



CONSORT Adherence among Randomised Controlled Trials in the Behavioural Addictions Literature: A Systematic Review

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Abstract

Purpose of Review We aimed to determine the extent to which articles reporting Randomised Controlled Trials (RCTs) of behavioural addiction interventions adhere to CONSORT (CONsolidated Standards Of Reporting Trials) standards.

Recent Findings A 2019 study evaluated CONSORT adherence among RCTs for substance use interventions (Vasser et al., 2019), but no studies have explored this in the context of behavioural addictions.

Summary We searched the PubMed database and *Journal of Gambling Issues* for articles reporting RCTs of interventions for gambling or gaming disorder published between 2010 and 2023. We coded articles according to the number and percentage of relevant CONSORT items reported in their abstract and main text. Sixty-three articles met inclusion criteria. Of these, 52 (82.5%) focused on Gambling Disorder and 11 (17.5%) on Gaming Disorder. The mean percentage of items reported in abstracts and main texts was 34.5% and 58.6%, respectively. Rates of reporting were higher in our sample of behavioural addiction RCTs ($Mdn = 57.6\%$) than in a sample of previously-scored substance addiction RCTs ($Mdn = 54.1\%$) evaluated by Vasser et al. (2019), $U = 14,622$, $p = 0.023$, $Mdn_{diff} = 5.15$ [95% CIs: 0.76, 9.46]. We identified commonly omitted CONSORT items, including missing study details in abstracts (e.g., how participants were allocated, recruitment/trial status and number of participants analysed) and in the main text of articles, changes to trial methods and outcomes, trial designs, harms/unintended consequences of interventions, and effect sizes and their precision. Through this review, we have developed specific recommendations for improving CONSORT compliance (e.g., alternative ways of reporting adherence checklists, evidence-based education programs, and normalising reporting information that could be perceived as study shortfalls), which will boost the interpretability of the published behavioural addictions literature. The review preregistration, materials, data, and analysis code can be accessed on the Open Science Framework: <https://osf.io/8yskr>.

Keywords RCTs · Open science · Gambling disorder · Gaming disorder · Internet gaming · Treatment

Introduction

Behavioural addictions are characterised by a compulsive engagement in rewarding but non-substance-related behaviours such as gambling, gaming, and internet use that results in functional impairments in daily life [1, 2]. Despite the

absence of an exogenous psychoactive substance, excessive engagement with these behaviours has been associated with a range of negative consequences for individuals and those close to them [3–5]. The clinical presentation of behavioural addictions appears to resemble that of substance addictions in several ways, including difficulties with control, cravings, preoccupation, and continued engagement despite adverse outcomes [6]. Recognising this, Gambling Disorder was officially recognised as a form of addiction in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in 2013 (5th edition, [7]). Gaming disorder (internet- or video gaming) was added to the 11th edition of the International Classification of Diseases in 2018 [8], but is only included as a condition requiring more clinical research in

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the DSM-5. To date, no other behavioural addictions have been officially recognised by diagnostic systems.

Having only been officially recognised as clinical diagnoses relatively recently—and with Gaming Disorder still being debated in this regard [9]—the literature on these disorders is less well-established than that for substance use addictions. However, the need for appropriate preventative and treatment interventions has been well-documented [10–13], given evidence of severe adverse consequences resulting from compulsive engagement with behaviours like gambling and gaming (e.g., financial ruin, relationship breakdown; [13–15]). Accordingly, several trials evaluating interventions for behavioural addictions have been reported in recent years, particularly for Gambling Disorder. These include psychological therapies such as cognitive behavioural therapy [16, 17] and motivational interviewing [18], but also personalised feedback [19] and pharmacological interventions such as nalmefene (for gambling), naltrexone, bupropion, methylphenidate (for gaming disorder), and selective serotonin reuptake inhibitors [20, 21]. These studies provide essential information for clinicians and clinical authorities involved in supporting those with behavioural addictions.

Across all fields, randomised controlled trials (RCTs) are the gold-standard method of evaluating interventions and are frequently used to inform treatment and policy. Given their importance, complete reporting of RCTs is essential to ensure readers gain an accurate understanding of the methods used, the risk of bias in trial design and implementation, the outcomes for which data were collected, and any harms or unintended consequences of the intervention. The CONSORT (CONsolidated Standards Of Reporting Trials) Statement [22] was developed to guide researchers in reporting RCTs and ensure such standards are achieved. CONSORT outlines 37 items for authors to report and is now endorsed by a large number of peer-reviewed journals [23].

Despite widespread adoption of CONSORT, the completeness of RCT reporting in the literature is often poor [24–26]. Dechartres et al. [27] recorded instances where the risk of bias was unclear due to inadequate reporting within over 20,000 RCTs included in Cochrane reviews. Insufficient reporting included details of allocation concealment (57.5% of trials), sequence generation for participant randomisation (48.7%), blinding (30.6%), and outcome variables (24.7%). Ambiguity regarding risk of bias in studies included in systematic reviews and meta-analyses can preclude firm conclusions about treatment efficacy. Reporting inadequacy is therefore a potential source of substantial research waste in addition to potentially resulting in inadequate or even harmful interventions being implemented in practice [28].

Vassar et al. [29] recently evaluated the completeness of RCT reporting in the substance/drug addiction literature. They reviewed 394 PubMed-indexed RCTs published between 2013 and 2017, recording the number of CONSORT items reported in each article. The mean number of items reported was 19.2 (out of a possible [31])¹. The aim of the present study was to conceptually replicate the study by Vassar et al. [29] to [1] better understand the completeness of reporting in the *behavioural addictions* literature (i.e., studies focusing on RCTs for Gambling and Gaming Disorders), [2] identify areas of reporting that need improvement to inform recommendations that can advance the literature, and [3] compare our outcomes with those from the substance addiction literature as a way to understand where the field stands, generally, in terms of reporting quality.

