



AKADÉMAI KIADÓ

Journal of Behavioral Addictions

12 (2023) 2, 309–351

DOI:

10.1556/2006.2023.00013

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REVIEW ARTICLE



A scoping review of the association between loot boxes, esports, skin betting, and token wagering with gambling and video gaming behaviors

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Received: September 28, 2022 • Revised manuscript received: February 28, 2023 • Accepted: April 1, 2023

Published online: May 9, 2023

ABSTRACT

Background and aims: Many new digital gambling-like activities such as loot boxes, esports betting, skin betting, and token wagering have recently emerged and grown in popularity. This scoping review aimed to: (a) synthesize the existing empirical research literature on gambling-like activities and their associations with gambling and video gaming behaviors, including problem gambling and video gaming; (b) identify sociodemographic, psychological, and motivational factors associated with engagement in gambling-like activities; and (c) identify research gaps and areas for further research. **Methods:** A systematic search of Ovid, Embase, and ProQuest databases and Google Scholar was conducted in May 2021 and last updated in February 2022. The search yielded a total of 2,437 articles. Articles were included in the review if they were empirical studies that contained quantitative or qualitative results regarding the relationship between gambling-like activities and gambling or gaming. **Results:** Thirty-eight articles met inclusion criteria and were included in the review. Overall, the review results suggest that all forms of gambling-like activities were positively associated with gambling and gaming with small to medium effects. Gambling-like activity participation was also positively associated with mental distress and impulsivity. Gaps identified included a lack of inquiry into skin betting and token wagering, a lack of diversity in the research methods (i.e., mainly cross-sectional surveys), and a paucity of research that includes more ethnically, culturally, and geographically diverse populations. **Discussion:** Longitudinal studies with more representative samples are needed to examine the causal link between gambling-like activities and gambling and video gaming.

KEYWORDS

gambling, video gaming, loot box, esports betting, skin betting, review

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INTRODUCTION

The convergence of gambling and video gaming (hereafter referred to as gaming) has included the introduction of gambling-like activities (GLAs) into video games, such as loot boxes, esports betting, skin betting, and token wagering. These gaming features are highly lucrative to the gaming industry. A market research report by [Juniper Research \(2021\)](#) suggested that loot boxes generated \$15 billion in 2020 and this figure is expected to increase to \$20 billion by 2025. Furthermore, the esports betting market was close to \$10 billion in 2021 and is projected to increase to \$24 billion by 2028 ([Business Research Insights, 2022](#)). There is growing evidence that engagement in GLAs is associated with problematic gambling and gaming ([Kim & King, 2020](#); [Li, Mills, & Nower, 2019](#)). However, the research literature on GLAs and gambling/gaming has often focused on loot boxes, and less is known about the other forms of GLAs ([Macey & Hamari, 2019](#)).

Definition of loot boxes, esports, skin betting, and token wagering

Loot boxes are virtual containers of in-game goods of varying value and desirability, including cosmetic items and performance upgrades ([Zendle & Cairns, 2018](#)). Loot boxes can be obtained in several ways, including with in-game currency, purchased with real-world money, or by completing in-game tasks ([Xiao, 2022](#)). The contents of loot boxes are typically random and not revealed until the box is opened, with the items ranging from cosmetic changes (i.e., skins) to items that may provide a competitive advantage, such as powerful weapon. The chance-based nature of loot boxes has generated comparisons to gambling ([Drummond & Sauer, 2018](#); [Griffiths, 2018](#); [King & Delfabbro, 2018](#)). Additionally, some contents of loot boxes can be transferred or sold to other players for real world money ([Drummond, Sauer, Ferguson, & Hall, 2020](#)), which further blurs the line as to whether loot boxes should be considered a form of gambling. Engagement with loot boxes can include watching online videos of openings, acquisition through regular gameplay, purchase with in-game or real-world currency, and selling the acquired items in online marketplaces ([Macey & Hamari, 2019](#)).

Esports refers to competitive gaming where teams or individual players can compete for prizes, sometimes worth millions of dollars ([Bányai, Griffiths, Király, & Demetrovics, 2019](#)). Esports contain formal structures such as leagues and tournaments (both amateur and professional leagues), which can be viewed via live streams or in-person at stadiums, sharing similarities with traditional sporting events. The formal structure, as well as the competitive aspect of player versus player, have been suggested as fundamental characteristics of esports ([Hamari & Sjöblom, 2017](#)). In the context of the convergence of gambling and gaming, because individuals can bet on the outcome of esports using money, esports betting may in fact constitute gambling. Further complicating the matter, individuals can bet on the outcome

of esports using skins, virtual currency, and items, which blurs the line regarding whether it constitutes gambling or gaming depending on the definition of virtual items having monetary value. Consequently, previous researchers have conceptualized esports betting under the convergence of gambling and gaming ([Greer, Rockloff, Browne, Hing, & King, 2019](#)). Thus, it is not surprising that previous studies have empirically investigated esports betting along with skin betting and loot box purchasing ([Macey & Hamari, 2019](#)). With regard to watching esports, we conceptualized this aspect as a GLA given that video game/esports viewers are often encouraged to engage in these forms of gambling via exposure to marketing of esports betting in esports events and skin betting via online streamers, which could lead to normalization of the two activities ([Greer et al., 2019](#)).

Skins are virtual items that alter the appearance of a player's on-screen character, such as their clothing and equipment. Players can acquire skins through regular gameplay, opening loot boxes, or purchasing them from online marketplaces ([Grove, 2016](#); [Macey & Hamari, 2019](#)). Within a game, skins serve only a cosmetic purpose. It should be noted that not all skins can be used in a gambling context. When used in a gambling context, they are often associated with unregulated third-party providers ([Greer et al., 2019](#)). Skins work in a similar fashion to casino chips, in that they can be traded between the player and the house and cashed out for real-world money ([Grove, 2016](#); [Macey & Hamari, 2019](#)). Skins have been reported to reach values as high as USD \$150,000 ([Kotwani, 2021](#)) and, like traditional gambling, skin betting can be financially beneficial or harmful ([Johnson & Brock, 2019](#)).

Lastly, token wagering involves players placing bets on the outcome of their gaming efforts. Tokens are in-game currencies that are specific to a particular game. Tokens can be obtained through gameplay and, in some instances, can be purchased for real world money. An example of token wagering can be found in the immensely popular multiplayer online battle arena game *DOTA 2*, wherein players can wager their tokens before a match ([Zendle, 2020](#)). If they win, players receive an additional equal number of tokens to those wagered, but if they lose the match, they also lose the number of tokens wagered. The in-game currency has an element of value in that it can be exchanged to improve the attributes or abilities of a player's character ([Zanescu, French, & Lajeunesse, 2020](#); [Zendle, 2020](#)). In contrast to loot boxes and, to some extent, esports engagement and skin betting, token wagering has received very research little focus ([Zendle, 2020](#)).

The link between GLAs and gambling

The introduction of GLAs into video games has allowed for increased and widespread access to gambling-related products. Herein, we use the term GLA to amalgamate various behaviors that have been suggested to blur the line between gambling and gaming. Unlike gambling companies that are



regulated to implement consumer protection tools, there is often zero regulation and consequently no consumer protection for gaming companies that include GLAs. For example, age verification is often not required for websites that offer activities such as skin betting, thus making gambling more readily accessible to underage players (Greer et al., 2019). Even when required to comply with probability disclosures regarding loot boxes, only 2/3 of companies complied, and even when present, disclosures were difficult to access (Xiao et al., 2021). Furthermore, no consumer protection tools related to loot boxes exist for residents of the United Kingdom (UK) despite the fact that in the UK, loot boxes contravene gambling laws (Xiao, Henderson, Nielsen, & Newall, 2022). Unfortunately, it has been suggested that GLAs may introduce and normalize gambling behaviors to vulnerable and naïve populations such as younger players (King & Delfabbro, 2019), as GLAs may serve as their first experiences with gambling-related products (Rockloff et al., 2021). For example, a study by Zendle, Meyer, Cairns, Waters, and Ballou (2020a) revealed that loot boxes were available in approximately 36% of desktop computer games and 94% of mobile games considered appropriate for children as young as 12 years old.

There have been some calls to regulate the availability of GLAs given the robust positive link between GLAs and gambling (Gainsbury, Abarbanel, & Blaszczynski, 2017b; Hing et al., 2021; Rockloff et al., 2021; von Meduna, Steinmetz, Ante, Reynolds, & Fiedler, 2020; Wardle, 2019; Wardle, Petrovskaya, & Zendle, 2020; Wardle & Zendle, 2021). Government responses to regulation have been varied and the topic of regulation regarding the most well-known GLA, loot boxes, is complex. For example, it is a popular misconception that loot boxes were outright banned in Belgium. Rather, loot boxes are legal, so long as they are not provided to underage players (Xiao, 2023). Furthermore, regulations in Belgium have classified paid loot boxes as gambling, and therefore, gaming companies that wish to provide paid loot boxes would need to apply and be approved for gambling licenses to do so (Xiao, 2023). Skin betting has also been subject to regulation in some jurisdictions. In 2017, the Norwegian Gaming Authority classified skin betting as a form of gambling (Abbot, 2017) and, in 2019, Denmark's gambling regulator, Spillemyndigheden, blocked access to 15 websites where skin betting was available (Luongo, 2019). The effective regulation of loot boxes and other GLAs is challenging and may be dependent on the legal definition of gambling (Xiao, 2023). As an example, even in the case where the contents of loot boxes are not transferable, loot boxes are illegal in the Isle of Man given that virtual items are considered to hold monetary value (Xiao, 2023). The debate regarding the regulation of loot boxes may be further compounded by the relative lack of empirical studies examining their addictive potential (McCaffrey, 2019). Furthermore, while recent empirical evidence supports a consistent cross-sectional link between loot boxes and problem gambling, less is known about the links of esports engagement, skin betting, and token

wagering with gambling. Consequently, the aims of this scoping review were to: (a) synthesize the empirical research literature on GLAs and their associations with gambling and gaming behaviors, including problem gambling and gaming; (b) identify sociodemographic, psychological, and motivational factors associated with GLA engagement; and (c) identify gaps and emerging areas that will require further research.

The convergence of gambling and gaming is a relatively recent phenomenon. Yet, there is a growing interest in the potential impact of GLAs on gambling and gaming. Given the burgeoning research in this area, a better understanding of the current landscape will help summarize what is currently known and what is not known regarding the links between GLAs on gambling and gaming. Importantly, this synthesis of knowledge may help inform the future directions of studies regarding the convergence of gambling and gaming to expand our understanding of this growing topic of interest. Moreover, if the synthesized knowledge of the scoping review is strongly suggestive of a link between GLAs and gambling, it may help guide regulators and policy makers in the regulation of these GLAs for consumer protection – not only to reduce the potential links to gambling but also in the mitigation of problematic gaming, which is also associated with significant societal, individual, and interpersonal harms (Carey, Delfabbro, & King, 2021). Additionally, comprehensively examining GLAs may provide a more nuanced understanding of whether certain forms of GLAs (e.g., loot boxes, esports betting) have a greater link than other forms to problematic gambling and gaming.

The present study

The primary objective of the present study was to provide a comprehensive review of the links between GLAs and gambling/gaming. Although previous systematic reviews and meta-analyses (Garea, Drummond, Sauer, Hall, & Williams, 2021; Montiel, Basterra-González, Machimbarrena, Ortega-Barón, & González-Cabrera, 2021; Yokomitsu, Irie, Shinkawa, & Tanaka, 2021) have assessed the link between loot box engagement and gambling and gaming behaviors, the present review provides a comprehensive synthesis of the current knowledge in this rapidly growing area by examining a wider array of GLAs. Scoping reviews are favored over systematic reviews when the aims of the review are to: (1) determine the scope of the literature on a given topic, (2) examine the emerging evidence of a given topic, and (3) examine future gaps (Munn et al., 2018). These stated aims of a scoping review align well with those of the present study. Specifically, the present scoping review was guided by the following research questions (RQs): RQ1: Are GLAs associated with gambling/gaming behaviors as well as problematic gambling/gaming? RQ2: What are the demographic and psychological characteristics associated with engaging in GLAs? and RQ3: What are the research gaps in the study of GLAs and their association with gambling and gaming?



