Grey Literature citation and inclusion rates in gambling review articles: Opportunities for improvement

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Abstract

Commercial gambling is expanding in many countries worldwide, and researchers and governments are increasingly approaching gambling as a public health issue. Grey literature is a popular avenue for disseminating findings from gambling studies, accounting for over 20% of gambling research publications. As evidence-based policy decisions increasingly rely on systematic and scoping reviews, it is important that grey literature evidence is included in these reviews. To date, two umbrella review has assessed systematic reviews for gambling-related interventions, and using the AMSTAR 2 critical appraisal tool, both found the overall quality of the reviews to be low. One of the AMSTAR 2 criteria is "a comprehensive literature search strategy", which includes grey literature where relevant. The goal of this study is to assess the extent to which grey literature is cited in gambling related review articles, how often grey literature searches are included in reviews with systematized search strategies, and how grey literature is discussed (or not).

Using the multidisciplinary scholarly database Web of Science, a broad keyword search for "gambl*" was performed, limited to documents of type "Review" published from 2016 to 2020. After screening for articles unrelated to gambling, 174 reviews were included. The references section of each article was reviewed and all grey references were catalogued. For articles with a formal search strategy, the proportion of grey items included in the systematic search results was also recorded. To determine if and how grey literature is discussed, the full text was searched for grey literature related terms.

Of the 174 included studies, 100 had systematized search strategies and 74 did not. In systematized reviews, grey literature sources were included in just over half of reviews (n=54). Of the 46 systematized reviews that excluded grey literature, only one provided a methodologically sound reason for doing so and only eight acknowledged grey literature exclusion as a limitation of the review, while many did not mention grey literature at all. Across all review types, grey literature represented an average of 9.2% of works cited. Compared to similar reviews in other domains, it appears that grey literature is underutilized in gambling reviews. Efforts to improve grey literature uptake in gambling reviews may be most effective if focused on increasing awareness of grey literature and providing information or training resources to gambling researchers, peer reviewers and journal editors.

"One of the problems with systematic reviews is to get it published in a regular gambling journal, you'll get reviewers like me who know the psychology but don't really know... What is there to actually critique in a systematic review? It kind of is what it is. [...] Maybe that's my naive take on something that I do very little in research. Maybe I just don't understand the nuances." - Aaron, Male researcher based in Canada who studies gambling from a psychological perspective

Introduction

Gambling as a growing public health issue

Gambling is a quickly expanding multinational industry. The global gambling industry grew from $250 billion USD in 2003 to $450 billion in 2013 (The Economist, 2014), to a projected $635 billion by 2022 (Morgan Stanley 2015, as cited in Cassidy, 2020).

Commercial gambling is heavily marketed as a legitimate and harmless leisure activity, but has been called a "dangerous commodity" similar to tobacco and alcohol because of the addiction and other social harms is presents (Markham & Young, 2015). Many people who gamble do not experience harm from gambling; clinically diagnosed problem gambling affects around 2-3% of the global population and has even decreased to 0.6% in Canada (Williams et al., 2020; Williams, Volberg, et al., 2012), but governments and gambling researchers are increasingly approaching gambling as a public health issue as problem gambling is only a small part of the picture.

Firstly, for each person with problem gambling, an average of six other people are harmed by that person's gambling, usually their closest family and friends (Goodwin et al., 2017). Secondly, although few people gamble at a level that qualifies as clinical problem gambling, many more gamble at what is called a low- or moderate-risk level and still experience harms from that (Browne et al., 2016; Langham et al., 2016).

Thirdly, harms from gambling disproportionately fall onto people in poorer and racialized communities (Abbott et al., 2004), thus the harms from gambling pose an equity issue related to social determinants of health, although the gambling industry's conflict with public health has been implicated as a "commercial determinant of health" (Ndebele et al., 2020). Finally, there is evidence for a "total consumption model" of gambling harm, meaning there is a strong positive association between the total gambling in a population and harmful gambling in that population (Rossow, 2019; Sulkunen et al., 2019). In light of the gambling industry's growth over the past 20 years, this means we can expect there has been a concomitant growth in overall gambling-related harms.

