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FULL-LENGTH REPORT



Young people who purchase loot boxes are more likely to have gambling problems: An online survey of adolescents and young adults living in NSW Australia

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ABSTRACT

Background and aims: Loot boxes are a common feature in video games where players win, buy or are gifted a virtual box or other container that is unwrapped to reveal virtual items of value, such as skins, weapons, in-game currency or special abilities. The current study aimed to relate the use of loot boxes to gambling problems and harm. *Methods:* An online survey was conducted with 1,954 adolescents and young adults from NSW Australia, 59.9% female (aged 12–24), recruited by online panel aggregator, Qualtrics. *Results:* Buying and selling loot boxes was associated with higher 12-month gambling frequency and gambling problems in young adults, aged 18–24 (Problem Gambling Severity Index). Young adults who bought loot boxes additionally had more gambling-related harms (Short Gambling Harms Screen). Young women, aged 18–24, who opened, bought and/or sold loot boxes spent more money in the last 12 months on gambling. In adolescents, aged 12–17, buying loot boxes was similarly associated with gambling problems (DSM-IV-MR-J). Furthermore, adolescent girls who bought and/or sold loot boxes viewed gambling more positively than other girls (Attitudes Towards Gambling Scale). There was no evidence, however, that longer-term experience in opening or purchasing loot boxes, a differentiating feature of the survey, is associated with current gambling problems. *Discussion and conclusions:* This study suggests that loot boxes may be attractive to people who are already predisposed to engage in other gambling, and females who use loot boxes may have unique vulnerabilities to gambling problems that could be explored in future research.

KEYWORDS

gaming, games, video games, online gaming, loot boxes

INTRODUCTION

As an integral feature of many modern video games, loot boxes offer players the chance to digitally unwrap a container that contains a random virtual prize (Rockloff et al., 2020; Zendle, Meyer, Cairns, Waters, & Ballou, 2020). This construction makes loot boxes structurally similar to a lucky dip prize or trading cards, where a prize is guaranteed but it has unknown value prior to unboxing. Importantly, these virtual prizes are “owned” such that they can be used in subsequent play sessions, which distinguishes them from power-ups that are also common in video games.

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When purchased, rather than received for free or as a skilled-play achievement, loot boxes are arguably a gambling product (Drummond, Sauer, Hall, Zendle, & Loudon, 2020). Money is risked based on a chance outcome for a prize of uncertain value (Devereux, 1979). Loot boxes bear an even closer functional relationship to gambling products when the prizes contained therein can be redeemed for cash (Drummond & Sauer, 2018). Some video game developers allow prizes to be sold back to the developer or sold to other players in a supported marketplace. Loot box prizes in other games can be sold on a third-party website, and some skins won in loot boxes can be used as a virtual currency for online gambling. In most cases entire game accounts, including prizes won from loot boxes, can be sold to others regardless of the intentions of the game developers.

Since loot boxes are available in many popular video games and structurally resemble traditional gambling games, there is a natural question whether these games are associated with gambling problems as a mental health condition and gambling harm as a public health issue. It is possible that children and/or adults recognise the similarity of loot boxes to gambling, and their use and enjoyment encourages interest in adult forms of traditional gambling. It is also possible that excessive spending on loot boxes can be a direct source of harm. Since video game loot boxes are a first experience of a gambling-related product for many young-people, it is necessary to understand how exposure to loot boxes relates to young-people's engagement and interest in traditional gambling. Past research has supported the notion that loot box use is more common in people with gambling problems (Brooks & Clark, 2019; Drummond, Sauer, Ferguson, & Hall, 2020; Kristiansen & Severin, 2020; Li, Mills, & Nower, 2019; Zendle & Cairns, 2018, 2019; Zendle et al., 2020; Zendle, Meyer, & Over, 2019). However, these studies have not attempted to use retrospective survey questions to understand if loot box use precedes gambling problems and harm (or potentially vice versa). The current study sought to remedy this deficit. The current study aimed to:

1. relate play on games with loot boxes, as well as opening, purchasing, and selling loot boxes to current gambling, and experiences of gambling problems and harm.
2. relate longer-term experiences with loot boxes to current gambling, and experiences of gambling problems and harm.

