Updating and Refining Prevalence Estimates of Disordered Gambling Behaviour in the United States and Canada

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ABSTRACT

Background: This study updates prevalence estimates of gambling-related disorders in the United States and Canada, identifies differences in prevalence estimates among population segments, and identifies changes in prevalence over the past 25 years.

Method: A meta-analytic strategy guided the synthesis of 180 estimates derived from 146 prevalence studies.

Results: Prevalence estimates among adolescent samples were significantly higher than estimates among adult samples for both clinical (level 3) and sub-clinical (level 2) measures of disordered gambling within both lifetime and past-year time frames. Among adults, level 3 prevalence estimates continue to increase significantly.

Conclusions: Membership in youth, treatment, and prison population segments is significantly associated with experiencing gambling-related disorders. Understanding sub-clinical gamblers provides a meaningful opportunity to lower the public health burden associated with gambling disorders. Prospective studies of incidence are necessary to determine whether the prevalence of disordered gambling continues to increase among the adult general population and how adolescent gambling experiences change as this cohort ages.

ABRÉGÉ

Contexte : L'étude vise à mettre à jour les estimations de prévalence des troubles associés aux jeux de hasard aux États-Unis et au Canada, à en cerner les différences selon divers segments de population et à définir les changements de prévalence des 25 dernières années.

Méthode : Une stratégie méta-analytique a guidé la synthèse de 180 estimations, dérivées de 146 études de prévalence.

Résultats : Tant au niveau clinique (3) que subclinique (2), les estimations de prévalence du jeu pathologique, la vie durant et au cours des 12 mois précédents, sont sensiblement plus élevées chez les adolescents que chez les adultes. Dans les échantillons d'adultes cependant, les estimations de prévalence de niveau 3 continuent à augmenter de manière significative.

Conclusions : L'appartenance aux segments des jeunes, des personnes suivant un traitement et de la population carcérale présente une corrélation significative avec les troubles associés aux jeux d'argent. En étant mieux renseignés sur les joueurs qui présentent des troubles subcliniques, on réduirait considérablement le fardeau de santé publique associé au jeu pathologique. Il faudrait aussi mener des études de cohortes prospectives pour déterminer si la prévalence du jeu pathologique continue à augmenter dans la population adulte générale et comment évoluent dans le temps les expériences de jeu d'une cohorte d'adolescents.

The National Gambling Impact Study Commission[1] and the National Research Council[2] have promulgated new estimates of disordered gambling in America. This new research is the result of an increasing demand among researchers and public policy-makers to develop better estimates of gambling-related disorders among both adults and adolescents throughout the United States. Since the research that first established the use of synthetic analyses to generate stable estimates of disordered gambling prevalence,[3-5] more epidemiological research has been completed throughout the United States and Canada. This study integrates the expanding range of scientific strategies used to estimate disordered gambling prevalence.

Background

Numerous studies have revealed the risk of serious adverse psychological, social, and biological consequences of gambling for a proportion of the population.[6,7] The American Psychiatric Association states, "The essential feature of pathological gambling is persistent and recurrent maladaptive gambling behavior... that disrupts personal, family, or vocational pursuits."[8]

The media[9] and researchers have suggested that an increased availability of legal gambling opportunities is associated with an increasing prevalence of disordered gambling among adults[10-13] and adolescents[11] in the United States and Canada. In addition, researchers have suggested that younger segments of the population are more susceptible to gambling problems than adults.[11,14] Despite these concerns, few researchers have addressed these issues empirically. (e.g., ref. 5)

This study revisits the original effort to integrate the extant research on disordered gambling prevalence and examines two hypotheses regarding the extent of disordered gambling: 1) Prevalence estimates of gambling disorders among different population segments (e.g., adolescent and adult) will be significantly different; and 2) The prevalence of gambling disorders will have increased since the first estimate was promulgated more than two decades ago; however, this increase will vary for different levels of disorder and different population segments.

METHODS

This study used methods described in previous research; interested readers can review these works for additional methodological details.[4,5] To identify studies on the prevalence of disordered gambling, we searched Medline, PsycINFO, the Harvard OnLine Library Information System, and the *Journal of Gambling Studies*. In addition, we requested unpublished studies from colleagues. This search strategy identified 193 prevalence studies,* almost one third more than our original research. The articles must have been available for review by June 30, 1999. Of the 193 studies, 160 satisfied the inclusion criteria. Fourteen studies used the same data as other included studies and were removed from the analysis. Weighting studies for the use of multiple instruments† resulted in a total of 180 distinct prevalence estimates of disordered gambling.