Gambling research and the public interest

Governments can use gambling research to inform gambling policies to reduce gambling harm, but there are some limitations to the gambling evidence base. The gambling research funded and conducted in any given country will be shaped by that country's existing gambling policies. For example, countries that have a history of approaching gambling as a public health issue (e.g., New Zealand) or strong public health research programmes generally (e.g., Nordic countries) produce more public health research on gambling harm prevention, whereas nations like Canada that have a history of viewing gambling as an individual addiction primarily produce research focused on individuals who have gambling problems and how to treat them (Baxter et al., 2019; Nordmyr & Forsman, 2018). Overall, research on the characteristics of individual gamblers is much more common than research on the broader social, cultural, and economic aspects of gambling (Baxter et al., 2019; Hilbrecht & Baxter, 2021).

In addition to this, the gambling industry funds a fair amount of the available gambling research, either by sponsoring research directly or through funding "independent" gambling research organizations. Research funding from the gambling industry has risks of conflict of interest in common with funding from tobacco and alcohol industries (P. J. Adams, 2007; Peter J. Adams, 2016). The 2013 report "Fair Game: Producing gambling research" found that gambling research is behind studies of tobacco, alcohol and other drugs in terms of methods used and dealing with conflicts of interest, and funding

structures tends to focus on "safe" research questions unlikely to lead to further gambling regulation (Cassidy et al., 2013). Two other studies found industry funding had no biasing effect on gambling research, but these studies were themselves funded by the gambling industry and must be approached with caution (Ladouceur et al., 2019; Shaffer et al., 2019).

Finally, for governments and policymakers to utilize gambling research to make evidence-informed decisions, the research must also be summarized and brought to their attention. A common method for summarizing research from multiple research articles on a topic are knowledge syntheses such as systematic reviews and scoping reviews. Unfortunately, the results of the two umbrella reviews evaluating gambling review articles are not promising: one found that primary research articles and systematic reviews on gambling were of low methodological quality in general (McMahon et al., 2019), and the other avoided doing a quality assessment altogether as "most of the studies would have been rated of weak quality and eliminated" (Velasco et al., 2021).

Gambling grey literature

The limitations discussed above largely refer to gambling research and reviews published as primary academic literature, but can be addressed in part by gambling grey literature. Gambling has a sizable and unique body of research published as grey literature: a systematic search of gambling grey literature published in Australia, Canada, New Zealand, the United Kingdom and the United States found that grey literature makes up over 26% of gambling research publications (Baxter et al., 2021b), and a thematic analysis of recent gambling research found that studies published as grey literature tended to focus on broader population health and well-being aspects of gambling, whereas studies published as journal articles tended to focus on the individual characteristics of people who gamble (Baxter et al., 2021a).

Grey literature has other general benefits, such as being more up-to-date and detailed than what is available in the primary literature, as well as providing a "unique global perspective" (Bonato, 2018, p. 28). The latter is especially important in gambling with local research being constrained by the existing policies of the jurisdiction, as context-specific research from different jurisdictions with different gambling policies is more likely to be published as grey literature. For example, the Australian Productivity Commission's two inquiry reports on gambling (Productivity Commission, 1999, 2010) are highly regarded and well-cited internationally despite their focus on Australian gambling, as they present highly detailed investigative research and analysis that could not be published in an academic journal or book. Somewhat paradoxically, the academic literature aims to make generalized/universal claims, but in doing so loses attention to specific contexts that may inform policies in other contexts. Grey literature such as the Productivity Commission reports achieves this.

Although much of gambling grey research is government-funded and the resulting reports may be consulted by that funder when it is first completed, reuse of those reports is generally lower due to limited distribution of grey literature. One way to ensure that grey research is considered in more gambling policy decisions is to include it in systematic reviews. There are several arguments in favour of this practice.

Firstly, grey literature is a strong contributor to systematic reviews in other health topics (Farrah & Mierzwinski-Urban, 2019; Severn et al., 2017), and the inclusion of grey literature in systematized review articles is consistently considered a best practice and a measure of quality where applicable in prominent review methodologies (Higgins et al., 2021; Kugley et al., 2017; Shea et al., 2017). Due to its significant body of grey literature,

gambling should by default be considered a "where applicable" topic for the inclusion of grey literature in reviews, unless there is an argument for exclusion for a specific gambling topic. Additionally, although grey literature searching is more labour intensive and utilizes more specialized skills, guidelines have been developed for searching health and public health grey literature (Bonato, 2018; Godin et al., 2015) and have been successfully applied to the gambling domain (Baxter et al., 2021b).

