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The Relationship Between Physical Availability of Gambling and Gambling Behaviour or Gambling Disorder: A Systematic Review

Madeleine Zoglauer,[1,2] Robert Czernecka,[2] Gerhard Bühringer,[2,3,4] Roxana Kotter,[2,5] & Anja Kräplin[2]

[1] Department of Psychology, Technische Universität Chemnitz, Chemnitz, Germany
[2] Faculty of Psychology, Technische Universität Dresden, Dresden, Germany
[3] IFT Institut für Therapieforschung, Munich, Germany
[4] Unit of Clinical Alcohol Research, Faculty of Health, University of Southern Denmark, Odense, Denmark
[5] Department of Psychology, Julius-Maximilians-Universität of Würzburg, Würzburg, Germany

Abstract

Although it is often regarded as obvious, the exact nature of the relationship between gambling availability and gambling behaviour or disordered gambling remains unclear. However, disordered gambling is an important public health issue and restrictions on availability are seen as an important strategy to reduce gambling-related problems in many jurisdictions. Applying the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, we reviewed studies on the relationship between physical gambling availability and gambling behaviour, as well as disordered gambling, and focused on several currently discussed hypotheses about their relationship. We used a systematic electronic search strategy involving 12 search terms and several databases. We included 27 studies and evaluated them by applying a comprehensive quality rating and quality weighting of evidence. We found a high proportion of quality-weighted evidence for both a positive relationship (access hypothesis) and a decrease or plateau in the prevalence of gambling participation and disorders over time with increasing availability (adaptation hypothesis). However, several conceptual and methodological problems hamper final conclusions. For example, studies were often not based on precise hypotheses, only two studies had a longitudinal design, overall quality ratings varied widely, operationalizations of gambling availability were sometimes not objectively measured, follow-up periods were insufficient, and shifting behaviour was not assessed. To understand the causal role of gambling availability in the development and course of gambling disorder and to derive evidence-based prevention strategies,

investigators need to perform more high-quality longitudinal research that is based on a solid theoretical framework with the corresponding statistical analyses.

Keywords: pathological gambling, problem gambling, gambling industry, review, gambling disorder, regulation

Résumé

Bien qu'on la considère souvent comme évidente, la nature exacte de la relation entre la disponibilité des jeux de hasard et le comportement lié à la pratique de ces jeux ou le jeu compulsif demeure incertaine. Le jeu compulsif représente toutefois une importante question de santé publique et les restrictions touchant la disponibilité sont considérées comme une stratégie très valable pour réduire les problèmes associés aux jeux de hasard dans de nombreux pays. En appliquant les directives PRISMA, nous avons examiné les études sur la relation entre la disponibilité physique des jeux de hasard et le comportement lié à ces jeux et au jeu compulsif, en mettant l'accent sur plusieurs hypothèses qui font actuellement l'objet de discussions. Nous avons employé une stratégie de recherche électronique systématique comportant douze termes d'interrogation et plusieurs bases de données. Vingt-sept études ont été évaluées en y appliquant une cote de qualité et une pondérée de la preuve de qualité exhaustives. Nous avons constaté une forte proportion de pondèrèe probante pour les deux, une relation positive (hypothèse de l'accès) et une diminution ou un plateau dans la prévalence de la pratique des jeux de hasard ou du jeu compulsif au fil du temps en présence de disponibilité croissante (hypothèse d'adaptation). Cependant, plusieurs problèmes conceptuels et méthodologiques nuisent à la formulation de conclusions finales. Par exemple, plusieurs études n'étaient pas fondées sur des hypothèses précises, seulement deux études faisaient l'objet d'un plan longitudinal, les cotes de qualité globale variaient énormément, les opérationnalisations de la disponibilité du jeu n'étaient parfois pas mesurées objectivement, les périodes de suivi étaient insuffisantes et les changements de comportement n'étaient pas évalués. Pour comprendre le rôle causal de la disponibilité du jeu dans le développement et le cours du jeu compulsif, et pour en tirer des stratégies de prévention fondées sur des données probantes, une étude longitudinale de plus grande qualité est requise, et doit être basée sur un cadre théorique rigoureux et comporter les analyses statistiques correspondantes.

Introduction

In this systematic review, we aim to provide a theory-based overview of current empirical evidence on the relationship between gambling availability and gambling behaviour (e.g., gambling participation) with a focus on gambling disorder (GD).

Various models on the impact of availability on the prevalence of substance use disorders assume a direct and positive relationship (e.g., Gillespie et al., 2009). This hypothesis also underlies etiological models of GD (e.g., Blaszczynski & Nower, 2002) and policy measures intended to prevent GD with availability restrictions: The more gambling opportunities available, the more people will have gambling-related problems (Hesselbarth, 2009). Several narrative and critical literature overviews have so far summarized the evidence for a significant positive association between gambling availability and the prevalence of GD, but a number of studies also found no evidence for such a relationship (e.g., Abbott, 2020; Johansson et al., 2009; St-Pierre et al., 2014). These contradictory results have led some researchers to suggest that there may not be a direct or linear relationship between gambling availability and the prevalence of GD (Shaffer et al., 2004). Shaffer et al. (2004) developed the public health regional exposure model (REM) that incorporates three primary exposure components: dose, potency, and duration. Dose is a measure of exposure quantity (e.g., to casinos); potency is a measure of source strength, amount, or threshold (e.g., type of gambling); and duration is a measure of time (e.g., years of legal gambling). Applying the REM to empirical data, the authors concluded that in addition to exposure effects (i.e., a positive linear relationship), adaptation processes should be considered in order to better understand the impact of gambling availability on the prevalence of GD (LaPlante & Shaffer, 2007). Adaptation over time can result from a number of influences, such as a decrease in novelty effects, social learning, an increase in adverse consequences, or the development of prevention and intervention strategies (LaPlante & Shaffer, 2007).

Despite a large number of narrative literature overviews, we see the need for further systematic literature reviews on gambling availability and problem gambling (see also Abbott, 2020). To our best knowledge, there have been three systematic reviews of the relationship between the availability of gambling and gambling behaviour or GD. Vasiliadis et al. (2013) focused on the relationship between the physical availability of electronic gaming machines (EGMs) and gambling behaviour, problem gambling, and gambling-related treatment seeking. This review included 39 studies and revealed that both proximity and density of EGMs are associated with gambling participation, whereas proximity is specifically more strongly associated with increased GD prevalence rates. The authors concluded that, among other things, there is a need for a better theoretical framework. LaPlante et al. (2018) included 20 studies on the relationship between gambling expansion and gambling behaviour and gambling problems or GD. They found that 12 of 34 expansion outcomes (35.3%) were related to an increase in gambling outcomes, whereas 64.7% of outcomes suggested no changes or a decrease in gambling outcomes. G. Meyer et al. (2018) included eight studies and focused on the effect of supply reduction on the prevalence of gambling participation and GD. They found that gambling participation and GD prevalence decreased after supply reduction. Only a few study results did not show significant changes or an increase in gambling participation after supply reduction.

A second research need is a more theory-based approach. An innovative aspect of this systematic review is that we aim to structure the empirical evidence according to

the following four hypotheses on the relationship between the availability of gambling and the prevalence of GD (Becker, 2015):

1. Independence hypothesis: There is no causal relationship; that is, if gambling availability increases, an increase in the prevalence of GD does not automatically follow.

2. Access hypothesis: There is a positive linear relationship; that is, the prevalence of GD will proportionally rise if availability rises and will proportionally drop if availability drops.

3. Satiation hypothesis: There is a positive linear relationship that reaches a plateau; that is, the prevalence of GD proportionally rises with higher availability, but above a certain level of availability, the prevalence remains constant and no longer proportionally follows the increase in availability.

4. Adaptation hypothesis: There is a positive causal relationship for a given period; that is, if availability increases over time, the prevalence of GD initially increases linearly and then remains stable or decreases over time (the only hypothesis that considers a development over time).

Evidence for one or more of these hypotheses remains unclear, even though public health policy actions in many countries are based on the access hypothesis and aim to reduce the prevalence of gambling-related problems with quantitative restrictions of the gambling market. For instance, countries such as Italy, Belgium, Austria, Portugal, Slovenia, Sweden, South Africa, and the United Kingdom have restricted the number of casinos and slot machines (Williams, West, & Simpson, 2012). In 2007, Norway banned slot machines completely, which resulted in heterogeneous effects on gambling problems (Rossow et al., 2013).

A third research need is the use of comparable and objective operationalizations of gambling availability and gambling problems or GD. Regarding the operationalization of GD, established diagnostic instruments or screenings should be used. Conclusions regarding increased or decreased GD prevalence rates have often been drawn from indicators such as treatment seeking, which is problematic because only a small proportion of individuals with GD seek treatment (Slutske, 2006). Regarding the operationalization of availability, Hing and Nisbet (2010) and Becker (2015) heuristically distinguished three dimensions:

1. Cognitive availability (e.g., degree of knowledge about gambling such as product knowledge)

2. Social availability (e.g., degree of normalization of gambling through exposure such as advertisement or family involvement)

3. Physical availability (e.g., distance to the next gambling opportunity such as opening hours, number, distribution, and geographic location of gambling venues)

To facilitate comparability and integration of study results from different countries, in this review, we focus on physical availability, since cognitive and social availability are strongly influenced by cultural (e.g., attitude towards gambling) and political characteristics (e.g., bans on advertisement) and are much harder to objectively measure. We included studies on both increased and decreased physical availability because the four hypotheses indirectly assume that the relationship (if any) to gambling behaviour or GD is a continuous function. Accordingly, studies are included that investigated an increase in physical availability (e.g., opening of a new casino), a decrease in availability (e.g., prohibition of slot machines), or other forms of physical availability (e.g., number of years that a casino exists). In addition to GD, we also included gambling behaviour outcomes (e.g., gambling duration and stakes), as certain aspects of gambling behaviour (e.g., increase in money spent on gambling) are relevant predictors of gambling problems and GD (Currie et al., 2017; Gray et al., 2012; Xuan & Shaffer, 2009).

As a fourth research need, quality ratings of the reviewed studies should be applied. With the exception of the review by LaPlante et al. (2018), no quality ratings were conducted, and so there may have been interpretation biases regarding novel or prominent findings. Moreover, none of the reviews weighted the evidence according to the quality of studies; that is, results of studies with higher research quality were not weighted more strongly than those with lower quality, which we consider important for research synthesis.

A final research need is to include studies on different gambling types. It is known that some types of gambling have higher proportions of participants with GD and thus have a higher potency according to the REM (Shaffer et al. 2004). Because most literature reviews focus on slot machines or casinos, it remains unclear whether certain availability hypotheses apply only to certain gambling types (St-Pierre et al., 2014).

In sum, we applied a systematic review to address the relevant research question of how physical gambling availability is related to gambling behaviour, with a focus on GD. We thereby focused on the following conceptual and methodological research needs: (a) a systematic review of the literature and expansion of the scope of previous systematic reviews regarding the time period of the search, (b) synthesis and evaluation of the research evidence according to four currently discussed hypotheses (independence, access, satiation, adaptation), (c) a focus on studies that used established diagnostic or screening instruments to assess GD and that assessed increasing or decreasing physical availability, (d) performance of comprehensive quality ratings of all studies and weighting of their evidence accordingly, and (e) inclusion of gambling segments other than EGMs.

Method

This systematic review was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses system (Moher et al. 2009).

Information Sources and Search Strategy

A computer-based database search was carried out by the first author and an independent research assistant that included the databases Embase, PubMed, PsycINFO, PSYNDEX, and Web of Science (until June 2019). In accordance with the population, intervention, comparison, outcome, and study design (PICOS) criteria (Shamseer et al., 2015), 12 keywords were chosen. Three keywords described the selection of the population (P): pathol* gambl*, problem* gambl*, AND gambl* disorder. For the relevant intervention (I), we chose the keywords access*, availab*, exposure, AND density. Keywords for outcome were (O), prevalence, frequen*, duration, severity, AND stake. We linked all keywords and used all 60 ($3 \times 4 \times 5$) combinations by means of the Boolean operators OR and frequent (for the detailed review protocol, see Supplement A).

