

**Adicciones comportamentales: epidemiología,
factores de riesgo, fenotipos y resultado terapéutico**

Rocío Elena Ayala Rojas

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Adicciones comportamentales: epidemiología, factores de riesgo, fenotipos y resultado terapéutico

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*Señor, tú me conoces a fondo.
Sabes cuándo me levanto y cuándo descanso,
conoces mis pensamientos y mis caminos,
me rodeas con tu presencia y me sostienes con tu mano,
tú estás conmigo en todo lugar.
Una ciencia tan admirable me sobrepasa.
¿A dónde iré lejos de ti?
Tú me creaste con cuidado desde el vientre de mi madre.
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Glosario de abreviaturas

AADO	Adicción a las Apuestas Deportivas Online
AC	Adicciones Comportamentales
AVJO	Adicción a los Videojuegos Online
CIE	Clasificación Internacional de las Enfermedades
DSM	Diagnostic and Statistical Manual of Mental Disorders
APA	American Psychiatric Association
OMS	Organización Mundial de la Salud
TJ	Trastorno de juego
AVJ	Adicción a Videojuegos
AIRTJ	Actos ilegales relacionados con el trastorno de juego
TCC	Terapia cognitivo conductual
TUS	Trastorno por Uso de Sustancias

Enumeración de los artículos

La presente tesis se estructura como un compendio de publicaciones y está conformada por tres artículos científicos publicados en revistas indexadas en el *Journal Citation Reports* (JCR), así como un cuarto manuscrito actualmente en proceso de publicación. A continuación, se enumeran estos trabajos, los cuales serán referidos a lo largo de este documento:

- Artículo 1: Ayala-Rojas RE, Granero R, Fernández-Aranda F, Gómez-Peña M, Moragas L, Perales I, & Jiménez-Murcia S. (2025). Online gaming disorder and sports betting addiction: convergences and divergences. *International Journal of Mental Health and Addiction*, 23(6), 4913–4937. doi: 10.1007/s11469-024-01386-x.
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- Artículo 2: Granero R, Fernández-Aranda F, Ayala-Rojas RE, Tapia J, Nadal R, Vinet-Valdebenito G, Rosinska M, & Jiménez-Murcia, S. (2025). A network approach of gambling disorder profile with and without related illegal acts. *International Journal of Mental Health and Addiction*, 23(3), 1803–1827. doi: 10.1007/s11469-023-01199-4.
Clave: Artículo. Factor Impacto (JCR 2023, SCIE): 3.2
Q2 en área Psychiatry (posición de la revista 88/276 Social Sciences)
- Artículo 3: Ayala-Rojas RE, Rosinska M, Perales-Cárdenas I, Soldevilla-Morera J, Granero R, Fernández-Aranda F, & Jiménez-Murcia S. (2025). Features related to the presence of internet gaming disorder and their impact on the treatment outcomes. *Journal of Behavioral Addictions*, 14(1), 361-372. doi: 10.1556/2006.2024.00070.
Clave: Artículo. Factor Impacto (JCR 2024, Social Sciences and Sciences): 6.2
Q1 en área de Psiquiatría (posición revista 21/288 Social Sciences)

Además, se incluye un cuarto artículo que en el momento del depósito de la tesis se encuentra preparado y pendiente de ser enviado a publicación:

- Artículo 4: Granero R, Ayala-Rojas RE, Parrilla-Cáceres J, Fernández-Aranda F, Munguía, L., Baenas-Soto, I., Jiménez-Murcia S. (2025). Biopsychological markers of gambling disorder: a path analysis approach.

Resumen

Marco teórico y objetivos

En la actualidad, la proliferación de plataformas de juego en línea, de fácil acceso y sin una regulación estricta, ha captado la atención de la sociedad, especialmente entre los jóvenes e incluso menores de edad. Este fenómeno ha generado un impacto considerable en la salud pública. Al mismo tiempo, las tasas de prevalencia de las adicciones comportamentales (AC) han experimentado un aumento notable en los últimos años. Este hecho ha suscitado un creciente interés en la comunidad científica, enfocándose en áreas como la epidemiología, la etiología, la conceptualización y el diagnóstico de las AC, y buscando identificar los factores que predisponen la aparición y el desarrollo de estos trastornos.

La literatura científica señala que las AC son de naturaleza multicausal producto de una interacción dinámica entre diversos factores biopsicosociales, que favorecen tanto su aparición como su mantenimiento, especialmente en poblaciones vulnerables. Hasta el momento, el trastorno de juego (TJ) es la única adicción conductual oficialmente reconocida en el *Manual Diagnóstico y Estadístico de los Trastornos Mentales- Quinta edición* (DSM-5). Por otra parte, la adicción a los videojuegos (AVJ) ha sido clasificada en la sección III del DSM-5, bajo la categoría de “condiciones que requieren investigación adicional”, y la *Clasificación Internacional de Enfermedades – Decimoprimer edición* (CIE-11) la incluyó dentro de la sección de “trastornos debidos a conductas adictivas” conceptualizándola como un patrón de comportamiento adictivo, persistente o recurrente que puede manifestarse tanto en entornos virtuales como presenciales (WHO, 2020). El TJ y la AVJ, son dos de las modalidades de AC con mayor prevalencia en las sociedades industrializadas, mostrando un crecimiento alarmantemente en las últimas décadas. Al mismo tiempo, son cuadros clínicos cuyas características están en transformación, en gran medida como resultado de la rápida aparición y evolución de nuevas plataformas en formato presencial y virtual.

Ante este escenario, la presente tesis tiene como objetivos principales: a) identificar componentes biopsicosociales que actúan como factores de riesgo para la presencia de las AC más prevalentes en la actualidad, en concreto para el TJ (en especial la adicción a las apuestas deportivas online [AADO]) y para la adicción a los videojuegos online (AVJO); b) analizar los mecanismos subyacentes que contribuyen a la expresión

fenotípica y endofenotípica de estos comportamientos adictivos y c) determinar las variables con capacidad predictiva a la respuesta al tratamiento mediante la terapia cognitiva conductual (TCC). De este modo, se pretende obtener evidencia empírica que permita identificar los fenotipos y endofenotipos asociados a los perfiles clínicos de los diferentes tipos de AC, comprender los mecanismos que subyacen y los factores que influyen en la respuesta al tratamiento, con el propósito de desarrollar programas de intervención más precisos y eficaces.

Hipótesis

La hipótesis general señala que existen múltiples variables que interactúan en la expresión de los diferentes tipos de AC, así como de sus fenotipos y endofenotipos, y de la probabilidad de éxito de los tratamientos psicológicos, específicamente de la TCC.

Métodos

Los estudios que conforman esta tesis por compendio de artículos incluyeron pacientes que solicitaron tratamiento en la Unidad de Juego Patológico y Otras Adicciones Comportamentales del Hospital Universitario de Bellvitge. Se consideraron criterios de inclusión como la edad igual o superior a 18 años y el diagnóstico de adicción conductual (TJ y AVJO), y como criterios de exclusión la presencia de trastornos neurológicos, discapacidad intelectual (condiciones que afectan la capacidad de los pacientes para facilitar información en las medias rutinarias de evaluación y para participar en los programas estándar de tratamiento). Las muestras fueron seleccionadas en base a los objetivos específicos de cada estudio. Los participantes fueron evaluados a través de entrevistas clínicas, análisis de sangre, pruebas neuropsicológicas y una batería amplia de cuestionarios, que valoran constructos concretos relacionados con cada trastorno. El programa de tratamiento se basó en el modelo de TCC. Los análisis estadísticos realizados fueron determinados según los objetivos específicos de cada estudio, y se ejecutaron mediante los programas Stata18 y Gephi9.2 para Windows.

Resultados

En términos generales, las muestras analizadas estuvieron compuestas mayoritariamente por hombres, solteros, con niveles educativos primarios o secundarios

y estatus socioeconómico bajo. En el primer estudio, se observó que la prevalencia de AADO fue del 13.01%, casi cuatro veces superior a la de AVJO, que alcanzó un 3.82% en una muestra de 3.036 pacientes que consecutivamente acudieron a solicitar tratamiento por comportamientos adictivos. Además, se identificó una tendencia lineal creciente en la prevalencia de AADO entre el 2012 (8.6%) y el 2022 (15.5%), mientras que la AVJO mostró solo una ligera tendencia creciente, aunque no alcanzó la significación estadística. A nivel psicopatológico, los pacientes con AADO presentaron mayores niveles de depresión, ansiedad, ideación paranoide y malestar psicológico global, así como mayores índices de impulsividad, desregulación emocional y consumo de sustancias. El perfil de personalidad de este grupo de pacientes se caracterizó por una mayor búsqueda de novedades, mayor dependencia de la recompensa, mayor persistencia y menor evitación del daño.

En el segundo estudio, que se realizó mediante análisis de redes, la autotranscendencia fue identificada como el nodo “puente” y el más relevante, seguido del síntoma DSM-5 A7 “mentiras para ocultar el grado de implicación en el juego”, en los pacientes con actos ilegales relacionados al trastorno de juego (AIRTJ). En contraste, con los pacientes sin AIRTJ, el nodo con mayor relevancia y que se identificó como “puente”, fue el síntoma DSM-5 A5 “apuesta cuando se siente estresado (deprimido, culpable o ansioso)”.

El tercer estudio evidenció que el riesgo de recaída durante la TCC, aplicada a pacientes con AVJO fue superior en sujetos con puntuaciones más altas en sensibilidad interpersonal, hostilidad y persistencia. Asimismo, ser hombre y presentar un inicio del comportamiento adictivo más tardío aumentó la probabilidad de abandono del tratamiento, mientras que un bajo cumplimiento terapéutico se asoció a mayores niveles de ideación paranoide, dependencia de la recompensa y bajos niveles de cooperatividad.

El cuarto estudio que se incluye como anexo en esta tesis doctoral evidenció que, en comparación con sujetos controles sin adicciones, el TJ se asocia directamente con una edad más joven, mayores niveles de impulsividad, mayores déficits a nivel neuropsicológico y un nivel más bajo de LEAP2. De igual modo, se identificaron vínculos indirectos-mediadores que destacaron el papel relevante de la impulsividad y el funcionamiento neuropsicológico en la predisposición al desarrollo del TJ.

Conclusiones

Los resultados de los estudios que conforman esta tesis evidencian la heterogeneidad de las AC, así como la presencia de múltiples factores biopsicosociales que influyen en su desarrollo y mantenimiento. Asimismo, se identificaron perfiles diferenciados en los grupos de pacientes con TJ (en particular con AADO) y AVJO, caracterizados por variables sociodemográficas, psicopatológicas y rasgos de personalidad específicos que permiten comprender mejor los mecanismos subyacentes que configuran la expresión fenotípica propia de cada condición clínica.

Se identificó una prevalencia significativamente mayor de pacientes que consultan por AADO en comparación con las consultas por AVJO, con una tendencia creciente entre 2012 y 2022. Los pacientes con AADO presentaron un perfil clínico más grave, así como un perfil de personalidad más desadaptativo. Asimismo, se identificó que la presencia de AIRTJ se asocia a un perfil clínico más severo y se hallaron distintas estructuras e interrelaciones en las redes neuronales que se obtienen en pacientes con TJ según presenten o no AIRTJ (evidencia que también refuerza la existencia de patrones psicopatológicos diferenciados dentro del TJ).

En los pacientes con AVJO, se obtuvieron perfiles específicos y distintos a los que se observan en otras AC, en los que interactúan factores sociodemográficos, psicopatológicos y rasgos de personalidad. Estos pacientes presentan además un elevado riesgo de abandono y recaída durante la TCC, especialmente aquellos con mayor malestar psicopatológico en la línea base y un perfil de personalidad más disfuncional.

Respecto al TJ, se han identificado factores endocrinos que interactúan con otras variables del endofenotipo (incluyendo el funcionamiento neuropsicológico y la impulsividad) y que contribuyen de forma directa e indirecta en la etiopatogenia de este trastorno.

Palabras clave. Trastorno de juego, Trastorno por adicción a los videojuegos online, Apuestas deportivas online, Actos ilegales relacionados con el trastorno de juego, Terapia cognitivo-conductual.

1. Introducción

1.1 Adicciones comportamentales conceptualización

Las AC constituyen un conjunto de condiciones clínicas caracterizadas por la pérdida de control sobre una determinada conducta, y por su realización repetitiva a pesar de las consecuencias negativas que genera al propio sujeto y/o a su entorno (Brand et al., 2025; Zeng et al., 2023). Estos patrones comportamentales son muy similares en expresión clínica y etiológica a las adicciones relacionadas con el consumo de sustancias. En los últimos años, se ha observado una tendencia al aumento de prevalencias cada vez más importante, ocupando un lugar significativo dentro del conjunto de comportamientos adictivos (Brand et al., 2022; Sassover & Weinstein, 2022).

Desde la perspectiva clínica y de investigación se reconoce la existencia de múltiples formas de AC (como el uso excesivo de videojuegos, la compra compulsiva, la adicción al sexo, o el uso problemático de nuevas tecnologías). Aunque ciertos comportamientos pueden generar patrones adictivos, la falta de evidencia empírica suficiente no ha permitido incorporarlos en los manuales diagnósticos de los trastornos mentales (Griffiths, 2022). No obstante, solamente el TJ y la AVJ se han incluido como categorías diagnósticas en la CIE-11 (Brand & Potenza, 2023; CIE - 11th Revision., 2020).

Por otro lado, el TJ es la única AC reconocida como trastorno mental según el DSM-5, clasificándolo bajo el epígrafe de “Trastornos adictivos y relacionados con sustancias”, y lo ha definido como una conducta de juego recurrente y desadaptativa que provoca un malestar clínicamente significativo. Por otro lado, la AVJ ha sido incluida en la sección III del DSM-5, denominada “condiciones que requieren estudio adicional” y se encuentra a la espera de futuras investigaciones científicas que avalen su inclusión (American Psychiatric Association, 2013).

Los estudios disponibles hasta el momento constatan que las características centrales presentes en las AC guardan similitud con otras conductas adictivas relacionadas con el trastorno por uso de sustancias (TUS), como síntomas de abstinencia y tolerancia, preocupación por la actividad (desatendiendo otras ocupaciones personales), dificultad para reducir la cantidad de tiempo dedicado o fracaso en el intento de dejarlo, e interferencia con otras actividades (Castro-Calvo et al., 2021; Zeng et al., 2024). La evidencia acumulada también sugiere que tanto el inicio como la evolución de las AC

están asociados a características neurobiológicas, psicológicas y sociales similares a las observadas en las adicciones con sustancias. Sin embargo, todavía no se conocen bien los mecanismos de interacción que contribuyen a la presencia de estos complejos cuadros clínicos, lo que hace necesario indagar sobre los endofenotipos específicos de cada AC (Jiménez-Murcia et al., 2016; Solé-Morata et al., 2023), así como del conjunto de variables biopsicosociales impacta en el desarrollo de estos trastornos (Ayala-Rojas et al., 2022).

1.2 Trastorno de juego

El juego de azar es un comportamiento intrínsecamente relacionado con la humanidad. Se sabe que los sumerios y los asirios utilizaban astrágalos, huesos de animales que se encuentran en el tarso y se lanzaban al aire con la finalidad de adivinar qué cara/s quedaría/n a la vista. Más tarde, el juego con dados se hizo popular en el Imperio romano (aunque los dados más antiguos de la humanidad datan del Antiguo Egipto). También existen indicios de juegos de azar en los vestigios de la civilización china, como el Keno (inventado hace más de 3000 años). Y desde su aparición, los juegos de azar han ido evolucionando, incorporando nuevos elementos, creciendo en popularidad, y ocupando un lugar esencial en la cultura y en la sociedad. Actualmente, se puede jugar y hacer apuestas desde cualquier dispositivo electrónico que tenga conexión a internet, desde el lugar donde uno se encuentre y a cualquier hora del día.

Muchas personas juegan a modo de entretenimiento sin generar problemas, lo que se conoce como “juego social” o “juego recreativo”. Sin embargo, existe otro grupo que presenta un juego excesivo y persistente a pesar de las consecuencias negativas para su desarrollo personal, psicológico y/o social (Hodgins et al., 2011).

A inicios del siglo XXI, Blaszczynski y Nower publicaron un estudio que se ha convertido en un referente para la comprensión del TJ (Blaszczynski & Nower, 2002). En esta investigación se identificaron diferentes mecanismos subyacentes que contribuyen al desarrollo del juego problemático y patológico. Este modelo sugiere que el TJ es un fenómeno heterogéneo, siendo posible identificar subtipos diferenciados en función de la implicación e importancia de cada uno de los factores de riesgo. En este sentido existiría un primer subtipo caracterizado por el condicionamiento de los factores ambientales como la oferta, la disponibilidad, el acceso y el entorno social y familiar, así como por el

propio potencial adictivo de los juegos de apuesta. Por otro lado, se encontrarían los jugadores emocionalmente vulnerables, que utilizarían el juego como un mecanismo de afrontamiento para manejar la inestabilidad afectiva y afrontar emociones negativas (ansiedad, depresión, soledad). Finalmente, los jugadores impulsivos/antisociales serían los que se caracterizarían por niveles altos de impulsividad, comportamientos desadaptativos, edad de inicio precoz, rápida progresión del trastorno y mayor probabilidad de abuso de sustancias y comportamientos delictivos. El trabajo de Blaszczynski y Nower supone un primer intento por clasificar perfiles de jugadores, con diferentes grados de implicación en el juego. Siguiendo esta línea, se han propuesto otros criterios para tipificar la conducta de juego de azar (Jiménez-Murcia & Aymamí, 2015). Por ejemplo, en base a las consecuencias y gravedad de la propia conducta: a) juego no problemático (sin sintomatología ni consecuencias negativas asociadas); b) juego problemático (se presentan síntomas del TJ pero no son suficientes para cumplir con un diagnóstico según las taxonomías de referencia); y c) juego patológico (con pérdida de control y cumpliendo criterios clínicos según taxonomías psiquiátricas) que genera en los sujetos un malestar clínicamente significativo y un deterioro funcional.

El TJ se introdujo por primera vez en la tercera edición del Manual Diagnóstico y Estadístico de los Trastornos Mentales (DSM-III) con el nombre de juego patológico y se clasificó como un trastorno del control de impulsos no clasificados en otros apartados (American Psychiatric Association, 1980). Se mantuvo así hasta la versión quinta del DSM, que en mayo de 2013 se denomina formalmente como “Trastorno de Juego” y lo clasifica en la categoría de “trastornos relacionados con el uso de sustancias y otras conductas adictivas” (American Psychiatric Association, 2013). Esta clasificación es importante porque por primera vez se reconoce la similitud del TJ con el resto de adicciones que cursan con el consumo de sustancias psicoactivas, tanto en la etiología (características neurobiológicas y clínicas), la fenomenología clínica, y los resultados del tratamiento (Potenza et al., 2019). Además, en la nueva definición del DSM-5-TR para el TJ se elimina el criterio de realizar actos ilegales para financiar el juego (como el robo o fraude) y se reduce el umbral de criterios a 4 (las versiones anteriores proponían 5). El DSM-5-TR también presenta una clasificación dimensional del TJ en función del número de síntomas presentes: leve (con 4 o 5 síntomas presentes), moderado (con 6 o 7 síntomas presentes) y grave con 8 o más síntomas presentes. El TJ ha sido definido por el DSM-5-TR como un trastorno que se caracteriza por un comportamiento de juego desadaptativo,

persistente y recurrente que conduce a un malestar clínicamente significativo. Se establece su diagnóstico si durante un periodo de 12 meses cumple con al menos 4 de los siguientes 9 criterios: (A1) necesidad de jugar con cantidades de dinero cada vez más elevadas para conseguir el mismo grado de excitación, (A2) irritabilidad o inquietud cuando se intenta dejar de jugar, (A3) fracaso repetido al controlar, interrumpir o detener el juego, (A4) preocupación constante por el juego, (A5) juega con frecuencia cuando se siente angustiado, utilizando el juego como una vía de escape de los problemas o alivio de los sentimientos de desesperanza, culpa, ansiedad o depresión, (A6) recurrir al juego como una forma de recuperar el dinero perdido (perseguir las pérdidas), (A7) mentir a familiares, terapeutas u otros sobre el comportamiento de juego, (A8) poner en peligro o perder relaciones importantes a nivel laboral o académico debido al juego y (A9) depender de otros para aliviar los problemas financieros causados por el juego (American Psychiatric Association, 2022).

La estimación de la prevalencia del TJ es muy heterogénea, como consecuencia de los diferentes instrumentos de medida para la evaluación del trastorno (de cribado o de diagnóstico, autoadministrado o entrevista clínica), de la composición de las muestras (de procedencia clínica, comunitaria, o incluyendo diferentes niveles de vulnerabilidad), o de la zona geográfica. Diversos estudios han informado que la prevalencia mundial a lo largo de la vida para el TJ oscila entre el 1-2% de la población general, observándose prevalencias más elevadas en adolescentes y jóvenes (Calado & Griffiths, 2016; Potenza et al., 2019). De esta manera, los estudios epidemiológicos han proporcionado información sobre distintos perfiles de riesgo, obteniendo tasas más altas de TJ en sujetos jóvenes, particularmente al final de la adolescencia e inicio de la vida adulta, y en el sexo masculino, quienes presentan un riesgo de 2.5 veces mayor que las mujeres (Feng et al., 2017; Mihara & Higuchi, 2017; Solé-Morata et al., 2023).

También es significativo el incremento en las prevalencias durante las últimas décadas. La revisión de Calado y Griffiths concluía que la prevalencia mundial del juego problemático estaba entre el 0.12% y 5.80 (Calado & Griffiths, 2016), mientras que otros estudios previos estimaron valores dentro del rango 1% al 2% (Haagsma et al., 2012; Müller et al., 2015; Rehbein et al., 2015). Se ha hipotetizado que una de las razones del incremento en la prevalencia del TJ durante los últimos años puede ser por el cambio en la definición de esta condición clínica en las principales taxonomías diagnósticas (como los cambios en el DSM-5). Asimismo, se ha postulado que el aumento en el juego

problemático puede relacionarse con factores contextuales como por ejemplo la pandemia por COVID-19 (concretamente con el mandato de confinamiento) (King et al., 2020; Király et al., 2020). Sin embargo, investigaciones posteriores no confirmaron un aumento generalizado del juego durante este periodo. Lo que se encontró fue que aquellas personas que presentaban un patrón problemático o patológico de juego tendieron a intensificar su conducta, mientras que muchos jugadores sociales o incluso excesivos redujeron su participación, probablemente como consecuencia de la pérdida de empleo, la incertidumbre económica o el cambio en las prioridades personales y familiares. Estas discrepancias en los hallazgos sugieren la necesidad de interpretar con cautela la evolución del TJ durante estos contextos, considerando no solo los factores externos, sino también las características individuales de los distintos perfiles de jugadores (Gainsbury et al., 2021; Håkansson et al., 2020; Jiménez-Murcia & Fernández-Aranda, 2022).

1.2.1 Factores biopsicosociales implicados

Una revisión sistemática actual ha señalado diversos factores de riesgo que predisponen al individuo al desarrollo y mantenimiento del TJ (Moreira et al., 2023). Se trata de una condición clínica compleja en la que interactúan de forma dinámica múltiples variables biológicas, psicológicas y sociales (Allami et al., 2021; Browne et al., 2019).

Factores biológicos: A nivel neurobiológico diversos estudios han revelado que las AC comparten mecanismos neurobiológicos con las adicciones relacionadas con sustancias psicoactivas (Jentsch & Pennington, 2014; Quaglieri et al., 2020; Tatari et al., 2021; Verdejo-Garcia et al., 2019; Weinstein et al., 2016; Zeng et al., 2024; Zhao et al., 2018). Asimismo, se ha identificado un deterioro estructural y funcional en diferentes regiones cerebrales, generando déficits en funciones ejecutivas y en el control de los impulsos. Estos déficits contribuyen tanto al inicio como a la progresión del TJ (Calluso et al., 2020; Mora-Maltas et al., 2024; Yücel et al., 2017), y se presentan de manera similar a lo que ocurre en los TUS (Kim & Hodgins, 2018; Linnet, 2020; Ngetich et al., 2023; Potenza, 2014). Estudios de neuroimagen han identificado alteraciones en las estructuras cerebrales como la corteza prefrontal, las áreas orbitales y ventromediales en individuos con TJ, asociadas a niveles reducidos de la actividad neuronal en estas regiones (Marek & Dosenbach, 2018; Moccia et al., 2017; Quintero, 2016; Zeng et al., 2024). A su vez, se han identificado disfunciones significativas en las regiones cerebrales asociadas al sistema dopaminérgico. Estas disfunciones afectan tanto la motivación, entendida como

el proceso de búsqueda e impulso para mantener la conducta de juego, como al procesamiento de la recompensa (Pettorruso et al., 2020; Potenza, 2014; Shevchouk et al., 2021; Solé-Morata et al., 2023). Además, se observa una menor conectividad funcional o deterioro en las áreas relacionadas con las funciones ejecutivas, lo que repercute en la planificación, control de impulsos, flexibilidad cognitiva, memoria de trabajo y toma de decisiones, optando por gratificaciones arriesgadas e inmediatas (Calluso et al., 2020; Lee et al., 2018; Palaus et al., 2017; Pan et al., 2018; Solé-Morata et al., 2022). En consecuencia, los individuos con TJ presentan múltiples déficits neurocognitivos, siendo los más representativos el deterioro de las funciones ejecutivas, las dificultades en toma de decisiones y las respuestas impulsivas, factores que contribuyen negativamente en la evolución clínica del trastorno y a su cronicidad (Agibalova et al., 2020; Mallorquí-Bagué et al., 2018; Moccia et al., 2017; van Timmeren et al., 2018). Asimismo, los neurotransmisores y particularmente la dopamina, que parece desempeñar un rol principal en el desarrollo y mantenimiento de las conductas adictivas, en general, debido a su implicación en los mecanismos de gratificación y refuerzo, se considerarían factores de riesgo en el TJ (Antons et al., 2020). Se ha observado que cuando los individuos juegan se produce la liberación de dopamina en la zona tegmental ventral (VTA) y se incrementa la sensación de placer en el núcleo accumbens (NAcc), lo cual actúa reforzando positivamente este comportamiento (Pettorruso et al., 2020). En esta línea de trabajos, se ha sugerido que los individuos con TJ presentan una sensibilidad reducida en procesos específicos implicados con el sistema de recompensa, por lo que son más propensos a buscar frecuentemente repuestas gratificantes pudiendo llegar a una pérdida del control de la conducta de juego y también a un progresivo deterioro cognitivo (Mayer et al., 2022; Solé-Morata et al., 2022, 2023). Otros neurotransmisores que parecer estar involucrados en la etiología del TJ son la serotonina (en especial en las fases de inicio y cese de la conducta adictiva), el cortisol (en las respuestas que se producen como reacción al estrés), los opioides (en los síntomas de abstinencia y en la percepción de sensaciones placenteras), y el glutamato (particularmente relacionado con las respuestas de compulsividad y con la falta de flexibilidad cognitiva) (Pettorruso et al., 2020; Potenza, 2014).

Si bien la literatura científica se ha centrado tradicionalmente en el área de la neurobiología de las conductas adictivas, estudios recientes han puesto de relieve que también los sistemas endocrinos participan en la modulación de los circuitos de

recompensa y gratificación, destacando el papel de hormonas gástricas grelina (y su antagonista LEAP-2) y las adipocitocinas (la leptina y adiponectina), relacionadas desde hace muchos años con la ingesta de alimentos y la homeostasis del organismo (Etxandi et al., 2022; Farokhnia et al., 2018; Iovino et al., 2022). Las evidencias disponibles sugieren que estos componentes del sistema endocrino participarían directa o indirectamente en el control de impulsos, las funciones ejecutivas y otros sistemas cognitivos (Baenas et al., 2024; Etxandi et al., 2022, 2023; Geisel et al., 2018; Iovino et al., 2022; Moccia et al., 2017; Quintero, 2016; Shevchouk et al., 2021; Stievenard et al., 2017). Los mecanismos explicativos son similares a los que se observan en las adicciones como el TUS y las AC (Ngetich et al., 2023; Quaglieri et al., 2020; Zeng et al., 2024). La grelina es una hormona producida principalmente en el estómago, cuya función principal es modular la sensación de apetito contribuyendo a la ingesta de alimentos (Revitsky & Klein, 2014). También se ha asociado con diferentes facetas de la impulsividad, como la desinhibición motora (impulsividad motora), la toma de decisiones (impulsividad de elección) y la búsqueda de novedades (impulsividad de rasgo) (Anderberg et al., 2016; Hansson et al., 2012; Skibicka & Dickson, 2011). Un estudio realizado por Etxandi y colaboradores encontró que los individuos con TJ, en comparación con los controles sanos, presentaron perfiles endocrinos alterados que se caracterizaban por mayores concentraciones plasmáticas de grelina en ayunas (Etxandi et al., 2022). De modo similar, en una investigación con mujeres se encontró una asociación positiva entre determinadas respuestas frente a la conducta de juego y las concentraciones de grelina en ayunas, y se concluyó que esta hormona actúa como un predictor de la persistencia en el juego de apuesta a pesar de las pérdidas (Sztainert et al., 2018). Se debe destacar también que otros estudios realizados con otro tipo de adicciones, como al consumo de alcohol, observó que la grelina contribuye a incentivar las propiedades gratificantes de esta sustancia y a predecir sus efectos subjetivos (el placer y el deseo de seguir bebiendo), lo cual constata que la grelina activa conductas relacionadas con la recompensa en los procesos adictivos (Müller et al., 2015; Ralevski et al., 2017; Shevchouk et al., 2021). También se ha observado que esta hormona puede actuar como un reforzador neuronal tanto para conductas naturales (como la comida) como no naturales (como el dinero que se obtiene tras ganar en el juego de azar) (Revitsky & Klein, 2014). Si esto se constata, la grelina podría intervenir en el sistema de recompensa en múltiples aspectos, como la motivación, el deseo, la gratificación, la abstinencia y la recaída (elementos fundamentales para el inicio y mantenimiento del TJ). Por otro lado, el péptido antimicrobiano 2 expresado en

el hígado (LEAP-2), que actúa como antagonista endógeno del receptor de la grelina mediante una función inhibidora del hambre y regulando el metabolismo energético del organismo (Ge et al., 2018), podría estar relacionado con el funcionamiento ejecutivo y las distorsiones cognitivas relacionadas con el juego (Lugilde et al., 2022; Mora-Maltas et al., 2024; Voigt et al., 2021). Puntuaciones altas en LEAP-2 en ayunas se han asociado a menor tiempo de reacción (mayor rapidez en la respuesta), incrementando comportamientos de tipo impulsivo (Voigt et al., 2021). Por el contrario, en comparación con muestras controles de sujetos sin comportamiento adictivo, los pacientes con TJ han obtenido puntuaciones más bajas en LEAP-2 (Etxandi et al., 2022). A pesar de la escasa evidencia disponible, el LEAP-2 podría tener efecto significativo en los programas de intervención para los trastornos adictivos en el futuro (Ge et al., 2018; Lugilde et al., 2022). Otros factores endocrinos implicados en el TJ son las adipocitocinas (leptina y adiponectina). Estas hormonas han sido estudiadas por su asociación con las respuestas de impulsividad (Sutin et al., 2013), y por consiguiente por su implicación en los procesos adictivos (Bach et al., 2021; Peters et al., 2018). Se ha sugerido que podrían ser biomarcadores asociados con los TUS, y específicamente con el comportamiento de urgencia o *craving* (Martinotti et al., 2017; Mehta et al., 2020). La leptina es una hormona producida principalmente por las células adiposas (grasas) del cuerpo y su función principal es regular el equilibrio energético, contribuyendo a la respuesta del hipotálamo para que inhiba el apetito y aumente el gasto de energía (Etxandi et al., 2023; Guzmán et al., 2019). Algunos estudios han revelado que la leptina modula la actividad de las neuronas dopaminérgicas mesolímbicas y puede influir en los comportamientos relacionados con los alimentos y las drogas (Escobar et al., 2018). Un estudio reciente en pacientes con TJ comparó dos grupos, con y sin adicción a la comida, encontrando que en los pacientes con TJ y adicción a la comida, las concentraciones altas de leptina se asociaban positivamente con la impulsividad, la disminución del control inhibitorio, la dificultad en la flexibilidad cognitiva y con el juego problemático más grave (Etxandi et al., 2023). A pesar de la falta de evidencia científica, investigaciones recientes han relacionado concentraciones séricas altas en leptina y bajas en adiponectina con la pérdida de control sobre la alimentación en personas con sobrepeso y obesidad (Yu, Fernandez, et al., 2021), y con los TUS (Shahouzehi et al., 2013). Asimismo, concentraciones más bajas de adiponectina se han identificado en pacientes con TJ (Etxandi et al., 2022), y parecen también predecir mayor gravedad tanto de este trastorno como de otros procesos adictivos (Mora-Maltas et al., 2024; Yu, Fernandez, et al., 2021).

Por otro lado, se han investigado posibles bases genéticas en relación con el TJ, sin embargo, los resultados siguen siendo controvertidos. Mientras que estudios con muestras amplias no ha identificado componentes del genoma que participen en el TJ (Lang et al., 2016; Lind et al., 2013), otras investigaciones han concluido que sí existe asociación entre la dotación genética y los procesos de recompensa, la motivación, el control de los impulsos y las emociones (Leeman & Potenza, 2013; Lobo et al., 2015; Potenza et al., 2019; Slutske, 2019). Esta discrepancia podría explicarse por la heterogeneidad metodológica entre estudios, las características clínicas de la muestra u otras variables. En esta línea, se ha planteado que la participación de las neurotrofinas (NTF) y sus receptores, están presentes en la etiopatogenia del TJ (Geisel et al., 2012; Koskela et al., 2017; Solé-Morata et al., 2022).

Factores psicológicos: En relación con los rasgos de personalidad vinculados a las AC, la evidencia científica señala que el TJ se caracteriza por altos niveles de búsqueda de novedad y autotrascendencia, baja cooperación y autodirección (Pettorruso et al., 2021). Estas características se han vinculado con la transición más prolongada del trastorno y con mayor gravedad clínica. En esta línea, la alta impulsividad es también un factor de riesgo psicológico muy significativo para explicar el TJ (Browne et al., 2019; Dufour et al., 2020; Flórez et al., 2016; Gori et al., 2022; Jiménez-Murcia, Granero, Fernández-Aranda, et al., 2020). De hecho, tanto la impulsividad como las dificultades en la regulación emocional se asocian a mayor gravedad del TJ y una peor respuesta al tratamiento (Vintró-Alcaraz, Mestre-Bach, Granero, Gómez-Peña, et al., 2022). En este sentido, la alexitimia, entendida como la dificultad para identificar, expresar y comprender las propias emociones, puede aumentar el riesgo de desarrollar TJ, dado que limita la capacidad de responder de manera favorable a las demandas contextuales y favorece el uso de estrategias desadaptativas, como la conducta de juego, concebida como una forma de regulación y afrontamiento emocional (Gori et al., 2022; Neophytou et al., 2023). En síntesis, estos déficits psicológicos se han asociado tanto con un aumento del riesgo de desarrollar problemas relacionados con el juego de apuesta como con su progresión y gravedad (Baenas et al., 2024; Etxandi et al., 2022; Yücel et al., 2017).

Además de los factores de personalidad, la presencia de distorsiones cognitivas desempeña un papel fundamental en las AC, constituyéndose como un predictor tanto del inicio (Chrétien et al., 2017; Mathieu et al., 2018; Mora-Maltas et al., 2024) como de la gravedad del TJ (Cunningham et al., 2014; Tang & Oei, 2011). Entre las cogniciones

irracionales asociadas al comportamiento adictivo, destaca la ilusión de control, que se manifiesta a través de comportamientos supersticiosos, rituales o el uso de amuletos, así como las expectativas distorsionadas sobre dichos comportamientos, sobrevalorando la gratificación que se obtiene al jugar. En el caso específico del TJ, se ha descrito la persistencia en el juego a pesar de pérdidas recurrentes, caracterizada por la creencia de falta de control en donde el juego me controla y no soy capaz de detenerlo (Potenza, 2014; Stojunic et al., 2019), y por la falacia del jugador que hace referencia a que un evento pasado influirá en el resultado de un evento futuro, por ejemplo: si algo ocurre con más frecuencia, con el tiempo ocurrirá menos o viceversa, para equilibrar la naturaleza. En este sentido, la falacia del jugador parece estar asociada con peores resultados del tratamiento, ya que se relaciona significativamente con otras distorsiones cognitivas, mayor impulsividad y comorbilidad con adicciones a sustancias (Ledgerwood et al., 2020). Otros sesgos cognitivos frecuentes en el TJ son el control predictivo (procesamiento inexacto sobre los resultados del juego en función de ganancias o pérdidas) y el sesgo interpretativo (atribuir el éxito a la habilidad propia y los fracasos a la influencia de otros) (Del Prete et al., 2017; Goodie & Fortune, 2013; Raylu & Oei, 2004). Este aparente control sobre los resultados del juego parece afectar la capacidad de los jugadores de estimar objetivamente las probabilidades reales de ganar, impactando sobre la toma de sus decisiones (Black & Allen, 2021; De Pasquale et al., 2018; Granero et al., 2020). Algunos estudios han observado que los jugadores estratégicos (los que escogen juegos en los que el resultado depende tanto del azar como de las propias habilidades o conocimientos del jugador) y los jugadores en línea, presentan mayores distorsiones cognitivas consistentes en sobreestimar sus habilidades y conocimientos para obtener premios en comparación con los jugadores no estratégicos (Mallorquí-Bagué et al., 2019; Stojunic et al., 2019; Valenciano-Mendoza et al., 2023). También se ha documentado que a lo largo del curso del TJ se produce una disminución en la memoria de trabajo (Gong et al., 2016; Marek & Dosenbach, 2018; Ngetich et al., 2023). Asimismo, un peor rendimiento neuropsicológico ha sido identificado como un predictor de un mayor número de distorsiones cognitivas relacionadas con el juego y de niveles más elevado de impulsividad, contribuyendo significativamente tanto a la sintomatología como a la gravedad del TJ (Mora-Maltas et al., 2024; Vintró-Alcaraz, Mestre-Bach, Granero, Gómez-Peña, et al., 2022).