The first aim, above, sought to replicate previous cross-sectional findings. Opening, purchasing, and selling loot boxes are progressive levels of involvement in loot box play with respect to its relationship to gambling. People can open loot boxes that are freely given to them as part of gameplay. Purchasing loot boxes, however, makes an investment of money that is put at-risk for an uncertain reward, which is akin to the definition of a gambling product. Lastly, selling loot boxes contents (prizes) transforms the loot box "winings" back into cash that can be reinvested into additional purchases, which is another feature common to traditional forms of gambling.

The second aim sought to explore the potential time course of loot box use to find if longer term (as opposed to shorter term) engagement is associated with gambling activity, gambling problems and gambling harm, and thus implicate loot boxes as risk for, or facet of, broader gambling engagement.

Adults who have gambling problems often develop their first problems in adolescence (Rahman et al., 2012), and gambling problems have also been found to be more prevalent amongst adolescents than adults (King, Russell, & Hing, 2020). In addition, gambling problems are more common amongst males than females (Carneiro et al., 2020). These results may stem, at least in part, from high impulsivity amongst young people; and more specifically young males (Cosenza, Ciccarelli, & Nigro, 2019). Video games are more frequently played by males, although increasingly a common hobby for females as well (Willoughby, 2008). Consequently, it is important to account for these gender and age difference in examination of how loot box use might relate to gambling problems.

METHODS

A retrospective online survey was given to 12 to 24-year-old people from New South Wales (NSW), the most populous Australian state. Adolescents (12–17) were included in the sample because they are exposed to loot boxes but are legally excluded from other forms of commercial gambling. Young adults (18–24) were included because these respondents were likely to have experience with loot boxes in adolescence and are now allowed to participate in other forms of commercial gambling. Older respondents (25+), in contrast, may not have been exposed to loot boxes in adolescence, since loot boxes have only reached widespread popularity in the last decade. The survey included questions about gambling and loot box video game use, as well as problems and harm resulting from them.

Participants

An online panel aggregator, Qualtrics, assisted in the recruitment of an initial group of 8,522 persons 12–24 years of age residing in NSW, Australia, which is the state where the research was funded.

From the initial group of 8,522 potential respondents, 5,605 were excluded for living outside NSW, 100 declined the consent, 118 failed a simple attention check and 50 provided poor data (e.g., straight lining). Of the remaining 2,650 persons, 1,954 (59.9% female) completed the full survey and were included in the dataset for analysis. A little less than a third (28.5%) spoke a language other than English at home, and 8.6% identified as being of Aboriginal or Torres Strait Islander background. Of the adult respondents ($n = 1,035$), 3.8% were married and a further 18.9% were living with a partner. A plurality of adults (47.0%) had a secondary education as their highest award, and a further 24.4% had a bachelor's degree or post-graduate degree.



Measures

Some questions on the survey, notably questions about commercial gambling participation and harm, were only asked of adults aged 18–24. Commercial gambling was not surveyed amongst youth to avoid disclosure of illegal activity, whereas other more general questions on gambling problems are not specific about activities. Some gambling activities are legal for youth (e.g., private betting at home, such as card games). Gambling harm was not surveyed amongst youth since the measure has not been validated for this cohort.

Problem Gambling Severity Index, last 12 months (PGSI, Ferris & Wynne, 2001). The PGSI is a nine-item screen for gambling problems developed for self-administration in survey research. Items ask about behaviours and perceptions around gambling, with answer stems range from never (0) to almost-always (3). Items are summed to form a total score between 0 and 27, where a score of 8+ is indicative of problem gambling.

DSM-IV-MR-J for adolescents, last 12 months (Fisher, 2000). The DSM-IV-MR-J is a revised version of an earlier screen, the DSM-IV-J, that is validated for use in a juvenile population. The nine-item screen is based on the clinical criteria for problem gambling drawn from the Diagnostic and Statistical Manual of the American Psychiatric Association (revision IV) with one point for each qualifying positive response summed to a score 0 through 9. A score of 4+ on the DSM-IV-MR-J is indicative of gambling problems.