Few meta-scientific reviews within this field have been performed, with the exception of a small number which focused specifically on gambling studies [30, 31]. Meta-science refers to the study and evaluation of the methods and reporting of scientific work—the “science of science”—and is being increasingly used as a tool to diagnose and rectify problems in research practices [32]. In the behavioural addictions field, Louderback and colleagues [30] reviewed 500 gambling studies published between 2016 and 2019 to determine the uptake of various open science practices (e.g., data and materials sharing, and study pre-registration), finding adoption rates less than 10% for all practices other than open access publishing. Heirene et al. [31] reviewed gambling study preregistration practices, identifying gaps in reporting and undeclared deviations from prespecified plans that represented threats to the value of the preregistration process. The most similar study to ours presented here reviewed 26 articles reporting nonrandomised behavioural interventions for Gambling Disorder published between 2000 and 2011, and coded their adherence to the Transparent Reporting of Evaluations with Nonrandomised Designs (TREND) checklist [33]. The TREND statement [34] was modelled on, and designed as a counterpart to, the CONSORT checklist for non-randomised trials, including items such as “Eligibility criteria for participants” and “Settings and locations where the data were collected”. After developing a 59-question assessment based on TREND items, Fink

¹ There are 25 full CONSORT items and 12 sub-items (e.g., Item 3b), bringing the total to 37. Vassar et al. (2019) appear to have omitted items 6b (“Any changes to trial outcomes after the trial commenced, with reasons”), 7b (“When applicable, explanation of any interim analyses and stopping guidelines”), 11b (“If relevant, description of the similarity of interventions”), 14b (“Why the trial ended or was stopped”), and 17b (“For binary outcomes, presentation of both absolute and relative effect sizes is recommended”). These five items all appear to be items that may not be relevant to all RCT studies. We contacted the authors for clarification as to why they removed these items but did not receive a reply.

and colleagues found an average of 61.5% of questions received a positive response across the 26 articles. Overall, these studies—like the work presented here—serve to highlight areas for improving research quality in a field and provide a benchmark for future meta-scientific evaluations to determine whether improvements have been made.

Here, we aimed to better understand rates of RCT reporting in behavioural addiction fields, specifically those relating to Gambling and Gaming Disorders, and compare rates with those in substance addiction trials by using Vassar and colleagues' 2019 [29] findings for comparison. Our pre-specified hypothesis was that the reporting completeness of RCTs in the behavioural addiction literature, as determined by the number of CONSORT items reported, would be significantly poorer (i.e., fewer mean items) than the reporting quality of RCTs in the substance addiction literature. This prediction was based on the comparatively less-established nature of the behavioural addictions field. We focused specifically on RCTs for Gambling and Gaming Disorder as the only two behavioural addictions recognised by diagnostic systems. This review provides the first systematic evaluation of RCT reporting quality in the behavioural addictions literature, offering researchers and clinicians clear insight into potential biases and highlighting specific reporting domains that need strengthening to ensure clinical guidelines and treatments for these disorders used in practice are grounded in reliable evidence.

Materials & Methods

We preregistered this study on Open Science Framework (OSF; <https://doi.org/10.17605/OSF.IO/FNV2J>). Unless otherwise stated, we adhered to the methods outlined in our preregistration. The review data, analysis scripts, and materials are all available on our OSF page (<https://osf.io/8yskr/>). To ensure the comprehensiveness and clarity of reporting, we followed the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) guidelines when developing this article [35] and the PRISMA-P (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) guidelines when developing our preregistration [36]².

² Because we report the outcomes from a meta-scientific systematic review not focused on evaluating an intervention or diagnostic approach, some PRISMA items were not relevant to report (a PRISMA compliance check for our article can be found here: <https://osf.io/3zams/>).

Study Eligibility

For inclusion in the review, a study needed to report an RCT of an intervention for Gambling Disorder and/or Internet gaming disorder/Gaming disorder. We defined RCTs according to the National Institute of Health's definition; specifically, as a study involving the prospective placement of participants to an experimental condition using randomisation methods and testing the effects of an intervention [37]. We only included peer-reviewed studies that used human participants and were published in English. We did not include meta-analyses, systematic reviews, case reports, commentaries, editorials, letters, or perspective articles. We restricted the date range to articles published after October 6, 2010 (i.e., 10 years before the start of our review and after the publication of the 2010 CONSORT paper).

Search & Selection Process

Consistent with the method used by Vassar et al. [29], we restricted our database searches to PubMed. This database indexes almost all journals focused on behavioural addictions (e.g., *Journal of Behavioural Addictions*, *Addiction Research & Theory*, *Addiction*) and most psychology/psychiatry journals that may publish research on behavioural addictions (e.g., *BMJ*, *European Archives of Psychiatry and Clinical Neuroscience*). Pilot searches of other databases (e.g., ProQuest, Ovid) revealed few to no additional articles of relevance beyond those we identified via PubMed, supporting the value of relying on PubMed as our primary source. The following search string was used to identify studies in PubMed on 2020/10/07, restricting the date range for relevant articles to between 6 October 2010 and 6 October 2020:

("gambling disorder" OR "pathological gambling" OR "problem gambling" OR "internet addiction" OR "gaming disorder" OR "gaming addiction" OR "behavioural addiction" OR "behavioral addiction" OR "non-drug addiction") AND (Clinical Trial[ptyp]) AND 2010/10/06:2020/10/06[dp]³