Por otro lado, el TJ se ha relacionado con múltiples comorbilidades psiquiátricas como la depresión (Black & Allen, 2021; Dufour et al., 2020; Guillou Landreat et al., 2020), ansiedad (Guillou Landreat et al., 2020; Medeiros et al., 2016; Rodriguez-Monguio et al., 2017), TUS (Bergamini et al., 2018; Cowlshaw et al., 2016; Konkoly Thege et al., 2016; Rodriguez-Monguio et al., 2017; Wong et al., 2018), trastorno por déficit de atención e hiperactividad (TDAH) (Quaglieri et al., 2020), y otras formas de psicopatología como la esquizofrenia, el trastorno bipolar y los trastornos de personalidad (Bergamini et al., 2018; Tackett et al., 2017).

Factores sociales: A nivel sociodemográfico diversos estudios han identificado que el TJ presenta una mayor prevalencia en el sexo masculino (Çakıcı et al., 2021; Cunha et al., 2017; De Pasquale et al., 2018). Asimismo, se ha asociado con la ausencia de una pareja estable (Buth et al., 2017; Çakıcı et al., 2016; Montiel et al., 2021), con niveles educativos bajos en general, aunque esta relación puede variar según el contexto sociocultural y el tipo de juego de azar (Hing et al., 2016; Hing & Russell, 2020; Jiménez-Murcia, Granero, Giménez, et al., 2020; Volberg et al., 2018), desempleo y dificultades financieras (Buth et al., 2017; Çakıcı et al., 2016, 2021; Cowlshaw et al., 2016; Hing & Russell, 2020; Jiménez-Murcia, Granero, Giménez, et al., 2020; Volberg et al., 2018). La participación en juegos de azar a edad temprana también es un factor de riesgo, especialmente antes de la edad legal, que en la mayoría de países se sitúa a partir de los 18 años. La identificación de problemas de juego de apuesta a estas edades tan tempranas se puede explicar por diferentes vías, como la existencia de múltiples plataformas de juego de azar a través de internet con escasos elementos de control y el manejo habitual de dinero en menores de edad (Jiménez-Murcia et al., 2016; Turowski et al., 2023). Respecto a patrones de juego diferenciados, los estudios señalan que las mujeres suelen preferir juegos de carácter social, que les permite interactuar con otras personas y se perciben como apuestas más fáciles y seguras como los rascas y el bingo. En cambio, los hombres prefieren apostar dinero en juegos estratégicos (como apuestas deportivas o casinos), y son más propensos a comportamientos agresivos en juegos sociales (Delfabbro et al., 2018; Hing, Russell, Vitartas, et al., 2016; Moreira et al., 2023). En cuanto al contexto familiar, los jugadores con mayor riesgo proceden de hogares monoparentales, con problemas de adicción en la historia familiar y con ausencia de supervisión parental (Buth et al., 2017; Cavalera et al., 2018).

Por último, los componentes estructurales y tecnológicos han desempeñado un papel clave en la evolución del TJ. El acceso fácil, rápido, amplio y continuado a los juegos de azar en línea han impactado en la transformación de los perfiles sociodemográficos y clínicos de los jugadores. En los últimos años internet ha incrementado de forma exponencial el número de plataformas que facilitan acceso a juegos de azar (que operan durante las 24 horas del día, los 7 días de la semana), propiciando el uso de dinero digital, y facilitando el acceso al crédito. Estas características han contribuido a que los jugadores tengan un control más deficiente de su conducta de juego (Hing, Russell, Gainsbury, et al., 2016; Moreira et al., 2023). En relación con los patrones conductuales de la actividad de juego, algunos estudios han concluido que jugar a múltiples juegos de azar y sesiones de juego más largas, suponen un riesgo mayor de desencadenar adicción al juego, estando ambos aspectos muy presentes en el juego en línea (Cavalera et al., 2018; Hing & Russell, 2020; Jiménez-Murcia, Granero, Giménez, et al., 2020). También se ha hipotetizado que la motivación por el reconocimiento social, es decir, la tendencia a jugar con el fin de obtener aprobación, estatus o integración en un grupo podría estar asociada con niveles más bajos de gravedad en el juego problemático (Hearn et al., 2021).

1.2.2 Subtipos en función de la preferencia de juego: Apuestas deportivas

Los estudios que analizan las preferencias de juego han destacado la importancia de factores contextuales como la accesibilidad y la disponibilidad de los juegos de azar, así como las características técnicas y estructurales que las configuran (Moragas et al., 2015). Existen diferentes criterios para clasificar la conducta de juego de azar, siendo una de las más comunes la diferenciación entre juego estratégico (caracterizado por el hecho de que las habilidades y los conocimientos del jugador pueden influir en los resultados) versus juego no estratégico (el resultado depende totalmente del azar). Entre los juegos estratégicos se incluyen las apuestas deportivas, las cartas, la inversión en bolsa, o algunos juegos de casino. En contraste, los juegos no estratégicos abarcan las loterías, las máquinas recreativas con premio (conocidas como tragaperras), la ruleta electrónica y el bingo (Jiménez-Murcia et al., 2020).

Las apuestas deportivas son una forma de juego estratégico y una de las modalidades del TJ, caracterizada por un deseo incontrolable y persistente de apostar en deportes a pesar

de las graves consecuencias que ocasionan al sujeto y su entorno; lo que puede derivar en dificultades financieras (deudas), deterioro en las relaciones interpersonales y problemas legales (Estévez et al., 2017; Mestre-Bach et al., 2022). Actualmente, las nuevas tecnologías han transformado el mercado de apuestas deportivas, generando estructuras de oportunidad para prácticas lícitas e ilícitas (Moriconi Bezerra & Almeida, 2021). Las apuestas deportivas se han expandido globalmente, con prevalencias en aumento especialmente en Norteamérica, Oceanía y Europa, siendo más relevante la comercialización y la promoción de las apuestas deportivas en Australia y el Reino Unido (Deans et al., 2017; Etuk et al., 2022; Gainsbury, Russell, Hing, et al., 2015).

Las apuestas deportivas pueden realizarse de forma online y presencial, siendo más frecuentes la modalidad virtual (con una ratio de 7 a 3) y las que cursan con mayores niveles de gravedad (Gainsbury et al., 2013, 2014). Actualmente las apuestas deportivas se han normalizado en la población general, con prevalencias crecientes siguiendo una tendencia lineal positiva del 8.6% en 2012 al 15,5% en 2022 (Ayala-Rojas et al., 2024). Entre los factores que explican este auge se encuentran los avances de la tecnología, que facilitan el acceso a múltiples plataformas desde cualquier ubicación geográfica y en cualquier momento, permitiendo su ejecución inmediata y garantizando el anonimato (McGee, 2020). Asimismo, diferentes estudios han concluido que las apuestas deportivas contienen muchas características atractivas y novedosas que pueden motivar a los jugadores a apostar y mantenerlos en el juego a pesar de las pérdidas, como el *cash-out* (que gestiona los riesgos en las apuestas), las apuestas en vivo, los depósitos instantáneos y las microapuestas (factores que generan en los jugadores decisiones más impulsivas y por tanto disminuyen el control sobre el juego) (Lopez-Gonzalez et al., 2018; Winters & Derevensky, 2019). Las estrategias de publicidad y *marketing* que se utilizan desde la industria del juego son también un importante factor de riesgo que ha contribuido a su incremento (Bouguettaya et al., 2020; Etuk et al., 2022; Newall et al., 2019). De modo que es habitual que se promocionen anuncios con estrategias persuasivas que minimizan la percepción del riesgo del juego y generan una falsa ilusión de control en los apostadores (Lopez-Gonzalez et al., 2018). Además, los incentivos que se ofrecen resultan también atractivos, ya que promocionan ofertas de reembolso/devolución de apuesta, ofertas de registro y cuotas promocionales de fácil gestión (Hing, Sproston, et al., 2017). Las apuestas con bonificación (como las ofertas por apuestas múltiples y/o por recomendar a un amigo/conocido), resultan atractivas para muchos apostadores, que subestimaban los

costes reales de estos incentivos (Hing et al., 2019) y las aprueban sin conocer realmente las contraprestaciones (Etuk et al., 2022; Hing et al., 2015).

El perfil más habitual de jugador de apuesta deportiva corresponde a un sujeto joven, soltero, de sexo masculino y con nivel educativo medio-alto (Hing, Russell, & Browne, 2017; Quintero, 2016; Valenciano-Mendoza et al., 2023). El TJ que cursa con las apuestas deportivas presenta una rápida evolución y mayor gravedad en comparación con otras formas de juego (Ayala-Rojas et al., 2024; Valenciano-Mendoza et al., 2023). Los pacientes presentan altas puntuaciones en impulsividad (especialmente en búsqueda de novedades) y en reactividad emocional (experimentan emociones intensas como resultado de las victorias y también de las derrotas) (Baenas et al., 2024; Cooper et al., 2021). Estas características se asocian con un mayor impacto en el área financiera, ya que las apuestas deportivas suelen generar pérdidas más rápidas y significativas a diferencia de otras modalidades del TJ (Granero, Jiménez-Murcia, et al., 2020; Hing, Russell, & Browne, 2017; Valenciano-Mendoza et al., 2023). Asimismo, se ha observado una mayor frecuencia de consumo de sustancias (Ayala-Rojas et al., 2024; Granero, Jiménez-Murcia, et al., 2020) y una mayor comorbilidad con otras AC (Valenciano-Mendoza et al., 2023). También son más graves y frecuentes las distorsiones cognitivas, que suelen aparecer como una forma de minimizar el riesgo de las apuestas, entre ellas destacan la ilusión de control, la creencia en rituales de buena suerte y la sobreestimación de las propias habilidades para ganar (Cooper et al., 2021). Otro aspecto a destacar es la intensidad de las motivaciones para apostar, los jugadores de apuestas deportivas puntúan más alto que otros perfiles en todas las dimensiones de la motivación, como la socialización, el reconocimiento social, la emoción, el desafío intelectual, y la ganancia monetaria (Cooper et al., 2021). Finalmente, se ha observado que los pacientes que realizan apuestas deportivas presentan mayor probabilidad de abandonar el tratamiento que otros pacientes con otras modalidades de TJ (Valenciano-Mendoza et al., 2023).

1.2.3 Consecuencias del TJ: Actos ilegales

El TJ puede conllevar consecuencias negativas importantes y duraderas en la vida de las personas, entre las que destacan problemas en las relaciones sociales (incluyendo las familiares), dificultades económicas, bajo rendimiento laboral (que puede conducir a ceses o despidos), e incluso actos ilegales con objeto de financiar la conducta de juego

(que pueden acarrear problemas legales e incluso la pena privativa de la libertad) (Adolphe et al., 2019; Blum & Grant, 2017).

Los AIRTJ se han conceptualizado como toda conducta ilícita que comete el individuo con el fin de afrontar las deudas originadas por el juego de apuesta (como falsificaciones o fraudes, por ejemplo, emitir cheques sin fondos suficientes), o para financiar el juego (como robos o malversación de fondos) (Grant & Chamberlain, 2023; Laursen et al., 2016). Estudios recientes reportan prevalencias que oscilan entre el 27 % y el 60% en sujetos con TJ que manifestaron haber cometido por lo menos un acto ilegal. Investigaciones actuales han estimado valores del 43.3% (Grant & Chamberlain, 2023) y el 23.3% (Jiménez-Murcia et al., 2019) para los pacientes con AIRTJ.

A pesar de la alta frecuencia de pacientes con TJ que cometen actos ilegales, el DSM-5 eliminó este criterio diagnóstico (American Psychiatric Association, 2022). En este sentido, algunas investigaciones concluyeron que los actos ilegales no impactaban significativamente en la precisión del diagnóstico de TJ (Petry et al., 2013; Weinstock et al., 2013), mientras que otras advirtieron que la eliminación de los AIRTJ de los criterios diagnósticos no estaba adecuadamente justificada y que se provocarían importantes consecuencias clínicas (y también legales) (Granero et al., 2014; Temcheff et al., 2016). Uno de los puntos de acuerdo en la comunidad clínica y científica es que los AIRTJ deberían considerarse como una medida de gravedad, así como también un predictor de peor pronóstico (Jiménez-Murcia et al., 2019; Mestre-Bach et al., 2018; Turner et al., 2016).

Por otro lado, se ha identificado una estrecha relación entre los AIRTJ con el sexo y la edad de los pacientes. Es así cómo se ha observado una mayor probabilidad en hombres jóvenes (final de la adolescencia e inicio de la edad adulta) (Kryszajtys et al., 2018). Las conductas ilegales también se han asociado a una edad de inicio de la conducta de juego más temprana, y a niveles más elevados de psicopatología comórbida (como depresión, ansiedad y consumo de sustancias) (Gorsane et al., 2017). Del mismo modo, los AIRTJ se presentan con mayor prevalencia en pacientes con perfiles de personalidad más disfuncionales, en concreto, con niveles más altos de búsqueda de novedad, y más bajos en dependencia de la recompensa, evitación del daño, autodirección, cooperación y persistencia (Gorsane et al., 2017; Mestre-Bach et al., 2021). El estudio realizado por Vintró-Alcaraz y colegas también observó que las conductas ilegales en los pacientes con TJ se asocian a un perfil clínico más grave, presentan una mayor sintomatología de TDAH

y mayores niveles de impulsividad, siendo además estos factores predictores del riesgo de recaída y abandono del tratamiento (Vintró-Alcaraz et al., 2021).

Es también importante destacar que, a pesar de la impulsividad presente en los pacientes que presentan AIRTJ, estudios recientes concluyen que la motivación de la conducta ilegal está sujeta a obtener fondos para el juego y/o recuperar déficits financieros (Adolphe et al., 2019; Dennison et al., 2021). En cualquier caso, la presencia de AIRTJ tiene un impacto negativo a nivel personal en los sujetos y en su entorno social, interfiriendo en la efectividad y los resultados del tratamiento (Granero et al., 2025; May-Chahal et al., 2017).

1.3 Adicción a videojuegos

En las últimas décadas los videojuegos se han convertido en una actividad recreativa en la población general, especialmente en los más jóvenes. Si bien, algunos estudios han destacado los efectos positivos del uso de videojuegos a nivel recreativo y académico (Martínez et al., 2022; Sanz-Ramos et al., 2024), otros han alertado de que existen múltiples factores (biopsicosociales) que predisponen a ciertos individuos a pasar del juego recreativo, lúdico y social a un comportamiento excesivo y problemático (Imataka et al., 2024; Zendle & Cairns, 2018).

Actualmente, persisten controversias sobre la conceptualización y el diagnóstico de esta AC, e incluso hay autores que proponen que no se trata de un trastorno independiente, sino que subyace a otras condiciones psiquiátricas (Castro-Calvo et al., 2021; Columb et al., 2022; Kardefelt-Winther et al., 2017). El DSM-5-TR clasifica la AVJ en la sección III. Esta categoría incluye los trastornos que requieren más investigación empírica para determinar si pueden ser reconocidos como trastornos mentales, así como para precisar sus criterios diagnósticos y su clasificación (American Psychiatric Association, 2022). Sin embargo, la CIE-11 clasifica la AVJ dentro de los trastornos relacionados con comportamientos adictivos, describiéndolo como un patrón de conducta persistente o recurrente, que puede realizarse de forma virtual o presencial, durante un período de 12 meses, cuyas características son la pérdida de control, la priorización elevada sobre otras actividades y la continuación o aumento del juego a pesar de las consecuencias negativas en los individuos (CIE - 11th Revision, 2020).

Los estudios epidemiológicos han estimado que la prevalencia media mundial de la AVJ oscila entre el 4%-6% en los países desarrollados (Darvesh et al., 2020). Una revisión sistemática actual realizada por Stevens y colaboradores encontró que la prevalencia mundial de AVJ fue de 3.05%, reduciéndose esta tasa al 1.96% cuando se consideraron estudios específicos que cumplieron con criterios más estrictos para la AVJ (Stevens et al., 2021). Sin embargo, las estimaciones son muy inconsistentes y variables entre los distintos estudios (Mihara & Higuchi, 2017). Es así como algunas investigaciones describen valores entre el 1-2% (Haagsma et al., 2012; Müller et al., 2015; Rehbein et al., 2015), otras hasta el 14% (Wang et al., 2015; Wartberg et al., 2019) e incluso hasta el 20% (Vadlin et al., 2018). No obstante, las cifras en Europa central y oriental son superiores a las de Europa occidental y del norte (Chia et al., 2020). Esta alta variabilidad entre áreas geográficas y estudios se ha relacionado tanto con factores socioculturales como metodológicos, tales como el tipo de evaluación utilizada (cribado versus diagnóstico), la composición de las muestras y el diseño del estudio (transversal frente a longitudinal). Por ejemplo, durante un tiempo se creía que en zonas asiáticas como Corea del Sur y China los diagnósticos de AVJ en jóvenes eran más bajos que en países occidentales, debido a que estos países consideran que hay otras formas más constructivas de ocupar el tiempo libre y valoran más el rendimiento académico (Carbonell, 2020; González-Bueso et al., 2018; A. King et al., 2020).

La complejidad de la AVJ, que se manifiesta tanto en su conceptualización como en su prevalencia, también se refleja en los múltiples factores que incrementen el riesgo de aparición y desarrollo del trastorno. Entre los más relevantes destacan los siguientes:

Factores biológicos: Diversos estudios han identificado procesos neurobiológicos implicados en el TUS, que también podrían estar presentes en la AVJ, entre ellos se encuentran las alteraciones en los sistemas de recompensa, el control inhibitorio, la coordinación sensoriomotora y las funciones ejecutivas relacionadas con la toma de decisiones (Bailey et al., 2013; Tonioni et al., 2014). En esta línea, otras investigaciones concluyen que las regiones cerebrales clásicamente vinculadas con la dependencia de sustancias psicoactivas, también se encuentran comprometidas en la etiología del AVJ (Brand et al., 2019), produciendo déficits neuropsicológicos como una liberación de dopamina de magnitud comparable a la inducida por drogas de abuso, así como deficiencias en el control de impulsos y los mecanismos de recompensa (Weinstein & Lejoyeux, 2015).

Factores psicológicos: En relación con la AVJ, se han descrito dos grupos principales. El primero corresponde a un perfil de personalidad caracterizado por la falta de habilidades sociales, introversión, tendencia al aislamiento, evitación, búsqueda de sensaciones, elevados niveles de persistencia, impulsividad y neuroticismo y bajos en autodirección, concienciación y madurez (Currie et al., 2020; Granero, Fernández-Aranda, Demetrovics, et al., 2021; Şalvarlı & Griffiths, 2021). El segundo presentaría un perfil relacionado con la comorbilidad de otros trastornos mentales y síntomas psiquiátricos preexistentes, como la ansiedad, la depresión, el TDAH, la fobia social, somatización, obsesión-compulsión, sensibilidad interpersonal, hostilidad, ideación paranoide y psicoticismo; que constituyen un factor de riesgo para el desarrollo y mantenimiento de la AVJ (Ayala-Rojas et al., 2025; González-Bueso et al., 2020; Lee et al., 2017; Männikkö et al., 2020; Mathews et al., 2019; Musetti et al., 2019; Panagiotidi, 2017; Stockdale & Coyne, 2018; Weinstein & Lejoyeux, 2015; Yen et al., 2017). También es frecuente que la AVJ se presente de manera comórbida con otras AC, como por ejemplo con el TJ (Ayala-Rojas et al., 2022). Sin embargo, esta comorbilidad de la AVJ carece de suficiente evidencia empírica para confirmar si esta adicción es causa o consecuencia de los diferentes problemas psicopatológicos concurrentes. Algunos estudios han observado relaciones bidireccionales, es decir, que los trastornos y síntomas psiquiátricos aumentan la probabilidad de aparición o incluso pueden empeorar la progresión de la AVJ, y a la vez la AVJ es un factor de riesgo para el desarrollo de otras enfermedades mentales (Ayala-Rojas et al., 2025; Meng et al., 2024).

Factores sociales: Desde una perspectiva sociodemográfica, diversos estudios han señalado un mayor riesgo de AVJ en el sexo masculino y en edades tempranas, especialmente durante la adolescencia y los primeros años de la edad adulta (Fam, 2018; King, 2018; Lopez-Fernandez et al., 2019; Palaus et al., 2017; Sugaya et al., 2019; Vermeulen et al., 2017). Entre otros factores de riesgo significativos para el desarrollo de la AVJ en adolescentes y adultos jóvenes, destacan la disfuncionalidad de las relaciones familiares y el bajo rendimiento académico (Gao et al., 2022). La falta de cohesión entre los distintos miembros de la familia, las relaciones deficientes entre padres e hijos y la ausencia de figuras parentales, como la crianza monoparental o el abandono, pueden favorecer a que esta población recurra a los videojuegos como un mecanismo de afrontamiento emocional, utilizándolos para evadir situaciones desagradables o para regular emociones intensas como la tristeza o la ira (Schneider et al., 2017). Por su parte,

el bajo rendimiento académico, ya sea previo al inicio de la conducta problemática o como consecuencia del tiempo excesivo dedicado a los videojuegos, se ha asociado de forma consistente con la AVJ (Hawi et al., 2018; Kuss & Griffiths, 2012), lo que puede derivar en el ausentismo o la necesidad de repetir el curso académico.

De igual manera, existen otros elementos que pueden incrementar el riesgo de desarrollar un comportamiento adictivo, entre ellos los componentes estructurales y técnicos de algunos videojuegos. Muchas plataformas incorporan características con potencial adictivo, similares a las empleadas en los juegos de azar. Esto supondría que algunas personas que inician jugando videojuegos de forma recreativa puedan migrar hacia plataformas de juegos de apuestas, incrementando el riesgo de desarrollar una conducta adictiva (King et al., 2011; King & Delfabbro, 2018). Por ejemplo, uno de los mecanismos de recompensa de los videojuegos son las cajas de botín o recompensa conocidas por su término en inglés como *loot boxes*, que los jugadores pueden adquirir mediante pagos o microtransacciones, con dinero real o virtual y cuyo contenido es aleatorio (Carbonell, 2020; Kristiansen & Severin, 2020; Zendle et al., 2019). Asimismo, en los videojuegos se incluyen los *skin gambling*, que implica el uso de bienes virtuales (monedas) para apostar en resultados de partidos profesionales, adquirir objetos o ciertas ventajas dentro del juego como por ejemplo desbloquear contenidos específicos. Cabe señalar que algunos videojuegos pueden representar entornos virtuales que simulan casinos o salas de póquer (King et al., 2020; King et al., 2015; Leino et al., 2015; Wardle, 2019). Por otro lado, los videojuegos de rol multijugador masivos en línea (MMORPG) y los entornos virtuales recreados en los videojuegos fomentan la interacción continua con otros jugadores y una experiencia de juego en equipo, en la que los sujetos compiten por alcanzar objetivos comunes y forjan un sentido de compromiso y comunidad, lo cual puede hacer que algunos sujetos presenten serias dificultades para desconectarse del mundo virtual (Blasi et al., 2019; Carbonell, 2020). De modo que los diseños estructurales de los videojuegos generan una experiencia de juego social altamente reforzante, que puede ser utilizada por los jugadores como una vía de escape para evitar situaciones del mundo real, regular sus estados de ánimo negativos y como un medio para ser aceptados socialmente e interactuar de forma satisfactoria con otras personas (Forrest et al., 2016; Hamonniere & Varescon, 2018; King et al., 2011; King & Delfabbro, 2014; Kuss, 2013; Laier et al., 2018). Finalmente, las características de disponibilidad inciden de forma importante en el riesgo que presenta la AVJ. El fácil acceso y la gran oferta de

videojuegos a través de plataformas en línea promueve que los jugadores permanezcan conectados por largos períodos de tiempo (Kim et al., 2015; Van Rooij et al., 2011).

En síntesis, se sabe que la AVJ es una AC muy compleja, en la que participan múltiples factores que interactúan de forma dinámica y que facilitan el progreso de un comportamiento recreativo a uno excesivo y problemático (Zendle & Cairns, 2018). Sin embargo, se requieren de más estudios empíricos para identificar los mecanismos explicativos que contribuyen al inicio de esta adicción, su progresión, y su respuesta al tratamiento.

1.4 Terapia cognitivo-conductual

La terapia cognitivo-conductual (TCC) constituye uno de enfoques psicoterapéuticos con mayor respaldo empírico en el tratamiento de una amplia variedad de trastornos mentales (Nakao et al., 2021; Potenza et al., 2019; Thoma et al., 2015). Este modelo de intervención se caracteriza por utilizar un esquema estructurado, limitado en el tiempo y centrado en los problemas actuales del paciente. Su propósito fundamental es reducir el malestar emocional y promover conductas más adaptativas, a través de la identificación y modificación de patrones de pensamiento disfuncionales que influyen negativamente en la conducta y en las emociones, promoviendo una mejor adaptación social y mayor calidad de vida (David et al., 2018; Guzman, 2023; Hernández Pineda et al., 2020; Moorey & Lavender, 2019). Una de las fortalezas más destacadas de la TCC es su aplicación estratégica. Las intervenciones surgen a partir de una formulación del caso clínico, se desarrollan en colaboración con el paciente, se orientan directamente al logro de objetivos terapéuticos y se ejecutan de manera sistemática, evaluando su eficacia mediante datos concretos obtenidos por el paciente durante el proceso terapéutico. Entre las estrategias fundamentales se encuentran la reestructuración cognitiva, que permite cuestionar y modificar pensamientos automáticos y creencias desadaptativas; la activación conductual, orientada a incrementar la participación en actividades que generen refuerzo positivo; la exposición, que busca disminuir la ansiedad a través del contacto progresivo con estímulos que son evitados; y la solución de problemas, que ofrece herramientas prácticas para afrontar de manera eficaz los desafíos cotidianos. Esta integración de componentes cognitivos y conductuales convierte a la TCC en una intervención terapéutica eficaz, eficiente y adaptable a las características y necesidades individuales de cada paciente (Carson & McWhirter, 2022; Wenzel, 2017).

1.4.1 Tratamiento cognitivo-conductual de las AC

Durante los últimos años se han analizado distintas intervenciones psicológicas, farmacológicas y de neuromodulación para el tratamiento de las AC (Dong et al., 2024). Entre ellas, la terapia cognitivo-conductual (TCC) es la que ha obtenido una mayor evidencia empírica, mostrando resultados clínicos consistentes a corto y largo plazo (Di Nicola et al., 2020; Menchon et al., 2018; Potenza et al., 2019; Thoma et al., 2015). Este nivel de eficacia la ha llevado a considerarse un *"gold standard"* en el abordaje del TJ (Abbott, 2019) y de otras AC como la AVJ (Lourenço Leite et al., 2014; Petry et al., 2017; Tolin, 2010). La TCC integra diversas técnicas terapéuticas como la reestructuración cognitiva, el control de estímulos, el autoreforzamiento, la motivación para el cambio, la exposición en vivo, el entrenamiento de habilidades sociales, la relajación y técnicas de regulación emocional y las estrategias de prevención de recaídas (Granero et al., 2022). Estas herramientas permiten actuar sobre las cogniciones y conductas disfuncionales que favorecen el desarrollo y mantenimiento de los comportamientos adictivos, a la vez que facilitan la identificación de factores internos y externos que los desencadenan, promoviendo alternativas más adaptativas y saludables (Baño et al., 2021; King et al., 2012; Stevens et al., 2019; Winkler et al., 2013). En este sentido, la TCC no solo se centra en la reducción de la conducta desadaptativa, sino también en promover cambios más amplios en el estilo de vida, fortaleciendo la autonomía del paciente y favoreciendo sus recursos de afrontamiento y la prevención de recaídas (Young & Brand, 2017). Su carácter colaborativo y orientado a la práctica continua facilita, la adquisición de habilidades para la autorregulación y la toma de decisiones responsables, lo que contribuye a consolidar resultados sostenibles a largo plazo (Beck & Dozois, 2011; Cuijpers et al., 2019).

La intervención en las AC también debe realizarse atendiendo a la presencia de posibles comorbilidades y conociendo cuáles son las características específicas de cada paciente (Petry et al., 2014; Quaglieri et al., 2020). Es fundamental identificar y tratar los factores que podrían impactar en mayor grado sobre la respuesta al tratamiento (tanto en los procesos de recuperación como en el riesgo de recaída y abandono) (Nower et al., 2013; Ralevski et al., 2017).

1.4.2 Respuesta al tratamiento con TCC de las AC

La respuesta al tratamiento en las AC constituye un tema controvertido, en el que aún no existe consenso claro sobre como definir el éxito/fracaso de las intervenciones (Mestre-Bach & Potenza, 2023). En términos generales, los indicadores más estudiados son la recaída y el abandono, considerados parámetros centrales para evaluar la eficacia de los distintos abordajes (Granero, Valero-Solis, et al., 2020).

Las elevadas tasas de abandono y recaída observadas en este tipo de trastornos se han asociado a la ambivalencia de los pacientes frente al cambio, quienes a menudo experimentan el comportamiento adictivo como gratificante a corto plazo, a pesar de sus consecuencias negativas a largo plazo (Wulfert et al., 2006). En el caso del TJ, numerosos estudios plantean como objetivo terapéutico principal la abstinencia completa de todo tipo de juego de apuestas, sin embargo, en otras AC, como la compra compulsiva, la adicción al sexo o la AVJ, la abstinencia total no se considera un criterio realista. En este caso, la meta terapéutica suele centrarse en la reducción y el control de la conducta problemática, con el fin de promover un uso regulado y menos perjudicial (King & Delfabbro, 2014).

Las investigaciones también han señalado que la duración de la conducta adictiva se relaciona tanto con la gravedad del trastorno (Ledgerwood et al., 2020; Medeiros et al., 2017) como con la respuesta a las intervenciones terapéuticas, principalmente en relación con el riesgo de recaída y abandono (Lucas et al., 2023; Roberts et al., 2020).

La recaída suele definirse como cualquier comportamiento que va en contra de los objetivos del tratamiento. En algunas AC este concepto presenta ciertas particularidades. En el TJ, la recaída se considera como cualquier episodio de juego con apuesta tras un periodo de abstinencia, lo que refleja la dificultad de mantener el control absoluto sobre la conducta. En cambio, en la AVJ, la recaída se conceptualiza en relación con la pérdida de control sobre el comportamiento, el tiempo y la frecuencia de uso, interfiriendo de manera significativa en el bienestar del individuo (King & Delfabbro, 2014; Mestre-Bach & Potenza, 2023). Los predictores de la recaída son múltiples e incluyen variables como la duración de la conducta adictiva, los déficits en la resolución de problemas, la desinhibición, la gravedad de las distorsiones cognitivas y la baja flexibilidad cognitiva (Mallorquí-Bagué, Mestre-Bach, et al., 2018). Asimismo, los problemas socioeconómicos se han asociado a un mayor riesgo de recaídas (Quaglieri et al., 2020), la edad de inicio temprana (Mena-Moreno et al., 2022), la alta impulsividad y la búsqueda

de sensaciones (Ramos-Grille et al., 2015). Por el contrario, los niveles altos en autodirección pueden ser un factor protector contra la recaída (Ayala-Rojas et al., 2022; Grall-Bronnec et al., 2021; Jiménez-Murcia, Granero, Fernández-Aranda, Stinchfield, et al., 2019; Montag et al., 2012). Sin embargo, otros estudios también sugieren que una menor gravedad del TJ también podría predecir una mayor probabilidad de recaída, debido a su asociación con menores puntuaciones en conciencia del trastorno, una motivación más baja hacia el tratamiento y una menor adherencia al mismo (Mena-Moreno et al., 2022).

En relación con el abandono, a pesar de la falta de consenso sobre su conceptualización, la mayoría de los estudios lo definen como ausencia continuada, ya sea por la falta de asistencia a varias sesiones consecutivas, o por la acumulación de un número de inasistencias al tratamiento (Baño et al., 2021; Mestre-Bach & Potenza, 2023; Ronzitti et al., 2017). Se ha observado que la edad avanzada del TJ es un predictor estadístico significativo del abandono (Roberts et al., 2020), y se ha hipotetizado que probablemente esto es debido a que sujetos mayores presentan una mayor comorbilidad con otros trastornos y perfiles de personalidad más disfuncionales (Granero, Fernández-Aranda, Castro-Calvo, et al., 2021a; Granero, Fernández-Aranda, Demetrovics, et al., 2021; Han et al., 2018). Otros resultados señalan que los pacientes más jóvenes con TJ son los que obtienen mayores tasas de abandono y/o asisten a menos sesiones de tratamiento (Ledgerwood et al., 2020; Mena-Moreno et al., 2022). También se han encontrado asociaciones entre el género y el abandono del tratamiento, en función del tipo de AC. En el TJ se han encontrado resultados en ambas direcciones: algunos estudios han identificado mayor riesgo de abandono en los hombres (Granero, Fernández-Aranda, Castro-Calvo, et al., 2021; Kuss & Griffiths, 2012; Lopez-Fernandez et al., 2019), y otros en las mujeres (Mestre-Bach et al., 2022; Valenciano-Mendoza et al., 2021). Además, se ha observado que, la comorbilidad del TJ con otros trastornos (Baño et al., 2021), mayores niveles de impulsividad (Ledgerwood et al., 2020; Odlaug et al., 2013), puntuaciones elevadas en búsqueda de novedades (Ramos-Grille et al., 2015), mayor gravedad del trastorno (Granero, Valero-Solis, et al., 2020) y presencia de conductas delictivas (Vintró-Alcaraz, Mestre-Bach, Granero, Caravaca, et al., 2022) contribuyen a incrementar el riesgo de abandono. Asimismo, se han identificado otros predictores relevantes del abandono terapéutico, como los déficits en la toma de decisiones, alteraciones en funciones ejecutivas y alta excitabilidad exploratoria (Van Holst et al., 2010).

Otro aspecto relevante en relación con la eficiencia terapéutica es el grado de cumplimiento con las pautas de tratamiento. La evidencia científica ha señalado que ciertos rasgos de personalidad como los altos niveles de psicoticismo (caracterizados por el aislamiento, rigidez interpersonal y dificultades para expresar problemas y preocupaciones), la alta dependencia a la recompensa y la baja cooperación, se asocian a un mayor riesgo de incumplimiento y predicen una menor adherencia terapéutica (Li et al., 2016; Schimmenti et al., 2017). En esta misma línea, la falta de habilidades sociales y la falta de confianza hacia el terapeuta podría afectar la vinculación con el tratamiento y en consecuencia afectar negativamente su cumplimiento (Festl et al., 2013; Montag et al., 2012; Şalvarlı & Griffiths, 2021; Wang et al., 2015). Por el contrario, se han identificado factores que favorecen una mayor adherencia al tratamiento, como las bajas puntuaciones en búsqueda de novedades y una mayor consciencia de las consecuencias negativas de las AC (Jiménez-Murcia et al., 2015; Ronzitti et al., 2018). Asimismo, la participación de figuras del entorno personal-familiar que actúen como co-terapeutas, ha mostrado un efecto positivo en los resultados de la terapia. De modo que, su participación favorece una mayor asistencia a las sesiones terapéuticas, reduce el riesgo de recaídas y abandonos, y potencia las mejoras clínicas significativas (Jiménez-Murcia et al., 2017; Menchon et al., 2018; Solé-Morata et al., 2023).

1.5 Justificación de la tesis

El reconocimiento de la heterogeneidad de las AC, reflejada en la diversidad de los fenotipos y endofenotipos, así como en la respuesta al tratamiento, suponen un reto relevante en el ámbito clínico y subraya la necesidad de nuevos estudios empíricos. En la actualidad, el juego de azar, las apuestas deportivas (como uno de los tipos de TJ) y los videojuegos son condiciones clínicas prevalentes en el área de las AC, y por tanto es fundamental identificar los componentes biopsicosociales que actúan como factores de riesgo, los mecanismos subyacentes que contribuyen a su expresión fenotípica y las variables que influyen en la respuesta al tratamiento. Disponer de esta evidencia científica facilitará el conocimiento de los perfiles de estos pacientes, sus diferencias individuales, y los elementos que deberían incluirse en los planes de intervención con el propósito que sean más precisos y eficaces. Asimismo, permitirán promover políticas públicas para el desarrollo de estrategias de prevención dirigidas a grupos con distintos niveles de vulnerabilidad.

2. Hipótesis

La presente tesis doctoral tiene por objeto aportar evidencia empírica sobre las variables que conforman los fenotipos y endofenotipos de las AC más prevalentes, así como los indicadores que contribuyen a la respuesta al tratamiento. De manera que, se hipotetiza de forma general, que existen múltiples variables que interactúan en la expresión de los diferentes tipos de AC, así como de sus fenotipos y endofenotipos, y de la probabilidad de éxito de las intervenciones psicoterapéuticas, específicamente de la TCC.

A continuación, se listan las hipótesis empíricas específicas formuladas para cada uno de los estudios que forman este compendio:

Artículo publicado 1:

- 1.1 La prevalencia estimada de la adicción a los videojuegos online (AVJO) será inferior a la prevalencia estimada de la adicción a las apuestas deportivas online (AADO), calculada en pacientes que solicitan tratamiento por AC en general.
- 1.2 Se identificarán diferencias en las variables sociodemográficas y clínicas en pacientes que consultan por problemas relacionados con AVJO y AADO.

Artículo publicado 2:

- 2.1 Los diagramas de interrelaciones obtenidos mediante análisis de redes (*Network*) presentarán estructuras distintas y resaltarán variables con mayor centralidad en los pacientes con TJ, según presenten o no AIRTJ.

Artículo publicado 3:

- 3.1 Los perfiles clínicos de la AVJO caracterizados por mayor malestar psicopatológico y un patrón de personalidad más disfuncional se asociarán a peores resultados de la TCC.

Artículo preparado para enviar 4:

- 4.1 Peor rendimiento neuropsicológico, alteraciones endocrinas y mayor impulsividad incrementarán la probabilidad de presentar TJ.

3. Objetivos

Esta tesis doctoral se plantea en el ámbito de estudio de las AC, con objeto de obtener evidencia empírica sobre las variables que conforman los fenotipos y endofenotipos de los comportamientos adictivos más prevalentes en el ámbito clínico, e identificar los atributos que contribuyen a la respuesta terapéutica.

Los objetivos generales de la tesis son: a) identificar componentes biopsicosociales que actúan como factores de riesgo para la presencia de las AC, en concreto para el TJ (subtipo AADO) y para la AVJO; b) analizar los mecanismos subyacentes que contribuyen a la expresión fenotípica y endofenotípica de estos comportamientos adictivos e c) identificar las variables con capacidad predictiva a la respuesta al tratamiento con TCC.

