the GMAB-R in assessing adolescents' gambling cognition and behaviors is needed.

This study aimed to adapt the GMAB-R to an adolescent version (GMAB-A) with a sample of high school students recruited in Macao, China. The findings would facilitate gambling research, particularly from a developmental perspective, among Chinese people. We first examined whether the factor structure of each of the three domains (i.e. motives, attitudes, and behaviors) of the GMAB-R could be replicated in an adolescent gambler sample, and would propose a revision if necessary. Then, we evaluated the criterion validity of the inventory by observing the pattern of associations between the subscale scores and gambling-related variables, including gambling problems, gambling urge, and perceived norms for gambling (Wu et al. 2012, 2013). We also extended the use of the GMAB-R to non-gamblers by testing the psychometric properties of the attitudinal domain among an adolescent non-gambler sample.

Method

Participants and Procedures

This study was a cross-sectional questionnaire survey. Before conducting it, four male and two female students aged 17–18 years with gambling experience were recruited by newspaper advertisement to participate in a focus group discussion for exploring any new gambling motives, beliefs, and behaviors not covered by the GMAB. They were asked to respond to discussion questions like "what factors drive you to start and maintain playing these games?" and "what are the positive and negative consequences of gambling participation?" with a psychologist as the facilitator. The focus group lasted for about 90 min and each participant was rewarded with MOP200 (about US$25). After analyzing the discussion content of the focus group, no new construct was identified and thus no new item was added into the inventory item pool.

In the main phase of this study, a participation invitation letter was sent to the prime ministers of all the high schools in Macau. In two-week time after sending the invitation, we received affirmative responses from ten schools. Subsequently, we sent four trained research assistants to each school to administrate this paper-pencil based survey with an anonymous and structured questionnaire. Before the data collection, a short briefing was given to students to explain the rationale of the study and to clarify questions from students. Confidentiality was ensured. The participants were also explained that their participation was totally voluntary without any monetary reward and were asked to sign a consent form for participation. In total, 809 successful cases (41.6 % females) have been collected from three grades (I: 43.9 %, II: 33.4 %, III: 22.7 %) with an age ranging from 14 to 21 years (M=16.86, SD=1.36).

According to past gambling experience in a lifetime, 320 participants were self-identified as gamblers (61.1 % males; Age: M=16.94, SD=1.38) whereas the rest 489 participants reported as non-gamblers (56.6 % males; Age: M=16.82, SD=1.34). Regarding past-year gambling frequency, the majority (66.2 %) engaged in gambling less than four times in the past year whereas 18.0 % gambled more than twice in every month. Mahjong (68.4 %), cards (59.6 %), and lottery tickets (24.2 %) were most frequently endorsed gambling types among adolescent gamblers within past 12 months. The average betting amount involved in each gambling session was approximately US$16 with a median of US$2.5.

Instruments

Gambling Motives, Attitudes, and Behaviors The 63-item GMAB-R was first screened for appropriateness and relevance to adolescents and later adopted in the survey after removing one item (i.e., "spending more time in casino gambling than gambling with friends") from the behavioral domain because of the legal age of casino gambling has been increased to 21 years or above in Macao since 2012. Self-identified gamblers were asked to respond to items regarding their gambling motives and attitudes on a 5-point Likert scale (1=*strongly disagree* to 5=*strongly agree*) and gambling behaviors on a 4-point Likert scale (0=*never* to 3=*always*). The sample items for the subscales of motives, attitudes, and behaviors were "gambling relieves your stress", "those who have good skills are likely to win", and "you have collected charms to increase chance of winning", respectively. Non-gamblers were only requested to respond to the attitudinal subscale.

Gambling Problem The Chinese version of 20-item South Oaks Gambling Screen (SOGS; Lesieur and Blume 1987) was used to evaluate gambling problems among self-identified

gamblers in this study. It showed good reliability and validity in both student and clinical Chinese samples (C. S. Tang and Wu 2009; C. S. Tang et al. 2010). For those participants with gambling experience, they were asked to provide either *yes* or *no* response to SOGS items. A higher total score of the affirmative responses represented more severe gambling problem. In this study, a Cronbach's alpha of 0.74 was obtained.

