

Recollected usage of legal youth gambling products: Comparisons between adult gamblers  
and non-gamblers in the UK and Australia

Philip W. S. Newall<sup>1\*</sup>

Alex M. T. Russell<sup>1</sup>

Steve Sharman<sup>2,3</sup>

Lukasz Walasek<sup>4</sup>

\* Correspondence: Philip Newall, PhD, p.newall@cqu.edu.au

1. Experimental Gambling Research Laboratory, School of Health, Medical and Applied Sciences, CQUniversity, Sydney, NSW, Australia a.m.russell@cqu.edu.au

2. National Addictions Centre, King's College London, London, SE5 8AF, United Kingdom

3. School of Psychology, University of East London, London, E15 4LZ, United Kingdom  
S.Sharman@uel.ac.uk

4. Department of Psychology, University of Warwick, Coventry, CV4 7AL, United Kingdom  
l.walasek@warwick.ac.uk

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Abstract: The UK is rare in allowing a number of gambling forms to be used legally by children under the age of 18. Some previous research indicates that adult problem gamblers are more likely to recollect using these products as children. However, no research has as yet assessed recollected levels of use irrespective of adult gambling status, or investigated these issues in other countries. This is relevant given that at least two of the tested products, coin push machines and crane grab machines, exist in other countries. The present research involves cross-sectional surveys conducted amongst UK (N=2,010) and Australian adults (N=640), associating recollected legal youth gambling usage with past 12-month gambling, and levels of problem gambling amongst adult gamblers. Adult gamblers recollected using more legal youth gambling products than non-gamblers. For example, 66.6% of UK gamblers reported legally buying National Lottery tickets aged 16-17, compared to 20.9% of UK non-gamblers; 60.8% of Australian gamblers reported using coin push machines as a child, compared to 48.6% of Australian non-gamblers. Overall, 18 of 19 tested associations were significant and in the hypothesized direction for the UK sample, compared to five of eight for the Australian sample. The legal provision of gambling to children is a topic for further international research and policy consideration.

Keywords: underage gambling, child gambling, adolescent gambling, problem gambling

Adult problem gambling is often associated with an earlier age of gambling onset (Dowling et al., 2017; Kessler et al., 2008; Sharman, Murphy, Turner, & Roberts, 2019), which is one reason why youth gambling is an active area of research (Delfabbro, King, & Derevensky, 2016; Derevensky & Gupta, 2004; Hardoon & Derevensky, 2002; King, Russell, & Hing, 2020; Molinaro et al., 2018). In addition, a recent UK survey suggested that 11% of 11-16 year-olds have spent their own money on gambling in the last week (Gambling Commission, 2019). However, much youth gambling occurs illegally, as most gambling products are only made available to adults (Hanss et al., 2015), with a standard legal age of gambling in both Australia and the UK of 18. The fact that much youth gambling is illegal may be one reason why youth gambling often correlates with illicit drug use and antisocial behaviors (Dowling et al., 2017). However, some gambling products are made legally available to children, an activity which may plausibly have fewer negative correlates, and which is an issue that has received recent policy attention in UK research (Orford, 2019) and policy (DCMS, 2019; House of Lords, 2020). Legal youth gambling is also relevant to the recent phenomena of “emerging” gambling-like forms, such as “loot boxes” in video games (Rockloff et al., 2020; Wardle, 2019; Zendle, Meyer, & Over, 2019), which many countries are trying to understand how to regulate (Gambling Commission, 2017; Xiao & Henderson, 2019).

The UK makes a number of gambling products legally available to children (Fisher, 1991; Parke & Griffiths, 2006), including a class of low-stakes electronic gambling machines known as “category D fruit machines” (Forrest & McHale, 2012; White & Frost, 2019). The UK’s National Lottery products, both the main prize-draw introduced in 1994, and scratchcards introduced in 1995, can be legally bought from age 16. A recent survey suggested that 3% of 11-15 year olds had illegally played a National Lottery game in the past seven days, compared to 9% of 16 year olds (Gambling Commission, 2019). This suggests that, where gambling products are made legally available to some children, that legal use can