A continuación, se listan los objetivos específicos que han sido contrastados en cada uno de los estudios que forman este compendio:

Artículo publicado 1:

- 1.1 Estimar la prevalencia de la AVJO y la AADO en pacientes que acuden a una unidad especializada en el tratamiento de las AC.
- 1.2 Explorar y comparar las variables sociodemográficas, síntomas psicopatológicos, rasgos de personalidad y los diferentes endofenotipos latentes que contribuyen al desarrollo de la AVJO y AADO.

Artículo publicado 2:

- 2.1 Visualizar mediante análisis de redes (*Network*) la estructura de interrelaciones de las variables que forman parte del perfil clínico de pacientes con TJ, en función de la presencia o ausencia de AIRTJ.
- 2.2 Identificar las variables con mayor centralidad en los diagramas de redes, considerando los síntomas centrales del TJ (según se definen en el DSM-5), el malestar psicopatológico global, el consumo de sustancias y las dimensiones de la personalidad que presentan los pacientes.

Artículo publicado 3:

- 3.1 Identificar las variables que contribuyen al perfil de los pacientes con AVJO considerando indicadores sociodemográficos y clínicos en la línea base (antes de la intervención terapéutica).
- 3.2 Conocer la probabilidad de éxito/fracaso de la TCC, explorando las variables que influyen en la respuesta al tratamiento de los pacientes con AVJO, considerando la recaída, el abandono y el grado de cumplimiento.

Artículo preparado para enviar 4:

- 4.1 Obtener un modelo de mediación (*path analysis*) para identificar los mecanismos subyacentes que contribuyen a la presencia del TJ, incluyendo variables de funcionamiento neuropsicológico y endocrino.

4. Metodología

4.1 Participantes

Los estudios que forman parte de este compendio de tesis incluyen pacientes que acudieron a solicitar tratamiento en la Unidad de Juego Patológico y Otras Adicciones Comportamentales del Servicio de Psicología Clínica, en el Hospital Universitario de Bellvitge. Cabe señalar que es una unidad especializada (de referencia), en la atención de AC. La selección de los participantes de cada estudio se realizó en base a los criterios de inclusión-exclusión de cada trabajo.

En términos globales, los criterios de inclusión fueron: edad igual o superior a 18 años, y cumplir los criterios clínicos para el diagnóstico de cada tipo de AC que se analiza en cada estudio (TJ, AVJO y AADO).

Asimismo, y de forma global, el criterio de exclusión principal fue la presencia de cualquier trastorno neurológico (como por ejemplo lesión cerebral traumática o trastorno neurodegenerativo [como la enfermedad de Parkinson]), trastornos psicóticos, o discapacidad intelectual.

A continuación, se indica la composición de cada una de las muestras que formaron parte de los 4 estudios incluidos en esta tesis.

Artículo publicado 1:

De una muestra inicial de $N=3036$ sujetos que solicitaron tratamiento para AC entre enero de 2012 y diciembre de 2022, se escogieron 495 pacientes cuyo motivo de consulta fue AVJO (un total de 108 sujetos) o AADO (387 individuos). Los grupos de estudio fueron mutuamente excluyentes, y no se incluyeron pacientes con la condición comórbida de AVJO+AADO. La distribución del sexo fue de 467 hombres frente a 28 mujeres, y la edad media fue de 29.9 años ($DE=10.6$).

Artículo publicado 2:

Se incluyeron un total de $N=401$ pacientes consecutivos que consultaron por TJ entre enero 2021 y diciembre 2022. Se excluyeron sujetos que de forma comórbida al TJ presentaron otras AC. La muestra se clasificó en dos grupos, según presentaran o no AIRTJ (105 sí informaron de estos comportamientos, y 296 no).

Artículo publicado 3:

La muestra del estudio incluyó a todos los pacientes que de forma consecutiva consultaron por AVJO entre los años 2005 y 2022. Fueron un total de 105 sujetos, hombres y mujeres (95 versus 10), con una edad media de 25.0 años (DE=12.0).

Artículo publicado 4:

La muestra de participantes incluyó un total de 297 pacientes que consultaron en la unidad de tratamiento por TJ. Además, se incluyó un grupo de control de 41 sujetos sin AC, que acudieron al Hospital Odontológico y Podológico, de la Fundación Josep Finestres de la Universidad de Barcelona y que aceptaron voluntariamente participar en la investigación.

4.2 Procedimiento

El circuito de atención de la Unidad de Juego Patológico y otras Adicciones Comportamentales, del Hospital Universitario de Bellvitge, suele iniciarse en atención primaria. En este sentido, los médicos de familia son los profesionales que, mayoritariamente, derivan a los pacientes a este dispositivo. A pesar de ello, también pueden ser referidos desde los Centros de Salud Mental de Adultos (CSMA) o de Infanto-Juvenil (CSMIJ) o, incluso, desde los Centros de Atención a las Drogodependencias (CAS). Finalmente, hay que destacar que también los servicios médicos de los centros penitenciarios derivan casos a la unidad. Dado que la unidad está considerada de alta especialización, no está sectorizada y puede atender pacientes de toda Cataluña. Así, los pacientes que acuden a la unidad de tratamiento por los diferentes tipos de AC tienen una primera entrevista clínica, seguida de una evaluación en donde se les toma una muestra de sangre en ayunas y el paciente autocompleta diversos cuestionarios y auto-informes enfocados en el motivo de consulta por el que acude. Con la obtención de los resultados se lleva a cabo una segunda entrevista con el paciente y un acompañante (familiar o persona cercana) en donde se les comenta los hallazgos clínicos y el plan terapéutico. Luego el paciente inicia su tratamiento de forma semanal, 16 sesiones grupales en el caso del TJ, de 90 minutos de duración, y 12 sesiones individuales para la AVJ, con una duración de 30-45 minutos. El tratamiento que se lleva a cabo está basado en el modelo cognitivo-conductual. Finalmente, en la última sesión del programa de intervención, el paciente completa unos cuestionarios post-tratamiento. Si el paciente ha recuperado el autocontrol perdido, ha estabilizado su estado de ánimo y ha recuperado la funcionalidad

recibe una pre-alta, iniciando la fase de seguimiento, que consiste en sesiones individuales o grupales al cabo de 1 mes, 3, 6, 12 y 24 meses de haber finalizado la fase intensiva de tratamiento.

Todos los participantes del estudio fueron atendidos por psicólogos clínicos con una amplia experiencia en el diagnóstico y tratamiento de estas adicciones y sus comorbilidades. Asimismo, el equipo de trabajo en el caso de las evaluaciones incluye sanitarios de diferentes áreas: psicología, psiquiatría y enfermería.

Las muestras de sangre fueron obtenidas en ayunas de 8 horas, y analizadas en el Centro para la Investigación en Medicina Molecular y Enfermedades Crónicas, de la Universidad de Santiago de Compostela (CIMUS).

La realización de los estudios forman parte de proyectos de investigación que cuentan con la aprobación del Comité de Ética del Hospital Universitario de Bellvitge con las correspondientes referencias, estudio 1: PR338/17 [CSI 18/04]), estudio 2: PR338/17 [CSI 18/04]) y estudio 3: PR393/17 [CSI 18/04]).

Los participantes aportaron un consentimiento firmado de forma voluntaria para el uso de la información recabada con propósito de investigación.

4.3 Instrumentos

La evaluación de los participantes se realizó a partir de la batería de instrumentos que se utiliza en la unidad. A continuación, se listan las medidas concretas que se han analizado en los estudios que forman esta tesis.

- Cuestionario diagnóstico para el TJ (según los criterios del DSM). Este cuestionario incluye 19 ítems codificados en una escala binaria (sí-no), y fue desarrollada originalmente para identificar la presencia de los criterios diagnósticos del TJ según el DSM-IV-TR (American Psychiatric Association, 2000). La escala fue adaptada para evaluar los 9 criterios diagnósticos para el TJ (American Psychiatric Association, 2013).
- SOGS (*South Oaks Gambling Screen*). Esta herramienta de evaluación incluye 20 ítems diseñados para identificar la presencia de conducta de juego, incluyendo juego probable, problemático y no problemático. La puntuación total de la escala se ha utilizado habitualmente como medida de la gravedad de los síntomas del juego patológico (Echeburúa et al., 1994; Lesieur & Blume, 1987).

- Criterios clínicos para la AVJ. Este cribado incluye 9 ítems para detectar la presencia de AVJ, como preocupación u obsesión, irritabilidad cuando no se puede jugar, tolerancia, pérdida de control, pérdida de interés, uso excesivo continuo, engaño, liberación o escapismo de sentimientos negativos y poner en riesgo relaciones u oportunidades. Además del punto de corte propuesto por el DSM-5 (se requieren 5 de 9 criterios) para la presencia de AVJ, requirió que los síntomas tuvieran que ser respaldados dentro de un período de 12 meses para establecer el diagnóstico (American Psychiatric Association, 2022).

- SCL-90 (*Symptom Checklist-90-Revised*). Es un cuestionario de autoinforme que evalúa la sintomatología psicológica durante los últimos meses y permite identificar el nivel de malestar o *distress* psicológico que experimenta una persona. Presenta 90 ítems factorizados en nueve dimensiones primarias (de primer orden) (somatización, obsesivo-compulsivo, sensibilidad interpersonal, depresión, ansiedad, hostilidad, ansiedad fóbica, ideación paranoide y psicoticismo), y tres índices globales [índice global de severidad (GSI), síntomas positivos totales (TPS) e índice de malestar de síntomas positivos (PSDI)] (Derogatis, 2002).

- TCI-R (*Temperament and Character Inventory-Revised, TCI-R*). Es un cuestionario de autoinforme desarrollado para evaluar rasgos de personalidad mediante 240 ítems basados en el modelo multidimensional de Cloninger y estructurado en siete factores, cuatro para el temperamento (búsqueda de novedad, evitación del daño, dependencia de la recompensa y persistencia), y tres para el carácter (autodirección, cooperación y autotranscendencia) (Cloninger C. Robert et al., 1994).

- UPPS-P (*Impulsive Behavior Scale*). Es una escala de impulsividad de 59 ítems que evalúa el comportamiento impulsivo en 5 escalas diferentes: búsqueda de sensaciones, falta de premeditación, falta de perseverancia y urgencia negativa y positiva. La urgencia positiva se incluyó recientemente. Todos los ítems se califican en una escala de 4 puntos, donde 1 corresponde a totalmente de acuerdo y 4 a totalmente en desacuerdo. La UPPS-P tiene propiedades psicométricas satisfactorias en términos de validez convergente y discriminativa (Whiteside et al., 2005).

- DERS (*Difficulties in Emotion Regulation Scale*). Evalúa la desregulación emocional mediante 36 ítems divididos en seis subescalas: rechazo a las respuestas emocionales, dificultades para alcanzar objetivos al experimentar emociones intensas, dificultades para

controlar la impulsividad al experimentar emociones negativas, falta de conciencia emocional, acceso limitado a estrategias de regulación emocional y falta de claridad emocional (Gratz & Roemer, 2004).

- IGT (*Iowa Gambling Task*). Es una tarea informatizada para evaluar la toma de decisiones, el riesgo y la recompensa, así como el valor del castigo. El participante debe seleccionar 100 cartas de cuatro barajas (es decir, A, B, C y D) y, tras cada selección de cartas, se obtiene una ganancia o una pérdida de dinero. Las puntuaciones más altas indican un mejor rendimiento cognitivo, mientras que las puntuaciones negativas indican una elección persistente de barajas desventajosas (Bechara et al., 1994, 2000).

- WCST (*Wisconsin Card Sorting Test*). Es una tarea informatizada que evalúa la flexibilidad cognitiva y el control de la inhibición. Se compone de cuatro tarjetas de estímulo y 128 tarjetas de respuesta que muestran diferentes formas, colores y números de figuras en cada una. El participante debe emparejar las tarjetas de respuesta con las de estímulo de forma que le parezca justificable antes de recibir la retroalimentación (es decir, correcta o incorrecta). Después de diez respuestas secuenciales correctas, los criterios de categorización cambian (Grant & Berg, 1948).

- SCWT (*Stroop Colour and Word Test*). Esta prueba evalúa la capacidad de inhibir la interferencia cognitiva, que se produce cuando el procesamiento de una característica del estímulo afecta al procesamiento simultáneo de otro atributo del mismo estímulo. Consta de tres listas diferentes, primero una lista de palabras que contiene los nombres de los colores impresos en tinta negra. Segundo una lista de colores que comprende la letra «X» impresa en color. Por último, una lista de colores-palabra constituida por nombres de colores en un color de tinta que no coincide con el nombre escrito. Se obtienen tres puntuaciones finales de cada lista basadas en el número de elementos que el participante puede leer en un tiempo de 45 segundos (Golden, 1978).

- TMT (*Trail Making Test*). Consiste en 25 círculos repartidos en dos hojas de papel (partes A y B). Se pide al participante que conecte estos círculos trazando una línea con un lápiz y sin levantarlo de la hoja, entre números consecutivos (parte A) y alternando números y letras siguiendo un orden secuencial (parte B). La tarea evalúa el seguimiento visual conceptual y visual-motor, lo que implica la velocidad motora, la atención y la capacidad de alternar entre categorías cognitivas (set-shifting). Cada parte se puntúa en función del tiempo empleado en completar la tarea (Reitan, 1958).

- *Wechsler Adult Intelligence Scale*, 3rd edition (WAIS-III). Esta prueba está diseñada para medir la capacidad cognitiva en varias áreas (vocabulario, comprensión, aritmética y capacidad de razonamiento). Se han empleado dos subpruebas: dígitos y vocabulario. La tarea de dígitos proporciona una medida de la atención y la memoria de trabajo, basada en una secuencia de números presentados verbalmente por los examinadores que los individuos deben repetir en orden secuencial. La tarea de vocabulario evalúa la comprensión verbal y el conocimiento de palabras, basándose en una lista de palabras presentadas oralmente y administradas con dificultad creciente, que los individuos deben describir o conceptualizar (Wechsler, 1997, 1999)

- Variables endocrinas. Se realizó un análisis de sangre periférico mediante aspiración venosa con ácido etilendiamino tetraacético (EDTA) (25 mM de concentración final), requiriéndose ayuno durante las ocho horas previas. La sangre se centrifugó a 1700g en una centrifugadora refrigerada (4°C) durante 20 minutos. El plasma se separó inmediatamente del suero y se almacenó a -80°C hasta su análisis. Se emplearon kits comerciales específicos para las determinaciones de los parámetros, en un único análisis para reducir la variabilidad entre ensayos. Las absorbancias de cada muestra se midieron por duplicado utilizando un lector espectrofotométrico de microplacas a la longitud de onda correspondiente (lector de microplacas Versamax; Associates of Cape Cod Incorporated, East Falmouth, MA, EE.UU).

- Entrevista clínica semiestructurada. Esta herramienta incluyó características sociodemográficas (sexo, estado civil, nivel de estudios, situación laboral), así como el índice de posición socioeconómica, según la escala de Hollingshead (basada en el nivel de estudios y la profesión de los participantes) (Hollingshead, 2011). Asimismo, se incluyeron variables relacionadas con la conducta adictiva como la edad de inicio, la duración, deudas acumuladas, el consumo de sustancias, el tipo de juego (en línea, fuera de línea o mixto) y otros diagnósticos comórbidos con la pregunta «¿Está diagnosticado de algún trastorno mental o recibe tratamiento para algún trastorno mental?» (Jiménez-Murcia et al., 2006).

- Registro de las sesiones de tratamiento. Durante el protocolo de tratamiento grupal para el TJ, los psicólogos clínicos van completando un registro de observación del terapeuta que detallan la asistencia del paciente a la sesión, la asistencia del familiar designado como co-terapeuta, si se han producido recaídas entre sesiones, el número de recaídas, el dinero invertido, el juego en el que recae el paciente, si hace control de estímulos

(autoprohibición de juego online o presencial, control de dinero, cambio de recorrido, etc.), si evita situaciones de riesgo, si entrega sus registros y el grado de cumplimiento de las pautas de la terapia (bueno, regular, malo).

4.4 Análisis de datos

Los procedimientos estadísticos que se han empleado han sido escogidos en función de los objetivos específicos de cada estudio, la escala de medida de las variables y su rol que ocupan en los análisis. Estos mismos criterios se han empleado para escoger los programas estadísticos más apropiados para cada estudio.

A continuación, se listan las técnicas y programas usados en cada estudio¹:

Artículo publicado 1:

Los análisis de datos fueron realizados con el programa Stata18 para Windows. Se usaron pruebas de χ^2 para la comparación de los indicadores sociodemográficos categóricos entre grupos, y T-test para indicadores cuantitativos.

Los perfiles clínicos se compararon entre los grupos mediante análisis de la covarianza (ANCOVA) y regresión logística binaria, ajustados por las covariables sexo y edad. Estos procedimientos incluyeron el cálculo de los tamaños de efecto mediante coeficiente estandarizado Cohen-*d* y razones de *odds* (OR). Para evitar incremento en el error tipo-I debido a la aplicación de múltiples pruebas de significación estadística se usó la prueba de Finner para corregir el grado de significación de cada prueba bivariada.

Finalmente, se obtuvo un modelo logístico estimado por pasos para identificar las variables con capacidad discriminativa sobre el subtipo de la AC. El ajuste global del modelo final se valoró con la prueba de Homer-Lemeshow, y la capacidad predictiva global con el coeficiente R^2 de Nagelkerke y el área bajo la curva ROC.

Artículo publicado 2:

Los análisis de redes fueron realizados con el programa Gephi9 para Windows. Se definieron modelos indirectos, en los cuales las aristas representaban relaciones mutuas-recíprocas y no direccionales. Los pesos de las aristas se obtuvieron a partir de la matriz

¹ Los procedimientos estadísticos aquí mencionados fueron realizados por la directora Roser Granero Pérez en el marco de los estudios publicados que forman parte de esta tesis.

de correlaciones parciales entre cada par de nodos, ajustado a todos los otros nodos del grafo. La estructura inicial correspondía a un total de 25 nodos, y por consiguiente el número de aristas potenciales fue de 300. Debido a que muchas de las aristas obtuvieron pesos muy bajos (lo cual equivalía a relaciones muy pobres o nulas), para simplificar la estructura se escogieron únicamente asociaciones que alcanzaran coeficientes de correlación parcial estadísticamente significativos ($p < 0.05$). Esto permitió obtener un modelo mucho más parsimonioso, con la ventaja adicional de que únicamente se representaban las relaciones más relevantes. Los índices de centralidad de cada nodo fueron estimados con el algoritmo de Brandes, y la identificación de agrupaciones empíricas de nodos se basó en el algoritmo de modularidad de Blondel.

Artículo publicado 3:

Se realizaron análisis estadísticos con el programa Stata18 para Windows, y mediante la regresión logística binaria se identificaron las variables con capacidad predictiva y significativa sobre el riesgo de abandono, recaída, y buen cumplimiento terapéutico durante la intervención. El ajuste global de los modelos finales se valoró con la prueba de Homer-Lemeshow, y la capacidad predictiva global con el coeficiente R^2 de Nagelkerke.

En el caso de variables criterio cuantitativas discretas (número de sesiones a las que asistieron los pacientes y número de recaídas registrados durante la intervención) los modelos predictivos se obtuvieron mediante regresión de Poisson.

Finalmente, la función de Kaplan-Meier permitió obtener curvas de supervivencia para la tasa de incidencia con la que se registraron los abandonos y las recaídas.

Artículo preparado para enviar 4:

Se obtuvo un modelo de mediación (*path analysis*) con el programa Stata18 para Windows. Se implementó a través de ecuaciones estructurales, utilizando un método robusto para la estimación de los parámetros, definiendo una variable latente para las medidas neuropsicológicas (con la finalidad de obtener un resultado más parsimonioso) y usando los coeficientes habituales de bondad de ajuste (RMSEA, CFI, TLI y SRMR). La capacidad predictiva global se midió con el coeficiente de determinación.

5. Resultados

5.1 Artículo 1

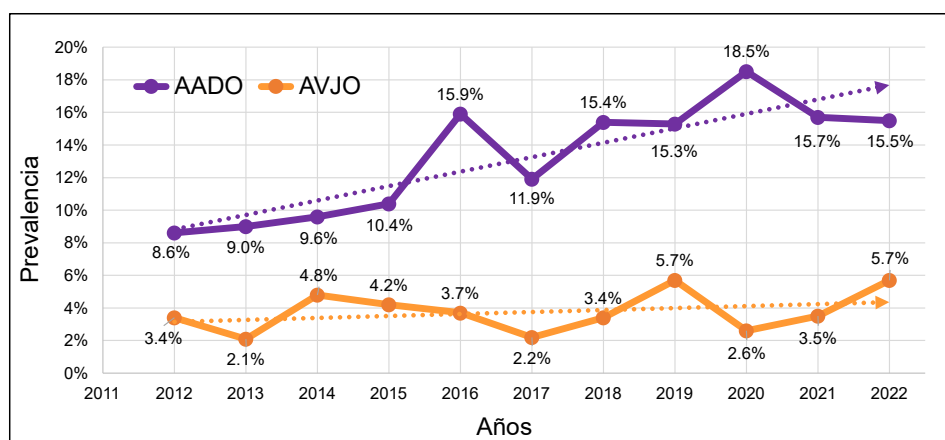
La muestra del estudio incluyó fundamentalmente pacientes de sexo masculino (94.3%), solteros (70.9%), con estudios primarios o secundarios (84.3%), activos laboralmente (58.8%), y con niveles socioeconómicos medio-bajos o bajos (75.0%). La edad media fue de 29.9 años (DE=10.6), la edad media de inicio de la conducta adictiva 23.4 años (DE=8.3) y la duración media de los problemas asociados a la adicción 3.8 años (DE=3.5).

La prevalencia de AADO durante el período de reclutamiento considerando la muestra total de pacientes que acudieron a solicitar tratamiento en la unidad especializada en AC (2012 al 2022) fue del 13.01%, frente a una prevalencia del 3.82% para AVJO. Estas estimaciones indicaban que la probabilidad de AADO era casi cuatro veces superior a la de AVJO.

Contrastes polinómicos identificaron una tendencia lineal creciente significativa para AADO (con un incremento de 8.6% en 2012 al 15.5% en 2022). No se identificó tendencia lineal para la AVJO (con un cambio de 3.4% en 2012 al 5.7% en 2022). (*Ver Figura 1*).

Figura 1

Prevalencia de la AVJO y AADO durante el período de recogida de datos



Nota. Línea discontinua: tendencias lineales.

Tabla 1*Descripción de la muestra*

		AVJO N=108		AADO N=387		
Características Sociodemográficas		<i>n</i>	%	<i>n</i>	%	<i>p</i>
Sexo	Femenino	12	11.1%	16	4.1%	.006*
	Masculino	96	88.9%	371	95.9%	
Estado Civil	Soltero	95	88.0%	256	66.1%	<.001*
	Casado/en pareja	12	11.1%	106	27.4%	
	Divorciado/separado	1	0.9%	25	6.5%	
Nivel educativo	Primaria	55	50.9%	121	31.3%	.001*
	Secundaria	43	39.8%	198	51.2%	
	Universitario	10	9.3%	68	17.6%	
Situación laboral	Desempleado	80	74.1%	124	32.0%	<.001*
	Empleado	28	25.9%	263	68.0%	
Posición Social	Alta	3	2.8%	13	3.4%	<.001*
	Media-alta	4	3.7%	39	10.1%	
	Media	11	10.2%	54	14.0%	
	Media-baja	26	24.1%	158	40.8%	
	Baja	64	59.3%	123	31.8%	
Edad, inicio y duración de la adicción		<i>Media</i>	<i>DE</i>	<i>Media</i>	<i>DE</i>	<i>p</i>
Edad (años)		24.95	12.27	31.25	9.65	<.001*
Inicio de la adicción (años)		20.05	10.72	24.30	7.18	<.001*
Duración de la adicción (años)		4.04	3.23	3.67	3.53	.327

Nota. DE: desviación estándar. *Negrita: comparación significativa (nivel 0.05).

La comparación entre los perfiles asociados a ambas adicciones evidenció que AADO incluía una mayor proporción de hombres, casados o divorciados, con mayores niveles de educación y empleo, índices socioeconómicos más elevados, mayor edad cronológica y una edad de inicio de las conductas adictivas más tardía. (*Ver Tabla 1*).

Ajustando por la distribución del sexo y la edad de ambas condiciones clínicas, el subtipo AADO se asoció a peor estado psicológico (mayores niveles en depresión, ansiedad, ideación paranoide y malestar global), mayor impulsividad, más dificultades en la regulación de las emociones y mayor consumo de sustancias. En cuanto al perfil de personalidad, los resultados ajustados también en sexo y edad mostraron que los pacientes con AADO presentaron mayor búsqueda de novedades, dependencia a la recompensa y persistencia, y menor evitación del daño. (*Ver Tabla 2*).

Tabla 2

Comparación de los perfiles clínicos

	AVJO N=108		AADO N=387		
	<i>Media</i>	<i>DE</i>	<i>Media</i>	<i>DE</i>	<i>p</i>
SCL-90R: Lista de Síntomas Revisada					
SCL-90R Somatización	0.79	0.75	0.85	0.76	.505
SCL-90R Obsesivo-compulsivo	1.24	0.79	1.13	0.80	.232
SCL-90R Sensibilidad interpersonal	1.16	0.93	1.00	0.82	.073
SCL-90R Depresión	1.27	0.99	1.47	0.91	.047*
SCL-90R Ansiedad	0.80	0.78	0.94	0.75	.079
SCL-90R Hostilidad	0.98	0.86	0.97	0.82	.874
SCL-90R Ansiedad fóbica	0.50	0.75	0.39	0.62	.154
SCL-90R Ideación paranoide	1.06	0.88	0.90	0.79	.092
SCL-90R Psicótico	0.73	0.76	0.82	0.71	.298
SCL-90R GSI	0.98	0.72	1.01	0.68	.743
SCL-90R PST	41.95	20.06	45.08	21.60	.188
SCL-90R PSDI	1.90	0.60	1.86	0.53	.457
UPPS-P: Escala de Conducta Impulsiva	<i>Media</i>	<i>DE</i>	<i>Media</i>	<i>DE</i>	<i>p</i>
UPPS-P Premeditación	23.73	5.56	25.17	4.91	.013*
UPPS-P Perseverancia	24.70	4.08	22.85	4.47	.001*
UPPS-P Búsqueda de sensaciones	28.48	5.92	29.33	6.92	.250
UPPS-P Urgencia positiva	26.81	8.13	30.21	8.58	.001*
UPPS-P Urgencia negativa	29.17	6.60	31.62	6.14	.001*
UPPS-P Impulsividad total	132.93	18.88	139.18	21.66	.009*
DERS: Dificultades en la Regulación Emocional	<i>Media</i>	<i>DE</i>	<i>Media</i>	<i>DE</i>	<i>p</i>
DERS No aceptación	14.15	4.30	15.76	4.71	.002*
DERS Conducta orientada a metas	16.00	2.85	14.02	3.32	.001*
DERS Control de impulsos	13.61	4.22	13.16	3.96	.316
DERS Falta de conciencia	16.88	3.39	16.81	3.48	.854
DERS Acceso limitado	17.90	4.61	18.29	5.37	.506
DERS Claridad emocional	11.86	2.95	11.81	3.27	.886
DERS Total	90.41	16.23	89.26	17.35	.555
Consumo de sustancias	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>p</i>
Tabaco	24	22.2%	160	41.3%	.001*
Alcohol	2	1.9%	37	9.6%	.021*
Otras drogas ilegales	4	3.7%	48	12.4%	.012*
TCI-R: Inventario de Temperamento y Carácter	<i>Media</i>	<i>DE</i>	<i>Media</i>	<i>DE</i>	<i>p</i>
TCI-R Búsqueda de novedades	102.56	13.94	112.00	13.42	.001*
TCI-R Evitación del daño	106.24	16.46	98.29	16.88	.001*
TCI-R Dependencia de recompensa	92.05	16.49	95.16	14.19	.041*
TCI-R Persistencia	91.54	18.76	108.66	20.19	.001*
TCI-R Autodirección	125.65	22.01	129.90	21.60	.085
TCI-R Cooperatividad	128.71	18.12	128.15	17.31	.775
TCI-R Autotrascendencia	60.51	14.42	59.73	14.38	.634

Nota. DE: desviación estándar. *Negrita: comparación significativa (nivel 0.05).

5.2 Artículo 2

La mayor parte de los pacientes participantes en el estudio eran hombres (91.5%), solteros (54.6%), laboralmente activos (56.9%), con un bajo nivel educativo (56.9%), y con un nivel socioeconómico medio-bajo o bajo (80.5%). La edad media fue de 41.9 años (DE=15.4), la edad media de inicio de los problemas relacionados con la conducta de juego de 30.0 años (DE=13.3) y la duración media del juego problemático 6 años (DE=6.8). El tipo de juego preferente fue de tipo no estratégico (42.6%) y en modalidad presencial (77.3%). Respecto al consumo de sustancias, 51.1% informó de hábito de fumar, 15.0% de uso de alcohol y 13.5% de otras drogas ilegales. (*Ver Tabla 3*).

Tabla 3

Descripción de las variables del estudio

Características Sociodemográficas		<i>n</i>	%
Sexo	Femenino	34	8.5%
	Masculino	367	91.5%
Estado civil	Soltero	219	54.6%
	Casado/en pareja	129	32.2%
	Divorciado/separado	53	13.2%
Nivel educativo	Primaria	228	56.9%
	Secundaria	145	36.2%
	Universitario	28	7.0%
Situación laboral	Desempleado	173	43.1%
	Empleado	228	56.9%
Posición social	Media-alta a alta	39	9.7%
	Media	39	9.7%
	Media-baja a baja	323	80.5%
Edad, inicio y duración del TJ		<i>Media</i>	<i>DE</i>
Edad (años)		41.86	15.41
Inicio de la adicción (años)		30.01	13.34
Duración de la adicción (años)		6.01	6.84
Formas del TJ		<i>n</i>	%
Preferencia	Solo no estratégicos	171	42.6%
	Solo estratégicos	158	39.4%
	Mixto	72	18.0%
Modalidad	Solo presencial	310	77.3%
	Solo online	43	10.7%
	Mixto	48	12.0%
Consumo de sustancias		<i>n</i>	%
Tabaco		205	51.1%
Alcohol		60	15.0%
Drogas ilegales		54	13.5%

Nota. TJ: Trastorno de Juego. DE: desviación estándar.

La presencia de AIRTJ se asoció a sexo masculino, edad más joven, inicio más precoz de los problemas relacionados con el juego y mayor duración del comportamiento adictivo. Este subgrupo también presentó mayor proporción de sujetos con los síntomas DSM-5 A1 “juega con cantidades de dinero mayores para conseguir el nivel de excitación deseado”, A7 “miente para ocultar el grado de implicación en el juego”, A8 “pone en peligro o pierde relaciones importantes, empleo o estudios, a causa del juego” y A9 “depende de otros para aliviar los problemas financieros”. Además, se relacionó con mayor puntuación en búsqueda de novedades y menor en cooperación. (*Ver Tabla 4*).

Tabla 4

Comparación de las submuestras en sus diferentes variables

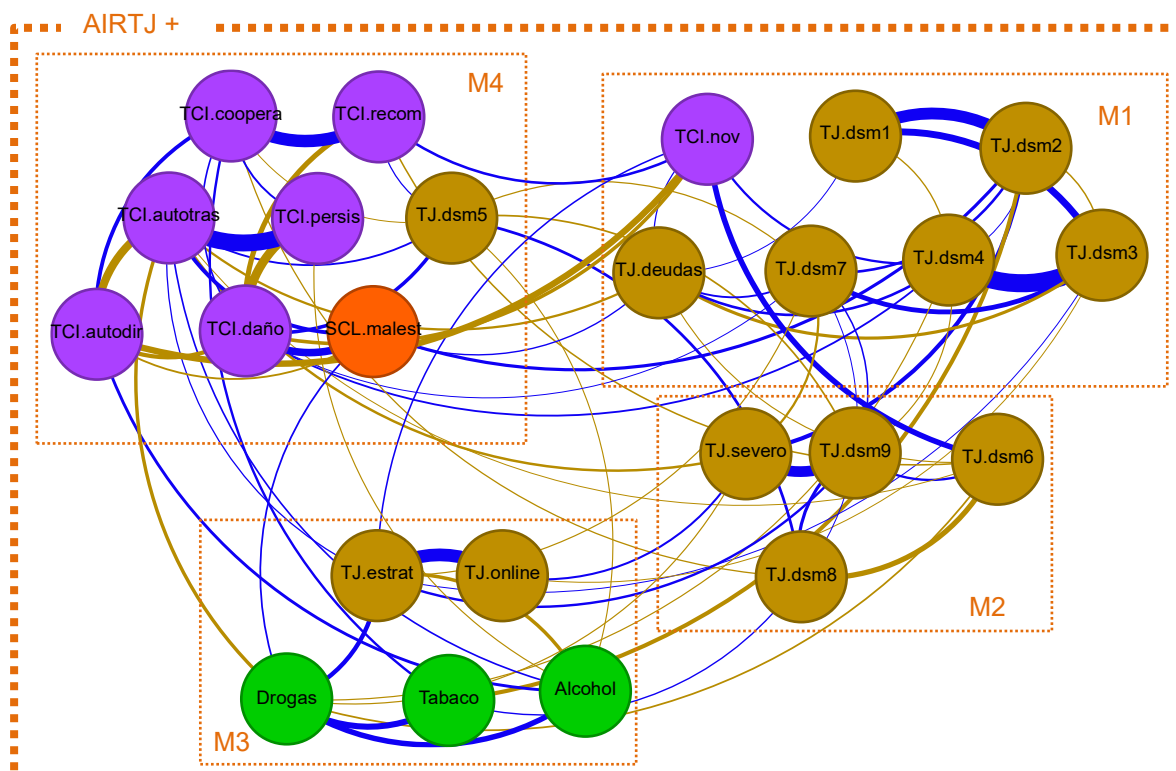
		AIRTJ– N = 296		AIRTJ+ N = 105		
Características Sociodemográficas		n	%	n	%	p
Sexo	Femenino	30	10.1%	4	3.8%	.046*
	Masculino	266	89.9%	101	96.2%	
Estado civil	Soltero	155	52.4%	64	61.0%	.236
	Casado/en pareja	102	34.5%	27	25.7%	
	Divorciado/separado	39	13.2%	14	13.3%	
Nivel educativo	Primaria	173	58.4%	55	52.4%	.195
	Secundaria	100	33.8%	45	42.9%	
	Universitario	23	7.8%	5	4.8%	
Situación laboral	Desempleado	128	43.2%	45	42.9%	.945
	Empleado	168	56.8%	60	57.1%	
Posición social	Media-alta a alta	28	9.5%	11	10.5%	.462
	Media	32	10.8%	7	6.7%	
	Media-baja a baja	236	79.7%	87	82.9%	
Edad, inicio y duración del TJ		<i>Media</i>	<i>DE</i>	<i>Media</i>	<i>DE</i>	<i>p</i>
Edad (años)		43.46	15.86	37.35	13.11	.001*
Inicio de la adicción (años)		31.69	13.94	25.27	10.13	.001*
Duración de la adicción (años)		5.33	6.54	7.93	7.34	.001*
TJ Gravedad, nivel de síntomas y deudas		<i>Mean</i>	<i>DE</i>	<i>Mean</i>	<i>DE</i>	<i>p</i>
SOGS Puntaje total		10.21	3.66	12.27	3.12	.001*
Deudas derivadas del TJ (euros)		8314	14134	11594	15190	.046*
TJ Síntomas según el DSM-5		<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>p</i>
A1: Juega con cantidades de dinero cada vez mayores		213	72.0%	86	81.9%	.044*
A2: Inquieto-irritable cuando deja de jugar		203	68.6%	76	72.4%	
A3: Repetidos esfuerzos por controlar-detener el juego		260	87.8%	97	92.4%	.201
A4: Está preocupado constantemente por el juego		231	78.0%	86	81.9%	.403
A5: Juega con frecuencia cuando se siente angustiado		239	80.7%	89	84.8%	.359
A6: Intenta recuperar las pérdidas volviendo a jugar		243	82.1%	90	85.7%	.396
A7: Miente para ocultar su implicación en el juego		249	84.1%	100	95.2%	.004*
A8: Ha perdido relaciones, trabajo o estudios		221	74.7%	94	89.5%	.001*
A9: Depende de otros por problemas financieros		210	70.9%	90	85.7%	.003*
Psicopatología y personalidad		<i>Media</i>	<i>DE</i>	<i>Media</i>	<i>DE</i>	<i>p</i>
SCL-90R Malestar global (GSI)		1.16	0.75	1.23	0.77	.374
TCI-R: Búsqueda de novedades		108.71	12.12	113.28	10.99	.001*
TCI-R: Evitación del daño		101.31	16.77	99.05	16.11	.230
TCI-R: Dependencia de la recompensa		95.25	13.23	94.06	13.32	.427
TCI-R: Persistencia		110.51	17.59	110.46	18.21	.978
TCI-R: Autodirección		126.87	19.28	123.28	18.05	.096
TCI-R: Cooperatividad		130.50	14.61	125.10	15.82	.002*
TCI-R: Autotrascendencia		64.71	14.32	61.73	15.60	.074

Nota. AIRTJ: actos ilegales relacionados al TJ. DE: desviación estándar. *Negrita: comparación significativa (nivel 0.05).

En el diagrama de redes obtenido para la submuestra de pacientes con AIRTJ+ el nodo más relevante fue el rasgo del carácter autotranscendencia, seguido del síntoma DSM-5 A7 “mentiras para ocultar el grado de implicación en el juego”. La autotranscendencia fue también el nodo identificado como “puente” (*bridge node*). (Ver Figura 2).

Figura 2

Visualización de las redes para la submuestra con actos ilegales



Nota. Las aristas positivas están representadas por líneas azules y las aristas negativas por líneas marrón-ocre. Cuanto más gruesa es la arista, mayor es el peso de la conexión. Los nodos se representan con colores según la dimensión: personalidad (morado), malestar psicopatológico (naranja), medidas relacionadas con el juego (ocre), sustancias (verde).

