Estimating the Prevalence of Disordered Gambling Behavior in the United States and Canada: A Research Synthesis

Howard J. Shaffer, PhD, CAS, Matthew N. Hall, BA, and Joni Vander Bilt, MPH

ABSTRACT

Objectives. This study developed prevalence estimates of gambling-related disorders in the United States and Canada, identified differences in prevalence among population segments, and identified changes in prevalence over the past 20 years.

Methods. A meta-analytic strategy was employed to synthesize estimates from 119 prevalence studies. This method produced more reliable prevalence rates than were available from any single study.

Results. Prevalence estimates among samples of adolescents were significantly higher than estimates among samples of adults for both clinical (level 3) and subclinical (level 2) measures of disordered gambling within both lifetime and past-year time frames (e.g., 3.9% vs 1.6% for lifetime estimates of level 3 gambling). Among adults, prevalence estimates of disordered gambling have increased significantly during the past 20 years.

Conclusions. Membership in youth, treatment, or prison population segments is significantly associated with experiencing gambling-related disorders. Understanding subclinical gamblers provides a meaningful opportunity to lower the public health burden associated with gambling disorders. Further research is necessary to determine whether the prevalence of disordered gambling will continue to increase among the general adult population and how prevalence among adolescents will change as this cohort ages. (*Am J Public Health*. 1999;89:1369–1376)

This report describes the first comprehensive empirical review of the literature that estimates the prevalence of disordered gambling in the United States and Canada. During the past decade, there has been an increasing demand among researchers and policymakers to develop precise estimates of gambling-related disorders among both adults and adolescents throughout the United States and Canada. This project employed a meta-analytic strategy to synthesize estimates of gambling-related disorders across an array of differing estimation methodologies and population samples. This approach provides the opportunity to evaluate and integrate the range of assumptions and strategies used by the various scientists who have estimated the prevalence of disordered gambling.

Numerous studies reveal the serious adverse psychological, social, and biological consequences of gambling for some people.[1,2] People experiencing severe adverse reactions to gambling have become known as "compulsive," "problem," or "pathological" gamblers. The American Psychiatric Association includes pathological gambling as an impulse-control disorder in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*).[3] The manual states that "the essential feature of pathological gambling is persistent and recurrent maladaptive gambling behavior that disrupts personal, family, or vocational pursuits."[3(p615)]

Lay observers of legalized gambling and its proliferation have suggested that the growth of legalized gambling is responsible for these negative consequences and is associated with a negative impact on public health.[4] Researchers have suggested that the increased availability of legal gambling opportunities is associated with an increasing prevalence of disordered gambling among adults[5–8] and adolescents[6] 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.[6,9] Despite these concerns, researchers have not addressed these issues empirically. Likewise, no study has systematically synthesized disordered gambling trends or the comparative prevalence of these problems across different segments of the population.

Although more than 150 prevalence studies of disordered gambling have been conducted to date, the absence of a system for integrating and evaluating the estimates generated from each study has made it difficult to determine the value of diverse estimates of the prevalence of disordered gambling. This matter is complicated further because prevalence estimates reflect a wide array of criteria and labels that characterize the levels of disordered gambling severity. This study is the first empirical effort to integrate the extant research and examine the following 2 hypotheses regarding the extent of disordered gambling among Americans and Canadians.

1. Estimates of the prevalence of gambling disorders among different population segments (e.g., adolescent and adult) will be significantly different.

2. The prevalence of gambling disorders will have increased since the first estimate was promulgated more than two decades ago.

Methods

Eligibility Criteria

This study employed an inclusionist[10] strategy: we attempted to identify every exist-

The authors are with the Division on Addictions, Harvard Medical School, Boston, Mass.

Requests for reprints should be sent to Howard J. Shaffer, PhD, CAS, Harvard Medical School, Division on Addictions, 220 Longwood Ave, Goldenson Bldg, Room 523, Boston, MA 02115–5729.