outstrip illegal use, and that legal youth gambling is a worthy topic of further research. These are products that do not have much by way of international comparison in terms of legal youth gambling (Orford, 2019). However, there are some UK legal youth gambling products that overlap with other countries. “Coin push” machines are popular at seaside resorts in the UK (Forrest & McHale, 2012), and involve inserting low denomination coins into a machine containing other coins on a series of moving platforms, with the hope of dislodging a higher-value amount of coins that can be collected as winnings. Coin push machines can be used by children and found in amusement arcades in other countries, such as Australia. Finally, “crane grab” machines allow a user to operate a crane to win a plush toy or related prize. Unlike the other products discussed here, crane grab machines do not directly provide monetary winnings, but nonetheless provide uncertain prizes of value at some cost of play. Crane grab machines exist in other countries, including Australia, and in fact policymakers in Thailand have recently decided to ban crane grab machines, in line with the country’s strict regulation of gambling (Pulitzer, 2020).

Legal youth gambling is an under-researched topic, compared to illegal youth gambling. On 3<sup>rd</sup> of March 2020 David Zandle stated to a House of Lords Select Committee that, “I am not aware of a single paper on coin pushers, for instance” (Zandle, 2020). However, since then some research has been conducted on legal youth gambling products using samples of UK gamblers, and found generally high levels of recollected usage, which correlated positively with adult problem gambling symptoms (Newall, Russell, Sharman, & Walasek, 2020a; Newall, Russell, Sharman, & Walasek, 2020b). However, this previous research focused only on current adult UK gamblers, and therefore did not provide any information on how these rates of recollected usage might differ in UK adults who do not currently gamble. This previous research was also limited to the UK, even though some legal youth gambling products are of relevance to other jurisdictions.

The present research set out to address these issues, by recruiting UK adults irrespective of adult gambling status, and in a second study, by recruiting adults from Australia. This was done in order to address the following hypotheses:

H1. That any level of recollected engagement with a given youth gambling product, versus not recollecting using that product, is associated with being an adult gambler.

H2. That any level of recollected engagement with a given youth gambling product, versus not recollecting using that product, is associated with higher Problem Gambling Severity Index (PGSI) scores amongst adult gamblers.

H3. For participants who recollect using a given youth gambling product, that increased frequencies of recollected usage are associated with being an adult gambler.

H4. For adult gamblers who recollect using a given youth gambling product, that increased frequencies of recollected usage are associated with higher PGSI scores.

## Method

Preregistration documents, data, and materials can be accessed from <https://osf.io/9e6n3/> on the Open Science Framework, a research management platform that is commonly-used in psychology research (Foster & Deardorff, 2017).

### Participants

In total, 2,010 participants were recruited for the UK study (UK and Australian samples were recruited via Prolific Academic, and no participant had taken part in the two previous studies on this topic). This sample size was as intended (preregistered  $N=2,000$ ). These participants were aged 18 – 40 ( $M = 28.2$ ,  $SD = 6.2$ ), and were 67.4% female (0.25% no response/prefer not to say). Age range was limited to ensure all participants had had an opportunity to use each gambling product legally while they were under 18 (National Lottery scratchcards were

introduced the most recently, in 1995). Since this was a convenience sample, the gender composition was based on the subset of eligible Prolific Academic users who consented into the study. Neither sample can therefore be considered as representative of that country's population. Overall, 70.0% of the sample had gambled in the past 12 months. Amongst these adult gamblers, 51.0% were non-problem gamblers, 27.1% were low-risk gamblers, 15.7% were moderate-risk gamblers, and 6.3% were current problem gamblers according to the PGSI. These participants were paid £0.35 each and took an average of 2.2 minutes to complete the task (£9.48/per-hour pro-rata). These participants were all UK nationals and had also been born in the UK.

In total, 640 participants were recruited for the Australian study. This sample size was based on the number of relevant participants that could be collected through the platform, as we were unable to collect our preregistered intended sample size ( $N=1,000$ ). These participants were aged 18 – 82 ( $M = 30.9$ ,  $SD = 10.7$ ), with 83.1% of these participants aged 18 – 40. Age range was not limited in order to maximize the sample size. These participants were 45.5% female (0.6% no response/prefer not to say). Overall, 60.2% had gambled in the past 12 months. Amongst these adult gamblers, 47.5% were non-problem gamblers, 28.1% were low-risk gamblers, 18.2% were moderate-risk gamblers, and 6.2% were current problem gamblers according to the PGSI. These participants were paid \$0.5 AUD each (approximately £0.35), and took an average of 2.1 minutes to complete the task (\$14.3/per-hour pro-rata). These participants were all Australian nationals and had also been born in Australia.