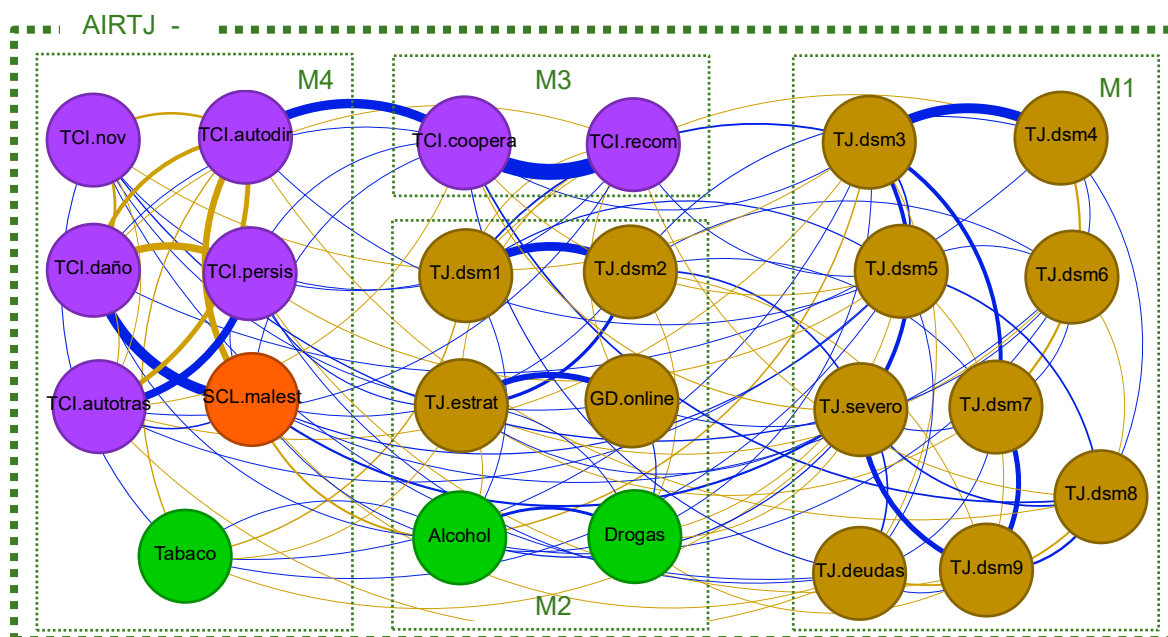
Los nodos incluyen los síntomas del DSM-5 para el TJ (TJ.dsm1 a TJ.dsm9), las deudas relacionadas con el juego (TJ.deudas), el nivel de síntomas del TJ (TJ.severo), la preferencia estratégica en el juego (TJ.estrat), la modalidad de juego en línea (TJ.online), el malestar psicopatológico global (SCL.malest), el consumo de sustancias (tabaco, alcohol y drogas), la búsqueda de novedades (TCI.nov), la evitación del daño (TCI.daño), la dependencia de la recompensa (TCI.recom), la persistencia (TCI.persis), la autodirección (TCI.autodir), la cooperatividad (TCI.coopera) y la autotranscendencia (TCI.autotras).

Los grupos M1 a M4 agrupan los nodos según las clases latentes identificadas en cada red.

Para los pacientes con AIRTJ– el nodo con mayor relevancia y el que se identificó como “puente” fue el síntoma DSM-5 A5 “apuesta cuando se siente estresado (deprimido, culpable o ansioso)”. (Ver Figura 3).

Figura 3

Visualización de las redes para la submuestra sin actos ilegales



Nota. Las aristas positivas están representadas por líneas azules y las aristas negativas por líneas marrón-ocre. Cuanto más gruesa es la arista, mayor es el peso de la conexión. Los nodos se representan con colores según la dimensión: personalidad (morado), malestar psicopatológico (naranja), medidas relacionadas con el juego (ocre), sustancias (verde).

Los nodos incluyen los síntomas del DSM-5 para el TJ (TJ.dsm1 a TJ.dsm9), las deudas relacionadas con el juego (TJ.deudas), el nivel de síntomas del TJ (TJ.severo), la preferencia estratégica en el juego (TJ.estrat), la modalidad de juego en línea (TJ.online), el malestar psicopatológico global (SCL.malest), el consumo de sustancias (tabaco, alcohol y drogas), la búsqueda de novedades (TCI.nov), la evitación del daño (TCI.daño), la dependencia de la recompensa (TCI.recom), la persistencia (TCI.persis), la autodirección (TCI.autodir), la cooperatividad (TCI.coopera) y la autotrascendencia (TCI.autotras).

Los grupos M1 a M4 agrupan los nodos según las clases latentes identificadas en cada red.

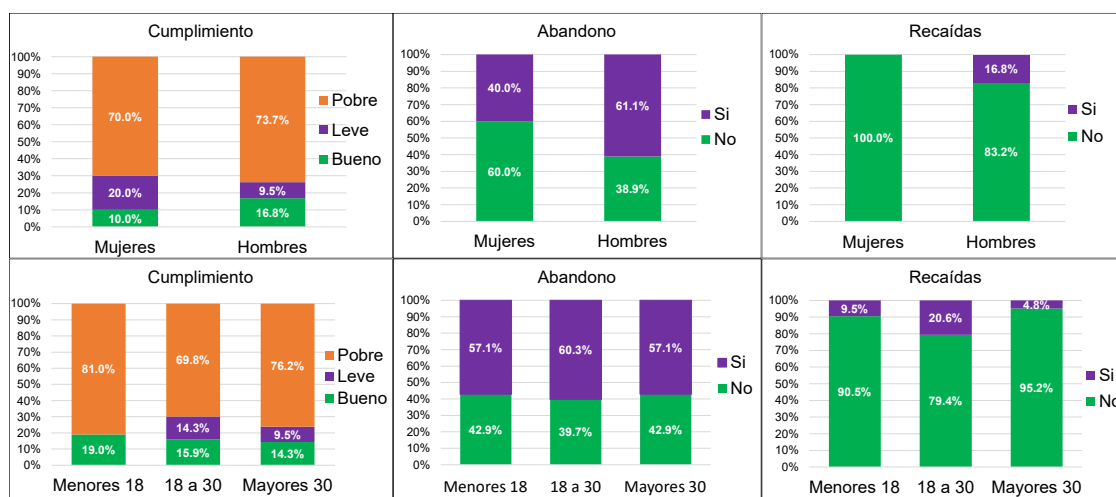
5.3 Artículo 3

Respecto al perfil de la AVJO, la mayoría de los pacientes del estudio fueron hombres (90.5%), solteros (87.6%), con un nivel educativo medio (secundarios 50.5%), inactivos laboralmente (74.3%) y con un nivel socioeconómico bajo (57.1%). La edad media fue de 25.0 años (DE=12.0), la edad media de inicio de la conducta adictiva de 19.9 años (DE=10.4) y la duración media del trastorno de 4.1 años (DE=3.3). Además, un 28.6% informó de la presencia de algún trastorno mental diferente a la AVJO.

Respecto a los resultados obtenidos en la intervención con TCC, los hombres tendieron a obtener resultados más pobres, y los sujetos con edades entre 18 y 30 años obtuvieron mayor riesgo de abandono y recaída durante la intervención. (Ver Figura 4).

Figura 4

Resultados del tratamiento: riesgo de abandono y recaídas durante la terapia



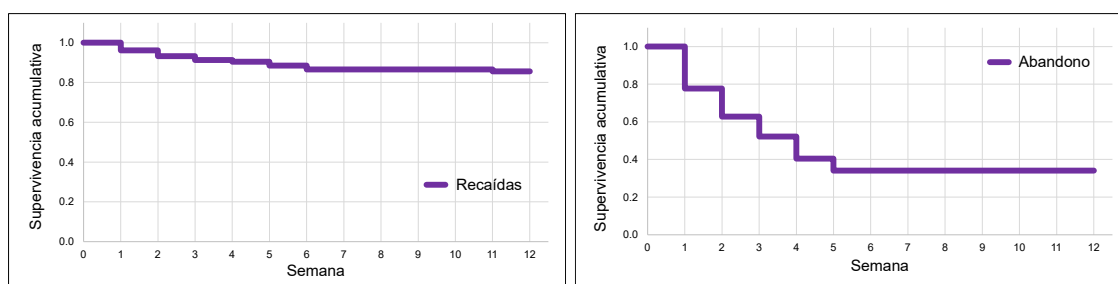
Respecto a los resultados obtenidos en los modelos de regresión logística predictiva, el riesgo de recaída fue superior para los pacientes con puntuaciones más altas en sensibilidad interpersonal, hostilidad y persistencia. Ser hombre y con inicio más tardío de la AVJO aumentó la probabilidad de abandono de la intervención. Fueron factores de riesgo de bajo cumplimiento terapéutico, las puntuaciones más altas en ideación paranoide, un nivel más alto en dependencia a la recompensa, y un nivel más bajo en cooperatividad. (Ver Tabla 5).

Tabla 5*Análisis de regresión logística predictiva*

Criterio: riesgo de recaída	B	EE	p	OR	95%CI (OR)	
SCL-90R Sensibilidad interpersonal	2.268	0.868	.009	9.658	1.762	52.925
SCL-90R Hostilidad	1.267	0.600	.035	3.550	1.096	11.499
TCI-R Persistencia	0.032	0.017	.049	1.033	0.999	1.000
Criterio: riesgo de abandono	B	EE	p	OR	95%CI (OR)	
Sexo (0: femenino; 1: masculino)	1.771	0.886	.046	5.875	1.034	33.370
Edad de inicio (años)	0.066	0.032	.040	1.068	1.003	1.137
Criterio: riesgo de baja adherencia	B	EE	p	OR	95%CI (OR)	
SCL-90R Ideación psicótica	1.629	0.600	.007	5.101	1.572	16.546
TCI-R Dependencia a la recompensa	0.070	0.023	.003	1.072	1.024	1.122
TCI-R Cooperatividad	-0.051	0.022	.020	0.951	0.911	0.992

Nota. EE: error estándar. OR: odds ratio. 95% IC: intervalo de confianza al 95%.

Las funciones de supervivencia mostraron que las recaídas se producían de forma muy uniforme durante las 6 primeras sesiones, y sólo unos pocos pacientes informaron de recaídas entre la sesión 6 y el final del tratamiento. En cuanto a los abandonos, todos se registraron durante las 5 primeras sesiones de tratamiento, siendo mayor el riesgo de abandono durante la primera quincena. (*Ver Figura 5*).

Figura 5*Funciones de supervivencia acumulativa para la tasa de recaídas y de abandono***5.4 Artículo 4**

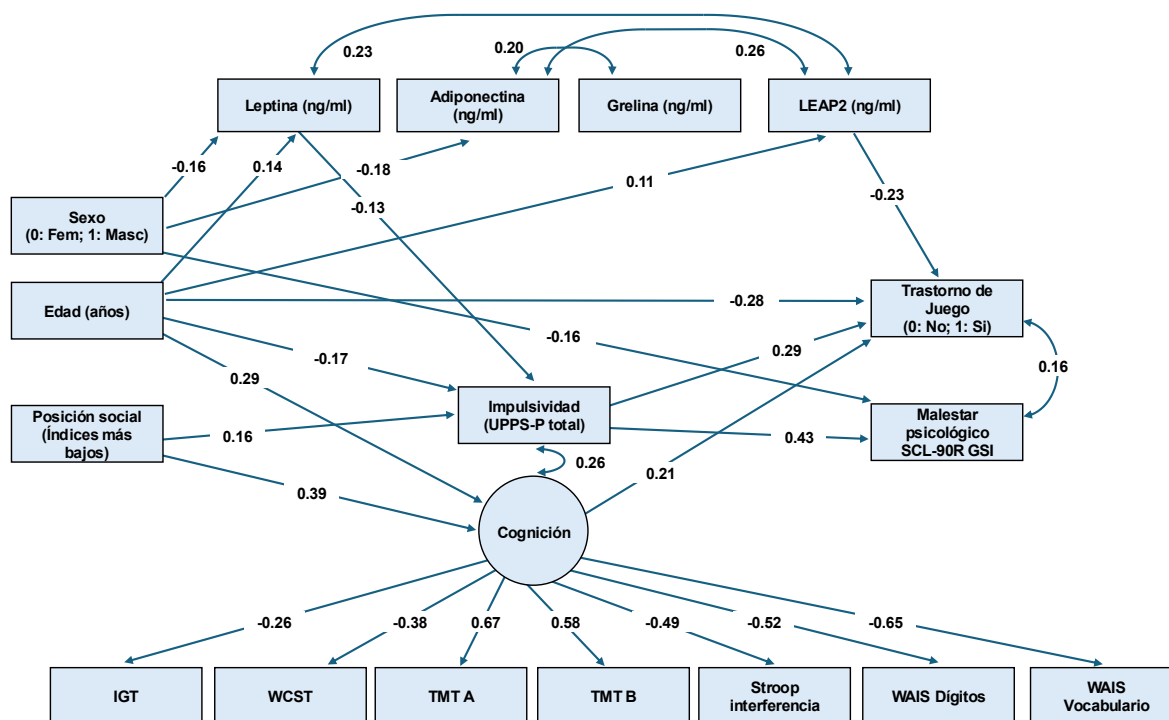
La mayoría de los participantes fueron hombres, con bajo nivel de estudios, solteros y con niveles socioeconómicos medio-bajos o bajos.

El modelo de ecuaciones estructurales evidenció que la presencia del TJ se asociaba de forma directa a una menor edad, mayores niveles de impulsividad, mayores déficits neuropsicológicos y un nivel más bajo de LEAP2. También se obtuvo correlación positiva

entre presencia del TJ y mayor *distress* emocional, y también entre impulsividad y déficit cognitivo. Respecto a los efectos indirectos, se obtuvieron diferentes vías de mediación. En primer lugar, edad más joven y posición social más baja se relacionaron con niveles más altos de impulsividad, y estos perfiles contribuyeron a aumentar el riesgo de presentar TJ. En segundo lugar, la edad más avanzada y los índices de posición social más bajos contribuyeron a un peor rendimiento en las pruebas neuropsicológicas, y estos perfiles también contribuyeron a la presencia de TJ. En tercer lugar, edad más joven y sexo femenino se relacionaron con niveles inferiores de leptina, que se asociaron a mayor impulsividad, y posteriormente con mayor probabilidad de TJ. Una menor edad también registró valores más bajos de LEAP2, favoreciendo a un mayor riesgo de TJ. (Ver Figura 6).

Figura 6

Diagrama de ruta con los coeficientes estandarizados



Nota. Solo se retuvieron los coeficientes significativos en el modelo final.

6. Discusión

6.1 Discusión global

El aumento significativo en las prevalencias de las AC durante los últimos años se ha convertido en un tema de creciente interés en la investigación científica, principalmente en los ámbitos de la conceptualización, etiología, epidemiología e intervención terapéutica (Carbonell et al., 2018; Potenza et al., 2019; Stefanovics & Potenza, 2022; Stevens et al., 2021). Sin embargo, son escasos los estudios que incluyen muestras clínicas amplias, AC diferentes al TJ, y poblaciones consideradas altamente vulnerables (como los jóvenes). En respuesta a esta necesidad, los objetivos generales de esta tesis fueron a) identificar componentes biopsicosociales que actúan como factores de riesgo para la presencia de las AC, concretamente para el TJ (el subtipo de AADO) y para la AVJO; b) analizar los mecanismos subyacentes que contribuyen a la expresión fenotípica y endofenotípica de estos comportamientos adictivos; y c) identificar las variables con capacidad predictiva sobre la respuesta al tratamiento con TCC.

El auge de los juegos por internet desde inicios de la década de los 2000 (Rho et al., 2017), y el interés que han despertado tanto en los jóvenes y los adultos, ha generado preocupación en el ámbito de la salud pública (Griffiths et al., 2012; Richard et al., 2020). Razón por la cual numerosas investigaciones han analizado cómo los cambios que se han producido en los juegos de azar (específicamente en los que se acceden a través de internet) han contribuido a un empeoramiento en el bienestar de las personas, afectando todas las áreas de la vida (personal, laboral, social, financiera, etc.) (Gainsbury et al., 2014; Papineau et al., 2018). La creciente disponibilidad de internet y la proliferación de las plataformas de juego en línea, tanto en el ámbito de las apuestas como en el de los videojuegos, han transformado de manera significativa los patrones de ocio y socialización en determinados grupos de la población. Si bien estas nuevas tecnologías ofrecen múltiples beneficios y posibilidades de interacción social, su uso desregulado o excesivo puede favorecer la aparición de comportamientos adictivos, con consecuencias negativas para la salud mental de las personas (Brand, 2022).

El primer estudio que conforma esta tesis surge en este contexto, y se plantea como primer objetivo estimar las prevalencias de la AVJO y AADO en una muestra clínica de pacientes que solicitaron tratamiento por AC, en una unidad especializada en el abordaje de estos trastornos, durante el período del 2012 al 2022. Los hallazgos revelan que la

prevalencia para la AADO fue del 13,01%, frente al 3,82% para AVJO. De modo que la probabilidad de que los pacientes que solicitan tratamiento presenten AADO era casi cuatro veces superior a la de AVJO, confirmando la primera hipótesis. Estos resultados son consistentes con los estudios que reportan el alza de las prevalencias de las apuestas deportivas; una tendencia observada a nivel mundial y asociada tanto a su creciente comercialización como a la intensidad de las campañas promocionales (Deans et al., 2017; Etuk et al., 2022; Gainsbury, Russell, Hing, et al., 2015). El elevado número de anuncios y publicidad que presentan las apuestas deportivas constatan la influencia de este tipo de estrategias, así como su capacidad persuasiva. Entre otros elementos que contribuyen a su impacto destacan los incentivos que brindan, como por ejemplo ofertas de reembolso, devolución de la apuesta, ofertas de registro, etc. (Etuk et al., 2022; Hing, Sproston, et al., 2017). Asimismo, se ha observado que incluso algunos sujetos consideran que las apuestas son una parte intrínseca de las actividades deportivas, lo que les hace subestimar los riesgos que conlleva el comportamiento de apostar, aumentando la probabilidad de involucrarse en este tipo de conductas (Brevers et al., 2022). Un estudio realizado por López-González y colaboradores identificó cómo las apuestas deportivas manejan una doble estrategia persuasiva de publicidad: por un lado aparentan reducir el riesgo percibido asociado a las apuestas (con temas como apostar con amigos, ofertas de dinero gratis, humor o el uso de celebridades como “gancho”), y por otro sugieren una ilusoria percepción de control en los apostadores (incluyendo temas relacionados con la masculinidad y el propio conocimiento sobre los eventos deportivos) (Lopez-Gonzalez et al., 2018). También, en los países desarrollados la expansión tecnológica ha potenciado el auge de los juegos en línea, a pesar de la evidencia sobre sus efectos adversos en los jugadores (Alhamoud et al., 2022; H. S. Kim et al., 2022; Mihara & Higuchi, 2017; Stevens et al., 2021), especialmente en las poblaciones más vulnerables como los jóvenes (Andreassen, 2015; Buil et al., 2015; Emond & Griffiths, 2020). Asimismo, el acceso fácil e inmediato que ofrecen estas plataformas virtuales (como apps y sitios web) permiten que las conductas de juego se realicen desde la privacidad y la comodidad del lugar, favoreciendo que los jugadores permanezcan durante largos periodos de tiempo jugando sin interrupciones, contribuyendo al uso excesivo y problemático (Buil et al., 2015; Gainsbury, Russell, Wood, et al., 2015; H. S. Kim et al., 2015; Van Rooij et al., 2011).

Diversos estudios han señalado la existencia de mecanismos de riesgo comunes implicados en el desarrollo problemático, tanto del juego de azar en línea como de los

videojuegos (Allami et al., 2021; Bisen & Deshpande, 2020; Browne et al., 2019; Moreira et al., 2023). Entre las variables desencadenantes de estos problemas y responsables de su progresión figuran factores neuropsicológicos, como los que participan en los circuitos de recompensa, las creencias irracionales y la impulsividad. También factores sociales, entre los que destacan el atractivo que las conductas de juego ejercen sobre la población adolescente y los jóvenes adultos, la percepción de bajo riesgo por la población general, la amplia aceptación social y el fácil acceso a múltiples plataformas especialmente a través de internet (Derevensky, 2019; Richard et al., 2020).

El fenómeno de convergencia y aproximación entre el juego de apuestas en línea y los videojuegos han sido de gran interés para los investigadores (Coelho et al., 2023; Delfabbro & King, 2020). Se ha sugerido que las barreras entre ambas modalidades de juego han comenzado a difuminarse, de manera que los videojuegos por internet podrían actuar como una "puerta de entrada" al juego de apuestas, especialmente desde la monetización de los videojuegos. En este sentido, los videojuegos actuales incorporan diferentes dinámicas de azar y/o elementos propios del juego de apuesta que favorecen a su convergencia, y suponen un elevado riesgo para que los jóvenes migren del uso de videojuegos a sitios webs de apuestas en línea (Emond & Griffiths, 2020; Griffiths et al., 2012). Cabe señalar que algunos videojuegos presentan entornos virtuales que simulan casinos o salas de póquer (King et al., 2020; King et al., 2015; Leino et al., 2015; Wardle, 2019), lo cual supone que existen claras similitudes entre ambas AC a nivel estructural (cajas botín o *loot boxes* con contenido aleatorio, los *skin gambling*, las microtransacciones con el objetivo de mejorar el personaje/avatar), estético (mundos virtuales recreados, sonidos y efectos de luz emocionantes y estimulantes) y motivacional (escapismo de la vida real e interacción social) (Brooks & Clark, 2019; Emond & Griffiths, 2020; King et al., 2015; Richard et al., 2020; Zendle & Cairns, 2018). Además, tanto los videojuegos de rol multijugador masivos en línea como los *e-Sports* (competiciones de videojuegos entre jugadores profesionales) han ganado gran popularidad y fomentan una interacción de juego en equipo donde compiten por alcanzar objetivos comunes forjando un sentido de compromiso y vinculación continuada con el mundo virtual (Blasi et al., 2019; Carbonell, 2020).

El interés científico suscitado por la convergencia de diferentes elementos que comparten los juegos de azar en línea y los videojuegos por internet (King et al., 2011) motivó la comparación entre la AVJO y la AADO, planteada en el primer estudio que se incluye en esta tesis. En relación con el nivel de *distress* emocional o psicopatología general medida

a través de una escala de *screening*, el grupo de pacientes con AADO presentaba un peor estado psicológico que aquellos con AVJO, evidenciando niveles más elevados de depresión, ansiedad, ideación paranoide y malestar emocional global. Asimismo, mostraban una mayor impulsividad, un consumo de sustancias más elevado y mayores dificultades en la regulación emocional. Estos resultados son coherentes con estudios que señalan que la participación frecuente en juegos de azar en línea (en particular las apuestas deportivas) se asocia a una mayor gravedad del juego problemático y con un incremento del malestar psicológico (Gainsbury et al., 2019; Hing, Russell, Lamont, et al., 2017). Diversos estudios han observado que el consumo de sustancias psicoactivas y la presencia de otras adicciones conductuales, son frecuentes en los individuos que realizan apuestas deportivas, con incidencias acumuladas que van del 22,1% al 71,2% (Bodor et al., 2018; Granero, Jiménez-Murcia, et al., 2020; Hing, Russell, & Browne, 2017). También se ha observado que estos pacientes tienen mayor impulsividad (búsqueda de sensaciones, urgencia positiva y negativa) y dificultades en la regulación de las emociones (Cooper et al., 2021; Hing et al., 2018; Jiménez-Murcia et al., 2021). Un estudio que examinó las características psicológicas y los comportamientos de juego entre los apostadores deportivos y no deportivos encontró que los sujetos que apuestan en deportes son más impulsivos y propensos a actuar como resultado de las emociones positivas y negativas, experimentando emociones intensas, como consecuencia de sus victorias y derrotas (Cooper et al., 2021). Este perfil psicológico específico podría ser de alto riesgo para desarrollar múltiples conductas problemáticas comórbidas y otros problemas de salud física y mental.

Respecto al perfil de personalidad, los pacientes con AADO presentaron mayor búsqueda de novedades, dependencia a la recompensa y persistencia, y menor evitación del daño. En esta línea, estudios previos han concluido que son predictores significativos para la presencia de problemas relacionados con las apuestas deportivas las puntuaciones altas en búsqueda de sensaciones (DiCicco-Bloom & Romer, 2012), persistencia (Estévez et al., 2017) y dependencia de la recompensa (Grant et al., 2012; Hodgins & Holub, 2015; Jiménez-Murcia, Fernández-Aranda, et al., 2017; Ledgerwood & Petry, 2010; Mestre-Bach et al., 2016). Por otro lado, las bajas puntuaciones en evitación del daño, en la AADO, justificarían las apuestas arriesgadas, asociándose a creencias irracionales como la minimización del riesgo, la ilusión de control del azar y la sobreestimación de las habilidades y conocimientos para la obtención de premios. Además, todo ello incrementaría la probabilidad de que a medio-largo plazo presenten problemas

financieros añadidos a las dificultades en las áreas personal y social (Cooper et al., 2021; Subramaniam et al., 2017; Valenciano-Mendoza et al., 2023).

Al comparar las variables sociodemográficas entre los dos grupos clínicos, se observó que el perfil asociado a la AADO se caracterizó por incluir a una mayor proporción de hombres, con nivel de estudios más alto, activos laboralmente y con índices socioeconómicos más elevados. Estos resultados son consistentes con investigaciones previas, que señalan que las apuestas deportivas son más habituales en el sexo masculino debido a su preferencia por este tipo de juego y a su vinculación con actividades deportivas tanto presenciales como virtuales (Håkansson et al., 2017; Marchica & Derevensky, 2016; Richard et al., 2019). En esta dirección, las investigaciones evidencian que ser hombre, soltero, joven y con niveles educativos más altos, aumentan la probabilidad de participar en apuestas deportivas (Cooper et al., 2021; Jiménez-Murcia et al., 2021). Igualmente, estar activo laboralmente, facilita el financiamiento de la conducta del juego de apuesta y prolongar este tipo de actividad (Hing, Russell, Vitartas, et al., 2016).

A pesar de que ambas AC en línea presentan un inicio temprano, la AADO se asocia a pacientes de mayor edad y con una edad media de aparición de los problemas adictivos superior. Este hallazgo tiene diversas explicaciones, entre ellas, porque las apuestas deportivas son ilegales en menores de edad, de manera que resulta más fácil que los adolescentes recurran a los videojuegos como actividad recreativa. Sin embargo, tal y como se ha planteado anteriormente, esto no excluye la posibilidad de que con el tiempo algunos puedan progresar a la AADO. Una revisión sistemática realizada por Kuss y colegas señala que los individuos que juegan videojuegos como actividad recreativa no problemática pueden presentar otras conductas de juego como las apuestas deportivas en el futuro (Kuss et al., 2014). De hecho, el juego de azar por internet es fácilmente accesible, siendo los mecanismos de control todavía limitados, particularmente en lo referido a la verificación de la identidad y la edad. De manera que, es relativamente sencillo que personas jóvenes accedan a plataformas de juego utilizando cuentas y datos de otras personas mayores de edad, derivando en prácticas ilegales como la suplantación de la identidad (Turowski et al., 2023). En este sentido, es relativamente sencillo que los adolescentes menores de edad puedan registrarse en sitios web con datos personales falsos y hacer microtransacciones y otros pagos con tarjetas bancarias ajenas, con el fin de iniciar y prolongar el juego por periodos extensos. Esto supone que a edades muy tempranas los sujetos que presentan AADO y también AVJO pueden recurrir a actos

ilegales (como la falsificación o el fraude) con el fin de financiar el juego y/o para afrontar las deudas que esta actividad les origina (Grant & Chamberlain, 2023).

Así, por la relevancia clínica y el impacto potencial de los actos ilegales en los pacientes con TJ, surgió el interés por realizar el segundo estudio que se incluye en esta tesis. En esta investigación se encontró que la presencia de la conducta delictiva originada por el TJ se asociaba al sexo masculino, a una menor edad, un inicio más temprano de los problemas de juego y a una mayor duración del comportamiento adictivo. Estudios previos ya habían relacionado la gravedad del TJ (incluyendo las dificultades financieras y el alto riesgo de delitos) con ser hombre y edad joven (Secades-Villa et al., 2024), además con el inicio temprano del trastorno y la alta comorbilidad con otros problemas mentales (Grant & Chamberlain, 2023; Sharman et al., 2019; Welte et al., 2009).

En este segundo estudio también se observó que, en el grupo de pacientes sin AIRTJ, el nodo central y con mayor capacidad de vinculación fue el criterio del DSM-5 “A5-juega a menudo cuando se siente angustiado”. Esta evidencia es congruente con otros estudios que revelan que las personas con TJ presentan déficits significativos en el manejo de las emociones, con dificultades para implementar de manera efectiva estrategias de autorregulación que les permitan aliviar estados emocionales negativos. En este sentido, la falta de capacidad para responder a las demandas ambientales y los déficits de control de los impulsos pueden llevar a los individuos a recurrir al juego como un medio de escape, para poder afrontar los eventos estresantes del día a día, lo que incluso podría actuar como factores moderadores de la gravedad del TJ (Mestre-Bach et al., 2020; Velotti et al., 2021; Wang et al., 2020). La actividad de juego puede resultar en muchas ocasiones como una actividad de entretenimiento alternativa que permite a los individuos hacer frente al malestar psicológico como la ansiedad, la depresión, los miedos, y desplazar el foco de la atención con el objetivo de sentirse más aliviados (Rogier & Velotti, 2018). También se ha evidenciado que la regulación de las emociones juega un papel fundamental en el desarrollo y la progresión del TJ, y que la propia actividad de juego estaría motivada por la necesidad de escapar de estados emocionales negativos (Alaba-Ekpo et al., 2024; Velotti et al., 2021). Diversos estudios han señalado que el juego puede funcionar como una estrategia de escape frente a déficits en la regulación emocional; en este proceso, la capacidad de control de los impulsos emerge como un factor de mediación relevante (Weatherly & Miller, 2013).

Por otro lado, en los pacientes con AIRTJ el nodo más relevante y con mayor capacidad de asociación en la red fue el rasgo de carácter conocido como autotrascendencia, que se

asocia al pragmatismo, materialismo, escepticismo cuando los niveles son bajos y a la espiritualidad, sensibilidad y desconexión del entorno cuando son elevados. Estos hallazgos confirman la hipótesis formulada en el segundo estudio de la tesis, que plantea que los pacientes con y sin AIRTJ presentan diferente estructura de interrelaciones entre las variables (en definitiva, reforzando la hipótesis que dentro del propio TJ pueden identificarse diversos tipos de perfiles clínicos). Estudios previos han mostrado una asociación positiva entre autotranscendencia y mayor gravedad del TJ (Pettorruso et al., 2021). Además, también se ha observado que una mayor autotranscendencia se asocia con un perfil de TJ más grave, especialmente en las mujeres (Granero et al., 2018). Clásicamente, la autotranscendencia se ha relacionado con diferentes trastornos, incluyendo las adicciones con sustancias y otras adicciones conductuales (Er & Buzlu, 2022; Vitali, 2014). También se han revelado interacciones significativas entre este factor de personalidad con aspectos psicopatológicos, deterioro cognitivo y rasgos de personalidad desadaptativos (tales como impulsividad, hostilidad y agresividad) (Marchetti et al., 2019; Schimmenti et al., 2017; Toneatto et al., 2009). Estas observaciones han llevado al supuesto de que la alta autotranscendencia contribuye a que la conducta de juego se convierta en problemática, que evolucione a cuadros más graves y que pueda incluso derivar en actos ilegales y conductas delictivas (Adolphe et al., 2019; Granero et al., 2015). Estudios recientes en esta área han observado que puntuaciones elevadas en autotranscendencia se asocian con baja autoconciencia, dificultad para identificar las propias emociones y una percepción limitada de las consecuencias de las acciones en el entorno, siendo precisamente este perfil el que facilitaría que los individuos cometieran actos ilegales como el robo, la falsificación o el fraude (Grant & Chamberlain, 2023). Esta manifestación psicológica de menor sensibilidad frente al impacto de las acciones encuentra una similitud en ciertos mecanismos biológicos, particularmente en el funcionamiento de las hormonas endocrinas, como la grelina. De este modo, se ha evidenciado que niveles elevados de esta hormona gástrica se relacionan con una reducción de la sensibilidad ante las consecuencias negativas, lo que facilitaría la persistencia en la conducta de juego a pesar de pérdidas económicas significativas (Pietrzak et al., 2024; Sztainert et al., 2018). Desde una perspectiva neurobiológica, la grelina participa en la modulación de las vías de recompensa y estrés, es así como, su activación se ha relacionado con un incremento del *craving* y del consumo de sustancias, lo que refuerza su implicación en las conductas adictivas y en la gravedad del trastorno (Müller et al., 2015; Ralevski et al., 2017; Shevchouk et al., 2021). Estos hallazgos ponen

de manifiesto que el TJ se conceptualiza como un fenómeno complejo, en el que convergen factores biológicos, psicológicos y sociales que influyen tanto en su desarrollo como en su gravedad. De hecho, estudios recientes han identificado la participación de diversos sistemas endocrinos en los circuitos de recompensa y gratificación, destacando no solo el papel de la grelina, sino también de las adipocitocinas como la leptina y la adiponectina (Etxandi et al., 2022; Farokhnia et al., 2018). Es así como se refuerza una relación positiva entre marcadores endocrinos y neurológicos implicados en el TJ, subrayando su relevancia clínica y su potencial como objetivo terapéutico (Etxandi et al., 2023; Iovino et al., 2022; Mora-Maltas et al., 2024). Este marco de referencia permitió la formulación de los objetivos del cuarto estudio orientados a identificar los mecanismos subyacentes que contribuyen a la presencia del TJ, considerando un conjunto de variables sociodemográficas, psicológicas, neurocognitivas y endocrinas. Los resultados de este estudio revelan que los individuos más jóvenes, con niveles más altos de impulsividad, déficits neuropsicológicos y niveles más bajos de LEAP2, presentan un mayor riesgo de desarrollar TJ. Estos resultados son consistentes con estudios actuales que refieren que las hormonas implicadas en la homeostasis energética poseen receptores en múltiples estructuras neuronales, por lo que el sistema endocrino podría contribuir directa o indirectamente a la disfunción de los procesos neuropsicológicos como el sistema de recompensa, la impulsividad y las funciones cognitivas, que estarían implicados en las conductas adictivas (Baenas et al., 2024; Geisel et al., 2018; Koob & Volkow, 2016; Shevchouk et al., 2021; Stievenard et al., 2017). En este contexto, se ha encontrado que LEAP-2 podría estar asociado con el funcionamiento ejecutivo y las distorsiones cognitivas que caracterizan al juego de apuestas (Lugilde et al., 2022; Mora-Maltas et al., 2024; Voigt et al., 2021). No obstante, la evidencia científica sobre el papel de LEAP-2 en el TJ sigue siendo limitada. Mientras algunos estudios han señalado que los niveles elevados de LEAP-2 se relacionan con tiempos de reacción más rápidos y un incremento del comportamiento impulsivo (Voigt et al., 2021), otros han identificado que niveles reducidos predicen estadísticamente la presencia del TJ (Etxandi et al., 2022). Nuestros hallazgos son consistentes con esta última línea de investigación al observar que, son precisamente las puntuaciones más bajas en LEAP-2, las que predicen la presencia del TJ. Esta discrepancia podría explicarse porque este hallazgo es todavía reciente y aún no existen suficientes estudios que lo confirmen. Sin embargo, a pesar de estas limitaciones, LEAP-2 se presenta como un objetivo terapéutico potencial en el ámbito de las adicciones ya que, al actuar como antagonista endógeno de la grelina, “neutraliza” sus efectos

negativos sobre el *craving*, la abstinencia y las recaídas en los trastornos adictivos (Ge et al., 2018; Lugilde et al., 2022). En el cuarto estudio de la tesis también se identificaron asociaciones indirectas que contribuyen a la presencia del TJ, actuando con un rol en la mediación tanto la impulsividad como el funcionamiento neuropsicológico. Diversos estudios han señalado que las personas con TJ suelen presentar déficits cognitivos, que impactan en la evolución clínica, agravando la conducta adictiva. Entre los más representativos se encuentran el deterioro del funcionamiento ejecutivo, la impulsividad y la presencia de estilos cognitivos desadaptativos (Agibalova et al., 2020; Mallorquí-Bagué, Mestre-Bach, et al., 2018; Moccia et al., 2017; van Timmeren et al., 2018). En particular, los jugadores presentan niveles elevados de impulsividad cognitiva y una mayor búsqueda de sensaciones, lo que refleja una relación mutua y compleja entre el TJ, la impulsividad y los sesgos cognitivos. De hecho, la impulsividad juega un rol relevante en la aparición y el mantenimiento del TJ (Browne et al., 2019; Dufour et al., 2020; Flórez et al., 2016; Gori et al., 2022; Jiménez-Murcia, Granero, Fernández-Aranda, et al., 2020), además se asocia con dificultades en la regulación emocional, mayor gravedad clínica y peor respuesta al tratamiento (Vintró-Alcaraz, Mestre-Bach, Granero, Gómez-Peña, et al., 2022). En este sentido, las evidencias obtenidas en el cuarto estudio de esta tesis avalan la importancia de identificar marcadores biopsicosociales, que subyacen a la génesis de la adicción conductual más prevalente hoy en día y que, al mismo tiempo, podrían condicionar el éxito o el fracaso de las intervenciones terapéuticas. La interacción entre variables psicológicas, biológicas y sociales se configura, como un eje fundamental para comprender el desarrollo del trastorno y la respuesta al tratamiento. Esta perspectiva se enlaza con el objetivo general del tercer estudio centrado en identificar las variables sociodemográficas y clínicas que configuran el perfil de los pacientes AVJO en la línea base, y analizar su impacto en la TCC. Los resultados evidencian que dicho perfil se caracteriza, predominantemente, por una mayor proporción de hombres, solteros, con educación secundaria, inactivos laboralmente y con un nivel social bajo. Estos resultados pueden explicarse por la propia naturaleza de los videojuegos, que durante mucho tiempo fueron desarrollados predominantemente para usuarios masculinos. Esta característica se refleja en la mayor prevalencia de la AVJO en el género masculino (De Pasquale et al., 2020; Stevens et al., 2021), señalando que esta conducta se inicia típicamente en la adolescencia y en los primeros años de la edad adulta (Macur & Pontes, 2021). En comparación con otras AC, los pacientes con esta adicción son más jóvenes, en su mayoría solteros, con una edad de inicio más temprana y con una mayor tasa de

desempleo, debido a que muchos todavía se encuentran cursando estudios o están en transición hacia el mercado laboral (Mallorquí-Bagué et al., 2017). Diversas investigaciones han evidenciado que el uso problemático de videojuegos tiende a manifestarse con mayor frecuencia en poblaciones jóvenes, especialmente entre adolescentes y adultos jóvenes (Buil et al., 2015; Carbonell, 2014; Ferguson et al., 2011; Kuss et al., 2013). En este sentido, resulta fundamental reconocer este grupo como una población altamente vulnerable, debido a su elevada exposición a las tecnologías digitales, su tendencia natural a la búsqueda de gratificación inmediata y su pertenencia a una etapa del desarrollo caracterizada por importantes cambios psicológicos, emocionales y sociales que pueden exacerbar su susceptibilidad hacia los comportamientos adictivos.