On the same date, we separately searched the articles published in *Journal of Gambling Issues* within our date range as the journal publishes exclusively on one of the behavioural addictions of interest and is not indexed by PubMed. To do this, we simply screened all issues of the journal published in our date range via the journal's website. Titles that

³ "Clinical Trial[ptyp]" is a PubMed filter that restricts results to studies indexed as clinical trial and "[dp]" refers to date of publication, in this case restricting articles to the date range specified at the end of the search string.

appeared potentially relevant were added to the PubMed search results. Given the delay between starting the review (October 2020) and submission for publication (September 2024), we decided to update our search and selection process by conducting a second search of the PubMed database in January 2024⁴. We used the same search string and selection procedure for our first and second searches. All articles added at this point were screened for relevance by SC and RH. An additional 25 articles were included in the review from this updated search (our transparent changes document outlines how this step represents a deviation from our pre-registration: <https://osf.io/cnkg4>). Studies returned from the above searches were imported into the citation management software Zotero for record keeping and then into Google Sheets for screening. A team of six research interns led by the first (SC) and last author (RH) screened articles at the title and abstract, and then full-text level according to our eligibility criteria. Two researchers performed all screening independently using Google Sheets and resolved their disagreements in discussion with the last author (screening files with all studies and selection decisions are available on our OSF page).

We computed the degree of inter-researcher consistency achieved during the article selection process. Specifically, we used the `'irr'` R package [38] and associated `'kripp.alpha'` function to compute Krippendorff's alpha (α) for the entire sample of title and abstract and full-text screening decisions. At title and abstract level, we achieved a Krippendorff's α of 0.707 (198 articles, 2 raters). At full-text level, we achieved an α of 0.795 (95 articles, 2 raters). The full process of study screening and selection is outlined in Fig. 1.

Data Extraction & Scoring CONSORT Adherence

For all articles included in the review, we extracted the title, authors, year of publication, journal where published, and whether the journal endorsed CONSORT in their author guidelines (as of January 2024). Although not stated in our preregistration, we also extracted the funding source(s) reported in articles. Funding sources were divided into four categories: *None* (i.e., the authors explicitly stated that no funding was received for the work), *gambling industry*, *other* (e.g., government funding, research body), and *unable to tell* (i.e., no funding statement is reported).

To determine whether the articles adhered to the CONSORT reporting guidelines, SC and RH independently read each article and recorded whether each of the 37 items (25 main items plus 12 sub-items) was reported using a simple

Yes/No/NA system. All inconsistencies in adherence coding were resolved through discussion between the two authors. To ensure consistency between and within each author's coding, we developed a set of "Decision rules" to guide the process of determining whether an article reported CONSORT items (see: <https://osf.io/8yskr/files/osfstorage>). For example, for Item 6a (*Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed*), we specified that:

-For authors to meet this criterion they must explicitly differentiate between outcome types by including the words "primary" and/or "secondary"; OR "main outcome" and/or "additional outcome"; OR something that could be reasonably deemed equivalent/ an appropriate way to describe primary and secondary outcomes. If there are no secondary outcome(s), the paper is still required to specify the primary outcome(s) to fulfil this item.

Sample Size Determination

Our sample size was determined based on an a priori power calculation for a statistical test of our only hypothesis. Specifically, we used G*Power software version 3.1 [39] to estimate the required sample size for a Welch's *t*-test to compare the mean number of reported items between behavioural addiction (outcomes from our review) and substance addiction (outcomes from Vassar et al. [29]) RCTs. With an estimated allocation ratio of 8:1 of substance to behavioural addiction articles, alpha at 0.05, power at 0.8, and a medium effect size (Cohen's *d*) of 0.5, a minimum of 28 behavioural addictions and 224 substance addiction articles were required.

Data Analysis

We used the statistical programming language R (version 4.4.0; 2024-04-24) for all analyses [40]. We developed an "Analysis Document" using a Quarto file in R that outlines the entire process of data analysis for this study, along with accompanying text describing analyses. The Analysis Document can be found *here*. All tables, figures (including the flowchart), and statistical test outputs presented here were computationally generated in R directly from the data and imported into the manuscript.

We calculated the number of CONSORT items reported for all articles by summing the number of "yes" responses in our coding. These summations were used to compute descriptive statistics (mean, SD, median, & range) for all articles and subgroups in the sample (i.e., behavioural addiction type, funding source, journal, & CONSORT

⁴ We manually searched the *Journal of Gambling Issues* for new articles published between October 2020 and January 2024, yet did not find any new articles meeting our including criteria.