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* A list of these studies is available at www.hms.harvard.edu/doa/html/cjph.htm.

† If a study used multiple instruments to assess disordered gambling among its sample, each reported estimate was weighted so that the aggregate weight of the study's estimates was equal to 1.0 within each time frame (e.g., 2 past-year estimates from a single study sample would be weighted 0.5 each, 3 past-year estimates would be rated 0.33 each).

Nomenclature and classification: Levels of disordered gambling severity

Given the wide array of taxonomical systems to identify and organize levels of disordered gambling, we employed a classification system consisting of three generic levels of gambling problem severity. This allows for the organization and integration of data from different studies.[3-5] The first of these three levels, **level 1**, represents respondents who do not experience gambling problems. This group includes both "non-problem" gamblers and non-gamblers. The second level, **level 2**, represents gamblers with sub-clinical levels of gambling problems (e.g., "problem," "at-risk," "in-transition," "potential pathological"). The third level, **level 3**, represents the most severe category of disordered gambling (e.g., "pathological"). In many studies, level 3 gamblers are those who meet established diagnostic criteria for pathological gambling (e.g., DSM-IV criteria). In some studies the criteria have been modified, but the group remains conceptually equivalent.

RESULTS

Study demographics

We classified the prevalence estimates identified in this study into the following four population groups: **adult general population** (N = 66); **adolescents** (N = 32); **college students** (N = 19); and **adults in prison or in treatment for psychiatric or substance use disorders** (N = 22). These four categories include prevalence estimates for 139 distinct study samples; the remaining prevalence estimates could not be classified into these broad categories and were excluded from the analyses.

Of the 139 prevalence estimates identified in this study, 74.1% derived from studies conducted in the United States (N = 103) and 25.9% from studies conducted in Canada (N = 36). Comparisons of the prevalence estimates available from the United States and Canada revealed no significant differences between American and Canadian estimates for any of the population segments (lifetime level 3, t = -0.942, df = 102, p = 0.349; lifetime level 2, t = -0.275, df = 85, p = 0.784; past-year level 3, t = 0.014, df = 65, p = 0.989; past-year level 2, t = 0.195, df = 60, p = 0.846). Consequently, the remainder of the analyses describes data pooled from the United States and Canada.

TABLE I
Mean Gambling Prevalence Estimates and 95% Confidence Intervals for Four Study Populations

	Adult	Adolescent*	College	Treatment/Prison
Level 3 Lifetime	1.92 (1.52 – 2.33)	3.38 (1.79 – 4.98)	5.56 (3.54 – 7.59)	15.44 (11.58 – 19.31)
Level 2 Lifetime	4.15 (3.11 – 5.18)	8.40 (5.61 – 11.18)	10.88 (4.86 – 16.89)	17.29 (11.05 – 23.53)
Level 1 Lifetime	93.92 (92.79 - 95.06)	90.38 (86.49 – 94.29)	83.13 (74.71 – 91.55)	67.61 (58.10 – 77.11)
Level 3 Past Year	1.46 (0.92 – 2.01)	4.80 (3.21 – 6.40)	—	—
Level 2 Past Year	2.54 (1.72 – 3.37)	14.60 (8.32 – 20.89)	—	—
Level 1 Past Year	96.04 (94.82 – 97.25)	82.68 (76.12 – 89.17)		

* Although mean past-year estimates are higher than mean lifetime estimates for adolescents, there is considerable overlap between the confidence intervals of these measures; adolescents' past-year gambling experiences are likely to be comparable to their lifetime gambling experiences. Differences between instruments that provide past-year estimates among adolescents and instruments that provide lifetime estimates among adolescents most likely account for these discrepancies.

The "file drawer" effect: Published versus unpublished prevalence estimates

Of the 139 prevalence estimates identified in this study, 65.8% (N = 91) are unpublished. Methodologists have posited that the findings of published research may differ significantly from those of unpublished research. (e.g., refs. 15, 16) To compare the prevalence rates of published and unpublished studies among all study types, we standardized prevalence rates within study type using z scores. T-tests revealed no significant differences between published studies and unpublished studies on lifetime or past-year measures of level 2 or level 3 (lifetime level 3, t = -0.530, df = 102, p = 0.597; lifetime level 2, t = 0.692, df = 85, p = 0.491; past-year level 3, t = -0.236, df = 64, p = 0.814; past-year level 2, t = 0.706, df = 59, p = 0.483).