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ing study of the prevalence of disordered gambling conducted in the United States or Canada. To be eligible for inclusion in this study, a prevalence study had to meet each of the following 7 criteria: (1) it was conducted in either the United States or Canada; (2) it was conducted before June 15, 1997; (3) it was written in English; (4) it specified the size of the sample; (5) it specified what instrument was used to identify disordered gambling; (6) it reported the sample's estimate of disordered gambling; (7) it was available to the authors for review by June 15, 1997.

Identifying Studies

To identify the maximum number of published studies on the prevalence of disordered gambling, we examined every issue of the *Journal of Gambling Studies* (formerly the *Journal of Gambling Behavior*) through the spring 1997 issue. In addition, we conducted searches of standard research databases, including MEDLINE[11] (1966–June 1997), PsycINFO[12] (1984–June 1999), and the Harvard OnLine Library Information System[13] (1975–1997). We examined all entries in these databases related to the key word "gambling" and selected potential prevalence studies for further examination. Finally, to identify unpublished studies that received limited distribution, we requested studies from colleagues and their networks of associates whose research relates to gambling. This search strategy identified 151 prevalence studies; of these, 119 satisfied the inclusion criteria and were accepted into this study for analysis. Weighting studies for the use of multiple instruments resulted in a total of 134 distinct prevalence estimates of disordered gambling. (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 [e.g., 2 estimates from a single study sample would be weighted 0.5 each, 3 estimates would be weighted 0.33 each].)

Nomenclature and Classification: Levels of Disordered Gambling Severity

Studies of the prevalence of disordered gambling have used a wide array of criteria and taxonomic systems to name, define, and organize levels of disordered gambling severity.[14] In many cases, conceptually equivalent categories have been given different names by different authors. For example, the most disordered level of gambling behavior has been called "pathological," "probable pathological," and "compulsive" gambling in different studies. Similarly, groups experiencing less severe problems have been called "potential pathological," "problem," "at-risk," and "in-transition" gamblers in different studies. Some investigators of adolescent gambling have argued that it is inappropriate to apply the term "pathological" to adolescents and have used the term "problem" in its place.[15]

To synthesize the extant data from different studies and avoid favoring nomenclature associated with particular schemas, we employed a classification system consisting of 3 generic levels of gambling problem severity that allows for the organization and integration of data from different studies.[14] Level 1 represents respondents who do not experience gambling problems. This group includes both "nonproblem" gamblers and nongamblers. Level 2 represents gamblers with subclinical levels of gambling problems (e.g., "problem," "at-risk," "in-transition," "potential pathological"). 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., the *DSM-IV* criteria); in other studies, the established diagnostic criteria have been modified, but the group remains conceptually equivalent.

Results

Study Demographics

Of the 134 prevalence estimates identified in this study, 73.9% were derived from studies conducted in the United States (n = 99) and 26.1% were derived from studies conducted in Canada (n = 35). A comparison 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. Consequently, the remainder of the analyses describes pooled data.

We classified these prevalence estimates into the following 4 population groups: general adult population (n = 50), adolescents (n = 22), college students (n = 16), and adults in prison or in treatment for psychiatric or substance abuse disorders (n = 18). These 4 categories include 94 studies that provide prevalence estimates for 106 distinct study samples; the remaining prevalence estimates could not be classified into these broad categories and were excluded from the analyses. The 106 study samples represent an aggregate of 122 286 respondents. The general adult population studies represent a total of 79 037 respondents, the adolescent studies represent 27 741 respondents, the college studies represent 8918 students, and the adult treatment/prison studies represent 6590 respondents.

Prevalence Differences Among Population Segments

The majority of studies included in this research synthesis generated prevalence estimates representing either lifetime or past-year time frames. Studies that failed to indicate the time frame for their estimates were recoded 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 recoded to represent a past-year time frame. Three estimates representing 6-month time frames were recoded 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 may represent conservative estimates.