Gambling Urge The 6-item Gambling Urge Scale (GUS; Raylu and Oei 2004) was used to assess participants' gambling urge. Participants were asked to indicate how much they agreed with each items such as "I want to gamble so bad I can almost feel it" on a 7-point Likert-scale (0=*strongly disagree* to 6=*strongly agree*). A higher overall score indicated a greater urge to gamble. GUS showed satisfactory internal consistency in different Chinese samples (e.g. Oei et al. 2007; Wu et al. 2012). Its Cronbach's alpha in this study was 0.94.

Perceived Norms Participants' perceived norms were measured from three references, namely, society, parents, and friends, with three self-devised items on a 5-point Likert-scale (1=*strongly disagree* to 5=*strongly agree*). A sample question was "my parents accept gambling among high school students". A higher accumulative score reflected stronger perceived acceptance of gambling among high school students from the society, parents, and friends. This study acquired a Cronbach's alpha of 0.72 for this scale.

Demographics Participants were asked to provide information on their gender, age, grade year, self-evaluated academic performance (five rankings including 1=*bottom*, 2=*below average*, 3=*average*, 4=*above average*, 5=*top*), and gambling experience (1=*yes*, 0=*no*). For those who had gambling experience (i.e., *gamblers*), they were asked to respond to the items about the game type(s) they engaged in, past-year gambling frequency, expense in each gambling session, and gambling partner(s) if any in the past 12 months.

Results

Missing Data

Because independent analyses were conducted for each GMAB domain (i.e., attitude, motive, behavior), cases involved exclusive zero responses in any one of the GMAB domains were excluded from subsequent analyses for that particular GMAB domain. As a result, 38 cases (11.9 %) in the behavioral domain, 51 cases (15.9 %) in the motivational domain, and five cases (1.6 %) in the attitudinal domain were removed from the self-identified gambler sample. Following the same rule, one case (0.2 %) in the attitudinal domain was also ruled out from the non-gambler sample. After eliminating these cases, the number of cases involving missing responses from three GMAB domains ranged from seven to fifteen (2.5 to 5.6 %) in the two samples.

We then conducted a series of tests to verify whether the missing data from both samples belonged to the category of missing completely at random. Those cases with completely null endorsements on a GMAB domain were first examined with χ^2 tests and independent *t* tests on their independence compared with the rest cases. No evidence indicated any significant differences between these excluded cases and the rest regarding any demographic aspects for both samples. After ruling out these cases, we performed another comparison between individuals who gave missing responses on any item within the GMAB domains and the rest who responded to all the GMAB items in both samples. Except a significant gender difference among gamblers who endorsed certain missing responses within the domain of motives

compared to those who did not, no other significant differences were discovered between two groups in both samples. Therefore, we concluded the missing data collected in both samples in our study as missing at random, though still with impact, and would not cast detrimental influence on successive analyses. Considering the potential effect of missing data, we resorted to maximum likelihood estimation (ML) to handle data missing at random.

Confirmatory Factor Analysis (CFA) of GMAB

Because most of the GMAB items violated the normality assumption assumed in maximum likelihood estimation, we harnessed the robust maximum likelihood estimation (MLR) that compensates for the non-normality of data with robust standard errors. Independent CFAs were conducted in gamblers and non-gamblers respectively using Mplus7.2. The multiple-factor model of each domain of the GMAB-R was tested first. Subsequent modifications were made if necessary to achieve a final solid model structure for GMAB-A, which was later compared with alternative one-factor model to examine its appropriateness. A model would be accepted and preferred if it met the threshold of a series of indices including a Comparative Fit Index (CFI) greater than 0.90 (Bentler 1992), a Root Mean Square Error of Approximation (RMSEA) less than 0.08 (Browne and Cudeck 1993), a Standardized Root Mean Square Residual (SRMR) less than 0.08 (Hu and Bentler 1999), as well as lower values of χ^2, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC) than alternative models (West et al. 2012). Furthermore, factor indicators with a factor loading smaller than 0.30 would be removed from the model (Hair et al. 2010; Kline 1994).