Short Gambling Harms Screen, last 12 months (Browne, Goodwin, & Rockloff, 2017). Only adults, aged 18–24, were asked about a checklist of 10 common harms that people often experience from their gambling, including “sold personal items” and “felt distressed about my gambling.” These items are summed to form a total harms score ranging between 0 and 10.

Intentions to gamble as adults. Only adolescents, i.e. those aged 12–17 years, were asked about their intentions to gamble in the future as adults (i.e., when reaching age 18 years old in Australia) from a list of 14 gambling activities as compiled from the NSW Gambling Survey 2019 (Browne et al., 2019). Adolescents were classified as intending to gamble (yes, no) based on selection of one or more of these items.

Played a game with loot boxes in the last 12 months?. All respondents were asked if they had played one or more games in the last 12 months that are known to contain loot boxes. An environmental scan (Rockloff et al., 2020) identified 51 of such games, and these were made available for participants’ selection. Provision was also made for them to enter up to 5 additional games that they played in the last 12 months that contained loot boxes. Two of the authors (AR and NG) looked through the additional responses and back-coded those that were already listed. Verifying if the 900+ “other” responses had loot boxes was a time-prohibitive task.

However, authors included games as having loot boxes if 1) a respondent has not identified any other game that contained loot boxes (thus potentially influencing whether that person could be classified as someone who played a game with loot boxes in the last 12 months), or 2) if a game was nominated by 5 or more players. These criteria helped to identify 13 additional games that verifiably contained loot boxes. Based on the total list of 64 loot box games, players were classified according to whether they had played a game containing loot boxes (yes, no) within the last 12 months.

Loot box use, purchasing, and sales. All respondents were asked as separate questions if they had ever opened or bought a loot box and, if so, the age(s) at which they first opened and first bought a loot box. In addition, participants were asked if they had ever sold items won in a loot box. Participant were provided with pictures of loot boxes and a description as follows: “Many of the video games listed in the previous question offer in-game items known as loot boxes. Loot boxes are consumable in-game items which can be purchased with real money, in-game currency, or awarded for free. When opened loot boxes contain a random selection of virtual items (e.g., in-game items such as weapons, cosmetic items known as skins, or in-game currency).”

Attitudes towards loot boxes, no timeframe. Participants were asked questions about their negative attitudes towards loot boxes based on 13 items compiled from issues discussed on internet chat forums (Rockloff et al., 2020). Using a 4-point Likert scale ranging from Strongly Disagree to Strongly Agree, commonly endorsed items included “encourages play to win”, “makes non-purchasers grind for in-game items” and “often don’t disclose the odds of getting valuable items.” The 13 measured attitudes included only negative aspects of loot boxes since positive forum comments were restricted to only the contents of loot boxes rather than loot boxes themselves.

Attitudes towards gambling, no timeframe. The Attitudes Towards Gambling Scale (ATGS, Orford, Griffiths, Wardle, Sproston, & Erens, 2009) consists of 14 items, where 7 are coded in the negative and 7 in the positive direction. Cronbach’s alpha was 0.85 for the scale in this sample. There is no adolescent form for this scale, although the nature of the questions appears to be suitable for adolescent understanding. This scale was administered to both adolescents and adults.

Procedure

Respondents were invited by Qualtrics via email to take part in the study from volunteer panels of respondents maintained by other providers. Respondents were screened based on their age (i.e., 12–24 years), and their place of residence in NSW Australia. Participants read an information sheet and provided informed consent that promised anonymity of responding. Panel participants were rewarded with compensation in the form of points redeemable for small value items (e.g., gift certificates).