Temporal trends in the prevalence of disordered gambling

To identify any significant trends in prevalence estimates over time, we investigated correlations between prevalence estimates and the year studies were conducted within each population segment. Analyses of adolescent, college, and treatment/prison studies revealed no significant patterns. Among adult studies, however, there was a significant positive correlation between the year a study was conducted and past-year level 3 gambling prevalence (r = 0.313, p < 0.05).

We examined the prevalence trends among adult studies in more detail by identifying states and provinces that met the following criteria: 1) two or more state- or province-wide prevalence studies had been conducted among the adult general population in the geographical area; 2) the studies were conducted during different years; and 3) the studies used the same instrument. Fifteen different geographical areas met these criteria. Paired t-tests matching each earlier study to the corresponding later study in the same geographical area indicated that later studies had significantly higher prevalence estimates of past-year level 3 gambling (mean = 1.35%) than earlier studies (mean = 1.02%; t = -2.57, d.f. = 10, p < 0.05). The other comparisons were not statistically different. However, for both past year level 1 and past-year level 2, earlier studies had higher estimates than later estimates (past-year level 1: earlier studies mean = 96.58%, later studies mean = 96.32%; past-year level 2: earlier studies mean = 2.40%, later studies mean = 2.33%).

It is possible that the observed increase in past-year level 3 gambling was a cohort-related artifact. Regions implementing replication studies initially might have had either higher or lower rates of level 3 gambling than the regions that have not conducted replication projects. To gain insight into the possibility of a confounding effect, we compared the prevalence estimates obtained from the first available statewide adult population studies from states that later conducted replication studies with

TABLE II
Multiple Prevalence Estimates of Disordered Gambling by Population Segment and Level

Estimate Time Frame & Statistic		Adult	Adolescent	College	Treatment or Prison
Level 3 Lifetime	Mean	1.92	3.38	5.56	15.44
	Median	1.80	3.00	5.00	14.29
	5% Trimmed Mean	1.78	3.33	5.14	15.07
	Andrews' Wave M-Estimator	1.73	2.74	4.64	13.49
Level 2 Lifetime	Mean	4.15	8.40	10.88	17.29
	Median	3.50	8.45	6.50	15.64
	5% Trimmed Mean	3.76	8.35	9.83	17.01
	Andrews' Wave M-Estimator	3.31	8.22	6.51	16.59
Level 3 Past Year	Mean	1.46	4.80	—	—
	Median	1.20	4.37	—	—
	5% Trimmed Mean	1.27	4.77	—	—
	Andrews' Wave M-Estimator	1.10	4.65	—	—
Level 2 Past Year	Mean	2.54	14.60	—	—
	Median	2.20	11.21	—	—
	5% Trimmed Mean	2.25	13.83	—	—
	Andrews' Wave M-Estimator	2.15	11.26	—	—

estimates derived from states without replication studies. Although initial prevalence estimates were consistently lower from the replication states, this analysis failed to identify any statistically significant differences between replication and non-replication states (Lifetime Level 3: t = 1.066, df = 27, p = 0.296; non-replication states, M = 2.06%; replication states, M = 1.55%; Lifetime Level 2: t = 0.220, df = 25, p = 0.828; non-replication states, M = 3.88%; replication states, M = 3.70%; Past-year Level 3: t = 1.408, df = 8.280, p = 0.195; non-replication states, M = 1.99%; replication states, M = 1.03%; Past-year Level 2: t = 0.351, df = 18, p = 0.730; non-replication states, M = 3.22%; replication states, M = 2.82%).

Prevalence estimates among population segments

To generate prevalence estimates from each of the four population segments described previously, we employed the following three-part strategy. First, because there may be meaningful temporal trends in disordered gambling prevalence, we selected only the most recent prevalence estimate from each state, province, or geographical area for both the adult general population segment and the adolescent population segment. We selected this strategy to best represent the current prevalence among these population segments. Second, if an estimate for an entire state or province was available, estimates from cities, metropolitan areas, or other subregions of that state or province were removed from the analysis. Third, for the college and treatment/prison population segments, we removed studies from the analysis only if a more recent study had been conducted at the same institution.

