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THE PSYCHOMETRIC EVALUATION OF THE MEMPHIS GAMBLING
INVENTORY: A PROBLEM GAMBLING BRIEF SCREEN FOR PRIMARY
CARE SETTINGS

by

George B. Mitzner, M.S.

A Dissertation

Submitted in Partial Fulfillment of the

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Dedication

I dedicate this dissertation to my wife and son, Crystal and Jackson. For their love, support, compassion, and patience, I will always be indebted. Crystal, thank you for giving me the opportunity to complete this project. Jackson, thank you for always laughing with me and inspiring me to give my best each day.

ABSTRACT

Mitzner, George Bader. PhD. The University of Memphis. December/2012. The Psychometric Evaluation of the Memphis Gambling Inventory: A Problem Gambling Brief Screen for Primary Care Settings. Major Professor: Andrew Meyers, Ph.D.

Central to a public health approach to gambling problems is early detection. Drawbacks of traditional screening efforts have reinforced the need for brief problem gambling screens particularly in time sensitive settings such as primary care. The only, existing primary care brief instrument is limited by its psychometric development and is not informed by contemporary gambling research. The Memphis Gambling Inventory (MGI) is a new problem gambling brief screen that assesses several dimensions of gambling behavior, cognition, motivation, and consequences. The current study evaluated the screening performance of the MGI's original 15-item pool. ROC analysis revealed a 3-item MGI that correctly classified 87% of at-risk gamblers. The MGI's items include one behavioral indicator, one gambling-specific cognitive distortion, and one consequence resulting from gambling. The MGI was associated with other measures of problem gambling and gambling behavior consequences. Implications for screening with the MGI are discussed.

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Introduction

Most adults have gambled in their lifetime and a minority experience symptoms consistent with a gambling disorder. The DSM-IV pathological gambling diagnosis (APA, 1994) has been characterized by several shortcomings and researchers have investigated the utility of alternate conceptualizations of the condition (Shaffer, Hall, & Vander Bilt, 1997). A public health framework offers a continuous view of gambling behavior and regards screening for gambling problems as central to prevention (Korn & Shaffer, 1999). Challenges facing traditional screening methods have made brief assessment of problem gambling a priority. Primary care settings including college student health centers are ideal for the application of these brief tools due to environmental constraints, practitioner need, and problem gambling co-morbidities. Only one measure has been developed for specific use in the primary care setting (Sullivan, 1999), but it is limited by its item composition and validation history. The Memphis Gambling Inventory is a new, brief problem gambling screen for use in health care settings. It was constructed from empirically supported gambling items including behavioral indicators, self-efficacy, cognition, DSM-IV criteria, and consequences. In the present study, we develop and evaluate the Memphis Gambling Inventory for brief problem gambling assessment.

Gambling is commonly defined as the wagering of money, property, or items of value on games or events of an unknown outcome (Whelan, Steenbergh, & Meyers, 2007). As many as 80% of adults have reported gambling in the past year and up to 85% have wagered in their lifetime (NPGAW, 2009). Current prevalence estimates show that between 1% and 4% of individuals gamble in an unsafe or harmful way and exhibit

symptoms consistent with a gambling disorder (Kessler et al., 2008; Welte, Barnes, Weiczorek, Tidwell, & Parker, 2001).

The DSM-IV defines pathological gambling as persistent gambling behavior that is marked by a preoccupation with gambling, unsuccessful attempts to stop gambling, having to gamble more, and the experience of negative social, financial, and occupational consequences that result from gambling (APA, 1994; see Appendix A). Some view the current five-symptom threshold for pathological gambling diagnosis as too demanding (e.g., Lakey, Goodie, Lance, Stinchfield, & Winters, 2007; Strong, Lesieur, Breen, Stinchfield, & Lejuez, 2004) and failing to capture individuals with early-stage gambling problems (Shaffer, Hall, & Vander Bilt, 1999; Toce-Gerstein, Gerstein, & Volberg, 2003).

Gambling researchers and clinicians have in turn advocated for the adoption of a public health perspective. A principle of this view maintains that gambling behavior and its associated harm are continuous phenomena, ranging from no gambling with minimal harm to very frequent gambling associated with debilitating harm (Korn, Gibbons, & Azmier, 2004; Korn & Shaffer, 1999). Korn and colleagues (1999, 2004) noted that early screening and identification are central to the prevention of gambling related problems.

Though indicated, traditional screening efforts have been deterred for a variety of reasons. Chief among them are inefficiency, cost, and requisite knowledge of the screening tool and its interpretation (Abbot, Volberg, Bellringer, & Reith, 2004; Rowan & Galasso, 2000; Tolchard, Thomas, & Battersby, 2007). As such, the development of problem gambling brief screens has been recommended. Ideally, brief screens are psychometrically valid, cost effective, amenable to time-limited settings, and inform

further assessment or need for service delivery (Neal, Delfabbro, & O'Neil, 2005; Volberg, Munck, & Petry, 2008). They help achieve public health prevention objectives by their efficiency and targeted application, particularly in health care settings.

Potenza, Feillin, Heninger, Rounsaville, and Masure (2002) argued that general practitioners should screen for problem gambling in primary care. Gambling disorders have been associated with poor mental and physical wellbeing (Desai, Desai, & Potenza, 2007; Morasco, Pietrzak, et al., 2006) as well as several Axis I and II disorders (Morasco, Petry, & vom Eigen, 2006). The use of brief screens in primary care can help general practitioners efficiently assess gambling problems and facilitate intervention (Larimer, Lostutter, & Neighbors, 2006).

Currently, the only problem gambling brief screen created for use in health care settings is the Early Intervention Gambling Health Test (EIGHT; Sullivan, 1999; see Appendix B). This dichotomous, 8-item survey is easy to use and displays good internal consistency and test-retest reliability (Sullivan, 2007). A central concern with the EIGHT is that the measure contains five items similar to those found in the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987), the most commonly used problem gambling measure (See items 2 – 4, 6, and 7 in Appendix B). This casts doubt on subsequent validation analyses that use both measures. More significantly, the EIGHT does not incorporate contemporary research on gambling assessment. The measure was created in 1999, and since that time, research on the distribution of DSM-IV items, distorted cognition, self-efficacy, and functional behavioral indicators has been used to inform gambling assessment (for reviews see Abbot et al., 2004; Whelan et al., 2007). Current

primary care gambling assessment is limited, and modifications are needed that attend to relevant content areas and public health principles.

The Memphis Gambling Inventory

The Memphis Gambling Inventory (MGI) is a new brief problem gambling screen for use in time-limited settings including primary care. It is self-report, forced choice, initially contained 15 items, and was later subjected to statistical reduction. The MGI differs from the EIGHT by featuring items that assess multiple, relevant gambling domains. These empirically supported items have served to distinguish those with and without gambling problems, and both their description and rationale for inclusion follow.

The provisional, 15-item MGI included 3 questions that correspond to behavioral indicators of gambling. Such frequency or quantity questions have been used in the assessment of other addictive behaviors (e.g., AUDIT; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993) and are effective at signaling risky or hazardous behavior. Weinstock, Whelan, and Meyers (2008) used a timeline follow back procedure to examine the behaviors of 160 gamblers. They found that monthly frequency, monthly duration, income intended to risk, and income risked were the most reliable metrics for differentiating gamblers with and without problems. Specifically, they suggested that gambling more than 1.25 times per month, spending more than 2.1 hours per month gambling, and wagering more than 10.5% of one's income on gambling were the most effective behavioral indicators of individuals who gamble problematically. These items were adapted to the MGI to enhance its classification abilities.

The MGI also assessed self-efficacy applied to gambling. Self-efficacy is the belief in one's ability to perform a particular behavior or manage a situation under

specific conditions (Bandura, 1994). Problem gamblers have been found to have lower self-efficacy than non-problem gamblers in their ability to refuse participation in gambling (May, Whelan, Steenbergh, & Meyers, 2003). Gambling abstinence self-efficacy has also been noted to increase in this population after treatment completion (Winfree, Roberts, Whelan, & Meyers, 2010). The MGI asked individuals whether they would be able to resist gambling when they have the urge to do so.

Five MGI items were adapted from the DSM-IV and chosen based on research documenting how diagnostic criteria and problem gambling status covary. Toce-Gerstein and colleagues (2003) found that symptoms including chasing, preoccupation, and escape are relatively common among gamblers who endorse only one to two diagnostic criteria (i.e., at-risk). When modeling diagnostic criteria on a latent continuum, Strong and Kahler (2007) also found preoccupation, escape, and tolerance to be characteristic of sub-clinical gamblers. Gambling to feel better or escape negative experiences and tolerance related to gambling were retained in the MGI to capture those individuals who specifically endorse few problem gambling symptoms (i.e., lower severity gamblers).

