

Loot Box Purchasing in Adolescents: Three-Wave Trajectories, Transitions, and Prospective Associations with Online Gambling Behavior

Abel Nogueira López

Faculty of Health Sciences. University of Burgos
Plaza de los Comendadores, s/n, 09001,
Burgos, Spain,
anogueira@ubu.es

Joaquín González-Cabrera

Institute for Transfer and Research (ITEI). Universidad Internacional de La Rioja (UNIR). Avenida de la Paz, 137. Logroño (La Rioja), Spain.
joaquin.gonzalez@unir.net

Aránzazu Basterra-González

Institute for Transfer and Research (ITEI). Universidad Internacional de La Rioja (UNIR). Avenida de la Paz, 137. Logroño (La Rioja), Spain.
mariaaranzazu.basterra@unir.net

Susana Jiménez-Murcia

Clinical Psychology Department, University Hospital of Bellvitge-IDIBELL Barcelona, Spain; Department of Clinical Sciences, School of Medicine and Health Sciences, University of Barcelona, Barcelona, Spain, Feixa Llarga, s/n 08907 L'Hospitalet de Llobregat, Barcelona, Spain.
sjimenez@bellvitgehospital.cat

Antonio Rial-Boubeta

Faculty of Psychology. Universidad de Santiago de Compostela. Campus Vida, Calle Xosé María Suárez Núñez, s/n, 15782 Santiago de Compostela, A Coruña, Spain.
antonio.rial.boubeta@usc.es

Juan Manuel Machimbarrena

Faculty of Psychology. Universidad del País Vasco (UPV/EHU). Avda. Tolosa Hirib., 70. 20018 Donostia-San Sebastián, Spain.
juanmanuel.machimbarrena@ehu.eus

Keywords: Loot boxes, adolescence, online gambling, Internet Gaming Disorder, longitudinal study

INTRODUCTION: Loot boxes (LBs) are chance-based microtransactions embedded in videogames and have attracted sustained attention because they share several structural features with gambling, including monetary expenditure, uncertainty of outcome, and rewards with perceived or real value (Drummond et al., 2020; Spicer et al., 2022). Their presence in games used by minors raises specific public-health and regulatory concerns, since adolescents may be exposed to gambling-like reinforcement mechanisms before legal access to traditional gambling. Prior evidence has consistently linked LB purchasing with problem gambling, online gambling and problematic gaming, but most studies remain cross-sectional, and longitudinal research with minors is still scarce (González-Cabrera et al., 2022, 2023; Montiel et al., 2022). Two-wave studies suggest that LB purchasing can be persistent and prospectively associated with online gambling; however, evidence based on three or more waves is limited. This study therefore examines LB purchasing in Spanish adolescents across three assessment waves, focusing on prevalence, longitudinal trajectories, transitions, temporal dependence and prospective associations with online gambling behaviour, Internet Gaming Disorder (IGD), and Online Gambling Disorder (OGD). **METHODS:** A prospective longitudinal school-based study was conducted in Valencia, Spain, using a non-probabilistic incidental sample. The final analytical sample consisted of 667 adolescents with complete LB purchasing data across three waves, assessed approximately six months apart (55.6% boys; age range: 11–17 years; mean age at T3 = 14.35, SD = 1.25). LB purchasing was assessed for the previous 12 months at T1 and for the previous 6 months at T2 and T3, matching the inter-wave interval. Online gambling behaviour was assessed with a dichotomous screening item; OGD symptoms were assessed with the Online Gambling Disorder Questionnaire among respondents reporting online gambling, and IGD was assessed using the Spanish version of the IGD9-SF. Analyses included point prevalence estimates, three-wave trajectory classification, transition matrices, incidence, remission and persistence rates, McNemar tests, Cohen's kappa, a first-order Markov GEE model, and relative risks (RR) for prospective associations with subsequent outcomes. **RESULTS:** LB purchasing was common and relatively stable across follow-up. Point prevalence was 27.7% at T1, 32.2% at T2 and 29.4% at T3. Marked sex differences were observed at all waves: among boys, prevalence ranged from 44.7% to 49.1%, whereas among girls it ranged from 6.4% to 11.1%. Trajectory analyses showed substantial heterogeneity. Sustained non-purchasing was the most frequent pattern (56.2%), while 16.6% of participants reported persistent purchasing across all three waves. Persistent purchasing was much more frequent among boys than girls (27.0% vs. 3.7%), whereas sustained non-purchasing was more frequent among girls (82.8% vs. 35.0%). Transition analyses indicated moderate temporal stability. From T1 to T2, incidence among non-purchasers was 14.3%, remission among purchasers was 21.1%, and persistence reached 78.9%. From T2 to T3, incidence was 12.4%, remission increased to 34.9%, and persistence declined to 65.1%, suggesting that the behaviour is stable but not immutable. Cohen's kappa values were moderate (0.62 for T1–T2; 0.54 for T2–T3; 0.55 for T1–T3). In the first-order Markov GEE model, prior purchasing was the strongest predictor of subsequent purchasing (OR = 11.34; 95% CI [7.93, 16.20]), and girls had substantially lower odds of purchasing than boys (OR = 0.27; 95% CI [0.20, 0.38]). LB purchasing was also prospectively associated with subsequent online gambling. In the total sample, T1 purchasing predicted higher risk of online gambling at T2 (RR = 2.38; 95% CI [1.51, 3.75]), and T2 purchasing predicted higher risk at T3 (RR = 1.80; 95% CI [1.07, 3.03]). The T1–T3 estimate also indicated increased risk, although with weaker evidence. Sex-stratified analyses showed increased risk among both boys and girls in the T1–T2 transition, while the T2–T3 association remained clearer among boys. For clinical indicators of IGD and OGD, point estimates were generally positive but confidence intervals were wide and often included the null value, indicating limited precision and insufficient evidence for firm