We classified these prevalence estimates as either lifetime or past-year rates. Studies that failed to indicate the time frame for their estimates were re-coded to represent a lifetime time frame. Studies that reported prevalence within a "current" time frame but failed to provide more information about the time frame were re-coded to represent a past-year time frame. Three estimates representing six-month time frames were re-coded into past-year time frames to allow their inclusion into the categories established in this study. As a result of these modifications, prevalence estimates reported in this study might be conservative. Table I provides the mean lifetime and past-year prevalence estimates and the confidence intervals associated with these estimates for each of the four population segments discussed above. Mean estimates were used effectively by Shaffer et al.[4,5] and by the National Academy of Sciences' National Research Council.[2] The unweighted mean has been selected as a prevalence index for two primary reasons: first, it is not influenced by statistical manipulations; and second, it has been very similar to trimmed estimates. Compared with our previous research, additional studies and a refined weighting procedure have increased the variability of prevalence estimates. Outliers might have influenced these new estimates more than previous estimates. Consequently, Table II provides three trimmed estimates of disordered gambling (i.e., median, 5% trimmed, and Andrews wave M-estimator) along with means. While the range of these different values is narrow, a trimmed estimate reduces the influence of outliers that potentially can inflate or deflate the meta-estimate.

Comparing population segments

Kruskal-Wallis tests revealed significant differences in lifetime level 3 and level 2 prevalence among population segments ($\chi^2 = 53.105$, $df = 3$, $p < 0.001$ and $\chi^2 = 29.151$, $df = 3$, $p < 0.001$, respectively). Dunnett's C tests for post-hoc analyses, assuming unequal variance, revealed the following group differences: for lifetime level 3 estimates, the estimate among adult general population studies was significantly lower ($p < 0.05$) than estimates among adolescent studies, college studies, and adult treatment/prison studies. The estimate of level 3 lifetime gambling among adolescent studies was significantly lower ($p < 0.05$) than the estimate among adult treatment/prison studies. College students also evidenced a meaningfully lower ($p < 0.05$) level 3 lifetime gambling estimate than adult treatment/prison studies. For level 2 lifetime gambling estimates, adult studies evidenced significantly lower ($p < 0.05$) prevalence than adolescent studies and adult treatment/prison studies.

For past-year prevalence, there were insufficient data to compare studies representing all four population segments. Therefore, we compared past-year prevalence among adult and adolescent studies using Kruskal-Wallis tests. For past-year level 3 and level 2 estimates, adult study estimates were significantly lower than those derived from adolescent studies ($\chi^2 = 15.612$, $df = 1$, $p < 0.001$; $\chi^2 = 20.454$, $df = 1$, $p < 0.001$, respectively).

While these analyses use pooled estimates derived from all available instruments and years, the additional cases available in the present study allow for a more controlled comparison than was previously possible.[4,5] In this new analysis, we identified states and provinces that met the following criteria: 1) state- or province-wide studies had been conducted among both

adolescents and adults; 2) these studies were conducted within two years of each other; 3) the studies of adults and adolescents used the same instrument. Ten geographical areas met these more rigorous criteria. We used Wilcoxon Signed Ranks Tests to match each study of adults with the corresponding study of adolescents in that state or province. This new analysis confirms previous findings: prevalence estimates among adolescents are significantly higher than estimates among adults for level 2 and level 3 gambling for both lifetime and past-year time frames (lifetime level 3: Z = -2.201; lifetime level 2: Z = -2.197; past-year level 3: Z = -2.201; past-year level 2: Z = -2.201; $p < 0.05$ for all analyses).

DISCUSSION

As with other meta-analytic strategies, this study confirms that the integration of smaller estimates provide comparable estimates to large-scale studies.[17] This finding holds the potential to usher in a new period of prevalence research that is less expensive than the era of large studies that preceded it. For example, using evidence generated by meta-analysis, new gambling-related research that examines issues beyond population prevalence already is beginning to emerge (e.g., ref. 18).

Nevertheless, it is important to note that neither meta-analytic nor cross-sectional repeated measures research strategies can take the place of more expensive prospective longitudinal studies. The dynamics of conversion from level 1 to level 2 or 3, or from level 2 to level 3 gambling represents a complex and under-studied process. The opposite pattern of conversion – from level 3 to levels 2 or 1 – reflects an equally complex set of processes. These processes can seem lucid in retrospect. However, since we cannot yet predict who will develop gambling-related disorders, it is critical that investigators implement prospective longitudinal studies. Studies of incidence can inform scientists about the dynamics of how gambling-related problems develop, are maintained, remit, and influence other psychological states.