Eligibility Criteria

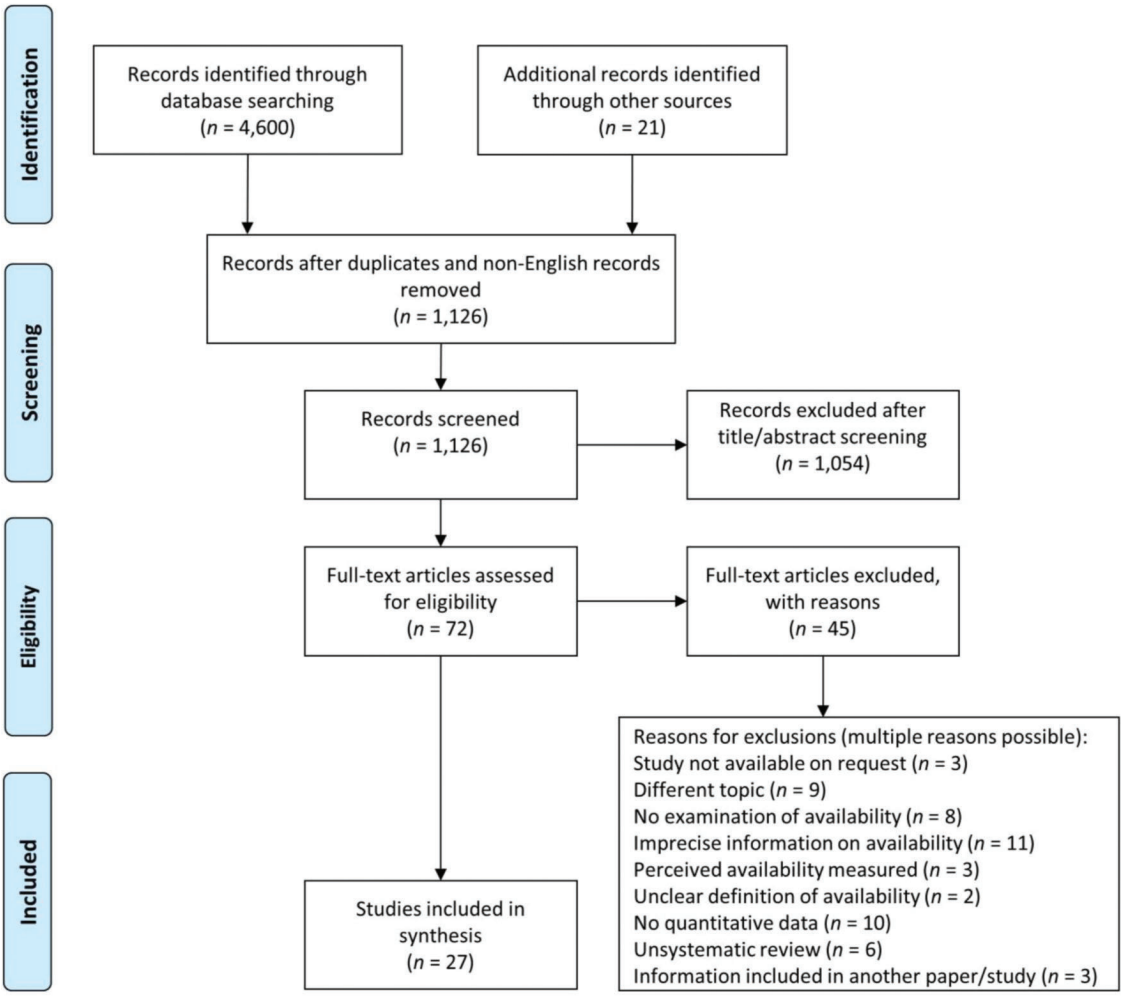
The population (P) included individuals with GD, problematic gamblers, and those with gambling behaviour in general community samples. The intervention (I) concerned the physical availability of gambling opportunities. The intervention included both a range of gambling availability measures at a given point in time (proxy for a real intervention effect) and changes in gambling availability over time due to real interventions such as liberalization of gambling segments. We included studies that objectively measured gambling availability (e.g., density of gambling opportunities) and those that provided a historical explanation of changes (e.g., before and after the introduction of a new gambling segment). The outcome (O) included the prevalence of GD, problem gambling, gambling frequency, gambling duration, and stakes. We omitted the two criteria, comparison and study design (C and S), because we expected a limited number of longitudinal studies or randomized controlled trials, which would have strongly reduced the eligible data. Only studies in English with quantitative data acquisition were included.

Study Selection

We used five steps for study selection (see Figure 1):

1. Exclusion of all duplicates
2. Exclusion of all non-English language studies
3. Title screening
4. Abstract screening
5. Full-text screening

Figure 1
Flow of Information Through the Different Phases of the Systematic Review (Modified According to Moher et al., 2009).



We decided to exclude studies on internet gambling for two reasons. First, although internet gambling is illegal in certain jurisdictions, participation in internet gambling is still high, as it is insufficiently controlled and several operators use grey zones arising from inter-jurisdictional inconsistencies (e.g., offshore sites). Second, because of new technologies, the internet is always and everywhere available so that there is no objective measure of physical availability. If one were to use legal status as an operationalization and compare jurisdictions with legal and illegal status of internet gambling, one would again be faced with the first problem (uncontrolled gambling offers). Studies that measured gambling availability as *perceived availability* were also excluded because these measures indicate social and cognitive availability. We also excluded studies on individuals who self-excluded from casinos because, theoretically, they should no longer be allowed to gamble and therefore gambling availability should be zero.

Synthesis of Results

To synthesize study results, we performed a stepwise quality weighting in which we analysed whether the outcomes of each study showed evidence (significant results) or no evidence (non-significant results) of one of the four hypotheses, taking the studies' quality rating scores (QRS) into account: First, a quality rating for each study was performed. Second, we allocated each outcome to one of the four hypotheses (Becker, 2015). Different outcomes of one study could be allocated to different hypotheses. One outcome could either support (if it was a significant result) or not support (if it was not significant) the hypothesis to which it was allocated. For simplicity's sake, in this review, we refer to "support of the hypothesis" and "rejection of the hypothesis." Third, we then calculated the proportion of outcomes per study that supported or rejected a hypothesis. Fourth, quality weighting was performed in which we considered the QRS of each study and the number of studies that supported or rejected one of the four hypotheses.

First Step: Quality Rating Scores (QRS)

Because the varying quality of research studies may bias systematic reviews, it is important to implement a quality rating system to achieve a better balance of the included results. We considered three quality rating instruments for systematic reviews of observational studies: The Downs and Black (D & B Downs & Black, 1998), the Newcastle–Ottawa Scale (NOS; Wells et al., 2019), and the Scottish Intercollegiate Guidelines Network (SIGN; checklist for cohort studies, 2012). However, some important aspects for quality ratings of studies on the effect of gambling availability were missing (e.g., longitudinal design to test causal hypothesis). Therefore, we used categories of the three scales and included further categories on the basis of an earlier systematic review by Kotter et al. (2019). The dichotomous quality rating included the following categories: Category 1 (study design) was based on D&B, NOS, SIGN, and the work of Kotter et al. (2019) and was completed by using aspects that were important for causal interference of results. For example, studies received 1 point for study design if a longitudinal or repeated cross-sectional design was applied (vs. no points for a single cross-sectional design). Category 2 (clarity) was based on D&B whereby 1 point could be achieved for clear statistics, tables, and graphics. One point could be achieved in Category 3 (declaration of funding or conflict of interest) if the funding of the study or the conflicts of interest were mentioned. The category was based on the work of Kotter et al. (2019) and has been highlighted as an important need in gambling research (Livingstone & Adams, 2016). Category 4 (measurement of availability) was adapted from D&B, NOS, SIGN, and the work of Kotter et al. (2019) and refers to the objectivity and reliability of gambling availability. For instance, 1 point could be achieved for using an objective geocoding system (exact distance to a gambling opportunity) versus no points for the sheer number of gambling opportunities without measures such as distance or density. Categories 5 (measurement of GD and problem gambling) and 6 (measurement of gambling behaviour) were based on D&B, SIGN, and the work of Kotter et al. (2019) and refer to the objectivity and reliability of outcome measures.

One point was given when established and validated instruments were used for measuring GD, problem gambling, and gambling behaviour. Every category had one to six subcategories. A study could receive 1 quality point per subcategory and reach a maximum of 15 points. The quality of all included studies was independently rated by the first author and an external research assistant. Discrepancies in ratings (n = 2) were resolved through consultation and consensus among the raters and by refining the quality criteria in Supplement C to prevent misunderstandings.

Second Step: Hypothesis Allocation

The next step was to allocate every outcome of every study to one of the four hypotheses. The allocation procedure was based on the concrete assumptions of the four hypotheses:

1. Independence hypothesis: Cross-sectional or longitudinal study designs could be allocated. Study outcomes could be allocated to this hypothesis if they resulted from statistical methods such as equivalence or non-inferiority testing, which are required to prove no or low relations. Notably, we cannot allocate non-significant results in linear testing (e.g., linear regression analyses) to the independence hypothesis because a lack of evidence is not evidence of lack. Null findings can also be low because of methodological issues, just by chance, or because relations are non-linear.

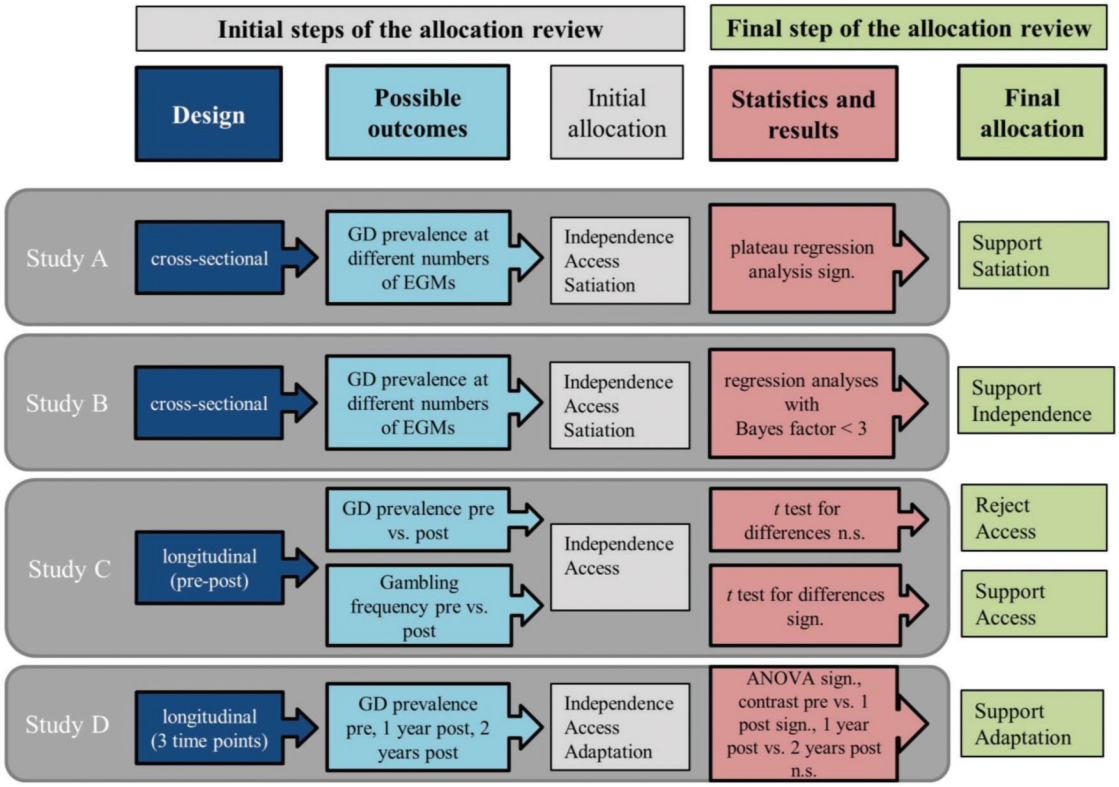
2. Access hypothesis: Cross-sectional or longitudinal study designs could be allocated. Study outcomes could be allocated to this hypothesis if they resulted from statistical tests for linear relations (e.g., linear regression) or group differences (e.g., comparison of the GD prevalence rates before and after an EGM ban).

3. Satiation hypothesis: A cross-sectional relationship was assumed so that we could allocate outcomes only from cross-sectional studies to this hypothesis. We allocated study outcomes to this hypothesis if they resulted from statistical tests with non-linear models (e.g., non-linear regression) or at least three levels of availability (testing Level 1 against Level 2 and Level 2 against Level 3), which are required to prove a plateau or constant limit after availability reaches a certain level.

4. Adaptation hypothesis: This is the only hypothesis that has assumptions about a development over time, so that we could allocate only longitudinal outcomes to this hypothesis. We allocated study outcomes to this hypothesis if they resulted from statistical tests with non-linear models (e.g., non-linear regression) or at least three levels of availability (testing Level 1 vs. Level 2 and Level 2 vs. Level 3), which are required to prove a plateau or constant limit of GD or problem gambling with increasing availability over time.

In the first allocation steps, we checked the design and the outcomes regarding the assumptions of each hypothesis (Figure 2). If the design was cross-sectional, the study outcomes could not be allocated to the adaptation hypothesis with its longitudinal assumptions. The *initial allocation* for such a study could be independence,

Figure 2
Allocation of Study Outcomes to the Four Hypotheses (Independence, Access, Adaptation, Satiation).



Note. GD = gambling disorder; EGMs = electronic gaming machines; sign. = significant; n.s. = not significant; ANOVA = analysis of variance.

access, or satiation hypotheses. In a longitudinal study with only two measurement points, the initial allocation could only be the independence and access hypothesis because a plateau assumed in the adaptation hypothesis could not be tested. In a longitudinal study with only three or more measurement points, the initial allocation could be independence, access, or adaptation hypotheses. The *final allocation* was then based on the statistical methods used in the study. For example, a study with a longitudinal design and two assessment points (example Study C in Figure 2) had two outcomes: general gambling prevalence rates and South Oaks Gambling Screen (SOGS) scores. The SOGS scores changed significantly, but the gambling prevalence rates did not. A test for independence was not performed. Consequently, we allocated the significant change in SOGS scores to "support access hypothesis" and the non-significant change in gambling prevalence to "reject access hypothesis".

Third Step: Consistency Outcome Weighting

The assumptions of the hypotheses were exclusive so that one outcome could only be allocated to one hypothesis. After the allocation of study outcomes to the hypotheses, we analysed whether the outcomes supported or rejected one hypothesis (see Figure 2).

If all outcomes of one study supported one hypothesis, the proportion would be 1 (or 100%); if two of three outcomes of a study supported one hypothesis and one outcome rejected the hypothesis, the proportion would be 2/3 support and 1/3 reject, respectively.

Fourth Step: Quality Weighting of Evidence

Because of the study heterogeneity, we could not perform a meta-analysis. However, to provide a more objective measure of evidence for one hypothesis, including the quality of the studies, we developed a quality weighting of evidence. We regard this procedure as an innovative aspect of our review. For further use or replication purposes, we provide an example calculation in Supplement E and the exact calculation for each hypothesis in Supplement F. The quality weighting integrated the quality of the study that an outcome belongs to (= QRS) and the strength of evidence (= consistency outcome weightings) for or against the hypothesis to which the outcome had previously been allocated (independence, access, adaptation, satiation).

For each study, we multiplied the consistency outcome weighting of the study supporting (e.g., 2/3) and rejecting one hypothesis (e.g., 1/3) with the QRS of the study (e.g., 7), which results in quality weighted evidence supporting (e.g., $2/3 \times 7 = 4.7$) and rejecting one hypothesis (e.g., $1/3 \times 7 = 2.3$). For each hypothesis (independence, access, adaptation, satiation), the quality weighted evidence from all studies was totalled, which results in separate sum scores of evidence for and against the hypothesis.

Finally, we multiplied the sum score by the number of studies that (partially) supported or (partially) rejected a given hypothesis in order to (a) give more weight to outcomes that were supported by several different studies and research groups (higher evidence level) versus outcomes supported by few research groups (lower evidence level) and (b) to take into account that some outcomes from different publications were based on the same sample and therefore counted as one study (for a detailed sample calculation, see Supplement E). If two or more studies were based on the same sample, we counted them as one single study. This was the case for the studies by Barnes et al. (2017), Lund (2009), and Welte, Barnes, et al. (2016; Survey of Gambling in the U.S. [SOGUS1] sample); the studies by Barnes et al. (2017) and Young et al. (2012; SOGUS2 sample); and the studies by Welte et al. (2004, 2009; Canadian Community Health Survey sample). The quality weighting of evidence for each hypothesis was calculated over all study results. To explore whether evidence differed between operationalizations of availability, we further calculated separate quality weightings for different operationalizations of availability (e.g., for proximity to the next gambling opportunity or for the opening of a new casino).