Table 1 provides the mean lifetime and past-year prevalence estimates and the confidence intervals associated with these estimates for each of the 4 population segments discussed above. (In addition to calculating unweighted means, we calculated 15 other measures of central tendency for each variable, including four maximum likelihood estimators [i.e., Huber's, Andrew's wave, Hampel's redescending, and Tukey's biweight estimators], Winsorized estimates, and estimates weighted by quality score. Analyses revealed no meaningful differences among these measures. For example, the 16 measures for lifetime level 3 gambling among adults ranged from 1.5% to 1.6%. As a result, we present here only the unweighted mean as the representative prevalence index because it is not influenced by statistical manipulations. Appendixes providing details on these 16 measures are available from the authors.) We compared these study groups to identify any differences that might exist among prevalence estimates. Kruskal-Wallis tests revealed significant differences in lifetime level 3 and level 2 prevalence among these 4 groups ($\chi^2 = 58.413$, $df = 3$, $P < .001$ and $\chi^2 = 31.430$, $df = 3$, $P < .001$, respectively).

The Dunnett C test for posthoc analyses, assuming unequal variance, revealed the following specific group differences: for lifetime level 3, the prevalence estimate among general adult population studies (mean = 1.60) was significantly lower ($P < .05$) than the prevalence estimates among adolescent studies (mean = 3.88), college studies (mean = 4.67), and adult treatment/prison studies (mean = 14.23). The estimate

TABLE 1—Mean Disordered Gambling Prevalence Estimates[a] (95% Confidence Intervals) for 4 Study Populations

	Adult	Adolescent[b]	College	Treatment/Prison
Level 3 lifetime	1.60 (1.35, 1.85)	3.88 (2.33, 5.43)	4.67 (3.44, 5.90)	14.23 (10.70, 17.75)
Level 2 lifetime	3.85 (2.94, 4.76)	9.45 (7.62, 11.27)	9.28 (4.43, 14.12)	15.01 (8.94, 21.07)
Level 1 lifetime	94.67 (93.71, 95.62)	89.56 (85.88, 93.25)	86.66 (80.90, 92.42)	71.54 (62.90, 80.18)
Level 3 past year	1.14 (0.90, 1.38)	5.77 (3.17, 8.37)	...	...
Level 2 past year	2.80 (1.95, 3.65)	14.82 (8.99, 20.66)	...	...
Level 1 past year	96.04 (95.04, 97.04)	82.31 (75.59, 89.03)	...	...

[a]Estimates are rounded to 2 decimal places.
[b]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.

of lifetime level 3 gambling among adolescent studies was significantly lower ($P<.05$) than the estimate among adult treatment/prison studies. College studies also evidenced a meaningfully lower ($P<.05$) lifetime level 3 gambling estimate than adult treatment/prison studies. For lifetime level 2 gambling estimates, adult studies (mean = 3.85) evidenced a significantly lower ($P<.05$) prevalence than adolescent studies (mean = 9.45) and adult treatment/prison studies (mean = 15.01).

For past-year prevalence, there were insufficient data to compare studies representing all 4 population segments; therefore, we compared past-year prevalence among adult and adolescent studies by using the Kruskal-Wallis test. For past-year level 3 and level 2 estimates, adult study estimates were significantly lower than those derived from adolescent studies ($\chi^2 = 16.703$, $df = 1$, $P<.001$ and $\chi^2 = 18.344$, $df = 1$, $P<.001$, respectively). These analyses suggest that for level 3 gambling, the lifetime prevalence ratio of adolescent to general adult population samples is approximately 2.4, while the past-year prevalence ratio for these groups is 5.1. The lifetime prevalence ratio of college samples to adult samples is 2.9, and the lifetime prevalence ratio of treatment/prison samples to adult samples is 8.9.

For level 2 gambling, the lifetime prevalence ratio of adolescent to adult samples is 2.5, while the past-year prevalence ratio for these groups is 5.3. The lifetime prevalence ratio of college samples to adult samples is 2.4, and the prevalence ratio of treatment/prison samples to adult samples is 3.9. There were insufficient past-year data to calculate similar comparative values for college and treatment/prison populations.