Behaviors After removing one content-inappropriate item (i.e., "spending more time in casino gambling than gambling with friends") from the original GMAB-R behavioral domain, the remaining 17-item in the five-factor structure was initially examined. Without postulating any cross-loadings within or between factors, the CFA result indicated a marginally fitted model using the Chinese adolescent gambler dataset with χ^2 (n=282, df=109)=261.83, p<0.001, RMSEA=0.071, 90 % CI [0.060, 0.081], CFI=0.87, SRMR=0.070, AIC=9284.10, BIC=9506.26. The model estimation result indicated that the two-item factor of controlled gambling led to a not positively defined latent variable covariance matrix. Therefore, we deducted the initial five-factor model to four-factor model by removing the factor of controlled gambling (i.e., "small bet size" and "having control over bet size and time spent") as well as another two items (i.e., "persistence after winning" and "having deteriorating relationship with family") from the impaired control factor that implied a risk for double factor loadings. The newly proposed structure revealed a satisfactory model fit with χ^2 (n=282, df= 59)=95.81, p= 0.002, RMSEA=0.047, 90 % CI [0.029, 0.064], CFI=0.95, SRMR=0.043, AIC=6670.26, BIC=6834.14. It also showed better fit with the data when competing with its alternative one-factor model with goodness-of-fit indices of χ^2 (n=282, df= 65)=144.27, p<0.001, RMSEA=0.066, 90 % CI [0.051,0.080], CFI=0.90, SRMR=0.055, AIC=6736.04, BIC=6878.07. Therefore, the four-factor structure was proposed for the behavioral domain in the GMAB-A. The detailed factor loadings of each item are listed in Table 1.

Motives The original 25-item and six-factor structure of the motivational domain of the GMAB-R was first replicated to examine its appropriateness for the Chinese adolescent gambler dataset. As starting with a model without any postulated cross-loadings within or between factors, the CFA result showed a marginally acceptable model fit, χ^2 (n=269, df=260)=598.00, p<0.001, RMSEA=0.070, 90 % CI [0.062, 0.077], CFI=0.88, SRMR=0.066, AIC=16493.76, BIC=16817.28. After consulting for model modification indices, three

Table 1 Factor Loadings of the 13 Items in the Behavioral Domain

	α	Factor loading
Factor 1 (B1): Impaired Control	0.64	
B1-1: Gambling till the last dollar is gone.		0.65
B1-2: Borrowing money		0.59
B1-3: Chasing when you lose		0.68
Factor 2 (B2): Gambling involvement	0.81	
B2-1: Gambles always		0.62
B2-2: Gambles regularly		0.80
B2-3: Gambles with a great deal of money		0.69
B2-4: Gambles when happy		0.65
B2-5: Playing various games		0.66
Factor 3 (B3): Arousal reaction	0.70	
B3-1: Vigorous reaction when winning		0.81
B3-2: Vigorous reaction when losing		0.72
Factor 4 (B4): Superstitious behaviors	0.63	
B4-1: Collecting charms		0.78
B4-2: Special behavioral rituals		0.66
B4-3: Investigation for winning		0.42

unique factor covariance were freed (i.e., M1-3 with M1-5, M1-4 with M1-6, and M1-1 with M1-6), which resulted in a satisfactory model structure with χ^2 (n=269,df=257)=533.52, p<0.001, RMSEA=0.063, 90 % CI [0.056, 0.071], CFI=0.90, SRMR=0.063, AIC=16403.08, BIC=16737.39. Another CFA was conducted to test its alternative one-factor model of the motivational domain, which generated a poorer model fit with the data, χ^2 (n=269, df=272)=934.36, p<0.001, RMSEA=0.095, 90 % CI [0.089, 0.102], CFI=0.76, SRMR=0.083, AIC=16950.54, BIC=17230.93. Therefore, the six-factor structure of the motivational domain in the GMAB-A was supported, and the detailed factor loadings of each item are listed in Table 2.