The other DSM-based MGI items were associated with more severe gambling problems and may help evaluate such pathology. Toce-Gerstein et al. (2003) documented that the symptoms of withdrawal and loss of control were reported at significantly different rates when comparing at-risk to problem gamblers (three to four diagnostic criteria), problem to pathological gamblers (five or more criteria), and gamblers endorsing four versus five symptoms. Similarly, Strong and Kahler (2007) found lying and loss of control to be located near the middle of the latent symptom continuum and associated with conversion to pathological status. With the inclusion of “transition”

criteria, the MGI could be effective at discriminating gamblers with and without problems.

Cognitive distortions are associated with gambling pathology (Raylu & Oei, 2004) and are often the target of cognitive-behavioral treatments (Ladouceur et al., 2003; Petry, Weinstock, Ledgerwood, & Morasco, 2008). Yet they are usually assessed with stand-alone measures like the Gambler's Belief Questionnaire (GBQ; Steenbergh, May, Whelan, & Meyers, 2002), a 21-item validated instrument. The MGI features 2 items selected for provisional inclusion that each come from one of the GBQ's two main factors, Luck/Perseverance and Illusion of Control. One question discounts independence of wagers, and the other item disregards probability or chance as an explanation for gambling outcomes. These items had the highest association with their parent scales and with problem gambling (Steenbergh et al., 2002).

The final MGI items are symptoms that have either appeared in other established measures of gambling assessment (i.e., SOGS and EIGHT) or have been clinically documented to be associated with problem gambling (e.g., Petry 2005; Whelan et al., 2007). These items assess borrowing money to gamble or prioritizing gambling over other activities. Other MGI items assess gambling consequences, for example being criticized for one's gambling. The clinical and empirical support for several of these items suggests they should be considered for inclusion in any gambling screening measure (e.g., Stinchfield, 2002). They also represent gambling's functional consequences found at various points along the spectrum of harm (Korn & Shaffer, 1999).

In this study we developed and conducted an initial psychometric validation of the MGI in a university health center. The health center offered a population of students who often gamble at a high rate (Neighbors, Lostutter, Larimer, & Takushi, 2002; Shaffer et al., 1999) and a primary care setting where practicality, time limitations, and efficiency are necessary. It was hypothesized that a subset of MGI items would be effective at discriminating gamblers with and without problems. This empirically reduced MGI would have high classification accuracy indicated by sensitivity and specificity. It was also believed that the MGI would significantly correlate with other measures of problem gambling, gambling behavior consequences, and a measure of alcohol abuse.

Method

Participants

For both the pilot and main studies we recruited health center patients at an urban, public south-central American university. Inclusionary criteria for both studies required that individuals be over the age of 18, a current university student, and receiving care at the health center on the day of the assessment. Lifetime history of gambling was required for both studies, but specific requirements differed as noted in the procedure.

The pilot study sample ($n = 30$) was 50% female with an ethnic makeup of 50% Caucasian, 43% African American, 3% Asian, and 4% other. The mean age was 24.4 years ($SD = 7.4$) with a range of 18 to 46. Approximately 80% were under the age of 27. Participants were asked to indicate which language they felt most comfortable speaking, and approximately 97% reported English. A majority (87%) of the sample reported being never married, 3% married, 3% cohabitating, 3% divorced, and 4% separated. Ten percent of the sample had one child or more. Approximately 30% of the sample lived on

campus. The education of the sample was: 80% high school graduate, 13% bachelor's degree, and 7% master's degree. Monthly income of the sample was \$1091.17 ($SD = \1293.78) and most reported that a job, graduate assistantship (GA), or their family as the source of this income.

Past year gambling frequency averaged 29.6 times ($SD = 39.1$) with a range from 0 to 160. Participants were also asked their lifetime gambling losses as well as gambling-related debt. The mean losses were \$569.17 ($SD = \1631.61), but no participant reported any current gambling related debt. Gambling severity was measured both by self-report and interview. In self-report surveys, participants reported a mean past year National Opinion Research Center DSM-IV Screen for Gambling Problems (NODS) score of 0.23 ($SD = 0.50$) with a range of 0 to 2. Twenty percent of the pilot respondents had a score of 1 or 2, placing them in the at-risk range, with the other 80% had a score of 0, suggestive of low risk. During interview using the Diagnostic Interview for Gambling Severity (DIGS), respondents reported mean past year score of 0.34 ($SD = 0.61$) and a lifetime mean DIGS score of 0.43 ($SD = 0.63$). These scores indicated that the average gambling severity of the pilot sample was non-pathological and low intensity. None reported that they had ever been treated for a gambling problem. Alcohol use was assessed with the Alcohol Use Disorders Identification Test – Consumption (AUDIT-C) and participants' mean score was 2.83 ($SD = 2.37$) with a range from 0 to 9. When examining the breakdown of AUDIT-C scores by recommended gender cut-offs, seven men (46.7%) and five women (33.3%) reported risky drinking.

The primary study sample ($n = 205$) was 66% female with an ethnic makeup of 51% Caucasian, 38% African American, 2% Asian, 2% Indian (South Asian), 1%

Hispanic, and 6% other. The mean age was 23.4 ($SD = 5.7$) with a range of 18 to 47. Participants were asked to indicate which language they felt most comfortable speaking, and approximately 98% reported English. Seventy-six percent of the sample reported never having married, 10% married, 10% cohabitating, 2% divorced, and 2% separated. Approximately 14% of the sample had one child or more. Approximately 26% of the sample lived on campus. The education of the sample was: 76.6% high school graduate, 12.7% Bachelor's Degree, 4.4% Master's Degree, 1.5% Doctoral Degree, and 4.9% Other (e.g., Associate's). Monthly income of the sample was \$982.45 ($SD = \1107.83) and most reported a job, GA or family as the income source.

Gambling behavior variables for the main sample showed past year gambling frequency averaged 25.8 times ($SD = 60.6$) with a range from 0 to 394. Participants reported average lifetime gambling losses of \$179.22 ($SD = \539.37). Approximately 99% of participants reported no gambling debt. Participants reported a mean past year NODS score of 0.27 ($SD = 0.73$) with a range of 0 to 5. One student scored in the pathological range (≥ 5), four students scored in the problematic range (3 – 4), 29 scored in the at-risk range (1 – 2), and 171 were classified as low risk (0). Respondents also reported mean past year DIGS score of 0.39 ($SD = 0.78$) and a lifetime DIGS score of 0.52 ($SD = 0.88$). Applying the NODS taxonomy to past year DIGS scores, one student scored in the pathological range, five scored in the problem range, 48 scored in the at-risk range, and 151 were classified as low risk. Both DIGS lifetime and past year scores ranged from 0 to 5 as well. None of the sample reported that they had ever been treated for a gambling problem. Alcohol use was assessed with the AUDIT-C, and the mean score was 2.18 ($SD = 2.27$) with a range from 0 to 12. When examining the

breakdown of AUDIT-C scores by gendered cut-off, 22 men (31.9%) and 45 women (33.3%) reported higher risk alcohol use.

Instruments

Demographic Questionnaire. This 11-item survey (see Appendix C) assessed demographic information including gender, age, ethnicity, education, marital status, and income. It also featured questions about gambling frequency, largest bet amount, sum of gambling expenses, and whether an individual has had previous gambling treatment.

National Opinion Research Center DSM-IV Screen for Gambling Problems (NODS; Gerstein et al., 1999). This 34-item gambling screen was created for a national gambling prevalence survey (Gerstein et al., 1999; see Appendix C). The NODS contains 17 lifetime and 17 corresponding past year items that encompass symptoms of preoccupation, tolerance, withdrawal, loss of control, escape, chasing, lying about gambling, illegal acts, ruined relationships, and bailout from gambling. Given the past year timeframe of the MGI, only the past year items were administered in the present study. When scored, the NODS items corresponded to the 10 DSM-IV criteria and a score of 5 or more classifies a respondent as a pathological gambler, a score of 3 to 4 is a problem gambler, a score of 1 to 2 is an at-risk gambler, and a score of 0 is considered low risk (Gerstein et al., 1999). The NODS has demonstrated high reliability and internal consistency and has shown significant correlations with other measures of problem gambling (Gerstein et al., 1999; Wickwire, Burke, Brown, Parker, & May, 2008).

Memphis Gambling Inventory (MGI). Developed in the current study, this self-report measure was designed to screen for gambling problems in time sensitive settings such as primary care. It initially contained 15-items (see Appendix C). The instructions

included definitions and examples of gambling and directed the respondent to answer the questions based on gambling in the previous 12 months. The MGI covers several domains of gambling drawn from diagnostic activities and clinical correlates.