Results

Study Sample

Twenty-seven studies met the eligibility criteria (Table 1; for study exclusions, see Supplement B). We decided to also include a meta-analysis as an original study because

Table 1

Study Characteristics and Quality Rating Scores (QRS) for Included Records (N = 26)

Study number	Author (year)	Study design (study years)	Country and sample description	Operationalization of gambling availability or study method	Outcome (gambling disorder and gambling behaviour)	QRS
1	Jacques & Ladouceur (2006)	Longitudinal, multivariate (1996–2001)	Canada Random sample From Hull (experimental group): n = 810 (pretest), n = 457 (post-test), n = 344 (2 years after), n = 203 (4 years after) From Quebec City (comparison group): n = 798 (pretest), n = 421 (post-test), n = 338 (2 years after), n = 227 (4 years after)	Opening of a new casino: Before opening of the Hull Casino (pretest) 1 year after (post-test) 2 years after (follow-up) 4 years after (follow-up)	Non-gambling Recreational gamblers At-risk gamblers Probable pathological gamblers Number of SOGS criteria Gambling participation Maximum amount of money lost in 1 day of gambling	14
2	Abbott (2017)	Repeated cross-sectional, multivariate (1985–2012)	New Zealand Selected data from (a) National Gambling Study (2012): N = 6,252, all adults with a private dwelling; (b) National Prevalence Surveys (1990): N = 4,053, National Prevalence Surveys (1999): N = 6,452, random samples; and (c) Department of Internal Affairs Surveys (1985, 1990, 1995, 2000, 2005): N = 1,200–1,672, random samples	Historical overview (increasing gambling availability through, e.g., the introduction of instant lotteries, a national lottery, and EGMs during the late 1980s)	Problem gambling Gambling disorder Gambling participation	12

Table 1 Continued.

Study number	Author (year)	Study design (study years)	Country and sample description	Operationalization of gambling availability or study method	Outcome (gambling disorder and gambling behaviour)	QRS
3	Room et al. (1999)	Repeated cross-sectional, bivariate (1995–1997)	Canada n = 1,002 adults from the Niagara region (1996, before the opening of the casino), n = 662 of the respondents from the Niagara region (1997, after the opening of the casino), new probability sample of n = 608 adults resident in the city of Niagara Falls (1997), province-wide probability sample of n = 1,030 adults (1995), new province-wide probability survey of n = 1,005 adults (Random-digit dialling, telephone interviews, 1997)	Opening of a new casino: Pre- and post-test Niagara Falls (experimental group: 1996, 1997) Ontario (control group: 1995, 1997)	Problem gambling, gambling-related problems Gambling participation Gambling expenditure	11
4	Storer et al. (2009)	Meta-analysis, multivariate (1991–2007)	Studies from New Zealand and Australia (N = 34)		Problem gambling	11
5	Govoni et al. (1998)	Repeated cross-sectional, bivariate (1993–1995)	Canada Random sample from Windsor (Ontario), adults, n = 2,682 (pretest), n = 2,581 (post-test)	Opening of a new casino: Pretest (1993/1994) Post-test (1995)	Problem gambling Gambling disorder Gambling expenditure Non-gambling Non-problem gambling	10
6	Rossow et al. (2013)	Repeated cross-sectional, multivariate (2006, 2008)	Norway n = 4,912 in 2006 and n = 3,855 in 2008 Students aged 13 to 18 years	Two school surveys: Before the ban and removal of slot machines in Norway (2006) After the intervention (2008)	At-risk gambling/problem gambling Changes in gambling behaviour Gambling participation Frequent gambling	11

Table 1 Continued.

Study number	Author (year)	Study design (study years)	Country and sample description	Operationalization of gambling availability or study method	Outcome (gambling disorder and gambling behaviour)	QRS
7	Welte, Tidwell, et al. (2016)	Repeated cross-sectional, multivariate (1999–2000, 2011–2013)	USA Two random samples: n = 2,631 and n = 2,963 Adults from all states of the USA and the District of Colombia	Number of legal gambling types Legality of casinos and lottery Changes in number of legal types Gambling exposure (sum of the number of years that all types of gambling were legal)	Problem gambling Frequent gambling Any gambling	11
8	Barnes et al. (2017)	Cross-sectional, multivariate (2011–2013)	USA N = 3,474 General population survey	Geocoding Density of casinos within 30 miles (48.2 km)	Problem gambling/gambling disorder Any gambling Frequent gambling	10
9	Sévigny et al. (2008)	Cross-sectional, bivariate (2002)	Canada Study 1: random sample from the region of Quebec: n = 18,842, adults Study 2: participants living within a driving distance of 100 km from the Montreal casino: n = 25,158	Distance	Problem gambling Gambling disorder Gambling participation Gambling expenditure	9
10	Ministry of Health (2008)	Cross-sectional, multivariate (2002–2003)	New Zealand N = 12.529 respondents aged 15 years and over from the 2002/03 New Zealand Health Survey	Geocoding Distance Number of gambling venues within a straight-line distance of 800 m and 5 km	Problem gambling/gambling disorder Gambling participation	9

Table 1 Continued.

Study number	Author (year)	Study design (study years)	Country and sample description	Operationalization of gambling availability or study method	Outcome (gambling disorder and gambling behaviour)	QRS
11	Welte, Barnes, et al. (2016)	Repeated cross-sectional, multivariate (2011–2013)	USA *N* = 2,963 Random landline sample and cell phone sample Adults from all states of the USA and the District of Colombia	Geocoding Distance Casinos within 30 miles (48.2 km)	Problem gambling Frequent gambling Any gambling	10
12	Welte et al. (2006)	Cross-sectional, multivariate (1999–2000)	USA *N* = 2,631 Random sample of US residents	Lottery outlets, bingo outlets, and video outlets in a 1-mile (1.6-km) radius Minutes to lottery, minutes to bingo Casinos within 16 km geocoded Bingo outlets, 1.6-km radius	Problem gambling Any gambling Frequent gambling	10
13	Young et al. (2012)	Cross-sectional, multivariate (2010)	Australia *N* = 7,044 households Geocoded mail survey of households in the Northern Territory of Australia	Geocoding Distance	Non-problem gambling Low risk Moderate risk High risk Gambling participation	10
14	Lund (2009)	Panel study, bivariate (2007)	Norway *N* = 1,293 Participants aged 18–90 years randomly drawn from the market research agency Synovate	Before the ban and removal of slot machines in Norway (May 2007) After the intervention (November 2007)	Problem gambling Betting Risk gambling Gambling participation	8
15	Welte et al. (2004)	Cross-sectional, multivariate (1999–2000)	USA *N* = 2,631 Random sample, US adults	Casinos within 10 miles (16.1 km) Number of types of legal gambling Distance	Problem gambling/gambling disorder Any gambling Frequent gambling	9

Table 1 Continued.

Study number	Author (year)	Study design (study years)	Country and sample description	Operationalization of gambling availability or study method	Outcome (gambling disorder and gambling behaviour)	QRS
16	Cox et al. (2005)	Cross-sectional, bivariate (2002)	Canada *N* = 34,770 Random sample aged 15 years and older	Availability of VLTs per 1,000 population Presence of permanent casinos	Gambling problems (moderate and severe problem gambling)	7
17	Adams et al. (2007)	Cross-sectional, multivariate (2001–2002)	Canada *N* = 1,579 College students from Ontario	Half of the students enrolled in universities near a casino and the other half far from a major casino Groups were compared	No problems Mild problems Moderate problems Gambling disorder Gambling participation	7
18	Ladouceur et al. (1999)	Repeated cross-sectional, bivariate (1989, 1996)	Canada Two random samples, adults from Quebec: *n* = 1,002 and *n* = 1,257	Historical overview (increasing availability through, e.g., more racetracks and VLTs in 1996 compared with 1989) Samples surveyed 7 years apart (1989, 1996)	Gambling disorder Problem gambling Maximum amount lost in 1 day to gambling	6
19	Pearce et al. (2008)	Cross-sectional, multivariate (2002–2003)	New Zealand *N* = 12,529 Adults aged 15 years and over	Geocoding Distance Density of gambling venues within 5 km	Problem gambling Being a gambler	7
20	Volberg (1994)	Cross-sectional, bivariate (1988–1990)	USA *N* = 4,442 Sample of adults from Massachusetts, Maryland, New Jersey, California, and Iowa	Historical overview Comparison between states with a different history of gambling legality	Gambling disorder Gambling participation Any gambling Per capita lottery sales	6

Table 1 Continued.

Study number	Author (year)	Study design (study years)	Country and sample description	Operationalization of gambling availability or study method	Outcome (gambling disorder and gambling behaviour)	QRS
21	Welte et al. (2009)	Cross-sectional, multivariate (2005–2007)	USA *N* = 2,274 National telephone survey Telephone sample randomly selected Respondents aged 14–21 years	Number of commercial gambling types operating in state	Problem gambling Gambling participation	7
22	Kato & Goto (2018)	Cross-sectional, multivariate (2014)	Japan *N* = 6,524 Online survey People aged 20–69 years	Geographical information system data of all pachinko parlours in Japan Number of pachinko parlours within a 1.5-km radius from home	Pathological gambling	7
23	Rush et al. (2007)	Cross-sectional, multivariate (2002)	Canada *N* = 36,984 Sample aged 15 years and older	Distance	Problem gambling	6
24	Wilson et al. (2006)	Cross-sectional, bivariate (2002)	Canada *N* = 1,206 High school students	VLT access (high and low)	Gambling participation	5
25	Black et al. (2012)	Cross-sectional, bivariate (2006–2008)	USA *N* = 356 Random sample of adults from eastern Iowa	Historical overview (increasing availability through, e.g., increasing the number of casinos) Data from 1989, 1995, and 2012 compared	Problem gambling Gambling participation Largest amount ever wagered	4

Table 1 Continued.

Study number	Author (year)	Study design (study years)	Country and sample description	Operationalization of gambling availability or study method	Outcome (gambling disorder and gambling behaviour)	QRS
26	Marshall (2005)	Cross-sectional, bivariate (2000–2001)	Australia *N* = 1,018 Residents in a number of selected residential centres of Richmond Tweed; recruited door to door	EGMs per capita	Gambling participation Gambling duration Gambling frequency Gambling expenditures	3
27	LaBrie et al. (2003)	Cross-sectional, multivariate (2001)	USA *N* = 10,765 Sample of college students	Having two or more gambling venues in the state they live in	Gambling participation	4

Note. SOGS = South Oaks Gambling Screen; EGMs = electronic gaming machine; VLT = video lottery terminal.

the authors did not perform a pooled analysis of published results, but a pooled analysis of raw data (mega-analyses), which does not contain the data of any of the other studies included in our review. The study years ranged widely from 1985 to 2013. Except for three studies (Black et al., 2012; Jacques & Ladouceur, 2006; Wilson et al., 2006), all studies examined large samples of 1,000 or more participants. Except for six studies (LaBrie et al., 2003; Lund, 2009; Marshall, 2005; Ministry of Health, 2008; Pearce et al., 2008; Wilson et al., 2006), all studies used established gambling screens such as the SOGS, the Diagnostic Interview Schedule, the Canadian Problem Gambling Index (or its nine-item subset), or the Problem Gambling Severity Index. Some studies operationalized availability through a historical explanation based on the changing gambling market and substantiated increasing availability, for example, with the introduction of electronic gambling machines or number of years a gambling opportunity was legal.

QRS and Quality Weighting of Evidence

Table 1 shows the QRS (for detailed quality ratings of included records, see Supplement D). One record reached a quality score of 14, but no record reached the maximum score of 15. The quartile of quality scores ranged between 6 and 10.

Study outcomes could be allocated only to the access and the adaptation hypotheses. No study explicitly tested the independence or satiation hypotheses or used the necessary statistical tests, and no study had outcomes that could have been allocated to these hypotheses. Accordingly, the quality weightings were calculated for the access and adaptation hypotheses only (see Tables 2 and 3). In the following sections, we present the synthesis of results according to the QRS and separately for gambling behaviour and GD (for the detailed calculation of the quality weighting, see supplement F). Because only four studies had outcomes that could be allocated to the adaptation hypothesis, we are not able to present separate analyses for the different operationalizations of availability in Table 3.

Results for the Access Hypothesis: Gambling Disorder and Problem Gambling

The calculation of the overall quality weighting resulted in support of the access hypothesis for the relationship between availability and GD and problem gambling; that is, 66% of the quality weighted scores supported the hypothesis and 34% did not support the hypothesis. Following the access hypothesis, these results show that GD and problem gambling prevalence are proportional to gambling availability.

The quality-weighted evidence supporting the hypothesis for different outcome operationalizations of availability varied widely between 50% and 93% for the different operationalizations. For the relationship between distance/proximity and density/number of gambling opportunities and GD/problem gambling, the access hypothesis was supported. For example, participants who lived close to a gambling opportunity were more likely to be problem gamblers and manifested more serious gambling problems (Adams et al., 2007; Ministry of Health, 2008; Pearce et al., 2008; Rush et al., 2007; Welte, Barnes, et al., 2016). Other results showed no significant relationships to the

Table 2
Quality Weightings of Evidence Supporting or Rejecting the Access Hypothesis (a Positive Linear Relationship Between Gambling Availability and Gambling Behaviour or Gambling Disorder) Across All Study Outcomes and Separately for the Different Operationalizations of Availability

Quality weighting category	Support of the access hypothesis	Rejection of the access hypothesis
1. Gambling disorder/problem gambling		
Overall quality weighted evidence	1,609	822
Total quality weighting scores	66%	34%
Quality weighted evidence separately for different operationalizations of availability		
Distance	258	102
Total quality weighting scores	72%	28%
Density and number of gambling opportunities	428	207
Total quality weighting scores	67%	33%
Exposure, legality, years of legality, and historical overview	57	4
Total quality weighting scores	93%	7%
Opening of a new casino	11	10
Total quality weighting scores	52%	48%
Ban of slot machines	19	
Total quality weighting scores	50%	50%
2. Gambling behaviour		
Overall quality weighting (operationalizations were distance, density, and number of gambling opportunities; exposure, legality, years of legality, and historical overview; opening of a new casino; ban of slot machines)	1,818	432
Total quality weighting scores	81%	19%

proximity to racetracks, a casino in a 30-mile (48.2-km) radius, the density of lottery outlets in a 1-mile (1.6-km) radius, and gambling venues within 5 km (Barnes et al., 2017; Ministry of Health, 2008; Pearce et al., 2008; Welte et al., 2006; Welte, Barnes, et al., 2016).