Statistical analyses

Gambling outcomes and attitudes. The results are organised into two tables. Table 1 considered the outcomes of interest with respect to adults, aged 18–24; including attitudes towards loot boxes, attitudes towards gambling, gambling frequency, spend, problems and harm. The separate results for adults, exclusive of adolescents, are provided because gambling problems were surveyed using a different instrument, the PGSI, than the one used for adolescents, the DSM-IV-MR-J. Moreover, adults answered additional questions about gambling frequency, gambling harms and gambling spending, which were not asked of adolescents due to privacy concerns. The second set of results, in Table 2, examined the outcomes of attitudes towards loot boxes, attitudes towards

gambling, intent to gamble when 18+, and gambling problems, using the DSM-IV-MR-J, for adolescents, aged 12–17.

Loot box Behavioural Correlates. A partial correlational analysis was conducted against outcomes noted above; controlling for age and reported separately by gender. Both age and gender are known to be associated with key outcomes, notably gambling problems, and therefore these effects were considered in the analyses. Outcomes for both adults and adolescents were examined in partial correlation with the Aim 1 binary variables of 1) playing games with loot boxes (last 12-months, y/n), 2) opening loot boxes (lifetime, y/n), 3) bought loot box (lifetime, y/n), 4) sold loot box (lifetime, y/n), as well as the Aim 2 continuous variables of 5) year since first opening loot boxes and 6)

Table 1. Partial correlations controlling for age between loot box engagement and gambling outcomes for men ($N = 335$) and women ($N = 690$)

	Subgroup	Outcomes					
		Attitudes to LB	Attitudes to gambling	12-mth Gambling Frequency	12-mnth Gambling Spend	PGSI Gambling Problems	SGHS Gambling harms
Played LB games (y,n)	Men	0.11	0.02	0.04	−0.01	0.00	0.05
	Women	0.07	0.13*	0.20*	0.17*	0.13*	0.14*
Opened LB (y,n)	Men	0.06	−0.03	0.01	−0.05	0.03	0.07
	Women	−0.02	0.07	0.17*	0.11*	0.13*	0.28*
Bought LB (y,n)	Men	0.14	0.07	0.24*	0.10	0.23*	0.26*
	Women	0.00	0.16*	0.28*	0.31*	0.28*	0.25*
Sold LB (y,n)	Men	0.09	0.10	0.22*	0.10	0.28*	0.24*
	Women	0.01	0.14*	0.26*	0.23*	0.27*	−0.02
Yrs. since 1 st opened LB	Men	−0.01	−0.10	−0.10	−0.08	−0.08	−0.05
	Women	−0.05	−0.01	0.01	−0.04	−0.04	−0.02
Yrs. since 1 st bought LB	Men	−0.07	−0.13	−0.02	−0.02	0.05	0.04
	Women	−0.01	−0.04	−0.07	−0.06	−0.02	0.01

Notes: * $P < 0.05$ using the Holm-Bonferroni groupwise error adjustment for multiple comparisons.

Table 2. Partial correlations controlling for age between loot box engagement and gambling outcomes for boys ($N = 430$) and girls ($N = 481$)

	Subgroup	Outcomes			
		Attitudes to LB	Attitudes towards gambling	Intent to Gamble 18+	DSM-IV-MR-J Gambling problems
Played games with LB (y/n)	Boys	0.03	0.00	−0.01	0.05
	Girls	0.08	−0.01	−0.01	0.09
Opened LB (y/n)	Boys	0.11	0.03	0.04	0.12
	Girls	0.09	0.07	0.09	0.14*
Bought LB (y/n)	Boys	0.10	0.06	0.06	0.20*
	Girl	0.17*	0.18*	0.09	0.29*
Sold LB (y/n)	Boys	−0.02	0.14	0.05	0.13
	Girls	0.05	0.18*	0.09	0.23*
Years since 1st opened LB	Boys	0.03	−0.10	−0.01	−0.06
	Girls	−0.09	−0.13	0.01	−0.14*
Years since 1st bought LB	Boys	0.03	−0.13	−0.04	−0.08
	Girls	−0.17*	−0.07	0.08	−0.11

Notes: * $P < 0.05$ using the Holm-Bonferroni groupwise error adjustment for multiple comparisons.



years since first purchasing loot boxes. These latter two variables were meant as measures of long-term (vs. short-term) experiences with loot boxes. It is important to note that all these analyses are correlational only and do not themselves suggest a direction of causation. Residual plots were inspected to rule out violations of normality (Mansfield & Conerly, 2012).

