

Effects of advertising on problem gambling: Neural-cue reactivity as a possible underlying mechanism

Javier García-Castro; Ana Cancela; Miguel-Ángel Martín-Cárdaba

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<https://revista.profesionaldelainformacion.com/index.php/EPI/article/view/86904>

Recommended citation:

García-Castro, Javier; Cancela, Ana; Martín-Cárdaba, Miguel-Ángel (2022). "Effects of advertising on problem gambling: Neural-cue reactivity as a possible underlying mechanism". *Profesional de la información*, v. 31, n. 6, e310614.

<https://doi.org/10.3145/epi.2022.nov.14>

Article received on March 08th 2022

Approved on October 10th 2022



Javier García-Castro ✉

<https://orcid.org/0000-0002-4017-3868>

Universidad Villanueva
Costa Brava, 6
28034 Madrid, Spain
jagcastro@villanueva.edu



Ana Cancela

<https://orcid.org/0000-0002-6949-0242>

Universidad Villanueva
Costa Brava, 6
28034 Madrid, Spain
acancela@villanueva.edu



Miguel-Ángel Martín-Cárdaba

<https://orcid.org/0000-0003-3897-2537>

Universidad Villanueva
Costa Brava, 6
28034 Madrid, Spain
mmartincar@villanueva.edu

Abstract

Problem gambling has recently been reclassified as a non-substance-associated behavioral addiction. To the associated vital impact (family, social, labor, and economic), we must add its increasing incidence in recent years, which has led to prioritizing the problem from the point of view of public health. Although the effects of advertising on gambling behavior have been explored since the second half of the twentieth century, there is a lack of research regarding its underlying mechanisms. Thus, the objective of this review is to present an update on the effects of advertisements on gambling attitudes and behavioral intentions, as well as to present the neurobiological correlates of gambling-related cues as a possible hypothesis for this effect. Advertisements in various formats may act both as a precipitating factor and as a maintenance factor for the gambling disorder, changing both attitudes and beliefs about gambling. Activation of brain areas related to reward, such as accumbens nucleus, to memory, such as hippocampus or amygdala, and to executive functions could be the underlying mechanism of this effect. Also, ads promoting responsible gambling do not appear to be effective in reducing behavior or encouraging self-control, but the available evidence is scarce. Therefore, the number of studies on this topic needs to increase. In addition, the available evidence questions the effectiveness of responsible gambling policies to promote self-control in this population, as well as to reduce the negative impact of this disorder, so future research on neural-cue reactivity to gambling-related stimuli may serve to improve the design of advertising strategies that increase the impact of these messages.

Keywords

Addictive behavior; Addiction; Advertising; Bets; Executive functions; Gambling; Learning; Neural reactivity; Prevention; Responsible advertising; Responsible gambling; Reward system; Risk factors; Review.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

1. Introduction

Both problem and pathological gambling (PG) are part of a mental disorder (**Nowak**, 2018) classified within the “substance-related and addictive disorders” in the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (APA, 2013). PG is characterized by an urgent need to bet increasing amounts of money (tolerance), an appearance of nervousness or irritation when one cannot gamble (abstinence), betting activity occupying much of the gambler’s time and thoughts (dependency), a continuous desire to gamble when it is not possible (craving), as well as attempts to recover from losses and repeated failures to give up the habit (**Petry et al.**, 2014). To avoid stigmatization, PG has been known as Gambling Disorder (GD) since the DSM-5. GD is related to severe disturbances of personal, familiar, social, occupational, and economic issues. For instance, among the primary burden of harm associated with gambling is generally damage to one’s health and relationships as well as psychological suffering (**Abbott**, 2020). Additionally, the financial repercussions of GD might range from poor credit to legal issues and even complete bankruptcy (**Williams; Rhem; Stevens**, 2011). Furthermore, an observational study revealed that children of compulsive gamblers had higher rates of smoking, drinking, and drug abuse (**Jacobs et al.**, 1989). In essence, the disorder causes a serious impact on different aspects of the person’s life, such as the family, social life, work, and the economic sphere (**DGOJ**, 2019).