Unfortunately, the "grey" of grey literature has been misrepresented as meaning dubious or unpublished in the gambling research community, and excluded from high profile gambling reviews on those grounds (Ladouceur et al., 2017; "Science has a gambling problem," 2018). On the contrary, grey literature should be included in reviews for the methodological reasons stated above, but also as a matter of principle: Most government-sponsored gambling grey research is funded through governments' gambling revenues, meaning the research is effectively paid for by gamblers through their gambling losses. Thus, there is an ethical imperative to heed that research in service of reducing gambling-related harms to those gamblers, their families, and their communities.

The present study

I have outlined several reasons why grey literature ought to be included in systematic reviews, as well as some signs that it may not be included to the extent it ought to be. This study presents a citation analysis of recent gambling review articles to answer the following questions:

- To what extent is grey literature cited in gambling review articles?
- To what extent are grey literature sources included in the search strategies of systematized review articles?
  - When included, what grey literature sources are searched?
  - When included, is relevant grey literature found?
- How is grey literature discussed in these articles, if at all?

Methods

All methods presented below were performed solely by the author.

Data source and search strategy

Bibliographic data were collected from the Web of Science (WoS) scholarly database. Of the large multidisciplinary databases Scopus, WoS, and Google Scholar, WoS was chosen because it was the only one to that included "cited references" in bibliographic downloads, and was thus ideal for data processing, although this option is no longer available at the time of publication.

The topic "gambl*" was searched across all WoS indexes, limited to document type "review" and years 2016 to present. The search is restricted to review articles due to our interest in search methodologies, and is in keeping with previous grey literature citation studies (Farrah & Mierzwinski-Urban, 2019; Severn et al., 2017). The initial search was performed December 9th, 2019 and the follow-up search was performed November 9th, 2021.

Eligibility criteria including selection process

Articles were included if they were review articles that investigated gambling or gambling harm (including problem gambling, gambling disorder, and pathological gambling). Reviews that had a scope of gambling and one other condition or activity (e.g., comparing problem gambling and alcohol use disorder) were also included, but articles with a scope

of three or more conditions or a scope of all addictions or addictive behaviours were excluded. Review protocols were included if the full study was not yet published.

Review articles containing the topic keyword "gambl*" were excluded as out of scope if the topic met any of the following criteria:

- Gambling is the method of investigation only. The most common example is the "Iowa Gambling Task", a laboratory task used to assess decision-making ability that does not resemble any real gambling situation.
- Gambling problems as a side effect of treatment for brain disorders such as Parkinson's disease
- Gambling in animal models such as rats
- Otherwise unrelated to gambling (e.g., mentions a person with surname "Gamble", describing a government's decision as "a gamble", etc.)

Coding/data collection process/Data items

A Google Form was created and used to input the following data collected from each article. After screening for eligibility, each article was coded for type of review according to Grant and Booth's (Grant & Booth, 2009) typology of reviews, and divided into systematized reviews (SRs) and non-systematized reviews (NSRs) according to whether or not they employ a systematized search methodology. The most common types of SRs are systematic or scoping reviews, while NSRs are most commonly referred to as literature reviews, narrative reviews, or critical reviews. SRs had additional data collected as described at the end of this section.

To determine whether grey literature is discussed in each review article, the full-text of the article was searched for the following grey literature keywords: *"grey", "gray", "government", "document", "report", "website", "conference", "clinical trial", "unpublished", "peer review", "peer-review", "dissertation", "thesis",* and *"theses"*. The phrase "peer review" is included as it may imply grey literature, based on the misconception that all grey literature is not peer-reviewed. If a keyword match was found, the paragraph was read to confirm that grey literature is referenced, and the text discussing grey literature was copied to the Google Form.

For all articles, the "References" or "Works Cited" section was reviewed by the author to determine how many grey literature works were cited. Greyness was determined in accordance with the Prague Definition of Grey Literature (Schöpfel, 2010), and if greyness could not be determined based on the citation alone, the original work was consulted whenever possible. The number of grey references and total number of references were recorded, and the list of grey citations was copied in the Google Form.