Although these inclusion criteria of using nationals of a country who were also based there will have reduced the representativeness of the samples, this helped increase the chances that participants were actually exposed to these gambling environments as children.

Task

The task had two main blocks, presented in a random order. In one block, participants were provided some descriptive text about a legal youth gambling product and a relevant image of that product, and then provided their level of recollected usage on a 5-point scale (Never, Rarely, Occasionally, Frequently, Very frequently). Although these are verbal descriptors of frequency of use, the interpretation of which might differ between participants (Karelitz & Budescu, 2004), we note that similar verbal descriptors are commonly used in gambling research, including in the PGSI (Ferris & Wynne, 2001).

Responses were given to each product on a separate page. Order of legal youth gambling product presentation was randomized. In the UK study, this period of recollected usage for the National Lottery and National Lottery scratchcards was based on the legal age to use these products (16). “How often do you recall buying National Lottery tickets / National Lottery scratchcards while being between the ages of 16 and 17?” For all other products there is no minimum age at which these products can be used, and so the text read: “How often do you recall using category D fruit machines / coin push machines / crane grab machines while being under the age of 18?” The descriptive text for category D fruit machines, the National Lottery, and National Lottery scratchcards were all taken from a previous study (Newall et al., 2020a). Novel descriptive text was created for crane grab and coin push machines, which removed UK-specific elements to the text, and was given to both the UK and Australian samples (to minimize between-sample differences).

All of this text is available from the file materialsuk.docx available from <https://osf.io/9e6n3/>, while the file materialsuk.qsf can be imported into the program Qualtrics to recreate the study’s visual appearance, including the images as shown to participants. As an example, the text used for coin push machines was as follows:

“Coin push machines, otherwise known as penny falls machines, involve multiple levels covered in coins, with mechanical devices pushing coins forward. Users insert coins into the machine, with the hope of causing the mechanical device to push a larger number of coins over the edge, which can then be collected by the user.”

In the other block, participants were asked:

“Have you gambled at all in the past 12 months? This includes: buying lottery or instant scratch tickets; betting on sports, races, or other events; playing casino card or table games, including for money with friends; or playing bingo or keno.”

This list was not meant to be an exhaustive list of gambling activities, but to include relevant activities that some participants may not consider to be gambling. If participants responded “yes,” then they were asked to complete the Problem Gambling Severity Index, a nine-item and commonly-used measure of problem gambling amongst community samples (Ferris & Wynne, 2001). Participants who responded “no” were skipped to the end of the block. Finally, participants also self-reported their age in years; other demographic details were automatically collected by the crowdsourcing platform.

## Analysis

Significance values were preregistered as Bonferroni-corrected  $p$ -values based on the number of products tested (.01 in UK, .025 in Australia). Separate models were used for each hypothesis (H) and each product, due to non-overlapping sample sizes and outcome measures. H1 used the full sample for each product; H2 the sub-sample that had gambled in the past 12 months; H3 used the full sample that ever recollected using that product; H4 used the sub-sample of gamblers that ever recollected using that product. Hypotheses 1 and 3 used logistic regression due to the dichotomous outcome variable (gambling/not gambling in past

12 months), and Hypotheses 2 and 4 used linear regression with log PGSI + 1 as the outcome variable, because PGSI amongst gamblers was skewed in both samples.

The response scale for each product contained the response “never” which is qualitatively different to the other potential responses. This is why never, versus any level of recollected usage (H1 and H2) was assessed separately from levels of recollected usage amongst those who recollected using a product (H3 and H4)

## Results

### Descriptive

A descriptive overview of the results is in Table 1. Recollected usage of coin push machines was higher in the UK than Australia, with 94.1% of the UK sample recollecting using coin push machines, compared to 55.9% of the Australian sample (59.4% when the Australian sample is restricted to the same age range as the UK sample). Crane grab machines had similar levels of recollected usage over the UK (90.8%) and Australia (89.2%; 91.4% when restricted to the same age range as the UK sample). In the UK sample, fruit machines were recollected as being used the least often (42.0%), and recollected usage was 55.6% for the National Lottery, and 55.4% for scratchcards.

Table 1: Recollected usage for each youth gambling product. The first number in each cell represents the overall average, the first number in parentheses is for non-gamblers, and the second is for gamblers.