Although social casino games are gambling-like in that they mimic the characteristics of traditional casino games (Gainsbury et al., 2014), they were excluded from the present review for several reasons. First, video games usually require some level of skill, whereas social casino games typically do not. Second, social casino games are specifically designed to simulate traditional forms of gambling (e.g., slots, bingo). Instead, loot boxes, esports betting, skin betting, and token wagering are gambling-like elements that are embedded into games where the primary theme is not gambling-related. There is also precedent for the exclusion of social casino games when studying relationships between gambling and gaming (Delfabbro & King, 2020).

METHODS

The review procedure included the five steps outlined by Arksey and O'Malley (2005), Levac et al. (2010), and Tricco et al. (2018): (a) the research goals were identified, (b) a systematic literature search was conducted to find relevant studies, (c) studies related to the research goals were identified, (d) data from the relevant studies were extracted and charted, and (e) the results were collated, summarized, and reported upon. A review protocol was registered with Open Science Framework (OSF) in May 2021 and updated in November 2021 (<https://osf.io/g9bmw/>).

Search strategy

Database and Google Scholar searches for relevant articles were first conducted in May 2021, followed by updated searches in September 2021 and February 2022 (please see [supplemental materials](#) for results of each search). The Ovid, EBSCO, and ProQuest search strategies are presented in the [Appendices](#). During the Google Scholar search, the first 100 records were screened. Finally, the reference sections of articles deemed eligible for inclusion were reviewed to identify relevant studies.

Study inclusion and exclusion criteria

Published, peer-reviewed journal articles and conference proceedings, and theses and dissertations were included if: (a) the research conducted was empirical, (b) the results of the studies contained a quantitative and/or qualitative measure of the relationship between GLA engagement and gambling and/or gaming behaviors, and (c) the articles were written in English, Hungarian, Korean, or Portuguese (i.e., languages understood by the authors of this article). Any non-English articles were required to include an abstract written in English. Non-empirical research (e.g., reviews, meta-analyses) was excluded.

Article selection

All titles, abstracts, and full-text articles were screened independently by the reviewers, BA, RDL, and JV, who periodically met throughout all screening processes to

discuss and resolve any discrepancies. Moderate to excellent agreement was achieved throughout the screening process including title, abstract, and full-text screen. The exception was for the full-text screen, which achieved only minimal agreement ($\kappa = 0.31$). However, the proportionate agreement was 80.6%. It should be noted that simultaneously low inter-rater reliability and high proportionate agreement are possible, which is known as the kappa paradox (Feinstein & Cicchetti, 1990). When a pair of reviewers were unable to reach consensus, a third reviewer (HSK) aided with making a final decision.

Data extraction and charting

The search strategy yielded a total of 2,138 articles. Ultimately, 38 articles were deemed eligible (see [Fig. 1](#)). BA, RDL, and JV extracted data from the articles, which were summarized to describe the research objectives, sample characteristics, specific GLA(s) studied, gambling, gaming, and GLA engagement measures, and reported relationships between GLA engagement and gambling and/or gaming. Also, where applicable, sociodemographic measures, psychological characteristics, and motivations for GLA engagement and their association with GLAs were extracted (see [Table 1](#)). Furthermore, a narrative summary and thematic analysis of the extracted data are presented to address the goals of this review.

Ethics

This research involved the synthesis of information from an already existing, publicly available knowledgebase, and did not involve the collection of primary data. Therefore, ethics approval was not required.

RESULTS

Characteristics of the selected articles

All 38 articles were published between 2017 and 2022 and written in English. Thirty-five articles came from peer-reviewed academic journals, and one each from a peer-reviewed conference proceeding, an independently peer-reviewed report, and a published thesis. All studies were cross-sectional. Of the 38 articles, 24 assessed loot box engagement, 16 assessed esports engagement, four assessed skin betting, and one assessed token wagering and their associations with gambling and/or gaming behaviors. The relationships between GLA engagement and gambling, and GLA engagement and gaming, were investigated in 34 and 20 studies, respectively.

Most studies were conducted with participants from North America, Australia, and Europe (31 of 38 articles). GLA engagement was examined in 20 studies with adults aged 18 years and older, five studies with adolescents and young adults aged 12–24 years, and four studies with children and adolescents between the ages of 10 and 19 years. One study included adolescents aged 14 years and under,



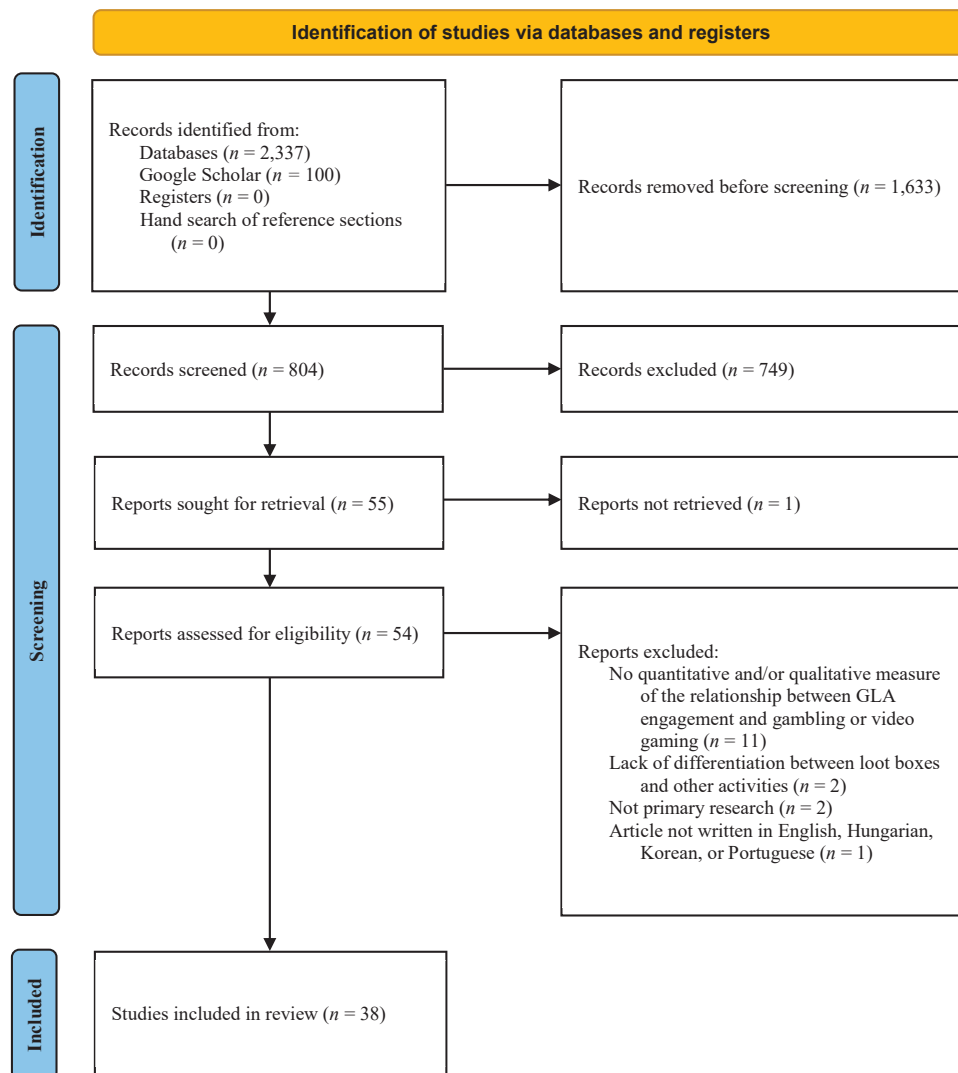


Fig. 1. Flow chart of the search strategy and study selection

and older adults aged 50 years and older, respectively. Three studies included adolescents and adults between 11 and 47 years old. Five studies did not specify age ranges; however, one of these studies included adolescents in grades seven through 12.

Overview of results

Several studies investigated more than one type of GLA, resulting in a total of 42 statistical tests that examined the association between any type of GLA and gambling, of which 40 (95.24%) reported significant positive associations between GLAs and gambling engagement. Specifically, 20 (95.24%) reported a significant relationship between loot box engagement and gambling. Of these studies, six reported a small effect, eight reported a medium effect, and four reported a large effect. Fourteen (93.33%) studies reported a significant relationship between esports engagement and gambling, of which three reported a small effect, four reported a medium effect, and one reported a large effect. Five

studies (100%) reported a significant relationship between skin betting and gambling, of which one reported a small effect, two reported a medium effect, and one reported a large effect. One study (100%) reported a significant relationship between token wagering and gambling with a small effect.

Twenty-three statistical tests examined the association between any type of GLA and gaming, with 20 (86.96%) reporting a significant positive association between GLAs and gaming. Specifically, 10 (83.33%) reported a significant positive association between loot box engagement and gaming. Of these studies, two reported a small effect, six reported a medium effect, and one reported a large effect. Eight studies (88.89%) reported a significant positive association between esports engagement and gaming, of which five reported a small effect, one reported a medium effect, and one reported a large effect. One study (100%) reported a significant positive association between skin betting and gaming with a small effect, and one (100%) reported a significant positive association between token wagering and gaming with a small effect.



Table 1. Summary of included studies ($N = 38$) investigating the relationship between gambling-like activities (loot boxes, esports, skin betting, and token wagering) and gambling/gaming behaviors

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
Abarbanel et al. (2020)	Esports engagement and gaming	Test the relationship between video gaming, esports spectatorship, and esports event wagering behaviors.	Not stated	$N = 1,328$ $n = 140$ esports bettors $n = 1,188$ non-esports bettors Mean age = 37.8 ± 13.6 years Age range = 18 – 80 years 62.2% male Proportion of other genders not specified	Video gaming Frequency of gaming Number of game genres played Social context of gameplay (i.e., alone and/or with others) GLA engagement esports betting (yes or no)	Esports bettors were more likely to play video games once per week and played a wider variety of video game genres.	Esports bettors were more likely to be younger, male, single, have higher incomes, and play video games with others rather than alone. Esports and non-esports bettors did not differ in terms of education level.
Brooks and Clark (2019)	Loot boxes, gambling, and gaming	Examine the relationships between loot box engagement, problem gambling, and gaming involvement.	North American (study 1) Canadian (study 2)	North American sample $N = 144$ Mean age = 34.0 ± 10.0 years Age range not specified 48.6% female Proportion of other genders not specified Canadian Sample $N = 113$ Mean age = 21.0 ± 2.4 years Age range not specified 12.8% female Proportion of other genders not specified	Gambling PGSI Video gaming IGDS GLA engagement RLI	Problem gambling severity and internet gaming disorder severity were positive predictors of risky loot box use in both samples. Risky loot box use was positively correlated with problem gambling severity and problem gaming severity in both samples.	In the North American sample, gender was predictive of risky loot box use (specific gender not stated). Age was not predictive of risky loot box use. Neither age nor gender were predictive of risky loot box use in the Canadian sample.
Carey et al. (2021)	Loot boxes and gaming	Determine whether game features such as loot boxes were related to gaming-related financial harm.	Mainland European (45.6%), North American (31.2%), British or Irish (13.8%), Australian or New Zealander (5.3%), Asian, African, or South American (4.0%)	$N = 471$ Mean age not specified Age range = 18 and older 80.7% male 15.5% female 3.8% of another gender	Video gaming GRHQ GLA engagement Loot box expenditure	Loot box expenditure was positively correlated with gaming-related financial harm, such as reduced savings.	

(continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
Close et al. (2022)	Loot boxes, esports engagement, and gambling	Examine the relationships between loot box expenditure and socioeconomic factors	British	$N = 16,196$ $n = 2,780$ loot box purchasers $n = 13,416$ non-loot box purchasers Mean age not specified Age range = 18 years and older 40.1% male 59.7% female 0.2% prefer not to disclose	Gambling Engagement (yes or no) GLA engagement Loot box purchasing (yes or no) Loot box expenditure Played esports (yes or no)	Compared to gamers who made non-loot box game purchases or did not make any game- related purchases, those who purchased loot boxes were the most likely to gamble. Compared to gamers who had not played esports, those who had were more likely to gamble.	People who had purchased loot boxes were more likely to be younger, male, non-university educated, and unemployed. When loot box expenditure was normalized as a percentage of monthly income spent on loot boxes, lower earners spent a larger proportion of their monthly earnings on loot boxes. No ethnic differences in loot box expenditure were found.
Drummond et al. (2020)	Loot boxes, gambling, and gaming	Examine the relationship between loot box expenditure and problem gambling.	American (37%), Australian (32%), Aotearoa New Zealander (31%)	$N = 1,049$ Mean age = 40.0 ± 15.4 years Age range not specified 63.4% female 35.5% male 0.7% non-binary 0.5% undisclosed gender	Gambling PGSI Video gaming IGDS GLA engagement RLI Loot box expenditure Mood PANAS-SF	Risky loot box use, and loot box expenditure were each positively correlated with problem gambling severity. People categorized as problem gamblers spent more on loot boxes than those categorized as moderate-risk, low- risk, and non-problem gamblers. People with concurrent problem gambling and gaming symptoms spent more on loot boxes than those who scored lower on the PGSI and/or IGDS.	Loot box expenditure was positively correlated with (a) positive mood, (b) negative mood, and (c) psychological distress.

(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
Gainsbury et al. (2017a)	Esports engagement and gambling	Compare the characteristics of online esports gamblers to those who bet on sports over the Internet.	Australian	<i>N</i> = 501 <i>n</i> = 160 esports bettors <i>n</i> = 341 sports bettors Mean age not specified Age range = 18 – 83 years 67.8% male Proportion of other genders not specified	Gambling Frequency of online and offline gambling in the past four weeks	Esports bettors were more likely to gamble at least once per day, and sports bettors were more likely to gamble at least once per week or month.	Esports betting was more likely to occur among those who were younger, female, employed full- time, highly educated, of Asian descent (compared to European), and had higher incomes.
Gainsbury et al. (2017b)	Esports engagement and gambling	Determine whether esports bettors were more likely than sports bettors to experience greater problem gambling severity.	Australian	<i>N</i> = 501 <i>n</i> = 160 esports bettors <i>n</i> = 341 sports bettors Mean age not specified Age range = 18 – 83 years 67.8% male Proportion of other genders not specified	Gambling PGSI Number of gambling types	Esports betting was linked to greater problem gambling severity and participation in more forms of gambling.	In their lifetime, people who had engaged in esports betting had been gambling for a shorter period of time than those who had engaged in sports betting; however, this finding became non- significant after controlling for age.
Garrett et al. (2022)	Loot boxes and gambling	Determine whether there is an interaction between problem gambling severity and income on loot box expenditure.	American (36.9%), Australian (32.3%), Aotearoa New Zealander (30.8%)	<i>N</i> = 1,049 Mean age not specified Age range not specified 63.2% female Proportion of other genders not specified	Gambling PGSI GLA engagement Loot box expenditure	Problem gamblers spent the most money on loot boxes, regardless of income.	Individuals in higher income brackets spent more on loot boxes than those in lower income brackets. Although income was a weaker predictor of loot box expenditure than problem gambling severity, the best model of loot box expenditure included the combined main effects of problem gambling severity and income. An interaction between problem gambling severity and income on loot box expenditure was not found.

(continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
González-Cabrera et al. (2022)	Loot boxes, gambling, and gaming	Examine the prevalence of loot box purchasing and its relationship to online gambling disorder and Internet gaming disorder symptoms.	Spanish	$N = 6,633$ $n = 2013$ loot box purchasers $n = 4,602$ non-loot box purchasers Mean age = 16.9 ± 3.1 years Age range = 11 – 30 years 63.9% male 36.1% female	Gambling OGD-Q Video gaming IGDS9-SF GLA engagement Loot box purchasing (yes or no) Number of loot boxes purchased Loot box expenditure PU-LB	Online gambling disorder and Internet gaming disorder were more prevalent among those who had purchased loot boxes. Adults and minors who had purchased loot boxes reported worse problem gambling and gaming severity than those who had not purchased loot boxes. Problematic use of loot box scores were positively correlated with (a) problem gambling severity, (b) problem gaming severity, (c) the number of loot boxes purchased, and (d) loot box expenditure.	Compared to adults, minors who had purchased loot boxes did so more frequently and spent more money on loot boxes.
Greer et al. (2021)	Esports engagement, skin betting and gambling	Determine whether esports bettors are more likely to experience gambling-related harms and problems than sports bettors.	Australian	$N = 598$ $n = 298$ esports bettors $n = 300$ sports bettors Mean age = 38.9 ± 12.0 years Age range = 18 – 77 years 71.2% male 28.8% female	Gambling PGSI Frequency of participation Number of gambling types SGHS GLA engagement Frequency of esports skin betting (i.e., using skins to bet on esports) Frequency of skin betting	Compared to sports bettors, esports bettors reported worse problem gambling severity, and experiencing a greater number of gambling-related harms. When controlling for age and gender, esports betting was predictive of increased problem gambling severity and gambling-related harm. On average, people who had participated in esports betting participated in fewer	Those who were younger, female, employed full- or part-time, university educated, or spoke a non-English language at home were more likely to participate in esports betting. No group differences in marital status or annual income were found.

(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						types of traditional gambling activities. Participation in esports betting was associated with an increased likelihood of gambling regularly on casino table games, private betting for money, slots/electronic gambling machines, scratch tickets, keno, fantasy sports and a decreased likelihood of gambling regularly on sports betting, lotteries, horse/greyhound racing. The frequency of skin betting a positive predictor of increased problem gambling severity. The frequency of esports cash betting was predictive of a greater frequency of participation in each of the four traditional gambling activities and regular gambling on at least one of these four activities. Esports skin betting was not associated with participation in any of the traditional gambling activities. Greater participation in skin betting was associated with reduced	
Greer et al. (2023)	Esports engagement, skin betting, gambling, and gaming	Assess associations between participation in video gaming, traditional gambling, esports betting, and skin betting.	American (73.0%), British (16.1%), Canadian (9.6%), Irish (1.2%),	$N = 737$ Mean age = 29.0 ± 8.1 years Age range = 18 – 64 years 80.2% male 19.8% female	Gambling PGSI SGHS Frequency of participation in four types of traditional gambling (i.e., EGMs, casino table games, sports betting, and fantasy sports betting). Video Gaming Frequency GLA engagement esports viewing frequency		

(continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
					frequency of using cash to bet on esports (i.e., esports cash betting)	frequency of sports betting. Increased frequency of sports betting was predictive of increased esports cash betting	
					frequency of esports skin betting (i.e., using skins to bet on esports)	frequency and lower frequency of skin betting. None of the traditional gambling activities were predictive of esports skin betting frequency.	
					frequency of skin betting on games of chance such as coin flips and roulette (i.e., skin betting)	The frequency of skin betting was predictive of problem gambling severity and experiencing a larger number of gambling- related harms. Neither esports cash betting frequency nor esports skin betting frequency were predictive of gambling severity or harms. Video gaming frequency was not predictive of esports cash betting frequency, esports skin betting frequency, or skin betting frequency; however, video gaming frequency was positively correlated with esports skin betting frequency and skin betting frequency.	

(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
Hall et al. (2021)	Loot boxes and gambling	Examine the effects of self-isolation and quarantine on loot box expenditure and gaming during the COVID-19 pandemic.	American (81%), Australian (15%), Aotearoa New Zealander (4%)	<i>N</i> = 1,144 Mean age = 31.4 ± 10.5 years Age range = 19 – 80 years 54.1% male 43.6% female 2.3% other gender	Gambling PGSI GLA engagement Loot box expenditure Psychological distress K-10	People identified as problem gamblers spent more money on loot boxes than those whose gambling was categorized as moderate-risk, low-risk, or non-problem. Problem gambling symptomatology was positively correlated with loot box expenditure. This correlation was stronger for those who were self- isolated or quarantined (compared to those who were not).	Loot box spending was positively correlated with psychological distress.
Hing et al. (2021)	Skin betting, gambling, and gaming	Examine the relationships between skin betting and risky or problem gambling among adolescent skin bettors	Australian	Sample 1 <i>N</i> = 843 Mean age Age range = 12 – 17 years 69.3% male 30.6% female 1.0% other gender Sample 2 <i>N</i> = 826 Mean age Age range = 12 – 17 years 44.8% male 55.1% female 0.1% another gender	Gambling DSM-IV-MR-J Number of gambling types GLA engagement DSM-IV-MR-J Video gaming IGDS Impulsivity BIS-Brief	Gambling on poker machines, lotteries, bingo, poker, casino table games, sporting events, fantasy sports games, and informal private betting were each predictive of participation in skin betting in both samples. Gambling on horse or greyhound races, or keno was predictive of skin betting only in sample 2. Participation in skin betting was predictive of at-risk gambling only in sample 2 and problem gambling in both samples. In both samples, meeting	In both samples, skin gamblers were more likely to be Indigenous and reported lower well-being scores. In sample 1, being Indigenous, being employed, having parents that do not live together, reporting lower well-being, and reporting higher impulsivity were each predictive of participation in skin betting. Age and gender were not predictive of skin betting participation. In sample 2, being older, male, Indigenous, employed, and (continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						criteria for internet gaming disorder was predictive of participating in skin betting.	reporting lower well- being were each predictive of participating in skin betting. Neither parental living situation, nor impulsivity were predictive of skin betting participation.
Ide et al. (2021)	Loot boxes and gaming	Examine the relationship between loot box expenditure and problem online gaming.	Japanese	$N = 1,615$ $n = 57$ Loot box purchasers $n = 1,158$ non-loot box purchasers All aged 14 years 63.2% male 36.8% female	Video gaming The nine DSM-5 criteria for gambling disorder restated to assess problem online gaming. GLA engagement Loot box purchasing (yes or no)	Loot box purchasing was associated with an increased likelihood of exhibiting problem online gaming behaviors.	The association between purchasing loot boxes and problem online gaming behaviors was most pronounced among female participants.
Kristiansen and Severin (2020)	Loot boxes and gambling	Explore loot box engagement patterns among young gamers and examine whether different levels and forms of loot box engagement were related to problem gambling.	Danish	$N = 1,137$ $n = 511$ no loot box engagement $n = 399$ earned loot boxes but did not purchase or sell items from the loot box $n = 190$ purchased loot box or key to unlock; did not purchase or sell items from loot box $n = 102$ sold items from loot boxes Mean age not specified Age range = 12 – 16 years 49.4% male 50.6% female	Gambling SOGS-RA GLA engagement Level of loot box engagement	Greater engagement with loot boxes was associated with greater problem gambling severity when controlling for demographic factors. At-risk and problem gambling behaviors were more likely to be exhibited by those who had purchased or sold loot boxes (compared to those who had not engaged in loot boxes, or only obtained them).	The association between loot box engagement and problem gambling was strongest for participants in the 14 – 15- and 16 – 17-year- old age groups. Overall, male gamers were more engaged with loot boxes than female gamers, but a stronger relationship between loot box engagement and problem gambling was exhibited by female players.