conclusions. **CONCLUSIONS:** LB purchasing in adolescence appears to be prevalent, sex-differentiated, and temporally dependent. The findings support the interpretation of LB purchasing as a stable behavioural risk marker and show a prospective association with later online gambling involvement. However, the results do not establish a causal gateway mechanism, and evidence regarding clinical IGD/OGD indicators remains inconclusive because of low case frequency and limited precision. These findings reinforce the need for prevention, systematic monitoring of digital spending practices among minors, and regulatory safeguards for chance-based monetisation mechanics in videogames.

ENDNOTES

1 Randomized, purchasable reward mechanisms embedded in videogames.

2 IGD = Internet Gaming Disorder; OGD = Online Gambling Disorder; LB = loot box; RR = relative risk; GEE = generalized estimating equations.

BIBLIOGRAPHY

- Brooks, G. A. & Clark, L. (2023). The gamblers of the future? Migration from loot boxes to gambling in a longitudinal study of young adults. *Computers in Human Behavior*, 141, 107605. <https://doi.org/10.1016/j.chb.2022.107605>
- Drummond, A., Sauer, J. D., Hall, L. C., Zendle, D. & Loudon, M. R. (2020). Why loot boxes could be regulated as gambling. *Nature Human Behaviour*, 4(10), 986–988. <https://doi.org/10.1038/s41562-020-0900-3>
- Garea, S., Drummond, A., Sauer, J. D., Hall, L. C. & Williams, M. (2021). Meta-analysis of the relationship between problem gambling, excessive gaming and loot box purchasing. *International Gambling Studies*, 21(3), 1–20. <https://doi.org/10.1080/14459795.2021.1914705>
- González-Cabrera, J., Basterra-González, A., Montiel, I., Calvete, E., Pontes, H. M. & Machimbarrena, J. M. (2022). Loot boxes in Spanish adolescents and young adults: Relationship with internet gaming disorder and online gambling disorder. *Computers in Human Behavior*, 126, 107012. <https://doi.org/10.1016/j.chb.2021.107012>
- González-Cabrera, J., Basterra-González, A., Ortega-Barón, J., Caba-Machado, V., Díaz-López, A., Pontes, H. M. & Machimbarrena, J. M. (2023). Loot box purchases and their relationship with internet gaming disorder and online gambling disorder in adolescents: A prospective study. *Computers in Human Behavior*, 143, 107685. <https://doi.org/10.1016/j.chb.2023.107685>
- González-Cabrera, J., Caba-Machado, V., Díaz-López, A., Jiménez-Murcia, S., Mestre-Bach, G. & Machimbarrena, J. M. (2024). The mediating role of problematic use of loot boxes between internet gaming disorder and online gambling disorder: Cross-sectional analytical study. *JMIR Serious Games*, 12(1), e57304. <https://doi.org/10.2196/57304>
- González-Cabrera, J., Machimbarrena, J. M., Beranuy, M., Pérez-Rodríguez, P., Fernández-González, L. & Calvete, E. (2020). Design and measurement properties of the Online Gambling Disorder Questionnaire (OGD-Q) in Spanish adolescents. *Journal of Clinical Medicine*, 9(1), Article 1. <https://doi.org/10.3390/jcm9010120>
- Grosemans, E., De Cock, R., Bradt, L. & Soenens, B. (2025). From gambling-like elements in and around video games to monetary gambling: Testing a pathway model among adolescents. *International Gambling Studies*, 25(3), 472–494. <https://doi.org/10.1080/14459795.2025.2567896>