Ethics

Potential respondents read an information sheet and agreed to consent in conformity with requirements of the Central Queensland Human Ethics Research Board (HREC # 22128). Adolescents (12–17) indicated receiving their parents' permission to take part in the survey. The survey was open between December 5th, 2019 and January 12th, 2020.

RESULTS

Aim 1

Table 1 shows partial correlations between outcomes and correlates for adults, 18–24, separately by gender and controlling for age. Aim 1 for the research sought to replicate findings that have shown correlations between loot box use and gambling problems. As illustrated in Table 1, adults (men and women) who either bought or sold loot boxes also gambled more frequently and had more gambling-related problems. In addition, women who simply played or opened loot boxes 1) gambled more frequently, 2) spent more on gambling, 3) had more gambling problems and 4) experienced more gambling-related harms. Women who played games with loot boxes in them, who bought loot boxes and sold loot boxes were also more likely to have relatively positive attitudes towards gambling.

Table 2 shows partial correlations between the outcomes and correlates for adolescents, aged 12–17, separately by gender and controlling for age. Both girls and boys who bought loot boxes more often had gambling-related problems. In addition, girls who opened loot boxes and girls who sold loot boxes were also more likely to have gambling problems. Lastly, girls who bought and girls who sold loot boxes more often had positive attitudes towards gambling. There was only modest evidence that negative attitudes about loot boxes were related to loot box behaviours. Girls 12–17 who bought loot boxes and/or had purchased them more recently were likely to have fewer negative attitudes about loot boxes.

Aim 2

The survey included questions on people's length of experience with loot boxes, including how many years it had been since respondents *first* opened and separately, *first* bought a loot box. As shown in Table 1, for adults there was no evidence that longer experience with loot boxes, controlling for participants' ages, correlated with any key outcome. For adolescent girls, however, Table 2 shows that

more recent first openings of loot boxes were associated with last 12-month gambling problems.

DISCUSSION

A differentiating feature of the current study over previous surveys on loot boxes were the retrospective survey questions. Specifically, the study asked people two questions, including 1) how long it had been since first opening and 2) first having purchased loot boxes, and related those findings to gambling outcomes. If use of loot boxes is a risk factor for gambling involvement and problems, it was expected that longer experience with loot boxes should predict these outcomes. For adults, there were no significant effects on length of experience with loot boxes on any gambling outcome. For adolescent girls, however, more recent experiences of first opening loot boxes were associated with past-12-month gambling problems. This result suggests that gambling interests in girls may develop near to, or at the same time as, interest in loot boxes.

Importantly, though, and contrary to our initial expectations, longer past experiences with loot boxes do not predict gambling outcomes in either adults or adolescents. Although loot boxes are superficially similar to gambling products, and even meet some technical definitions of gambling, there is only evidence in the current study that the same people who engage with loot boxes also more likely to have gambling problems. Our design did not allow for an exploration of whether past gambling involvement is related to current interest in loot boxes rather than the other way around, although this should be a fruitful avenue for future research.

Other concurrent findings on loot box engagement and gambling attitudes and outcomes support past findings (Brooks & Clark, 2019; Drummond, Sauer, Ferguson, et al., 2020; Kristiansen & Severin, 2020; Li et al., 2019; Zendle & Cairns, 2018, 2019; Zendle et al., 2020, 2019). People who bought and sold loot boxes gambled more frequently and also experienced more past 12-month gambling-related problems. Similarly, for adolescent girls, opening, buying, and selling loot box items was associated with 12-month gambling problems. For adolescent boys, those who bought loot boxes were more likely to have gambling problems too.