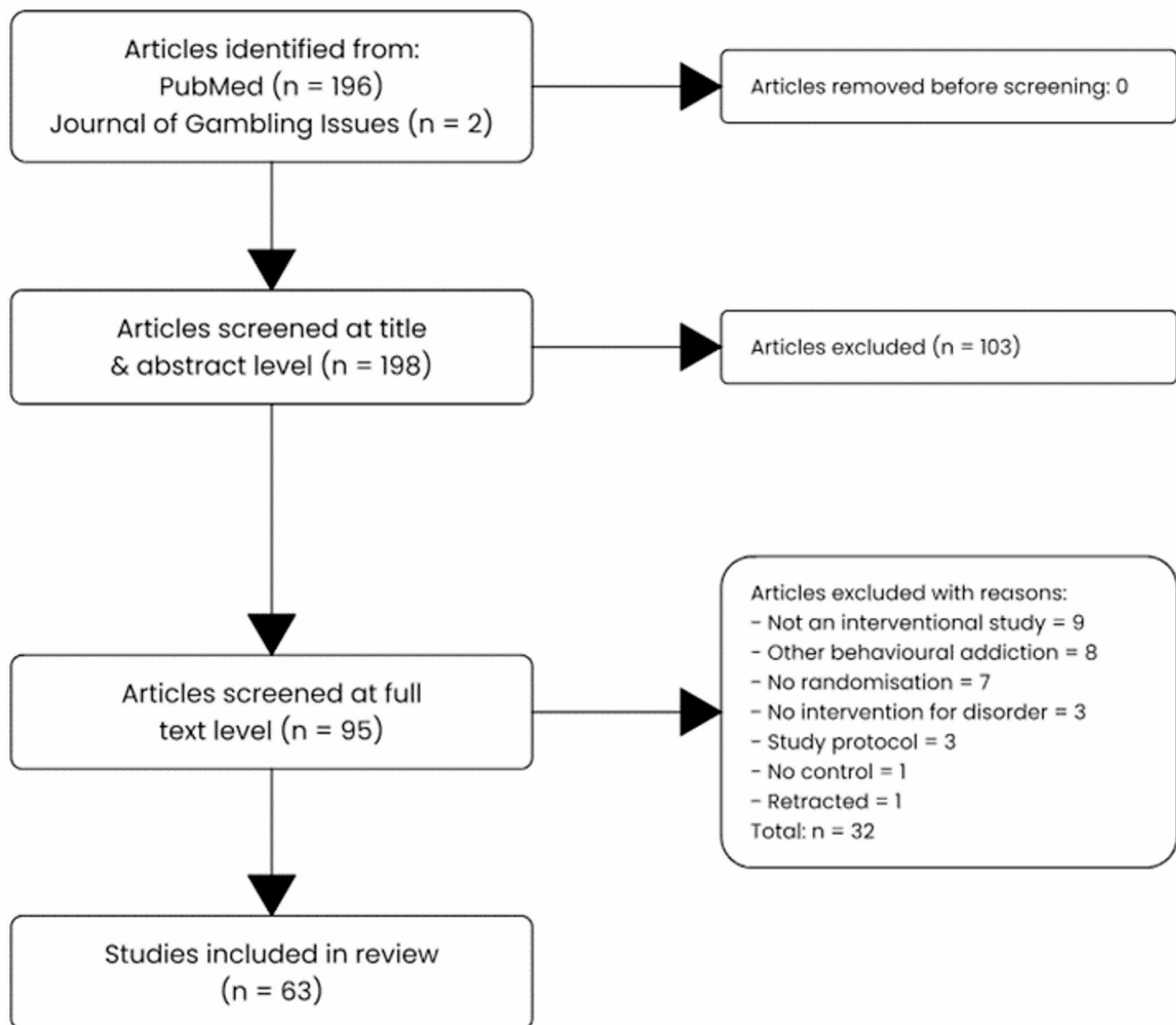


Fig. 1 PRISMA flow-chart of article search & selection process. This diagram shows the number of relevant articles identified and screened at title and abstract and full-text levels, along with reasons for excluding articles at full-text screening

endorsement status of publishing journal). To supplement our preregistered analysis plan, we calculated the percentage adherence to CONSORT for articles by dividing the total number of items reported (*Yes* scores) by the total number of items relevant to each specific article (i.e., all items without an NA response)⁵.

Following our preregistered analysis plan, we compared CONSORT item adherence between behavioural addiction articles (our sample) and substance addiction articles. We requested Vassar et al.'s raw dataset from the corresponding

author, which was provided to us in April 2024. In our pre-registration, we stated that we would compare the mean number of items reported in the two samples. However, during the coding of articles, it became clear that NA values were common for items where we permitted them (i.e., 6b, 7b, 11b, 14b, & 17b), and that items with NA scores varied between articles⁶. As such, we decided to use *percentage adherence* (i.e., all items scored as *yes* divided by the sum

⁵ The number of items relevant to each article varies depending on the methods used. For example, reporting the results from additional analyses (item 18) was only relevant when authors reported performing additional analyses.

⁶ Vassar et al. (2019) did not report adherence to several items (i.e., 6b, 7b, 11b, 14b, & 17b), meaning missing data also varied between samples if comparing our outcomes with those reported in their manuscript. However, the data provided by these authors for their study shows they scored every outcome and did not use NA scores for any item.

of all non-NA items) as the outcome by which to compare samples to account for variation in the relevance of items between samples (see our 3rd transparent changes document for more details: <https://osf.io/cnkg4>). We used a Shapiro-Wilk test to explore the distribution of percentage adherence scores and found evidence of non-normality ($p < 0.001$). As such, we used a Mann-Whitney U test to compare samples. As per our preregistration, additional inferential statistical tests were not carried out among subgroups of articles (e.g., those published in CONSORT endorsing journals and those not) given the limited sample size (we determined that a minimum of 51 articles per group would be needed to make the aforementioned example subgroup comparison using a one tailed t -test with alpha at 0.05, power at 0.8, and a medium effect size of interest [$d = 0.5$]).

Deviations from Our Preregistration

We made four deviations from our preregistration. First, we changed the CONSORT items for which we permitted “NA” responses, ultimately allowing a not-applicable response for items 7b, 11b, 14b, 17b, and 18 (see our 1st transparent changes document: <https://osf.io/jna6x>). Second, we had originally intended to rely on our team of research interns to code CONSORT adherence within the articles. However, the process of reliably and accurately documenting CONSORT adherence in the sample proved to be more complicated than initially anticipated. As a result, two more senior researchers (SC & RH) independently completed all adherence coding. As a result of this disruption, we were unable to calculate Krippendorff’s alpha to measure consistency between coders.