Items 1 – 3 included behavioral indicators effective at distinguishing problem and non-problem gamblers (Weinstock et al., 2008), monthly frequency, average time spent gambling, and percent of monthly income spent gambling. Item 4 was adapted from the Gambling Self-Efficacy Questionnaire (GSEQ; May et al., 2003) and assessed self-efficacy applied to gambling. Respondents were asked whether they would be able to resist gambling when they have the urge to do so. This item obtained the highest possible rater agreement for representing the “Urges and Temptations” group of Marlatt’s (1985) relapse risk categories in the May et al. study.

The next five MGI items were adapted from the DSM-IV. MGI 5 and 6, gambling to feel better and tolerance related to gambling, were included in order to capture sub-clinical levels of gambling. MGI items 7 – 9 are the symptoms of withdrawal, lying, and loss of control. These “transition” items can effectively screen gamblers en route to developing pathological behavior (Strong & Kahler, 2007).

MGI items 10 and 11 are related to irrational beliefs about gambling taken from the GBQ’s (Steenbergh et al., 2002) two main factors, Luck/Perseverance and Illusion of Control. MGI 10 detailed whether continued gambling would ultimately pay off. MGI 11 asked gamblers whether they felt their gambling wins were the result of skill.

Borrowing money to gamble, whether gambling caused other problems, being criticized for one’s gambling, and choosing to gamble instead of completing other tasks made up MGI items 12 through 15. These behavior or consequence symptoms have been

associated with problem gambling (e.g., Petry 2005; Whelan et al., 2007) and were considered important for effective screening (Stinchfield, 2002).

The MGI's 15 items remained unchanged through piloting and main data collection. However, cosmetic modifications were made to the measure to aid readability and flow. Per piloting feedback described in the Results, the answer choices were improved to capture the variety of response possibilities. For example, the "N/A" option was added to items 4 – 15 in case individuals felt these items were not relevant. Since the MGI's development was exploratory in nature, scoring of items reflected unweighted estimates. For items 1 – 3, the "None" choice (or "0%" on the piloted MGI 3) was scored as 0, the middle choice (Less than 1 time, less than 2 hrs, and less than 10%) was scored as 1, and the highest ordinal choice (1 time or more, 2 hrs or more, and 10% or more), was scored as 2. For items 4 – 15, "N/A" was scored as 0, "rarely" ('never' on pilot) was also scored as 0, "sometimes" was scored as 1, and "frequently" was scored as 2. The total score and range of the final MGI were based on the number of items retained after the ROC analyses and are presented in the Results.

Alcohol Use Disorders Identification Test – Consumption (AUDIT-C; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). This 3-item screen derived from the full length AUDIT (Saunders et al., 1993) assessed for alcohol use disorders (see Appendix C). All questions were behaviorally-based and evaluated either drinking frequency or intensity on a 5-point scale. Recommended gender thresholds for risky drinking were total scores of 3 for females and 4 for males. The measure is comparable to the full-length version in discriminating those with and without risk for developing an alcohol use disorder and has good psychometric properties (Bush et al., 1998).

Diagnostic Interview for Gambling Severity (DIGS; Winters, Specker, & Stinchfield, 2002). This clinical interview assessed problem gambling symptoms and social problems related to gambling (see Appendix C). The 10 DSM-IV items were assessed using 2 questions each, in both lifetime and past year timeframes. The endorsement of 5 criteria resulted in a positive case. There were also questions that described gambling frequency and other social, legal, and financial consequences of gambling. The DIGS has a high internal consistency and good test-retest reliability. The DIGS pathological gambling score has been associated with other problematic gambling behaviors including gambling frequency, largest bet, gambling debt, social problems, legal problems, and borrowing sources (Winters et al., 2002).

Reaction Form. This was an open ended 11-item measure used during the piloting phase of the study (see Appendix C). It followed the MGI in administration and instructed participants to consider whether the MGI's content and instructions were comprehensible. It also included questions about the MGI's length and format and gave the student an opportunity to make any recommendations about the survey. These results were collated and used to inform changes to the language, layout, and presentation of the MGI prior to primary data collection. This form was not administered during the main study.

Procedure

The pilot procedure took place in the student health center from March to May 2011. After completing their appointment, patients were approached by a researcher and asked if they were over the age of 18. If so, they were then asked to participate in a study about gambling and behavior. After agreeing, the student was then consented and asked

the following gateway question, “Have you ever gambled 5 times or more in any one year of your life?” This question appeared in the NESARC (Grant, Moore, & Kaplan, 2003) and was intended to help recruit a varied sample of lifetime gamblers. It also had the advantage of not including a requirement for a specific monetary amount spent on gambling that may not generalize to all participants. If the student responded “no” to the question, then his or her participation in the study was over. If the participant responded “yes”, then he or she was administered the survey packet featuring demographic information, MGI, reaction form, AUDIT-C, and NODS. After completing the measures, the respondents were interviewed using the DIGS. Participants were compensated for their time with a pen or granola bar and were given a pamphlet for a community gambling addiction treatment center. One-third of participants were selected in advance by pre-labeling of materials to return for a second time to the health center. This second collection event was to gather test-retest reliability information on the MGI and generally occurred 2 – 4 weeks later, though the DIGS was not administered again. For the second assessment, students scheduled a meeting with a researcher to fill out the paper and pencil assessment measures. Participants were offered 1 complimentary movie pass for their time, but a low response rate was noted during these return appointments.

During the primary study, a similar recruitment procedure was used. Although, the requirement of gambling at least 5 times was changed to at least once in order to optimize recruitment efforts. If the student responded to the gateway question by stating that they had not gambled, their study participation was complete. If the participant responded 1 time or more to this question, they were administered a packet of self-report measures. Of note, the MGI underwent modifications based on pilot study findings (see

Appendix D). Participants were then interviewed using the DIGS. One-third of the participants, determined by pre-labeling, were asked to return to the clinic approximately 2 – 4 weeks after the initial assessment to complete the self-report measures for a second time. The retest participation was characterized by low response rate. As a result, the retest rate was changed to 75% of the participants for the last 6 weeks of data collection in effort to increase recruitment. All participants were offered a pen or granola bar to participate in the primary study. Those selected for the second data collection were offered a \$5 grocery store gift card, rather than a movie pass that did not serve as an effective incentive in the pilot. The current project was approved by the university's IRB (No.030311-238 and No.2088). Statistical analyses were performed with IBM SPSS v20.

Results

Pilot Study – Reaction Form Findings

In addition to testing out the procedure and gathering preliminary participant data, one of the central purposes of the pilot study ($n = 30$) was to use the Reaction Form to gather qualitative feedback on the use of the MGI. As a new screen, it was important to find out how the MGI was perceived by the target audience before deployed for regular use. These data were aggregated and used to inform changes to the measure before the primary study was conducted.

Overall, the pilot results indicated that majority of respondents were able to read and comprehend the MGI, and would not change it. However, several useful suggestions were incorporated (See Appendix D), chief among them was modifying answer choices for MGI 1 – 3. The answer choices, particularly for #1 were too discrete and forced gamblers with less than monthly frequency to choose between two answers that were not

quite right (i.e., 0 or monthly). This was modified in the MGI used in the primary study. Some individuals had problems with the switch from #3 to #4, as there was a distinct break from freestanding sentences to a table. This was also addressed in the revision by compartmentalizing all items in one table. Finally, several individuals stated how little they gambled or that certain items were not relevant, and so a “not applicable” or N/A choice was added to items 4 – 15 to help capture the full range of response options.

Alternatively, some of the feedback was not addressed in the revisions. For example, some individuals asked about a change to the 12-month time frame. This was retained primarily due to the standard this duration represents in current assessment measures and to permit comparison to other past year measures such as the NODS or DIGS. In addition, it is believed that the timeframe suggestion was made in part due to respondent’s concerns with the range of MGI #1’s response choices. Another comment asked about gambler motivation, and actually this concept is captured in part by #5, which stems from the DSM-IV “escape” symptom. Further assessment of gambling motivation is outside the scope of the current project. Finally, separate patients wrote that the measure should be used in a more traditional gambling setting, presumably a casino, or should be shorter. To the first statement, the MGI is intended for primary care screening due to the current need for such resources; though validating the measure in other settings might be indicated, it is not the current development objective. In regards to its length, the MGI was shortened during the primary study’s analyses.