Estimating Population Prevalence Differences While Controlling for Instrument

To determine whether differences among population types were attributable to differences in the instruments commonly used for particular population types, we calculated the prevalence of disordered gambling for the primary population types by means of only the most commonly used instrument, the South Oaks Gambling Screen (SOGS).[16] Table 2 summarizes these prevalence estimates derived from the SOGS.

The Kruskal-Wallis test of SOGS lifetime measures of level 3 gambling revealed significant differences among the 4 study types ($\chi^2 = 48.929$, $df = 3$, $P<.001$). However, the Dunnett posthoc test identified a somewhat different pattern of results from those reported above. For SOGS lifetime estimates of level 3 gambling, the prevalence among adult studies (mean = 1.71) was significantly lower ($P<.05$) than that among college studies (mean = 5.05) and treatment/prison studies (mean = 14.55), but it was not significantly different from that among adolescent studies (mean = 4.25). However, we must exercise caution when interpreting the finding that adult prevalence estimates were not significantly lower than adolescent prevalence estimates in this analysis. Power analyses revealed that the capability to detect this difference was only 10%. This low power level, caused chiefly by the small number of studies available for this analysis, indicates that identifying any existing differences between these 2 groups is improbable. The Dunnett C test of lifetime level 3 estimates also revealed that the adolescent prevalence and the college prevalence were each significantly lower ($P<.05$) than the treatment/prison prevalence.

For SOGS lifetime estimates of level 2 gambling, the Kruskal-Wallis test revealed significant differences among the 4 groups ($\chi^2 = 23.118$, $df = 3$, $P<.001$). The Dunnett posthoc analysis revealed the following differences: general adult population estimates (mean = 3.41) were significantly lower ($P<.05$) than adolescent estimates (mean = 8.58) and college estimates (mean = 7.00). There were not sufficient data to make comparisons of past-year prevalence among the groups.

Temporal Changes in Prevalence of Disordered Gambling

To control for the observation that studies of populations with higher prevalence estimates (e.g., adolescents, treatment groups) were more likely to have been conducted in recent years, we standardized prevalence estimates within each study type by using z scores. We examined these standardized prevalence measures for all 4 population segments to identify any significant changes in these estimates over time. This analysis revealed a significant positive correlation between the year a study was conducted and the estimate of past-year level 3 gambling ($r = 0.45$, $P<.01$).

Next, we examined prevalence estimates within each population segment by using the method described above to identify significant patterns over time associated with individual population segments. Analyses of adolescent, college, and treatment/prison studies revealed no significant patterns over time. Among adult studies, however, there were significant positive correlations between the year a study was conducted and past-year level 3 gambling prevalence ($r = 0.56$, $P<.01$), the year a study was conducted and past-year combined level 2 and level 3 gambling prevalence ($r = 0.37$, $P<.05$), and the year a study was conducted and lifetime combined level 2 and level 3 gambling prevalence ($r = 0.34$, $P<.05$).

We validated these findings by using a second analytic strategy: we compared the prevalence from studies released before the median year for all adult studies (i.e., 1993.5) with the prevalence from studies released after the median year. The Kruskal-Wallis test revealed that for studies among the general adult population, recent (i.e., postmedian) studies had a significantly higher prevalence than earlier (i.e., premedian) studies for lifetime level 2 ($\chi^2 = 5.792$, $df = 1$, $P<.05$), lifetime level 2 and level 3 combined ($\chi^2 = 7.524$, $df = 1$, $P<.01$), and past-year level 3 ($\chi^2 = 4.033$, $df = 1$, $P<.05$).

TABLE 2—Mean Disordered Gambling Prevalence Estimates (95% Confidence Intervals) Associated With the South Oaks Gambling Screen (SOGS) Studies[a]

	Adult	Adolescent	College	Treatment/Prison
Level 3 lifetime	1.71 (1.46, 1.96) (n = 30)	4.25 (1.91, 6.59) (n = 6)	5.05 (3.55, 6.56) (n = 14)	14.55 (10.60, 18.50) (n = 16)
Level 2 lifetime[b]	3.41 (2.81, 4.0) (n = 27)	8.58 (5.69, 11.47) (n = 5)	7.00 (4.49, 9.50) (n = 9)	8.83 (3.34, 14.31) (n = 6)
Level 3 past year	1.12 (0.945, 1.30) (n = 26)	...	...	...
Level 2 past year[b]	2.16 (1.81, 2.50) (n = 25)	...	...	...