For systematized reviews, additional data was collected. The list of included studies in the Results section was reviewed and the number of grey items and total items included in the synthesis were recorded. The search strategy was also read and all databases potentially containing grey literature were recorded. A source was not recorded if the eligibility criteria excluded all grey literature, or if it was searched in such a way as to exclude grey literature. Data sources could be named databases (e.g., OpenGrey) or generic methods (e.g., snowball searching or contacting subject matter experts). Generic methods were only counted as a grey literature source if either 1) the review explicitly states the purpose was to find grey/unpublished work, or 2) grey literature was present in the included studies. As such, if a review included snowball searching, but the results included no grey literature and the methods did not otherwise acknowledge trying to find grey literature, the snowball searching was not recorded as a grey literature source.

Coding and Analysis

Data from the Google Form were imported to a Microsoft Access database for cleaning and coding. Data for grey literature sources were standardized to a controlled vocabulary and stored in a related table. For the grey literature discourse analysis, systematized articles were coded as to whether or not they included grey literature in the search strategy, and whether they mentioned grey literature in the article text. Where grey literature was discussed, the text was reviewed and the sentiment to grey literature was recorded as one of the following:

- Positive (e.g., "grey literature was included in order to reduce publication bias")
- Neutral (e.g., "both academic and grey literature sources were searched")
- Negative (e.g., "grey literature was excluded because it was presumed to be of low quality.
- Conflicted (a combination of positive and negative sentiments)

Summary statistics presented in the following section were created through database queries.

Results

The searches yielded 512 hits for the years 2016-2020. After ineligible articles were excluded, a sample of 174 gambling review articles remained. When coded for review type, 100 reviews had a systematized search strategy, while 74 were not systematized.

A summary of the number of reviews by type and year is shown in Table 1. Overall there is a trend in the number of gambling review articles increasing over time, but this is attributable to a spike in non-systematized review articles published in 2020, likely due to an increase in researchers conducting desk reviews during COVID-19 lockdowns. The number of systematized review articles increased slightly from 2016 to 2017 and remained stable thereafter.

Table 1: Gambling review articles retrieved from the Web of Science database by year, divided into systematized reviews (SRs) and non-systematized reviews (NSRs)

Year	SRs	NSRs	All reviews
2016	15	8	23
2017	22	14	36
2018	22	8	30
2019	20	12	32
2020	21	32	53
All years	100	74	174

Do systematized review search strategies include grey literature?

For the sample of 100 SRs, Table 2 shows how often grey literature sources are included in the search strategy. Just over half of the SRs included grey literature (54 of 100). There is no significant trend in grey literature inclusion increasing or decreasing over time, neither in raw numbers of SRs including grey literature or as a proportion of all SRs.

Table 2: Systematized review articles on gambling retrieved from the Web of Science database (n=100), summarized by year and whether grey literature is included in the search strategy.

Year	Includes grey literature	Excludes grey literature	Proportion including grey literature
2016	9	6	0.6
2017	11	11	0.5
2018	14	8	0.64
2019	10	10	0.5
2020	10	11	0.48
All years	54	46	0.54

What grey literature sources are searched?

Across the 54 reviews that included grey sources, 90 different sources were searched. The top 21 sources, which were employed in 4 or more reviews, are listed in Table 3. Of the other 69 sources, 44 were employed in only one review, 18 in two reviews, and 6 in three reviews. The full list of sources searched will be available in the published dataset.

Table 3: The most common sources of grey literature in gambling systematized reviews that search grey literature, 2016-2020 (n=54)

Source name	# of times searched	Source name (cont'd)	# of times searched
Google Scholar	17	GambLib.org	6
Google	12	McGill International Centre for Youth Gambling Problems	5
GREO Evidence Centre	11	[generic] Contact with experts	5
ProQuest Dissertations & Theses	11	Gambling Commission (Great Britain)	5
[generic] Snowball searching	10	Gordon Moody Association	5
Responsible Gambling Council (Ontario)	9	National Problem Gambling Clinic (UK)	5
Open Grey	8	GamCare	5
GambleAware InfoHub	8	WHO International Clinical Trials Registry Platform	4
Alberta Gambling Research Institute (AGRI) Repository	6	Advisory Board for Safer Gambling	4
ClinicalTrials.gov	6	Gamblers Anonymous	4
Victorian Responsible Gambling Foundation	6		

The two most popular grey literature sources were Google and Google Scholar, while several gambling-specific organization websites were also commonly used. A few general grey literature sources were popular, including ProQuest for theses and dissertations, two registries for unpublished clinical trials, OpenGrey for general grey literature, and snowball searching and contacting subject matter experts to find additional (including grey) material.