MGI Reduction by Classification Analysis

With the pilot data recommendations incorporated and approved by the IRB, primary data collection ensued from September 2011 to May 2012. Of the 205

participants in the main study, all participants completed at least 80% of each gambling symptom inventory and their data were retained for analyses. One individual did not complete the AUDIT-C. All DIGS clinical interviews were completed in their entirety and were used for analyses. The initial step in reducing the item count of the MGI was to determine the clinical utility of each item when discriminating those with and without problem gambling as measured by past year DIGS score. However, due to the fact that the sample featured only one pathological gambler and 5 who scored in the problematic range, treating only 6 participants as criterion positive cases (i.e., past year DIGS problem gamblers) would restrict the power of any classification analyses (Nunally & Bernstein, 1994). Therefore, these analyses aimed to classify individuals who met at-risk criteria (NRC, 1999), endorsing a minimum of 1 or 2 DSM-IV symptoms on the DIGS. On a continuum of gambling behavior, these sub-clinical participants can potentially move to problematic gambling and would benefit from screening and appropriate preventive education or short term treatment matching (Korn et al., 2004). Fifty-four patients (26% of the sample) scoring a 1 or higher on the past year DIGS timeframe were deemed positive cases and this allowed statistically meaningful interpretation of the subsequent analyses. Further discussion of the at-risk label can be found in the NODS development manuscript (NRC, 1999).

Stewart and Connors (2004) explained the technique of comparing a new screen such as the MGI to an established criterion measure that diagnoses those who have the condition of interest, in this case the at-risk group measured by the DIGS. Four findings result from screening with the MGI and diagnosing with the DIGS: true positives (TP) are those that screen positive on the MGI and positive on the DIGS; false positives (FP)

have a positive MGI result, but the DIGS indicates no presence of the condition; true negatives (TN) have both a negative MGI result and a negative DIGS outcome; and false negatives (FN) are those that test negative on the MGI, but are positive according to the DIGS. These outcomes can be cross-tabulated to determine classification accuracy of the new screen. The classification metrics examined include sensitivity, specificity, and positive predictive value. Sensitivity (SN) is the likelihood that a screen for a disorder will be positive when the disorder is truly present ($TP/(TP+FN)$). Specificity (SP) represents the likelihood that an individual who does not have a condition will screen negative for it ($TN/(TN+FP)$). Positive predictive value (PPV) is the likelihood of finding a true positive among all those who screen positive ($TP/(TP+FP)$).

As problem gambling has been associated with higher levels of physical and psychological problems (e.g., Morasco et al., 2006), it may be argued that it is important for the MGI to have high SN even if this results in excess false positives and a low PPV. Alternatively, a high SP is desirable but can be associated with increased false negatives, which may prevent individuals who need treatment from receiving it and detract from screening performance. Opting for higher SN over SP may be advantageous when assessing gambling problems not only because of the desire to identify those with gambling problems, but also since the risk of a false negative appears more detrimental than that of a false positive. Finding a balance between SN and PPV is indicated with SN being central to maximize screening impact.

The SN, SP, and PPV were determined for each of the MGI items in relation to past year DIGS score, categorically defined as at-risk or low risk. The method of examining each item's classification ability was adapted from that used by Gebauer,

LaBrie, and Shaffer (2010) in their creation of a brief gambling screen. In that study, Gebauer and colleagues used classification metrics on a series of possible screening items to rank order their utility. The best performing items were then summed to make all permutations of 2, 3, and 4-item screens to identify the best combination for the final screen. The present analyses used cross tabulation functions to dichotomously categorize each MGI item as 0 or non-zero (1 or 2 were both recoded to 1). Each MGI item was compared with past year DIGS classification that was also categorized as either 0 or 1, respectively low risk vs. at-risk. These results are displayed in Table 1.

Once the SN, SP, and PPV of each MGI item was calculated, Receiver Operating Characteristic (ROC) analysis (e.g., Hanley & McNeil, 1982) of each item was performed in relation to DIGS past year risk category. ROC analysis graphically determined to what extent each of the MGI items predicted membership in the at-risk DIGS category as compared to chance. It plotted SN against $1 - SP$ in what is known as ROC space (Faucett, 2006). A metric featured in ROC analyses is the Area Under the Curve (AUC). Statistically, AUC is interpreted as the average sensitivity over all false positive rates or as the average specificity over all sensitivities (Metz, 1989). It is also conceptualized as the probability that a classifier will rank a randomly chosen positive instance higher than a randomly chosen negative one (Hanley & McNeil, 1982; Obuchowski, 2005). In this manner, high AUC indicated that when randomly chosen at-risk and low risk gamblers each took the MGI, the at-risk gambler was more likely to score in the at-risk versus low risk range. This made AUC invaluable when assessing the utility of MGI items as it took into account SN, SP, and PPV while performing as a general measure of prediction. AUC scores range from 0 to 1.0 with scores above 0.5 indicating that the classifier (i.e., MGI

item) is performing better than chance. AUC for each MGI item is featured in Table 1 with associated statistical significance.

Table 1
Classification Indices of MGI Item and DIGS Past Year “At-Risk” Category

MGI Item #	Classification Metric			
	Sensitivity	Specificity	Positive Predicted Value	AUC
1	.87	.49	.38	.736**
2	.72	.56	.37	.661**
3	.74	.58	.38	.666**
4	.20	.97	.688	.585
5	.11	1.00	1.00	.556
6	.04	1.00	1.00	.519
7	.07	1.00	1.00	.537
8	.07	.98	.57	.527
9	.02	1.00	1.00	.509
10	.50	.89	.61	.695**
11	.28	.86	.42	.576
12	.02	.99	.50	.506
13	.02	.99	.50	.506
14	.22	.99	.92	.608*
15	.05	1.00	1.00	.528

All bolded tests are statistically significant; * = $p < .05$, ** = $p < .001$

The results of this initial examination indicated that not all MGI items categorized DIGS risk category with the same efficiency. Specifically, the behavioral items featuring frequency and duration of gambling as well as percentage of income spent were the best predictors of risk group according to SN. In addition, two other items revealed significant ability to discriminate between gamblers at-risk versus low risk, primarily as a function of their high SP. One was an irrational belief, derived from the gambler’s fallacy, that gambling would ultimately pay off. The other significant item was whether an individual

has been criticized about his or her gambling. This item can be thought of as a social consequence of gambling.

Given that MGI items 1 – 3, 10, and 14 were the statistically best classifiers, they were combined in multiple permutations of 2, 3, 4, and 5 item screens in order to maximize their discriminatory power. The use of each combination’s AUC determined which of these screening measures would best predict membership in the at-risk DIGS category. Table 2 features all item combinations’ AUC and standard error.

Table 2
Combinations of MGI 2, 3, 4, and 5 Item Measures With Associated AUC

Σ MGI Items	AUC	Standard Error
1 + 2	.729	.040
1 + 3	.746	.038
1 + 10	.775	.038
1 + 14	.756	.039
2 + 3	.698	.040
2 + 10	.736	.041
2 + 14	.687	.044
3 + 10	.746	.040
3 + 14	.727	.041
10 + 14	.728	.045
1 + 2 + 3	.737	.039
1 + 2 + 10	.761	.039
1 + 2 + 14	.740	.040
1 + 3 + 14	.766	.038
1 + 3 + 10	.777	.037
1 + 10 + 14	.787	.038
2 + 10 + 14	.748	.041
2 + 3 + 10	.748	.039
2 + 3 + 14	.724	.040
3 + 10 + 14	.776	.039
1 + 2 + 3 + 10	.763	.038
1 + 2 + 3 + 14	.752	.038
1 + 2 + 10 + 14	.768	.038
2 + 3 + 10 + 14	.763	.039
1 + 2 + 3 + 10 + 14	.775	.037

All AUC p 's < .001. The bolded row is the statistically best classifying screen.

Table 2 reveals that all combinations statistically significantly discriminated gamblers at-risk from those not at-risk. However, the ROC analyses and derived AUC indicated that the 3-item measure featuring one question on gambling frequency, one irrational belief about gambling, and a gambling-related consequence had the best ability to discriminate. The abbreviated screen featuring MGI items 1, 10, and 14 will be referred to henceforth as the MGI (see Appendix E). Cross tabulation of DIGS past year at-risk category by MGI total determined the SN, SP, and PPV at each total score to determine the best cut point. This is shown in Table 3.

Table 3
Classification of “At-Risk” Gamblers by MGI (#1,10, and 14)

MGI cut point [^]	Sensitivity	Specificity	Positive Predictive Value
1	.87	.48	.38
2	.65	.84	.59
3	.35	.93	.66
4	.17	1.00	1.00
5	.04	1.00	1.00

[^] The cut point indicates that if an individual scores at that level or higher on the MGI s/he would be classified at-risk on the DIGS.