[a]This table represents studies that used the original SOGS, the SOGS modified to reflect a past-year time frame, and the SOGS modified minimally for use with adolescent populations. This table does not include studies that used more substantial modifications of the original SOGS.

[b]The level 2 prevalence estimates in this table represent studies that defined level 2 gambling as a SOGS score of 3 or 4. These estimates are conservative compared with those derived from the use of scores from 1 to 4 on the SOGS as the definition of level 2 gambling. We used the more conservative definition for this analysis because the use of this definition provided more data for analysis than the use of the more liberal definition would have provided.

Table 3 summarizes these mean prevalence estimates.

Finally, we identified significant patterns of increasing prevalence estimates over time among adult studies by conducting curve estimation regression analyses (i.e., trend analyses). These analyses revealed significant increasing linear temporal patterns for lifetime level 3 estimates ($r^2 = 0.36407$, $F_{1,17} = 9.63720$, $P < .01$), combined lifetime level 3 and level 2 estimates ($r^2 = 0.22508$, $F_{1,17} = 4.88948$, $P < .05$), and past-year level 3 estimates ($r^2 = 0.28231$, $F_{1,17} = 6.62141$, $P < .05$).

Discussion

This project represents the first quantitative integration of prevalence estimates among a range of population segments reported in the literature on disordered gambling. This study indicates that prevalence estimates of disordered gambling vary by population segment and that an individual's likelihood of having experienced disordered gambling is primarily dependent on age and clinical situation. (Although beyond the scope of this study, sex [male] is also significantly associated with disordered gambling; we will present these findings in a future report.) Our research revealed that these estimates are very robust. Regardless of the methods used to calculate the estimates, the research protocols that produced the estimates, or our attempts to weight these estimates by a variety of algorithms, the resulting values of pathological gambling remained remarkably consistent and within a very narrow range (<1%).

The results of this research synthesis demonstrate that adolescent samples consistently show a significantly higher prevalence of level 3 and level 2 gambling for both lifetime and past-year time frames than general adult population samples. Youthful age appears to increase the chance of experiencing gambling-related problems. Risk-taking behavior is more normative for young people,[17] and, compared with adults, adolescents are more vulnerable to gambling exposure. Indeed, most young people in the United States and Canada have lived their entire lives within the context of legalized gambling. Study samples representing college students also had consistently higher estimates of lifetime level 3 gambling than samples of adults surveyed from the general population. The treatment/prison population evidenced the highest prevalence of disordered gambling among all the population groups studied. Membership in youth, college, treatment, or prison population segments must be considered a significant risk factor for experiencing gambling-related disorders. This relationship holds with lifetime and past-year measures of clinical and subclinical levels of gambling disorders.

Changes in Prevalence of Disordered Gambling Over Time

This study provides evidence supporting the notion that the prevalence of gambling disorders among adults in the general population increased between 1974 and 1997. This pattern of increasingly higher estimates of gambling disorder among the general adult population is most likely a result of the interaction between personality and social setting. Adults in the general population are much more sensitive to the social proscriptions of illicit behaviors than are their adolescent, psychiatric, or criminal counterparts. As gambling has become more socially accepted and accessible during the past 2 decades, adults in the general population have started to gamble in increasing numbers. In contrast, adolescents, college students, psychiatric patients, and criminals probably did not avoid gambling in the past just because it was illicit. Some adults in the general population, newly exposed to the gambling experience, are having difficulty adjusting and, unlike members of other population segments who already evidenced gambling problems, are beginning to experience increasing problems with gambling.