(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
Lelonek- Kuleta et al. (2021)	Esports engagement and gambling	Identify predictors of gambling disorder in a sample of esports bettors.	Polish	$N = 438$ Mean age = 33.1 ± 9.27 years Age range = 18 – 64 years 63.0% male 37.0% female	Gambling PGSI Coping Brief COPE	Increased time spent on one esports betting session was associated with problem gambling severity.	Age, gender, relationship status, education level, and income were not predictive of problem gambling. Increased endorsement of escape coping strategies for stress was associated with an increased probability of being a moderate-risk or problem gambler. Increased endorsement of engaged coping strategies for stress was associated with a decreased probability of displaying moderate- risk or problem gambling symptoms.
Li et al. (2019)	Loot boxes, gambling, and gaming	Examine the relationships between loot box expenditure and, problem gaming, and problem gambling behavior.	Not stated	$N = 618$ $n = 273$ loot box purchasers $n = 345$ non-purchasers Mean age = 27.0 ± 8.9 years Age range = 18 years and older 63.7% male Proportion of other genders not specified	Gambling PGSI Frequency of participation Time spent per online gambling session Video gaming IGDS Frequency of participation Time spent per session GLA engagement Loot box purchasing (yes or no) Mental distress BSI-18	Loot box purchasing was directly and positively associated with online gambling frequency, participation in extended online gambling sessions, and problem gambling severity. The link between loot box purchasing and problem gambling severity was also mediated by the frequency of online gambling and participation in extended online gambling sessions. Loot box purchasing was	People who had purchased loot boxes were likely to be older and less likely to be single. Loot box purchasing was associated with increased mental distress through direct and indirect effects on gambling and gaming behaviors (e.g., frequency of extended online gambling and gaming sessions, problem gambling, and gaming severity). Online gambling frequency had a suppressive effect on the association between (continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						directly and positively associated with gaming frequency, participation in extending gaming sessions, and problem gaming severity. The link between loot box purchasing and problem gaming severity was also mediated by gaming frequency and participation in extended gaming sessions. Loot box purchasing was associated with playing a wider variety of video games. Loot box purchasing was associated with a greater likelihood of participating in sports betting, video poker, card games, slots, lotteries, bingo, and other live casino games.	loot box purchasing and mental distress.
Macey and Hamari (2018)	Esports engagement, gambling, and gaming	Examine the relationships between engagement in esports viewing, gambling, and gaming.	Not stated	N = 613 Mean age not specified Age range = 14 years and younger to 50 years and older Modal range = 18 – 21 years 91.4% male 6.2% female 0.7% other gender	Gambling PGSI Habits ^a Video gaming GAS Habits ^a GLA engagement esports habits ^a	Direct, positive associations were found between esports viewing habits and (a) online gambling habits, and (b) video gaming habits. Online gambling habits mediated the relationship between esports viewing habits and increased problem gambling severity.	

(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						An association between esports viewing habits and (a) offline gambling and (b) problem video gaming severity was not found.	
Macey and Hamari (2019)	Esports engagement and gambling	Provide an overview of esports and video game-related gambling, and their association with gambling behaviors.	American (35.6%), British (7.9%), Finnish (7.0%), Canadian (6.7%), German (4.6%), Australian (3.1%), other nationalities (33.2%)	<i>N</i> = 582 Mean age not specified Age range not specified 91.9% male 5.5% female 0.7% another gender	Gambling PGSI Gambling consumption ^c GLA engagement esports consumption ^c Loot box consumption ^c	Increased esports spectatorship was linked to increased online gambling. Online and offline betting were positively associated with esports engagement. Playing lotteries was negatively associated with esports engagement.	
Macey et al. (2020)	Esports engagement, gambling, and gaming	Examine the role of demographics, gambling, esports viewing, and video game consumption in predicting esports betting.	American (97.9%); other nationalities (2.1%; not specified)	<i>N</i> = 1,368 Mean age = 37.8 years (<i>SD</i> not specified) Age range = 18 – 80 years 58.4% male Proportion of other genders not specified	Gambling PGSI Consumption ^b Video gaming Consumption ^c GLA engagement esports consumption ^d esports betting engagement (yes or no)	Gambling consumption was directly and positively associated with esports betting. Spectating on esports was associated with esports betting. There were no associations between video game consumption and esports betting.	Esports viewing was associated with younger age and male gender. Esports viewing and betting were not associated with educational attainment, income level, or marital status.
Macey et al. (2021)	Loot boxes, esports engagement, gambling, and gaming	Examine associations between esports viewing and betting, skin betting, and gambling and behaviors.	Not stated	<i>N</i> = 255 Mean age not specified Age range = 12 – 47 years 79.2% male 18.4% female 1.6% of another gender 0.8% undisclosed gender	Gambling Engagement (yes or no) Frequency of participation Time spent gambling Video gaming Time spent gaming	Time spent playing video games was predictive of loot box purchasing. Time spent, and frequency of watching esports events were positive predictors of participation in gambling activities. Time spent playing video	Age was negatively associated with esports betting. Gender was associated with esports betting (the specific gender was not stated). Male gender was positively associated

(continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
					GLA engagement Time spent watching online esports events Frequency of watching esports Frequency of esports betting Loot box purchasing (yes or no)	games was a statistically significant predictor of esports betting; however, the direction of this link was unclear.	with participation in skin betting.
Marchica et al. (2021)	Esports engagement, gambling, and gaming	Test the relationships between esports betting, problem gambling, problem video gaming, and externalizing and internalizing problems among adolescent gamers.	American	$N = 1,348$ Mean age = 14.7 ± 1.7 years Age range not specified 64.0% male The proportion of other genders not specified	Gambling NODS-CLiP Frequency of participation Video gaming IGDS Frequency of participation Internalizing and externalizing behaviors PSS	A link between esports betting and problem gambling was not found. Participation in esports betting was directly and positively associated with increased problem video gaming severity.	Adolescents who participated in more frequent esports betting reported increased problem video gaming severity, which in turn, was associated with increased internalizing (e.g., depression, anxiety, low self- esteem) and externalizing (e.g., conduct problems, inattention and/or hyperactivity) problems.
Nicklin et al. (2021)	Loot boxes, gambling and gaming	Investigate motives for loot box engagement.	British	$N = 28$ adult video gamers Mean age = 28.3 ± 9.1 years Age range = 18 – 56 years 67.9% male 32.1% female	Gambling PGSI Video gaming IGDS GLA engagement Loot box expenditure Reported motives for engagement	Loot box purchasing was not consistently associated with high PGSI scores. Four participants met criteria for moderate-risk gambling and three participants met criteria for problem gambling. Only one participant met criteria for both	Motives endorsed for loot box engagement included financial incentives (e.g., earning in-game currency), aesthetics/cosmetics, game advancement, desire to beat a game more quickly or easily, the necessity for game advancement,

(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						problem gambling and internet gaming disorder. Endorsement of urges, temptation, or lack of control of loot box expenditure was not consistently associated with high IGDS scores.	enhancement of the gaming experience, support for the game developers, charity, improvement of social status or self-esteem, influence from others to purchase, socialization, temptation or lack of control, boredom or escapism, the offer of promotions and time-limited events, and ease of purchase.
Purias (2021)	Loot boxes, gambling, and gaming	Assess the relationship between engagement in loot boxes and endorsement of gambling-related cognitions around chance and luck	Canadian	$N = 600$ Mean age = 26.2 ± 9.2 years Age range = 18 years and older 30.5% male 68.8% female 0.7% undisclosed	Gambling PGSI BGLS GamCog Motives (open-ended question) Video gaming IGDS GLA engagement Loot box use frequency RLI Loot box engagement motives Impulsivity ABIS	Greater problem gambling severity, problem gaming severity, BGLS scores, and GamCog scores were each positively correlated with greater risky loot box use. Purchasing loot boxes was associated with increased problem gambling and gaming. Having sold loot boxes for profit was associated with greater problem video gaming severity, but not problem gambling severity. Participants who spent time specifically to earn loot boxes reported worse problem gambling and gaming severity than those who did not.	Greater risky loot box use was correlated with greater attentional impulsiveness. Endorsed motives for gaming with loot boxes included enjoyment, the chance to win, and game progression. Some participants endorsed engaging with loot boxes passively with no specific motivation. Some participants noted that loot boxes coincidentally appear in the games they play, and some indicated that although they engage with loot boxes, they dislike doing so. Endorsed reasons for not engaging with loot boxes included lack of

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Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						Gamblers endorsed greater belief in dispositional luck than loot box users. The degree to which gamers believed in dispositional luck did not differ from gamblers or loot box users. Gamblers and gamers who had used loot boxes did not differ on their endorsement of gambling-related cognitive distortions. The frequency of loot box use was not correlated with GamCog or BGLS scores.	accessibility (e.g., not knowing what loot boxes are, not encountering loot boxes in the games they play), negative consequences, disinterest (e.g., lack of interest in games that contain loot boxes, believing loot boxes are a scam), and financial motives (e.g., not wanting to spend money on loot boxes).
Richard et al. (2021)	Esports betting, gambling, and gaming	Examine associations between esports betting, and disordered gambling and gaming, as well as clinical correlates of esports betting in a youth sample.	American	$N = 6,580$ $n = 296$ esports bettors $n = 551$ sports bettors $n = 896$ other gamblers $n = 4,761$ non-gamblers Mean age = 14.7 ± 1.8 years Age range = 10 – 19 years 50.1% male 49.9% female	Gambling NODS-Clip Gambling frequency Number of gambling activities Gaming IGDS-SF9 Substance use frequency Mental Health PSS	Compared to those who were categorized as sports bettors, other gamblers, and non-gamblers, those who were categorized as esports bettors gambled more frequently, participated in a larger number of gambling activities, were more likely to be at-risk for problem gambling, and were more likely to reach the threshold for disordered gaming. Predictors of participation in esports betting included greater symptoms of problem gambling or gaming	Male gender and greater mental health symptomatology were positive predictors of participation in esports betting; however, age and ethnicity were not. Participants categorized as esports bettors were more likely to report symptoms of severe or intense mental health problems. Compared to other gamblers and non-gamblers, those who were categorized as esports bettors engaged in more frequent binge drinking, more frequent alcohol, cigarette,

(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						and greater frequency of playing video games.	marijuana, non- medicinal benzodiazepine, and non-medicinal stimulant use, and more frequent caffeinated energy drink consumption.
Rockloff et al. (2021)	Loot boxes and gambling	Investigate the relationship between loot box engagement (i.e., opening, purchasing, and selling) and gambling-related harms and problems.	Australian	<i>N</i> = 1,954 Mean age not specified Age range = 12 – 24 years 59.9% female Proportion of other genders not specified	Gambling (adults) PGSI SGHS ATGS Gambling (adolescents) DSM-IV-MR-J Intentions to gamble as adults GLA engagement Played games containing loot boxes (yes or no) Opened loot boxes (yes or no) Purchased loot boxes (yes or no) Sold loot boxes (yes or no)	Adult men Playing video games with loot boxes and opening loot boxes were not correlated with gambling frequency, expenditure, severity, or harms. Purchasing and selling loot boxes were positively correlated with gambling frequency, severity, and harms. Neither purchasing nor selling loot boxes were correlated with gambling expenditure. Adult women Playing video games with loot boxes, opening loot boxes, and purchasing loot boxes were each positively correlated with gambling frequency, expenditure, severity, and harms. Selling loot boxes was positively correlated with gambling frequency, expenditure, and severity, but was	Adult men Playing video games containing loot boxes and opening, purchasing, or selling loot boxes were not correlated with attitudes towards gambling. Adult women Playing games containing loot boxes and purchasing and selling loot boxes was correlated with more positive attitudes towards gambling. Adolescent boys Playing games containing loot boxes and opening, purchasing, or selling loot boxes were not correlated with attitudes towards gambling. Adolescent girls Opening and selling loot boxes was correlated with more positive attitudes towards gambling. Neither playing games containing loot boxes, nor opening loot boxes (continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						not correlated with gambling-related harms. Adolescent Boys Purchasing loot boxes was positively correlated with problem gambling severity; however, playing video games with loot boxes, opening loot boxes, and selling loot boxes were not correlated with future intent to gamble or problem gambling severity. Adolescent Girls Opening, purchasing, and selling loot boxes were each positively correlated with problem gambling severity; however, playing games with loot boxes was not correlated with future intent to gamble or problem gambling severity.	were correlated with attitudes towards gambling.
Russell et al. (2021)	Loot boxes, esports engagement, skin betting, and gambling.	Examine associations between early experiences with engagement in emerging gambling- like technologies, including but not limited to loot boxes, esports, and skin betting, and gambling-related harm.	Australian	$N = 2,004$ $n = 1,089$ younger cohort (i.e., 18- to 24-year-olds) $n = 915$ older cohort (i.e., 25-to-29-year- olds) Mean age = 23.7 ± 3.6 years Age range = 18 – 29 years 37.0% male	Gambling PGSI NODS-CLiP GLA engagement Loot box opening (yes or no) Loot box purchasing (yes or no) Loot box purchasing frequency	Opening and purchasing loot boxes, playing, watching, and betting on esports, and participating in skin betting during participants' lifetime were all positively associated with greater gambling-related harm. More frequent opening and purchasing of loot	The younger cohort was more likely to have opened or purchased a loot box, and participated in skin betting in their lifetime. The younger cohort was likelier to have played esports, whereas the older cohort was likelier to bet on esports. No age differences were (continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
				62.3% female 0.7% other	Esports playing (yes or no) Esports viewing (yes or no) Esports betting (yes or no) Skin betting (yes or no) Age of GLA engagement onset Monthly expenditure on GLAs Impulsivity BIS-Brief	boxes, playing, watching, and betting on esports, and participation in skin betting were all associated with greater gambling-related harm. An onset of loot box opening and purchasing, watching and playing esports, and skin betting before 18 years of age were each negatively associated with past 12- month gambling- related harm. Esports betting before the age of 18 years was not associated with past 12- month gambling- related harm. No such associations were found for lifetime gambling- related harm. Lifetime and past-year participation in the opening or purchasing of loot boxes, watching, playing or betting on esports, and skin betting were each correlated with greater gambling-related harm. Monthly expenditure on purchasing loot boxes, watching or betting on esports, and skin betting did not differ between age groups.	found for watching esports. The younger cohort was more likely to have first opened or purchased a loot box, watched, played, or bet on esports, or participated in skin betting before the age of 18 years.