Attitudes The initial 20-item and four-factor structure of the attitudinal domain in the GMAB-R was first assessed for whether it can be fitted with the Chinese adolescent gambler dataset. The CFA result presented a marginally acceptable goodness-of-fit with χ^2 (n=315, df=164)=334.83, p<0.001, RMSEA=0.058, 90 % CI [0.049, 0.066], CFI=0.87, SRMR=0.076, AIC=18838.42, BIC=19086.09. After screening factor loading of each item, we removed one item (i.e., "the casino (i.e., house) has advantage over players") from negative gambling consequences factor because it carried relatively low factor loading of 0.25. Accordingly, another CFA indicated a good model fit with the adolescent gambler dataset, χ^2 (n=315, df=146)=271.59, p<0.001, RMSEA=0.052, 90 % CI [0.043, 062], CFI=0.90, SRMR=0.059, AIC=17758.08, BIC=17994.49. This model structure also fit with the data better when comparing with its alternative one-factor model, χ^2 (n=315, df=152)=1221.3, p<0.001, RMSEA=0.149, 90 % CI [0.142, 0.157], CFI=0.16, SRMR=0.222, AIC=19087.8, BIC=19301.7. Hence, the new 19-item and four-factor model structure was endorsed for the attitudinal domain of the GMAB-A among our Chinese adolescent gambler participants.

Table 2 Factor Loadings of the 25 Items in the Motivational Domain

	α	Factor loading
Factor 1 (M1): Self-worth	0.86	
M1-1: Proving expertise		0.70
M1-2: Actualizing ambition		0.78
M1-3: Utilizing ability		0.63
M1-4: Learning more to work at casino		0.64
M1-5: Being recognized and admired while winning		0.58
M1-6: Being oneself		0.78
Factor 2 (M2): Monetary gains	0.87	
M2-1: Winning money for expenses		0.78
M2-2: Chasing money lost		0.80
M2-3: Money to buy things		0.80
M2-4: Large jackpot		0.77
Factor 3 (M3): Sensation seeking	0.90	
M3-1: Feeling excited		0.83
M3-2: Feeling happy		0.86
M3-3: More fun than other activities		0.77
M3-4: Excitement seeking		0.77
M3-5: Reducing pressure		0.75
M3-6: Enjoying the process of decision-making		0.71
Factor 4 (M4): Boredom alleviation	0.81	
M4-1: Passing time		0.78
M4-2: Boredom relief		0.75
M4-3: Relaxation		0.77
Factor 5 (M5): Learning	0.72	
M5-1: Widening experience and horizon		0.60
M5-2: Learning different games		0.68
M5-3: Learning more		0.74
Factor 6 (M6): Socialization	0.75	
M6-1: Meeting friends		0.80
M6-2: Being with friends		0.84
M6-3: Playing with relatives/friends in holidays		0.57

After constraining the model structure for Chinese adolescent gambler dataset, another CFA was conducted to replicate the same model structure using the non-gambler dataset. The result demonstrated satisfactory model fit with χ^2 (n=488, df=145)=384.1, p<0.001, RMSEA=0.058, 90 % CI [0.051, 0.065], CFI=0.92, SRMR=0.082, AIC=24207.0, BIC=24475.1, after freeing one unique factor covariance (i.e., A2-1 with A2-2). The newly proposed model has also surpassed its alternative one-factor model, which yielded χ^2 (n=488, df=151)=1940.6, p<0.001, RMSEA=0.156, 90 % CI [0.150, 0.162], CFI=0.36, SRMR=0.252, AIC=26326.9, BIC=26570.0. The detailed information of factor loadings for both gambler and non-gambler datasets are listed in Table 3.

Table 3 Factor Loadings of the 19 Items in the Attitudinal Domain

	Gambler		Non-gambler	
	α	Factor loading	α	Factor loading
Factor 1 (A1): Negative gambling consequences	0.79		0.85	
A1-1: Negative impacts on family		0.55		0.60
A1-2: Less communication with family		0.68		0.83
A1-3: Losing temper		0.37		0.43
A1-4: Prohibition among adolescents		0.62		0.66
A1-5: Negative impacts of gambling		0.81		0.78
A1-6: Addicted to gambling is like throwing money away		0.77		0.86
Factor 2 (A2): Techniques	0.88		0.86	
A2-1: Skills		0.69		0.78
A2-2: Experience		0.76		0.69
A2-3: Investigation		0.63		0.54
A2-4: Good instinct		0.80		0.77
A2-5: Outcomes depends on skills		0.53		0.77
A2-6: Intelligence		0.66		0.69
Factor 3 (A3): Superstition	0.82		0.81	
A3-1: Specific locations		0.77		0.69
A3-2: Special numbers, colors or clothing		0.78		0.80
A3-3: Lucky days		0.74		0.77
A3-4: Divine blessing		0.66		0.63
Factor 4 (A4): Fate and luck	0.56		0.64	
A4-1: Chance		0.52		0.63
A4-2: Luck		0.38		0.57
A4-3: Fate		0.72		0.64