Concerning exposure, legality of gambling, years of legality, and historical overview, the access hypothesis was supported. For example, the number of years in which gambling was legal was associated with increased prevalence rates of GD or problem gambling (Volberg, 1994; Welte, Tidwell, et al., 2016). The prevalence of problem gambling increased with increasing numbers of legal gambling types and years they had been legal (Welte, Tidwell, et al., 2016), but when some variables were controlled for (e.g., legality of casinos, legal lottery), the results for some operationalizations of availability became non-significant.

Two studies that analysed the impact of the opening of a new casino found only partial evidence for a relationship with GD indicators. Two studies that examined the ban of slot machines showed conflicting results: Perceived gambling problems

Table 3
Quality Weighting of Evidence Supporting or Rejecting the Adaptation Hypothesis (After an Increase of Gambling Availability, the Prevalence of Gambling Behaviour or Gambling Disorder Initially Increases but Decreases Over Time Because of Adaptation Processes)

Quality weighting category	Support of the adaptation hypothesis	Rejection of the adaptation hypothesis
1. Gambling disorder/problem gambling		
Overall quality weighting of evidence for the relationship with gambling availability (operationalizations were the opening of a new casino, density, and historical overviews)	164	0
Total quality weighting scores	100%	0%
2. Gambling behaviour		
Overall quality weighting of evidence for the relationship with gambling availability (operationalizations were the opening of a new casino and historical overviews; gambling participation and maximum amount of money lost in 1 day of gambling were measured)	90	0
Total quality weighting scores	100%	0%

and weekly gambling on sports bets, lotteries, etc., were reported less frequently among problem and at-risk gamblers after the ban. However, weekly gambling on other games increased (Rossow et al., 2013).

Results for the Adaptation Hypothesis: Gambling Disorder and Problem Gambling

The calculation of the overall quality weighting resulted in support of the adaptation hypothesis for the relationship between availability and GD and problem gambling; that is, 100% of the quality weighted scores supported the hypothesis. With increasing availability over time, GD and problem gambling prevalence first linearly increase and then remain stable or decrease over time. For example, one study found that the rate of problem gamblers reached a plateau despite increased availability (Abbott, 2017) and another found decreased problem gambling prevalence rates after a period of stable availability (Storer et al., 2009). Even in a region where a new casino was opened, the rates of GD did not increase after 2 years and 4 years (Jacques & Ladouceur, 2006). Nevertheless, in the 4-year follow-up, participants in the experimental group indicated significantly more often than the control group that they knew someone who might be a problem gambler (Jacques & Ladouceur, 2006).

Results for the Access Hypothesis: Gambling Behaviour

The calculation of the overall quality weighting resulted in support of the access hypothesis for gambling behaviour; that is, of the quality weighted scores, 82%

supported the hypothesis and 18% did not support the hypothesis. Significant positive relationships were found between the proximity of gambling opportunities and gambling participation, gambling expenditures, the probability of being a gambler, and more gambling on slot machines and casino tables (Adams et al., 2007; Ministry of Health, 2008; Pearce et al., 2008; Sévigny et al., 2008). Concerning density, for example, one study showed a significant positive relationship between the presence of a gambling opportunity within a 30-mile (48.2-km) radius and frequent gambling (Barnes et al., 2017). After the opening of a new casino, gambling participation in the experimental group of a natural experiment increased significantly compared with that in the control group (Room et al., 1999). In regions where casinos and lotteries had been available for a long time, per capita lottery sales were higher than in states where gambling was not available, and states that later introduced legal lotteries had lower gambling participation and a lower number of gambling activities compared with that in other states (Volberg, 1994). As availability increased, the amount of money lost in 1 day through gambling increased significantly and, over time (historical overview), more participants gambled (Ladouceur et al., 1999).

One study found no significant relationship between the number of casinos within a 30-mile (48.2-km) radius and gambling participation, but did so with frequency of gambling (Welte, Barnes, et al., 2016). Another study showed that after the ban of slot machines, weekly slot machine gambling decreased, whereas gambling on other types of gambling increased (Rossow et al., 2013). Participants from states with a higher gambling exposure (combination of the number of legal gambling opportunities and years they had been legal) tended to have higher prevalence rates of frequent gambling, but years of legality and gambling participation were not associated (Welte, Tidwell, et al., 2016).

One study did not find a relationship between a casino within a 10-mile (16.1-km) radius and gambling participation or gambling frequency (Welte et al., 2004). Concerning distance, one of the studies did not find a significant relationship between 15 (of 17) types of gambling and gambling participation (Adams et al., 2007). One study did not find significant results for higher expenditures for gambling after the opening of a casino (Volberg, 1994), and another study found no significant association between gambling for any type of gambling activity in the last year and the number of gambling venues within 800 m or 5 km (Ministry of Health, 2008). Participation in new gambling opportunities increased in the first 2 years after their introduction, but decreased substantially thereafter; in contrast to the access hypothesis, gambling participation decreased despite increasing availability (Abbott, 2017).

Results for the Adaptation Hypothesis: Gambling Behaviour

The calculation of overall quality weighting resulted in support of the adaptation hypothesis concerning the relationship between availability and gambling behaviour; that is, 100% of the quality weighted scores supported the hypothesis. With increasing availability over time, gambling behaviour first linearly increases and then remains stable or decreases over time.

One study supported the adaptation hypothesis by showing that despite the increasing expansion of gambling opportunities over time, gambling participation decreased (Black et al., 2012). Another study showed a similar effect over time: 1 year after the opening of a casino, participants of the experimental group gambled more often, but the frequency decreased after 2 years and 4 years for both groups (Jacques & Ladouceur, 2006). The maximum loss of money per gambling day was higher for both the experimental and the control group, but this trend did not continue after 2 years and 4 years. After 4 years, the amount of gambling even decreased below the amount before the casino opening. Although the experimental group lost less money in 1 day compared with that in the control group, 4 years after the casino opening, they lost significantly more than they did before the opening (Jacques & Ladouceur, 2006).

Discussion

In this systematic review, we aimed to provide an overview of recent empirical evidence on the relationships between indicators of physical gambling availability and indicators of gambling behaviour, with a focus on problematic and disordered gambling. An innovative aspect of our review is that we used comprehensive quality weightings of evidence for one or more association hypotheses (independence, access, satiation, adaptation). The quality-weighted results supported both the access hypothesis (i.e., a positive linear association between gambling availability and gambling behaviour or GD) and the adaptation hypothesis (i.e., after an increase of gambling availability, the prevalence of gambling behaviour or GD initially increases but decreases or stabilizes over time because of adaptation processes). The other two hypotheses (independence, satiation) were not addressed in any study. Before coming to general conclusions, we would like to address some methodological reservations we have regarding the study situation to date.

Methodological Problems of Reviewed Studies

First, many of the included records did not explicitly examine any of the four (or other) hypotheses, thereby building on an incomplete theoretical framework. In addition, the assumptions of the hypotheses were not always formulated precisely enough and they varied between studies. For example, the definition of the adaptation hypothesis varied in that some studies defined it as a decrease in prevalence of GD over time with constant availability and others as a decrease in the prevalence of GD with increasing availability. Because of the limited number of longitudinal studies, all studies were combined in one quality weighting score, although their practical implications are different.

Second, operationalizations of changes in availability and the corresponding empirical evidence differed greatly. For instance, many studies simply assumed high availability because of the introduction of new gambling opportunities (historical overview) and found the highest quality weighted evidence for the access hypothesis

in comparison with, for example, geocoded distance, which is a more objective measure of availability. In addition, dichotomized operationalizations were also a problem, for example, studies that compared sites with low and high availability (without measuring continuous data). With such operationalizations, it is not possible to assess linear (or non-linear) relationships between availability and gambling participation or GD.

Third, a more objective operationalization of availability is geocoding, which measures the exact distance from a person's home to the nearest gambling venue. However, these studies did not examine whether the geocoded venue was also the most visited venue.

Fourth, studies often did not measure how long gambling opportunities had been available. For instance, if a study had measured the prevalence of GD shortly after the opening of a new casino, the novelty effect could lead to a high prevalence of gambling behaviour or GD; consequently, the access hypothesis would have been supported. If the measurement had been carried out later, adaptation could have contributed to reduced prevalence and consequently, the access hypothesis would have been rejected.

Fifth, because of the lack of longitudinal designs in almost all studies (only two studies with a longitudinal design were found), the causal or at least temporal relationship between availability and gambling behaviour or GD remains unclear. Although we included repeated and simple cross-sectional studies because they made statements about the adaptation hypothesis, their temporal assumptions cannot be tested with such study designs. For instance, it is possible that individuals with gambling problems tend to move to regions with more gambling venues, or that casinos tend to open in regions where the population already has higher prevalence rates of GD (Yoo et al., 2004, as cited in Sun et al., 2013). A third factor (e.g., demographic variables) could also affect both availability and GD.

Sixth, not every study that examined the ban of a particular gambling type also examined the effects on other types of gambling. However, this is necessary because the prohibition of one type of gambling could lead to a shift of gambling participation towards other types of gambling.

Strengths and Limitations of the Review

The strength of this systematic review is its theory-based approach and its comprehensive quality rating and weighting. The innovative calculation of the quality weighting of evidence allows a quantitative and thus more objective statement on how strongly the four hypotheses were supported by the study outcomes. In addition, we examined in detail whether different operationalizations of availability affected the evidence for the four hypotheses.

We included studies on increased and decreased availability because the four hypotheses indirectly assume that the relationship to gambling behaviour or GD is a

continuous function. However, this could be oversimplified, as it ignores interaction effects. For example, although supply reduction is used as a prevention measure in contexts with high gambling availability (risk condition), the opening of a new venue takes place in other contexts with other moderating factors (novelty condition).

Our review included some evidence from the grey literature on the relationship between the availability of gambling and the prevalence of gambling behaviour or GD. This evidence pointed in the same direction as the evidence from peer-reviewed journal articles. However, we did not explicitly and systematically search for grey literature on this topic. This could lead to a higher proportion of studies that do not provide evidence for the hypothesized relationships (e.g., because of publication biases). Moreover, two grey literature studies could not be considered for this review because they were unavailable online or on request from the first authors. There is a need for open data in the research field of gambling availability and GD in order to facilitate the accumulation of evidence.

Furthermore, the conclusions of a review are also limited regarding the limitations of the studies included. No study had outcomes that could be allocated to the independence or satiation hypotheses. Only a few study authors had examined common control variables for an adequate interpretation; in the present review, we therefore examined no control, mediator, or moderator variables. We partly accounted for this by giving higher quality ratings to studies with multivariate analyses. A meta-analysis was not possible due to the methodological heterogeneity of the included studies. To nevertheless obtain an overview of the statistical results of the studies, we classified the study results in support or rejection of a hypothesis. However, it is important to note that significant outcomes may be due to chance, and non-significant outcomes do not mean that there is no relationship. Moreover, the overall quality weighting of evidence should be interpreted with caution because (a) different instruments and indicators were used for all relevant dependent and independent variables such as prevalence rates of gambling behaviour, problem gambling, and GD; and (b) the methodological quality (QRS) varied widely.

Finally, our findings may be specific to a particular historical period when the availability of several specific forms of gambling increased rapidly. In North America and Australia, for example, there was a rapid increase in EGMs and casinos in the late 1990s and early 2000s (Williams, Volberg, & Stevens, 2012). The study years of the included studies ranged from 1985 to 2013, with 17 studies exclusively or partially occurring in the late 1990s and early 2000s and 11 studies occurring in earlier and later periods. Therefore, we are confident that our results are not strongly biased by the time period and the rapidly increasing gambling opportunities.

General Conclusions and Research Needs

We found moderate to strong evidence supporting the access hypothesis and the adaptation hypothesis. Concerning the access hypothesis, the evidence for the

assumed positive linear association with gambling availability is stronger for gambling behaviour than for GD: 66% and 81% of the quality weighted scores support this hypothesis for gambling behaviour and GD, respectively. However, some study outcomes showed weak or even contradictory associations. Concerning the adaptation hypothesis, only a few study outcomes could be allocated to this hypothesis, but they all support it. As a basis for implementing efficient regulatory measures to prevent problem gambling and GD, our results show that the empirical evidence for quantitative regulations is currently insufficient. The methodological issues described earlier make it clear that more high-quality longitudinal research is needed that directly addresses the four hypotheses with the corresponding statistical analyses. Future studies should distinguish between different types of gambling for two reasons. First, different association hypotheses could apply to different gambling types to which different potencies are attributed (Shaffer et al., 2004). For example, one study in our review found evidence for the access hypothesis only for the distance of casinos, but not for other gambling types (Cox et al., 2005). Second, the prohibition of one type of gambling could lead to a shift in gambling participation towards other types of gambling, which has to be considered. Concerning the assessment of gambling availability, future studies should apply geocoding and check whether the nearest gambling venues are also those used by the individuals studied. There is also a need for research on the influence of gambling availability over time, distinguishing between subpopulations with different vulnerabilities for the development of GD. For example, Welte et al. (2007) found that residential proximity to casinos specifically predicted gambling problems for men who were over 30 years of age. The question remains open as to whether the different availability hypotheses apply differently to non-risk and high-risk populations. One assumption could be that the independence hypothesis applies to high-risk populations, as they also overcome longer distances and other obstacles in order to gamble (Becker, 2015). This assumption is consistent with recent longitudinal evidence in several jurisdictions of decreasing gambling participation over time, but a plateauing of problem and at-risk gambling (Abbott et al., 2016); the authors who reported this concluded that the availability models are too simplistic. It is important to highlight that the development of GD involves a multifaceted interplay of risk factors in which availability is only one piece of the puzzle (Kräplin & Goudriaan, 2018). Several GD models assume that distal vulnerability factors (e.g., genes, temperament, early childhood experiences) increase an individual's risk of developing GD and that more proximal risk factors that occur later in life, such as societal factors (e.g., gambling availability), psychosocial factors (family, peers), or game characteristics (e.g., high event frequencies), add to this vulnerability and result in GD onset (for an overview, see Kräplin & Goudriaan, 2018). In summary, prevention programs must include not only the regulation of gambling availability, which applies to all gamblers (low risk and high risk), but also the early detection and support of vulnerable individuals (Bühringer et al., 2018).