El tercer estudio de la tesis también reveló que la AVJO se asocia con puntuaciones altas en psicopatología general y *distress* emocional, como somatización, obsesividad-compulsividad, sensibilidad interpersonal, depresión, ansiedad, hostilidad, ansiedad fóbica, ideación paranoide y psicoticismo. Esta concurrencia de la AVJO con otros problemas emocionales también ha sido reportada en estudios previos (Han et al., 2018; Kim et al., 2016; Wang et al., 2023). Sin embargo, el sentido de las asociaciones no es clara. Mientras que algunos autores sostienen que los individuos que juegan a videojuegos de forma problemática, intentan lidiar con la angustia emocional, otros argumentan que el uso excesivo y prolongado de los juegos en línea puede conllevar a que los sujetos obtengan consecuencias graves para su salud mental (De Pasquale et al., 2020; King & Delfabbro, 2016). Seguramente, las relaciones sean de tipo bidireccional de manera que la AVJO conlleva un alto riesgo de desarrollar trastornos y síntomas concurrentes, y estos síntomas a su vez podrían incrementar la probabilidad de aparición y gravedad de la propia AVJO (De Pasquale et al., 2020; González-Bueso et al., 2018; Meng et al., 2024; Shi et al., 2020).

El segundo objetivo del tercer estudio incluido en la tesis fue identificar variables predictivas de probabilidad de éxito/fracaso de la TCC en pacientes con AVJO. Se observó que el riesgo de recaída era mayor en los pacientes con puntuaciones más elevadas en sensibilidad interpersonal, hostilidad, y persistencia, y más bajas en autodirección. Estos rasgos de personalidad podrían reflejar una mayor vulnerabilidad emocional, baja tolerancia a la frustración y dificultades en la autorregulación, lo que afectaría el afrontamiento de situaciones sociales o la participación en nuevas actividades. En esta línea, diversos estudios han señalado que los individuos con AVJO tienden a

evitar vincularse con su entorno y muestran escasa motivación para involucrarse en experiencias novedosas, posiblemente debido a las dificultades en las relaciones interpersonales (De Pasquale et al., 2020; Ryu et al., 2018). En este sentido, la sensibilidad interpersonal se ha asociado significativamente con la AVJO y su presencia podría estar relacionada con los déficits en las habilidades sociales, lo que explicaría la presencia de los problemas sociales observados en los pacientes (Torres-Rodríguez et al., 2018). Asimismo, se ha sugerido que las dificultades en las relaciones sociales y los sentimientos de inadecuación e inferioridad, podrían estar implicadas en el inicio y la intensificación de uso problemático de videojuegos, lo que podría generar consecuencias negativas que incrementen el riesgo de recaída (Granero, Fernández-Aranda, Castro-Calvo, et al., 2021; Wartberg et al., 2019; Wichstrøm et al., 2019). En relación con la hostilidad, estudios previos han demostrado que los individuos con AVJO presentan niveles más altos de este rasgo en comparación con sujetos control sanos (Maia & Reis, 2022; Yen et al., 2017). Se ha señalado que la hostilidad puede actuar como un mediador para el manejo del malestar emocional, facilitando una vía de escape para sentirse más satisfecho (Stavropoulos et al., 2017). Así, las relaciones sociales en línea, el escapismo y el uso de estrategias de afrontamiento desadaptativas pueden contribuir al mantenimiento del trastorno y la recaída de los individuos con AVJO (Kuss, 2013).

Otro factor identificado como predictor del riesgo de recaída fue la persistencia, característica que se asocia a la rigidez. Una puntuación alta en esta dimensión sugiere que el individuo persevera en su conducta de uso de los videojuegos, a pesar de la fatiga y/o la frustración derivada de dicho comportamiento. A pesar del cansancio, la persona continúa jugando y muestra dificultades para detener la conducta y alternarla con otras actividades (Ayala-Rojas et al., 2022; Jiménez-Murcia, Granero, Fernández-Aranda, Stinchfield, et al., 2019). Otra característica de los pacientes con AVJO es que presentan bajos niveles de autodirección. Esta característica ha sido asociada con una mayor probabilidad de recaída en la conducta adictiva (Mestre-Bach & Potenza, 2023). Un estudio realizado por Montag y colegas reveló que la baja autodirección en estos pacientes se asocia a su vez con una baja regulación y adaptación de la conducta al cumplimiento de metas y proyectos personales (Montag et al., 2012). También se ha observado que los individuos con AVJO presentan un peor autoconcepto (una acusada evaluación negativa de sí mismos) (Kim et al., 2018), baja autoestima y falta de habilidades sociales (González-Bueso et al., 2020; Jiménez-Murcia et al., 2014). Es así como estas dificultades en el conocimiento y la valoración personal impiden a los jugadores con AVJO tener una

concepción más positiva y realista de sí mismos, de manera que puedan proyectar su vida en base a objetivos y compromisos funcionales, tanto personales como sociales.

El mal cumplimiento con las pautas terapéuticas del tratamiento se asoció con puntuaciones más altas en psicoticismo y dependencia de la recompensa, y con menor cooperación. Estos resultados son coherentes con estudios previos que encontraron un perfil de personalidad caracterizado por baja empatía, calidez, compasión, rasgos paranoides y baja concienciación (Li et al., 2016; Schimmenti et al., 2017), lo que supone un perfil de alta disfuncionalidad que podría interferir de forma directa con la adherencia al tratamiento. El adecuado cumplimiento con las pautas de la TCC se ha relacionado con una buena capacidad de los pacientes para establecer y mantener vínculos con el entorno social, lo cual queda gravemente comprometido en pacientes con estas características. Por otro lado, diferentes trabajos han concluido que las personas introvertidas son más vulnerables a presentar conductas adictivas (en general), en gran medida como consecuencia de su baja capacidad para socializar, la alta sensibilidad al rechazo, la dificultad para establecer relaciones con su grupo de iguales y para confiar en los demás (Festl et al., 2013). Esto sugiere que, precisamente, con objeto de evitar interactuar con el medio social, los jugadores de videojuegos prefieren estar inmersos en entornos virtuales, que les permiten ocultar su identidad y no abrirse a nuevas experiencias (Wang et al., 2015). Este perfil de usuario de videojuegos estaría menos expuesto a sentimientos de vergüenza, así como a la posibilidad de ser ridiculizado o rechazado, lo que facilitaría el establecimiento de relaciones interpersonales en entornos online, que perciben como más seguros (Şalvarlı & Griffiths, 2021). Se ha observado que la AVJO se relaciona con puntuaciones altas en neuroticismo y con puntuaciones bajas en autoconciencia, extraversión, agradabilidad y apertura a nuevas experiencias (Andreassen et al., 2013; Kayış et al., 2016). Asimismo, se ha planteado la hipótesis de que la baja autodirección y la falta de autocontrol no solo pueden aumentar la probabilidad de adicción a los videojuegos, sino que también puede afectar negativamente la capacidad de cooperación (Montag et al., 2012), lo que repercute en la capacidad para adherirse al tratamiento y seguir adecuadamente las pautas de la TCC. Ciertamente, si el paciente tiene bajos niveles de cooperación y confianza, el vínculo con el terapeuta es más complejo y limitado, y por consiguiente también su capacidad de adhesión a la terapia. Contrariamente, la alta cooperación se asocia significativamente con una mayor empatía, aceptación social y amabilidad (Bojanowska & Urbańska, 2021), características que resultan fundamentales

para el establecimiento de una alianza terapéutica positiva y que constituyen un factor clave para lograr una mayor eficacia psicoterapéutica (Cook et al., 2017).

Los hallazgos de este estudio indicaron que el sexo masculino y una edad de inicio más tardía de los problemas adictivos se asociaron a un mayor riesgo de abandono del tratamiento en pacientes con AVJO. Estos resultados son congruentes con estudios previos que han señalado que los varones con conductas adictivas son más proclives a no finalizar las terapias, posiblemente debido a una combinación de factores psicológicos y neurobiológicos (Granero, Fernández-Aranda, Castro-Calvo, et al., 2021; Kuss & Griffiths, 2012; Lopez-Fernandez et al., 2019). En comparación con las mujeres, los hombres suelen mostrar una mayor inclinación al riesgo, así como una mayor activación neuronal en las regiones cerebrales vinculadas con el sistema de recompensa durante la toma de decisiones arriesgadas. Además, puntúan más alto en sensibilidad a las recompensas asociadas a los videojuegos, y presentan una mayor sobrevaloración de la actividad lúdica y necesidad intensa de jugar (Dong & Potenza, 2022; Wang et al., 2023; Yu, Mo, et al., 2021). En cuanto a la edad de inicio más tardía como variable predictora del abandono de la terapia, estos resultados se alinean con el estudio de clasificación de Granero y colegas, quienes identificaron dos perfiles clínicos diferenciados en pacientes con AVJO. El primer perfil agrupaba a sujetos más jóvenes, con una edad de inicio más temprana en el uso de videojuegos, mejor estado psicopatológico y un perfil de personalidad más funcional. El segundo perfil incluía a pacientes con mayor edad cronológica, inicio más tardío de la AVJO, mayor comorbilidad con síntomas psicopatológicos, consumo de sustancias, presencia de otras adicciones comportamentales, y un perfil de personalidad más disfuncional (Granero, Fernández-Aranda, Castro-Calvo, et al., 2021a). Este segundo grupo caracterizado por una mayor complejidad clínica sería precisamente el que presenta mayor riesgo de abandono del tratamiento, en línea con lo observado en este estudio. Además, estudios epidemiológicos han respaldado la asociación entre edad cronológica, edad de inicio de la AVJO y niveles elevados de malestar emocional (Granero, Fernández-Aranda, Demetrovics, et al., 2021). En su conjunto, estos hallazgos sugieren que una edad más avanzada y un inicio más tardío de la AVJO podrían ser indicadores de un perfil más grave, caracterizado por la presencia de problemas mentales comórbidos (Han et al., 2018), menor adhesión al tratamiento y un mayor riesgo de abandono.

Respecto a los resultados que se han obtenido en los análisis de curvas de supervivencia en pacientes con AVJO, se observa que las primeras seis sesiones constituyen una fase de

alto riesgo para que se registren recaídas, y mientras que las cinco sesiones iniciales, se identifican como el periodo de mayor probabilidad para el abandono del tratamiento. Estos datos ponen de manifiesto la importancia de los momentos iniciales de la intervención como un punto clave para la adherencia y eficacia terapéutica. Estudios previos han encontrado que las primeras semanas de tratamiento representan un intervalo con mayor probabilidad de abandonos (Lara-Huallipe et al., 2021; Mestre-Bach et al., 2022). Ante este escenario, es fundamental implementar estrategias de prevención y acompañamiento intensivo en las fases tempranas de las intervenciones, incluyendo procedimientos específicamente diseñados para mejorar el cumplimiento de las pautas terapéuticas y garantizar la adherencia a las intervenciones.

En definitiva, los planes de intervención en pacientes con AC deben plantearse desde una perspectiva holística, a la vez que personalizada, capaz de ofrecer una respuesta eficaz a las necesidades psicológicas, emocionales y conductuales que subyacen a cada tipología adictiva como a las particularidades individuales de cada paciente.

6.2 Limitaciones

Los estudios que forman esta tesis doctoral deben interpretarse en el contexto de algunas limitaciones. En primer lugar, las muestras de los estudios son mayoritariamente clínicas, y procedentes de una unidad de referencia para el tratamiento de adicciones comportamentales, lo cual limita la capacidad para generalizar los resultados a la población general.

Asimismo, la distribución por sexos fue asimétrica, de modo que la representación de las mujeres es muy inferior en comparación con la de los hombres. Sin embargo, esta distribución es coherente con la proporción de mujeres y hombres que solicitan tratamiento por TJ y adicción a videojuegos (que son condiciones clínicas mucho más frecuentes en los hombres). En este sentido, la composición de la muestra es representativa de la distribución real de hombres y mujeres en consulta clínica.

En relación con lo anterior, el tamaño de muestra de sujetos con AVJO es relativamente pequeña, valorándose en términos estadísticos. No obstante, es importante señalar que esta condición clínica también se presenta con una frecuencia relativamente baja, incluso en unidades especializadas en tratamiento para AC. Por ello, el tamaño muestral del estudio se valora como amplio en términos clínicos.

Respecto al estudio de redes neuronales, no ha sido posible incluir nuevas variables (nodos) que pudieran estar relacionados con la presencia de AIRTJ (como por ejemplo los factores socioculturales, la historia de violencia familiar o el comportamiento antisocial temprano). Además, debido a los cambios socioculturales que se suscitaron durante este periodo de tiempo, entre ellos la pandemia de COVID-19, el número de participantes en este estudio concreto fue relativamente limitado, incluyendo únicamente a los pacientes que acudieron a la unidad para recibir tratamiento durante los años 2021 y 2022. La falta de investigaciones previas basadas en análisis de redes tampoco permitió generar un marco teórico sólido con el que se pudieran contrastar y contextualizar las evidencias empíricas de este estudio, en concreto la identificación de los nodos con mayor relevancia y capacidad de vinculación.

Por otro lado, debido al largo periodo de reclutamiento de los pacientes con AVJO y TJ, se han producido cambios en los instrumentos de evaluación utilizados, lo que podría haber influido en los perfiles clínicos de los pacientes, particularmente al comparar pacientes evaluados en las primeras fases del estudio con aquellos evaluados en etapas más recientes. Estas inconstancias podrían haber influido en los resultados obtenidos.

Se sabe que los perfiles asociados a las AC están estrechamente relacionados con factores socioculturales, cuya evolución ha sido notoria durante las últimas décadas. La ventaja de haber realizado estudios que abarcan registros de datos tan amplios es el tamaño muestral, que otorga gran validez interna a los estudios.

Finalmente, la naturaleza transversal de los datos analizados dificulta poder interpretar las relaciones observadas en términos de causalidad.

6.3 Fortalezas

Los estudios que conforman esta tesis amplían el conocimiento sobre los fenotipos y endofenotipos de los pacientes con diferentes AC. Por un lado, se analizan variables que exploran múltiples aspectos del funcionamiento de los individuos, como los rasgos de personalidad, el perfil sociodemográfico, estados psicopatológicos, variables neuropsicológicas y endocrinas, y otras variables específicas de cada comportamiento adictivo (como la edad de inicio de la adicción, la duración, los subtipos y la modalidad). Además, se dispone de nuevas evidencias obtenidas en muestras que se consideran de gran tamaño en términos clínicos.

Otra de las fortalezas es el carácter novedoso de las investigaciones. Por ejemplo, el estudio sobre AIRTJ es pionero en el uso de redes neuronales.

La inclusión de la dimensión de género también es un aspecto que destacar en esta tesis. A diferencia de muchos estudios que se realizan en contextos clínicos sobre TJ y AVJO y que excluyen el subgrupo de mujeres debido a su baja representatividad, los artículos de esta tesis sí incluyeron a las mujeres. Aunque su presencia haya sido muy inferior a la de los hombres, tenerlas en cuenta permite aumentar la capacidad de generalización de los hallazgos, ya que se trata de muestra más representativas.

6.4 Implicaciones

Los resultados obtenidos en los estudios que conforman esta tesis tienen diferentes implicaciones. A nivel terapéutico resulta esencial que las intervenciones consideren las variables que influyen de manera significativa en los resultados del tratamiento. En particular, se destaca la necesidad de reforzar el entrenamiento en habilidades sociales, estrategias de afrontamiento ante situaciones de estrés, mejorar la resolución de problemas, la toma de decisiones y el control de los impulsos. El propósito final es desarrollar intervenciones personalizadas, adaptadas a las necesidades concretas de cada paciente, que garanticen la adherencia terapéutica y el buen cumplimiento de las pautas, obteniendo resultados terapéuticos sostenibles que favorezcan el éxito de los distintos abordajes.

A nivel preventivo, es preciso prestar atención a los factores de protección y de riesgo de las AC, y más concretamente del TJ y de la AVJO. Por ejemplo, en los videojuegos se observa que los individuos más jóvenes (adolescentes) son más vulnerables; y en el caso de las apuestas deportivas, los individuos que se encuentran entre la adolescencia tardía y la edad adulta emergente son un grupo diana para el inicio de estos problemas. Asimismo, se sabe que la publicidad y el marketing tienen un gran impacto en este tipo de comportamiento, por lo que se requieren políticas de salud pública, educativas y legislativas, que sean verdaderamente eficaces para controlar el acceso al juego y mejorar los marcos normativos.

Los resultados obtenidos también son de enorme utilidad para la elaboración de instrumentos de diagnóstico y de cribado. Es importante que estos instrumentos incluyan evaluaciones exhaustivas que vayan más allá de los síntomas concretos que se listan en las taxonomías de diagnóstico, y que se incluyan otras variables también con alta relación

a cada AC (por ejemplo, nodos “puente” que pueden facilitar la transición entre diferentes condiciones clínicas, como estados emocionales negativos, impulsividad, problemas en la regulación emocional y consumo de sustancias).

7. Conclusiones

Se evidencia la heterogeneidad clínica de las AC, así como la presencia de componentes biopsicosociales que contribuyen tanto a su desarrollo como a su mantenimiento. En esta línea, se identificaron perfiles clínicos (TJ, AADO y AVJO) diferenciados y constituidos por variables sociodemográficas, psicopatológicas y rasgos de personalidad, que permiten comprender mejor los mecanismos subyacentes que configuran la expresión fenotípica propia de cada AC. De modo que, se refuerza la necesidad de abordajes terapéuticos adaptados a las características individuales de cada subtipo clínico.

Estudio 1

Este estudio evidenció una prevalencia significativamente mayor de AADO en comparación con la AVJO, con una tendencia creciente de AADO entre 2012 y 2022. Los pacientes con AADO presentaron un perfil clínico más grave, caracterizado por mayores niveles de psicopatología, impulsividad, desregulación emocional y consumo de sustancias, así como un perfil de personalidad más disfuncional.

Estudio 2

Se identificó que la presencia de actos ilegales en pacientes con TJ se asocia a un perfil clínico más severo, con inicio más temprano, mayor duración del problema y mayor número de criterios diagnósticos. Asimismo, los diagramas de redes revelaron diferencias estructurales entre los pacientes con y sin AIRTJ, destacando la autotranscendencia como nodo central en los primeros y el juego como mecanismo de afrontamiento del malestar emocional en los segundos. Estos hallazgos sugieren la existencia de trayectorias clínicas distintas dentro del TJ.

Estudio 3

Se identificaron factores sociodemográficos, psicopatológicos y rasgos de personalidad que constituyen el perfil de pacientes con AVJO, previos a la intervención terapéutica. Los resultados indicaron que los pacientes con AVJO presentan una alta vulnerabilidad al abandono y recaída durante la TCC, especialmente aquellos con mayor malestar psicopatológico y un perfil de personalidad más disfuncional. Las primeras sesiones

fueron críticas, tanto para recaídas como para abandonos, lo que enfatiza la necesidad de intervenciones efectivas durante las etapas iniciales del tratamiento.

Estudio 4

Las variables neuropsicológicas y endocrinas se relacionan directa e indirectamente con la presencia del TJ. El modelo de mediación reveló que tanto los déficits cognitivos como la impulsividad actúan como mecanismos intermediarios claves, favoreciendo una comprensión más integral del TJ.

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9. Anexos

En este anexo se incluyen los cuatro estudios que forman parte de esta tesis doctoral.

A continuación, se indican las URL a través de las cuales los trabajos que ya están publicados se encuentran disponible en formato abierto.

Artículo publicado 1:

Online gaming disorder and sports betting addiction: convergences and divergence.

Accesible a través de las URL:

<https://doi.org/10.1007/s11469-024-01386-x>

<https://ddd.uab.cat/record/300694?ln=ca>

Artículo publicado 2:

A network approach of gambling disorder profile with and without related illegal acts.

Accesible a través de las URL:

<https://doi.org/10.1007/s11469-023-01199-4>

<https://ddd.uab.cat/record/287134?ln=ca>

Artículo publicado 3:

Features related to the presence of internet gaming disorder and their impact on the treatment outcomes.

Accesible a través de las URL:

<https://doi.org/10.1556/2006.2024.00070>

<https://ddd.uab.cat/record/305797?ln=ca>

Artículo pendiente de enviar a publicar 4:

Biopsychological markers of gambling disorder: a path analysis approach.



Online Gaming Disorder and Sports Betting Addiction: Convergences and Divergences

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Abstract

Worldwide estimates of the prevalence of online gaming disorder (OGD) and online sports betting addiction (OSBA) have become exceedingly high, particularly among young people. The objective of this study was to compare the sociodemographic and clinical profiles of treatment-seeking patients for these mental health disorders. The sample included $n=495$ patients ($n=108$ OGD and $n=387$ OSBA) recruited from a tertiary care unit specialized in the treatment of behavioral addictions. Sociodemographic variables, psychopathologic state, impulsivity, emotion regulation, substances, and personality traits were assessed and compared between both these diagnostic subtypes. The prevalence for OGD was 3.82% and for OSBA was 13.01% among the whole sample of $n=3,036$ patients. Compared with OGD, OSBA presented a profile characterized by a greater proportion of non-single men with higher levels of education, employed, and of higher socioeconomic status. OSBA was also characterized by older chronological age, later age of onset of the addictive behaviors, worse psychopathology state (greater likelihood of depression and anxiety), higher impulsivity, and higher substance use. The personality profile related to OSBA presented higher novelty seeking, reward dependence and persistence, and lower harm avoidance. Despite the similarities between OGD and OSBA, and even though both behaviors could be perceived by the general population as low-risk leisure activities (as opposed to other gambling types, such as casinos or slot machines), the differences in the clinical profiles should be considered in efforts to improve assessment tools and specialized intervention plans.

Keywords Behavioral addictions · Online gaming · Online sports betting · Clinical profile · Personality

The digital transformation in the gaming and gambling industries has provided immersive and awe-inspiring forms of entertainment worldwide. Online platforms can offer a new experience that transcends traditional offsite modalities, with a much larger and more diverse range of games, more personalized gaming experiences, more opportunities to interact with other players around the world, and countless gaming experiences across

multiple devices (e.g., smartphones, tablets, and PCs) (Gainsbury et al., 2015). This has led to the widespread acceptance of online gaming and online sports betting among the general population, and both activities have been identified as the most popular forms of online gambling in Europe, particularly among young men (European Gaming & Betting Association, 2019; Li et al., 2020).

The remarkable ascendancy of both video games and sports betting in digital format can increase players' susceptibility to problem gambling, as described by certain studies that have found higher rates of problematic behavior in samples of Internet gamblers compared to non-Internet gamblers (Gainsbury et al., 2014). A study of 6682 gamblers found that online problem gamblers were more likely to bet on sports and in a greater number of ways than their offline peers (Gainsbury et al., 2013).

Gaming Disorder: Definition and Epidemiological Data

Gaming disorder has been considered a type of behavioral addiction and has been defined as a pattern of problematic, persistent, uncontrolled, and recurrent gaming behavior that can occur both online or offline, generating maladaptive consequences for individuals. The latest version of the International Classification of Diseases published by the World Health Organization (ICD – 11th Revision, 2020) has incorporated this mental disorder into the section on non-substance related addictions, classified as *Gaming Disorder*. The latest version of the Diagnostic and Statistical Manual of Mental Disorders DSM-5-TR published by the American Psychiatric Association (American Psychiatric Association., 2022) has classified *Internet Gaming Disorder* in section III (which includes disorders requiring further empirical investigation).

Epidemiological studies have estimated the global mean prevalence of gaming disorder to be the range from 1 to 6% in developed countries (Darvesh et al., 2020; Feng et al., 2017; Mihara & Higuchi, 2017; Petry et al., 2014; Stevens et al., 2021; Wartberg et al., 2017; Yau & Potenza, 2014; Yu & Cho, 2016), but there is much variation between individual estimates. While some studies have reported values around 1 to 2% (Haagsma et al., 2012; Müller et al., 2015; Rehbein et al., 2015), others are as high as 14% (Wang et al., 2015; Wartberg et al., 2019) and even 20% (Vadlin et al., 2018). It has been observed that prevalence rates in Central and Eastern Europe are higher than those in Northern and Western Europe (Chia et al., 2020). This major variability among countries and studies has been associated with the influence of sociodemographic factors and methodological issues (such as the use of diverse screening and diagnostic tools) (González-Bueso et al., 2018; King et al., 2020). Other studies, including systematic reviews, have also reported important differences according to sex and age, finding greater risks associated with males and younger individuals (teenagers and young adults) (Romrell, 2014; Fam, 2018; Lopez-Fernandez et al., 2019; Palaus et al., 2017; Romrell, 2014; Vermeulen et al., 2017).

Sports Betting: Definition and Epidemiological Data

Sports betting addiction is typically viewed as a strategic form of gambling disorder, being a mental disorder categorized as a non-substance-related addiction in the latest version of the DSM-5-TR (American Psychiatric Association., 2022). Problematic sports betting disorder is characterized by an uncontrollable and persistent desire to bet on sports despite the

severe adverse consequences that can impact many areas of the individuals' life, including financial struggles (sometimes even debts), strain on personal relationships, or legal problems (such as fraud or embezzlement to finance the betting activity) (Estévez et al., 2017; Mestre-Bach et al., 2022).

Sports betting has expanded globally, especially in Western regions such as North America, Oceania, and Europe (Deans et al., 2017; Gainsbury et al., 2015). Differences have been observed between online versus offline modalities, with a higher prevalence of online betting platforms (the ratio is around 7 to 3) (Gainsbury et al., 2014), particularly among younger individuals (Gainsbury et al., 2013). This increase in sports betting has coincided with the incorporation of novel features, such as cash-out and live betting, instant deposits, and micro-betting (Lopez-Gonzalez et al., 2019; Winters & Derevensky, 2019). The Internet has contributed to this growth in gambling activity, since it permits immediate betting, anonymity, and access to a number of platforms that are easily accessible from any geographical location and at any time (McGee, 2020). The dynamics generated by betting on a sports event generate such engagement that some people consider the former to be an intrinsic part of the latter (Li et al., 2012; Mao et al., 2015; Koning and van Velzen, 2009). Excessive advertising targeted at people who like to watch sports has become extremely effective at encouraging them to engage in betting activities and is therefore a high risk factor for addiction to sports betting (Bouguettaya et al., 2020; Newall et al., 2019).

Correlates of Online Gaming Disorder and Sports Betting Addiction

Online gaming disorder (OGD) and online sports betting addiction (OSBA) are complex behavioral addictions (which are not related to substance use) to which multiple interacting biopsychosocial factors contribute (Wartberg et al., 2019). Certain common variables have commonly been associated with the onset and progression of both mental conditions. Regarding sociodemographic profiles, the features with the greatest associations are young age (adolescence and early adulthood) (Andreassen, 2015; Kuss et al., 2014), male gender (Durkee et al., 2012; Rehbein & Baier, 2013; van Deursen et al., 2015), not being married and living alone (Hing et al., 2016). Both OGD and OSBA have also been considered avoidance strategies to cope with and escape from stress, in a process consistent with the stress-coping model (Compas et al., 2001) and in contrast to effective problem-solving. Thus, addictive behaviors such as online gaming or betting could be conceptualized as attempts to disengage from stress and the associated negative emotional states. These motivational drivers have also been associated with negative reinforcers, in a process described as cognitive-behavioral (Dong & Potenza, 2014), which has recently been modified on the basis of the individual differences in the self-regulatory executive function (Zhou et al., 2023).

Regarding personality traits, compared with control samples, OGD and OSBA have been related with higher levels of impulsivity, persistence and neuroticism, and lower levels of self-consciousness and extroversion (Andreassen et al., 2013; Kardefelt-Winther, 2014; Littel et al., 2012; Müller et al., 2014; Seong et al., 2019). Similar cognitive biases have also been observed in several domains among patients with online video gaming and sports betting problems. These distortions have been associated with a decrease in the perceived risk and potential long-term negative impacts caused by gaming/betting, together with an increase in the perceived notion that personal skills could contribute to positive gambling outcomes (Valenciano-Mendoza et al., 2023). The most typical cognitive biases are

considering gaming/betting as the only way to perceive satisfactory self-esteem and social acceptance, overvaluing the rewards and tangibility of gaming, or dysfunctional and inflexible rules about gaming behavior (Forrest et al., 2016; Hamonniere & Varescon, 2018; King & Delfabbro, 2014; Laier et al., 2018). A similar comorbid phenotype has also been identified, the psychopathological states with the greatest risk of concurrence with online gaming and sports betting addiction being depression, anxiety, social phobia, antisocial behavior, attention-deficit hyperactivity disorder, and other addictive behaviors, including substance-related disorders (Derevensky & Gupta, 2004; González-Bueso et al., 2018; Lee et al., 2017). Other typical impairments related with excessive-problematic online gaming and sports betting are academic problems, poor sleep quality, and worsening of social relationships (Bonnaire & Baptista, 2019; S. Wang et al., 2022; Wong et al., 2020).

Differences Between OGD and OSBA

Despite the similarities in the endophenotype of OGD and OSBA, differences do seem to exist. Based on the available literature, the phenotype of patients with OSBA is characterized by older age and higher education and employment levels (Hing et al., 2016; Jiménez-Murcia et al., 2021; Russell et al., 2019). Studies have also provided evidence of the major heterogeneity within each diagnostic subtype and the existence of separate empirical functional profiles (Mallorquí-Bagué et al., 2017). For example, a recent paper identified two separate clusters in sports betting disorder (Granero et al., 2020): (a) one group of patients with more severe addiction, with a higher proportion of single, younger and lower socioeconomic status individuals, and a greater likelihood of other comorbid substance and non-substance addiction related problems and (b) another group formed by individuals with less severe addiction, of older age, mostly married or with a stable partner, and of higher socioeconomic status.

Research exploring the existence of different profiles among a sample of patients seeking treatment for gaming disorder have also identified two separate empirical profiles (Granero et al., 2021); one of them characterized by older age, worse psychological state, and more dysfunctional personality traits. This evidence suggests that age could play a central role in both gaming disorder and gambling disorder, but the sense of the relationships could be different: while older age seems to predict a more complex clinical profile in terms of gaming disorder, it appears to predict a less severe clinical state in gambling disorder (including sports betting).

Rationale of the Study and Objectives

In summary, current studies have revealed the increasing prevalence of OGD and OSBA, mainly among younger populations. But while gambling disorder is fully recognized as a behavioral addiction (and hence OSBA) in taxonomies such as the DSM-5, OGD requires further study before it can be considered and empirically based concrete mental condition classified into the non-substance addiction category. And although many studies have provided strong evidence regarding the similarities in the endophenotypes, current research suggest the need of a better understanding of OGD compared with OSBA, particularly in clinical samples of adult patients. An accurate characterization of the specific profiles related to each form of gambling (problematic video gaming versus problematic sports

betting) may help clinicians improve their screening of these two disorders and will allow to refer patients to more appropriate and effective treatments. Therefore, the aims of this study were to establish the prevalence of each diagnostic subtype (OGD and OSBA) in a large clinical sample of patients treatment seeking at a health unit specialized in the treatment of behavioral addictions and to explore the sociodemographic and clinical features that characterize each form of gambling. Based on the available scientific evidence, the profiles of OGD and OSBA patients are expected to differ.

Method

Participants

The sample included patients seeking treatment for OGD or OSBA at a tertiary care center, namely the Behavioral Addictions Unit of Bellvitge University Hospital. This tertiary center provides sub-specific health care for patients with behavioral addictions, after referral from the providers of primary and secondary care, and with clinic staff members specialized in these mental health conditions. The total sample of patients who consecutively received treatment for behavioral addictions between January 2012 and December 2022 was $n=3036$. The inclusion criterion was to report OGD or OSBA as the reason for treatment. The exclusion criterion was the presence of any neurological disorder (e.g., traumatic brain injury, neurodegenerative disorder such as Parkinson's disease), psychotic disorders, or intellectual disability (these conditions were excluded because their presence could interfere with the standardized measures used in the assessment process).

The sample selected for the comparison between groups included $n=495$ participants who met clinical criteria for OGD or OSBA (108 with OGD and 387 with OSBA), men and women (467 vs 28), with a mean age of 29.9 years ($SD=10.6$). The groups were mutually exclusive, and the presence of the potential comorbid condition of gaming disorder plus sports betting was excluded in order to adequately assess the specific phenotypes related to each diagnostic condition.

Measures

Diagnostic Questionnaire for Pathological Gambling (Stinchfield, 2003) This is a self-report questionnaire developed to identify the presence of GD using 19 items based on the DSM criteria [diagnoses are available for the DSM-IV-TR (American Psychiatric Association, 2022) and DSM-5 versions (1)]. The psychometrical Spanish adaptation of this tool achieved adequate properties (Cronbach's alpha $\alpha=0.81$ for a population-based sample and $\alpha=0.77$ for a clinical sample) (Jiménez-Murcia et al., 2009). The internal consistency achieved in this study was good ($\alpha=0.814$).

Clinical Criteria for Gaming Disorder A semi-structured face-to-face clinical interview assessed the criteria included in section 3 of the DSM-5 ("Conditions for Further Study") for the presence of gaming disorder (American Psychiatric Association, 2022; Petry et al., 2014), preoccupation or obsession, withdrawal, tolerance, loss of control, loss of interest, continued overuse, deception, release of negative feelings, and functional impairment. In addition to the cut-off proposed in the DSM-5 (5 out of 9 criteria are required to endorse the condition), the presence of gaming disorder in this study required the symptoms to be

endorsed within a 12-month period to establish the diagnosis [this method is aligned with recent research showing that laxer criteria are susceptible to pathologization of non-pathological gaming patterns] (Billieux et al., 2019; Deleuze et al., 2017). For patients assessed between 2005 and 2013 (before the release of DSM-5), gaming disorder was identified by means of a semi-structured face-to-face interview adapted from DSM-III-R pathological gambling criteria (Griffiths & Hunt, 1998).

Symptom Checklist-Revised (SCL-90-R) (Derogatis, 2002) This is a self-report questionnaire developed to assess psychological state using 90 items factorized into nine primary (first order) dimensions (somatization, obsessive–compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism), and three global indices [global severity index (GSI), total positive symptoms (TPS), and positive symptom discomfort index (PSDI)]. The psychometrical Spanish adaptation of this tool obtained adequate properties (the mean Cronbach's alpha was $\alpha=0.75$) (Gonzalez De Rivera et al., 1989). The internal consistency in our sample was also in the adequate to good range ($\alpha=0.790$, for the paranoid ideation scale, to $\alpha=0.981$ for the global indices).

Temperament and Character Inventory-Revised (TCI-R) (Cloninger et al., 1994) This is a self-report questionnaire developed to assess personality traits using 240 items based on Cloninger's multidimensional model and structured into seven factors [four for temperament (novelty seeking, harm avoidance, reward dependence, and persistence), and three for character (self-directedness, cooperation, and self-transcendence)]. The psychometrical Spanish adaptation of the tool obtained adequate properties (the mean Cronbach's alpha was $\alpha=0.87$) (Gutiérrez-Zotes et al., 2004). The internal consistency in the studied sample was in the adequate to good range ($\alpha=0.703$, for novelty seeking, to $\alpha=0.868$ for persistence).

Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004) Validated in the Spanish population (Wolz et al., 2015). This assesses emotion dysregulation in six subscales: non-acceptance of emotional responses, difficulties in pursuing goals when experiencing strong emotions, difficulties in controlling impulsive behaviors when experiencing negative emotions, the lack of emotional awareness, limited access to emotional regulation strategies, and the lack of emotional clarity. The measure consists of 36 items and is answered on a 5-point Likert scale. The internal consistency of the subscales for our sample ranges between $\alpha=0.796$ and $\alpha=0.924$, and the one for the total score was $\alpha=0.950$.

The UPPS-P Impulsivity Scale (Whiteside et al., 2005) The UPPS-P Impulsivity Scale is a 59-item scale that assesses impulsive behavior on 5 different scales: sensation seeking, the lack of premeditation, the lack of perseverance, and negative and positive urgency. Positive urgency was included more recently. All items are rated on a 4-point scale from 1 (strongly agree) to 4 (strongly disagree). The UPPS-P has satisfactory psychometric properties in terms of both convergent and discriminative validity. The Spanish version of the UPPS-P scale was obtained via a back-translation process and presents adequate psychometric properties (Verdejo-García et al., 2010). The internal consistency in our sample was between $\alpha=0.827$ (sensation seeking) and $\alpha=0.911$ (total score).

Other Variables This study also analyzed additional data assessed by means of a semi-structured interview. This tool covered socio-demographic characteristics (sex,

marital status, level of education, employment status), as well as the socio-economic position index, according to Hollingshead's scale (based on the participants' level of education and profession) (Hollingshead, 2011). Patients also completed questions on OSBA-related variables (age of onset, duration, bets per gambling episode, and accumulated debts due to the gambling addiction) and substance use (no vs. at least sometimes).

Procedure

The data analyzed in this study was collected as part of different research projects approved by the Ethics Committee of Bellvitge University Hospital (Barcelona) (Ref: PR338/17 [CSI 18/04]). All the patients provided signed informed consent. No financial compensation was given to the participants. All data were collected by qualified clinical psychologists from a single assessment session lasting approximately 90 min.

Statistical Analysis

Statistical analysis was conducted with Stata18 for Windows. The comparison of sociodemographic variables between the groups was performed with chi-square (χ^2) tests for categorical variables and *T*-test for quantitative measures.