Reliability and Validity of the GMAB-A

Internal Consistency In the gambler sample, the behavioral domain's gambling involvement and arousal reaction displayed good internal consistency (αs=0.81 and 0.70, respectively), whereas impaired control and superstitious behaviors manifested marginally acceptable internal consistency (αs=0.64 and 0.63, respectively). For the motivational domain, all the factors presented good internal consistency, including self-worth, monetary gains, sensation seeking, boredom alleviation, learning, and sensation among gamblers (αs=0.72 to 0.90; Table 2). For the attitudinal domain, negative gambling consequences, techniques, and superstition demonstrated good internal consistency (αs=0.79 to 0.88; Table 3) but the three-item fate and luck exhibited a relatively lower reliability (α=0.56) among gamblers. Similar findings were observed in their non-gambler counterparts: negative gambling consequences, techniques, and superstition showed good internal consistency (αs=0.81 to 0.85; Table 3), while fate and luck had a relatively lower reliability as 0.64.

Validity The validity tests of the GMAB-A were achieved by examining the correlation between each factor of the GMAB-A and the criterion-related constructs including gambling

problems, gambling urge, and perceived norms. Multiple bivariate correlation tests were conducted among gamblers (Table 4) and non-gamblers (Table 5), respectively.

Correlation With Gambling Behaviors and Problem As expected, gambling frequency was significantly correlated with all the GMAB-A subscales in a positive direction (rs=0.15 to 0.46, ps<0.001 to 0.01), except negative consequences (r=−0.13, p=0.03) and fate and luck (r=0.07, p=0.20). Consistently, gambling expense was also positively correlated with GMAB-A subscales including impaired control, gambling involvement, arousal reaction, superstitious behaviors, motive for self-worth, motive for monetary gain, attitude toward technique, and attitude toward superstition (rs=0.14 to 0.24, ps<0.001 to 0.047).

The SOGS scores were also employed as the indicator of gambling problem and the convergent validity test reference of all the GMAB-A factors in the current study. Only the self-identified gamblers (n=320) gave responses on the SOGS items for this association testing. Except negative gambling consequences (r=−0.13, p=0.03), all the behavioral (rs= 0.39 to 0.51, ps<0.001), motivational (rs=0.17 to 0.44, ps<0.001 to 0.01) and attitudinal factors (rs=0.12 to 0.30, ps<0.001 to 0.046) manifested a positive association with gambling problems.

Three hierarchical regressions were conducted for evaluating the predictive effects of three GMAB-A domains on gambling problems. The first step was controlling demographic variables (i.e., gender, age, and grade), which was mutual among three regressions. In the second step, four behavioral factors were entered in the first regression and showed an increased explained variance of gambling problem as 29.5 % (p<0.001) with impaired control (β=0.21, p=0.004), gambling involvement (β=0.20, p=0.01), and arousal reaction (β=0.16, p=0.004) as significant predictors. In the second regression, six attitudinal factors were entered in the equation at the same time, which resulted in a 17.5 % (p<0.001) increment of explained variance of gambling problem with monetary gain (β=0.38, p<0.001) as the only significant predictor. Four attitudinal factors were entered in the third regression and explained 11.1 % (p<0.001) variance of gambling problem with superstition as the only significant predictor (β=0.25, p=0.001).