Figure 1 summarizes how many grey literature sources were searched in each article. Of the 54 systematized review articles that searched grey literature, nearly 60% (32 of 54) only searched one or two grey literature sources, which were most commonly a simple query of Google or Google Scholar or a snowball search of the references in included studies. This is in addition to the remaining 46 systematized reviews that did not search grey literature at all.

However, there were also some thorough grey literature search strategies employed. Seven articles searched over 10 grey literature sources, while three searched over 20. The top five articles by number of grey sources search each represent high quality review methods generally and grey literature search methods specifically, and provide useful models for gambling grey literature inclusion (Beynon et al., 2020a, 2020b; Bramley et al., 2018; Wardle et al., 2019; Yakovenko & Hodgins, 2018).
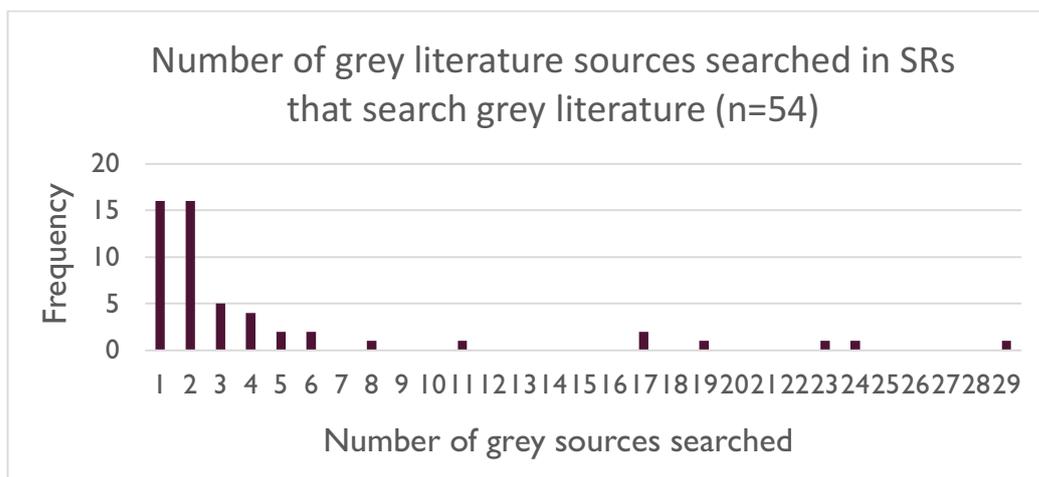

Figure 1: **Distribution of number of grey literature sources searched in gambling systematized reviews that include grey literature, 2016-2020 (n=54)**

To what extent is grey literature cited?

Of the 54 SRs that included grey literature in the search strategy, nearly three quarters (40 of 54) ultimately included one or more grey publication in the included studies. This is encouraging considering that 32 (nearly 60%) of these reviews only searched one or two grey literature sources, so the proportion of gambling review topics for which relevant grey literature exists is likely higher than what is reported here.

When looking at individual studies included in systematic review syntheses, a total of 3961 citations were made. Of these, 353 were citations of grey literature, or approximately 9% of included studies. This increases to 12% when only SRs that included grey literature are considered (352 of 2,385 included studies).

When considering the full references list of gambling reviews, grey literature represents 9% of all works cited (1,257 of 13,728 citations; see Table 4). When broken down by type of review, the proportion ranges from 14% in SRs that include grey literature, to 7% both for SRs that do not include grey literature as well as NSRs. This shows that for all types of

reviews, including systematized reviews that exclude grey literature from the search strategy, there is a certain baseline of grey literature citation in the introduction, methods, and/or discussion sections. However, the total proportion of grey literature cited is much lower than the 26-47% that has been found in systematic reviews of other health domains (Farrah & Mierzwinski-Urban, 2019; Severn et al., 2017), and is also lower than the 18% in a sample of research publications on education (Česarek & Merčun Kariž, 2019).

Table 4: Summary of number of grey literature and total works cited in a sample of gambling review articles (N=174), according to type of review.

Type of article	Grey citations	Total citations	% grey citations
SRs that include grey literature (n=54)	569	4032	14.1%
SRs that exclude grey literature (n=46)	259	3672	7.1%
NSRs (n=74)	429	6024	7.1%
All articles (N=174)	1,257	13,728	9.2%

How is grey literature discussed in gambling review articles?