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Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						Past 12-month frequency of purchasing loot boxes and watching esports was more strongly associated with past 12-month gambling-related harm for the older cohort. The associations between each GLA and gambling-related harm remained statistically significant when controlling for age, impulsivity, and participation in traditional gambling games.	
Sanmartín et al. (2021)	Loot boxes and video gaming	Determine whether the use of loot boxes is associated with guilt, loss of control, and emotional distress.	Spanish	$N = 475$ $n = 266$ adolescents $n = 209$ adults Mean age = 19.3 ± 6.2 years Age range = 11 – 38 years 65.0% male 35.0% female	GLA engagement Loot box purchasing (yes or no) Loot box expenditure Emotions associated with loot box purchasing Video gaming Time spent playing	Time spent playing video games was not associated with loot box expenditure. Although participants who gamed regularly or excessively spent more money on loot boxes than those who gamed casually, the difference was not statistically significant.	Adolescents spent more money on loot boxes than adults. When video game companies announced new content (e.g., skins), increased loot box purchasing was reported by 42% of gamers; however, no statistically significant differences in purchasing were found between adolescents and adults. After seeing loot boxes advertised on online multimedia platforms, 37% of participants reported having felt a need to purchase them. Half of these

(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
							participants went on to purchase loot boxes; however, no statistically significant differences in purchasing were found between adolescents and adults. Adults reported greater feelings of guilt after purchasing loot boxes than adolescents. No statistically significant differences were found for loss of control or emotional distress. Socioeconomic status was not associated with the level of spending on loot boxes. Feeling the need to purchase loot boxes after seeing them being opened on online multimedia platforms did not differ between adolescents and adults. Furthermore, feeling this need was not predictive of loot box purchasing. Failure to obtain desired items after purchasing a loot box was predictive of increased feelings of guilt and distress. Obtaining desired items after purchasing a loot box was predictive of feelings of loss of control.

(continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
Spicer et al. (2022)	Loot boxes, gambling, and video gaming.	Determine whether gateway effects (i.e., loot box purchasing leading to subsequent gambling and vice versa) exist, and the extent to which such effects are associated with risks and harms.	British	<i>N</i> = 1,102 Mean age not specified Age range = 18 years and older Gender distribution not specified	Gambling Age of onset Monthly expenditure PGSI GRCS RLI Reverse gateway effects (i.e., whether gambling influenced the decision to purchase loot boxes) GLA Age first loot box was purchased RLI Forward gateway effects (i.e., whether purchasing loot boxes influenced the decision to gamble) Monthly expenditure Video gaming IGDS Impulsivity BIS-Brief	The proportion of participants who had gambled before purchasing loot boxes did not differ significantly from those who had purchased loot boxes before gambling. Participants who endorsed forward or reverse gateway effects spent more money on gambling and endorsed greater gambling- related harm, gambling- related cognitions, problem video gaming, and risky loot box use.	Participants who felt that loot box purchasing led to subsequent gambling were more likely to have been under 18 years old when they first purchased a loot box. Male players were more likely than female players to report forward gateway effects; however, there was no difference between the proportion of male and female players who reported reverse gateway effects. Participants who endorsed forward or reverse gateway effects reported greater levels of impulsivity. Impulsivity was not associated with loot box expenditure but was positively associated with risky loot box engagement. Participants who endorsed forward or reverse gateway effects did not have a higher income than those who did not report such effects. Self-reported reasons for forward gateway effects included (a) sensation- seeking (i.e., replicating the excitement associated with loot (continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
							boxes in a different format); (b) normalization (i.e., transitioning to gambling or loot box purchasing occurred because of similarities between the activities); (c) loot box use altering attitudes and perceptions of gambling; (d) gambling serving as a way to satisfy the addictiveness of purchasing loot boxes; and (e) transitioning from loot boxes to gambling to make real money. The age at which participants first purchased a loot box differed based on forward gateway reasons. Those who had endorsed addiction and normalization were the youngest; however, accurate post-hoc analyses could not be conducted. There were no significant differences between forward gateway reasons, and the age participants had first gambled. Self-reported reasons for reverse gateway effects included (a) sensation (continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
							seeking (i.e., replicating the excitement associated with gambling in a different format); (b) normalization (i.e., transitioning to loot box purchasing occurring because of its similarities to gambling); (c) a perception that loot boxes are a safer form of gambling; (d) gambling creating false perceptions about the reality of purchasing loot boxes; and (e) loot boxes serving as a way to satisfy the addictiveness of gambling. The age at which participants first purchased a loot box or gambled did not differ based on reported reverse gateway reasons. Those who had purchased loot boxes were more likely to be younger and male; however, age and gender were not associated with purchasing frequency. Income level was not related to the likelihood or frequency of loot box purchasing.
von Meduna et al. (2020)	Loot boxes and gambling	Examine the relationship between loot box purchasing and gambling problems, and understand factors that influence this relationship in a representative sample of adult Internet users.	German	$N = 1,508$ $n = 582$ loot box purchasers $n = 922$ non-loot box purchasers Mean age = 36.7 years (<i>SD</i> not specified) Age range = 18 years and older 55.3% female 44.7% male	Gambling PGSI GLA engagement Loot box purchasing (yes or no) Loot box purchasing frequency	Loot box purchasing and loot box purchasing frequency were positive predictors of both gambling expenditure and problem gambling. Online horserace and sports betting were positively and negatively associated with loot box purchasing, respectively.	(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						Gambling on lotteries and casino games were positive predictors of loot box purchasing frequency.	Lower educational attainment and being employed was associated with an increased likelihood and frequency of loot box purchasing.
Wardle (2019)	Skin betting and gambling	Examine the relationship between skin betting and engagement in traditional forms of gambling, the influence of sociodemographic and economic factors on this relationship, and rates of at-risk and problem gambling in relation to engagement in skin betting.	British	N = 2,881 adolescents Mean age not specified Age range = 11 – 16 years Gender distribution not specified	Gambling DSM-IV-J-MR Frequency of participation GLA engagement Frequency of skin betting	Compared to those who had gambled (but not with skins), those who had gambled and participated in skin betting engaged in more gambling types. On its own, skin betting was not associated with at-risk or problem gambling. Engagement in skin betting plus other gambling types was linked to increased rates of at-risk and problem gambling. Participation in online betting and playing slot machines were each associated with engagement in skin betting. Playing lotteries, scratch cards, bingo, or private games were not.	Rates of skin betting rose with age. Boys were more likely than girls to bet with skins. The likelihood of participation in skin betting did not differ based on ethnicity, academic performance, or receipt of free school meals. Adolescents who had engaged in both skin betting and other gambling activities reported worse academic achievement.
Wardle et al. (2020)	Esports engagement, gambling, and gaming	Study the characteristics of adolescent and young adult esports bettors.	British	N = 3,549 n = 104 esports bettors n = 584 sports bettors n = 829 other gamblers n = 2,033 non-gamblers Mean age not specified Age range = 16 – 24	Gambling PGSI Frequency of participation Video gaming Frequency of participation	Participation in esports betting was linked with increased gambling frequency and engagement in more types of gambling compared to	Esports betting was more likely to occur among those who were older and male, from non-White ethnic groups, students who resided in more deprived areas,

(continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement and exhibited higher levels of impulsivity.
				years 51.0% male 49.0% female	GLA engagement esports betting (yes or no) Impulsivity EIS	participation in sports betting. Participation in esports betting was associated with higher rates of problem gambling. People who had engaged in esports betting were more likely to play video games more than once per week than those who engaged in sports betting or had not gambled at all. The frequency of gaming was not significantly associated with the likelihood of participating in esports betting	
Wardle and Zendle (2021)	Loot boxes and gambling	Explore the relationship between loot box purchasing and problem gambling among adolescents and young adults, and examine the influence of sociodemographic, economic, and personality traits on this relationship.	British	$N = 3,549$ $n = 412$ loot box purchasers $n = 3,072$ non-loot box purchasers $n = 65$ unsure Mean age not specified Age range = 16 – 24 years 51.3% male 48.7% female	Gambling PGSI Engagement (yes or no) Frequency of participation Expenditure GLA engagement Loot box purchasing (yes or no)	People who had purchased loot boxes were more likely to have gambled on any form of gambling, spend more money on gambling, and exhibit problem gambling behaviors.	People who had purchased loot boxes were more likely to be younger, male, and impulsive. When controlling age, sex, and ethnicity, the link between loot box purchasing and problem gambling was strengthened. Further controlling for impulsivity and different gambling activities weakened this link; however, the link remained significant. (continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
Zendle (2020)	Loot boxes, esports engagement, token wagering, gambling, and gaming	Assess the relationship between various GLAs and both problem gambling and gaming.	British	<i>N</i> = 1,081 Mean age not specified Age range = 18 years and older 48.7% male 50.8% female 0.5% of other genders	Gambling PGSI Frequency of participation Video gaming IGDS GLA engagement Loot box expenditure Frequency of watching loot box openings Engagement in esports betting (yes or no) Frequency of esports betting Engagement in token wagering (yes or no) Frequency of token wagering	Loot box spending, watching loot box openings, esports betting, and token wagering were positively correlated with problem gambling and problem gaming. Loot box spending, esports betting, and token wagering were each positively correlated with gambling on bingo, games of skill for money, slots, and table casino games. Only esports betting was correlated (positively) with horse race betting.	
Zendle and Cairns (2018)	Loot boxes and gambling	Investigate the relationship between loot box expenditure and problem gambling.	American (44%), British (8%), Canadian (7%), other nationalities (36%), undisclosed nationality (5%)	<i>N</i> = 7,442 Mean age not specified Age range = 18 years and older 89.1% male 9.4% female 1.5% other gender or undisclosed	Gambling PGSI GLA engagement Loot box expenditure	Loot box expenditure was associated with increased problem gambling severity.	
Zendle and Cairns (2019)	Loot boxes and gambling	Test the link between loot box purchasing and problem gambling.	American	<i>N</i> = 1,172 Mean age not specified Age range = 18 years and older 64.1% male 31.7% female 4.3% of other genders	Gambling PGSI GLA engagement Loot box purchasing (yes or no) Loot box expenditure	Loot box expenditure was positively correlated with problem gambling classification. Symptoms of low-risk, moderate-risk, and problem gambling were linked to greater loot box expenditure than	

(continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						non-problem gambling behaviors. Differences were not found between those whose gambling behaviors were categorized as low-risk, moderate-risk, and problem.	
Zendle, Meyer, & Over (2019)	Loot boxes and gambling	Examine loot box features that may moderate the relationship between loot box expenditure and problem gambling and investigate motives for purchasing loot boxes.	Not stated	$N = 1,155$ $n = 468$ loot box purchasers $n = 687$ non-loot box purchasers Mean age = 17.2 years \pm 0.8 years Age range = 16 – 18 years 88.3% male 9.3% female 2.4% of another gender	Gambling CAGI GLA engagement Loot box purchasing (yes or no) Loot box expenditure How quickly loot boxes had been purchased after starting a game Impulsivity Author-compiled questions	Loot box purchasing and increased expenditure were associated with worse problem gambling severity. The provision of time-limited loot box items and free loot boxes strengthened the link between loot box spending and problem gambling. The ability to (a) cash out, (b) use loot box contents for gameplay advantage, (c) use in-game currency to purchase loot boxes, and (d) showing near misses were significant moderators of the relationship between loot box spending and problem gambling. This finding was significant at $p < 0.05$, but not at the α -level specified by the authors ($p < 0.0041$).	A positive correlation between loot box spending and impulsivity was found. This finding was significant at $p < 0.05$ but not at the α -level specified by the authors ($p < 0.0041$) Endorsed motivations for purchasing loot boxes included achieving gameplay advantages, obtaining specific items and characters, creating a collection, the fun, excitement, or thrill of opening loot boxes, cosmetics, supporting the game developers a perception that loot boxes are good value, game advancement, and the ability to make a profit off of the items.

(continued)





Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
Zendle et al., 2020b	Loot boxes and gambling	Examine the relationship between loot box engagement and problem gambling and determine whether the availability of various features strengthen the link between loot box expenditure and problem gambling.	Not stated	<i>N</i> = 1,200 <i>n</i> = 749 loot box purchasers <i>n</i> = 451 non-loot box purchasers Mean age not specified Age range = 18 years and older 60.8% male 37.1% female	Gambling PGSI GLA engagement Loot box purchasing (yes or no) Loot box expenditure	<p>The ability to re-invest loot box items into other loot boxes was not a significant moderator of this relationship.</p> <p>People who had purchased loot boxes reported greater problem gambling severity and spent more money on loot boxes than those who had not purchased loot boxes.</p> <p>The ability to (a) cash out in in-game and/or externally hosted marketplaces, (b) trade loot box items, and (c) use in-game currency to purchase loot boxes strengthened the relationship between loot box spending and problem gambling.</p> <p>Problem gambling severity was positively correlated with the amount of money made by selling loot boxes.</p> <p>Moderation analyses shows that making money by selling loot boxes weakened the loot box spending-problem gambling relationship.</p> <p>The relationship between loot box spending and problem gambling remained significant</p>	

(continued)

Table 1. Continued

Author(s), year	Activities assessed	GLA-related study objective	Sample nationality	Sample characteristics	Measures	Relationships between GLA engagement and gambling and/or gaming	Other participant characteristics associated with GLA engagement
						regardless of the presence of (a) pay-to- win features, (b) near- misses when purchasing loot boxes, (c) crate and key mechanics, and (d) exclusive items.	

ATGS = Attitudes Towards Gambling Scale; BIS-Brief = Barratt Impulsiveness Scale – Brief; Brief-COPE = Coping Orientation to Problems Experienced Inventory; BSI-18 = Brief Symptom Inventory; CAGI = Canadian Adolescent Gambling Inventory; COVID-19 = coronavirus disease 2019; DSM-5 = Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; DSM-IV-MR-J = juvenile multiple-response version of the DSM-IV criteria for pathological gambling; EIS = Eysenck Impulsivity Scale; GAS = Game Addiction Scale; GRHQ = Gambling-Related Harm Questionnaire (modified to assess gaming); IGDS = Internet Gaming Disorder Scale; IGDS9-SF = Internet Gaming Disorder Scale-Short Form; PANAS-SF: Positive and Negative Affect Scale – Short Form; PGSI = Problem Gambling Severity Index; PSS = Ohio Scales Youth Problem Severity Scale; K-10 = Kessler Psychological Distress scale; NODS-CLIP = NORC DSM-IV Screening for Gambling Problems; OGD-Q = Online Gambling Disorder Questionnaire; PU-LB = Problematic Use of Loot Boxes Questionnaire RLI = Risky Loot Box Index; SGHS = Short Gambling Harm Screen; SOGS-RA = South Oaks Gambling Screen Revised for Adolescents.

^aHabits = aggregate measure of the frequency of participation, average weekly hours of participation, and average monthly expenditure.

^bGambling consumption = an aggregate measure of the frequency of participation, average hours spent playing per session, and the average expenditure per session.

^cVideo game consumption = an aggregate measure of the frequency of participation, average hours spent playing per session, and the social context of gameplay.

^desports consumption = an aggregate measure of the frequency of esports viewing, average hours spent viewing per session, social context of viewership, and the type of esports broadcast (i.e., live or pre-recorded).

^eConsumption = an aggregate measure of the frequency of participation, average weekly hours participating, and average monthly expenditure.



Several demographic characteristics were associated with engaging in GLAs including age, gender, marital status, ethnicity, language, education, and income. Regarding psychological characteristics, positive and negative affect, mental distress, and impulsivity were commonly associated with GLAs. Excitement was the most common motive identified for engaging in loot boxes; no studies examined motivations to engage in other forms of GLAs.

Loot box engagement and gambling

In terms of purchasing loot boxes, [Close, Spicer, Nicklin, Lloyd, and Lloyd \(2022\)](#) reported that compared to people who had not purchased loot boxes, those who had were more likely to gamble. Loot box expenditure was reported to be positively correlated with gambling frequency ([Garrett, Sauer, Drummond, & Lowe-Calverley, 2022](#); [Li et al., 2019](#); [Rockloff et al., 2021](#)). Also, an increased frequency ([von Meduna et al., 2020](#)) and likelihood ([von Meduna et al., 2020](#); [Wardle & Zendle, 2021](#)) of loot box purchasing was associated with increased gambling expenditure. Furthermore, [Russell et al. \(2021\)](#) reported that purchasing and opening loot boxes were positively correlated with gambling-related harm. Effect sizes of the association between purchasing loot boxes and gambling ranged from small to medium.

In exploring the relationship between watching loot box openings and problem gambling severity, [Zendle \(2020\)](#) reported that individuals who had watched pre-recorded or live online openings were likelier to engage in problem gambling behaviors. In terms of loot box purchasing and problem gambling, the majority of studies reported a positive association between the two ([Brooks & Clark, 2019](#); [Drummond et al., 2020](#); [González-Cabrera et al., 2022](#); [Hall, Drummond, Sauer, & Ferguson, 2021](#); [Kristiansen & Severin, 2020](#); [Li et al., 2019](#); [Rockloff et al., 2021](#); [von Meduna et al., 2020](#); [Wardle & Zendle, 2021](#); [Zendle, Cairns, Barnett, & McCall, 2020](#); [Zendle et al., 2019, 2020b](#), [Zendle & Cairns, 2018, 2019](#)) with mostly medium effect sizes. [Nicklin et al. \(2021\)](#) did not find a statistically significant relationship between loot box purchasing and problem gambling. Factors that strengthened the loot box-gambling link included time-limited loot box items, free loot boxes, near misses, and cash-out and trading opportunities ([Zendle, Meyer, & Over, 2019](#); [Zendle, Cairns, Barnett, and McCall \(2020b\)](#)). [Rockloff et al. \(2021\)](#) reported a positive correlation between selling loot boxes and problem gambling severity, whereas [Purias \(2021\)](#) did not find a statistically significant link. Interestingly, [Zendle et al. \(2020b\)](#) reported that the amount of money made from selling loot box items weakened the link between loot box spending and problem gambling severity. [Kristiansen and Severin \(2020\)](#) reported that gamers who had purchased or sold loot box items were more likely to engage in risky gambling behaviors than those who had simply obtained loot boxes or had not engaged with them at all. Additionally, two studies reported that risky loot box use – which includes experiences such as the endorsement of loot boxes being the cause of one's problems and the belief that obtaining

loot boxes is an effective way to generate money – was correlated with increased problem gambling behavior ([Brooks & Clark, 2019](#); [Drummond et al., 2020](#)) with medium effect sizes. Lastly, [Spicer et al. \(2022\)](#) examined the presence of gateway effects between loot box purchasing and gambling. The authors reported that participants who endorsed experiencing gateway effects between the two activities reported greater risky loot box use and greater problem gambling severity, regardless of whether they perceived that their gambling led to subsequent loot box purchasing or vice versa.

Loot box engagement and video gaming

In a sample of esports spectators and bettors, the time they spent playing video games positively predicted loot box purchasing ([Macey et al., 2021](#)). [Li et al. \(2019\)](#) reported that loot box purchasing was linked to increased gaming frequency and participation in extended gaming sessions (i.e., lasting seven hours or longer). Conversely, [Sanmartín et al. \(2021\)](#) did not find a statistically significant link between loot box expenditure and time spent gaming. In terms of gaming-related harm and severity, watching loot box openings was positively associated with problem gaming symptoms, and purchasing loot boxes was linked to experiencing gaming-related financial harm such as reduced savings ([Carey et al., 2021](#)) and increased problem gaming severity ([Ide et al., 2021](#); [Li et al., 2019](#); [Zendle, 2020](#)) with medium effect sizes. [Brooks and Clark \(2019\)](#) and [Drummond et al. \(2020\)](#) reported that risky loot box use was positively correlated with problem gaming severity, with medium to large effect sizes. However, in a study that involved in-depth interviews with a small sample of gamers, [Nicklin et al. \(2021\)](#) reported that “those who described feeling urges, temptation, or lack of control over their loot box purchasing were not consistently characterised by high scores on gaming ... symptom scales” (p. 15).

Esports engagement and gambling

[Macey and Hamari \(2018; 2019\)](#) reported that esports spectatorship was positively associated with participation in online (but not offline) gambling, with medium effect sizes. [Macey et al. \(2021\)](#) reported that the amount of time spent on, and the frequency of viewing esports events were positive predictors of gambling participation, with medium and small effect sizes, respectively. Furthermore, engaging in esports was also related to an increased likelihood of gambling participation ([Close et al., 2022](#)). Regarding problem gambling behaviors, [Macey and Hamari \(2018\)](#) reported that esports viewing engagement (measured as an aggregate of the frequency of participation, average weekly hours of participation, and average monthly expenditure) was directly and positively related to online gambling participation, which in turn, was directly and positively related to problem gambling severity with medium effect sizes. [Russell et al. \(2021\)](#) also reported that the frequency of esports spectatorship was positively associated with experiencing gambling-related harm.



Regarding the relationship between esports betting and gambling, Macey, Abarbanel, and Hamari (2020) reported that esports betting was positively associated with an aggregate measure of gambling engagement with a medium effect size. Five studies compared gambling behaviors among esports bettors and non-esports bettors (Gainsbury, Abarbanel, & Blaszczynski, 2017a; Greer, Rockloff, Russell, & Lole, 2021; Richard, Ivoska, & Derevensky, 2021). These studies reported that esports bettors gambled more frequently, participated in more forms of gambling, and experienced more gambling-related harms. Effect sizes were reported only by Gainsbury et al. (2017a), who found a small effect. Also, a link between participation in esports betting and an increased likelihood of exhibiting problem gambling behaviors was found in six studies (Gainsbury et al., 2017b; Greer et al., 2021; Lelonek-Kuleta & Bartczuk, 2021; Richard et al., 2021; Wardle et al., 2020; Zendle, 2020) with effect sizes ranging from small to large.