Next, clinical profiles were compared using analysis of covariance (ANOVA, for the quantitative scores) and logistic regression (for the categorical measures). For these analyses, the effect size was obtained with the Cohen's *d* coefficient for the mean differences and with the odds ratio (OR) coefficient for the proportional differences. Cohen's *d* are standardized coefficients, which are interpreted as having a null effect for values around 0, low-poor for values higher than 0.20, mild-moderate for values higher than 0.50, and large-high for values higher than 0.80. OR were interpreted as mild-moderate for $OR > 1.86$ and large-high for $OR > 3.00$. These procedures comparing the clinical profiles between OGD and OSBA also included as covariates the participants' sex and age, to avoid the presence of biases due to the impact of these two confounding variables. Additionally, the increase in the type I error due to the application of multiple significance tests was controlled by the Finner's method, a procedure that has proved far more powerful than classical Bonferroni correction.

A logistic regression was obtained to identify the variables with statistical discriminative capacity to differentiate between clinical profiles, by means of a back-stepwise method. The list of potential predictors included the main variables of the sociodemographic and clinical profiles, namely sex, age, duration of the addiction related problems, social position, global psychopathology distress (SCL-90R GSI), impulsivity (UPPS-P total), difficulties in emotion regulation (DERS total), and personality (TCI-R scales). Goodness-of-fit was calculated with the Hosmer–Lemeshow test, global predictive capacity with Nagelkerke's pseudo- R^2 coefficient, and global discriminative capacity with the area under the ROC curve (AUC).

Results

Descriptive and Between-Group Comparison of Sociodemographic Profiles

The first block in Table 1 includes the descriptive of the complete sample. Most patients in the study were men, single, with a primary or secondary education, employed and of

mean-low to low socioeconomic status. The mean age of onset of the addiction problems was 23.4 years old ($SD = 8.3$) and mean duration 3.8 years ($SD = 3.5$).

The second block in Table 1 includes a comparison between the groups for the sociodemographic variables. Compared with OGD, OSBA included a higher proportion of married or divorced men, with higher levels of education and employment, and higher socioeconomic indexes. OSBA was also characterized by older age and later age of onset of the addictive behaviors.

Prevalence of OGD and OSBA

Among the total sample of patients treated during the sample recruitment period, the prevalence of OSBA was 13.01% (95% confidence interval [95%CI] 11.81 to 14.21%), versus 3.82% for OGD (95%CI 3.14 to 4.50%). These estimates indicated that the likelihood of OSBA was almost four times higher than for OGD (prevalence ratio $PR = 3.41$, 95%CI 2.79 to 4.16). Figure 1 shows a line graph with the trajectories of the prevalence figures during the recruitment period. For OSBA, polynomial contrasts identified

Table 1 Descriptive for the sample

	Total <i>N</i> = 495		Gaming <i>N</i> = 108		Sports betting <i>N</i> = 387		<i>p</i>
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Sex							
Female	28	5.7%	12	11.1%	16	4.1%	.006*
Male	467	94.3%	96	88.9%	371	95.9%	
Civil status							
Single	351	70.9%	95	88.0%	256	66.1%	< .001*
Married, couple	118	23.8%	12	11.1%	106	27.4%	
Divorced, separated	26	5.3%	1	0.9%	25	6.5%	
Education							
Primary	176	35.6%	55	50.9%	121	31.3%	.001*
Secondary	241	48.7%	43	39.8%	198	51.2%	
University	78	15.8%	10	9.3%	68	17.6%	
Employment							
Unemployed	204	41.2%	80	74.1%	124	32.0%	< .001*
Employed	291	58.8%	28	25.9%	263	68.0%	
Social position							
High	16	3.2%	3	2.8%	13	3.4%	< .001*
Mean-high	43	8.7%	4	3.7%	39	10.1%	
Mean	65	13.1%	11	10.2%	54	14.0%	
Mean-low	184	37.2%	26	24.1%	158	40.8%	
Low	187	37.8%	64	59.3%	123	31.8%	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
Age (years-old)	29.88	10.59	24.95	12.27	31.25	9.65	< .001*
Onset of addiction (years-old)	23.38	8.26	20.05	10.72	24.30	7.18	< .001*
Duration of the addiction (years)	3.75	3.47	4.04	3.23	3.67	3.53	.327

Note. SD: standard deviation. *Bold: significant comparison (.05 level)

a positive significant lineal trend (Wald-statistic = 20.65, $p < 0.001$), with an increase from 8.6% in 2012 to 15.5% in 2022. No significant lineal trend was identified for the OGD condition (Wald-statistic = 1.01, $p = 0.314$), with an increase from 3.4 in 2012 to 5.7 in 2022.

Comparison of Clinical Profiles

Tables 2, 3, and 4 contain a comparison between the groups for psychopathological state (SCL-90R), impulsivity (UPPS-P), emotion regulation (DERS), substance use, and personality traits (see also Fig. 2). After adjusting (controlling) by the patients' sex and age, compared with OGD, OSBA presented a profile characterized by worse psychological state (higher likelihood of depression, anxiety, paranoid ideation, and total psychological symptoms), higher impulsivity levels, higher difficulties in emotion regulation, and higher substance use. The personality profile related to OSBA presented higher novelty seeking, reward dependence and persistence, and lower harm avoidance.

Logistic Regression

Table 5 displays the logistic regression with the variables with statistical capacity to discriminate between the diagnostic conditions. The likelihood of OSBA is higher for men, older patients, shorter duration of the addictive problems, higher novelty seeking, higher persistence, and lower self-transcendence. Adequate goodness-of-fit was achieved ($p = 0.405$ in the Hosmer–Lemeshow test), along with a global predictive capacity of around 26% (Nagelkerke's $R^2 = 0.263$) and global discriminative capacity of $AUC = 0.850$.

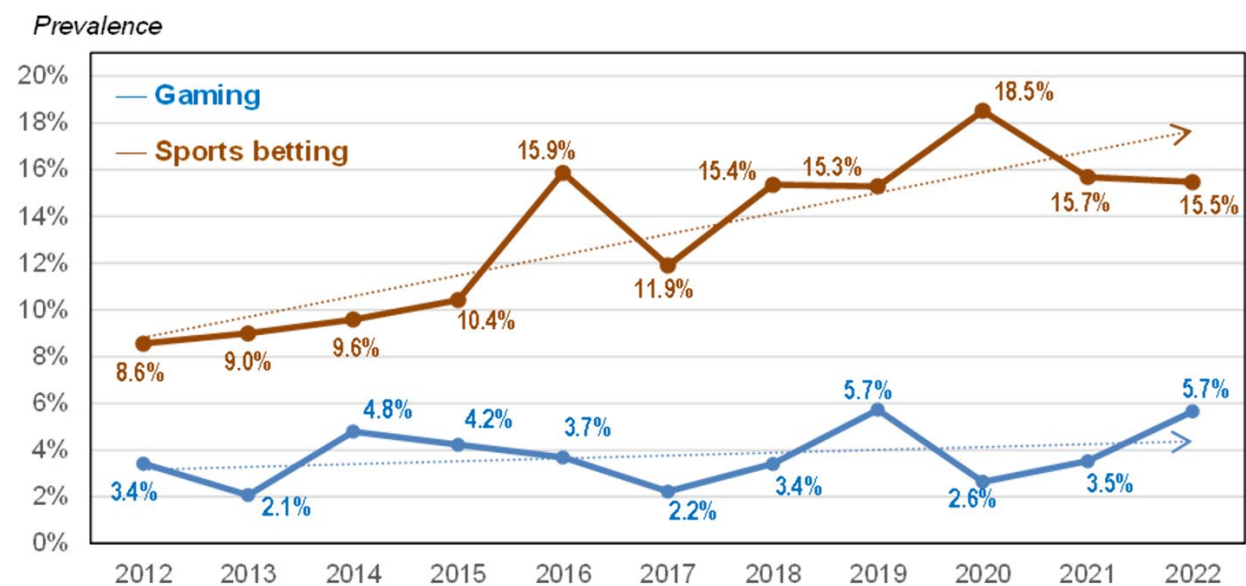


Fig. 1 Prevalence of gaming disorder and sports betting during the recruitment of data. Note. Dash line: linear trends

Table 2 Comparison of the clinical profiles: results adjusted (controlled) by the patients’ sex and age

	Raw scores				Patients within the clinical range							
	Gaming <i>N</i> = 108		Sports betting <i>N</i> = 387		<i>p</i>	<i>d</i>	Gaming <i>N</i> = 108		Sports betting <i>N</i> = 387			
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>			<i>n</i>	%	<i>n</i>	%		
SSCL-90R Somatization	0.79	0.75	0.85	0.76	.505	0.08	33	30.6%	133	34.4%	.896	1.03
SSCL-90R Obsess.-comp	1.24	0.79	1.13	0.80	.232	0.14	51	47.2%	170	43.9%	.600	0.89
SSCL-90R Interp.sensitivity	1.16	0.93	1.00	0.82	.073	0.19	57	52.8%	174	45.0%	.260	0.77
SSCL-90R Depression	1.27	0.99	1.47	0.91	.047*	0.20	50	46.3%	220	56.8%	.048*	1.57
SSCL-90R Anxiety	0.80	0.78	0.94	0.75	.079	0.19	30	27.8%	159	41.1%	.026*	1.89[†]
SSCL-90R Hostility	0.98	0.86	0.97	0.82	.874	0.02	36	33.3%	109	28.2%	.283	0.77
SSCL-90R Phobic anxiety	0.50	0.75	0.39	0.62	.154	0.15	31	28.7%	92	23.8%	.292	0.76
SSCL-90R Paranoid ideation	1.06	0.88	0.90	0.79	.092	0.18	44	40.7%	100	25.8%	.019*	2.15[†]
SSCL-90R Psychotic	0.73	0.76	0.82	0.71	.298	0.11	40	37.0%	169	43.7%	.252	1.31
SSCL-90R GSI	0.98	0.72	1.01	0.68	.743	0.04	52	48.1%	208	53.7%	.313	1.26
SSCL-90R PST	41.95	20.06	45.08	21.60	.188	0.15	47	43.5%	208	53.7%	.049*	1.58
SSCL-90R PSDI	1.90	0.60	1.86	0.53	.457	0.08	26	24.1%	72	18.6%	.151	0.68
UPPS-P Premeditation	23.73	5.56	25.17	4.91	.013*	0.27	21	19.4%	78	20.2%	.526	1.20
UPPS-P Perseverance	24.70	4.08	22.85	4.47	.001*	0.43	33	30.6%	86	22.2%	.049*	0.66
UPPS-P Sensation seeking	28.48	5.92	29.33	6.92	.250	0.13	10	9.3%	44	15.4%	.048*	2.11[†]
UPPS-P Positive urgency	26.81	8.13	30.21	8.58	.001*	0.41	17	15.7%	125	32.3%	.001*	2.63[†]
UPPS-P Negative urgency	29.17	6.60	31.62	6.14	.001*	0.38	26	24.1%	99	25.6%	.761	1.08
UPPS-P Impulsivity total	132.93	18.88	139.18	21.66	.009*	0.31	22	20.4%	116	30.0%	.029*	1.89[†]
DERS Non acceptance	14.15	4.30	15.76	4.71	.002*	0.36	13	12.0%	90	23.3%	.015*	2.23[†]
DERS Goal directed behaviors	16.00	2.85	14.02	3.32	.001*	0.64[†]	14	13.0%	39	10.1%	.517	0.80
DERS Impulse control	13.61	4.22	13.16	3.96	.316	0.11	13	12.0%	81	20.9%	.012*	2.36[†]
DERS Lack awareness	16.88	3.39	16.81	3.48	.854	0.02	10	9.3%	62	16.0%	.029*	2.30[†]

Table 2 (continued)

	Raw scores		Patients within the clinical range									
	Gaming <i>N</i> = 108		Sports betting <i>N</i> = 387		<i>p</i>	<i>dl</i>	Gaming <i>N</i> = 108		Sports betting <i>N</i> = 387		<i>p</i>	<i>OR</i>
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>			<i>n</i>	%	<i>n</i>	%		
DERS Limited access	17.90	4.61	18.29	5.37	.506	0.08	12	11.1%	63	16.3%	.077	1.87[†]
DERS Emotional clarity	11.86	2.95	11.81	3.27	.886	0.02	12	11.1%	55	14.2%	.228	1.54
DERS Total	90.41	16.23	89.26	17.35	.555	0.07	14	13.0%	84	21.7%	.023*	2.10[†]

Note. *SD* standard deviation. *ldl*: Cohen's *d* coefficient
SCL-90R Symptom Checklist-Revised, *UPPS-P* Impulsivity Behavior Scale
DERS, Difficulties in Emotion Regulation Scale
* Bold: significant comparison (.05 level)
[†] Bold: effect size into the ranges mild-moderate to high-large (*ldl* > 0.50 or *OR* > 1.86)

Table 3 Comparison of substances use: results adjusted (controlled) by the patients’ sex and age

	Gaming <i>N</i> = 108		Sports betting <i>N</i> = 387		<i>p</i>	<i>OR</i>
	<i>n</i>	%	<i>n</i>	%		
Tabaco	24	22.2%	160	41.3%	.001*	2.43[†]
Alcohol	2	1.9%	37	9.6%	.021*	5.60[†]
Other illegal drugs	4	3.7%	48	12.4%	.012*	3.98[†]

Note. *SD* standard deviation, *OR* odds ratio. *Bold: significant comparison (.05 level)
[†]Bold: effect size into the ranges mild-moderate to high-large (*OR* > 1.86)

Table 4 Comparison of the personality profiles: results adjusted (controlled) by the patients’ sex and age

	Gaming <i>N</i> = 108		Sports betting <i>N</i> = 387		<i>p</i>	<i>ldl</i>
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>		
TCI-R Novelty seeking	102.56	13.94	112.00	13.42	.001*	0.69[†]
TCI-R Harm avoidance	106.24	16.46	98.29	16.88	.001*	0.48
TCI-R Reward dependence	92.05	16.49	95.16	14.19	.041*	0.20
TCI-R Persistence	91.54	18.76	108.66	20.19	.001*	0.88[†]
TCI-R Self-directedness	125.65	22.01	129.90	21.60	.085	0.19
TCI-R Cooperativeness	128.71	18.12	128.15	17.31	.775	0.03
TCI-R Self-transcendence	60.51	14.42	59.73	14.38	.634	0.05

Note. *SD* standard deviation. *ldl*: Cohen’s-*d* coefficient
TCI-R, Temperament and Character Inventory-Revised
*Bold: significant comparison (.05 level)
[†]Bold: effect size into the ranges mild-moderate to high-large

Discussion

This study aimed to estimate the prevalence of OGD and OSBA among all patients seeking treatment at a hospital unit specialized in behavioral addictions during the period from 2012 to 2022 and to explore the sociodemographic and clinical features characterizing each diagnostic subtype. To our knowledge, this is the first study to have compared the phenotypes of these forms of online gambling, recruited from a large clinical sample of patients seeking treatment for behavioral addictions.

The prevalence of OSBA was higher than that of OGD (13.0% vs. 3.8%). Different factors may explain this difference. First, among the general population, sports betting (both offline and online) could be perceived as a leisure behavior of low risk and little social stigma. Secondly, the large rise in OSBA advertising and marketing, as well as the immediacy and easy access to multiple virtual platforms (apps and websites) for largely uncontrolled and private betting (Buil et al., 2015), may also have contributed to the fast-growing popularity of this gambling trend (Gainsbury et al., 2015). Indeed, some subjects consider betting to be an intrinsic part of the sports event itself, which reduces awareness of the risks that this type of behavior entails and hence increases vulnerability to OSBA (Brevers

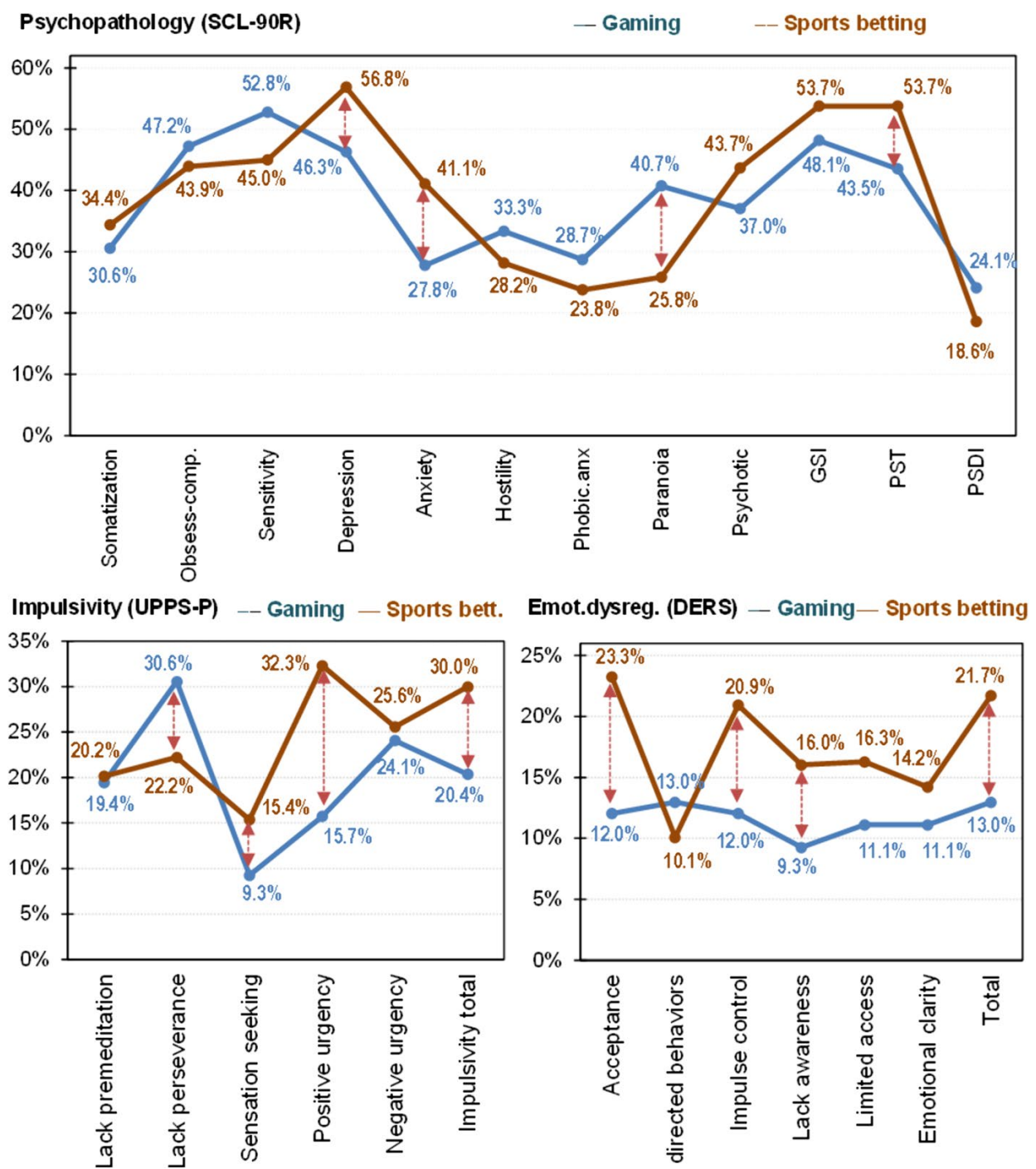


Fig. 2 Prevalence of patients within the clinical ranges. Note. Dash line: significant comparison (adjusted by sex and age)

et al., 2022). Additionally, individuals with other gambling behaviors may be attracted by the popularity of online sports betting, which increases the risk of onset and advance of OGD (Hing et al., 2015b; Russell et al., 2019), particularly among males and young people (Gainsbury et al., 2013). This result is consistent with previous studies, which observed that young subjects are currently most vulnerable to advertising of sports betting on online platforms (Derevensky et al., 2010; Lopez-Gonzalez et al., 2019; Martin & Nelson, 2014; Martin et al., 2016, 2018).

This study also observed an increase in the prevalence of OGD and OSBA in recent years, with a positive linear trend for OSBA (increasing from 8.6% in 2012 to 15.5% in 2022, compared with an increase from 3.4 to 5.7% for OGD). This increase is strongly related with faster, easier and more widely available access to internet and advances in

Table 5 Logistic regression with the final discriminative model

	B	SE	p	OR	95%CI (OR)	
Sex (1 = men versus 0 = women)	1.866	0.560	.001	6.464	2.156	19.376
Age (years-old)	0.098	0.016	<.001	1.103	1.069	1.138
Duration of the problems (years)	−0.109	0.040	.006	0.897	0.829	0.970
TCI-R Novelty seeking	0.063	0.011	<.001	1.065	1.043	1.089
TCI_R Persistence	0.055	0.008	<.001	1.057	1.040	1.074
TCI-R Self-transcendence	−0.031	0.010	.001	0.969	0.950	0.988
Fit-statistics:	Hosmer–Lemeshow: $p = .405$, Nagelkerke’s- $R^2 = .263$; AUC = .850					

Note. Criterion: diagnostic subtype: 1=OSBA (online sports betting addiction) versus 0=OGD (online gambling disorder)

SE standard error, *OR* odds ratio, *95%CI* 95% confidence interval, *AUC* area under ROC curve

List of predictors: sex, age, duration of the addiction related problems, social position, global psychology distress (SCL-90R GSI, impulsivity (UPPS-P total), emotion dysregulation (DERS total), and personality (TCI-R scales)

modern technology (Baggio et al., 2017; Gainsbury et al., 2015). Regarding the growth in the prevalence of OGD in our study (from 3.4 to 5.7% during the recruitment period between 2012 to 2022), recent studies have also concluded that the advancement of technology in developed countries has occurred in parallel with increasingly serious OGD prevalences among high-risk populations (such as young age people) (Kim et al., 2022). The increasing popularity of online video games has also been related with the increase in reported negative consequences on physical, mental, and social well-being of gamers (Alhamoud et al., 2022), which have led the considerable interest of researchers across the world to estimate accurate prevalence of OGD and its correlates among groups of people with different vulnerabilities. Variable prevalence rates have been related with strong discrepancies in the measurement tools, the lack of consensus among researchers regarding diagnostic criteria (that may result in false positive screening inflating prevalence rates), and even the impact of cultural background (Zhou et al., 2024). But there is a clear consensus on the worldwide increase of OGD prevalences.

Compared with OGD, this study found that OSBA affects a higher proportion of males, with higher levels of education, in active employment and of higher socioeconomic status. Regarding these differences in the sociodemographic profile, it seems consistent to assume that sports betting is associated with a better economic situation, since this activity is more expensive to finance than gaming (which is typically associated with younger males with fewer financial resources) (Andreassen, 2015; Kuss et al., 2014). These findings agree with other studies which have also reported that, as opposed to many other types of gambling (and also compared to gambling disorder), sports betting is associated with higher likelihood of males (Håkansson et al., 2017; Richard et al., 2019), higher levels of education (Cooper et al., 2021; Jiménez-Murcia et al., 2021), and active employment (Hing et al., 2016).

Other differences between OSBA and OGD in this work were the means for chronological age and for the age of onset of the problematic addictive behavior. Concretely, OSBA patients were older, and reported later onset of the disorder. These results could be explained by the fact that in many patients OSBA may have evolved from previous forms of gaming. Indeed, previous studies have observed that some individuals who

play videogames (even as a non-problematic recreational activity) may progress to other gambling behaviors such as sports betting (Kuss et al., 2014). Previous research has estimated the prevalence of gaming disorder at around 15% in a clinical sample of patients seeking treatment for gambling disorder (Jiménez-Murcia et al., 2014). In fact, both cross-sectional and longitudinal research has found that gambling disorder is a highly prevalent comorbid condition of gaming disorder (Zendle & Cairns, 2018). It has been suggested that certain structural features of video games (such as “loot boxes”) and the proliferation of betting websites may lead to the natural progression from online video gaming to online gambling platforms (King & Delfabbro, 2018; King et al., 2011). Another explanation is that they start out as land-based gamblers, where it is a form of entertainment, and later switch to online gambling, which studies have revealed to be the cause of greater dependence and problem gambling than the offline form (Gainsbury et al., 2014), with problem Internet gamblers betting more on sports and in a greater number of ways than off-line gamblers (Gainsbury et al., 2013). However, there is a lack of further research on the different types of game and their impact on the onset of problem gambling. Both OGB and OSBA are behavioral addictions, and some studies have attempted to explain the cross-sectional or longitudinal concurrence between the two.

Furthermore, compared with OGD, OSBA is characterized by worse psychological state (specifically in terms of depression, anxiety, paranoid ideation and total psychological symptoms), greater difficulties in emotion regulation, and higher likelihood of substance use. This clearly more dysfunctional clinical profile has also been identified in other previous studies on problematic and disordered sports betting (Derevensky & Gupta, 2004), and the explanation can be found in the higher levels of impulsivity among OSBA. Studies have observed that more difficulties in the impulse control may act as a transdiagnostic trait associated with a wide range of clinical disorders (including depression, anxiety, and substance related disorders) (Hing et al., 2016, 2015a; Johnson et al., 2013). Previous research has also linked higher impulsivity with high emotionally dysregulation (Bagby et al., 2007), and this specific concurrence has been found in the basis of the onset and maintenance of addictions. For example, studies have found that alcoholism is more comorbid with gambling disorder than with gaming disorder (Cronce & Corbin, 2010), and clinical studies have also identified a greater presence of comorbid mental conditions in OSBA as compared with OGD [particularly other problematic forms of gambling (Cooper et al., 2021; Hing et al., 2016; LaPlante et al., 2014) and other behavioral addictions (Hing et al., 2017)]. This empirical evidence suggests that individuals with higher levels of emotion dysregulation would exhibit higher impulsivity, and therefore constitute a group at higher risk for developing multiple problematic behaviors and mental illnesses.

In comparison with OGD, the personality profile associated with OSBA showed higher scores in novelty seeking, reward dependence and persistence, and lower scores for harm avoidance and self-transcendence. Research also suggests a dysfunctional self-regulatory capacity in many heavy sports betters (Hing et al., 2018). Indeed, the lack of self-control is a significant characteristic among problem gamblers (Bergen et al., 2014). Novelty seeking defines the exploratory level in response to novel situations and impulsive decision-making (Costa et al., 2014). High levels of this trait are characteristic of individuals who pursue excitement are inclined to explore new experiences and make decisions quickly and on the basis of limited information and therefore are at greater risk of engaging in addictive behaviors. It is also worth noting that novelty seeking and persistence have been shown to have a strong relationship with impulsive-compulsive behavior. The association of OSBA with higher levels of impulsivity and persistence (as compared with OGD) is congruent

with other studies on sports betting and non-sports betting (Cooper et al., 2021; Jiménez-Murcia et al., 2021).

Reward dependence has also been observed as one of the key drivers of addiction high levels of which are related to extroversion (De Fruyt et al., 2000; Smillie, 2013), a personality trait that is typically observed among individuals with sports betting disorders as compared with other gamblers (Hodgins & Holub, 2015; Jiménez-Murcia et al., 2017; Mestre-Bach et al., 2016). Research on OSBA has also observed that higher rates of persistence are related with reward dependence (Grant et al., 2012; Ledgerwood & Petry, 2010; Odlaug et al., 2011), suggesting that OSBA patients (as opposed to those with other behavioral addictions, including OGD) may represent a specific subgroup within the addiction spectrum characterized with specific personality traits that could increase the likelihood of associated negative outcomes (Estévez et al., 2017).

OSBA is viewed as strategic, whereby gamblers attempt to use their skill and knowledge of the game to influence or predict sports results (Odlaug et al., 2011). This attribute could boost the perception of gambling as a low risk activity, thereby minimizing concerns and making it appear acceptable as a harmless form of recreation (Cantinotti et al., 2004; Lopez-Gonzalez et al., 2020). However, misguided beliefs about this ability to control one's luck may cause sports gamblers to miscalculate win/loss ratios and overestimate their own gambling skills, leading them to place riskier bets, which might explain the lower scores for harm avoidance in the OSBA group as compared with OGD (Cooper et al., 2021; Subramaniam et al., 2017).

Limitations and Strengths

Despite its positive aspects, the findings of this study are limited by several factors. One is the gender distribution, since the low prevalence of women means the results cannot necessarily be generalized to all women with problematic online gaming or sports betting behaviors. The counterargument is that the proportion of women in our sample is consistent with those of treatment-seeking patients in clinical studies (mainly because gambling and gaming disorders are far more prevalent among men). Second, the cross-sectional design means the evidence cannot be interpreted in the form of causal relationships. And finally, the low incidence of patients being treated at the Behavioral Addictions Unit for video game addiction, due to the fact that many young people view this addiction as a harmless form of everyday entertainment.

The main strengths of the study are the inclusion of two large samples of treatment-seeking patients for OGD and OSBA and the assessment of multiple variables related to a wide variety of sociodemographic and psychological areas.

Conclusions and Implications

Online gaming and sports betting share similarities and differences. Both are considered forms of entertainment among the general population, and especially young men. Both are normalized and perceived as low-risk and are also easily accessible. Sports betting is even associated with such a healthy activity as sport.

Our study adds to the few empirical studies of clinical samples of patients with OGD and OSBA, and it provides new evidence about the differing characteristics of both mental

disorders. Our results should be considered in the development of reliable assessment tools and the design of precise preventive and intervention plans that are focused on the concrete needs of the patients. For example, it is well known that online sports betting advertising and marketing greatly impact among individuals, particularly late adolescence and emerging adulthood, so effective educational and legislative public health policies are required for controlling access to gambling and improving comprehensive regulatory frameworks. These actions are particularly needed to target highly vulnerability groups, such as young age video gamers and/or individuals with history of problematic gaming. On the other hand, assessment tools in clinical settings specialized in behavioral addictions should include comprehensive procedures to identify the presence and severity of comorbid mental disorders (particularly depression, anxiety, and substance-related disorders), as well as tools to measure the impulsivity levels, difficulties in emotion regulation strategies, and personality profiles. The combination of these measures will help to accurately establish the patients' personalized profiles, who would benefit from the precise care for their comorbid mental conditions and the required training in coping, problem-solving skills, and in control of impulsive behaviors.

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Data Availability The datasets analyzed during the study are not publicly available due to patient confidentiality and other ethical reasons but are available from the corresponding author on reasonable request.

Declarations

Ethics Approval The data analyzed in this study was collected as part of different research projects approved by the Ethics Committee of Bellvitge University Hospital (Barcelona) (Ref: PR338/17 [CSI 18/04]). All the patients provided signed informed consent.

Conflict of Interest FFA and SJM received consultancy and speaking honoraria from Novo Nordisk. The rest of the authors declare that they have no known competing financial interests or personal relationships that

could have appeared to influence the work reported in this paper.

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A Network Approach of Gambling Disorder Profile with and Without Related Illegal Acts

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Abstract

Gambling disorder (GD) is a complex mental health condition that can cause many severe psychological, physical, and social impairment. Illegal acts have been recognized in quite a few cases because of the debts related with the gambling activity. This study used network methodology to visualize the relationships among patients seeking treatment for gambling related problems, separately for the patients with and without illegal behaviors. The aim is to identify the diverse and differentiate mechanisms, as well as the central nodes, that occur within GD patients depending on the presence/absence of illegal acts. The sample included $N = 401$ patients (age range 18 to 80 years). Network analysis was performed considering the nodes that measure gambling features (the core symptoms based on the DSM-5 taxonomy, global symptom severity, and forms of gambling), psychopathology distress, substance use (tobacco, alcohol, and illegal drugs), and personality traits. Two separate networks were adjusted for patients with illegal acts ($n = 105$) and without these behaviors ($n = 296$). The most relevant nodes among patients with GD plus illegal acts were self-transcendence and the GD DSM-5 symptom “A7-lies to conceal the extent of gambling” (these variables were also identified as the *bridge* nodes, those with the highest linkage capacity). Among the patients with GD without illegal acts, the node with the greatest authority was the GD DSM-5 symptom “A5-often gambles when feeling distressed” (this was also the variable with the highest linkage capacity). The study provides empirical evidence of the most relevant features and the linkage capacity among patients seeking treatment for problematic gambling, which can support the development of precise plans for treatment and prevention of the risk of GDRIA.

Keywords Illegal acts · Gambling disorder · Network · Nodes · Personality

Introduction

The latest version of the *Diagnostic and Statistical Manual of Mental Disorders* DSM-5 (American Psychiatric Association, 2013) defines gambling disorder (GD) as a behavioral addiction disorder characterized by persistent and recurrent problematic gambling activity,

leading to clinically significant distress, and not better explained by a manic episode. The presence of GD in this taxonomy is based on exhibiting four (or more) behaviors from a list of 9 symptoms (needs to gamble with increasing amounts of money, restless/irritable when attempting to stop gambling, unsuccessful efforts to control/stop gambling, frequent preoccupations with gambling, gambling to cope with distress, chasing, lies related with gambling activity, impact on social areas, and relies on others to relieve financial situations caused by gambling).

GD has long been associated with serious clinical and social functional impairment and with poor quality of life (Ioannidis et al., 2019). It has been observed that some patients report the presence of illegal acts (behaviors that are observed constituting legal problems) in the progression of the GD, such as forgery, fraud (for example writing bad checks/paying bills from accounts that contain no funds), theft, or embezzlement to finance gambling activity (Grant & Chamberlain, 2023). But despite the strong link between illegal behaviors with GD, the Pathological Gambling Committee that developed the DSM taxonomy decided to remove illegal acts and lower the cut-off score from five to four criteria in the list of symptoms from the latest version of the manual (American Psychiatric Association, 2013). These changes raised clinical and scientific interest. Research on the impact of the removal of illegal acts concluded that it had little impact on the identification of problematic gambling and the diagnosis of GD, since patients who reported gambling disorder-related illegal acts (GDRIA) usually reached the cut-off point regardless, due to the presence of the other criteria (Petry et al., 2013; Weinstock et al., 2013). However, studies also concluded that the elimination of GDRIA from the DSM-5 diagnostic criteria for GD did not justify its exclusion from the assessment of problematic gambling due to the severe clinical and legal consequences (Granero et al., 2014; Temcheff et al., 2016). Studies in this line conclude that even if GDRIA is not an independent diagnostic criterion, it should be considered a measure of the severity of GD and the prognosis of the disorder (Jiménez-Murcia et al., 2019; Mestre-Bach et al., 2018, 2021; Turner et al., 2016). Studies have also suggested that illegal behaviors are associated with earlier onset of gambling problems, higher psychopathology levels (including depression, anxiety and substance use), and poorer quality of life (Gorsane et al., 2017; Grant & Chamberlain, 2023). GD patients with a history of illegal acts have also presented more dysfunctional personality traits in comparison with GD without criminal behavior, concretely higher levels of novelty seeking, and lower levels of reward dependence, persistence, self-directedness, and cooperativeness (Mestre-Bach et al., 2021).

The presence of these gambling-related crimes has been estimated to range from anywhere between 23 and 89% (Folino & Abait, 2009). This huge disparity is largely due to the lack of consensus on the definition of “crime” and to sample composition (clinical or population-based). Studies have also suggested that very low prevalences of illegal acts among samples of patients seeking treatment for GD could be the consequence of inadequate assessment methods/tools that could lead to underreporting crime acts due to social desirability bias (Rash & Petry, 2016). Sex and age are also potential factors explaining the large differences in the prevalence estimates. Since illegal acts are more prevalent in males and young age individuals, the frequency of these behaviors tends to increase for samples with a large number of men with ages within adolescence to young adulthood (Kryszejtys et al., 2018).

A current systematic review concluded that GDRIA are generally non-violent and motivated by the need to obtain gambling funds and/or recoup financial shortfalls (Adolphe et al., 2019). Like other research, this review also outlined that even supposing that the relationship between gambling activity and illegal behavior could be explained by financial

motivations (Laursen et al., 2016), the pathways explaining the concurrence of problematic gambling and crime remain uncertain, and that the complex underlying processes are doubtlessly mediated by a large number of features (Dennison et al., 2021). In whatever case, GDRIA has a negative impact on the patients' clinical state, on the families' perception of safety, and on the individuals' local environment (May-Chahal et al., 2017).

The association of GDRIA with a clinical profile characterized by greater severity and poorer functions has suggested that illegal activity could interfere with the effectiveness of the therapy, concretely increasing the likelihood of poor treatment outcomes. Studies such as that by Ledgerwood and colleagues suggest that when the presence of illegal behavior is identified, treatments should be intensified because the severity of these behaviors may interfere with adherence to the guidelines and affect outcomes (Ledgerwood et al., 2007). The more recent research by Víntró-Alcaraz and colleagues also observed that the presence of illegal behaviors is associated with a more severe clinical profile at baseline (specifically with greater comorbidity of other mental disorders, substance use, more maladaptive personality traits, and higher levels of impulsivity), and that these factors could predict a higher risk of dropout and relapse during interventions (Víntró-Alcaraz et al., 2022). However, none of the previous studies provides specific guidelines on how to intervene among the complex structure of interrelations in the patients' clinical profile when illegal behavioral conduct is present. Thus, one of the therapeutic targets should be to identify the underlying mechanisms of patients who report the presence of these acts and to apply adequate intervention plans to eliminate them. These programs should also be able to identify subjects that are highly vulnerable to illegal acts during the progression of the disorder, with the aim of employing specific prevention plans.

Although the limited empirical data on GDRIA, the published studies notice that illegal behaviors are common in patients with problematic gambling, and that these criminal acts are mostly linked with more severe clinical profile and worse quality of life. But it is unknown how the presence of illegal acts impacts the underlying complex structure of the GD profile, the treatment outcomes, and the trajectory of the disease. Moreover, since illegal behaviors are not defined as a specific diagnostic criterion for GD in the reference diagnostic taxonomies (such as the DSM), validated scales, in-person assessments, and specific treatment actions are limited and/or unstandardized procedures (Gorsane et al., 2017; Laursen et al., 2016). The main objective of this study was to perform network analysis to visualize the relationships between a set of nodes containing information on the clinical profile (including the core symptoms of GD, psychopathology distress, substance use, and personality dimensions) of patients seeking treatment for GD who reported the presence of illegal acts. The secondary objectives of the study were (a) to visualize separate networks obtained among patients' treatment seeking for GD who reported and not the presence of illegal acts that was performed and (b) to identify the central nodes (those of greatest relevance and linking capacity in the graph) and to explore the existence of empirical clusters of nodes (also known as modules or communities) in the two separate networks. The new results obtained in this work will provide evidence for designing new measurement tools and treatment plans for patients' treatment seeking for GD who report illegal behaviors associated to their gambling activity.