Self-identified gamblers reported higher scores on attitudes toward technique (r= −0.08, p=0.02), whereas non-gamblers were more likely to endorse negative gambling consequences (r=0.12, p=0.001). One should also note that there was significant gender impact on bet size, gambling frequency, gambling urge, gambling problems (rs=−0.12 to −0.24, ps<0.001 to 0.046) with male gamblers endorsing with larger score. Male gamblers also scored significantly higher than female gamblers on impaired control, gambling involvement, superstitious behaviors, self-worth, monetary gain, and sensation seeking (rs=−0.15 to −0.20, ps=0.001 to 0.014), whereas female non-gamblers reported more negative attitudes toward gambling consequences than their male counterparts (r=0.13, p=0.003). Age also had significant correlation with socialization motive among gamblers (r=−0.16, p=0.01) and fate and luck (r=−0.09, p=−0.09) among non-gamblers.

Correlation With Gambling Urge In the gambler sample, all the behavioral and motivational factors, except arousal reaction (r= 0.12, p=0.52), showed a positive association with gambling urge (rs=0.14 to 0.47, ps<.001 to 0.03). In the both gambler and non-gambler samples, gambling urge had significant relations with technique (r=0.21, p< 0.001 and r=0.10, p=0.03 respectively), superstition (rs=0.32 and 0.21 respectively, p<0.001) and negative correlation with negative gambling consequences (rs=−0.22 and −0.37, ps<0.001), but not fate and luck (ps=0.73 and 0.15 respectively).

Table 4 Inter-correlations among the Psychological Variables in Gambler Dataset

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	B1	1.00																
2.	B2	0.68**	1.00															
3.	B3	0.43**	0.47**	1.00														
4.	B4	0.65**	0.72**	0.43**	1.00													
5.	M1	0.43**	0.48**	0.28**	0.52**	1.00												
6.	M2	0.50**	0.48**	0.30**	0.49**	0.73**	1.00											
7.	M3	0.46**	0.50**	0.32**	0.43**	0.71**	0.65**	1.00										
8.	M4	0.31**	0.32**	0.17**	0.21**	0.49**	0.43**	0.67**	1.00									
9.	M5	0.39**	0.39**	0.23**	0.35**	0.59**	0.54**	0.64**	0.58**	1.00								
10.	M6	0.22**	0.35**	0.14**	0.28**	0.51**	0.37**	0.52**	0.60**	0.44**	1.00							
11.	A1	−0.07	−0.17**	−0.03	−0.13*	−0.17**	−0.08	−0.10	−0.07	.−0.01	−0.07	1.00						
12.	A2	0.26**	0.20**	0.28**	0.29**	0.47**	0.46**	0.44**	0.45**	0.44**	0.40**	0.04	1.00					
13.	A3	0.32**	0.37**	0.33**	0.42**	0.58**	0.50**	0.44**	0.35**	0.45**	0.42**	−0.08	0.60**	1.00				
14.	A4	0.14**	0.18**	0.25**	0.10*	0.21**	0.20**	0.30**	0.27**	0.29**	0.21**	0.25**	0.33**	0.35**	1.00			
15.	SOGS	0.51**	0.51**	0.39**	0.47**	0.34**	0.44**	0.33**	0.17**	0.26**	0.17**	−0.13*	0.25**	0.32**	0.12*	1.00		
16.	Urge	0.31**	0.38**	0.12	0.47**	0.46**	0.39**	0.30**	0.14**	0.21**	0.27**	−0.22**	0.21**	0.32**	0.02	0.30**	1.00	
17.	Norms	0.30**	0.32**	0.20**	0.25**	0.31**	0.25**	0.35**	0.37**	0.38**	0.38**	−0.15*	0.26**	0.31**	0.17**	0.21**	0.20**	1.00
	Mean	0.39	0.47	1.11	0.30	1.80	2.00	2.21	2.58	2.32	2.23	3.85	2.66	2.20	2.98	1.71	1.47	2.80
	SD	0.55	0.51	0.91	0.51	0.73	0.91	0.89	1.01	0.90	0.95	0.84	0.98	0.92	0.93	2.22	0.74	0.84

B1 impaired control, *B2* gambling involvement, *B3* arousal reaction, *B4* superstitious behavior, *M1* self-worth, *M2* monetary gain, *M3* sensation seeking, *M4* boredom alleviation, *M5* learning, *M6* socialization, *A1* negative gambling consequences, *A2* technique, *A3* superstition, *A4* fate and luck