Frequency	Coin push (UK)	Coin push (Australia)	Crane grab (UK)	Crane grab (Australia)	Fruit machine (category D; UK)	National Lottery (UK)	Scratchcards (UK)
Never	5.9% (10.5%, 4.0%)	44.1% (51.4%, 39.2%)	9.2% (13.1%, 7.5%)	10.8% (12.6%, 9.6%)	58.0% (70.1%, 52.8%)	44.4% (70.1%, 33.4%)	44.6% (66.8%, 35.1%)
Rarely	19.6% (29.4%, 15.4%)	34.8% (34.9%, 34.8%)	33.1% (41.0%, 29.8%)	44.5% (56.1%, 36.9%)	27.3% (23.3%, 29.0%)	33.2% (22.9%, 37.6%)	30.7% (24.3%, 33.5%)

Occasionally	45.1% (41.9%, 46.5%)	16.6% (11.4%, 20.0%)	40.9% (36.1%, 42.9%)	34.1% (25.1%, 40.0%)	11.4% (6.0%, 13.7%)	17.2% (5.8%, 22.0%)	18.4% (7.5%, 23.0%)
Frequently	21.3% (13.3%, 24.7%)	4.0% (2.0%, 4.7%)	13.0% (8.0%, 15.1%)	8.3% (5.1%, 10.4%)	2.8% (0.7%, 3.8%)	3.9% (1.0%, 5.2%)	4.9% (1.5%, 6.4%)
Very frequently	8.1% (5.0%, 9.5%)	0.9% (0.4%, 1.3%)	3.9% (1.8%, 4.8%)	2.3% (1.2%, 3.1%)	0.5% (0.0%, 0.7%)	1.3% (0.2%, 1.8%)	1.4% (0.0%, 2.1%)

Table 1 also highlights systematic differences, where non-gamblers were more likely to recollect low levels of usage, and gamblers were more likely to recollect high levels of usage. For example, 20.9% of UK non-gamblers recollected buying National Lottery tickets aged 16-17, compared to 66.6% of gamblers. For coin push and crane grab machines, the scale point where gamblers exceeded non-gamblers occurs at “Occasionally.” For fruit machines, the National Lottery, and scratchcards, this change occurs earlier at “Rarely.”

#### Confirmatory (preregistered)

The preregistration document specified some inclusion criteria, as for example the study required a mix of adult gamblers and non-gamblers, with varying levels of recollected usage. The only model failing an inclusion criteria check was H2 for UK coin push machines, as 96.0% of UK gamblers recollected using these machines as a child (95% or less was required to test this hypothesis).

Statistical output results are shown in Table 2. As can be seen from the coefficients in bold, 18 of 19 tested associations for the UK were significant and in the hypothesized direction. The one non-significant association for the UK was for H2 for crane grabs; a non-significant association that matches a previous finding (Newall et al., 2020a). For Australia, five of eight tested associations were significant and in the hypothesized direction. For the two overlapping products, estimated coefficients were often quite similar (1.69 UK, coin push

H3; 1.62 for corresponding Australian estimate). Interestingly, the one non-significant finding in the UK sample (H2 crane grabs) was significant in the Australian sample ( $p = .010$ ). Differences in the proportion of significant associations may be due to sample size. The Australian associations for coin push machines (three out of four) were slightly stronger than for crane grabs (two out of four). This again supports previous UK findings that crane grab machines might have the weakest associations with adult gambling. For example, the UK coin push H4 coefficient was significant ( $B = 0.15$   $t(1351) = 6.07$ ,  $p < .001$ ), while the corresponding Australian coefficient was similar but not significant ( $B = 0.13$   $t(233) = 1.83$ ,  $p = .068$ )

Table 2: Regression models predicting gambling status (no/yes) and (log+1) PGSI scores by engagement (no/yes) and frequency of engagement for the two samples and each youth gambling product. For each product, the coefficients in the first row relate to H1 and H2 from left to right. The second row shows coefficients for H3 and H4.