Esports engagement and video gaming

Esports spectatorship and gaming were investigated in two studies. Macey and Hamari (2018) found that esports viewing habits positively predicted gaming habits (each defined as an aggregate measure of the frequency, time, and money spent on the activity), but did not find a statistically significant association between esports viewing habits and problem gaming severity.

Regarding esports betting and gaming, two studies indicated that esports bettors played a wider variety of games and gamed more frequently than non-esports bettors (Abarbanel et al., 2020; Wardle et al., 2020). Greet et al. (2022) and Wardle et al. (2020) each reported that the likelihood of engaging in esports betting was not related to gaming frequency. Conversely, Richard et al. (2021) reported that gaming frequency was a positive predictor of participation in esports betting. Lastly, in terms of problem gaming behaviors, both Marchica et al. (2021) and Zendle (2020) reported that participation in esports betting was positively associated with problem gaming severity with small effect sizes, and Richard et al. (2021) noted that compared to non-esports bettors, esports bettors were more likely to report symptoms of disordered gaming.

Skin betting, token wagering, gambling, and video gaming

Wardle (2019) reported that on its own, skin betting was not associated with at-risk or problem gambling. However, participation in skin betting, along with traditional forms of gambling, was linked to participation in a larger number of gambling activities and increased rates of at-risk and problem gambling. Similarly, Hing et al. (2021) reported that the symptoms of at-risk and problem gambling were positive predictors of engaging in skin betting. Moreover, Greer et al. (2021) reported that greater frequency of skin betting was a predictor of increased problem gambling severity among a sample of esports bettors with a medium effect size. In a later study, Greer et al. (2023) assessed the use of skins to bet on

esports (i.e., esports skin betting), and the use of skins to bet on games of chance, such as coin flips and roulette. The authors reported that esports skin betting was not associated with participation in traditional forms of gambling, such as electronic gambling machines and sports betting, and that participation in traditional gambling activities was not predictive of esports skin betting frequency. However, the frequency of sports betting was predictive of skin betting on games of chance. Furthermore, the frequency of skin betting on games of chance was a positive predictor of being an at-risk gambler and experiencing a greater number of gambling-related harms with small effect sizes.

In terms of gaming behaviors, Greer et al. (2023) reported that gaming frequency was not predictive of engaging in esports skin betting or skin betting on games of chance. Regarding problem gaming severity, Hing et al. (2021) noted that symptoms of internet gaming disorder were a positive predictor of skin betting participation with a medium effect size. Lastly, token wagering was positively correlated with problem gambling and problem gaming severity (Zendle, 2020), with small effect sizes.

Characteristics of gambling-like activity participants

Demographic characteristics. Several demographic characteristics were associated with both increased loot box and esports engagement, but with mixed results. For example, while several studies reported that loot box and esports engagement were associated with younger age (Abarbanel et al., 2020; Gainsbury et al., 2017a; Greer et al., 2021; Macey et al., 2020, 2021; Russell et al., 2021; von Meduna et al., 2020; Wardle & Zendle, 2021), other studies reported that older players were more likely to engage with loot boxes (Li et al., 2019) and esports (Wardle et al., 2020) or did not find statistically significant relationships (Brooks & Clark, 2019; Richard et al., 2021). Similar to the findings regarding age, the relationships between loot boxes and esports with gender were also inconsistent. Specifically, while some studies found an association between male gender and loot box and esports engagement (Close et al., 2022; Macey et al., 2020; von Meduna et al., 2020; Wardle & Zendle, 2021), other studies did not find gender differences (Lelonek-Kuleta & Bartczuk, 2021; von Meduna et al., 2020). Interestingly, two studies reported that the link between loot box engagement and problem gambling was strongest among female players (Kristiansen & Severin, 2020; Rockloff et al., 2021). Two studies also reported that women were more likely to gamble on esports than men (Gainsbury et al., 2017a; Greer et al., 2021). Relationships between other demographic characteristics such as marital status, ethnicity, education, employment status, and income with loot box and esports engagement were also found, but with inconsistent results (Close et al., 2022; Greer et al., 2021; von Meduna et al., 2020).

Regarding the demographic characteristics of skin betting, older age (Hing et al., 2021; Wardle, 2019), male gender (Hing et al., 2021; Wardle, 2019), and identification as being Indigenous (Hing et al., 2021) were associated with



skin betting. Demographic differences in relation to token wagering were not examined.

Psychological characteristics. Psychological characteristics were examined in 10 studies. Loot box purchasing was related to increased positive and negative mood (Drummond et al., 2020), psychological distress (Drummond et al., 2020; Hall et al., 2021; Li et al., 2019), and impulsivity (Wardle & Zendle, 2021; Zendle et al., 2019). Moreover, Purias (2021) and Spicer et al. (2022) reported that risky loot box use was positively associated with impulsivity, although loot box purchasing was not statistically significantly associated with impulsivity (Spicer et al., 2022).

Regarding esports betting, Marchica et al. (2021) reported that among a sample of adolescents, participation in esports betting was indirectly associated with increased levels of internalizing (e.g., depressive) and externalizing (e.g., problematic conduct) behaviors. Wardle et al. (2020) found greater levels of impulsivity among people who had participated in esports betting compared to other forms of betting, including traditional sports betting. Lastly, skin betting was associated with increased levels of impulsivity in a sample of adolescents with a small effect size (Hing et al., 2021). Psychological correlates of token wagering were not investigated.

Motivations for GLA engagement. GLA engagement motives were examined only in terms of loot boxes, in four studies (Nicklin et al., 2021; Purias, 2021; Spicer et al., 2022; Zendle et al., 2019). Across all four studies, excitement (i.e., enhancement) motives were among the most reported motives for loot box engagement and are also commonly reported motives for engaging in gambling (Dechant, 2014; Stewart & Zack, 2008). Other common motives for engaging in loot boxes were related to gaming motives, including the desire to obtain valuable in-game items and competitive advantages in the game through the acquisition of powerful items. Lastly, among people who reported that their loot box purchasing led to subsequent gambling, participants' self-identified reasons for this trajectory included wanting to replicate the excitement experienced with loot boxes in a different format (i.e., sensation-seeking), perceived similarities between loot box purchasing and gambling (i.e., normalization), loot box use causing altered attitudes and perceptions about gambling, gambling functioning to satisfy the addictiveness of loot box purchasing, and wanting to make real money via gambling (Spicer et al., 2022).

Recommendations for policy and regulation

Some articles in this review included recommendations for policy and regulatory practices that could reduce the potential for consumers to experience GLA-related harms, which are summarized below.

Regarding loot boxes, harm reduction strategies were proposed that placed responsibility on the consumer, the video game industry, and government agencies. Kristiansen and Severin (2020) endorsed strategies recommended by Brooks and Clark (2019) and Drummond et al. (2020),

including providing users with loot box exclusion options and the ability to set pre-commitment spending limits so that players can identify a maximum amount of money they are willing to spend on loot boxes before starting a game. Additionally, Kristiansen and Severin (2020) suggested reducing the ability to purchase loot boxes and reducing online marketplace structures to decrease opportunities to sell loot boxes, which would require cooperation between governmental bodies and the gaming industry and potential legislation that would restrict loot box features in video games. Nicklin et al. (2021) suggested that limiting the coverage of loot box openings in videos created by online streamers and professional gamers may be beneficial. Calls were also made for rating agencies such as the Entertainment Software Ratings Board (ESRB) or Pan European Game Information (PEGI) to make game content more transparent for consumers. Suggestions included attaching advisories and content descriptors for loot boxes and implementing age limits to restrict minors from playing games with paid loot boxes (González-Cabrera et al., 2022; Zendle et al., 2019, 2020b; Zendle & Cairns, 2019). Furthermore, Zendle et al. (2019) suggested that loot boxes be defined and regulated as gambling at the government level.

In terms of esports betting, Gainsbury et al. (2017b) suggested consumer protection measures be implemented, such as providing spending limits, cooling-off periods during which betting cannot take place, and more permanent self-exclusion options. Greer et al. (2021) proposed the development of educational programs and awareness campaigns to improve stakeholders' understanding of the convergence of video gaming and esports.

Regarding skin betting, Greer et al. (2021) and Hing et al. (2021) proposed suggestions such as requiring skin betting operators to hold gambling licenses, implementing strict age restrictions and age verification processes, and penalizing operators who do not comply. Hing et al. (2021) also recommended increasing awareness among parents of children about the risks associated with skin betting and its illegality in some jurisdictions, as well as teaching parents how to discourage their children from participating in skin betting. No recommendations were provided for token wagering.

DISCUSSION

The present review found that engagement in GLAs is generally positively associated with gambling and gaming behaviors, including problem gambling and problem gaming symptoms. Although most studies demonstrated a link between GLAs and both problem gambling and gaming, the results should be interpreted with caution, given the methodological limitations of the research. Firstly, all studies retrieved were cross-sectional, which precludes conclusions about the directionality of the GLA-gambling/gaming relationship. Having said that, two longitudinal studies of loot boxes have been published after the scoping review (Brooks



& Clark, 2023; González-Cabrera et al., 2023), in which loot box engagement at baseline was predictive of gambling at follow-up. These results provide preliminary support that loot boxes may increase the risk of gambling in the future. Yet, important questions remain. For example, are the individuals who migrate to gambling those who would have done so regardless of their exposure to loot boxes? Future studies that employ a longitudinal design with a matched cohort (i.e., those already at risk of gambling) would be beneficial in further teasing out the potential role of loot boxes in the migration to gambling. While recent research has investigated the link between loot boxes and migration to gambling prospectively, none have done so for the other GLAs reviewed in the present study.

It is important to note that most people gamble without experiencing problems. Consequently, even when GLAs influence the transition to gambling, it is important to be cognizant that this does not necessarily mean that individuals will experience gambling problems. Future research that investigates the unique role that GLAs have on *problematic* gambling would be informative. In the present review, engaging in GLAs was consistently associated with problematic gaming. Yet, it is unknown whether engaging in GLAs is predictive of problematic gaming or whether problematic gamers are more drawn to gambling-like features given the absence of longitudinal studies in this area. In addition to the relative lack of longitudinal studies, there was a lack of experimental studies. While previous lab-based studies suggest that, as with gambling, loot box openings result in physiological arousal (Larche, Chini, Lee, Dixon, & Fernandes, 2021), there was a clear lack of experimental studies investigating the impact of GLAs on gambling and gaming. Future studies that experimentally manipulate exposure to various GLAs and measure its impact on subsequent gambling and gaming behavior would be informative. Additionally, ecological momentary assessments would be informative in investigating the temporal association between GLAs and problematic gambling/gaming over time, in addition to providing much needed knowledge on the antecedents and potential consequences of engaging in GLAs.

Secondly, most studies used convenience sampling, with only three using a representative sample. Although convenience sampling allows for easier recruitment of the sample of interest, this limits the generalizability of results to the broader population of individuals who engage in GLAs. Relatedly, only one study was conducted with a non-Western sample, which also reported a link between loot box engagement and gaming. Therefore, more research on ethnically, culturally, and regionally diverse populations is needed to improve understanding of factors that may impact associations between GLA engagement, gambling, and gaming behaviors. Indeed, gaming is a global phenomenon and most gamers reside in non-Western countries (Clement, 2022). There are also important jurisdictional considerations that may influence the link between GLAs and gambling/gaming. For example, in some jurisdictions, gambling is partially prohibited (e.g., Brazil, Korea; Maia & Picchi, 2022;

Oksanen et al., 2021) while in others, gambling/gaming may be more culturally accepted. Furthermore, the differing societal attitudes toward gambling and gaming may also impact the characteristics of gamers who engage in GLAs in non-Western countries as well as the links between GLAs and gambling/gaming.