In addition, the incidence of this disorder has increased notably in recent years in several countries such as China (**Long et al.**, 2018), the United Kingdom (UK), Australia, or the United States of America (USA) (**Abbott**, 2020; **Calado; Griffiths**, 2016; **Erbas; Buchner**, 2012; *World Health Organization [WHO]*, 2017). According to the WHO (2017), the growth in commercial gambling has been associated with a considerable increase in PG. The problem is especially worrisome in young people, since the period of greatest vulnerability to the disorder is between 18 and 24 years of age (**Hing et al.**, 2016). In fact, it has been observed that minors may be exposed to this content due to its extraordinary ubiquity, both in television advertising during sporting events, and through its growing presence on social media and web portals (**Monaghan; Derevensky; Sklar**, 2008; **Rossi et al.**, 2021). Thus, **Chóliz** (2016) observed a considerable increase in online gambling since the legalization of this type of gambling in Spain (*Law 13/2011*), particularly in young people, going from 0% to 44.46% in a period of four years in under 26-year-olds. Other countries such as the UK, Australia, and the USA have reported similar increases in gambling consumption, something that has been noticeably accentuated as a result of the Covid-19 pandemic (**Håkansson**, 2020), especially in its online modality (**Hubert; Griffiths**, 2018).

At the same time, spending on advertising for gambling has also increased. For example, in Spain alone, gambling companies spent 48% more on advertising in 2018 than in the previous year, which is equivalent to about 328 million euros (**DGOJ**, 2019). Advertising spending also increased in other countries such as the UK and Australia in the same period (*GambleAware*, 2018; *Victorian Responsible Gambling Foundation*, 2019).

The increased incidence of problem gambling in recent years, especially in the online mode (**Lindner et al.**, 2020), has led to prioritizing the problem from the point of view of public health (*Responsible Gambling Strategy Board*, 2019). One of the most relevant questions to determine therapeutic targets and design effective programs to reduce the incidence of problem gambling consists of the identification of factors leading to greater risk and maintenance of the problem. Risk factors for problem gambling are usually divided into three groups: personal, family, and socio-environmental (**Garrido; Jaén; Domínguez**, 2004). Since the early work of **Hess and Diller** (1969), several studies in the 90’s have attempted to clarify the role of advertising over gambling consumption habits (**Heiens**, 1993; 1999). Furthermore, **Griffiths** (2005) observed that the possible effect of gambling advertising over gambling behavior should be placed in the same category as alcohol and tobacco public health policies. Subsequently, over the past decades, this interest has increased (**Floyd; Whelan; Meyers**, 2006; **Hing et al.**, 2014; **Planzer; Wardle**, 2012; **Syvrtsen et al.**, 2022). Despite this growing attention to this topic, it is not yet clear what its role in this disorder is, through what mechanisms it acts, or how it affects each individual based on different gambler profiles (**Binde**, 2013). Furthermore, very few evidence-based recommendations are readily available for policymakers (**López-González; Griffiths**, 2021).

Therefore, the main objective of this review is to present the state of the art in relation to the possible impact of advertising on gambling in the initiation and maintenance of problem gambling behavior. Afterwards, a hypothesis concerning the neural reactivity to gambling-related stimuli as a possible underlying mechanism of this effect is proposed based on the evidence available until the present. This approach could serve to boost new insights for developing more effective messages and prevention campaigns in the field of marketing, public health policies and communication.

Increasing incidence of problem gambling in recent years has led to prioritizing the problem from the point of view of public health

2. Effects of advertising over gambling behavior and attitudes

To our knowledge, the first work studying the effects of advertising on gambling behavior was published in 1969 (**Hess; Diller, 1969**). In this research, the motives to gamble are analyzed (explored) through a qualitative content analysis methodology in relation to marketing appeals. Since then, many works have tried to examine the effects of advertising on gambling behavior and attitudes. Although the subject has been receiving increasing attention in the past decades, to date no firm conclusions can be offered (**Hanss et al., 2015**). Thus, the question is very simple: does gambling advertising cause an increase in problem gambling? And, furthermore, what is the possible underlying mechanism of this effect?

It has been proven that more exposure to advertisements is associated with more positive attitudes, usage initiation and problematic use of addictive products such as alcohol or tobacco (**Anderson et al., 2009; Lovato; Watts; Stead, 2011**). But before answering these questions applied to gambling consumption, we must bear in mind the conceptualization of the mass media effect. According to **Potter (2011)**, a mass media effect is a

“change in an outcome within a person or social entity that is due to mass media influence following exposure to a mass media message or series of messages” (p. 903).