Within this sample, grey literature is mentioned or discussed in 76 of 100 systematized reviews (76%), and only 6 of 74 non-systematized reviews (8%). It is not expected that grey literature be mentioned or discussed in non-systematized reviews since they normally do not report search methods. Thus, this section will focus on systematized reviews only.

Table 5 summarizes how grey literature is referred to and discussed in gambling systematized reviews. When grey literature is included it is usually acknowledged neutrally, but over one quarter of these articles mention some positive aspect of including grey literature, such as providing additional evidence or reducing publication bias. One review included grey literature but in the study quality assessment scheme assigned grey literature a lower score (Kotter et al., 2019), so this is classified as a negative sentiment. Interestingly, seven reviews included grey literature through a general source such as Google Scholar but did not acknowledge its greyness in any way.

In reviews that did not include grey literature, there were many more articles that did not mention grey literature at all (17 of 46, or 37%). Another 19 articles discussed grey literature neutrally by acknowledging that grey literature was excluded or that only peer-reviewed literature was included, without any reasoning or elaboration. Only one review, the umbrella review by McMahon et al. (2019), provided a neutral methodological justification for excluding grey literature. Only five articles, including one by the present author, were positive about grey literature by acknowledging its exclusion as a limitation of the study, while two were negative in that grey literature was excluded because it was assumed to be of lower quality than academic journal articles. Finally, three reviews were classified as "conflicted" in their sentiment towards grey literature, because they state the exclusion of grey literature was a limitation of the study while simultaneously calling in to question the quality or suitability of grey literature.

Table 5: **Summary of sentiments towards grey literature in gambling systematized review articles (n=100)**

Review type	Sentiment	n	Description or Examples
Grey literature included (n=54)	Positive	14	Grey literature as source of evidence beyond the published literature (n=5) Grey literature addresses publication bias (n=5) Grey literature as a significant source of gambling literature generally (n=1)
	Neutral	32	Specific grey literature sources included and acknowledged as such Sources that include both primary and grey literature (e.g., Google Scholar), acknowledged as a source of grey literature.
	Negative	1	Grey literature included in review but assigned a lower score in the study quality assessment scheme
	N/A	7	Sources that include grey literature (e.g., Google Scholar) are included but not acknowledged as sources of grey literature, and grey literature is not subsequently excluded
Grey literature excluded (n=46)	Positive	5	Grey literature not included but this is noted as a limitation of the study.
	Neutral	19	Grey sources or "non-peer reviewed" sources excluded, with no reasoning given "*Only peer-reviewed articles published in academic journals [are included]*". Grey literature excluded by omission One article, an umbrella review, appealed to previous umbrella reviews only reviewing primary literature (McMahon et al., 2019)
	Negative	2	Appeal to the assumption that journal articles are more rigorous than grey literature as grounds for exclusion. *"To be included as an output to be evaluated, the published paper had to have: [...] (iv) been subjected to peer-review. It was assumed that those studies that had undergone peer-review would be more scientifically rigorous than anything in the "grey" literature"* (Harris & Griffiths, 2018)
	Conflicted	3	Exclusion of grey literature discussed in limitations section, but the quality or suitability of grey literature is also questioned *"The current review was also limited by its inclusion of only peer-reviewed work. It remains possible that books, dissertations, or grey literature could provide more detail [on the topic] given the multi-disciplinary nature of the field. However, these forms of media were excluded to ensure a consistent level of quality throughout the review."* (Barton et al., 2017)
	N/A	17	Grey literature not included nor discussed

Discussion

In previous work we have shown that grey literature constitutes a sizable and unique portion of research produced about gambling (Baxter et al., 2021a). This study extends that previous work by analyzing how that grey literature evidence base is incorporated into knowledge syntheses (i.e., review articles) about gambling. Grey literature was found to play an important role in knowledge syntheses but is perhaps underutilized.

Although grey literature was searched in just over half of systematized reviews on gambling, most of these grey literature search strategies were not comprehensive. Furthermore, the proportion of reviews including grey literature did not increase over the five-year period investigated.

Grey literature represented 9% of the "included" studies in systematized reviews, and this increases to 12.5% when only considering those that included grey sources at all. Grey literature also represented 9% of all works cited across all types of reviews. These figures are lower than results from similar grey literature analyses in other health-related

domains. A study sampling review articles employing Godin et al.'s (2015) grey literature search methodology found that grey literature made up 23% of documents cited (Severn et al., 2017). This figure jumps to 47% for horizon scanning reports on non-drug health technologies (Farrah & Mierzwinski-Urban, 2019), although it is reduced to 33% when excluding manufacturer information, which would have limited applicability in reviews on gambling harm-related topics .