Third, during the coding of CONSORT item 1b (*Title & I abstract: structured summary of trial design, methods, results, and conclusions*) it became apparent that to accurately code whether an article met the requirements for this item, we needed to confirm whether the abstract included the 16 items listed in the CONSORT for trial abstracts requirements. As such, we also report adherence to abstract reporting guidelines here for a more comprehensive review of RCT reporting in the behavioural addictions literature (see 3rd transparent changes document: <https://osf.io/cnkg4>).

Results

Figure 1 shows the process of identifying and selecting relevant studies for inclusion in the review. A total of 63 studies were included and assessed for adherence to CONSORT reporting guidelines. Thus, our sample and that of Vassar et al. ($n = 394$) were sufficiently large to perform the pre-specified statistical test of our hypothesis (a priori minimum

sample size determination = 28 [our sample] & 22 [Vassar et al.’s sample]). The included articles were published between 2010 and 2023, across 32 different journals. Fifty-two (82.5%) reported an RCT for Gambling Disorder and 11 (17.5%) for gaming disorder.

Summary of Abstract CONSORT Adherence

Table 1 shows the rate of item reporting in the abstracts of all 63 studies. The percentage of items reported varied from 0 to 98.4%, with 2 items (i.e., Results: recruitment status item; Methods: randomisation) not reported in any article. Across all items, the mean percentage of CONSORT items reported in the sample was 34.5% ($Mdn = 20.6\%$).

Summary of CONSORT Adherence

Table 2 presents the rate of reporting for the 37 CONSORT items across all articles. The percentage of items reported varied from 0% (Item 1b: “Structured summary of trial design, methods, results, and conclusions”) to 100% (Items 2a [“Scientific background and explanation of the rationale”], 2b [“Specific objectives or hypotheses”], 12a [“Statistical methods used to compare groups for primary and secondary outcomes”], 14b [“Why the trial ended or stopped”]⁷ and 22 [“Interpretation consistent with the results, balancing the benefits and harms, and considering other relevant evidence”]).

Table 3 presents the overall rate of adherence across all 37 CONSORT items combined. The mean percentage of relevant items reported across the 63 studies was 58.6% ($Mdn = 57.6\%$). Rates of adherence were slightly higher for gambling than for gaming studies ($M_{diff} = -2.56$ items, $SD_{pooled} = 15.1$). Articles that reported receiving funding from the gambling industry reported the greatest number of items, followed by those explicitly stating no funding was received, then those receiving funding from other sources (e.g., government agencies), and finally articles where no funding statement was reported.

Studies published in journals endorsing CONSORT had a slightly lower mean percentage of relevant items reported compared to those published in non-endorsing journals ($M_{diff} = -1.9$ items, $SD_{pooled} = 15.1$). Studies published in *PloS one* had the highest rates of CONSORT adherence, closely followed by those in *Addiction*.

⁷ Although we agreed not to assign NA scores to this item, scoring it was challenging in practice. No authors explicitly outlined a reason for the end of their trial or stated that it had run to the intended duration. It appeared from the information reported in articles that all trials ran to the end of their prespecified period, but this conclusion is difficult to determine and relies on assuming the authors did not cut-short their trial without reporting it.

Table 1 Number & percentage of CONSORT items reported in study abstracts

Item	Adherence		
	Reported	Not reported	Percentage reported
Author contact details	57	6	90.48
Trial design	12	51	19.05
Methods - sample & setting	6	57	9.52
Methods - interventions	62	1	98.41
Methods - objective	60	3	95.24
Methods - outcomes	21	42	33.33
Methods - randomisation	0	63	0.00
Methods - blinding	14	49	22.22
Results - number analysed	20	43	31.75
Results - recruitment	0	63	0.00
Results - number randomised	2	61	3.17
Results - outcomes	7	56	11.11
Results - harms	2	61	3.17
Conclusion	60	3	95.24
Trial registration	17	46	26.98
Funding ¹	8	55	12.70

¹ This item was only scored if reported in the abstract or alongside other article meta-data towards the top of the article. A further 46 studies (73%) reported funding later in the article (note that this does not reflect the number where the funder and role of the funder were reported, as per Item 25 for full CONSORT adherence). See Table 2 in the following article for a more detailed description of the abstract reporting items: <https://doi.org/10.1016/j.ijso.2011.10.001>

Confirmatory Analysis

We performed one pre-specified statistical test of our hypothesis. Percentage adherence scores for our sample of behavioural addictions articles ($Mdn=57.6$, $range=30.3-85.7$) were significantly higher than Vassar and colleagues' (2019) substance addiction articles ($Mdn=54.1$, $range=16.2-89.2$), $U=14622$, $p=0.023$, $Mdn_{diff}=5.15$ [95% CIs: 0.76, 9.46]).

Exploratory Analysis

We performed a non-preregistered, exploratory correlational analysis to determine the relationship between the year of publication and CONSORT adherence. Using a Spearman's rank correlation test because the year variable was non-normally distributed, we found that the relationship between year of publication and CONSORT adherence was positive and statistically significant: $R_s(61)=0.27$, $p=0.033$ (see Fig. 2 for a visual representation of the relationship between year and adherence rate).