Following this definition, we must consider several factors when studying the influence of mass media. For example, the *outcome*, which includes cognitions, attitudes, beliefs, affects, physiology and behaviors. Also, the *mass media* must be precisely defined, especially regarding new technologies like social media. The *change*, which is measured as a shift in a magnitude. And finally, the *influence*, which can be direct or indirect, in the long or short term and conscious or unconscious. Then, two classification rules are proposed to organize the conceptualization of mass media effect: there must be a clear outcome that shows change, and the media must be shown to have had an impact (**Potter, 2011, p. 911**). Finally, due to the cyclical nature of mass media exposure, it is of special importance to rule out the influence of “third variables” which could be acting on the effect considered.

In relation to the influence of mass media on gambling, the principal outcomes considered by the research so far have been cognitive functions, attitudes, physiological response and behaviors, besides content analysis or subjective reports. Recent research on this question (**GambleAware, 2020; Syvertsen et al., 2022**) seems to indicate that there is a relationship between gambling advertising exposure and gambling behavior. Indeed, two recent systematic reviews conclude that advertising about gambling may act as a facilitating agent of gambling behavior, greater desire or craving, greater participation, and more impulsive and risky behaviors when gambling (**Bouguettaya et al., 2020; Newall et al., 2019**). These studies and others carried out in the past decade reveal that exposure to gambling advertisements is related to a higher probability of gambling (**Abdi; Ruiter; Adal, 2015; Clemens; Hanwinkel; Morgenstern, 2017; Fried; Teichman; Rahav, 2010; Pitt et al., 2017a**), even becoming the main predictor of gambling behavior, making it three times more probable to gamble measured through an odds ratio (OR = 3.53) (**Hayer et al., 2018**).

In relation to attitudes, **Derevensky et al. (2010)**, found in a qualitative study through a questionnaire applied to 1,147 young participants (12-19 years old) that gambling advertising exposure by several means (internet pop-up ads, TV advertisements) influenced attitudes towards gambling, especially in those with established gambling habits. Moreover, **Thomas et al.'s. participants (2012)** felt ‘bombarded’ and ‘targeted’ by sports bet marketing, highlighting the effectiveness of betting promotions in influencing gambling-related attitudes. In addition, a cross-sectional study in the USA found that more self-reported exposure to adverts for gambling was associated with improved gambling attitudes (**Lee; Lemanski; Jun, 2008**). More recently, **Deans et al. (2017)** explored the influence of marketing on sports betting, finding that sports betting marketing saturation promotes normalization of gambling in sports. In fact, in a qualitative focus groups study, **López-González et al. (2020)** found that several forms of gambling advertising such as bonuses and free money gambling promotions along with stimuli designed on the basis of cognitive heuristics (i.e., availability, confirmatory, representative and hindsight biases), were particularly harmful and persuasive in triggering gambling intentions and behavior. Also, it is interesting to note that gambling advertising may also act as a risk factor for the initiation of gambling behavior, especially through a system of incentives or welcome bonuses (**Hidalgo-Cerezo, 2018; Hing et al., 2017**). **Grant and Won-Kim (2001)** studied the factors that produced craving in a sample of 131 American adults with PG. Despite the fact that previous studies confer a marginal weight to craving, social pressure, and advertising (12%) as precipitating factors of relapses in problem gambling (**Binde, 2007; Fernández-Montalvo; Echeburúa; Báez-Gallo, 1999**), these authors found that almost half of the sample of their study (n = 60) affirmed that the gambling advertisements on TV, radio, and billboards acted as a precipitating motivation to gamble.

Regarding cognitive effects, it has been consistently demonstrated that exposure to gambling advertising notably increases knowledge about it and recall of advertisements and brands and their notoriety. Indeed, the recall of the content of the advertisements is better in gamblers than in control subjects (**Amey, 2001; López-González; Griffiths, 2021; Pitt et al., 2017b**). Also, several recent investigations using biometric techniques such as eye-tracking or facial recognition of emotional expressions conclude that specific gambling-related stimuli draw attention more easily than responsible gambling messages while viewing commercial advertisements about gambling (**Cuesta-Cambra et al., 2019; Lole et al., 2019**).