The results indicate that lifetime estimates of disordered gambling among adolescents exceed those among adults. Since, in theory, a lifetime estimate for a particular cohort cannot decrease over time, when the adolescents represented in this report reach adulthood, they should evidence a higher lifetime prevalence of disordered gambling than the adults represented in this study. These findings suggest that there is a cohort effect influencing prevalence estimates of level 3 gambling. In other words, the higher estimate of disordered gambling found among contemporary adolescents may be attributable not simply to adolescence but rather to some interaction of adolescence and the current social setting (e.g., availability of gambling, changes in the social setting, cultural approval of gambling). If this is the case, the prevalence of disordered gambling in the general population will increase as these adolescents grow into adulthood and new generations of adolescents repeat this pattern. Additional studies, and incidence studies in particular, are necessary to determine how the prevalence of disordered gambling will change as the current generation of adolescents ages.

Caveats and Limitations

Despite our blind, multistep data abstraction and review process, it is possible that we made strategic, methodologic, or interpretive decisions with which some colleagues would

TABLE 3—Mean Adult Disordered Gambling Prevalence Estimates for Premedian-Year and Postmedian-Year Groups

	Early Studies (1977–1993)	Recent Studies (1994–1997)
Lifetime level 2	2.93	4.88[a]
Lifetime combined	4.38	6.72[a]
Past-year level 3	0.84	1.29[a]

[a]Significantly higher than early studies' estimates; $P<.05$

disagree. Consequently, this analysis of the prevalence of gambling-related problems should be regarded as a "first approximation" to summarizing the literature. In addition to this caveat, there are some specific sampling limitations that require consideration. The sampling strategies employed by prevalence studies can introduce bias into research findings. Walker and Dickerson[18] note that sources of sampling bias can include (1) excluding particular groups from the sample, (2) undersampling specific ethnic or cultural groups, and (3) underrepresenting pathological gamblers among the selected sample. Although we examined many factors that could compromise the internal validity of the research included in this study, this research synthesis was unable to explore these potential sources of research bias. Thus, for example, 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 questions.

This research synthesis was also limited by the breadth and depth of the prevalence studies that met the criteria for inclusion in this study. In general, the adult population studies included in this research synthesis had large sample sizes and the treatment population studies had small sample sizes. This pattern may, in part, be a reflection of the sources of funding available for researchers of gambling. Furthermore, the investigation of adolescent and treatment populations began only in the mid-1980s. Continued study of disordered gambling will provide valuable information necessary to develop strategies for prevention and treatment. For example, a large-scale study of psychiatric patients would have sufficient power to inform clinicians, researchers, and policymakers regarding the unique health care and treatment needs of pathological gamblers, who compose an important segment of the substance-abusing and psychiatric patient populations.

Conclusions

Future research must continue to examine the prevalence of gambling disorders to determine whether it increases as gambling opportunities become even more readily available and more socially approved. While it is possible that the prevalence of these problems will continue to increase in the near future, it also is possible that it 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. This social learning process occurred among hallucinogen users during the 1970s.[19]

Understanding the behavior of level 2 gamblers holds considerable potential for lowering the social costs associated with gambling disorders. Researchers[20,21] have noted that, with other disorders, the preponderance of social costs in the general population results from individuals with low- and intermediate-level symptom patterns. As a result, small improvements among these individuals can result in greater overall improvements in the public health than larger improvements among those with the most severe symptoms. In addition, as was the case with research on problem drinkers, future research on gambling likely will reveal that level 2 gamblers are more responsive to treatment and social policy interventions than level 3 gamblers.

Throughout the scientific literature, the pool of prevalence-related research syntheses is still quite limited. New research will contribute innovative methodologies that can advance our understanding of prevalence and its potentially shifting trends. In addition, as the field of gambling research matures, epidemiologic science and public health demands likely will exert a stronger influence on the nature of disordered gambling research, yielding improved methodologies for studying gambling-related disorders. □

Contributors

Each of the authors participated in every phase of this research project, including conception, instrument development, prevalence study identification and acquisition, data abstraction, data analysis and interpretation, and writing of the manuscript.

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* This list includes all of the studies identified during the literature search, but only 119 of the studies met our inclusion criteria. The studies not included are marked with an asterisk.