References

Abbott, M. W. (2017). Gambling and gambling harm in New Zealand: A 28-year case study. *International Journal of Mental Health and Addiction*, *15*(6), 1221–1241. https://doi.org/10.1007/s11469-017-9767-6

Abbott, M. W. (2020). The changing epidemiology of gambling disorder and gambling-related harm: Public health implications. *Public Health*, *184*, 41–45. https://doi.org/10.1016/j.puhe.2020.04.003

Abbott, M., Stone, C. A., Billi, R., & Yeung, K. (2016). Gambling and problem gambling in Victoria, Australia: Changes over 5 years. *Journal of Gambling Studies*, *32*(1), 47–78. https://doi.org/10.1007/s10899-015-9542-1

Adams, G. R., Sullivan, A. M., Horton, K. D., Menna, R., & Guilmette, A. M. (2007). A study of differences in Canadian university students' gambling and proximity to a casino. *Journal of Gambling Issues*, *19*, 9–18. http://dx.doi.org/10.4309/jgi.2007.19.1

Barnes, G. M., Welte, J. W., & Tidwell, M. C. O. (2017). Gambling involvement among Native Americans, Blacks, and Whites in the United States. *The American Journal on Addictions*, *26*(7), 713–721. https://doi.org/10.1111/ajad.12601

Becker, T. (2015). *Verfügbarkeit und Sucht beim Automatenspiel* [Availability and addiction to slot machine gambling]. https://glueckspiel.uni-hohenheim.de/fileadmin/einrichtungen/glueckspiel/Sucht/VerfuegbarkeitAutomatenspiel.pdf

Black, D. W., McCormick, B., Losch, M. E., Shaw, M., Lutz, G., & Allen, J. (2012). Prevalence of problem gambling in Iowa: Revisiting Shaffer's adaptation hypothesis. *Annals of Clinical Psychiatry*, *24*(4), 279–284.

Blaszczynski, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction*, *97*(5), 487–499. https://doi.org/10.1046/j.1360-0443.2002.00015.x

Bühringer, G., Kotter, R., Czernecka, R., & Kräplin, A. (2018). Beyond Reno II: Who cares for vulnerable gamblers? *Sucht*, *64*(5–6), 325–334. https://doi.org/10.1024/0939-5911/a000566

Cox, B. J., Yu, N., Afifi, T. O., & Ladouceur, R. (2005). A national survey of gambling problems in Canada. *The Canadian Journal of Psychiatry*, *50*(4), 213–217. https://doi.org/10.1177/070674370505000404

Downs, S. H., & Black, N. (1998). The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised

studies of health care interventions. *Journal of Epidemiology and Community Health*, *52*(6), 377–384. http://dx.doi.org/10.1136/jech.52.6.377

Currie, S. R., Hodgins, D. C., Casey, D. M., el-Guebaly, N., Smith, G. J., Williams, R. J., & Schopflocher, D. P. (2017). Deriving low-risk gambling limits from longitudinal data collected in two independent Canadian studies. *Addiction, 112*(11), 2011-2020. https://doi.org/10.1111/add.13909

Gillespie, N. A., Neale, M. C., & Kendler, K. S. (2009). Pathways to cannabis abuse: A multi-stage model from cannabis availability, cannabis initiation and progression to abuse. *Addiction*, *104*(3), 430–438. https://doi.org/10.1111/j.1360-0443.2008.02456.x

Govoni, R., Frisch, G. R., Ruprich, N., & Getty, H. (1998). First year impacts of casino gambling in a community. *Journal of Gambling Studies*, *14*(4), 347–358. https://doi.org/10.1023/A:1023021009398

Gray, H. M., LaPlante, D. A., & Shaffer, H. J. (2012). Behavioral characteristics of Internet gamblers who trigger corporate responsible gambling interventions. *Psychology of Addictive Behaviors, 26*(3), 527–535. https://doi.org/10.1037/a0028545

Hesselbarth, U. (2009). *Pathologisches Glücksspiel: Vorkommen und psychosoziale Einflussfaktoren* [Pathological gambling: Incidence and psychosocial determinants]. https://docplayer.org/11030584-Dissertation-pathologisches-gluecksspiel-vorkommen-und-psychosoziale-einflussfaktoren.html

Hing, N., & Nisbet, S. (2010). A qualitative perspective on physical, social and cognitive accessibility to gambling. *Journal of Gambling Issues*, *24*, 101–120. http://dx.doi.org/10.4309/jgi.2010.24.7

Jacques, C., & Ladouceur, R. (2006). A prospective study of the impact of opening a casino on gambling behaviours: 2- and 4-year follow-ups. *Canadian Journal of Psychiatry*, *51*(12), 764–773. https://doi.org/10.1177/070674370605101206

Johansson, A., Grant, J. E., Kim, S. W., Odlaug, B. L., & Götestam, K. G. (2009). Risk factors for problematic gambling: A critical literature review. *Journal of Gambling Studies*, *25*, 67–92. https://doi.org/10.1007/s10899-008-9088-6

Kato, H., & Goto, R. (2018). Geographical accessibility to gambling venues and pathological gambling: An econometric analysis of pachinko parlours in Japan. *International Gambling Studies*, *18*(1), 111–123. https://doi.org/10.1080/14459795.2017.1383503

Kotter, R., Kräplin, A., Pittig, A., & Bühringer, G. (2019). A systematic review of land-based self-exclusion programs: Demographics, gambling behavior, gambling

problems, mental symptoms, and mental health. *Journal of Gambling Studies*, *35*(2), 367–394. https://doi.org/10.1007/s10899-018-9777-8

Kräplin, A., & Goudriaan, A. E. (2018). Characteristics and risk factors of gambling disorder as basis for responsible gambling strategies. *Sucht*, *64*(5–6), 247–256. https://doi.org/10.1024/0939-5911/a000559

LaBrie, R. A., Shaffer, H. J., LaPlante, D. A., & Wechsler, H. (2003). Correlates of college student gambling in the United States. *Journal of American College Health*, *52*(2), 53–62. https://doi.org/10.1080/07448480309595725

Ladouceur, R., Jacques, C., Ferland, F., & Giroux, I. (1999). Prevalence of problem gambling: A replication study 7 years later. *The Canadian Journal of Psychiatry*, *44*(8), 802–804. https://doi.org/10.1177/070674379904400807

LaPlante, D. A., Gray, H. M., Williams, P. M., & Nelson, S. E. (2018). An empirical review of gambling expansion and gambling-related harm. *Sucht*, *64*(5–6), 295–306. https://doi.org/10.1024/0939-5911/a000563

LaPlante, D. A., & Shaffer, H. J. (2007). Understanding the influence of gambling opportunities: Expanding exposure models to include adaptation. *American Journal of Orthopsychiatry*, *77*(4), 616–623. https://doi.org/10.1037/0002-9432.77.4.616

Livingstone, C., & Adams, P. J. (2016). Clear principles are needed for integrity in gambling research. *Addiction*, *111*(1), 5– 10. https://doi.org/10.1111/add.12913

Lund, I. (2009). Gambling behaviour and the prevalence of gambling problems in adult EGM gamblers when EGMs are banned: A natural experiment. *Journal of Gambling Studies*, *25*(2), 215–225. https://doi.org/10.1007/s10899-009-9127-y

Marshall, D. (2005). The gambling environment and gambler behaviour: Evidence from Richmond-Tweed, Australia. *International Gambling Studies*, *5*(1), 63–83. https://doi.org/10.1080/14459790500099471

Meyer, G., Kalke, J., & Hayer, T. (2018). The impact of supply reduction on the prevalence of gambling participation and disordered gambling behavior: A systematic review. *Sucht*, *64*(5–6), 283–293. https://doi.org/10.1024/0939-5911/a000562

Ministry of Health. (2008). *Raising the odds? Gambling behaviour and neighbourhood access to gambling venues in New Zealand* (Public Health Intelligence Occasional Bulletin No. 47). https://www.health.govt.nz/publication/raising-odds-gambling-behaviour-and-neighbourhood-access-gambling-venues-new-zealand

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Open Med*, *3*(3), e123–130.

Pearce, J., Mason, K., Hiscock, R., & Day, P. (2008). A national study of neighbourhood access to gambling opportunities and individual gambling behaviour. *Journal of Epidemiology & Community Health*, *62*(10), 862–868. http://dx.doi.org/10.1136/jech.2007.068114

Room, R., Turner, N. E., & Ialomiteanu, A. (1999). Community effects of the opening of the Niagara casino. *Addiction*, *94*(10), 1449–1466. https://doi.org/10.1046/j.1360-0443.1999.941014492.x

Rossow, I., Bang Hansen, M., & Esbjerg Storvoll, E. (2013). Changes in youth gambling after the removal of slot machines in Norway. *Nordic Studies on Alcohol and Drugs*, *30*(4), 317–330. https://doi.org/10.2478/nsad-2013-0024

Rush, B., Veldhuizen, S., & Adlaf, E. (2007). Mapping the prevalence of problem gambling and its association with treatment accessibility and proximity to gambling venues. *Journal of Gambling Issues*, *20*, 193–213. http://dx.doi.org/10.4309/jgi.2007.20.6

Scottish Intercollegiate Guidelines Network. (2012). Critical appraisal: Notes and checklists. https://www.sign.ac.uk/media/1712/checklist_for_cohort_studies.rtf

Sévigny, S., Ladouceur, R., Jacques, C., & Cantinotti, M. (2008). Links between casino proximity and gambling participation, expenditure, and pathology. *Psychology of Addictive Behaviors*, *22*(2), 295. https://doi.org/10.1037/0893-164X.22.2.295

Shaffer, H. J., LaBrie, R. A., & LaPlante, D. A. (2004). Laying the foundation for quantifying regional exposure to social phenomena: Considering the case of legalized gambling as a public health toxin. *Psychology of Addictive Behaviors*, *18*(1), 40–48. https://doi.org/10.1037/0893-164X.18.1.40

Shamseer, L., Moher, D., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., Stewart, L. A., & PRISMA-P Group. (2015). Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015: Elaboration and explanation. *British Medical Journal*, *349*, g7647. https://doi.org/10.1136/bmj.g7647

Slutske, W. S. (2006). Natural recovery and treatment-seeking in pathological gambling: Results of two U.S. national surveys. *American Journal of Psychiatry*, *163*(2), 297–302. https://doi.org/10.1176/appi.ajp.163.2.297

Storer, J., Abbott, M., & Stubbs, J. (2009). Access or adaptation? A meta-analysis of surveys of problem gambling prevalence in Australia and New Zealand with respect to concentration of electronic gaming machines. *International Gambling Studies*, *9*(3), 225–244. https://doi.org/10.1080/14459790903257981

St-Pierre, R. A., Walker, D. M., Derevensky, J., & Gupta, R. (2014). How availability and accessibility of gambling venues influence problem gambling: A review of the literature. *Gaming Law Review and Economics*, *18*(2), 150–172. https://doi.org/10.1089/glre.2014.1824

Sun, A.-P., Ashley, L., & Dickson, L. (2013). *Behavioral addiction: Screening, assessment, and treatment*. Central Recovery Press.

Vasiliadis, S. D., Jackson, A. C., Christensen, D., & Francis, K. (2013). Physical accessibility of gaming opportunity and its relationship to gaming involvement and problem gambling: A systematic review. *Journal of Gambling Issues*, *28*, 1–46. https://doi.org/10.4309/jgi.2013.28.2

Volberg, R. A. (1994). The prevalence and demographics of pathological gamblers: implications for public health. *American Journal of Public Health*, *84*(2), 237–241. https://doi.org/10.2105/AJPH.84.2.237

Wells, G.A., Shea, B., O'Connell, D., Peterson, J., Welch, V., Losos, M., & Tugwell, P. (2019). *The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses*. Ottawa Healthcare Institute. http://www.ohri.ca/programs/clinical_epidemiology/oxford.htm

Welte, J. W., Barnes, G. M., Tidwell, M. C. O., & Hoffman, J. H. (2009). The association of form of gambling with problem gambling among American youth. *Psychology of Addictive Behaviors*, *23*(1), 105–112. https://doi.org/10.1037/a0013536

Welte, J. W., Barnes, G. M., Tidwell, M. C. O., Hoffman, J. H., & Wieczorek, W. F. (2016). The relationship between distance from gambling venues and gambling participation and problem gambling among US adults. *Journal of Gambling Studies*, *32*(4), 1055–1063. https://doi.org/10.1007/s10899-015-9583-5

Welte, J. W., Barnes, G. M., Wieczorek, W. F., Tidwell, M.-C. O., & Hoffman, J. H. (2007). Type of gambling and availability as risk factors for problem gambling: A Tobit regression analysis by age and gender. *International Gambling Studies*, *7*(2), 183–198. https://doi.org/10.1080/14459790701387543

Welte, J. W., Tidwell, M. C. O., Barnes, G. M., Hoffman, J. H., & Wieczorek, W. F. (2016). The relationship between the number of types of legal gambling and the rates of gambling behaviors and problems across US states. *Journal of Gambling Studies*, *32*(2), 379–390. https://doi.org/10.1007/s10899-015-9551-0

Welte, J. W., Wieczorek, W. F., Barnes, G. M., & Tidwell, M. C. O. (2006). Multiple risk factors for frequent and problem gambling: Individual, social, and ecological. *Journal of Applied Social Psychology*, *36*(6), 1548–1568. https://doi.org/10.1111/j.0021-9029.2006.00071.x

Welte, J. W., Wieczorek, W. F., Barnes, G. M., Tidwell, M. C. O., & Hoffman, J. H. (2004). The relationship of ecological and geographic factors to gambling behavior and pathology. *Journal of Gambling Studies*, *20*(4), 405–423. https://doi.org/10.1007/s10899-004-4582-y