The lower grey literature citation rate in gambling could be because there is simply less relevant grey literature available, but it is likely at least in part due to less thorough methods. In Severn et al.'s (2017) sample a grey literature search methodology and checklist was always used, whereas in the gambling sample grey literature searches were only employed in just over half of systematized reviews, and were usually not thorough. Despite these limitations, at least one relevant grey document was found in nearly three quarters of gambling systematized reviews that searched for it. Taken together this suggests that more relevant grey literature may be found and included in gambling review articles if a grey literature search methodology was applied more often.

The discourse analysis revealed some further concerning results. I have argued that grey literature is relevant to many aspects of gambling harm and thus for most gambling review articles a grey literature search is required for the search strategy to be considered comprehensive. This study found that of 46 systematized reviews that did not include grey literature, 17 did not mention grey literature at all, and of the other 29 only one was judged to give a sufficient methodological justification for its exclusion. The three studies with a "conflicted" position on grey literature are interesting as they demonstrate a tension between understanding of grey literature's value and reservations about its quality.

Thus, it is not only the case that grey literature ought to be included in gambling review articles more often, but also when it is excluded it should be discussed as a limitation of the study, or some methodological reason should be given, even if the reason is that a grey literature search was beyond the scope of the article or the means of the authors.

As this study has focused on academic journal articles, the opportunities for improvement lie with the study authors, journal editors, and peer reviewers. For this reason, attention should be paid to the journals in which gambling research is published. A mapping review of 2,266 articles investigating antecedents to harmful gambling found that gambling research is overwhelmingly published in gambling-specific or addiction journals (Hilbrecht & Baxter, 2021). Similarly, of the 23 "generally of low quality" review articles in the two umbrella reviews on gambling (McMahon et al., 2019; Velasco et al., 2021), all but two were published in a gambling or addiction journal (the exceptions being Williams, West, et al., (2012) and Livingstone et al., (2014)). Although detailed analysis is not presented here, 29% of the systematized reviews in the current study sample were published in gambling journals, while another 31% were published in addiction or behavioural addiction journals, and the rest distributed across psychology, psychiatry, neuroscience, medicine, public health, and social sciences journals. Thus, it is possible that grey literature methods are not as well understood utilized in gambling and behavioural addictions research communities as they are in the broader health research community.

Opportunities for improvement
For researchers writing gambling review articles, it is of course recommended to include grey literature sources in the search strategy. Godin et al.'s (2015) methodology serves as a strong basis for grey literature searches treating gambling as a public health issue, and if a thorough grey literature search is not possible, our previous application of the

methodology (Baxter et al., 2021b) has shown that Greo's International Gambling Research Evidence Centre (Greo, n.d.) and the Alberta Gambling Research Institute Repository (Alberta Gambling Research Institute, n.d.) have strong international coverage and are functional and up-to-date at the time of writing, and are recommended as baseline gambling grey literature sources.

Review methods can also be improved generally through the assistance of an information specialist. A study of general medicine systematic reviews found that those with a librarian coauthor had the highest quality search strategies, and those with a librarian listed in the "Acknowledgements" section were still significantly higher quality than those with no librarian involvement (Rethlefsen et al., 2015). Thus, researchers are encouraged to take advantage of any systematic review services that may be available through their organization's library.

As the value of peer-review has been raised in many gambling systematized reviews excluding grey literature, another method to improve one's review is to seek peer-review from those who are experienced with review methods. Systematic reviews can be preregistered in PROSPERO and some journals will accept review protocols for peer review and publication (e.g., *Systematic Reviews*, see Beynon et al., 2020a, 2020b). Although it is often not feasible to publish a protocol, proactive peer-review for review methods is available through PRESS (Peer Review of Electronic Search Strategies, McGowan et al., 2016). Proactive peer review was encouraged in the original PRISMA statement (Moher et al., 2009), but was expanded to its own reporting item in the 2021 PRISMA-S extension in acknowledgement of its value in reducing errors and potentially increasing the number of included relevant studies (Rethlefsen et al., 2021). Although one study found that peer review only added additional relevant studies in 4% of a sample of rapid reviews (Spry & Mierzwinski-Urban, 2018), the current study suggests that peer review would bring greater benefits to the "generally low quality" systematic reviews on gambling, especially if it resulted in the addition of grey literature sources.