Estimates of disordered gambling prevalence fail to reveal either a "file drawer" or country-of-origin effect. Despite the observation that prevalence rates derived from the United States and Canada do not differ significantly, we caution readers that there may be important differences in the psychosocial profiles of gamblers from these countries.[19]

This study confirms earlier estimates of disordered gambling suggesting that population segments vary and that an individual's likelihood of experiencing disordered gambling is dependent in part upon their personal attributes, including clinical circumstances. Regardless of the methods used to calculate prevalence estimates, the research protocols that produced the estimates, or our mathematical attempts to trim these estimates (e.g., M-estimators), the resulting prevalence estimates remained remarkably consistent and within a narrow range (e.g., for level 3, < 0.20%).

The results of this research synthesis demonstrate that adolescent samples experience significantly higher prevalence of level 3 and level 2 gambling for both lifetime and past-year time frames than adult general population samples. Youthful age appears to increase the chance of experiencing gambling-related problems. Risk-taking behaviour is more normative for young people[20] and, compared to adults, adolescents are more vulnerable to gambling exposure and adverse consequences. Since college students, treatment and prison populations also had higher estimates of lifetime level 3 gambling than adults from the general population, membership in these population segments must be considered significant risk factors for gambling-related disorders.

Changes in the prevalence of disordered gambling over time

This study supports previous findings[4,5] that estimates of level 3 gambling disorders have increased only among adults in the general population during the period between 1975 and 1999. This pattern is likely the result of the interaction between personality and social setting.[4,5,21] Adults in the general population are more sensitive to the social proscriptions of illicit behaviours than are their adolescent, psychiatric, or criminal counterparts. As gambling became more socially accepted and accessible during the past two decades, this population segment started to gamble in increasing numbers. In contrast, adolescents, college students, psychiatric patients, and criminals have not avoided gambling in the past just because it was illicit. Newly exposed to the gambling experience, some adults in the general population are having difficulty adjusting and, unlike members of other population segments who already evidenced gambling problems, are beginning to encounter increasing gambling-related difficulties.

Caveats and limitations

Despite our blind, multi-step data abstraction and review process, it is possible that we made strategic, methodological, or interpretive decisions with which some colleagues would disagree.

There are some study limitations that require consideration. Sampling strategies can introduce bias into the findings of prevalence research. Walker and Dickerson[22] note that sampling bias can result from 1) excluding particular groups from the sample, 2) under-sampling specific ethnic or cultural groups, and 3) under-representing pathological gamblers among the selected sample. It is possible that samples within the different age groups or time periods analyzed in this study were not equivalent in terms of ethnic or cultural composition. Additional research is necessary to address these concerns.

Estimating prevalence is a dynamic process. Prevalence is a moving and malleable target. Estimates of prevalence reside within a statistical confidence interval. We encourage readers to avoid thinking of estimates of prevalence as representing anything more than our current best approximation. As we know, estimates are subject to revision.

There is also the matter of construct validity. While the present data reveal a relatively robust phenomenon that is measured reliably across many different study methods, this evidence fails to reflect the underlying nature of the construct being measured. For example, it might be that youthful gambling problems are qualitatively different problems occurring among adults. It might even be possible that responses to identical screening items rep-

resent different phenomena across these population segments. These thorny conceptual issues have been addressed elsewhere[4,5] and considerable research will be necessary to resolve these matters. These considerations suggest that we should conservatively consider this research as a "second approximation" to summarizing the prevalence literature.

CONCLUSIONS

Future research must monitor the prevalence of gambling disorders to determine whether the prevalence of gambling problems increases as gambling opportunities become even more readily available and more socially approved. Recent evidence reveals that while a relationship between disordered gambling and legal gambling can exist, it is not certain.[23] The social setting, including the historical moment, is critical in understanding the relationship between availability and disordered gambling. While it is possible that the prevalence of these problems will continue to increase in the near future, it also is possible that the extent of disordered gambling will remain constant or even begin to diminish. For example, after people have gained sufficient experience with gambling activities, they may begin to adapt to the experience by protecting themselves from the potential adversities associated with gambling. As hallucinogen users of the 1970s experienced a social learning process that changed their drug-using patterns,[24] gamblers likely will change both the way they gamble and the games they play. Recently, for example, casino gamblers have moved away from electronic games and returned to table games as a way of making gambling more social and less isolating.[25]

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