“The effect of advertising is rarely cited in the scientific literature as a modulating factor”

Finally, several studies have pointed out the link between gambling adverts exposure and intentions and behavior. For example, **Hing, Vitartas and Lamont** (2013), using an online survey with 212 participants, reported an increase in both gambling intentions and behavior in relation to exposure to gambling sponsorship of sport. Also, gambling behavior was influenced by a significant increase in gambling advertising due to the removal of gambling marketing restrictions in Macau in a survey with 4208 participants (**Ho; Sau-kuen; Man-Chu**, 2012). In another study conducted in Norway, half of the sample (n = 25) reported an expected increase in their gambling behavior as a consequence of gambling advertising exposure (**Binde**, 2009). Several quantitative cross-sectional studies conducted in different countries such as Norway, Australia and the USA demonstrate the relationship between increased gambling advertisement exposure and gambling or problem gambling behavior (**Hanss et al.**, 2015). Remarkably, a study developed in three US states revealed that for every 1% increase in lotteries advertising expenditure, there was a .1%-24% increase in revenue because of a rise in gambling consumption. Furthermore, in a self-reported survey performed with a Swedish population, perceived negative influence from gambling advertising was positively associated with problem gambling severity, frequency and online participation through a multivariate regression analysis (**Binde; Romild**, 2019).

Several studies have outlined the possible harmful effect of gambling advertising over gambling behavior

In general, the available evidence exposed here seems to support an important role of gambling advertising in influencing gambling attitudes, beliefs and behavioral intentions. However, we must consider that almost half of the scientific literature published in this field employed qualitative methodologies, thus more objective, empirical evidence is needed in order to achieve stronger conclusions (**Bouguettaya et al.**, 2020). More recently, nevertheless, neural response to gambling-related stimuli paradigms is being considered as a promising approach which can lead us measure the influence of mass media over persons or social entities.

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3. Neural reactivity to gambling-related stimuli (GRS) as a possible underlying mechanism for the effects of gambling advertising

The study of neural reactivity to stimuli related to addiction has shown its usefulness as a biomarker of the severity of the disorder, efficacy of the treatment, and risk of relapse (**Brevers et al.**, 2019). Although there is currently no agreement on the brain areas involved and the sense of activation (increased or decreased) in the case of problem gambling, these investigations have served to raise interesting questions. Some of these are whether these stimuli are capable of inducing craving in PG, if there are some regions of the brain that are especially sensitive to them, and possible differences depending on various factors, such as the patient's clinical status, the duration of abstinence, or if there is a specific reactivity depending on the type of game practiced (i.e. lottery, betting or machines).

In general, the available evidence seems to support greater activation of the brain areas involved in PG when exposed to gambling-related stimuli (GRS) (**Brevers et al.**, 2019). For example, **Goudriaan et al.** (2010) found greater activation in parahippocampal regions, right amygdala, and prefrontal cortex (DLPFC) in PG. In addition, they reported a positive relationship between the intensity of the BOLD (*Blood Oxygen Level-Dependent*) signal in ventrolateral prefrontal regions, left insula and left caudate nucleus, and the subjective craving of the subjects when they watched scenes related to gambling compared to other, neutral scenes. In fact, another series of studies has shown greater activation in the prefrontal cortex, parahippocampal regions, and occipital cortex when PGs are exposed to GRS, something that is consistent with research conducted with other behavioral addictions (**Crockford et al.**, 2005; **Holst et al.**, 2010; **Miedl et al.**, 2010). The activation of the ventral and dorsal striatum, as well as the accumbens nucleus, has been associated with the anticipation of economic rewards in PG, in addition to a reduced sensitivity of the same regions for erotic stimuli (**Sescousse et al.**, 2013). Other regions involved in the emotional assessment of stimuli and the anticipation of consequences, such as the orbitofrontal cortex (OFC), have also shown greater activation in PG when they obtained a monetary gain in a "delayed incentive task" (**Sescousse et al.**, 2013). These results are consistent with the main theories on addictive behavior, which point to the convergent involvement of three brain systems: reward and motivation system, learning system, and executive functioning (**Cummings; Blum**, 2000; **Robinson; Berridge**, 2001; **Volkow; Fowler; Wang**, 2003). In fact, it has been found that both types of addictions could share the same neurobiological circuits (**Crockford et al.**, 2005; **Holst et al.**, 2010; **Kober et al.**, 2016).