Table 2 Number & percentage of studies reporting CONSORT items

CONSORT Item		Adherence			
Item	Description	Reported	Not reported	NA	Percentage reported*
1a	Identification in title	39	24	0	61.90
1b	Structured summary abstract	0	63	0	0.00
2a	Scientific background	63	0	0	100.00
2b	Objectives or hypothesis	63	0	0	100.00
3a	Design & allocation ratio.	17	46	0	26.98
3b	Changes to methods	9	54	0	14.29
4a	Eligibility criteria	57	6	0	90.48
4b	Settings & locations	41	22	0	65.08
5	Intervention & control	61	2	0	96.83
6a	Primary & secondary outcomes	35	28	0	55.56
6b	Changes to trial outcomes	3	60	0	4.76
7a	How sample size was determined.	39	24	0	61.90
7b	Interim analyses & stopping	0	0	63	NA
8a	Randomisation: sequence	30	33	0	47.62
8b	Randomisation: type	19	44	0	30.16
9	Randomisation: implementation	25	38	0	39.68
10	Randomisation: roles	19	44	0	30.16
11a	Blinding	37	26	0	58.73
11b	Similarity of interventions	15	4	44	78.95
12a	Statistical methods used	63	0	0	100.00
12b	Methods: additional analyses	22	2	39	91.67
13a	No. of participants randomised	54	9	0	85.71
13b	Dropout rates & reasons	36	27	0	57.14
14a	Trial dates	35	28	0	55.56
14b	Why the trial ended	63	0	0	100.00
15	Baseline characteristics table	50	13	0	79.37
16	No. participants analysed	46	17	0	73.02
17a	Effect sizes & precision	17	46	0	26.98
17b	Binary outcome effect sizes	2	4	57	33.33
18	Other analysis outcomes	17	7	39	70.83
19	Important harms	18	45	0	28.57
20	Trial limitations	61	2	0	96.83
21	Generalisability	45	18	0	71.43
22	Fair interpretation	63	0	0	100.00
23	Registration number	32	31	0	50.79
24	Full trial protocol	11	52	0	17.46
25	Funding & role of funders	21	42	0	33.33

* Calculated as the percentage of studies where relevant (i.e., excluding NA values). Darker colours indicate that an item was reported more frequently. See Table 1 in the following article for a more detailed description of all CONSORT reporting items: <https://doi.org/10.1016/j.ijsu.2011.10.001>

Table 3 Summary of CONSORT adherence in reviewed studies

	<i>N</i>	Adherence		
		<i>M</i> (<i>SD</i>)	<i>Mdn</i> (range)	<i>M</i> % reported ^{*,†}
Overall	63	19.49 (5.29)	19 (10-30)	58.61
Behavioural addiction type				
Gambling	52	19.69 (5.53)	19 (10-30)	59.05
Gaming	11	18.55 (4.01)	19 (12-27)	56.49
Funding source				
Gambling Industry	4	26 (2.94)	26.5 (22-29)	74.91
None	3	20.33 (1.15)	21 (19-21)	60.99
Other	47	19.77 (5.01)	19 (12-30)	59.72
Can't tell	9	14.89 (4.76)	12 (10-22)	44.75
Journal endorsement				
No endorsement	23	19.96 (5.46)	19 (12-29)	59.84
Endorses CONSORT	40	19.23 (5.23)	19 (10-30)	57.90
Journal[‡]				
PloS one	2	27 (2.83)	27 (25-29)	79.41
Addiction	3	26.67 (0.58)	27 (26-27)	78.55
Journal of Consulting and Clinical Psychology	4	22.25 (4.03)	21 (19-28)	67.23
Journal of Behavioral Addictions	5	22.2 (5.07)	24 (14-27)	67.16
Addictive Behaviors	4	19.75 (5.68)	18 (15-28)	58.59
Journal of Gambling Studies	17	17.18 (4.82)	18 (10-27)	52.51
Journal of Gambling Issues	2	16 (0)	16 (16-16)	50.00
Journal of Psychopharmacology	2	15.5 (3.54)	15.5 (13-18)	45.41

M=mean, SD=standard deviation, Mdn=Median

* Darker colours indicate greater adherence to CONSORT reporting guidelines.

† Percentages calculated as the proportion of relevant items, excluding NA values.

‡ Rates are reported for journals publishing 2 or more articles (this includes 39 articles in total, equivalent to 62% of the full sample)

In our preregistration, we said we would statistically compare CONSORT adherence scores for the articles in our sample published within the same date range as Vassar and colleagues' sample (2013–2017). However, the number of articles in our sample published within this date range did not meet our prespecified minimum for statistical comparison (i.e., ≥ 28 articles). There were 20 articles in our sample published between 2013 and 2017, with a median percentage adherence score of 54.6 ($range=30.3-85.7$).

Discussion

We conceptually replicated Vassar et al.'s 2019 [29] review of substance addiction studies and reviews from other fields (e.g., [26, 41, 42]) that have evaluated adherence to CONSORT in RCT articles. Our work extends previous studies in several ways. We provide a more granular breakdown of CONSORT compliance by study characteristics (e.g., by funding source & year of publication), cover a longer period