Williams, R. J., Volberg, R. A., & Stevens, R. M. G. (2012). *The population prevalence of problem gambling: Methodological influences, standardized rates, jurisdictional differences, and world-wide trends*. https://www.uleth.ca/dspace/handle/10133/3068

Williams, R. J., West, B. L., & Simpson, R. I. (2012). *Prevention of problem gambling: A comprehensive review of the evidence, and identified best practices*. https://www.uleth.ca/dspace/handle/10133/3121

Wilson, D. H., Gilliland, J., Ross, N. A., Derevensky, J., & Gupta, R. (2006). Video lottery terminal access and gambling among high school students in Montreal. *Canadian Journal of Public Health*, *97*(3), 202–206. https://doi.org/10.1007/BF03405585

Xuan, Z., & Shaffer, H. (2009). How do gamblers end gambling: Longitudinal analysis of Internet gambling behaviors prior to account closure due to gambling related problems. *Journal of Gambling Studies, 25*(2), 239-252. https://doi.org/10.1007/s10899-009-9118-z

Young, M., Markham, F., & Doran, B. (2012). Too close to home?: The relationships between residential distance to venue and gambling outcomes. *International Gambling Studies*, *12*(2), 257–273. https://doi.org/10.1080/14459795.2012.664159

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For correspondence: Anja Dr. Kräplin, Faculty of Psychology, Technische Universität Dresden Work Group Addictive Behaviors, Risk Analysis and Risk Management, Faculty of Psychology, 01062 Dresden, Germany.
E-mail: anja.kraeplin@tu-dresden.de

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Supplement A: Review Protocol

Database	Search strategy	Results
Embase	Keywords in all combinations	
(Date: June 19, 2019)	pathol* gambl* AND access*	
	AND prevalence	57
	AND frequen*	27
	AND duration	3
	AND severity	29
	AND stake	0
	pathol* gambl* AND availab*	
	AND prevalence	99
	AND frequen*	71
	AND duration	29
	AND severity	55
	AND stake	1
	pathol* gambl* AND exposure	
	AND prevalence	22
	AND frequen*	31
	AND duration	20
	AND severity	33
	AND stake	0
	pathol* gambl* AND density	
	AND prevalence	1
	AND frequen*	5
	AND duration	0
	AND severity	7
	AND stake	0
	Results without filter	490
	problem* gambl* AND access*	
	AND prevalence	43
	AND frequen*	28
	AND duration	1
	AND severity	41
	AND stake	0
	problem* gambl* AND availab*	
	AND prevalence	51
	AND frequen*	26
	AND duration	2
	AND severity	39
	AND stake	2
	problem* gambl* AND exposure	
	AND prevalence	11
	AND frequen*	12
	AND duration	5
	AND severity	17
	AND stake	1
	problem* gambl* AND density	
	AND prevalence	1
	AND frequen*	3
	AND duration	0

Continued.

Database	Search strategy	Results
	AND severity	0
	AND stake	0
	Results without filter	283
	gambl* disorder AND access*	
	AND prevalence	10
	AND frequen*	4
	AND duration	1
	AND severity	7
	AND stake	0
	gambl* disorder AND availab*	
	AND prevalence	16
	AND frequen*	14
	AND duration	1
	AND severity	18
	AND stake	1
	gambl* disorder AND exposure	
	AND prevalence	5
	AND frequen*	5
	AND duration	4
	AND severity	3
	AND stake	0
	gambl* disorder AND density	
	AND prevalence	0
	AND frequen*	0
	AND duration	0
	AND severity	1
	AND stake	0
	Results without filter	90
	All results without filter	863
	Number of all duplicates in Embase	425
	All results without duplicates	438
	Exclusion because of the language	0
	Studies added to Endnote	438
PubMed	Keywords in all combinations	
(Date: June 13, 2019)	pathol* gambl* AND access*	
	AND prevalence	31
	AND frequen*	10
	AND duration	2
	AND severity	7
	AND stake	0
	pathol* gambl* AND availab*	
	AND prevalence	85
	AND frequen*	18
	AND duration	7

Continued.

Database	Search strategy	Results
	AND severity	21
	AND stake	1
	pathol* gambl* AND exposure	
	AND prevalence	27
	AND frequen*	17
	AND duration	8
	AND severity	22
	AND stake	0
	pathol* gambl* AND density	
	AND prevalence	6
	AND frequen*	6
	AND duration	6
	AND severity	6
	AND stake	0
	Results without filter	280
	problem* gambl* AND access*	
	AND prevalence	80
	AND frequen*	37
	AND duration	2
	AND severity	39
	AND stake	0
	problem* gambl* AND availab*	
	AND prevalence	118
	AND frequen*	49
	AND duration	4
	AND severity	38
	AND stake	2
	problem* gambl* AND exposure	
	AND prevalence	39
	AND frequen*	15
	AND duration	4
	AND severity	23
	AND stake	3
	problem* gambl* AND density	
	AND prevalence	4
	AND frequen*	4
	AND duration	0
	AND severity	1
	AND stake	0
	Results without filter	462
	gambl* disorder AND access*	
	AND prevalence	36
	AND frequen*	8
	AND duration	2
	AND severity	12
	AND stake	0

Continued.

Database	Search strategy	Results
	gambl* disorder AND availab*	
	AND prevalence	77
	AND frequen*	24
	AND duration	8
	AND severity	29
	AND stake	1
	gambl* disorder AND exposure	
	AND prevalence	50
	AND frequen*	23
	AND duration	9
	AND severity	21
	AND stake	0
	gambl* disorder AND density	
	AND prevalence	10
	AND frequen*	6
	AND duration	4
	AND severity	6
	AND stake	0
	Results without filter	326
	All results without filter	1,068
	Number of all duplicates in PubMed	556
	All results without duplicates	512
	Exclusion because of the language	0
	Studies added to Endnote	512
PsycINFO	Keywords in all combinations	
(Date: June 13, 2019)	pathol* gambl* AND access*	
	AND prevalence	27
	AND frequen*	11
	AND duration	2
	AND severity	14
	AND stake	3
	pathol* gambl* AND availab*	
	AND prevalence	50
	AND frequen*	22
	AND duration	5
	AND severity	34
	AND stake	3
	pathol* gambl* AND exposure	
	AND prevalence	10
	AND frequen*	10
	AND duration	4
	AND severity	18
	AND stake	0
	pathol* gambl* AND density	
	AND prevalence	2
	AND frequen*	1

Continued.

Database	Search strategy	Results
	AND duration	0
	AND severity	3
	AND stake	0
	Results without filter	219
	problem* gambl* AND access*	
	AND prevalence	50
	AND frequen*	48
	AND duration	2
	AND severity	62
	AND stake	5
	problem* gambl* AND availab*	
	AND prevalence	74
	AND frequen*	44
	AND duration	3
	AND severity	62
	AND stake	7
	problem* gambl* AND exposure	
	AND prevalence	15
	AND frequen*	18
	AND duration	2
	AND severity	41
	AND stake	0
	problem* gambl* AND density	
	AND prevalence	4
	AND frequen*	3
	AND duration	0
	AND severity	3
	AND stake	0
	Results without filter	443
	gambl* disorder AND access*	
	AND prevalence	53
	AND frequen*	32
	AND duration	3
	AND severity	49
	AND stake	5
	gambl* disorder AND availab*	
	AND prevalence	84
	AND frequen*	44
	AND duration	4
	AND severity	60
	AND stake	5
	gambl* disorder AND exposure	
	AND prevalence	18
	AND frequen*	20
	AND duration	5
	AND severity	34
	AND stake	0

Continued.

Database	Search strategy	Results
	gambl* disorder AND density	
	AND prevalence	4
	AND frequen*	3
	AND duration	0
	AND severity	3
	AND stake	0
	Results without filter	426
	All results without filter	1,088
	Number of all duplicates in PsycINFO	681
	All results without duplicates	407
	Exclusion because of the language	15
	Studies added to Endnote	392
PSYNDEX	Keywords in all combinations	
(Date: June 17, 2019)	pathol* gambl* AND access*	
	AND prevalence	1
	AND frequen*	0
	AND duration	1
	AND severity	1
	AND stake	0
	pathol* gambl* AND availab*	
	AND prevalence	6
	AND frequen*	2
	AND duration	1
	AND severity	1
	AND stake	0
	pathol* gambl* AND exposure	
	AND prevalence	1
	AND frequen*	1
	AND duration	0
	AND severity	0
	AND stake	0
	pathol* gambl* AND density	
	AND prevalence	0
	AND frequen*	1
	AND duration	0
	AND severity	0
	AND stake	0
	Results without filter	17
	problem* gambl* AND access*	
	AND prevalence	1
	AND frequen*	0
	AND duration	0
	AND severity	1
	AND stake	0

Continued.

Database	Search strategy	Results
	problem* gambl* AND availab*	
	AND prevalence	4
	AND frequen*	1
	AND duration	0
	AND severity	1
	AND stake	0
	problem* gambl* AND exposure	
	AND prevalence	0
	AND frequen*	0
	AND duration	0
	AND severity	0
	AND stake	0
	problem* gambl* AND density	
	AND prevalence	0
	AND frequen*	0
	AND duration	0
	AND severity	0
	AND stake	0
	Results without filter	8
	gambl* disorder AND access*	
	AND prevalence	0
	AND frequen*	0
	AND duration	0
	AND severity	0
	AND stake	0
	gambl* disorder AND availab*	
	AND prevalence	1
	AND frequen*	1
	AND duration	0
	AND severity	0
	AND stake	0
	gambl* disorder AND exposure	
	AND prevalence	0
	AND frequen*	0
	AND duration	0
	AND severity	0
	AND stake	0
	gambl* disorder AND density	
	AND prevalence	0
	AND frequen*	0
	AND duration	0
	AND severity	0
	AND stake	0
	Results without filter	2
	All results without filter	27
	Number of all duplicates in PSYNDEX	17
	All results without duplicates	10

Continued.

Database	Search strategy	Results
	Exclusion because of the language	3
	Studies added to Endnote	7
Web of Science (Date: June 17–18, 2019)	Keywords in all combinations	
	pathol* gambl* AND access*	
	AND prevalence	58
	AND frequen*	23
	AND duration	4
	AND severity	25
	AND stake	1
	pathol* gambl* AND availab*	
	AND prevalence	83
	AND frequen*	47
	AND duration	11
	AND severity	31
	AND stake	3
	pathol* gambl* AND exposure	
	AND prevalence	36
	AND frequen*	33
	AND duration	16
	AND severity	19
	AND stake	1
	pathol* gambl* AND density	
	AND prevalence	8
	AND frequen*	9
	AND duration	7
	AND severity	4
	AND stake	1
	Results without filter	420
	problem* gambl* AND access*	
	AND prevalence	113
	AND frequen*	66
	AND duration	3
	AND severity	63
	AND stake	1
	problem* gambl* AND availab*	
	AND prevalence	115
	AND frequen*	68
	AND duration	8
	AND severity	46
	AND stake	5
	problem* gambl* AND exposure	
	AND prevalence	58
	AND frequen*	33
	AND duration	6
	AND severity	36
	AND stake	2

Continued.

Database	Search strategy	Results
	problem* gambl* AND density	
	AND prevalence	9
	AND frequen*	8
	AND duration	2
	AND severity	2
	AND stake	0
	Results without filter	644
	gambl* disorder AND access*	
	AND prevalence	81
	AND frequen*	33
	AND duration	4
	AND severity	37
	AND stake	0
	gambl* disorder AND availab*	
	AND prevalence	85
	AND frequen*	42
	AND duration	11
	AND severity	41
	AND stake	2
	gambl* disorder AND exposure	
	AND prevalence	47
	AND frequen*	32
	AND duration	12
	AND severity	33
	AND stake	0
	gambl* disorder AND density	
	AND prevalence	9
	AND frequen*	10
	AND duration	5
	AND severity	6
	AND stake	0
	Results without filter	490
	All results without filter	1,554
	Number of all duplicates in Web of Science	928
	All results without duplicates	626
	Exclusion because of the language	0
	Studies added to Endnote	626
Results of all databases	All results of all databases without filter	4,600
	Total number of duplicates of all databases	2,607
	Exclusion because of the language	18
	Number of studies after the application of the filters	1,975

Continued.

Database	Search strategy	Results
Exclusion strategy for the studies in Endnote	Number of all studies added to Endnote	1,975
	Number of all duplicates in Endnote	836
	Results without duplicates	1,139
	Number of studies excluded because of the language	34
	Results without duplicates and with language filter	1,105
Number of excluded studies	Number of studies excluded because of the title	934
	Number of studies excluded because of the abstract	100
	Number of studies excluded because of reference type (book, conference, dissertation)	21
	Number of studies excluded because of the full text	46
Number of studies after the application of the exclusion strategy	Number of studies after the exclusion because of the title	173
	Number of studies after the exclusion because of the abstract and reference type	51
	Number of studies after the exclusion because of the full text	20
Studies found through secondary literature	Number of studies found through secondary literature	21
	Number of found studies excluded after full-text screening	14
	Number of found studies after full-text screening	7
	Number of all eligible studies: 27	
Databases of the eligible studies	PsycINFO [Study numbers 1, 2, 4, 6, 8, 9, 11, 14, 17, 20, 21, 22][a]	12
	PubMed [Study numbers 15, 19, 27][a]	3
	Web of Science [Study numbers 7, 12, 13, 16, 24][a]	5
	Secondary literature [Study numbers 3, 5, 10, 18, 23, 25, 26][a]	7

[a] Study numbers refer to the numbers allocated to the studies listed in Table 1 of the main text.