Our findings with respect to both women and girls are surprising for generally showing a greater number of significant relationships between loot box behaviours and gambling outcomes than those found for males. For instance, both women and girls who had simply opened loot boxes, which is a low threshold for loot box involvement, were more likely to have current 12-month gambling problems. The same was not true for men and boys.

Limitations

Despite the retrospective survey questions, only suggestive relationships are implied in the absence of a stronger methodology, such as prospective longitudinal data collection or even experimental research. No causal inference can



be made from correlational data. Our data relies on self-report, which could affect data integrity due to inaccuracies in recall. Some of these inaccuracies may have contributed to weaker results or null findings.

CONCLUSIONS

This survey supports past findings that correlate use of loot boxes and gambling related problems. In this survey, we made a distinction between playing games with loot boxes, opening loot boxes, buying loot boxes, and selling the contents of loot boxes, since each of these activities arguably makes loot boxes operate progressively more like a traditional gambling product and therefore are indicators of greater involvement in a gambling-like experience. Contrary to expectations, we did not find support for longer experience with loot boxes predicting gambling problems or other gambling-involvement outcomes. In adolescent girls, we contrarily found that more recent experience in opening loot boxes was associated with gambling problems. More generally, we found that loot box involvement was predictive of more gambling-related outcomes for women and girls than for men and boys. This suggests there may be something special about females who play video games with loot boxes, which is potentially indicative of a unique and yet unexplored vulnerability to gambling problems.

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Conflicts of interest: The authors declare no conflicts of interest.

REFERENCES

- Brooks, G. A., & Clark, L. (2019). Associations between loot box use, problematic gaming and gambling, and gambling-related cognitions. *Addictive Behaviors*, 96, 26–34. <https://doi.org/10.1016/j.addbeh.2019.04.009>.
- Browne, M., Goodwin, B. C., & Rockloff, M. J. (2017). Validation of the short gambling harm screen (SGHS): A tool for assessment of harms from gambling. *Journal of Gambling Studies/Co-Sponsored by the National Council on Problem Gambling and Institute for the Study of Gambling and Commercial Gaming*. <https://doi.org/10.1007/s10899-017-9698-y>.
- Browne, M., Rockloff, M., Hing, N., Russell, A., Boyle, C. M., Rawat, V., et al. (2019). *NSW gambling survey, 2019*. NSW Office of Responsible Gambling. <https://www.responsiblegambling.nsw.gov.au/research2/nsw-gambling-survey-2019>.
- Carneiro, E., Tavares, H., Sanches, M., Pinsky, I., Caetano, R., Zaleski, M., et al. (2020). Gender differences in gambling exposure and at-risk gambling behavior. *Journal of Gambling Studies/Co-Sponsored by the National Council on Problem Gambling and Institute for the Study of Gambling and Commercial Gaming*, 36(2), 445–457. <https://doi.org/10.1007/s10899-019-09884-7>.
- Cosenza, M., Ciccarelli, M., & Nigro, G. (2019). The steamy mirror of adolescent gamblers: Mentalization, impulsivity, and time horizon. *Addictive Behaviors*, 89, 156–162. <https://doi.org/10.1016/j.addbeh.2018.10.002>.
- Devereux, E. C. (1979). Gambling. In D. L. Sills (Ed.), *International encyclopedia of the social sciences* (Vol. 17). New York: Macmillan.
- Drummond, A., & Sauer, J. D. (2018). Video game loot boxes are psychologically akin to gambling. *Nature Human Behaviour*, 2, 530–532. <https://doi.org/10.1038/s41562-018-0360-1>.
- Drummond, A., Sauer, J. D., Ferguson, C. J., & Hall, L. C. (2020). The relationship between problem gambling, excessive gaming, psychological distress and spending on loot boxes in Aotearoa New Zealand, Australia, and the United States-A cross-national survey. *PLoS One*, 15(3), e0230378. <https://doi.org/10.1371/journal.pone.0230378>.
- Drummond, A., Sauer, J. D., Hall, L. C., Zendle, D., & Loudon, M. R. (2020). Why loot boxes could be regulated as gambling. *Nature Human Behaviour*, 4(10), 986–988. <https://doi.org/10.1038/s41562-020-0900-3>.
- Ferris, J. A., & Wynne, H. J. (2001). *The Canadian problem gambling index*. Retrieved from <http://www.ccg.ca/en/projects/resources/CPGI-Final-Report-English.pdf>.
- Fisher, S. (2000). Developing the DSM-IV-TR criteria to identify adolescent problem gambling in non-clinical populations. *Journal of Gambling Studies/Co-Sponsored by the National Council on Problem Gambling and Institute for the Study of Gambling and Commercial Gaming*, 16(2–3), 253–273. <https://doi.org/10.1023/a:1009437115789>.
- King, D. L., Russell, A., & Hing, N. (2020). Adolescent land-based and internet gambling: Australian and international prevalence rates and measurement issues. *Current Addiction Reports*, 7(2), 137–148. <https://doi.org/10.1007/s40429-020-00311-1>.
- Kristiansen, S., & Severin, M. C. (2020). Loot box engagement and problem gambling among adolescent gamers: Findings from a national survey. *Addictive Behaviors*, 103, 106254. <https://doi.org/10.1016/j.addbeh.2019.106254>.
- Li, W., Mills, D., & Nower, L. (2019). The relationship of loot box purchases to problem video gaming and problem gambling. *Addictive Behaviors*, 97, 27–34. <https://doi.org/10.1016/j.addbeh.2019.05.016>.
- Mansfield, E. R., & Conerly, M. D. (2012). Diagnostic value of residual and partial residual plots. *The American Statistician*, 41(2), 107–116. <https://doi.org/10.1080/00031305.1987.10475457>.
- Orford, J., Griffiths, M., Wardle, H., Sproston, K., & Erens, B. (2009). Negative public attitudes towards gambling: Findings