This study explored the complex system of reciprocal interactions including variables from different functional dimensions using a network approach, a procedure based on graph theory that is useful for visualizing intricate multifaceted phenomena (Borsboom, 2017; Borsboom et al., 2018; Borsboom & Cramer, 2013; Epskamp et al., 2018; Hevey, 2018; McNally, 2016). This methodology provides an image of the underlying interactions between connected variables (which can represent diverse biological, psychological and social features)

(Boschloo et al., 2015; Goekoop & Goekoop, 2014). The aforesaid structure is displayed with two components: (a) the nodes (shown as circles) containing the symptoms and other sociodemographic and clinical variables and (b) the edges (shown as connecting lines) depicting the relationships between the nodes-variables (Borgatti et al., 2009). The values of the edges represent the effect sizes of the associations between the nodes, which is visualized by the thickness of lines (for example, a large effect size is reflected with a thick edge, while two unrelated variables are reflected by two unconnected nodes). Centrality coefficients are the indexes used and interpreted for determining the relevance of the nodes in the network. Concretely, the highest centrality capacities are the most relevant in the graph (they are typically labeled “central nodes”) (Fried et al., 2017; Fried & Cramer, 2017). And nodes with the highest linkage capacity are described as those facilitating the paths between structures (usually labeled “transition/bridge” nodes) (Braun et al., 2018; Cramer et al., 2010). Compared with other classical multivariate analytical procedures, network is a graphic-based approach particularly useful to estimate and visualize the structure of the relationships among complex systems. Applied to the study of psychiatric conditions, network allows conceptualizing mental unhealthy phenomena as dynamic structures of mutually reinforcing nodes, which represent multiple inter-connected constructs (typically symptoms but also other functional measures such as personality traits) (Bringmann & Eronen, 2018). Instead of passive underlying latent entities, psychopathological states are conceptualized in the network theory through a set of pathways linking variables pertaining to different functional areas (Jones et al., 2021). The organization of the nodes based on their location in the net-structure (defined as the relevance-centrality) provides valuable information about their capacity for generating local or global connectivity, and therefore allows a better understanding of the etiology of mental phenomena. Also relevant network recognizes that certain parts of the structure are categorized into clusters of nodes (also termed “communities”), that could be interpreted as a higher level of structural organization (like upper-level functional systems) (Goekoop & Goekoop, 2014). The interpretation of both nodes and communities with high connectivity capacity should be considered important targets for designing reliable assessment tools and precise treatment plans (Robinaugh et al., 2016). While network analysis has not been widely applied for the study of mental health states, this approach is especially salient in this area because psychopathological phenomena are theorized to depend upon a large number of variables interacting in a dynamic way (Hevey, 2018).

To our knowledge, this is the first study to explore the network structure among patients with GDRIA; hence, we were unable to define empirical hypotheses regarding the most central nodes or the presence of communities of nodes. However, considering a theoretical model of psychopathology states based on the interaction between multi-level mechanisms contributing to the onset and course of mental diseases (Robinaugh et al., 2020), we expected: (a) the identification of central nodes that would represent different information according to the presence-absence of GDRIA and (b) the existence of distinct empirical classes of nodes (more densely connected to each other than to the rest of the network) and of different compositions depending on the presence-absence of GDRIA. The fulfillment of these hypotheses will imply new empirical evidence regarding the heterogeneity of the GD and the manifestation of multiple profiles.

Material and Methods

Participants

This study analyzed the data of $N = 401$ consecutive treatment-seeking patients at the Behavioral Addictions Outpatient Unit, Bellvitge University Hospital (Barcelona, Spain), between January 2021 and December 2022. This unit is a tertiary service for the treatment of behavioral addictions, including gambling disorder.

The inclusion criteria for the study were age 18+ years and treatment for GD-related problems. The exclusion criteria were the presence of other behavioral addictions, or an organic mental disorder that prevents the use of measurement tools due to the potential low reliability of responses (for example, intellectual disability or neurodegenerative disorder [such as Parkinson's disease]). The use of substances was not considered an exclusion criterion in this work.

All the individuals included in the study were patients seeking treatment for GD. The whole sample was classified according to the presence/absence of illegal acts, resulting in $N = 105$ patients in the GDRIA+ and $N = 296$ in the GDRIA-.

Materials

Diagnostic Questionnaire for Pathological Gambling (According to DSM Criteria) (Stinchfield, 2003)

This tool includes 19 items coded on a binary scale (yes-no). It was originally developed to assess the presence of GD according to the DSM-IV-TR (American Psychiatric Association, 2000). The scale was adapted to assess the nine DSM-5 diagnostic criteria for GD (American Psychiatric Association, 2013). In this work, this diagnostic tool was used to assess the presence/absence of the nine DSM-5 criteria for GD, as well as the presence (or absence) of illegal acts as defined in the DSM-IV-TR (“have committed illegal acts, such as forgery, fraud, theft, or embezzlement, in order to finance gambling”). The Spanish adaptation used in this study presented adequate psychometric indexes (Jiménez-Murcia et al., 2009). The internal consistency for this scale in the study sample was excellent (Cronbach's alpha equal to $\alpha = 0.901$).

South Oaks Gambling Screen (SOGS) (Lesieur & Blume, 1987)

This tool includes 20 items developed to identify the presence of gambling behavior, including probable, problem, and non-problem gambling. The total score for the scale has usually been used as a measure of gambling symptom severity. The adapted Spanish language version used in this study presented adequate psychometric indexes (Echeburúa et al., 1994). The internal consistency in this study was adequate, $\alpha = 0.784$.

Symptom Checklist-Revised (SCL-90-R) (Derogatis, 1994)

This tool includes 90 items developed to assess the presence/level of a large set of psychological symptoms. The adapted Spanish language version used in this study presented adequate psychometric indexes (Gonzalez De Rivera et al., 1989). This study used global psychological distress measured with the global severity index (GSI), which obtained excellent internal consistency in the sample ($\alpha = 0.981$).

Temperament and Character Inventory-Revised (TCI-R) (Cloninger et al., 1994)

This tool includes 240 items developed to assess personality profile based on Cloninger's multidimensional model. It is structured into 4 dimensions of the individual's temperament (novelty seeking, harm avoidance, reward dependence, and persistence) and 3 dimensions of the individual's character (self-directedness, cooperation, and self-transcendence). The adapted Spanish language version used in this study presented adequate psychometric indexes (Gutiérrez-Zotes et al., 2004). The internal consistency in the study sample was between adequate ($\alpha = 0.748$ for reward dependence) and very good ($\alpha = 0.857$ for persistence).

Semi-Structured Clinical Interview

This tool is used in the treatment unit to assess additional information, including sociodemographic and clinical variables. The complete instrument has been described elsewhere (Jiménez-Murcia et al., 2006). In this study, the socioeconomic variables analyzed were sex, marital status, level of education, employment status, and social status, calculated according to Hollingshead's Four Factor Index (Hollingshead, 2011) (based on four domains: marital status, retired/employed status, educational attainment, and occupational prestige). The semi-structured interview also allowed measurement of a set of gambling related variables: age of onset and duration of the problematic gambling, the presence of accumulated debts related to the gambling activity, the presence of GDRIA, gambling preferences (only non-strategic, only strategic, or mixed), type of gambling (only offline, only online, or mixed), and the use of substances (patients reported the consumption of tobacco, alcohol, or other illegal drugs). The non-strategic form of gambling is a category that includes little decision-making or skill, and hence participants have no influence on the outcome/s (slot-machines, bingo, and lotteries) (Jiménez-Murcia et al., 2020). Strategic forms of gambling belong to a category in which gamblers attempt to use their ability to predict outcome/s (such as poker, sports/animal betting, and craps).

Ethics

The research was carried out in accordance with the Declaration of Helsinki of 1975, as revised in 2000. It was approved by the Ethics Committee of Bellvitge University Hospital (ref: PR338/17 [CSI 18/04]). All the patients provided informed consent (the acceptance

rate was 100% of all the consecutive patients from the treatment unit who met the inclusion criteria).

Procedure

Data analyzed in this study correspond to the measurement at baseline (on arrival in the treatment unit). In addition to assessment of the clinical and sociodemographic variables included in the semi-structured interview, the clinicians involved in the recruitment of the sample helped the participants to complete the self-report questionnaires to guarantee that they fully understood all the items and completed the tools properly. All the clinicians were specialized in the treatment of behavioral addictions and had extensive experience in the assessment and treatment of patients with problematic and disordered gambling. The assessments were run in single sessions, with a mean duration of between 90 to 120 min.

Statistical Analysis

In this study, two networks were obtained for the subsamples GDRIA+ ($N = 105$) and GDRIA- ($N = 296$). A set of 24 nodes was considered for analysis: the nine key DSM-5 criteria for GD, the GD severity level (as measured by the total SOGS and debts related with the gambling activity), gambling preference (only strategic versus strategic or mixed), the type of gambling (only land-based versus online or mixed), global psychological distress (SCL-90 GSI), the presence of substance use (tobacco, alcohol, or illegal drugs), and personality profile (as measured with the seven TCI-R dimensions). The justification for selecting many nodes was to visualize a more realistic profile based on different functional areas, including the core criteria for GD (as defined in the DSM-5), other gambling activity measures, and psychological performance (psychopathology and personality). In addition, this study used direct comparison based on the visualization of the two network structures generated from the two independent data sets (patients with and without illegal acts, GDRIA+ *versus* GDRIA-), the identification of the nodes with the highest centrality measures within each graph, and the identification of the clustering of nodes.

Many network analysis methods have been developed to be implemented in generic software such as MATLAB, Stata or R-open-source. Also, specialized network packages are now available, such as Gephi (Bastian et al., 2009), an open-source system with some interesting benefits including large data structures (i.e., over 20,000 nodes) and a powerful spatialization process for a range of algorithms (including parameters of centrality, linkage, density, and modularity-clustering). The Gephi 9.2 version for Windows was used in this work (available at <http://gephi.org>).

Various statistical procedures can estimate the effect sizes for edges visualized with Gephi, including the partial correlations matrix, adjusted regression coefficients, adjusted odds ratio coefficients, and factorial loads (adjusted coefficients must be obtained to avoid biases due to the impact of possible confounding variables) (Bringmann et al., 2013; Clifton & Webster, 2017; Hevey, 2018). This study defined an undirected network (nodes have a connecting line representing mutual relationship but with no arrowheads to indicate the direction of the effect), and its edges represented partial correlations between nodes after controlling for all other nodes in the network (these coefficients also provided the signal of the adjusted size for edges). The initial data structure for the network resulted

in 25 nodes and 300 potential edges, most of which had very low weights (partial correlations around 0). To simplify this initially complex structure, edges that did not reach significance ($p < 0.05$) were excluded, resulting in a final structure consisting of 91 edges (around 30.3% of all potential connectors). This selection of the edges yielded a more parsimonious graph (with fewer connections between nodes), with the advantage of representing only the most relevant empirical relationships in the data and with the consideration that the absence of an edge is not evidence that the association between the nodes is exactly zero (Epskamp et al., 2017).

Centricity indexes were estimated with Brandes' algorithm (Brandes, 2001). The relevance of each node in the network was calculated with the eigenvector centrality, which is obtained as the weighted sum of the centrality scores of all the other nodes connected to a concrete node. High eigenvector centrality is interpreted as highly valuable information for the whole graph.

The linkage capacity of each node was calculated by closeness centrality, which is calculated as the reciprocal of the sum of the length of the shortest paths between each node and all the other nodes in the graph (and interpreted as how close the node is to all the other nodes). High closeness values suggest a short average distance between one node versus all the other nodes. Nodes with high closeness are characterized by a high capacity to promote relevant changes in other parts of the graph, while these nodes are also highly vulnerable to the impact of modifications to any part of the whole structure.

The presence of empirical clusters of nodes (also called communities or modules) was automatically identified based on the Blondel's modularity algorithm (Blondel et al., 2008), and clustering coefficient metric is based on Latapy's algorithm (Latapy, 2008). The empirical clusters in Gephi represent groups of nodes that are well connected to the other nodes in the same cluster but sparsely connected to the rest of the graph.

Additional graph distance coefficients obtained and interpreted in the study were (a) the (average) path length, calculated as the mean of the shortest paths between all pairs of nodes (and interpreted as a measure of the efficiency of information transport in the network) and (b) the diameter, calculated as the greatest distance between the two furthest nodes (and interpreted as the maximum eccentricity of any vertex in the graph) (Brandes, 2001). The density of the graph was also calculated, concretely as the ratio between the number of edges in the graph divided by the potential number of connections (this index provides a measure of how close the network is to being complete, that is, a graph with all possible edges and achieves [a density measure equal to 1]).

Results

Descriptive for the Sample

Out of the total sample ($N = 401$), most patients were single (54.6%), employed (56.9%), men (91.5%), with a primary education (56.9%), and belonging to a mean-low to low social status indexes (80.5%). Mean age was 41.9 (SD = 15.4), mean age of onset of the GD-related problems was 30.01 (SD = 13.34), and mean duration of the GD problems was 6.8 years (SD = 6.84). The most frequent form of gambling in the study was non-strategic (42.6%) and off-line (77.3%). The prevalence of patients who reported tobacco use was 51.1%, alcohol use was reported by 15.0%, and other illegal drugs by 13.5%.

Table 1 Descriptive of the variables of the study

<i>Sociodemographic features</i>	<i>Total (N = 401)</i>		<i>GDRIA- (N = 296)</i>		<i>GDRIA+ (N = 105)</i>		<i>p</i>
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	
Sex							
Women	34	8.5%	30	10.1%	4	3.8%	.046*
Men	367	91.5%	266	89.9%	101	96.2%	
Marital							
Single	219	54.6%	155	52.4%	64	61.0%	.236
Married	129	32.2%	102	34.5%	27	25.7%	
Divorced	53	13.2%	39	13.2%	14	13.3%	
Education							
Primary	228	56.9%	173	58.4%	55	52.4%	.195
Secondary	145	36.2%	100	33.8%	45	42.9%	
University	28	7.0%	23	7.8%	5	4.8%	
Employed							
Unemployed	173	43.1%	128	43.2%	45	42.9%	.945
Employed	228	56.9%	168	56.8%	60	57.1%	
Social position							
Mean-high to high	39	9.7%	28	9.5%	11	10.5%	
Mean	39	9.7%	32	10.8%	7	6.7%	.462
Mean-low to low	323	80.5%	236	79.7%	87	82.9%	
<i>Age, onset, and duration of GD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
Age (yrs-old)	41.86	15.41	43.46	15.86	37.35	13.11	.001*
Onset of GD related problems (yrs-old)	30.01	13.34	31.69	13.94	25.27	10.13	.001*
Duration of GD related problems (yrs-old)	6.01	6.84	5.33	6.54	7.93	7.34	.001*
GD severity symptom level and debts	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
SOGS total score	10.75	3.64	10.21	3.66	12.27	3.12	.001*
Debts due to the gambling activity (euros)	9173	14471	8314	14134	11594	15190	.046*
<i>GD symptoms based on the DSM-5</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>p</i>
A1 gambling with increasing amounts of money	299	74.6%	213	72.0%	86	81.9%	.044*
A2 restless-irritable when stop gambling	279	69.6%	203	68.6%	76	72.4%	.467
A3 repeated efforts to control-stop gambling	357	89.0%	260	87.8%	97	92.4%	.201
A4 preoccupied with gambling	317	79.1%	231	78.0%	86	81.9%	.403
A5 often gambles when feeling distressed	328	81.8%	239	80.7%	89	84.8%	.359
A6 chasing one’s losses	333	83.0%	243	82.1%	90	85.7%	.396
A7 lies to conceal the extent of gambling	349	87.0%	249	84.1%	100	95.2%	.004*
A8 has lost relationships, job, education	315	78.6%	221	74.7%	94	89.5%	.001*
A9 relies related with financial issues	300	74.8%	210	70.9%	90	85.7%	.003*
<i>Forms of gambling</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>p</i>
Preference							
Only non-strategic	171	42.6%	133	44.9%	38	36.2%	.240
Only strategic	158	39.4%	114	38.5%	44	41.9%	
Mixed	72	18.0%	49	16.6%	23	21.9%	
Modality							
Only land-based	310	77.3%	231	78.0%	79	75.2%	.696

Table 1 (continued)

<i>Sociodemographic features</i>	<i>Total (N = 401)</i>		<i>GDRIA- (N = 296)</i>		<i>GDRIA+ (N = 105)</i>		<i>p</i>
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	
Only online	43	10.7%	32	10.8%	11	10.5%	
Mixed	48	12.0%	33	11.1%	15	14.3%	
<i>Substances use</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>p</i>
Tobacco	205	51.1%	151	51.0%	54	51.4%	.942
Alcohol	60	15.0%	44	14.9%	16	15.2%	.927
Illegal drugs	54	13.5%	35	11.8%	19	18.1%	.106
<i>Psychopathology and personality</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
SCL-90R global distress (GSI)	1.18	0.76	1.16	0.75	1.23	0.77	.374
TCI-R novelty seeking	109.91	11.99	108.71	12.12	113.28	10.99	.001*
TCI-R harm avoidance	100.72	16.61	101.31	16.77	99.05	16.11	.230
TCI-R reward dependence	94.94	13.25	95.25	13.23	94.06	13.32	.427
TCI-R persistence	110.50	17.73	110.51	17.59	110.46	18.21	.978
TCI-R self-directedness	125.93	19.01	126.87	19.28	123.28	18.05	.096
TCI-R cooperativeness	129.09	15.10	130.50	14.61	125.10	15.82	.002*
TCI-R self-transcendence	63.93	14.70	64.71	14.32	61.73	15.60	.074

GD gambling disorder, GDRIA gambling disorder related illegal acts, SD standard deviation

*Bold: significant comparison

Table 1 contains the distribution of all the variables in the study and the comparison between patients with and without GDRIA. The GDRIA+ group was characterized by a higher proportion of men, younger patients, earlier onset of the GD-related problems, and longer duration of the problematic gambling. This group also reported higher prevalence for the DSM-5 criteria for GD “A1-gambling with increasing amounts of money,” “A7-lies to conceal the extent of gambling,” “A8-loss of relationships, job, or education due to the gambling activity,” and “A9-relies on others to relieve financial issues.” Regarding personality profile, GDRIA+ achieved a higher mean score in the novelty seeking dimension and a lower mean score in the cooperativeness dimension.

Network Study

Figure 1 presents the networks obtained in the study (Tables S1 and S2, supplementary material, include the full statistics for these analyses). The network for the GDRIA+ group was defined for 80 edges, resulting in a density of 0.29, a diameter value equal to 4, and the average path length was 2.297. For the GDRIA- subsample, the network included 113 edges, with a density of 0.409, a diameter of 3, and an average path length equal to 1.594.

The first bar chart in Fig. 2 shows the nodes ordered by eigenvector centrality (which depicts the importance of each variable in the network), and the second bar chart presents the closeness centrality (which provides the linkage capacity). In the GDRIA+ subsample, the most relevant node was the one for TCI-R self-transcendence, followed by the DSM-5 criterion “A7-lies to conceal the extent of gambling.” The self-transcendence trait was also identified as the *bridge* node in this group (the nearest node to all the others). In the

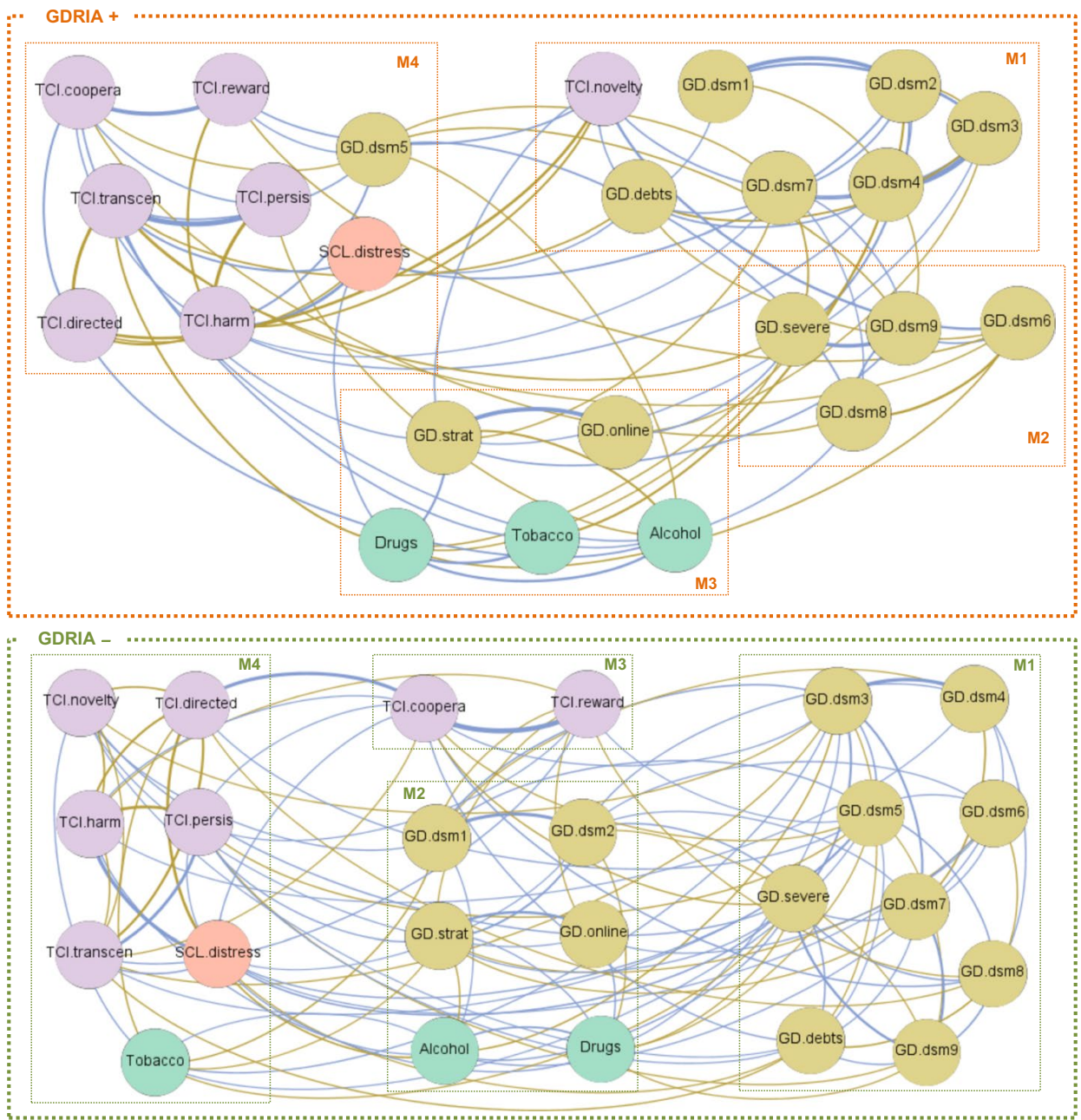


Fig. 1 Visualization of the networks for the subsample with illegal acts. Note: Positive edges are represented by blue lines and negative edges by brown-ochre lines. The thicker the edge, the stronger the connection weight. Nodes are plotted in colors depending on the dimension: personality (purple), psychopathology distress (orange), gambling related measures (ochre), substances (green). Nodes: DSM-5 symptoms for gambling disorder (GD.dsm1 to GD.dsm9), debts related with gambling (GD.debts), GD symptom level (GD.sogs), strategic preference gambling (GD.strat), online modality gambling (GD.online), global psychopathology distress (SCL.distress), substances (tobacco, alcohol, and drugs), novelty seeking (TCI.novelty), harm avoidance (TCI.harm), reward dependence (TCI.reward), persistence (TCI.persis), self-directedness (TCI.directed), cooperativeness (TCI.coopera), and self-transcendence (TCI.transcen). M1 to M4 group the nodes into the latent classes identified in each network

GDRIA- subsample, the most important node in the whole graph was the DSM-5 criterion “A5-often gambles when feeling distressed,” which was also recognized as the *bridge* node (the closest node to all the others).

Four modules (communities or clusters of nodes) were identified in each network, but the nodes included in each latent cluster differed among patients with and without GDRIA. For the group of patients in the GDRIA+ sample, the composition of latent classes was: Module 1 (M1) included novelty seeking plus the DSM-5 criteria for GD A1, A2, A3, A4,

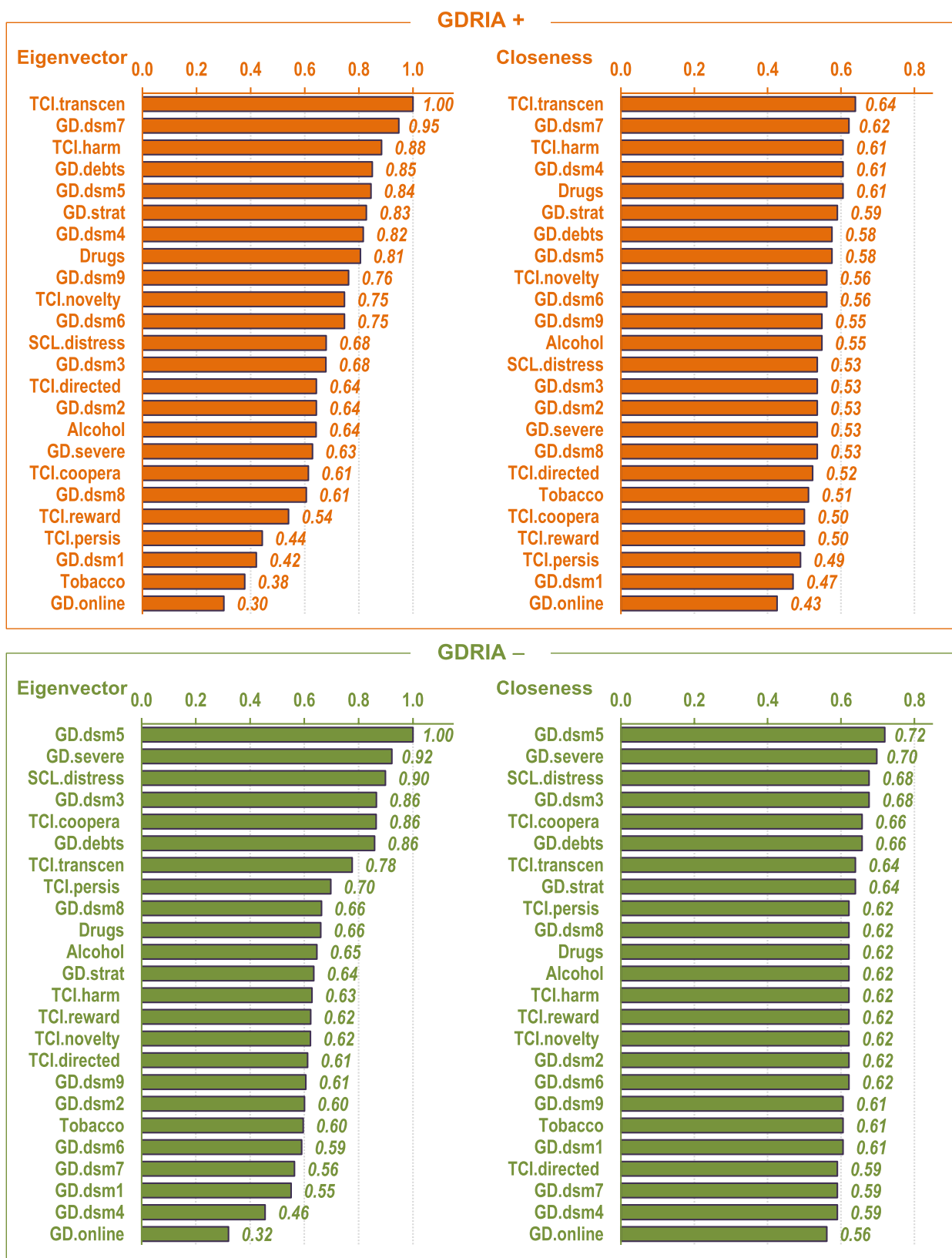


Fig. 2 Relevance of the nodes in the networks. Nodes: DSM-5 symptoms for gambling disorder (GD.dsm1 to GD.dsm9), debts related with gambling (GD.debts), GD symptom level (GD.sogs), strategic preference gambling (GD.strat), online modality gambling (GD.online), global psychopathology distress (SCL. distress), substances (tobacco, alcohol, and drugs), novelty seeking (TCl.novelty), harm avoidance (TCl. harm), reward dependence (TCl.reward), persistence (TCl.persis), self-directedness (TCl.directed), cooperativeness (TCl.coopera), and self-transcendence (TCl.transcen)

and A7, debts related with the gambling activity; M2 included the DSM-5 criteria for GD A6, A8, A9, and the GD severity level; M3 included the gambling preference, the type of gambling, and substance use; and M4 included the personality profile (except for novelty seeking), the DSM-5 criterion for GD A5, and the global psychopathology distress. For the patients in the GDRIA- group, the composition of the latent classes of nodes was: M1 including the DSM-5 criteria for GD (except for A1 and A2), GD severity level, and debts related with the gambling activity; M2 including the DSM-5 criterion for GD A1 and A2, the gambling preference, the type of gambling, and the use of alcohol and drugs; M3 including cooperativeness and reward dependence; and M4 including the remaining personality profile, the global psychopathology distress, and tobacco use.

Figure 3 shows the main linkage for the nodes with the greatest centrality in the study (eigenvector and closeness). In the GDRIA+ group, activation of the self-transcendence

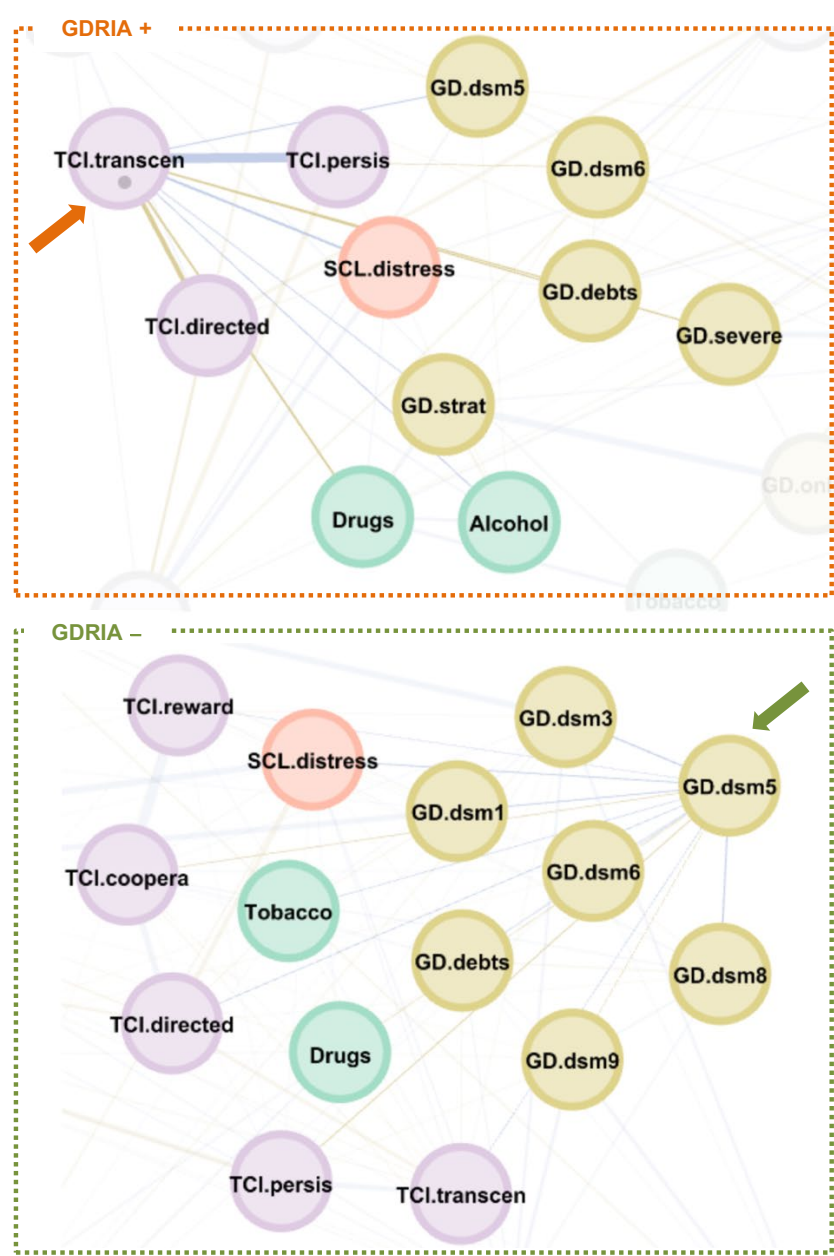


Fig. 3 Main linkages for the variables with the highest centrality. Nodes: DSM-5 symptoms for gambling disorder (GD.dsm1 to GD.dsm9), debts related with gambling (GD.debts), GD symptom level (GD.sogs), strategic preference gambling (GD.strat), online modality gambling (GD.online), global psychopathology distress (SCL.distress), substances (tobacco, alcohol and drugs), novelty seeking (TCI.novelty), harm avoidance (TCI.harm), reward dependence (TCI.reward), persistence (TCI.persis), self-directedness (TCI.directed), cooperativeness (TCI.coopera), and self-transcendence (TCI.transcen)

node had a major impact on the persistence and self-directedness personality traits, global psychopathology distress, the DSM-5 criteria for GD A5 and A6, gambling severity, debts related to gambling activity, and alcohol and drug use. In the GDRIA- sample, the activation of the node defined for the DSM-5 criterion A5 impacted the personality profile (except for novelty seeking), the consumption of tobacco and drugs, global psychopathology distress, the DSM-5 criteria for GD A1, A3, A6, and A8, and debts related to the gambling activity.

Discussion

This study provides empirical evidence for the network structure of the core symptoms of GD, other gambling measures (gambling preferences and gambling related debts), emotional distress, substance use, and personality profile, among patients seeking treatment for gambling-related problems. The most central nodes were self-transcendence (among patients with GDRIA+) and the DSM-5 criterion for GD “A5-often gambles when feeling distressed” (among patients with GDRIA-). Four latent classes of nodes were identified in each network, each module including variables with information measuring different functionality domains.

The node of greatest relevance and closeness in the GDRIA+ group was the personality trait self-transcendence. Our results are consistent with previous studies suggesting that illegal acts can be implied in the pathways between some personality traits (including self-transcendence) and GD severity (Jiménez-Murcia et al., 2019; Mestre-Bach et al., 2021). Self-transcendence is a complex transpersonal construct (Garcia-Romeu, 2010) that is largely related with certain aspects of psychopathology, including substance and behavioral addictions (Er & Buzlu, 2022; Pettorruso et al., 2021; Spalletta et al., 2007; Vitali et al., 2016), with implications for etiology and treatment. The measure used in the study was registered with the TCI-R questionnaire (Cloninger et al., 1993), and therefore, the self-transcendence construct assessed facets such as self-forgetfulness, unconscientiousness, and dissolution of the self in experience (Schimmenti et al., 2017). Some research has observed that compared with control samples with normal scores for self-transcendence, high levels for this trait are typical of individuals with high levels of negative emotions and introversion (Anglim et al., 2020; Rezaei et al., 2020), psychotic tendencies and paranoid-schizotypal traits (Galindo et al., 2016), and strange perceptions (such as delusions and bizarre-unconventional beliefs) (Miskovic et al., 2018).

The contribution of self-transcendence to the presence of GD and some of its severe correlates has also been evidenced, concretely with illegal acts and criminal behavior (Adolphe et al., 2019; Granero et al., 2015; Martinotti et al., 2006). Studies have found that self-transcendence plays a mediational role between leisure activities (such as video gaming) and aggressive antisocial behavior (Espinosa & Clemente, 2013). Research in this area suggests that patients with dysfunctional scores for self-transcendence could evidence certain characteristics related to dispositional traits like high anger and hostility (Giumetti & Markey, 2007; Zillmann & Weaver, 2007) and even aggression (Benish-Weisman, 2015; McGinley & Carlo, 2007). Based on this hypothesis, individuals with high levels of self-transcendence may be motivated toward activities such as gambling because there is less social interaction (Svrakic et al., 2002). Specifically, it has been postulated that the relationship between leisure activity and antisocial behaviors could be explained by a deficit in social interactions and role-taking opportunities. Deficits in socialization could

also be related to an inability to predict the consequences of behavior and to understand other people's proposals (needs, intentions, and desires). This characteristic is observed in individuals with an egocentric bias, a key component of self-transcendence. And how does this hypothesis apply to the outcome of this study? In the subsample of patients with GDRIA+, self-transcendence was identified as the most central node. Activation of this node could explain the inability of the subjects to understand the possible consequences of their actions on others (they have a restricted social perspective). And since the interaction provided by the gambling activity is clearly simplified (compared with "real" social contexts), patients with dysfunctional self-transcendence may tend to only consider the effects on themselves, and long-term consequences could also be perceived as irrelevant. The craving to gamble (which could even be the consequence of an underdeveloped and self-centered social perspective) contributes to a restriction in the source of interaction with the activity, further limiting one's own social perspective and problem-solving capacities. In these situations, illegal acts (such as forgery) might be perceived as an easy way to finance gambling activity.

In the GDRIA- group, the most central node was the DSM-5 criterion "A5-often gambles when feeling distressed." It is well established that negative emotional states predict a poor capacity to respond to environmental stressors (even daily events). Individuals with high negative emotional feelings could become anxious and emotionally unstable and perceive any event as potentially stressful. These individuals might use unhealthy behaviors to cope with these negative states (Zhou et al., 2017).

Interestingly, previous studies have observed that individuals who use gambling activity as a way to handle with adverse psychological conditions could experience greater gambling problems, regardless of their levels of impulsivity and other psychological-contextual constraints (Sharma & Sacco, 2015). This evidence could suggest that since negative moods can trigger externalizing behaviors, gamblers with high likelihood to cope uncomfortable feelings may increase the risk of more severe gambling consequences, including financial losses, bankruptcy, and even illegal acts. But studies have evidenced that the relationships between motivation to gambling and gambling-related problems are complex, and multiple moderator and mediation variables must be considered (Canale et al., 2015). For example, it has been found that gambling, to cope with adverse psychological states, could be a moderator into the link between the presence of stressful life events and gambling severity (Wang et al., 2020): among participants who report coping as high motivation to gambling, stressful life events may achieve low contribution on the perceived GD severity levels, and this could advise that individuals regularly turn to gambling to cope as a way to detract from their negative emotions regardless of what is going on in their lives and without the requirement of additional severe adverse consequences (such as illegal behavior).