Supplement B: Reasons for Exclusion of Studies After Full-Text Screening

Source	Reasons for exclusion
Embase	
Shaffer, H. J., LaBrie, R. A., & LaPlante, D. (2004). Laying the foundation for quantifying regional exposure to social phenomena: Considering the case of legalized gambling as a public health toxin. *Psychology of Addictive Behaviors*, *18*(1), 40–48. https://doi.org/10.1037/0893-164x.18.1.40	• No examination of correlations in terms of availability • Even though the study shows that states with a higher prevalence of gambling disorder have a higher gambling exposure (Regional Index of Gambling Exposure), there was no statistical assignment • Study proposes a model called Regional Exposure Model (RIGE) to integrate the adaptation and the exposure theories
Thomas, A. C., Allen, F. L., Phillips, J., & Karantzas, G. (2011). Gaming machine addiction: The role of avoidance, accessibility and social support. *Psychology of Addictive Behaviors*, *25*(4), 738–744. https://doi.org/10.1037/a0024865	• Measures perceived availability
PsycINFO	
Abbott, M. W., Romild, U., & Volberg, R. A. (2014). Gambling and problem gambling in Sweden: Changes between 1998 and 2009. *Journal of Gambling Studies*, *30*(4), 985–999. https://doi.org/ 10.1007/s10899-013-9396-3	• Imprecise information on distance/number/density/expansion of gambling opportunities • No examination of correlations in terms of availability • Study compares two other studies and justifies results through gambling availability
Abbott, M. W., Stone, C. A., Billi, R., & Yeung, K. (2016). Gambling and problem gambling in Victoria, Australia: Changes over 5 years. *Journal of Gambling Studies*, *32*(1), 47–78. https://doi.org/ 10.1007/s10899-015-9542-1	• Imprecise information on distance/number/density/expansion of gambling opportunities • No examination of correlations in terms of availability
Abdi, T. A., Ruiter, R. A. C., & Adal, T. A. (2015). Personal, social and environmental risk factors of problematic gambling among high school adolescents in Addis Ababa, Ethiopia. *Journal of Gambling Studies*, *31*, 59–72. https://doi.org/ 10.1007/s10899-013-9410-9	• Unclear definition of availability • No clear demarcation between physical availability and perceived media influence • Self-report of the participants about availability without geocoding
Carrà, G., Crocamo, C., & Bebbington, P. (2017). Gambling, geographical variations and deprivation: Findings from the adult psychiatric morbidity survey. *International Gambling Studies*, *17*(3), 459–470. https://doi.org/10.1080/14459795.2017.1355405	• Unclear definition of availability
Cunha, D., De Sousa, B., Fonseca, G., & Relvas, A. P. (2016). Gambling behavior severity and psychological, family, and contextual variables: A comparative analysis. *Journal of Social Work Practice in the Addictions*, *16*(3), 266–289. https://doi.org/10.1080/1533256X.2016.1200985	• Measures perceived accessibility
Emerson, M. O., & Laundergan, J. C. (1996). Gambling and problem gambling among adult Minnesotans: Changes 1990 to 1994. *Journal of Gambling Studies*, *12*(3), 291–304. https://doi.org/10.1007/BF01539324	• No examination of correlations in terms of availability
Hodgins, D. C., Stea, J. N., & Grant, J. E. (2011). Gambling disorders. *The Lancet*, *378*(9806), 1874–1884. https://doi.org/10.1016/S0140-6736(10)62185-X	• No reference to the research question
Jacques, C., Ladouceur, R., & Ferland, F. (2000). Impact of availability on gambling: A longitudinal study. *The Canadian Journal of Psychiatry*, *45*(9), 810–815. https://doi.org/10.1177/070674370004500904	• The study contents and results were included in another study (final study number 1; see Table 1 of main text) by the same authors and further investigations followed

Continued.

Source	Reasons for exclusion
Johansson, A., Grant, J. E., Kim, S. W., Odlaug, B. L., & Götestam, K. G. (2009). Risk factors for problematic gambling: A critical literature review. *Journal of Gambling Studies*, *25*(1), 67–92. https://doi.org/10.1007/s10899-008-9088-6	• Unsystematic literature review
Jonsson, J. (2006). An overview of prevalence surveys of problem and pathological gambling in the Nordic countries. *Journal of Gambling Issues*, *18*, 31-38. https://doi.org/ 10.4309/ jgi.2006.18.4	• Unsystematic literature overview • No reference to the research question
Kim, W. (2012). Acculturation and gambling in Asian Americans: When culture meets availability. *International Gambling Studies*, *12*(1), 69–88. https://doi.org/10.1080/ 14459795.2011.616908	• No reference to the research question
Ladouceur, R. (1996). The prevalence of pathological gambling in Canada. *Journal of Gambling Studies*, *12*(2), 129–142. https://doi.org/10.1007/BF01539170	• No reference to the research question
LaPlante, D. A., & Shaffer, H. J. (2007). Understanding the influence of gambling opportunities: Expanding exposure models to include adaptation. *American Journal of Orthopsychiatry*, *77*(4), 616–623. https://doi.org/10.1037/0002-9432.77.4.616	• Unsystematic literature overview with reference to the RIGE model • Study proposes model and implications for society and individuals • Imprecise information about correlations in terms of availability
Luo, H., & Ferguson, M. (2017). Gambling among culturally diverse older adults: A systematic review of qualitative and quantitative data. *International Gambling Studies*, *17*(2), 290–316. https://doi.org/10.1080/14459795.2017.1316415	• No information on distance/number/density/expansion of gambling opportunities
Ólason, D. T., Skarphedinsson, G. A., Jonsdottir, J. E., Mikaelsson, M., & Gretarsson, S. J. (2006). Prevalence estimates of gambling and problem gambling among 13-to 15-year-old adolescents in Reykjavík: An examination of correlates of problem gambling and different accessibility to electronic gambling machines in Iceland. *Journal of Gambling Issues*, *18*, 39–55. http://dx.doi.org/10.4309/jgi.2006.18.7	• Different definition of accessibility (frequency of playing in a certain location: public places vs. bars) • No information on distance/number/density/expansion of gambling opportunities
Rossow, I., & Bang Hansen, M. (2015). Gambling and gambling policy in Norway: An exceptional case. *Addiction*, *111*(4), 593–598. https://doi.org/ 10.1111/add.13172	• Unsystematic literature overview • No quantitative data collection
Shead, N. W., Derevensky, J. L., & Gupta, R. (2010). Risk and protective factors associated with youth problem gambling. *International Journal of Adolescent Medicine and Health*, *22*(1), 39–58.	• No quantitative data • No information on distance/number/density/expansion of gambling opportunities
Szczyrba, Z., Mravčík, V., Fiedor, D., Černý, J., & Smolová, I. (2015). Gambling in the Czech Republic. *Addiction*, *110*(7), 1076–1081. https://doi.org/10.1111/add.12884	• No reference to the research question
Thorne, H. B., Goodwin, B., Langham, E., Rockloff, M., & Rose, J. (2016). Preferred electronic gaming machine environments of recreational versus problem gamblers: An in-venue mixed methods study. *Journal of Gambling Issues*, *34*, 221–243. https://doi.org/ 10.4309/jgi.2016.34.12	• No information on distance/number/density/expansion of gambling opportunities • No quantitative data
Xouridas, S., Jasny, J., & Becker, T. (2016). An ecological approach to electronic gambling machines and socioeconomic deprivation in Germany. *Journal of Gambling Issues*, *33*, 82–102. http://dx.doi.org/10.4309/jgi.2016.33.6	• No examination of correlations in terms of problem gambling (PG) • Examines risk factors for PG
PSYNDEX	
Meyer, G., Kalke, J., & Hayer, T. (2018). The impact of supply reduction on the prevalence of gambling participation and disordered gambling behavior: A systematic review. *Sucht*, *64*(5-–6), 283-–293. https://doi.org/10.1024/0939-5911/a000562	• No quantitative data

Continued.

Source	Reasons for exclusion
PubMed	
Felsher, J. R., Derevensky, J. L., & Gupta, R. (2004). Lottery playing amongst youth: Implications for prevention and social policy. *Journal of Gambling Studies*, *20*(2), 127–153. https://doi.org/10.1023/B:JOGS.0000022306.72513.7c	• No information on distance/number/density/expansion of gambling opportunities
Slutske, W. S., Deutsch, A. R., Statham, D. J., & Martin, N. G. (2015). Local area disadvantage and gambling involvement and disorder: Evidence for gene-environment correlation and interaction. *Journal of Abnormal Psychology*, *124*(3), 606–622. https://doi.org/10.1037/abn0000071	• No examination of correlations in terms of availability and outcomes • Examines gene-environment correlation and interaction (e.g., interaction between local disadvantage and density of gambling opportunities and their consequences for gambling disorder and gambling behaviour) • Results are not separable; therefore, no conclusions can be drawn in terms of availability and its influence on gambling outcomes
Wick, J. (2012). High-stakes gambling: Seniors may be the losers. *The Consultant Pharmacist*, *27*(8), 544–551. https://doi.org/10.4140/TCP.n.2012.544	• Study not available
Web of Science	
Bondolfi, G., Osiek, C., & Ferrero, F. (2000). Prevalence estimates of pathological gambling in Switzerland. *Acta Psychiatrica Scandinavica*, *101*(6), 473–475. https://doi.org/10.1034/j.1600-0447.2000.101006473.x	• No information on availability
Derevensky, J. L., & Gilbeau, L. (2015). Adolescent gambling: Twenty-five years of research. *Canadian Journal of Addiction*, *6*(2), 4–12.	• No quantitative data
Ho, K. W., Sau-kuen, S. W., & Lo Man-chun, J. H. (2012). The relationship between gambling accessibility and Hong Kong people's participation in gambling activities. *Asia Pacific Journal of Social Work and Development*, *22*(4), 266–274. https://doi.org/ 10.1080/02185385.2012.726135	• Imprecise information on distance/number/density • Examines expansion of gambling opportunities and perceived influence of casino opening on motivation to gamble
LaPlante, D. A., Gray, H. M., Williams, P. M., & Nelson, S. E. (2018). An empirical review of gambling expansion and gambling-related harm. *Sucht*, *64*(5-–6), 295-–306. https://doi.org/10.1024/0939-5911/a000563	• No quantitative data
Philander, K. S. (2019). Regional impacts of casino availability on gambling problems: Evidence from the Canadian Community Health Survey. *Tourism Management*, *71*, 173–178. https://doi.org/10.1016/j.tourman.2018.10.017	• Imprecise information on distance/number/density/expansion of gambling opportunities
Vasiliadis, S. D., Jackson, A. C., Christensen, D., & Francis, K. (2013). Physical accessibility of gaming opportunity and its relationship to gaming involvement and problem gambling: A systematic review. *Journal of Gambling Issues*, *28*, 1–46. https://doi.org/ 10.4309/jgi.2013.28.2	• Systematic review • Exclusion and inclusion criteria differ from this systematic review
Welte, J. W., Barnes, G. M., Tidwell, M. C. O., & Wieczorek, W. F. (2017). Predictors of problem gambling in the US. *Journal of Gambling Studies*, *33*(2), 327–342. https://doi.org/10.1007/s10899-016-9639-1	• Study contents and results were included in another study by the same authors and further investigations followed

Continued.

Source	Reasons for exclusion
Secondary references	
Abbott, M. (2006). Do EGMs and problem gambling go together like a horse and carriage? *Gambling Research: Journal of the National Association for Gambling Studies (Australia)*, *18*(1), 7–38.	• Unsystematic literature overview • Imprecise information about the eligibility criteria • Study does not give precise insight into the quality of the studies
Delfabbro, P. H. (2002). *The distribution of electronic gaming machines (EGMs) and gambling-related harm in metropolitan Adelaide.* Independent Gambling Authority of South Australia.	• Study not available on request • Contact with author not successful
Fisher, S. (1992). Measuring pathological gambling in children: The case of fruit machines in the UK. *Journal of Gambling Studies*, *8*(3), 263–285. https://doi.org/ 10.1007/BF01014653	• No direct reference to the research question • No examination of correlations in terms of availability
Gerstein, D., Murphy, S., Toce, M., Hoffmann, J., Palmer, A., Johnson, R., ... & Hill, M. (1999). *Gambling impact and behavior study: A report to the National Gambling Impact Study Commission*. National Opinion Research Center.	• No statistical analyses for results presented
Grun, L., & McKeigue, P. (2000). Prevalence of excessive gambling before and after introduction of a national lottery in the United Kingdom: Another example of the single distribution theory. *Addiction*, *95*(6), 959–966. https://doi.org/10.1046/j.1360-0443.2000.95695912.x	• No quantitative data
Ladouceur, R., Jacques, C., Sévigny, S., & Cantinotti, M. (2005). Impact of the format, arrangement and availability of electronic gaming machines outside casinos on gambling. *International Gambling Studies*, *5*(2), 139–154. https://doi.org/10.1080/14459790500303121	• No quantitative data in one of the studies • Examines arrangement, format, and concentration (number in a single casino) of electronic gaming machines in casinos
McMillen, J., & Doran, B. (2006). Problem gambling and gaming machine density: Socio-spatial analysis of three Victorian localities. *International Gambling Studies*, *6*(1), 5–29. https://doi.org/ 10.1080/14459790600644093	• No reference to the research question (examines spatial clusters of gaming machines)
Shepherd, R.-M., Ghodse, H., & London, M. (1998). A pilot study examining gambling behaviour before and after the launch of the National Lottery and scratch cards in the UK. *Addiction Research*, *6*(1), 5–15. https://doi.org/10.3109/16066359809008839	• No direct reference to the research question • No quantitative data
St-Pierre, R. A., Walker, D. M., Derevensky, J., & Gupta, R. (2014). How availability and accessibility of gambling venues influence problem gambling: A review of the literature. *Gaming Law Review and Economics*, *18*(2), 150–172. https://doi.org/ 10.1089/glre.2014.1824	• Unsystematic literature overview
Thalheimer, R., & Ali, M. M. (2003). The demand for casino gaming. *Applied Economics*, *35*(8), 907–918. https://doi.org/ 10.1080/0003684022000018259	• No reference to the research question (examines accessibility in relation to cross-effects of different gaming opportunities)
Welte, J. W., Barnes, G. M., Wieczorek, W. F., Tidwell, M. C. O., & Hoffman, J. H. (2007). Type of gambling and availability as risk factors for problem gambling: A Tobit regression analysis by age and gender. *International Gambling Studies*, *7*(2), 183–198. https://doi.org/ 10.1080/14459790701387543	• Study contents and results were taken up again in another study by the same authors and further investigations followed
Wildman, R. W. (1997). *Gambling: An attempt at an integration*. Wynne Resources.	• Study not available on request • Contact with author not successful

Supplement C: Quality Rating Table

Quality categories	Category	One point	No point
Study design			
1	Longitudinal study	Longitudinal study, meta-analyses, or repeated cross-sectional study	Cross-sectional study
2	Period of the study	Period of at least 5 years, or if it is a meta-analysis or review, at least 10 studies	Less than 5 years or fewer than 10 studies
3	Prospective or retrospective	Prospective	Retrospective
4	Control group	Comparison with a control group, control region, or natural experiment (e.g., a new law)	A simple examination if a relationship exists at the present time, without control group or control region
5	Sample size	Study design is cross-sectional and initial *n* is in total bigger than 1,000Study design is longitudinal and initial *n* is in total bigger than 400 *(this threshold ensures power of ~80% to detect differences of 3% in gambling disorder rates; see LaPlante et al., 2018, in main text)*	Study design is cross-sectional and initial *n* is in total smaller than 1,000Study design is longitudinal and initial *n* is in total smaller than 400
6	Analysis	Multivariate analysis	Bivariate analysis
Clarity			
7	Clarity	Clear statistical data, tables, graphics	Unclear or non-transparent representation of the data
Conflict of interest			
8	Conflict of interest	Study makes a statement about the conflict of interest or is financed by an independent donor (e.g., health ministry)	Study does not make a statement about the conflict of interest

Continued.