* $p<0.05$, ** $p<0.01$

Table 5 Inter-correlations among the Psychological Variables in Non-gambler Dataset

		1	2	3	4	5	6
1.	A1	1.00					
2.	A2	0.06	1.00				
3.	A3	−0.12**	0.72**	1.00			
4.	A4	0.38**	0.45**	0.38**	1.00		
5.	Urge	−0.37**	0.10*	0.21**	−0.07	1.00	
6.	Norms	−0.20**	0.21**	0.19**	0.11*	0.22**	1.00
	Mean	4.06	2.51	2.25	3.10	1.41	2.35
	SD	0.84	0.84	0.85	0.90	0.66	0.78

A1 negative gambling consequences, *A2* technique, *A3* superstition, *A4* fate and luck

* $p<0.05$, ** $p<0.01$

Correlation with Perceived Norms As expected, perceived norms were significantly associated with all the GMAB-A factors in the gambler sample in a positive direction (rs=0.20 to 0.38, ps<0.001 to 0.008) except negative gambling consequences ($r=-0.15$, $p=0.008$). The non-gambler sample replicated the association pattern of the gambler sample, and perceived norms was positively associated with attitudes toward technique, superstition, as well as fate and luck (rs=0.11 to 0.21, ps<0.001 to 0.014) but negatively with attitude toward negative gambling consequences ($r=-0.20$, $p<0.001$).

Discussion

In this study, we observed that the life-time gambling prevalence is about two-fifth in our high school sample, and about 85 % of them had gambled at least once in the past 12 months. About 18 % of the gambler participants engaged in gambling more than twice in every month and 22.5 % reported symptoms of gambling disorders (i.e. endorsing three or more SOGS items) with female gamblers reporting fewer symptoms than male counterparts. This gender difference in vulnerability to disordered gambling was also reported as a reduced risk of problem gambling for females by Scholes-Balog et al. (2014). Though adolescents are forbidden to gamble at local casinos by laws, it seems common and socially acceptable for them to play mahjong and card games with friends and families as well as to buy lottery tickets. These findings highlight the significance of adapting a reliable measurement inventory to facilitate better understanding of Chinese adolescent gambling. Overall, our findings are in favor that the GMAB-A can serve this purpose well.

The results of confirmatory factor analyses, reliability analyses, and correlation analyses consistently suggested that the GMAB-A is generally a reliable and valid tool for assessing Chinese adolescent gamblers' gambling motives, attitudes, and behaviors as well as non-gamblers' attitudes towards gambling. Based on the results, we recommended two major modifications to the GMAB-R for its transition to the GMAB-A: (1) Five items should be removed from the behavioral domain, as well as one item from the motivational domain. The resultant four-factor behavioral model, which corresponds to impaired control, gambling involvement, arousal reaction, and superstitious behavior, stood using Chinese adolescent data; (2) The attitudinal domain has high relevance and value for understanding non-gamblers and is applicable to Chinese adolescent non-gamblers.

In accordance with other previous findings (e.g., Liu, et al. 2012), the behavioral factors had positive correlations with gambling problem and gambling urge. Generally speaking, the more frequently adolescents engage in those gambling behaviors assessed, the more likely they would display gambling problems and experience gambling urge. Furthermore, another set of positive associations were found between all the behavioral factors and perceived norms for gambling. As predicted, the more support one perceived from the society, family, and friends for high school student's participation in gambling, the more gambling-related behaviors reported. Such positive association has also been underscored by other previous studies (e.g., Scholes-Balog et al. 2014; Wickwire et al. 2007).

When comparing demographic differences within the behavioral domain, consistent results were found that males tended to display more gambling involvement and impaired control behaviors than females among Chinese adolescents as previous findings with adults (e.g., Fong and Ozorio 2005; Wong and So 2003; Wu et al. 2012). Moreover, female adolescents were less likely to engage in superstitious behaviors than males as discovered by former adults gambling studies (Moore and Ohtsuka 1999; Wu et al. 2012).