The article in the present sample with the most thorough grey literature search strategy, Beynon et al. (2020a), is an exemplar for all the above recommendations and is available Open Access. It is a protocol published in the journal *Systematic Reviews*, meaning the methods were preregistered and received external peer-review of the search strategy before any searches were performed. It acknowledges that the search strategy was developed by a senior information scientist and internally peer-reviewed by a second information specialist. Not surprisingly, this review protocol has thorough grey literature searches that include the baseline gambling websites recommended above. It is recommended that this protocol be referenced by anyone aiming to perform a high-quality systematic search of gambling literature.

These improvements can likewise be encouraged by peer reviewers and editors of gambling and addiction journals. As peer review normally happens after a review article has been completed, it may not be feasible for a peer reviewer to require revisions that include a comprehensive grey literature search. If there is no grey literature search in a submitted systematic review, peer reviewers could ask for a simple search of the "baseline" gambling databases listed above, or at minimum should require that the exclusion of grey literature be noted as a limitation. Peer reviewers not experienced with systematized review methods should refer to the PRISMA-S reporting guidelines checklist while reviewing (Rethlefsen et al., 2021).

Editors of gambling and addiction journals could provide these guidelines and resources to subject-matter-expert peer reviewers, but can also seek to recruit information

specialists as methodology-expert peer reviewers for systematic review articles. Librarians are an underutilized source of peer-review expertise: A recent survey found that less than a quarter of health librarians had been approached to do peer review, but their reviews almost always result in revisions or rejection based on the search methods, while 95% of those who hadn't been approached said they would (54%) or might (41%) peer review (Grossetta Nardini et al., 2019).

Gambling and addiction journal editors are also encouraged to acknowledge the value of grey literature in editorial policy documents, for systematic reviews as well as an important source of evidence for narrative reviews and research article introductions. The new journal *Critical Gambling Studies* explicitly and positively acknowledges grey literature in the article assessment rubric provided to authors and peer reviewers ("Submissions," n.d.). Editors of other journals may use this as a model and are also encouraged to escalate grey literature guidelines and standards to their peers and communities of practice, such as the International Society of Addiction Journal Editors (ISAJE).

Limitations and further research

This study has noteworthy limitations which present opportunities to build on or further analyze the existing dataset. Firstly, the scope of the study was limited to a five-year period and only one multidisciplinary article database, Web of Science, which was selected because it provided the most relevant bibliographic data. Future analyses could extend the time period and searching more databases. Scopus is recommended as the next scholarly database to include as it has broad and complementary multidisciplinary coverage and the necessary search functions.

It would be remiss and hypocritical to not acknowledge that this review does not itself include grey literature. Although the focus on journal articles provides specific insight into peer review and publishing practices of scholarly journals, there are also many gambling review studies that are published as grey literature reports that are better positioned to inform and influence policy decisions. Thus, it would be valuable to also investigate to what extent grey gambling reviews themselves utilize grey literature and what the opportunities for improvement may be there. Again, the Greo and AGRI gambling grey literature databases provide excellent baseline sources for this investigation.

This study did not differentiate between disciplinary approaches to gambling research other than the preliminary analysis of journals. Further analysis by discipline will be particularly revealing for biological approaches to gambling, such as neuroscientific and animal model studies, which are often published outside the popular journals for gambling (Hilbrecht & Baxter, 2021). In the current study, grey literature inclusion and citation was low in both systematized and non-systematized reviews on these topics. This field of gambling research merits further investigation as it may also have a different yet also underutilized body of grey literature (for example, mainly preprints, conference proceedings, or clinical trials rather than government and institute reports).

A broad variety of grey literature sources were consulted across the reviews in this study, but these were not investigated in detail. An analysis comparing the number and types of grey literature sources searched to the number of relevant grey resources found would provide valuable insight into which grey literature sources are most useful for gambling, and the number of relevant sources that constitutes a sufficiently comprehensive gambling grey literature search.

Finally, future analysis of the dataset could catalogue the individual grey literature items cited in this sample and the number of times each item is cited. This would provide an informative impact assessment as to what grey gambling publications are cited the most often. These data are not readily available for bodies of grey literature as they are for journal articles and can provide insight into the attributes of the most influential and potentially highest quality gambling grey literature.

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