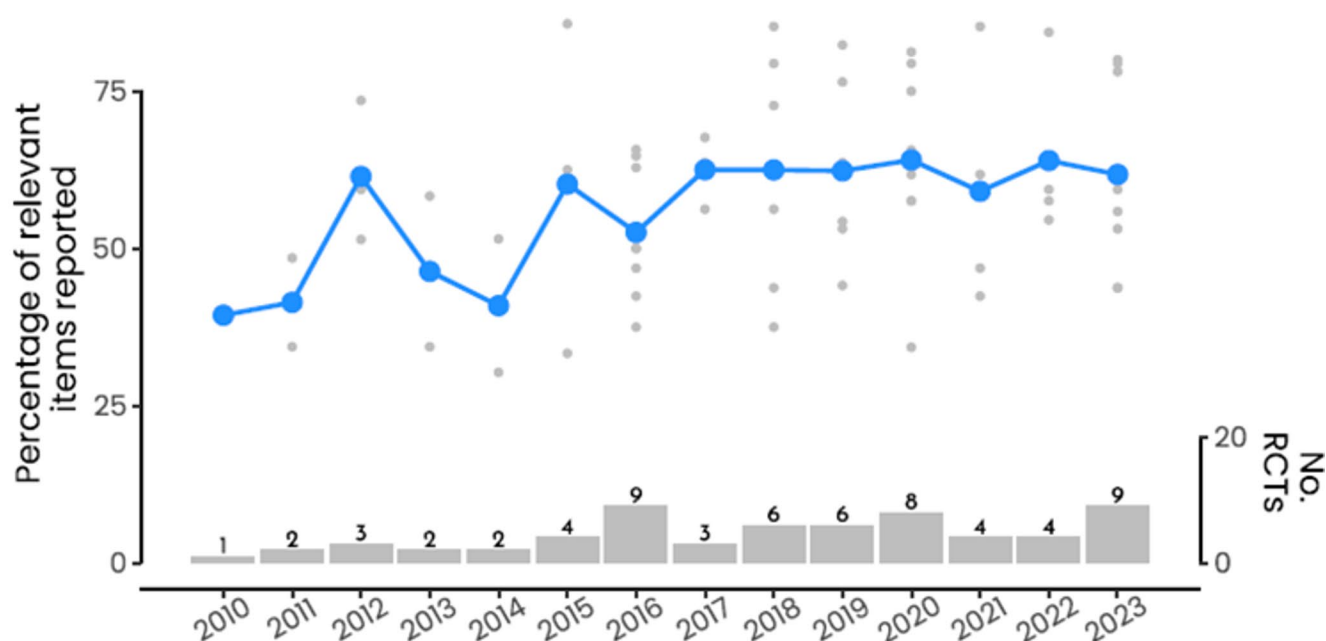


Fig. 2 CONSORT adherence among articles published each year. The blue dots and connecting the line represent the median percentage of relevant items reported across all articles published each year. Smaller

grey dots represent individual articles. The grey bars represent the number of RCTs included in this review each year from 2010 to 2023

(2010–2024), present rates of compliance with abstract and main-text CONSORT items, directly compare our findings with that of Vassar et al., and have made all analysis code and data openly available. Finally, we provide the first review of reporting quality of RCTs in the behavioural addictions field, providing a benchmark for future evaluations of the field and insights for researchers and clinicians involved in the treatment of Gambling and Gaming Disorders.

We identified 63 behavioural addictions RCTs that met our eligibility criteria. This sample is substantially smaller than the 394 RCTs reviewed by Vassar et al. [29], although consistent with behavioural addictions being the newer field. Contrary to our hypothesis, rates of reporting were higher in behavioural than in substance addictions RCTs. However, this result is likely because our sample was newer, and consistent with reviews of RCTs from other fields [27, 43, 44], we found a trend towards improved trial reporting in behavioural addiction studies over time. An exploratory, informal comparison of the articles in our sample published during the same period studied by Vassar and colleagues (i.e., 2013–2017) showed that our sample scored ($Mdn=54.6$) very similar to that of Vassar et al. ($Mdn=54.1$). Nonetheless, these findings should give some confidence to researchers and clinicians that the reporting in the behavioural addictions field is at least equivalent to, if not better than, that for substance additions. Articles published in journals that endorse CONSORT guidelines in their instructions to authors did not exhibit higher rates of adherence than articles published in non-endorsing journals.

This diverges from the findings of Vassar and colleagues and an earlier review of RCTs for alcohol treatments [43]. This finding is potentially explained by the small number of available articles (i.e., there were only 23 articles published in non-endorsing journals).

Improved reporting of several specific CONSORT items is warranted to improve the overall quality of RCTs in the field. Few authors report whether there were any changes to the trial outcomes or methods (5–14% of articles), the trial design (27%), important harms (29%), effect sizes and their precision (27–33%), the trial funder and the role of the funding agency (33%), and the information required to meet the four items relating to randomisation (30–48%). These items also had low reporting rates in Vassar et al.'s study [29]⁸ and in reviews from other fields (e.g., [42]), suggesting that this is not indicative of a unique problem in behavioural addiction trials. Our findings are also partially consistent with Fink et al.'s review [33] of non-randomised trials of Gambling Disorder interventions published between 2000 and 2011, which found underreporting of information relating to randomisation and harms or unintended consequences, but also baseline sample characteristics which

⁸ One exception to this comparison is item 25 (funding) which had a reporting rate of 90% in Vassar et al. (2019) and only 33% in our study. However, we suspect this discrepancy is due to differences in scoring the item, rather than reporting differences between the samples. We coded this item as satisfied if authors stated both the funding source and role of the funder in the trial, as per CONSORT guidelines; looking at some articles in their sample, we suspect Vassar et al. viewed this item as satisfied if the funder was stated even if their role was not.

were described in nearly 80% of our sample. This suggests potential improvements in some areas (sample characteristics) but stagnation in others (participant randomisation). It is unclear exactly why certain CONSORT items are consistently underreported, but could indicate that these items require more examples and guidance for researcher to be able to accurately report⁹.

We extended previous research by also scoring CONSORT reporting in the abstracts of our sample. Proper reporting in trial abstracts is essential, as some readers may decide whether to read the full text based on the abstract and might even rely on it for extracting key study information and results. Our results support previous research showing that full reporting of trial abstracts is poor [46]. A median of 20.6% of CONSORT abstract items were reported in our sample, highlighting substantially lower adherence than in the main texts. Finally, we present reporting rates for the journals publishing behavioural addiction RCTs most frequently. These rates can be used by journals to determine their relative levels of performance, and by researchers and institutions to determine each journal's commitment to ensuring the articles they publish abide by widely accepted reporting guidelines. However, the number of studies published in some journals is small and therefore these findings should be interpreted with caution.