However, data have also been found showing the opposite pattern. For example, **Potenza et al.** (2003) found that PGs showed less activation in the anterior cingulate cortex (ACC), OFC, caudate nucleus, basal ganglia (BG) and thalamus when exposed to a video about gambling intended to produce desire to play compared to control subjects. Likewise, **Balodis et al.** (2012) found less activation in the medial and ventral prefrontal regions, left inferior frontal gyrus, insula, ACC and left ventral striatum in PG when they performed a delayed economic incentive task. These discrepancies could be reflecting methodological differences such as the type of stimuli used, screening instruments to select the participants or the specificity of the type of game (lottery, slots, online betting, horseracing, etc.). Other research has found similar results using visual and auditory GRS interchangeably (**Sodano; Wulfert**, 2010; **Wegmann; Stodt; Brand**, 2018).

In line with these results, the recent meta-analysis by **Starcke et al.** (2018) about reactivity to stimuli in behavioral addictions, concludes that PG showed greater reactivity to GRS than did controls. This activation was correlated with a greater subjective desire to play (*craving*) and with psychophysiological measures such as heart rate, sweat gland activity

or skin temperature. The brain areas that showed greater activation in response to these stimuli were caudate nucleus, medial cingulate, subgenual cingulate, inferior frontal gyrus, and precentral gyrus, areas associated with anticipation, processing and decision-making related to rewards.

Prevention campaigns, as well as responsible gambling advertising, should be empirical-based in order to effectively prevent problem gambling behavior

Furthermore, studies carried out to date have consistently found that GRS visualization is capable of inducing craving in people with PG, showing a direct relationship with the severity of the disorder (Balodis *et al.*, 2012; Crockford *et al.*, 2005; Goudriaan *et al.*, 2010). Not only that, but Limbrick-Oldfield *et al.* (2017) found that the greater the abstinence, the lower the craving caused by the GRS (video), also reducing neural reactivity. This finding is relevant to be able to design cessation programs, by being able to estimate how long PGs need to avoid gambling, so that their reactivity to contextual signals related to gambling is neurologically minimal and they feel less craving. This would significantly reduce the chances of a relapse. Considering that two thirds of all relapses, approximately, occur in the first three months after the end of treatment (Brown, 1987; Marlatt; Gordon, 1985), it would be interesting to complement these results with the study of their correlates in terms of neural reactivity. In fact, in brain connectivity studies, higher craving scores after exposure to GRS were associated with lower connectivity between regions of the accumbens nucleus and frontomedial prefrontal cortex (Quester; Romanczuk-Seiferth, 2015). This reinforces the hypothesis that a disconnection between prefrontal cognitive control centers and areas of the reward and pleasure circuit such as the *nucleus accumbens* and adjacent regions could explain the problems of inhibition and control over immediate reinforcement in people with gambling problems (Volkow; Fowler; Wang, 2003).

4. Conclusions and recommendations for the future

Pathological gambling is a disorder with high personal, social, and economic costs. Its incidence has increased in recent years at the same rate as the proliferation of online gambling operators and the advertising spending of gambling companies, worryingly and more pronounced in young people. Therefore, it is a public health problem that deserves reflection.

Although there is evidence that seems to point to a possible causal role of advertising in the initiation and maintenance of gambling behavior, especially in the online mode (Hing *et al.*, 2014), the results of the scientific literature available on this topic are not conclusive at present. Most of the studies use qualitative methodologies such as interviews or self-reports (Binde, 2009; Bouguettaya *et al.*, 2020), making it necessary to increase the number of studies that use a quantitative methodology, in addition to suffering from a lack of homogeneous criteria regarding the methodological approach to study this problem (Torrance *et al.*, 2021). Thus, although the topic has been studied since at least the second half of the 20th century, more quantitative studies are needed to allow us to develop more evidence-based knowledge in this field (Labrador *et al.*, 2021). Therefore, most studies conclude that it is necessary to improve the methodological rigor of the research and increase the number of investigations in the near future.