Based on the principles of casting a wide screening net, by maximizing the identification of true positives and minimizing false negatives, choosing the cut point with high SN was a priority. In this vein, a cut point of 1 provides a SN of .87, meaning that 47 of 54 respondents screening positive on the MGI, were classified at-risk by the DIGS. The SP of .48 indicates that 73 individuals screened negative on the MGI when 151 were not at-risk per the DIGS. The PPV of .38 corresponds to a false positive rate of 62%, indicating that 47 of 125 MGI positive individuals did actually meet at-risk

classification by the DIGS. Though not reported in Table 3, the false negative rate associated with this cut point was 8.75%, or 7 of 80 respondents who screened MGI negative, were at-risk on the DIGS.

The MGI appeared to serve its purpose in classifying individuals meeting at-risk criteria. This measure has a scoring range from 0 to 6, and a score of 1 or more indicates a positive case. In the present sample, the mean MGI score was 1.09 ($SD = 1.18$), with a range of 0 to 5. Analyses that examined the construct and convergent validity of this screen as well as its test-retest reliability follow.

Validation of MGI

As part of the current validation methods, the MGI was entered in cross tabulation analyses in order to determine its discriminatory abilities with other measures of problem gambling. When compared against the DIGS lifetime at-risk category (endorsing 1 symptom or more), the MGI obtained an SN of .81, an SP of .49, and a PPV of .45. These classification indices are consistent with DIGS past year findings above.

When compared against the NODS at-risk category (1 symptom or more), the MGI was found to have an SN of .88, an SP of .44, and a PPV of .24. Here the first two metrics are similar to those found above: 30 of 34 individuals screened positive on the MGI were at-risk per the NODS, and 76 scored negative on the MGI out of 171 negative on the NODS. The false positive rate was approximately 16% higher than was originally found, which is likely due to scoring rules of the NODS that may ask a gateway question followed by a second scored item describing the same symptom. At the same time, the false negative rate of this analysis was 5%, with 76 individuals scoring low risk on the MGI out of 80 in the NODS low risk range.

Convergent validity of the MGI was established through Spearman correlations with other measures of gambling pathology. This analysis was used, as the MGI's ordinal response options did not permit interval data assumptions to be met (Choi, Peters, & Mueller, 2010; Nunally & Bernstein, 1994). The MGI and NODS total scores correlated significantly ($r_s = 0.41, p < .001$). When compared against the DIGS past year and lifetime total scores, the MGI correlated at .47 and .46 (p 's $< .001$) respectively.

Using the NODS and DIGS as comparators, the MGI was recoded categorically, where all individuals scoring 1 or more were at-risk. The utility of belonging to either MGI grouping should be indicated by meaningful differences in participants' scores on other measures of gambling pathology. The MGI at-risk group had a mean NODS score of .41 ($SD = 0.88$) compared with the low risk group mean score of .06 ($SD = 0.29$), an approximate 6 fold difference found to be statistically significant, $F(1, 203) = 11.49, p = .001$. Likewise, when examining the two MGI groupings with past year DIGS total score, the at-risk group had a mean of 0.58 ($SD = .91$) and the low risk group mean was .10 ($SD = .34$). Again, the MGI at risk group's DIGS score was about 6 times larger than the low risk group, $F(1, 203) = 20.08, p < .001$.

Construct validity of the MGI was also evidenced by its comparison with gambling behavior variables including past year gambling frequency, total lifetime gambling losses, and money owed as a result of gambling. Gambling frequency was assessed in the DIGS where individuals were asked how often they engaged in 11 different gambling behaviors. They were then directed to respond to one of five frequency choices including never, less than monthly, monthly, weekly, or daily. These responses were converted to numerical amounts for analysis where "never" corresponded

to 0, “less than monthly” to 5, “monthly” to 12, “weekly” to 52, and “daily” to 365. The frequencies of the 11 types of gambling were aggregated into a total sum that was used for the participant data presented above and the present validation analyses.

Higher MGI scores should be associated with increased gambling behavior variables if the screen accurately captures the at-risk construct. MGI total and past year frequency correlated significantly ($r_s = .56, p < .001$). Specifically, those in the at-risk category had a mean past year gambling frequency of 33.89 ($SD = 68.19$) while those in the low risk group gambled an average of 13.28 times ($SD = 44.04$). The MGI was also associated with total lifetime gambling losses ($r_s = .42, p < .001$). Those classified at-risk by the MGI had a mean loss of \$257.87 ($SD = \672.09), and the low risk group had a mean loss of \$56.34 ($SD = \130.90). The relationship of the MGI and gambling-related debt could not be adequately examined with 202 of 205 respondents reporting no debt accumulated as a result of gambling, heavily skewing this distribution toward zero.

The MGI did not reveal a strong association with the AUDIT-C. Total scores of the two measures were non-significantly correlated ($r_s = .06$). When conducting an ANOVA to examine whether MGI risk category differed significantly in their AUDIT-C scores, the outcome was similarly non-significant ($p > .33$). This non-significant relationship persisted when men and women were examined separately.

Reliability of the MGI was assessed through test-retest analysis. A portion of the current sample was asked to return for a second time for completion of self-report measures, but only 12 of the expected 67 clinic patients did so. Data from these 12 participants was used for this retest analysis and revealed that scores at initial and second time points non-significantly correlated at .49 ($p > .09$). Though the limited number of

individuals along with few screening items compared in this analysis can adversely influence statistical outcome, further examination of these 12 cases was conducted in order to understand how scores changed on the MGI between time points. Five of the 12 re-testers had the same MGI score at first and second testing. The other seven had 1-point score changes between test periods, with four increasing and three decreasing their scores. Of the seven individuals with score changes, four differed on item 1, two on item 10, and one on item 14.

Another way to understand the limited test-retest data is to consider the change in classification of risk status between time points. At the first time point, seven individuals were classified at-risk and five were low risk. At the second collection, 10 were classified as at-risk with two as low risk. The three individuals who changed groupings between time points all moved to at-risk due to an increase in item 1 (i.e., gambling frequency). Seventy-five percent of the respondents retained their original classification status.

Inter-item reliability was not assessed in the MGI due to the nature of the scale's creation with different domains intentionally being assessed. The MGI would likely be associated with a lower internal consistency despite its classification ability and this type of reliability would not provide a useful metric. In addition, the limited number of items can be associated with lower alpha (Nunally & Bernstein, 1994), which again could misrepresent the utility of the scale.

Demographic variables were also compared with MGI scores. Gender was associated with MGI score, with men's mean score of 1.32 ($SD = 1.29$) significantly greater ($p = .05$) than women's mean of 0.98 ($SD = 1.11$). Ethnic group, age, marital status, employment status, and education were all not associated with MGI total score

(p 's > .05). However, those living on campus had significantly higher MGI scores than those living off campus (p < .05).

Discussion

The present study examined the development and psychometric evaluation of the Memphis Gambling Inventory (MGI), a brief gambling risk screen for use in healthcare settings and other time sensitive venues. The provisional 15-item MGI was devised to include various symptoms from contemporary, pertinent gambling domains. The reduction of the 15-item MGI via ROC analysis revealed that three items were best able to discriminate gamblers at-risk for problems from those who were low risk. The three items were monthly gambling frequency, whether one subscribed to the belief that continuing to gamble would result in financial gain, and if one has been criticized about his or her gambling. The endorsement of at least one of these items correctly classified 87% of at-risk gamblers as determined by clinical interview. Further, current results supported the notion that effective screening can be conducted in the primary care setting. Completing the MGI takes approximately 1 minute or less and may inform additional assessment or referrals when needed. The MGI builds on current primary care gambling screening by its simplicity, ease of administration and interpretation, as well as the incorporation of behavioral assessment.

The empirical reduction of the MGI to its 3 items is consistent with the assumption that behavioral indicators can serve as effective gambling screening measures (Weinstock, Whelan, & Meyers, 2004; Weinstock et al., 2008). Just as demonstrated with other addictive behaviors (e.g., Frank et al., 2008), assessing frequency of use can serve as a clinically meaningful way to efficiently screen individuals who might be at-risk. Our

results also indicate that endorsing a specific maladaptive or distorted belief about gambling perseverance can function to assess risk for pathology. This corresponds to a well-developed line of research by Ladouceur and colleagues (Ladouceur & Walker, 1996; Sylvain, Ladouceur, & Boisvert, 1997) that has documented adherence to gambling-related erroneous cognitions as important in the development and maintenance of gambling problems. Lastly, the act of being criticized for gambling was similarly effective in gambling risk classification. This item is similar to a question featured on two widely used measures of gambling pathology, the SOGS and the EIGHT, and is related to an item on a brief screen for alcoholism, the CAGE (Ewing, 1984). Aside from its present empirical support, the item is clinically intuitive; if someone is criticized for his or her participation in an addictive behavior, then they are likely exhibiting some noticeable levels of harmful use. As pathological gambling symptoms split into dependence criteria and consequences, this symptom is reflective of the social reactions that can result from excessive gambling.