Form	Variable	Statistic	UK Gambling status (no vs yes)	UK (log +1) PGSI	Australian gambling status (no vs yes)	Australian (log +1) PGSI	
Coin push	Engagement (ref = no)	Coeff	<b>2.82</b>		<b>1.64</b>	<b>0.35</b>	
		CI	[1.73, 4.61]		[1.14, 2.36]	[0.17, 0.54]	
		$t/z$	5.44	Product not tested due to inclusion criteria	3.02	4.34	
		$P$	<.001		.003	<.001	
		$N$	2,010		640	385	
		Frequency	Coeff	<b>1.69</b>	<b>0.15</b>	<b>1.62</b>	0.13
	CI	[1.43, 2.00]	[0.08, 0.22]	[1.08, 2.44]	[-0.03, 0.30]		
	$t/z$	8.10	6.07	2.67	1.83		
	$P$	<.001	<.001	.008	0.068		
	$N$	1,891	1,352	358	234		
	Crane grab	Engagement (ref = no)	Coeff	<b>1.87</b>	0.04	1.35	<b>0.35</b>
			CI	[1.25, 2.81]	[-0.17, 0.24]	[0.76, 2.40]	[0.05, 0.66]
$t/z$			3.98	0.44	1.17	2.58	
$p$			<.001	.659	.242	.010	

		<i>n</i>	2,010	1,408	640	385
	Frequency	Coeff	<b>1.60</b>	<b>0.20</b>	<b>1.92</b>	0.12
		CI	[1.33, 1.91]	[0.13, 0.27]	[1.43, 2.57]	[-0.01, 0.24]
		<i>t/z</i>	6.65	7.71	4.98	2.14
		<i>p</i>	<.001	<.001	<.001	.033
		<i>n</i>	1,826	1,303	571	348
Fruit machine (category D)	Engagement (ref = no)	Coeff	<b>2.09</b>	<b>0.30</b>		
		CI	[1.60, 2.73]	[0.20, 0.41]		
		<i>t/z</i>	7.11	7.31		Product not collected in this sample
		<i>p</i>	<.001	<.001		
		<i>n</i>	2,010	1,408		
	Frequency	Coeff	<b>2.01</b>	<b>0.25</b>		
		CI	[1.33, 3.05]	[0.13, 0.37]		
		<i>t/z</i>	4.33	5.43		
		<i>p</i>	<.001	<.001		
		<i>n</i>	844	644		
National Lottery	Engagement (ref = no)	Coeff	<b>4.68</b>	<b>0.17</b>		
		CI	[3.57, 6.14]	[0.05, 0.28]		
		<i>t/z</i>	14.63	3.74		Product not collected in this sample
		<i>p</i>	<.001	<.001		
		<i>n</i>	2,010	1,408		
	Frequency	Coeff	<b>2.04</b>	<b>0.12</b>		
		CI	[1.38, 3.00]	[0.02, 0.21]		
		<i>t/z</i>	4.74	3.26		
		<i>p</i>	<.001	.001		
		<i>n</i>	1,118	938		
Scratchcards	Engagement (ref = no)	Coeff	<b>3.72</b>	<b>0.22</b>		
		CI	[2.85, 4.85]	[0.10, 0.33]		
		<i>t/z</i>	12.75	4.96		Product not collected in this sample
		<i>p</i>	<.001	<.001		
		<i>n</i>	2,010	1,408		
	Frequency	Coeff	<b>2.10</b>	<b>0.19</b>		
		CI	[1.48, 2.98]	[0.11, 0.28]		
		<i>t/z</i>	5.44	5.74		
		<i>p</i>	<.001	<.001		
		<i>n</i>	1,114	914		

*Note:* Confidence intervals (CIs) are 99% for the UK and 97.5% for Australia, based on the Bonferroni-adjust significance criterion for each sample. Coefficients are odds ratios for gambling status, and are unstandardized for (log +1) PGSI. Statistically-significant associations are shown in bold.

### Exploratory (non-preregistered)

The Australian sample was expected to be older. Older participants may have been exposed to different legal youth gambling products in their youth, and may also suffer from increased levels of memory bias. Planned exploratory analyses were therefore conducted on the Australian sample, adding main effects for age and interaction terms between age and recollected product usage. None of these interactions were statistically significant ( $p$ 's > .055), suggesting that observed associations were similar across all age levels (output.txt from <https://osf.io/9e6n3/>, lines 194 - 217).