- Montiel, I., Basterra-González, A., Machimbarrena, J. M., Ortega-Barón, J. & González-Cabrera, J. (2022). Loot box engagement: A scoping review of primary studies on prevalence and association with problematic gaming and gambling. *PLOS ONE*, 17(1), e0263177. <https://doi.org/10.1371/journal.pone.0263177>
- Palmer, L., Brooks, G. A. & Clark, L. (2025). A longitudinal replication study testing migration from video game loot boxes to gambling in British Columbia, Canada. *BMC Psychology*, 13(1), 459. <https://doi.org/10.1186/s40359-025-02766-1>
- Spicer, S. G., Nicklin, L. L., Uther, M., Lloyd, J., Lloyd, H. & Close, J. (2022). Loot boxes, problem gambling and problem video gaming: A systematic review and meta-synthesis. *New Media & Society*, 24(4), 1001–1022. <https://doi.org/10.1177/14614448211027175>
- Xiao, L. Y. (2025). Failing to protect the online consumer: Poor compliance with Dutch loot box and video game consumer protection guidelines. *International Journal of Law and Information Technology*, 33, eaaf011. <https://doi.org/10.1093/ijlit/eaaf011>

BIO

Abel Nogueira López is a professor and researcher at the Faculty of Health Sciences at the University of Burgos. His research interests focus on the field of behavioral addictions, particularly the study of risk behaviors and problematic and/or potentially addictive use related to video games, gambling, and the Internet and the conceptualization and diagnosis of these behaviors. In parallel, within the field of sport psychology, his work has focused on promoting healthy practices and the well-being of individuals engaged in physical activity through the study of pain and personality.

Joaquín González-Cabrera is a professor and researcher at Universidad Internacional de La Rioja (UNIR), Spain. His work focuses on adolescent digital well-being, problematic gaming, gambling-related harms, loot boxes, cyberbullying, online risks, and technology-mediated psychosocial outcomes. He has led and collaborated on large-scale and longitudinal studies with Spanish adolescents, with a strong emphasis on prevention, assessment, and evidence-based public policy in child and adolescent online safety. Co-author bios should be completed individually if required by the conference.

Susana Jiménez-Murcia is full professor at the University of Barcelona. She is the Director of the Behavioral Addictions Unit at the University Hospital Bellvitge (Barcelona, Spain) and currently the Head of the Department of Clinical Psychology at the same Hospital and Director of the Territorial Mental Health Plan MetroSud. She is the Co-Chair of Group CIBERObn (Excellent Spanish Research Network for Obesity and Nutrition) and of the IDIBELL Group on Psychoneurobiology of Eating and Addictive Behaviors.

Antonio Rial Boubeta is a professor and researcher at the University of Santiago de Compostela (USC). He is a member of the UNESCO High Commissioner's expert group on the global fight against bullying and cyberbullying. He has also been part of the Expert Committee established by the Government of Spain for the development of the Law on the Protection of Minors in the Digital Environment. He led the study on the impact of technology on

adolescence, conducted by UNICEF with a sample of more than 90,000 adolescents, which remains one of the largest scientific studies on this topic carried out in Europe.

Juan Manuel Machimbarrena Garagorri is a professor and researcher at University of the Basque Country (UPV/EHU). His research is mainly focused on bullying, cyberbullying, the use of new technologies by adolescents and its relation to personal and family variables and Health Related Quality of Life. His work examines relational risks such as cyber dating abuse and sexting, as well as dysfunctional technology behaviors including problematic social media use, Internet Gaming Disorder, and loot boxes. He has contributed to the development of prevention programs addressing these challenges and has participated in research and knowledge transfer projects.

FUNDING

This study was funded by Universidad Internacional de La Rioja (UNIR), Project “Cyberpsychology (2020–2022)”, and Dirección General de Ordenación del Juego–Ministerio de Consumo de España (SUBV23/00022 & SUBV25/00005).

CONFLICTS OF INTEREST

No conflicts of interest are reported in the source manuscript. The authors should confirm whether any conference-specific organisational or editorial role requires additional disclosure.

ACKNOWLEDGMENTS

The authors thank the participating schools, teachers, families and adolescents who made the longitudinal study possible. This proposed acknowledgement should be confirmed by the authors because no separate acknowledgments section was included in the source manuscript.