Quality categories	Category	One point	No point
Measurement of availability			
9	Measurement	Geocoding, exact distance between participant and gambling opportunity, summary of many addresses into one approximate distance or historically documented data about gambling availability	Study only makes statements about the number of gambling opportunities in a region without distance or density data
10	Examination of more than one facet (density, distance, number etc.), meta-analyses with studies that examine more than one facet	Study examines more than one facet	Study examines only one facet
Measurement of gambling disorder and problem gambling			
11	Measurement of gambling disorder or problem gambling	Study presents data on gambling disorder or problem gambling	Study does not present data on gambling disorder or problem gambling
12	Instruments	Well-established instruments	Self-developed instruments without data on validation
Measurement of gambling behaviour			
13	Measurement of gambling behaviour, meta-analyses with studies that measure gambling behaviour	Study presents data on gambling behaviour	Study does not present data on gambling behaviour
14	Instruments	Well-established instruments or precise explanation for, e.g., a cut-off for categories such as “current frequent gambler” regarding a diagnostic or screening instrument	Self-developed instruments without data on validation
15	Examination of more than one facet (stake, gambling frequency etc.), meta-analyses with studies that examine more than one facet	Study examines more than one facet	Study examines only one facet

Supplement D: Detailed Quality Ratings for Included Records

	Quality categories[b]															
Study number[a]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	QRS
1	X	X	X	X	X	X	X	X	X		X	X	X	X	X	14
2	X	X		X	X	X		X	X		X	X	X	X	X	12
3	X			X	X		X	X	X	X	X	X	X		X	11
4	X	X			X	X	X		X		X	X	X	X	X	11
5	X			X	X		X		X		X	X	X	X	X	10
6	X			X	X	X	X	X	X		X	X	X		X	11
7					X	X	X	X	X	X	X	X	X	X	X	11
8					X	X	X	X	X		X	X	X	X	X	10
9					X		X	X	X	X	X	X	X		X	9
10					X	X	X	X	X	X	X		X	X		9
11	X				X	X		X	X	X	X	X	X		X	10
12					X	X	X		X	X	X	X	X	X	X	10
13					X	X	X	X	X		X	X	X	X	X	10
14	X		X		X			X	X				X	X	X	8
15					X	X	X		X	X	X	X	X		X	9
16					X		X	X	X	X	X	X				7
17					X	X	X	X			X	X	X			7
18					X			X	X	X	X	X				6
19					X	X		X	X		X		X		X	7
20					X			X			X	X	X		X	6
21					X	X			X		X	X	X	X		7
22					X	X	X	X	X		X	X				7
23					X	X		X	X		X	X				6
24					X		X	X	X				X			5
25					X			X			X	X				4
26									X				X		X	3
27					X	X		X					X			4

Note. QRS = quality rating scores.
[a]Study numbers refer to the numbers allocated to the studies listed in Table 1 of the main text.
[b]Quality categories refer to the numbers allocated to the quality rating categories listed in the previous Table in Supplement C.

Supplement E: Detailed Quality Weighting Calculation Example

Please see these example calculations for all three steps for the example of the access hypothesis:

1. Quality rating

Five studies received different quality rating scores (QRS) according to the quality criteria: 10 points for study A, 8 for study B, 7 for study C, 8 for study D, and 9 for study E.

2. Consistency outcome weighting

The outcomes of Study A (QRS = 10) and B (QRS = 8) were allocated to the access hypothesis and all outcomes were significant (supported the access hypothesis) so that their proportion is 100%.

The outcomes of Study C (QRS = 7) were also allocated to the access hypothesis: One outcome was not significant and two outcomes were significant; consequently, their proportions are 1/3 reject and 2/3 support, respectively.

The outcomes of Study D (QRS = 8) were allocated to the access hypothesis and had non-significant results. The proportion is 100% for reject.

Study E had results that were allocated only to the adaptation hypothesis and are not included in the calculation of the access hypothesis.

3. Quality weighting

To calculate the quality weighting for the support of the access hypothesis, we totalled the consistency outcome weightings of Studies A, B, and C (partially):

$10 + 8 + 7 \times 2/3 = 22.7$

This result was multiplied by the number of studies (3) = 68.1.

For the calculation of the quality weighting for the rejection of the access hypothesis, we totalled the consistency outcome weightings of study C (partially) and D:

$7 \times 1/3 + 8 = 10.3$

This result was multiplied by the number of studies (2) = 20.7.

In this fictional example, 68.1 quality weighting points were in favour of the support of the access hypothesis and 20.7 supported the rejection of the hypothesis. Results such as these are discussed in the main text.

Supplement F: Detailed Calculation of the Quality Weighting of Evidence

1. Calculation of the quality weighting for the access hypothesis

Calculation of the overall quality weighting of the availability hypothesis for gambling disorder or problem gambling

Studies that support the hypothesis		Studies that support the hypothesis partially		
Study number[1]	Quality score	Study number	Quality score	Proportion
3	11	6	11	$\frac{1}{2}$
4	11	11	10	$\frac{2}{3}$
16	7	7	11	$\frac{6}{10}$
18	6	12	10	$\frac{4}{5}$
17	7	15	9	$\frac{1}{2}$
20	6	19	7	$\frac{1}{2}$
23	6	14	8	$\frac{1}{2}$
21	7	22	7	$\frac{1}{2}$
		10	9	$\frac{4}{9}$

$$\left[11+11+7+6+7+6+6+7+\left(11\times\frac{1}{2}\right)+\left(10\times\frac{2}{3}\right)+\left(11\times\frac{6}{10}\right)+\left(10\times\frac{4}{5}\right)+\left(9\times\frac{1}{2}\right)+\left(7\times\frac{1}{2}\right)+\left(8\times\frac{1}{2}\right)+\left(7\times\frac{1}{2}\right)+\left(9\times\frac{4}{9}\right)\right]\times 15^2\approx \mathbf{1{,}609}$$

Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
5	10	6	11	$\frac{1}{2}$
9	9	11	10	$\frac{1}{3}$
13	10	7	11	$\frac{4}{10}$

Continued.

Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
8	10	12	10	$\frac{1}{5}$
		14	8	$\frac{1}{2}$
		15	9	$\frac{1}{2}$
		19	7	$\frac{1}{2}$
		22	7	$\frac{1}{2}$
		10	9	$\frac{5}{9}$

$$\left[10+9+10+10+\left(11\times\frac{1}{2}\right)+\left(10\times\frac{1}{3}\right)+\left(11\times\frac{4}{10}\right)+\left(10\times\frac{1}{5}\right)+\left(8\times\frac{1}{2}\right)+\left(9\times\frac{1}{2}\right)+\left(7\times\frac{1}{2}\right)+\left(7\times\frac{1}{2}\right)+\left(9\times\frac{5}{9}\right)\right]\times 11^2\approx \mathbf{822}$$

[1]Study numbers refer to the numbers allocated to the studies listed in Table 1 of the main text.
[2]If two or more studies were based on the same sample, we counted them as one single study: study numbers 8, 11, and 14 (Survey of Gambling in the U.S. [SOGUS1] sample); study numbers 7, 8, and 13 (SOGUS2 sample); and study numbers 15 and 21 (Canadian Community Health Survey [CCHS 1.2] sample).

Calculation of the quality weighting of the availability hypothesis for gambling disorder or problem gambling in terms of the operationalization distance

Studies that support the hypothesis		Studies that support the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
15	9	11	10	$\frac{1}{2}$
17	7			
19	7			
23	6			
10	9			
$\left[9+7+7+6+9+\left(10\times\frac{1}{2}\right)\right]\times 6=\mathbf{258}$				
Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
9	9	11	10	$\frac{1}{2}$
13	10			
8	10			
$\left[9+10+10+\left(10\times\frac{1}{2}\right)\right]\times 3^2=\mathbf{102}$				

Calculation of the quality weighting of the availability hypothesis for gambling disorder or problem gambling in terms of the operationalization density and number of gambling opportunities

Studies that support the hypothesis		Studies that support the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
4	11	7	11	$\frac{1}{2}$
11	10	12	10	$\frac{4}{5}$
16	7	22	7	$\frac{1}{2}$
21	7	10	9	$\frac{1}{6}$
$\left[11+10+7+7+\left(11\times\frac{1}{2}\right)+\left(10\times\frac{4}{5}\right)+\left(7\times\frac{1}{2}\right)\left(9\times\frac{1}{6}\right)\right]\times 8=\mathbf{428}$				

Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
15	9	7	11	$\frac{1}{2}$
19	7	12	10	$\frac{1}{5}$
		22	7	$\frac{1}{2}$
		10	9	$\frac{5}{6}$
$\left[9+7+\left(11\times\frac{1}{2}\right)\left(10\times\frac{1}{5}\right)+\left(7\times\frac{1}{2}\right)+\left(9\times\frac{5}{6}\right)\right]\times 6=\mathbf{207}$				

Calculation of the quality weighting of the availability hypothesis for gambling disorder or problem gambling in terms of the operationalization exposure, legality, years of legality, and historical overview

Studies that support the hypothesis		Studies that support the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
18 20	6 6	7	11	$\frac{5}{8}$
$\left[6+6+\left(11\times\frac{5}{8}\right)\right]\times 3\approx\mathbf{57}$				
Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
		7	11	$\frac{3}{8}$
$\left(11\times\frac{3}{8}\right)\times 1\approx\mathbf{4}$				

Calculation of the quality weighting of the availability hypothesis for gambling disorder or problem gambling in terms of the operationalization opening of a new casino

Studies that support the hypothesis		Studies that support the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
3	11			
$11 \times 1 = \mathbf{11}$				
Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
5	10			
$10 \times 1 = \mathbf{10}$				

Calculation of the quality weighting of the availability hypothesis for gambling disorder or problem gambling in terms of the operationalization ban of slot machines

Studies that support the hypothesis		Studies that support the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
		6	11	$\frac{1}{2}$
		14	8	$\frac{1}{2}$
$\left[\left(11 \times \frac{1}{2}\right) + \left(78 \times \frac{1}{2}\right)\right] \times 2 = \mathbf{19}$				
Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
		6	11	$\frac{1}{2}$
		14	8	$\frac{1}{2}$
$\left[\left(11 \times \frac{1}{2}\right) + \left(8 \times \frac{1}{2}\right)\right] \times 2 = \mathbf{19}$				

Calculation of the overall quality weighting of the availability hypothesis for gambling behaviour

Studies that support the hypothesis		Studies that support the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
3	11	6	11	$\frac{5}{6}$
9	9	11	10	$\frac{5}{6}$
13	10	7	11	$\frac{10}{11}$
8	10	12	10	$\frac{4}{9}$
18	6	15	9	$\frac{2}{3}$
19	7	17	7	$\frac{2}{17}$
20	6	14	8	$\frac{8}{10}$
27	4	10	9	$\frac{6}{18}$
21	7			
26	3			

$$\left[11+9+10+10+6+7+6+4+7+3+\left(11\times\frac{5}{6}\right)+\left(10\times\frac{5}{6}\right)+\left(11\times\frac{10}{11}\right)\right.$$
$$\left.+\left(10\times\frac{4}{9}\right)+\left(9\times\frac{2}{3}\right)+\left(7\times\frac{2}{17}\right)+\left(8\times\frac{8}{10}\right)+\left(9\times\frac{6}{18}\right)\right]\times 15^3\approx \mathbf{1{,}818}$$

Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
2	12	6	11	$\frac{1}{6}$
5	10	11	10	$\frac{1}{6}$
		7	11	$\frac{1}{11}$
		12	10	$\frac{5}{9}$

Continued.

Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
		15	9	$\frac{1}{3}$
		17	7	$\frac{13}{17}$
		14	8	$\frac{2}{10}$
		10	9	$\frac{12}{18}$

$$\left[12+10+\left(11\times\frac{1}{6}\right)+\left(10\times\frac{1}{6}\right)+\left(11\times\frac{1}{11}\right)+\left(10\times\frac{5}{9}\right)+\left(9\times\frac{1}{3}\right)+\left(7\times\frac{13}{17}\right)+\left(8\times\frac{2}{10}\right)+\left(9\times\frac{12}{18}\right)\right]\times 9^2\approx \mathbf{432}$$

[3]If two or more studies were based on the same sample, we counted them as one single study: study numbers 8, 11, and 14 (Survey of Gambling in the U.S. [SOGUS1] sample); study numbers 7, 8, and 13 (SOGUS2 sample); and study numbers 15 and 21 (Canadian Community Health Survey [CCHS 1.2] sample).

2. Calculation of the overall quality weighting of the adaptation hypothesis for gambling disorder or problem gambling

Studies that support the hypothesis		Studies that support the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
1	14			
2	12			
4	11			
25	4			
(14 + 12 + 11 + 4) × 4 **= 164**				
Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
0				

Calculation of the overall quality weighting of the adaptation hypothesis for gambling behaviour

Studies that support the hypothesis		Studies that support the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
1	14			
2	12			
25	4			
(14 + 12 + 4) × 3 **= 90**				
Studies that reject the hypothesis		Studies that reject the hypothesis partially		
Study number	Quality score	Study number	Quality score	Proportion
0				