The MGI showed evidence of convergent and construct validity by its associations with validated gambling pathology measures, gambling behavior, and demographic correlates. At-risk gamblers captured by the MGI gambled approximately 2 to 3 times as often and had 5 fold the amount of lifetime gambling losses than low risk gamblers. The MGI was also significantly associated with two measures of gambling pathology, the NODS and the DIGS. In addition, those positive on the MGI scored 6 times greater on these past year gambling pathology instruments than the low risk group. This is noteworthy as there is virtually no item overlap between the NODS and MGI. Consistent with previous findings, men were classified at-risk on the MGI more often than

women (Cunningham-Williams, Cottler, Compton, & Spitznagel, 1998; Whelan et al., 2007).

An unexpected result was that respondents living on campus were more likely to be found at-risk than those residing in the community. This finding is preliminary and could relate to increased student participation in risk behaviors when living in a college community (Baer, 2002; Dawson, Grant, Stinson, & Chou, 2004). Most participants who lived off campus resided with family, which alternatively may serve as a protective factor against risk behaviors (Park, Sher, & Krull, 2009). If this trend is replicated, screening and prevention efforts may be geared towards student residence hall orientation or other campus initiatives.

Unlike previous findings however, neither ethnicity nor education were associated with gambling risk. It is suspected that the nature of this sample, university undergraduates and some with graduate education, buffered against population-based findings of ethnic minority status as a risk factor (e.g., Gerstein et al., 1999; Welte et al., 2001). In other research assessing gambling in healthcare settings (e.g., Morasco et al., 2006), ethnicity was associated with gambling severity, but that research was conducted at a low-income clinic, where mean educational levels were lower. Sample and contextual differences within healthcare settings likely explain some of the differences found in this study.

Given that comorbidity between alcohol use disorders and problem gambling has been extensively demonstrated in previous gambling literature (e.g., Petry, Stinson, & Grant, 2005), it was expected that the MGI and AUDIT-C would be correlated. However, this association was not replicated in the current study and several hypotheses may

account for this. First, an essential difference in the present and prior studies is that the MGI was measured against at-risk but not problem or pathological gambling. This at-risk level of gambling may not have the characteristic multi-risk propensity that pathological status confers (e.g., Petry et al., 2005; Whelan et al., 2007). Another explanation for the present outcome relates to the type of questions that comprise the MGI versus other gambling addiction measures. The MGI's frequency, cognition, and criticism items are not found in the DSM-IV, unlike items that have previously correlated significantly with alcohol use (e.g., Kessler et al., 2008). Finally, population surveys that have documented the alcohol-gambling comorbidity have used DSM-IV based measurement of alcohol use disorders rather than the brief, behaviorally based AUDIT-C (Petry & Pietrzak, 2004).

The MGI's test-retest reliability was not fully demonstrated due to the limited number of individuals available for re-testing. This disappointing level of participant recapture may be due to the context of testing, that individuals did not wish to return to the health center to complete surveys a second time once they received treatment for their health concerns. Despite the fact that participant compensation was changed from a movie pass to a \$5 grocery store gift card, this incentive was not enough to garner sufficient participation. Additional effort is needed to better evaluate the stability of the MGI. Of the 12 individuals studied, however, it appeared that changes in monthly gambling behavior resulted in less stability between time points. Unlike test-retest analyses using more extensive behavioral information such as a timeline follow-back procedure (Weinstock et al., 2004), stability was more difficult to demonstrate when looking at one gambling frequency question on a 3-item measure. Different from clinical symptoms, which may take longer to develop or remit, the increase in frequency can

happen rather quickly and have marked impact on this type of analysis. That said, when examining the 12 respondents' categorization between time-points, 75% retained their classification status. This was an encouraging finding but must be replicated with a larger re-test sample.

The identification of at-risk individuals was central to the current development and validation analyses of the MGI. Coined in conjunction with the development of the NODS (Gerstein et al., 1999), "at-risk" fills a need to categorize gamblers on the low end of the severity continuum. Korn and Shaffer (1999) noted that this group moves up or down the continuum of harm depending on intrapersonal, social, and environment factors. The MGI offers the advantage of screening gamblers at early stages in settings with clinical prevention implications. The MGI can reduce community burden by triggering follow up assessment and promoting access to care while respondents are at lower symptom levels.

The MGI's empirical development is commensurate with theoretical views on the acquisition of gambling problems (e.g., Blaszczynski & Nower, 2002; Whelan et al., 2007). Gamblers who are moving up the continuum of harm gamble more often and begin to develop gambling-specific cognitions that contribute to sustaining their gambling involvement. With the bi-directional influences of increased monthly frequency and subscription to the belief that continuing to gamble would ultimately pay off, gamblers may incur criticism of their behavior. At that point, gamblers may begin to gamble as a form of escape, and the addition of a negatively reinforcing gambling component makes the behavior harder to extinguish (e.g., Blaszczynski, Walker, Sharpe, & Nower, 2008). These sub-clinical gamblers may begin to exhibit dependence criteria

and transition to pathological status and the need for intervention. This points to a potential benefit of the MGI for early detection in health care settings.

Another advantage of the MGI's functionality is related to the proposed changes of gambling's diagnosis in DSM 5. Among these changes is the relocation of pathological gambling to the Addiction and Related Disorders section (APA, 2010). In this section, substance use disorders will drop their abuse and dependence labels in favor of mild, moderate, or severe specifiers, with the lowest threshold corresponding to 2-symptoms. Mitzner, Whelan, and Meyers (2011) have suggested that the gambling addiction diagnosis would benefit from similar cut-off criteria by attending to the continuous view of the condition, adding to the precision when monitoring lifetime to past year symptom changes, and adding a measure of consistency across addiction diagnoses. Accordingly, the MGI can be easily adapted to such a framework, as it already functions to assess those at-risk for gambling problems, scoring either 1 or 2 symptoms. The MGI can serve as an update for primary care gambling assessment and appears ready to evolve with the broader changes to the addiction field.

Limitations of this study are also apparent and can help contextualize the current results. First and most important is the nature of the sample used. The sample consisted entirely of non-random, health center treatment seeking university students over the age of 18. They do not represent at-risk gamblers as a whole. They also do not represent all college students or patients in primary care settings. As an example, the patient population of the Morasco et al. (2006) study diverged from the present sample on a variety of socio-economic indicators. More importantly, this sample featured few problem and pathological gamblers, an unexpected finding considering the inclusionary

criteria of the study and previously documented college student gambling rates. The current sample's prevalence can be partly explained by measures used to assess gambling problems; the NODS tends to underestimate whereas the SOGS often inflates problem gambling rates. In addition, prior college student gambling studies have been conducted outside health centers (e.g., Neighbors et al., 2002), and may access broader samples. Thus, our findings only extend to at-risk gambling status. Research on the performance of assessment measures with at-risk gamblers is limited and additional study of this group's characteristics is warranted.

The MGI was also associated with a high false positive rate, which can detract from screening efficiency. This MGI attribute was counterbalanced with the prioritization of sensitivity and a desire to avoid missing individuals in need of intervention. It is also important to consider that the MGI is intended for screening rather than diagnosis, and false positives are more acceptable in this manner. In the primary care setting, the MGI can function as a screen embedded in intake paperwork. When a healthcare provider reviews the patient's chart and notes a positive MGI score, he or she can administer a longer DSM-IV based measure to help establish diagnostic clarification. Referral for treatment can then be arranged as needed. This administration model is in line with others (e.g., Thomas, Piterman, & Jackson, 2008) and can be tailored to stepped-care gambling treatment approaches (Marotta, 2003).

This study adds an important tool to the current gambling assessment literature. It used previous findings and pathological gambling theory to construct the initial 15-item MGI. Pilot testing with qualitative analyses refined its content and functionality, and empirical methodology was employed to reduce the MGI to a 3-item measure of

gambling risk. Answering calls to expand and simplify gambling screening (BMA 2007; Larimer et al., 2006; Potenza et al., 2002), the MGI is easy to deploy and interpret. Positive status on the measure indicates more specific assessment for diagnostic clarification and/or treatment referral. This functionality is also consistent with addictive behavior screening recommendations outlined by the United States Preventative Services Task Force (2004) as well as needs of college health center professionals (Foote, Wilkens, & Vavagiakis, 2004). Further assessment should evaluate the MGI with a larger sample of problem and pathological gamblers to evaluate its psychometric performance with other gamblers along the continuum of harm. The MGI's use in a non-university health center, such as the VA, or a private practice office, can also add credence to its applicability across health care settings. At present, results suggest the MGI is a promising instrument for the assessment of gambling problems in primary care.