- from the 2007 British gambling prevalence survey using a new attitude scale. *International Gambling Studies*, 9(1), 39–54. <https://doi.org/10.1080/14459790802652217>.
- Rahman, A. S., Pilver, C. E., Desai, R. A., Steinberg, M. A., Rugle, L., Krishnan-Sarin, S., et al. (2012). The relationship between age of gambling onset and adolescent problematic gambling severity. *Journal of Psychiatric Research*, 46(5), 675–683. <https://doi.org/10.1016/j.jpsychires.2012.02.007>.
- Rockloff, M., Russell, A. M. T., Greer, M. N., Lolé, L., Hing, N., & Browne, M. (2020). Loot boxes: Are they grooming youth for gambling? *NSW Responsible Gambling Fund*. Retrieved from <https://www.alexmrussell.com.au/s/R13-2020-Rockloff-Russell-Greer-Lole-Hing-Browne-Loot-boxes-are-they-grooming-youth-for-gambling-NSW-f5wy.pdf>.
- Willoughby, T. (2008). A short-term longitudinal study of Internet and computer game use by adolescent boys and girls: Prevalence, frequency of use, and psychosocial predictors. *Developmental Psychology*, 44(1), 195–204. <https://doi.org/10.1037/0012-1649.44.1.195>.
- Zendle, D., & Cairns, P. (2018). Loot box spending in video games is linked to problem gambling severity. <https://doi.org/10.31234/osf.io/u5dmr>.
- Zendle, D., & Cairns, P. (2019). Loot boxes are again linked to problem gambling: Results of a replication study. *PLoS One*, 14(3), e0213194. <https://doi.org/10.1371/journal.pone.0213194>.
- Zendle, D., McCall, C., Barnett, H., & Cairns, P. (2020). Paying for loot boxes is linked to problem gambling, regardless of specific features like cash-out and pay-to-win: A preregistered investigation. <https://doi.org/10.31234/osf.io/6e74k>.
- Zendle, D., Meyer, R., & Over, H. (2019). Adolescents and loot boxes: Links with problem gambling and motivations for purchase. *Royal Society Open Science*, 6(6), 190049. <https://doi.org/10.1098/rsos.190049>.