An exploratory effect size investigation was undertaken by calculating semi-partial squared correlations (similar to an  $R^2$  statistic) for H1 between adult gambler status and whether participants recollected using a given legal youth gambling product (the only hypothesis using the entire sample). For the Australian sample, coin push machines had the highest association (.012), and crane grab machines the lowest (<.001). For the UK sample, the semi-partial squared correlations were: .004 (coin push), <.001 (crane grab), .004 (fruit machines), .042 (National Lottery), .014 (scratchcards). This provides some evidence that, of the legal youth gambling products studied here, that the products unique to the UK can have stronger associations with adult gambling.

Finally, the main analyses were run for all products from both countries adding age and gender as control variables. The only effect of recollected usage that changed significance in these models was H2, crane grab, Australian sample (from  $p = .010$  to  $p = .069$ ). This suggests that the observed effects should be reasonably robust to differences across the two samples (output.txt available from <https://osf.io/9e6n3/>, lines 97 – 143 for UK, and lines 219 – 243 for Australia).

### Discussion

The present research explored associations between recollected usage of legal youth gambling products and adult gambling. The research built on previous research along these lines (Newall et al., 2020a; Newall et al., 2020b) by uniquely recruiting participants irrespective of adult gambling status and across a new country, Australia. The analysis showed that, generally, past year gamblers were more likely to recollect having used, and also recollected using at higher levels, legal youth gambling products. Amongst gamblers, adult PGSI was also generally positively associated with recollected usage of legal youth gambling products. Products unique to the UK may have the strongest associations with adult gambling, as suggested by comparisons of statistically significant associations, and the exploratory effect size analysis. In the UK sample, 18 of 19 tested associations were statistically significant and in the hypothesized direction. The only non-significant association, for engagement with crane grab machines, replicates a previous non-significant finding (Newall et al., 2020a). This suggests that crane grab machines may have weaker associations with adult gambling compared to other legal youth gambling products. Crane grab machines appear equally popular in the two countries, with coin push machines being less popular in Australia. The five of eight statistically significant associations in the Australian sample suggest that legal youth gambling is not a strictly UK issue. However, it is hard at present to compare these associations with those in the UK, and this may require the recruitment of a larger and younger Australian sample. Other products specific to Australia may also have stronger associations. The research might be of use to policy-makers in the UK and elsewhere who are interested in the topic of legal youth gambling (DCMS, 2019; House of Lords, 2020), given concerns about the current lack of evidence base on legal youth gambling products (Zendle, 2020).

The research was subject to the following limitations. Causation cannot be inferred from these observed associations. The response scale used verbal descriptors of frequency, which

might be interpreted differently amongst participants, for example between adult gamblers and non-gamblers. In each case a crowdsourcing platform was used to recruit participants, and the samples were not representative. Although crowdsourcing platforms are a major enabler of much current psychological research (Buhrmester, Kwang, & Gosling, 2011; Huff & Tingley, 2015), they are less commonly used in the gambling field, despite some indications that they can produce good-quality gambling data (Mishra & Carleton, 2017; Schluter, Kim, & Hodgins, 2018). The sample size on the Australian sample was limited based on the number of Australian participants active on the platform. Larger and more representative samples are needed in order to make more direct comparisons between countries on this topic. The research also relied on participants to accurately recollect events from the past, and so is subject to memory biases. This may particularly be the case for the Australian sample, due to the higher average age in that group. Furthermore, older adults will have been exposed to different environments as children, so their responses may be less valid for the current day. A longitudinal study would be one way to address these limitations, but would take time to collect useful data. A study on emerging adults (e.g., aged 18 – 21) could be another way to address these limitations, although gambling-related harm can take time to develop. The research only recruited UK and Australian nationals who had also been born in their respective countries. This research was therefore not relevant to child migrants, a potentially important cohort to study because immigrants can suffer elevated levels of gambling-related harm (Wardle, Bramley, Norrie, & Manthorpe, 2019). Additional information, including the specific area in which a child lived could be used to infer associations between the availability of youth-focused electronic gambling machines and adult problem gambling (Forrest & McHale, 2012). Ethnicity, including aboriginal status for the Australian sample, would have helped probe other potential between-group differences.

The present results add to a wider literature on the age at which a person begins to gamble and subsequent gambling-related harm (Delfabbro et al., 2016; Derevensky & Gupta, 2004; Dowling et al., 2017; Hardoon & Derevensky, 2002; Kessler et al., 2008; King et al., 2020; Molinaro et al., 2018), by uniquely probing the issue of legal youth gambling amongst adult gamblers and non-gamblers in the UK and Australia.

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