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Appendix A. DSM-IV Pathological Gambling Diagnostic Criteria

A. Persistent and recurrent maladaptive gambling behavior as indicated by five (or more) of the following:

1. Is preoccupied with gambling (e.g., preoccupied with reliving past gambling experiences, handicapping or planning the next venture, or thinking of ways to get money with which to gamble)
2. Needs to gamble with increasing amounts of money in order to achieve the desired excitement
3. Has repeated unsuccessful efforts to control, cut back, or stop gambling
4. Is restless or irritable when attempting to cut down or stop gambling
5. Gambles as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)
6. After losing money gambling, often returns another day to get even (“chasing” one’s losses)
7. Lies to family members, therapist, or others to conceal the extent of involvement with gambling.
8. Has committed illegal acts such as forgery, fraud, theft, or embezzlement to finance gambling.
9. Has jeopardized or lost a significant relationship, job, or education or career opportunity because of gambling
10. Relies on others to provide money to relieve a desperate financial situation produced by gambling (“bailout”)

B. The gambling behavior is not better accounted for by a Manic Episode

Appendix B. The Early Intervention Gambling Health Test (EIGHT)

Most people in New Zealand enjoy gambling, whether it's Lotto, track racing, the pokies or at the casino.

Sometimes however, it can affect our health.

To help us to check your well-being, please answer the questions below as truthfully as you are able from your own experience.

1. Sometimes I've felt depressed or anxious after a session of gambling.
yes, that's true no, I haven't
2. Sometimes I've felt guilty about the way I gamble
yes, that's so no, that isn't so
3. When I think about it, gambling has sometimes caused me problems.
yes, that's so no, that isn't so
4. Sometimes I've found it better not to tell others, especially my family, about the amount of time or money I spend gambling.
yes, that's true no, I haven't
5. I often find that when I stop gambling I've run out of money
yes, that's so no, that isn't so
6. Often I get the urge to return to gambling to win back losses from a past session
yes, that's so no, that isn't so
7. Yes, I have received criticism about my gambling in the past
yes, that's true no, I haven't
8. Yes, I have tried to win money to pay debts
yes, that's true no, I haven't

Appendix C. Pilot Self-Report Measures and Interview

The questions below concern your gambling and related behaviors. Please answer these questions as honestly as possible. Your answers will be kept **confidential**.

What is your age?	_____ years
Write in the space which ethnic group that best describes you:	_____
What language do you feel the most comfortable speaking?	_____
Is this language spoken in your home?	<input type="checkbox"/> Yes <input type="checkbox"/> No
What is the highest level of formal education you have completed?	<input type="checkbox"/> High School <input type="checkbox"/> Bachelor's Degree/ Licenciate <input type="checkbox"/> Master's Degree <input type="checkbox"/> Doctoral Degree <input type="checkbox"/> Other: _____
What is your estimated monthly income?	\$ _____
What are the sources of this income (e.g., job, family, or other sources)?	_____
How many times have you gambled in the past year?	_____
<p><i>During the past year:</i></p> <p>What is the largest single bet you have made? (For example, if your largest bet was \$250 on one horse race or on a roulette spin, then you would write 250 in the blank.)</p>	\$ _____
How much money have you won or lost as a result of your gambling?	\$ _____
Have you even been treated for a gambling problem?	<input type="checkbox"/> Yes <input type="checkbox"/> No

Appendix C. (contd.)

Memphis Gambling Inventory

Gambling is when you bet money, or something else of value, on an event of unknown outcome. Examples: poker, blackjack, slot machines, dice, lottery, sports betting, and Internet gambling.

Think about your gambling in the **past 12 months** when answering the following questions:

1. How many times did you gamble per month?
 - None
 - 1 time
 - 2 times or more

2. How many hours did you spend gambling per month?
 - None
 - 2 hours or less
 - More than 2 hours

3. Approximately, what percentage of your monthly income did you spend gambling?
 - 0%
 - 10% or less
 - More than 10%

	Never	Sometimes	Always
4. When you had an urge to gamble, was it hard not gambling?			
5. Did you gamble to feel better?			
6. As time passed, did you have to gamble more intensely to get the same feeling?			
7. Did you lie to others about your gambling?			
8. Were you unsuccessful at controlling your gambling?			
9. If you tried gambling less often, did you get restless or irritable?			
10. Did you think that continuing to gamble would pay off and you would win money?			
11. Did you think your gambling wins were because of your skill?			
12. Did you borrow money to gamble or pay gambling debts from family, friends, or other sources (e.g., bank accounts, credit card, or loans)?			

Appendix C. (contd.)

Memphis Gambling Inventory (contd.)

	Never	Sometimes	Always
13. Did gambling cause you physical or emotional problems?			
14. Have people criticized your gambling?			
15. Did you choose to gamble instead of completing other tasks?			

Appendix C. (contd.)

Reaction Form

A part of this study looks at how we measure gambling. We would like to get your reaction to the survey you just filled out called the **Memphis Gambling Inventory**. Please answer the following questions with this survey in mind. Feel free to refer back to the **Memphis Gambling Inventory** as needed.

1. Were the directions easy to understand?
2. Were the directions too long or short?
3. Overall, did the questions make sense?
4. Were questions that asked about how often or how long you gambled easy to understand?
5. Did the question that asked about the percentage (%) of income you gambled make sense to you?
6. Did the answer choices to every question make sense? If not, how could they be improved?
7. Did the switch from the first 3 questions to the questions located in the table make sense?
8. Do you think additional instructions at this switch are necessary?
9. How was the length of the survey?
10. Did we leave out a question that you felt should have been asked?
11. How would you change the survey if at all?

Appendix C. (contd.)

AUDIT – C

Please check the answer that is correct for you.

1. How often do you have a drink containing alcohol?

- Never
- Monthly or less
- Two to four times a month
- Two to three times per week
- Four or more times a week

2. How many drinks containing alcohol do you have on a typical day when you are drinking?

- 1 or 2
- 3 or 4
- 5 or 6
- 7 to 9
- 10 or more

3. How often do you have six or more drinks on one occasion?

- Never
- Monthly or less
- Two to four times a month
- Two to three times per week
- Four or more times a week

Appendix C. (contd.)

NORC Screen

1. In the past year, have there been any periods lasting two weeks or longer when you spent a lot of time thinking about your gambling experiences or planning future gambling ventures or bets?
 YES NO
2. In the past year, have there been any periods lasting two weeks or longer when you spent a lot of time thinking about ways of getting money to gamble with?
 YES NO
3. In the past year, have there been any periods when you needed to gamble with increasing amounts of money or with larger bets than before in order to get the same feeling of excitement?
 YES NO
4. In the past year, have you tried to stop, cut down, or control your gambling?
 YES (go to 5) NO (go to 8)
5. In the past year, on one of more of the times you tried to stop, cut down, or control your gambling, were you restless or irritable?
 YES NO
6. In the past year, have you tried but not succeeded in stopping, cutting down, or controlling your gambling?
 YES NO
7. In the past year, has this happened three or more times?
 YES NO
8. In the past year, have you gambled as a way to escape from personal problems?
 YES NO
9. In the past year, have you gambled to relieve uncomfortable feelings such as guilt, anxiety, helplessness, or depression?
 YES NO
10. In the past year, has there ever been a period when, if you lost money gambling on one day, you would often return another day to get even?
 YES NO
11. In the past year, have you more than once lied to family members, friends, or others about how much you gamble or how much you lost on gambling?
 YES (go to 12) NO (go to 13)

Appendix C. (contd.)

NORC Screen (contd.)

12. Has this happened 3 or more times?
 YES NO
13. In the past year, have you written a bad check or taken money that didn't belong to you from family members or anyone else in order to pay for your gambling?
 YES NO
14. In the past year, has your gambling caused you serious or repeated problems in your relationships with any of your family members or a friend?
 YES NO
15. In the past year, has your gambling caused you any problems in school, such as missing classes or days of school or getting worse grades?
 YES NO
16. In the past year, has your gambling caused you to lose a job, have trouble with your job, or miss out on an important job or career opportunity?
 YES NO
17. In the past year, have you needed to ask family members or anyone else to loan you money or otherwise bail you out of a desperate money situation that was largely caused by your gambling?
 YES NO

The Diagnostic Interview for Gambling Severity

Introduction: I am going to ask you about the difficulties and problems that you may be experiencing now or in the past. I will be recording your answers and making notes as we go.