Several papers included in the review made recommendations for the regulation of GLAs. However, we caution that regulation and policy recommendations are complex and involve multiple stakeholders and there are ongoing debates regarding regulation. For instance, legislation in Belgium posits that loot boxes are a form of gambling regardless of whether their rewards carry real-world monetary value and restricts consumers from accessing loot boxes unless they are offered by a licensed gambling operator (Xiao, 2021). However, some researchers have critiqued the Belgian approach as an example of the potential over-regulation of loot boxes (Xiao, 2021), given that it has forced many game companies to pull out of the Belgian market completely due to the low feasibility of obtaining gambling licenses. In turn, this paternalistic approach has barred many Belgian consumers entirely from accessing certain games and has stifled the creative output and economic potential of the affected game companies (Xiao, 2021). China has taken a different approach to regulation and instead mandates that game companies disclose to players their probability of winning a reward from a loot box (Xiao et al., 2022). However, this approach has also been critiqued because it has not been shown to significantly reduce the amount of money players spend on loot boxes (Xiao et al., 2022). As a potential alternative, Xiao et al. (2022) have suggested that game companies consider adopting a public health approach to loot box regulation. This would involve shifting responsibility away from the player and onto the companies in modifying the accessibility and features of the potentially harmful products they are selling (Xiao et al., 2022). For example, this could include restricting the sale of loot boxes by companies as well as limiting the amount of money that companies are able to receive from each player, restricting the number of loot boxes available in a single game, and/or removing the possibility of receiving a duplicate item to reduce the risk of chasing a novel reward (Xiao et al., 2022).

Limitations

The conclusions drawn from the present scoping review may be limited for the following reasons. First, the positive associations between GLAs and gambling and gaming may not be as strong in frequency or magnitude as found in our scoping review, given that non-significant findings are less likely to be published in the literature. Second, given the heterogeneity in the GLAs assessed and the measurement of gambling and gaming, we did not conduct a meta-analysis to provide a quantitative summary of the results. Lastly, we investigated esports betting regardless of whether it was done with real world money or with virtual items. It could be argued that betting on the outcome of esports with real



money can be conceptualized as gambling. Consequently, assessing the demographic profiles and risk of gambling problems among esports bettors who wager real-world money versus virtual items would be informative.

CONCLUSION

This review provides a synthesis of the current research literature that has examined the relationship between participation in GLAs and gambling and/or gaming behaviors. What these GLAs all have in common is that individuals may become exposed to gambling-like mechanics through their involvement in video games rather than through involvement in traditional gambling activities. There was consistency in the finding that GLAs were associated with greater engagement in gambling and gaming, with 95.2% and 87.0% of studies reporting small-to-moderate positive statistical associations between GLAs and gambling and gaming, respectively. To strengthen the available evidence of the link between GLAs and gambling/gaming, future research requires greater variety in methodological designs, including longitudinal research with representative samples and a focus on more diverse populations (e.g., ethnocultural, geographical) to improve understanding of the relationship between GLA participation and gambling/gaming behaviors.

Funding sources: This research was funded by the Alberta Gambling Research Institute (AGRI; Grant #88). ZD's contribution was supported by the Hungarian National Research, Development and Innovation Office (KKP126835).

Authors' contribution: This study was conceptualized and designed by HSK, SHS, DLK, ZD, JC, ALMA, HT, and DCH. RDL and BA conducted the investigation process. RDL prepared the original draft of the manuscript. All authors contributed to reviewing and editing the manuscript and approved the final draft.

Conflict of interest: HSK has received scholarships from the Alberta Gambling Research Institute (AGRI). He has also received grants and from the Alberta Gambling Research Institute and Gambling Research Exchange Ontario in the past three years. ELTE Eötvös Loránd University receives funding from Szerencsejáték Ltd. (the gambling operator of the Hungarian government) to maintain a telephone helpline service for problematic gambling. The University of Gibraltar receives funding from the Gibraltar Gambling Care Foundation, an independent, not-for-profit charity. None of these funding sources aren't related to this study, and the funding institution had no role in the study design or the collection, analysis, and interpretation of the data, the writing of the manuscript, or the decision to submit the paper for publication. ZD is Editor-in-chief of the Journal of Behavioral Addictions. RDL is the recipient of scholarships from AGRI that have supported her master's and doctoral

research, and has also received salary support from AGRI. HT has received grants from the Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq – (National Council for Scientific and Technological Development) for the concession of Productivity Grant Process CNPq 304767/2011-5; concession of the resource for the Universal Project Research Aid in the Process CNPq 445465/2014-0, Federal Bank of Brazil (CAIXA): worked from March/2015 to August/2017 as a responsible gambling consultant for the national lottery products under Contract #3800/2015 and Process #7066.01.0168.01/2015, World Lottery Association: member of the Independent Assessment Panel for the responsible gambling certification from October/2015 to February/2016, and Serasa-Experian: by granting resource contract with no number for the development of debt management and financial education for young couples' program during 2014. DCH receives partial salary support from the Alberta Gambling Research Institute and has received conference travel funds from the International Conference on Behavioral Addictions, Nordic Conference on Gambling, New Horizons, Responsible Gambling Council, V Congresso Clínica Psiquiatria, National Centre for Responsible Gambling conference, and the Gambling Addiction, Science, Independence, and Transparency, 4th International Symposium. On this topic, he has received grants from the Alberta Gambling Research Institute and the Canadian Centre of Substance Use and Addiction. DLK is an associate editor of the Journal of Behavioral Addictions. BA, SHS, ALMA, and JSC declare no conflict of interest.

Acknowledgements: We thank Kelly Dermody for assisting with the development of our search strategy, and Jenna Vieira (JV) for assisting with the article screening and data extraction process.

SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at <https://doi.org/10.1556/2006.2023.00013>.

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Appendix A

Ovid APA PsycINFO, MEDLINE, and Embase Search Strategy

1. exp Gambling Disorder/OR exp Gambling/
2. (gambl* OR "problem gambl*" OR "gambl* problem*" OR "disorder* gambl*" OR "gambl* disorder*" OR "gambl* addiction*").mp.
3. exp computer games/OR exp games/OR exp digital gaming/OR exp role playing games/OR exp simulation games/OR exp video game
4. ("video gam*" OR videogam* OR "internet gam*" OR "online gam*").mp.
5. exp Internet Addiction/
6. ("online gaming* addiction*" OR "internet gaming* addiction*" OR "internet gaming disorder*" OR "problem* internet use" OR "gaming disorder*" OR "video gaming disorder*" OR "videogaming disorder*" OR "gaming addiction*" OR "videogaming addiction*" OR "disordered gaming" OR "disordered video gaming" OR "disordered videogaming" OR "problem* gaming" OR "problem* video gaming" OR "problem* videogaming" OR "gaming problem*" OR "video gaming problem*" OR "videogaming problem*" OR nintendo OR xbox OR x-box OR playstation OR steam OR console OR PC).mp.
7. ("loot box*" OR "loot crate*" OR "loot prize*" OR "lock box*" OR "prize box*" OR "mystery box*" OR chest* OR prize* OR treasure*).mp. microtransaction* OR micro-transaction*.mp.
8. (skin* OR "skin* bet*" OR "skin* lotter*" OR "skin* gambl*").mp.
9. (esport* OR e-sport* OR "electronic sport*" OR "esport bet*" OR "e-sport bet*" OR "electronic sport* bet*" OR "esport spectat*" OR "e-sport spectat*" OR "electronic sport* spectat*" OR "esport* gambl*" OR "e-sport* gambl*" OR "electronic sport* gambl*" OR "competitive gam*").mp.
10. ("gambling-like" OR "gambling-like practice*" OR "gambling-like activit*" OR "gambling-like behav*" or "gambling-like experienc*").mp.
11. (twitch OR youtube OR "youtube gaming" OR "instagib tv" OR "smashcast tv" OR hitbox OR azubu OR mixer OR beam OR vimeo OR dailymotion OR ustream OR mirrativ OR periscope).mp.
12. 1 OR 2
13. 3 OR 4 OR 5 OR 6
14. 7 OR 8 OR 9 OR 10 OR 11 OR 12
15. 13 AND 14 AND 15

Appendix B

EBSCO CINAHL, and Academic Search Complete Search Strategy

1. (MH "Gambling") OR (gambl* OR problem gambl* OR gambling problem* OR disorder* gambl* OR gambl* disorder* OR gambl* addiction*)

2. (MH "Video Games") OR (video gam* OR videogam* OR internet gam* OR online gam*)
3. (MH "Internet Addiction") OR (online gaming* addiction* OR internet gaming* addiction* OR internet gaming disorder* OR problem* internet use OR gaming disorder* OR video gaming disorder* OR videogaming disorder* OR gaming addiction* OR videogaming addiction* OR disordered gaming OR disordered video gaming OR disordered videogaming OR problem* gaming OR problem* video gaming OR problem* videogaming OR gaming problem* OR video gaming problem* OR videogaming problem* OR nintendo OR xbox OR x-box OR playstation OR steam OR console OR PC)
4. (loot box* OR loot crate* OR loot prize* OR lock box* OR prize box* OR mystery box* OR chest* OR prize* OR treasure)
5. (microtransaction* OR micro-transaction*)
6. (skin* OR skin* bet* OR skin* lotter* OR skin* gambl*)
7. (esport* OR e-sport* OR electronic sport* OR esport bet* OR e-sport bet* OR electronic sport* bet* OR esport spectat* OR e-sport spectat* OR electronic sport* spetat* OR esport* gambl* OR e-sport* gambl* OR electronic sport* gambl* OR competitive gam*)
8. (gambling-like OR gambling-like practice* OR gambling-like activit* OR gambling-like behav* OR gambling-like experienc*)
9. (twitch OR youtube OR "youtube gaming" OR "instagib tv" OR "smashcast tv" OR hitbox OR azubu OR mixer OR beam OR vimeo OR dailymotion OR ustream OR mirrativ OR periscope)
10. S2 OR S3
11. (S4 OR S5 OR S6 OR S7 OR S8 OR S9)
12. (S2 OR S3) AND (S4 OR S5 OR S6 OR S7 OR S8 OR S9) AND (S1 AND S10 AND S11)

Appendix C

ProQuest Theses and Dissertations, and ABI Business Premium Collection¹ Search Strategy

1. (Gambling OR gambl* OR "problem gambl*" OR "gambling problem*" OR "disorder* gambl*" OR "gambl* disorder*" OR "gambl* addiction*" OR "gambling-like" OR "gambling-like practic*" OR "gambling-like activit*" OR "gambling-like behav*")
2. ("video game" OR "video gam*" OR videogam* OR "internet game*" OR "internet gaming" OR "online game*" OR "online gaming" OR "Internet addiction*" OR "online gaming* addiction*" OR "internet gaming* addiction*" OR "internet gaming disorder*" OR "problem* internet use" OR "gaming disorder*" OR "video gaming disorder*" OR "videogaming disorder*" OR "gaming addiction*" OR "videogaming addiction*" OR

¹The following source type limits were applied to the ABI Business Premium Collection search: dissertations and theses, reports, and scholarly journals only.



- “disordered gaming” OR “disordered video gaming”
OR “disordered videogaming” OR “problem* gaming”
OR “problem* video gaming” OR “problem* video-
gaming” OR “gaming problem*” OR “video gaming
problem*” OR “videogaming problem*” OR nintendo
OR xbox OR x-box OR playstation OR steam OR console
OR PC)
3. ab(microtransaction* OR micro-transaction* OR “skin*
bet*” OR “skin* lotter*” OR “skin gambl*” OR esport*
OR e-sport* OR “electronic sport*” OR “esport* bet*”
OR “e-sport* bet*” OR “electronic sport* bet*” OR
“esport* spectat*” OR “e-sport* spectat*” OR “elec-
tronic sport* spectat*” OR “esport* gambl*” OR “e-
sport* gambl*” OR “electronic sport* gambl*” OR
“competitive gam*” OR “loot box*” OR “loot crate*”
OR “loot prize*” OR “lock box*” OR “prize box*” OR
“mystery box*”)
4. 1 AND 2 AND 3