Limitations

Our review is subject to several limitations. First, we restricted our search to PubMed and the *Journal of Gambling Issues* (not PubMed indexed), so there is a potential risk that our sample does not include all behavioural addiction RCTs. Second, as noted by Vassar et al. [29], determining whether some CONSORT items were reported can be ambiguous, and therefore our interpretation of the reviewed articles might vary from other authors. However, we took steps to minimize the potential for bias and uncertainty at this step by openly sharing our “decision rules” used to guide CONSORT adherence coding (<https://osf.io/8yskr/files/osfstorage>). Third, we used a dichotomous approach for scoring compliance with CONSORT items, which has the potential to belie the more graded nature of reporting quality. For example, with item 7a (“How sample size was determined”), two articles can be said to report this item, and yet the quality of information provided may vary greatly between them. Given this potential shortfall, we recommend that future reviews of compliance with reporting guidelines apply a more graded approach to scoring.

⁹ At the time of revising this article for publication, the 2025 update to the CONSORT statement and checklist was published which does appear to provide more detail regarding participant randomisation, in particular [45].

Recommendations

Journals Our findings suggest that a journal simply endorsing CONSORT guidelines is not sufficient to ensure adherence. A recent study found evidence that CONSORT checklists submitted to journals alongside trials often do not reflect the contents of manuscripts [47]. As such, we recommend journals require authors to more directly highlight where in their article each item is reported as opposed to only stating the page where it can be found, as in the traditional CONSORT-checklist approach. This goal could be achieved by submitting a separate report that quotes the relevant text, or by submitting an annotated version of the manuscript linking text to reporting items (we have done this approach *here* for PRISMA reporting in this article). Journals, through their facilitation of peer review and quality assessment, should be responsible for ensuring that these reports are accurate and reflect the work they publish. There is also a need for better oversight of reporting in article abstracts by journals to ensure proper adherence to required standards. Given their prominence at the forefront of publications and importance in representing the full contents of an article, reporting of trial abstracts should be given equal weight to the main text. Lastly, some of the items that were most commonly omitted in articles in our sample related to information that authors may fear will be perceived as limitations for which they will be penalised—namely, deviations from the registered plans, harms/unintended consequences of interventions, effect sizes and their uncertainty, and the role of funders. The transparent reporting of such information—even if this detracts from the conclusiveness of findings—should be encouraged by journals (as modelled by Editors at *Nature Human Behaviour*, [48]) and reviewers.

Research Institutions The similarities between our study and similar reviews concerning the overall low reporting rates and poor reporting of specific items highlights the need for systemic training on proper reporting of randomized trials for researchers in all fields. As noted by Heirene et al. [31], research institutions have a key role to play in supporting, educating about, and normalising good reporting practices. We recommend they provide ongoing research education and training about the importance of complete and transparent reporting of their research. This education should start at the post-graduate level or earlier and could refer to accepted reporting guidelines for different article types (e.g., CONSORT for RCTs, PRISMA for systematic reviews/meta-analyses). The outcomes from this study and similar studies can be used to inform education efforts by identifying areas of reporting that represent targets for improvement. For example, our findings suggest researchers experience some difficulty in or barriers to fully

describing changes to their study studies post-registration, study designs and methods, all important outcomes, and the role(s) of funders.

Researchers Finally, researchers can take proactive steps to improve their reporting completeness and can also support others to do the same. First, where strict word counts preclude detailed reporting of methods and statistical analyses, supplemental documents should be used to fill gaps in reporting. Many journals offer the ability to publish such documents alongside articles. Alternatively, online repositories like OSF or webpages published directly from Quarto documents in R (as we have done for our *Analysis Document*) can be used. Second, researchers acting as reviewers have an important role to play in encouraging and normalising transparent reporting of all important parts of trials, regardless of whether more detailed reporting leads to a less “clean” narrative [48].

Conclusion

CONSORT adherence is an important tool for ensuring that the scientific literature is complete and interpretable. Optimistically, our exploratory analysis suggests that reporting standards appear to be improving over time and are comparable to—if not superior to—levels observed in the substance addictions field. This trend towards improved reporting appears to extend beyond the (behavioural) addictions field, indicating widespread progress in RCT reporting. Still, there is room to improve CONSORT compliance and we provide several recommendations for how this goal can be achieved. Journals and research institutions must support authors to ensure proper reporting of trials to avoid ambiguity and potential research waste.

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Author Contributions S.C: Conceptualization, Investigation, Methodology, Project administration, Writing - original draft, and Writing - review & editing. S.G: Conceptualization, Methodology, Supervision, and Writing - review & editing. D.L: Conceptualization, Methodology, and Writing - review & editing. E.L: Conceptualization, Methodology, and Writing - review & editing. S.N: Investigation and Writing - review & editing. M.D: Investigation and Writing - review & editing. R.H: Conceptualization, Investigation, Methodology, Formal analysis, Project administration, Supervision, Visualization, and Writing - original draft.

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Data Availability All data collected during this review has been stored on a GitHub repository (https://github.com/rheirene/behav_addic_consort_adherence_outcome_switch), which has been linked to our Open Science Framework page for this project: <https://osf.io/8yskr/>. Analyses script and outputs can be found here: <https://robheirene.quarto.pub/data-analysis-consort-adherence-among-behavioural-addiction-rcts/>.

Declarations

Human and Animal Rights and Informed Consent Formal ethical approval was not deemed appropriate for this review article and therefore not sought. Informed consent was also not relevant to this review project.

Competing Interests The authors declare no competing interests.

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