A possible mechanism through which advertising could modulate the onset and course of problem gambling disorder would be through a combination of processes such as motivation and drive, association and learning, attentional processes, and cognitive control. Neuroimaging studies have revealed that the associated brain areas in PG exposed to GRS (visual and auditory) involve the activation of specific areas such as the striatum, nucleus accumbens, OFC, amygdala, hippocampus and prefrontal regions. Advertising, by using game-related stimuli in its messages, would alter these systems, awakening curiosity, favoring their accessibility to memory and attentional processing, influencing attitudes and producing craving, eventually facilitating relapses. However, the results of research on this topic have some limitations that need to be discussed. First, the clinical status of the patients (active, in remission or abstinent), as well as the intensity and duration of the disorder, must be considered. Secondly, the study factors such as the type of reinforcement, the way to induce craving and the type of stimuli used, controlling that the GRS are specific to the type of game played by the person with the disorder (Kober *et al.*, 2016). In fact, most of the studies use only one type of stimuli (visual) and the typical cognitive paradigms include tasks of reaction time or estimation of gain/loss, each of these experimental situations involving different cognitive processes that could explain some inconsistencies; therefore, these methodological discrepancies must be considered. Finally, some authors have observed that the failure to correct the significance thresholds for analyzing neuroimaging data in some previous studies could increase the amount of *type I errors* (that is, finding statistical differences in brain regions activation when there is not) and, therefore, make the statistical validity of their results questionable (Brevers *et al.*, 2019; Potenza, 2008).

On the other hand, “responsible gambling” messages and guidelines have not proven their effectiveness in preventing problem gambling (Labrador *et al.*, 2021; Williams; West; Simpson, 2007). On the contrary, various investigations have documented that their application could be counterproductive (Cárdaba *et al.*, 2016; Syvertsen *et al.*, 2022). In fact, in a review carried out

Activation of brain areas related to reward, learning and memory, as well as executive prefrontal functions could act as a key risk factor for gambling when subjects are exposed to gambling-related stimuli

on the effect of RG campaigns, it was concluded that they would be ineffective as the main strategy to reduce problem gambling, since their impact on non-gamblers, or at-risk gamblers, is minimal (Williams; West; Simpson, 2007). Therefore, it appears that RG messages are perceived as ineffective, unattractive and not very credible (Labrador *et al.*, 2021). Not only that, but also, in PG, these ads would not have the desired effect either, but could even produce the opposite effect to that expected; that is, they would increase craving in people with the disorder, in addition to not producing any preventive effect in people without previous gambling problems. For example, Newall *et al.* (2022) observed in a study of 3000 players with PG that messages aimed at preventing gambling, such as the slogan ‘*When fun stops, stop!*’ used in advertising campaigns in the UK, not only did not reduce the frequency of gambling, but had a counterproductive effect by increasing the number of bets. Because of that, advertising regulations should be based on empirical evidence to accomplish their public health goals in preventing problem gambling behavior.

Responsible gambling advertisements do not appear to be effective in reducing behavior or encouraging self-control; on the contrary, a boomerang effect has been observed

These contributions, and other future ones, should be useful to guide and offer evidence-based information to political and legislative agents with the aim of developing effective strategies that regulate the content of advertising and reduce the damages of problem gambling, especially focused on prevention programs in early ages. Likewise, it is expected that they will serve to adequately regulate advertising about gambling and promote marketing that is more respectful of ethical principles and the code of ethics for advertising, which guarantees the protection of the most vulnerable people and minors, such as was established by the *EU Audio-visual media services directive 2018/1808 (Directive (EU) 2018/1808, 2018)*. “Responsible advertising”, rather than placing the responsibility of self-control on gamblers, seems a more promising and necessary goal in the short and medium term.

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Revista científica internacional

e-ISSN: 1699-2407
<https://doi.org/10.3145/EPI>

Revista internacional de
Información y Comunicación
indexada por WoS Social Sciences Citation Index (Q2),
Scopus (Q1) y otras bases de datos

Factor de impacto JCR:
JIF 2021=3,596

Scopus/SCImago Journal Rank:
SJR 2021=0,831