The GMAB-A replicated the original six-factor structure of the motivational domain in the GMAB-R using Chinese adolescent gambling sample with a relatively better internal consistency. All the motivational factors were positively correlated with each other to an extent from moderate to strong, which is consistent with previous studies (Stewart and Zack 2008; Tao et al. 2011; Wu and Tang 2011; Wu et al. 2012). We also found motivational factors' positive links with gambling urge, gambling problem, and positive perceived norms. These findings were consistent with the previous ones reporting stronger gambling motives (including material gains, boredom alleviation, emotion relief, and excitement seeking) among problem gamblers than non-problem gamblers (Chiu and Woo 2012; Clarke 2004; Clarke et al. 2007; Platz and Millar 2001; Stewart and Zack 2008; C. S. Tang and Wu 2012).

Distinct from the original GMAB, the GMAB-R has a motivational factor of socialization added. Given that adolescence is the essential period for socialization (Barnes et al. 1999; Dinges et al. 1979; Thomas and Weigert 1971), it is not surprising to see a good fit of socialization motive factor within Chinese adolescents. Moreover, we observed a decreasing trend of the endorsement of socialization as a motive for gambling with age. It may catch the process of increasing peer pressure resistance when older individuals become more socially mature (Sumter et al. 2009).

Regarding the four-factor attitudinal domain, the GMAB-A also achieved an acceptable model fit using both adolescent gamblers and non-gamblers for the same structure proposed in the GMAB-R. The internal consistency of four attitudinal factors were generally satisfactory (except for a lower reliability of fate and luck) among both gamblers and non-gamblers. All attitudinal factors generally manifested a significant association with gambling problem and urge in an expected direction among gamblers and non-gamblers. These findings highlight the important role of attitudes towards gambling in affecting one's urge and involvement in gambling as discovered by other previous studies (Wong and Tsang 2012; Wu et al. 2012, 2013). As expected, our adolescent gamblers reported fewer agreements on negative gambling consequences than non-gamblers and such lower endorsement rate was associated with higher gambling urge. Furthermore, adolescent gamblers reported more favorable attitudes toward technique than non-gamblers, which is in accordance with previous findings of gamblers' illusory control over gambling (e.g., Derevensky et al. 1996; Wong and Tsang 2012). This finding suggests distinct focuses on cognitive modification strategy in prevention and treatment program. Specifically, adolescent gamblers may respond better to a program targeting illusory controls over the games while their non-gambler counterparts may be effectively discouraged from gambling participation by combating their perceived benefits of gambling and promoting perceived adverse consequences.

Consistent with previous findings among Chinese adult gamblers (Wu et al. 2012, 2013), adolescent gamblers and non-gamblers with more favorable norms for gambling are more likely to hold more positive attitudes towards gambling. Consistent with some previous findings (Moore and Ohtsuka 1997; Wood et al. 2004), females were found to report more attitudes of negative gambling consequences than their male counterparts in our non-gambler sample, which also echoes to our finding that females gambled less frequently with a smaller bet size than males. Moreover, attitudes toward negative gambling consequences and fate and luck declined with age among non-gamblers, which may imply the increase in awareness and knowledge about gambling with age.

In conclusion, the present study adapted the GMAB-R for adolescents and supported the usefulness of GMAB-A to assess gambling cognitions and behaviors of adolescents by demonstrating its satisfying psychometric properties in a Chinese high school sample. The relatively lower internal consistency of fate and luck may be plausibly related to the limited item number and relatively broader construct essence. We suggest retaining such conceptually meaningful and valuable construct with further development and modification for achieving a higher reliability in future research. In addition to research purpose, the GMAB-A can benefit practitioners in devising intervention programs for disordering gambling as a useful enquiring tool for gambling attitudes, motives, and behaviors. This study also surpassed the restriction of the sole usage of the GMAB-R among gamblers by extending its application to non-gamblers, which enables the comparisons between two groups. After this first adaptation of the GMAB-R using adolescent students, we recommend further validations of the GMAB-A among Chinese adolescents in different regions, especially for those living outside of China. Using the GMAB-A in longitudinal studies are recommended to investigate the change in gambling cognitions and behaviors with age and its potential associations with the changes in developmental need and tasks.

Conflict of Interest All authors declare that they have no conflict of interest.

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