Demographic Section

1. Sex: 1 - Male 2 - Female
2. What is your current marital status?
 - Married
 - Living with someone as if married (not currently married or not separated)
 - Widowed
 - Divorced
 - Separated
 - Never married
3. Are you satisfied with your current marital situation?
 - 1 - No
 - 2 - Indifferent
 - 3 - Yes
4. Do you have any children?
 - 1 – Yes
 - 2 – No

If Yes: How many? _____
5. Where do you live? _____
6. Whom do you live with? _____
 - a. How long have you lived in these arrangement? _____
Years Months
7. Are you satisfied with your living arrangements?
 - 1 – No
 - 2 – Indifferent
 - 3 – Yes

Appendix C. (contd.)

The Diagnostic Interview for Gambling Severity (contd.)

8. What kind of work do you do? (Are you employed outside of your home?)

9. Are you working now? If *Yes*: How long have you worked there?

IF LESS THAN 6 MONTHS: Why did you leave your last job?

IF NOT WORKING NOW: Why is that? What kind of work have you done?

10. During your adult life, has there ever been a period of time when you were unable to work or go to school? IF *Yes*: When? Why was that?

Gambling Problems

For Question #17, please indicate how often you have played the following types of gambling activities within the last year.

	Never (1)	Less than Monthly (2)	Monthly (3)	Weekly (4)	Daily (5)
15a. Played cards for money or with friends?	_____	_____	_____	_____	_____
15b. Played cards at a casino?	_____	_____	_____	_____	_____
15c. Bet on horses, dogs, or other animals?	_____	_____	_____	_____	_____
15d. Bet on the outcome of a sporting event?	_____	_____	_____	_____	_____
15e. Played dice games for money?	_____	_____	_____	_____	_____
15f. Played numbers or bet on lotteries?	_____	_____	_____	_____	_____
15g. Played bingo for money?	_____	_____	_____	_____	_____
15h. Played slot/poker/gambling machines?	_____	_____	_____	_____	_____
15i. Bowled, shot pool, or golfed for money?	_____	_____	_____	_____	_____
15j. Played pull tabs?	_____	_____	_____	_____	_____
15k. Gambled on commodities/high risk stock	_____	_____	_____	_____	_____

Appendix C. (contd.)

The Diagnostic Interview for Gambling Severity (contd.)

16. I want to ask you more questions about possible financial problems. Has your gambling resulted in any of the following financial problems?

	Yes	No
Indebtedness to creditors	_____	_____
Bankruptcy	_____	_____
Cash in life insurance	_____	_____
Taking out a second mortgage on your home	_____	_____
Taking out a home improvement loan	_____	_____
Taking out a car loan	_____	_____
Taking out a business loan	_____	_____
Incurred business debts	_____	_____
Unable to pay taxes	_____	_____

The next set of questions is more specific about your gambling involvement.

17. Have there been periods in your life when you spent a lot of time thinking about past gambling experiences or thinking about future gambling ventures?

1 – Very True 2 – Somewhat True 3 – False (proceed to next question)

Has this been true for the past 12 months?

1 – Very True 2 – Somewhat True 3 – False

18. Have your gambling debts led you to do anything illegal, whether you were caught or not? Such as ...

	Yes	No
-Writing bad checks	_____	_____
-Stealing property and sold it for the money	_____	_____
-Stealing money from someone or an organization or business	_____	_____
-Falsifying legal or tax forms	_____	_____
-Enticing someone to give you money under false pretenses	_____	_____
-Forging someone's signature so you could cash-in an insurance policy or obtain a loan	_____	_____

19. At this point in time, how much total money have you lost permanently as a result of your gambling? Consider what you may have lost from savings, from what was borrowed and lost, credit card debt, what was lost from a paycheck, etc.

\$ _____

Appendix C. (contd.)

The Diagnostic Interview for Gambling Severity (contd.)

20. Now consider unpaid debt. How much total money, if any, do you currently owe people, financial institutions, businesses, or credit card company from your loans or borrowing as a result of your efforts to finance your gambling? \$ _____
21. Have you frequently thought about ways of getting money with which to gamble?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 24)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
22. Have you had periods when you needed to increase your frequency of betting in order to obtain the same excitement?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 25)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
23. Have you ever needed to gamble with increasing amounts of money or with larger bets in order to obtain the same feeling of excitement?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 26)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
24. Have you often tried to cut down or control your gambling and found it difficult?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 27)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
25. Have you tried to stop gambling several times in the past and been unsuccessful?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 28)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
26. Did you feel quite restless or irritable after you tried to cut down or stop gambling?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 29)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False

Appendix C. (contd.)

The Diagnostic Interview for Gambling Severity (contd.)

27. Were you not your normal self when you attempted to cut down or stop gambling?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 30)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
28. Do you feel that you gamble as a way to escape personal problems?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 31)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
29. Does gambling seem to relieve uncomfortable emotions, such as anxiety or depression?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 32)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
30. When you lose money gambling on a given day, did you often return soon another day to win back your losses?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 33)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
31. When you had a large gambling debt, did you gamble more and more frequently in the hopes of winning back your money?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 34)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
32. Have you often lied to family members, friends, co-workers or teachers about the extent of your gambling or of your gambling client?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 35)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False

Appendix C. (contd.)

The Diagnostic Interview for Gambling Severity (contd.)

33. Have you often hidden the signs of your gambling, such as betting slips, IOU's, lottery tickets, or money you've won, from you family, friends, co-workers or teachers?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 36)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
34. Have you ever forged a check or stole something in order to finance your gambling?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 37)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
35. Have you ever committed any other illegal acts, such as embezzlement or fraud, to support your gambling habit?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 38)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
36. Have you had periods, when your gambling or betting caused problems in your relationships with family, friends, co-workers or teachers?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 39)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
37. Has there been a time when you missed work, school or important social or recreational events because of gambling?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 40)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False
38. Have you had to approach other people and ask them to lend you money because of your financial problems due to gambling?
1 – Very True 2 – Somewhat True 3 – False (proceed to question 41)
- Has this been true for the past 12 months?
1 – Very True 2 – Somewhat True 3 – False

Appendix C. (contd.)

The Diagnostic Interview for Gambling Severity (contd.)

39. Have you actually borrowed a lot of money from friends or others, or have you had to sell personal property or engage in any illegal behavior because of your financial problems caused by gambling?

1 – Very True 2 – Somewhat True 3 – False

Has this been true for the past 12 months?

1 – Very True 2 – Somewhat True 3 – False

Appendix D. Main Study Memphis Gambling Inventory

Memphis Gambling Inventory

Gambling: Betting money, or something of value, on an event of unknown outcome.
Examples: poker, blackjack, slot machines, dice, lottery, sports betting, & Internet gambling.

Directions: Thinking about your *gambling during the past 12 months*, circle the response that best described you.

1	How many times did you gamble per month?		None	Less than 1 time	1 time or more
2	How many hours did you spend gambling per month?		None	Less than 2 hours	2 hours or more
3	About what percentage of your monthly income did you spend gambling?		None	Less than 10%	10% or more
4	When you had an urge to gamble, was it hard not gambling?	N/A	Rarely	Sometimes	Frequently
5	Did you gamble to feel better?	N/A	Rarely	Sometimes	Frequently
6	As time passed, did you have to gamble more intensely to get the same feeling?	N/A	Rarely	Sometimes	Frequently
7	Did you lie to others about your gambling?	N/A	Rarely	Sometimes	Frequently
8	Were you unsuccessful at controlling your gambling?	N/A	Rarely	Sometimes	Frequently
9	If you tried gambling less often, did you get restless or irritable?	N/A	Rarely	Sometimes	Frequently
10	Did you think that continuing to gamble would pay off and you would win money?	N/A	Rarely	Sometimes	Frequently
11	Did you think your gambling wins were because of your skill?	N/A	Rarely	Sometimes	Frequently
12	Did you borrow money to gamble or pay gambling debts from family, friends, or other sources (e.g., bank accounts, credit card, or loans)?	N/A	Rarely	Sometimes	Frequently

Appendix D. (contd.)

Memphis Gambling Inventory (contd.)

13	Did gambling cause you physical or emotional problems?	N/A	Rarely	Sometimes	Frequently
14	Have people criticized your gambling?	N/A	Rarely	Sometimes	Frequently
15	Did you choose to gamble instead of completing other tasks?	N/A	Rarely	Sometimes	Frequently

Appendix E. Three Item Memphis Gambling Inventory

Memphis Gambling Inventory

Gambling: Betting money, or something of value, on an event of unknown outcome.
Examples: poker, blackjack, slot machines, dice, lottery, sports betting, & Internet gambling.

Directions: Thinking about your *gambling during the past 12 months*, circle the response that best described you.

How many times did you gamble per month?	None		Less than 1 time	1 time or more
Did you think that continuing to gamble would pay off and you would win money?	N/A	Rarely	Sometimes	Frequently
Have people criticized your gambling?	N/A	Rarely	Sometimes	Frequently