The strong relationship between the experience and control of negative emotions with GD has suggested a potential classification that groups individuals with gambling disorder according to the nature of their emotion regulation motivations. The classical pathways model proposed by Blaszczynski and Nower suggested that problematic gambling could be the consequence of the complex connections between early life stressors, emotion regulation, and gambling incentives (Blaszczynski & Nower, 2002). These authors formulated the first etiological classification of gamblers into three separate pathways based on the primary motivations for gambling and the trajectories of the gambling activity, which has been highly validated in next studies (Nower et al., 2022): (a) "behaviorally conditioned" cluster, grouping individuals who initiated gambling behaviors for recreation or socialization reasons, with low levels of psychopathology at the beginning of the gambling and who progressed to GD due to conditioning effects and/or biased cognitions about winning;

(b) “emotionally vulnerable” cluster, grouping individuals who reported onset on gambling as a way primarily to escape aversive mood states, and who progressed to GD based due to poor stress-coping and problem-solving skills, problematic family backgrounds, and traumatic life events; and (c) “antisocial impulsivists” cluster, grouping individuals who related onset on gambling activity due to high levels in impulsivity, and who progressed to GD due to antisocial personality traits. The presence of illegal acts should be associated to the 3-pathways of this scheme.

Regarding the cope with negative psychological states as a motivation for the gambling activity, current literature has also related negative states characterized by boredom and/or numb discomfort as a reason for the onset in the gambling behaviors for the progression to the problematic gambling (without the need of severe gambling consequences, such as illegal acts), particularly among young age individuals with a personality characterized by low levels in persistence (Thompson et al., 2015). Current studies have also distinguished between the cluster labeled “action seekers” or “over-stimulated” gamblers (individuals with high levels of sensation seeking use gambling for thrills and to experience adrenaline) versus the cluster labeled “escape seekers” or “understimulated” gamblers (individuals with high levels of depression/anxiety use gambling to escape from negative emotions) (Milosevic & Ledgerwood, 2010; Moon et al., 2017). In recent years, studies focused on how emotion regulation contributes to the onset and progression of GD have even proposed that this disorder may be conceptualized within the process of emotion regulation (Rogier & Velotti, 2018): gambling could be viewed as a strategy that subjects use to cope with psychological distress, shifting their attention from anxiety/depression/fears/worry to an alternative leisure activity. In this line, a recent systematic review concluded that different associations exist between GD and emotion regulation deficits, including the nonacceptance of negative emotional states, and lack of control in reaction to these negative emotions (Velotti et al., 2021). Neurobiological research in GD has linked negative emotion-driven impulsivity with emotional suppression and increased middle frontal gyrus activation and pre-motor cortex (brain activation should be addressed to regulate negative emotions) (Navas et al., 2017).

Related with the study of the dysfunctional coping-motivated behaviors, some studies carried out in other clinical and population-based samples have identified diverse behavioral addictions as escaping motives. For example, the network study of Wei and colleagues in a large sample of young adults recruited from the general population concluded that excessive smartphone use should be conceptualized as a compensatory coping strategy for depressed emotions (Wei et al., 2023). This study also identified as bridge symptoms “escaping negative moods” and “concentration problems,” closely linked to both the depression and the addictive behavior levels. Other works have also positively related the severity of gaming internet addiction with negative-avoidance coping motives (Lin et al., 2021; Moudiab & Spada, 2019) and have concluded that the correlation between coping by gaming and negative mood states (stress, anxiety, or depression) might suggest a bidirectional association and therefore coping motive as a transdiagnostic trigger.

The exploration of the modules in this study enabled the identification of different separate communities (empirical clusters or classes of nodes). The classification procedure of nodes in network is quite different from the conventional classification procedures, such as the k-means or the latent class analysis (these classification methods are used for grouping individuals based on the level of similarity/difference between the set of components). The aim of the network module package is the identification of empirical groups of nodes (in this study, variables) based on the linkage capacity of the edges and the identity relationships between the empirical classes.

The visualization and characterization of empirical community structures in network-graphs have received special attention in the last two decades (Silverman & Loscalzo, 2012), since these groups provide a segmental/modular view of the network's dynamic (Radicchi et al., 2004). The detection of clusters of nodes could be of significant clinical importance, as it reveals the existence of topological sub-areas representing highly interlinked regions (Girvan & Newman, 2002). These structures within the network could denote separate processes that perform different functions with some degree of independence (Barabási et al., 2011). In this study, groups of nodes appeared containing information on different constructs-domains (such as the group of concrete DSM-5 criteria for GD and some personality trait/s), and these structures could relate to global aspects of the patients' profiles, or even be the result of more complex bio-psycho-social structures that might contribute to the specific behaviors measured and analyzed in this study. It is essential to emphasize that the nodes included in a specific module may be closely interacting with nodes pertaining to other modules, and therefore the high intra-cluster and between-cluster linkages evidence the strong connection between the global set of underlying processes.

Finally, and interestingly, there is evidence of clusters of nodes that do not specifically correspond to the DSM-5 classification or the measurement tools (for example, the different TCI-R scales were not grouped within the same cluster). It should be noted that classical disease classification systems (such as the categorical DSM) tend to neglect the interconnected nature of diseases (Fried et al., 2017). The system-based network framework is a powerful alternative paradigm that views endophenotypes as the systems-driven result of a series of related sub-networks, which incorporate the multiple factors ([neuro]biological, psychological, and environmental) contributing to the onset and progression of diseases (Borsboom, 2017; Boschloo et al., 2015). Complex clinical structures, such as comorbid-concurrent diseases, seem best visualized and conceptualized from the network perspective (Cramer et al., 2010).

The results of this study referred to the clusters of nodes that are a starting point for the conceptualization of the diverse, complex profiles of patients seeking treatment for GD based on the presence (or not) of concurrent illegal acts. For example, the empirical modules of this study include not only nodes of some symptoms/criteria for GD as defined in the DSM-5 taxonomy, but also nodes measuring other features related with the functional profile (substances use, global psychological distress of personality). And also interesting, since the activation of a node belonging to a module can transcend the cluster itself increasing the likelihood of activating related nodes belonging to other modules (e.g. “bridge nodes”), our network analysis allows the identification of variables that are likely to interact with other specific targets (potential “transdiagnostic symptoms”). In the case of GD patients who report the presence of illegal acts (GDRIA+ subsample), it seems particularly important to implement treatments focused on the self-transcendence trait and the DSM-5 symptom 7 (“lies to conceal the extent of involvement with gambling”), with the aim to modify the global psychopathology distress, the substances use, and other severe consequences related to the gambling activity (debts and total gambling symptom level as measured by the SOGS). In this context, the clusters of nodes identified in this network analysis could be interpreted as specific phenotypes within the subsamples of GDRIA+ and GDRIA- patients with and without illegal acts, with different vulnerabilities to the many correlates of this complex disorder, and therefore with different needs that should be addressed in precise intervention plans.

Limitations

Some limitations should be considered when interpreting the results. First, while the networks were defined for a large set of nodes that contained multiple aspects of the psychological and functional areas (this is a strength of the study), it was not possible to include additional nodes that might be related to the presence of GDRIA (such as sociocultural factors [including negative attitudes, values, or beliefs], history of family violence, or early and repeated anti-social behavior).

Second, the sex distribution was asymmetrical (the proportion of women was particularly low compared to men), but this distribution is consistent with the female/male ratio observed in clinical settings. It must be argued that while the limited proportion of women considered in the study needs to be considered for generalization purposes, the inclusion of women also provides ecological validity to our research.

Regarding the impact of the sample size on the statistical procedures, it should be noted that our study modeled a large number of nodes and edges, and this could impact the capacity to estimate accurate parameters. We should stress that the number of participants was relatively limited in this study due to the recruitment period for the sample. Because of major sociocultural changes in recent years (including the COVID-19 pandemic), we chose to only include patients who visited the treatment unit in 2021 and 2022, when the restrictions due to the pandemic had been relaxed and healthcare had returned to normal in our country. It should also be pointed out that there is no agreed standard on the optimal number of participants to ensure the reliability and validity of network approaches. A recent simulation study observed that sample requirements for this method are very broad ranging depending on different design factors, such as network architecture, network connectedness, number of nodes, and type of data (Constantin et al., 2022). In any case, the empirical evidence produced by this study should be interpreted with caution, for it is a pioneering study whose results will need to be corroborated/refuted by future studies with larger samples.

Finally, due the cross-sectional nature of the data, undirected edges were defined within the networks, so the results cannot be interpreted in causal terms. And the lack of previous research on the subject (network analyses to visualize the underlying pattern of relationships among patients with and without GDRIA) did not provide a solid theoretical framework with which to contrast and contextualize the new empirical evidence generated by this study.

Conclusions

This is a pioneering study focused on analysis of the centrality (relevance and linkage) of the nodes containing information on the profiles of patients with and without GDRIA. The identification of different network structures in the groups considered in the study (with and without illegal acts), the recognition of different nodes that achieved the highest centrality indexes, and the detection of distinct latent classes, support the hypothesis of high heterogeneity within the GD condition. The diverse, complex processes sustaining the clinical profile of these patients make it very hard to conceptualize the disorder as a well-defined nosological entity (as defined by the DSM-5 taxonomy). On the contrary, our results suggest that the clinical phenotype of GD patients could be the result of a complex network that includes sociodemographic features, psychological symptoms, personality traits, and other functional measures, and that the different graphs/structures could explain the presence of crucial correlates such as illegal acts.

The objective of this study was not to assess the network of core criteria for GD as described in the categorical taxonomy DSM-5 but to identify the network of these symptoms plus other sets of variables measuring personality profile, substance use, and other gambling-related indicators among patients with GDRIA. The identification of the most central nodes (in terms of relevance, linkage capacity, and clustering in modules) provides new evidence on GD endophenotypes, as well as a paradigm shift in the way that patients are diagnosed and treated. The pioneering study by Ledgerwood and colleagues observed that the group of GD patients with illegal acts presented poorer treatment outcomes compared with the group of patients without gambling-related offenses and suggested the need for longer, more intense treatments to achieve a reduction in GD symptomatology among gambling-related offenders (Ledgerwood et al., 2007). Our study provides new evidence to develop intervention plans focused on the specific clinical population of individuals with GDRIA.

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Data Availability The data that support the findings of this study are available on request from the corresponding author.

Declarations

Ethics Approval and Consent to Participate The research was carried out in accordance with the Declaration of Helsinki of 1975, as revised in 2000. The research was approved by the Ethics Committee of Bellvitge University Hospital (ref: PR338/17 [CSI 18/04]). All the patients provided informed consent (the acceptance rate was 100% of all the consecutive patients of the treatment unit who met the inclusion criteria).

Conflict of Interest FFA and SJM received consultancy honoraria from Novo Nordisk and FFA editorial honoraria as EIC from Wiley. The rest of the authors declare no competing interests.

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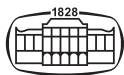
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FULL-LENGTH REPORT



Features related to the presence of internet gaming disorder and their impact on the treatment outcomes

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ABSTRACT

Background and aims: Internet gaming disorder (IGD) is a highly engrossing activity with the individual spending up to 10 h per day gaming, this causes issues in accomplishing their tasks and personal goals. Also, to generate in them increased anxiety, impulsivity and lack of social skills, this impacts the good personal development and individual's quality of life. Therefore, it is **vital** to better understand, in terms of treatment, which factors are associated with therapeutic outcomes (largely to achieve control over the use of video games and the lack of relapses) following a standardized Cognitive Behavioral Therapy (CBT) protocol. This study aimed to explore sociodemographic and personality variables and their relation to treatment outcome in patients with IGD. **Method:** The sample included $n = 105$ patients with IGD, considered between January 2005 and December 2022 and recruited from the Behavioral Addictions Unit at the University Hospital of Bellvitge. Data at baseline was registered (sociodemographic and clinical measures), as well as the therapy outcomes (compliance with the guidelines, presence of relapses and dropouts). **Results:** Patients were mainly males ($n = 95$) with a mean age of 24.97 (SD = 12.03). All patients included in this sample had individual CBT treatment in relation to their problematic gaming behavior. In terms of patients who relapsed, they had higher interpersonal sensitivity, hostility and persistence with lower self-directedness. Patients who dropped out were males with an older age of IGD onset. When looking at treatment noncompliance, it was related to higher psychoticism and reward dependence, and lower cooperation. Patients with IGD show higher levels of treatment noncompliance. **Conclusion:** These findings evidence a positive and promising effect of CBT on IGT. The factors identified as predictors of good and poor treatment outcomes should be considered for developing new evidence-based interventions focused on learning healthier key coping strategies to manage both cravings and triggers.

KEYWORDS

behavioral addictions, internet gaming disorder, cognitive behavioral therapy, response to treatment

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INTRODUCTION

Easy availability and access to online video games have enabled internet gaming to become a common leisure activity. But the increasing prevalences of problems arising from excessive use of these systems has captured the interests of both researchers and clinicians, particularly among adolescents and young adults due to their great risk to initiate an internet gaming disorder (IGD) (King, 2018; Sugaya, Shirasaka, Takahashi, & Kanda, 2019).

The definition of the clinical criteria and the classification of IGD in current taxonomies have been largely debated. The International Classification of Diseases (ICD - 11th Revision, 2020) describes IGD as a pattern of problematic, persistent, uncontrolled, and recurrent gaming behavior, both online and offline that generates negative consequences for individuals. This manual categorized IGD with disorders related to addictive behaviors. The Diagnostic and Statistical Manual of Mental Disorder states that patients with IGD show clinical profiles comparable to individuals with substance use disorder, and it places IGD as a mental disorder in section III: “Conditions for Further Study” (DSM-5-TR, American Psychiatric Association, 2022).

Epidemiological studies have published cross-sectional point prevalence estimations in a large range, from 0.7% to 27.5% (Fam, 2018; Stevens, Dorstyn, Delfabbro, & King, 2021; Zajac, Ginley, & Chang, 2020), with greater rates in Western industrialized countries (Brand, Young, Laier, Wölfling, & Potenza, 2016). The findings on the natural course of IGD are inconsistent and showed high variability across studies (Mihara & Higuchi, 2017), but it is noticeable a tendency to stability or aggravation (Krossbakken et al., 2018).

Regarding etiological research, it has been observed that male sex constitutes a highly vulnerable population (Durkee et al., 2012; Rehbein & Baier, 2013; Van Deursen, Bolle, Hegner, & Kommers, 2015), as well as young age (Andreassen, 2015; Kuss, Griffiths, Karila, & Billieux, 2014), and a psychological profile characterized by lack of social skills, low conscientiousness, high level of neuroticism, and high impulsivity levels (Currie et al., 2020; Şalvarlı & Griffiths, 2021).

Substantial harm from untreated IGD has been described (Zajac, Ginley, Kelly, Flori, & Pfund, 2014), including high rates of unemployment (or academic difficulty), comorbid mental health problems (such as depression and anxiety), physical health issues (including overweight and obesity, sleep disorders, weakness or numbness in the hands, and even blood clots), family conflicts, and social isolation. These negative consequences related to the problematic excessive gambling highlight the need to identify challenges related to treatment and the pathways for addressing these challenges.

Treatment efforts for IGD have developed and tested behavioral, pharmacological and neuromodulatory approaches (Dong, Dai, & Potenza, 2024). Systematic reviews have concluded that cognitive behavioral therapy (CBT) is the most widely employed intervention (King et al., 2017;

Sharma & Weinstein, 2024; Winkler, Dörsing, Rief, Shen, & Glombiewski, 2013; Zajac et al., 2020), as well as the treatment with the most promising results addressing excessive gaming, dysfunctional cognitions, social and behavioral deficits, motivation for change, negative mood states, and reinstatement of alternative behaviors (King, Delfabbro, Griffiths, & Gradisar, 2012; Stevens, King, Dorstyn, & Delfabbro, 2019; Winkler et al., 2013). In addition, Young and Brand (2017) have argued that CBT techniques may be particularly useful in targeting the maladaptive processes that contribute to IGD as described in the Interaction of Person-Affect-Cognition-Execution (I-PACE) model. This model postulates that IGD is maintained in the patient by decreased cognitive control, which inhibits decision-making processes that result in the decision to play videogames (Brand et al., 2016).

But the results obtained for CBT among IGD patients must be interpreted with caution (Wang, Liu, & Nogueira, 2023). Firstly, because of the variability in the type of CBT analyzed (some using standard CBT, others using gaming-specific interventions, others incorporating parent psychological components, and still others focused on craving). Secondly, because most of the studies have been criticized for poor design and methodological flows, such as relatively small sample sizes and lack of control groups (Gentile et al., 2017; Zajac, Ginley, Chang, & Petry, 2017). And thirdly, due to the differences in the diagnostic criteria to recruit participants (for example, self-report screening scales or diagnostic tools based on the criteria of DSM-5 or ICD-11 criteria) and the differences to evaluate the effectiveness of the treatment.

Related with the definition of the treatment outcomes, CBT studies have assessed cognitive and behavioral measures of recovery (King & Delfabbro, 2014). The most common included the change in the number (and/or severity) of the specific symptoms/criteria for IGD, the frequency of the gaming activity, the improvement in the global mental state, and the absence of relapses (defined as the recurrence of previously absent symptoms state, deterioration of the symptoms to a former worse state or the existence of uncontrolled gaming episodes). It is important to note that many intervention plans for IGD may not intend to completely abstain from gaming during the therapy, since total cessation of use may be counterproductive. That means that treatment goal for these programs is reduce gaming, controlled games use, and direct attention toward other healthy leisure activities.

Finally, knowledge of the predictors of treatment retention and outcomes in patients seeking treatment for IGD is very limited (King, Adair, Saunders, & Delfabbro, 2018). It has been observed that the severity of the disorder may negatively impact on treatment compliance and adherence (Kaptis et al., 2016). The presence of comorbidities (such as depression, anxiety, substances related disorders, attention deficit and hyperactivity) are likely to negatively affect the ability of individuals to abstain from or reduce gaming (Han, Yoo, Renshaw, & Petry, 2018; Ho et al., 2014; Lee, Lee, & Choo, 2017). Playing certain types of games (such as popular

competitive action shooting games) and the modality of gaming (such as massively multiplayer online games) have been associated to increased difficulty to reduce use and maintain at secure levels (James & Tunney, 2017).

In short, during the last decades IGD has become a significant concern in mental healthcare, particularly since the publication of the ICD-11 and the DSM-5. The increasing number of individuals engaging in unhealthy gaming has involved the development of several psychological interventions, with preliminary support for CBT approaches over their counterparts. However, the study of empirically validated treatments for IGT and the identification of multiple factors contributing to the ability to abstain from gaming are still at early stages. Therefore, the aim of this study is to explore the response to CBT treatment of patients diagnosed with IGD, looking at sociodemographic variables, personality traits and therapy outcomes (e.g., risk of dropout and relapse). Since this is an exploratory study, and due the lack of available empirical evidence regarding the potential role of the variables analyzed on the therapy results, no empirical hypotheses are formulated.

METHODS

Participants

In this study, participants were recruited from the Behavioral Addictions Unit at the University Hospital of Bellvitge. A consecutive sampling was considered between January 2005 and December 2022, due to the low number of IGD patients which attend the unit compared to other behavioral addictions (e.g., gambling disorder). All patients included in this sample had individual outpatient CBT treatment in relation to their problematic gaming behavior and all of them met criteria for IGD according to the DSM. For patients who were assessed between 2005 and 2013 (i.e., prior to the DSM-5), IGD was identified through a semi-structured interview adapted from DSM-III-R pathological gambling criteria (Griffiths & Hunt, 1998). The sample included $n = 105$ patients ($n = 95$ men, 90.5%), most of them with primary ($n = 45$, 42.9%) or secondary ($n = 53$, 50.5%) education levels, single ($n = 92$, 87.6%), unemployed ($n = 78$, 74.3%) and in mean-low to low socioeconomic groups ($n = 91$, 86.6%). The mean duration of gaming-related problems was 4.1 years ($SD = 3.3$).

Measures

Clinical criteria for Internet Gaming Disorder. A semi-structured face-to-face clinical interview assessed the criteria included in section 3 of the DSM-5 (“Conditions for Further Study”) for the presence of gaming (American Psychiatric Association, 2022; Petry et al., 2014) preoccupation or obsession, withdrawal, tolerance, loss of control, loss of interest, continued overuse, deception, release of negative feelings and functional impairment. In addition to the cut-off proposed in the DSM-5 (5 out of 9 criteria are required to confirm the condition), the presence of IGD in this study

required that the symptoms had to be endorsed within a 12-month period to establish the diagnosis (this method is aligned with recent research showing that more lenient criteria are susceptible to pathologization of non-pathological gaming patterns (Billieux, Flayelle, Rumpf, & Stein, 2019; Deleuze et al., 2017). As mentioned previously, for patients assessed between 2005 and 2013 (before the release of the DSM-5), gaming disorder was identified through a semi-structured face-to-face interview adapted from DSM-III-R pathological gambling criteria (Griffiths & Hunt, 1998).

Symptom Checklist-Revised (SCL-90-R) (Derogatis, 2002). This is a self-report questionnaire developed to assess the psychological state using 90 items factorized into nine primary (first order) dimensions (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism), and three global indices [global severity index (GSI), total positive symptoms (PST), and positive symptom distress index (PSDI)]. The psychometrical Spanish adaptation of this tool obtained adequate internal consistency (Cronbach’s alpha $\alpha = 0.75$) (Gonzalez De Rivera et al., 1989). The internal consistency in our sample was also in the adequate to good range ($\alpha = 0.79$, for the paranoid ideation scale, to $\alpha = 0.98$ for the global indices).

Temperament and Character Inventory-Revised (TCI-R). (Cloninger, Przybeck Thomas, Svrakic Dragan, & Wetzel, 1994). This is a self-report questionnaire developed to assess personality traits using 240 items based on Cloninger’s multidimensional model and structured into seven factors [four for temperament (novelty seeking, harm avoidance, reward dependence, and persistence), and three for character (self-directedness, cooperation, and self-transcendence)]. The psychometrical Spanish adaptation of the tool obtained adequate internal consistency (Cronbach’s alpha $\alpha = 0.87$) (Gutiérrez-Zotes et al., 2004). The internal consistency in this study was in the adequate to good range ($\alpha = 0.70$, for novelty seeking and $\alpha = 0.87$ for persistence).

Other variables. This study also analyzed additional data via a semi-structured interview. This tool covered socio-demographic characteristics (sex, marital status, education level, employment status), as well as the socio-economic position index, according to Hollingshead’s scale (based on the participants’ level of education and their profession) (Hollingshead, 2011). This interview also registered the presence of other comorbid diagnoses with the question “Are you diagnosed of any mental disorder, or are you receiving treatment for any mental disorder?”

Procedure

Therapeutic Program: The program consists of various sessions, the first one being focused on assessing the presence of IGD and the concrete profile of the gaming. This initial session also included the semi-structured clinical interview. The second session consisted of completing the psychometric tools, to measure personality traits, psychopathology, and other psychological constructs. Subsequently, there is a

third session with the patient and a concerned significant other, in which the results of the questionnaires and treatment plan are discussed. The CBT program protocol for IGD has a 12 week treatment plan, with 30-minute weekly sessions. The treatment is distributed into 6 phases: a) psychoeducation; b) cognitive restructuring; c) stimulus control and overcoming the desire; d) training in control techniques and appropriate use of video games; e) promotion of alternative tasks to the use of video games and f) training in relapse prevention. During the therapy, patients are instructed that the main goal of the treatment is not achieving complete abstinence from video games use, but to regain lost self-control and learn to use video games in a healthy way. Patients are also encouraged to change the problematic video game activity by others leisure healthy activities. After the treatment sessions, a final assessment is carried out, and the patient and the clinicians value the achievements.

Figure 1 displays the scheme with the study procedure.

Participation in this study was completely voluntary and explanation of the guidelines was provided prior to participation. Once the participants signed the consent form, the questionnaires were administered to them. Patients receive only psychotherapy CBT.

Statistical analysis

Statistical analysis was carried out with Stata18 for Windows (StataCorp, 2023). Logistic regression generated predictive models for the treatment outcomes of risk of relapse (no/yes), risk of dropout (no/yes) and risk of poor compliance (no/yes). In this study, relapse was defined as the presence of uncontrolled gaming episodes during treatment. Dropouts were considered for patients who completed less than 50% of the therapy sessions and they did not attend the final therapy session. And poor compliance was defined as patients who did not comply with the therapeutic guidelines (the assessment of the compliance level was made by the clinicians). The set of predictors included the sociodemographic and clinical profiles at baseline: sex, age, marital status, social position index), age of onset and duration of the gaming related problems, psychological state (SCL-90R scales) and

personality profile (TCI-R scales). The selection of the best predictors (with significant contribution of the therapeutic criteria) was based on the back-stepwise procedure, the goodness-of-fit was measured with the Hosmer-Lemeshow test (H-L), and the global predictive capacity with the Nagelkerke's pseudo- R^2 coefficient ($N-R^2$).

Poisson regression, used to analyze count data, was employed to obtain the variables with the most predictive capacity (between the list of variables measured at baseline) about the number of relapses during the treatment and the number of sessions attended.

Survival analysis was used to analyze the rate (expected duration of time) until the presence of the treatment outcomes, relapses and dropouts. The Kaplan-Meier function was used to estimate the probability that a patient survives longer than a concrete time.

Ethics

The latest version of the Declaration of Helsinki was used to conduct the present study. The Clinical Research Ethics Committee of Bellvitge University Hospital approved this study (ref. PR393/17). Signed informed consent was obtained from all participants.

RESULTS

Descriptive variables of the sample

Most participants were men (90.5%), single (87.6%), with a secondary education level (50.5%), unemployed (74.3%), and pertaining to a low social position index (57.1%). Mean age was 25.0 years ($SD = 12.0$), mean onset of the addictive behavior 19.9 years ($SD = 10.4$) and mean duration of the problematic gaming was 4.1 years ($SD = 3.3$).

The frequency of patients who replied in the affirmative for the item included in the diagnostic interview measuring the presence of any mental disorder different to IGD was $n = 30$ (28.6%). And the percentage of patients within the clinical range in the screening measure of psychopathology (SCL-90R) was in the range between 25.7% for the PSDI global index to 52.4% for the interpersonal sensitivity factor.

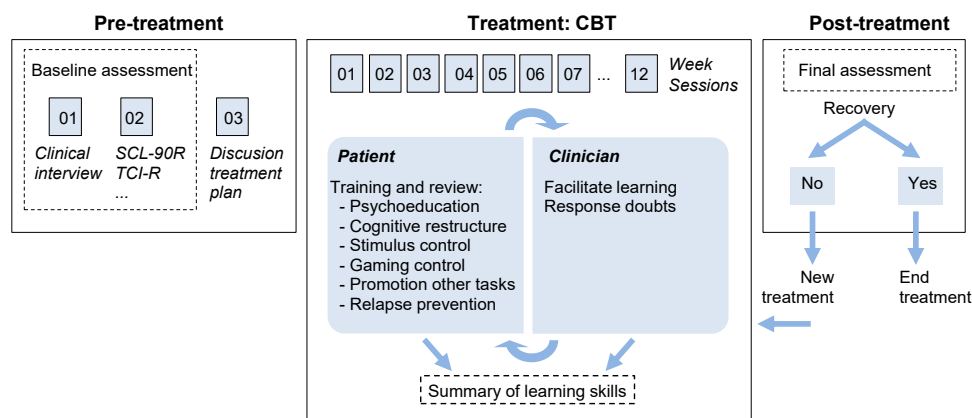


Fig. 1. Scheme with the study procedure

Table 1 displays the complete descriptive variables for the sample, with the frequency distribution of all the variables measured at baseline.

Predictive models of therapy outcomes

Figure 2 displays the 100% stacked bar chart with the distribution for the outcomes analyzed in the study (compliance with the therapy guidelines, dropout and relapses), stratified by sex and age groups. This figure shows that men tend to attain a poor treatment outcome, and that the likelihood of relapse tends to increase among patients within the middle age group (between 18 and 30 years-old). Table S1 (supplementary material), contains the comparison between patients with and without dropout and relapses, for all the variables registered at baseline.

Table 2 contains the results for the final models obtained in the logistic regression analyses. Adequate goodness-of-fit was achieved for the three models ($p > 0.05$ in the H-L tests). The risk of relapse was increased for patients with higher scores in the SCL-90R scales of interpersonal sensitivity and hostility, as well as with higher scores in the TCI-R scale of persistence. Being male and older age increased the likelihood of dropout. And poor compliance was associated with higher scores in SCL-90R psychotic ideation, higher level in the TCI-R reward dependence, and lower level in the TCI-R cooperativeness. The global predictive of the models was in the range $N-R^2 = 0.085$ (8.5%, for the regression on the criterion risk of dropout) to

$N-R^2 = 0.245$ (25.5%, for the regression on the criterion risk of poor compliance).

The results of the Poisson regression are displayed in Table 3. The first model of this table showed that the number of relapses increased for patients with higher levels of interpersonal sensitivity, hostility and persistence, and lower level in the self-directedness personality trait. Regarding the second model, the number of sessions attended during the treatment was higher in women, patients who reported higher education levels, higher scores in interpersonal sensitivity, hostility, paranoid ideation and cooperativeness, and lower scores in self-transcendence.

Survival analysis

Figure 3 shows the survival curves for the rate of relapses and dropout during treatment. The presence of uncontrolled gaming episodes was uniformly registered during the first 6 sessions, and only a few patients reported relapses between session 6 and the end of treatment. Regarding dropouts, all abandonments were registered during the first 5 sessions of treatment, with the risk of discontinuation being highest in the first week of treatment.

DISCUSSION

This study explored the profile of patients with IGD (sociodemographic variables, psychopathology distress and

Table 1. Descriptive variables for the sample at baseline

Sociodemographic profile	<i>n</i>	%	Psychopathology (SCL-90R)	Mean	SD	¹ <i>n</i>	¹ %
Sex			Somatization	0.84	0.81	37	35.24%
Female	10	9.5%	Obsessive-compulsive	1.23	0.84	48	45.71%
Male	95	90.5%	Interpersonal sensitivity	1.18	0.95	55	52.38%
Marital status			Depression	1.26	1.01	47	44.76%
Single	92	87.6%	Anxiety	0.80	0.77	29	27.62%
Married – couple	11	10.5%	Hostility	1.04	0.91	37	35.24%
Divorced – separated	2	1.9%	Phobic anxiety	0.52	0.77	30	28.57%
Education			Paranoid ideation	1.10	0.93	42	40.00%
Primary	45	42.9%	Psychotic ideation	0.77	0.80	39	37.14%
Secondary	53	50.5%	GSI	1.00	0.76	48	45.71%
University	7	6.7%	PST	41.08	21.30	43	40.95%
Employment			PSDI	1.93	0.64	27	25.71%
Unemployed	78	74.3%	Personality (TCI-R)	<i>Mean</i>	<i>SD</i>		
Employed	27	25.7%	Novelty seeking	104.00	13.20		
Social			Harm avoidance	104.02	17.26		
High	2	1.9%	Reward dependence	94.85	17.37		
Mean-high to high	3	2.9%	Persistence	92.62	19.20		
Mean	9	8.6%	Self-directedness	124.43	23.67		
Mean-low	31	29.5%	Cooperativeness	129.65	19.27		
Low	60	57.1%	Self-transcendence	60.09	14.61		
Age, onset and duration	<i>Mean</i>	<i>SD</i>					
Age (years-old)	24.97	12.03					
Onset of addiction (yrs-old)	19.92	10.36					
Duration of the addiction (yrs)	4.05	3.27					
Prevalence of mental disorders	<i>n</i>	%					
Any mental disorder	30	28.57					

Note. SD: standard deviation. ¹Prevalence of patients within the clinical range.

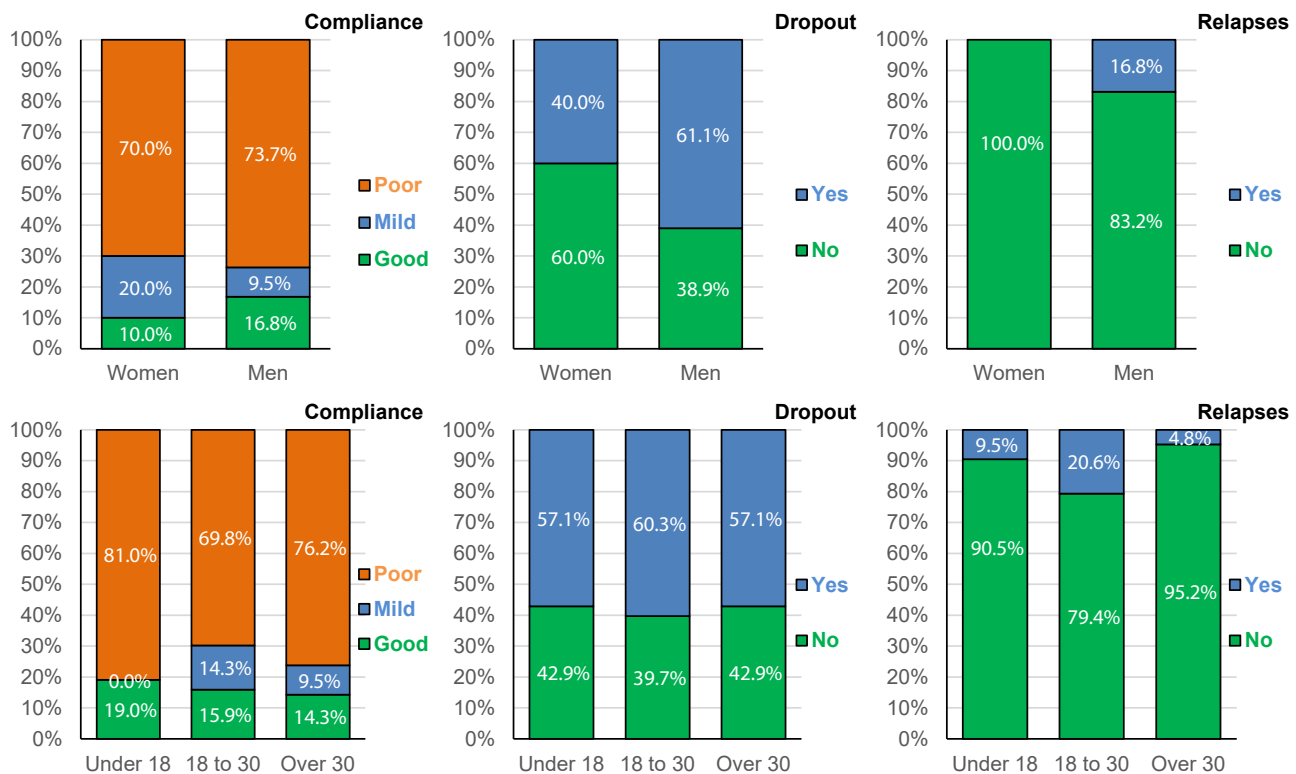


Fig. 2. Treatment outcomes: risk of dropout and relapses during therapy

Table 2. Logistic regression with the final discriminative models

Criterion: risk of relapse	B	SE	p	OR	95%CI (OR)		H-L	N-R ²
SCL-90R interpersonal sensitivity	2.268	0.868	0.009	9.658	1.762	52.925	0.118	0.210
SCL-90R hostility	1.267	0.600	0.035	3.550	1.096	11.499		
TCI-R persistence	0.032	0.017	0.049	1.033	0.999	1.000		
Criterion: risk of dropout	B	SE	p	OR	95%CI (OR)		H-L	N-R ²
Sex (0:female; 1:male)	1.771	0.886	0.046	5.875	1.034	33.370	0.188	0.085
Age of onset (years-old)	0.066	0.032	0.040	1.068	1.003	1.137		
Criterion: risk of poor compliance	B	SE	p	OR	95%CI (OR)		H-L	N-R ²
SCL-90R psychotic ideation	1.629	0.600	0.007	5.101	1.572	16.546	0.947	0.245
TCI-R reward dependence	0.070	0.023	0.003	1.072	1.024	1.122		
TCI-R cooperativeness	−0.051	0.022	0.020	0.951	0.911	0.992		

Note. SE: standard error. OR: odds ratio. 95%CI: 95% confidence interval.

Fit statistics: H-L: Hosmer-Lemeshow (*p*-value). N-R²: Nagelkerke pseudo R-squared.

List of predictors: sociodemographic profile (sex, age, marital status, social position index), age of onset and duration of the gaming related problems, psychological state (SCL-90R scales), and personality profile (TCI-R scales).

personality traits), as well as treatment outcomes (relapse, compliance, dropout). The IGD profile was characterized by a high proportion of men who are single, have a higher level of education, are unemployed, have a low social status, have a young average age and a young age of onset of addiction problems, and have a high probability of having several psychiatric symptoms at the same time. Poor treatment outcomes were associated to male gender, older age, worse psychopathology state, higher levels in persistence and reward dependence, and lower levels in cooperativeness and self-directedness.

Profile of patients with IGD

The sample included a higher percentage of males with IGD compared to females. These results are in line with previous studies where they indicate that IGD is more prevalent in males (Stevens et al., 2021). This could be due to the nature of internet games, which were oriented for many years to males, designed for men by men. In addition, and compared with other behavioral addictions, patients with IGD are mostly younger and single, and report an earlier age of onset. This is explained by the fact that video games are

Table 3. Poisson regression with the final discriminative models

Criterion: number of relapses	B	SE	p	95%CI (B)	
SCL-90R interpersonal sensitivity	1.708	0.581	0.003	0.570	2.846
SCL-90R hostility	0.953	0.422	0.024	0.125	1.781
TCI-R persistence	0.038	0.012	0.001	0.015	0.060
TCI-R self-directedness	−0.048	0.014	<0.001	−0.075	−0.021
Criterion: number of sessions	B	SE	p	95%CI (B)	
Sex (0:female; 1:male)	−0.309	0.176	0.078	−0.653	0.035
Education level (higher)	0.249	0.080	0.002	0.092	0.407
SCL-90R interpersonal sensitivity	0.255	0.128	0.047	0.004	0.506
SCL-90R hostility	0.158	0.081	0.050	0.000	0.317
SCL-90R paranoid ideation	0.444	0.109	0.000	0.231	0.657
TCI-R cooperativeness	0.008	0.003	0.019	0.001	0.015
TCI-R self-transcendence	−0.007	0.003	0.050	−0.014	0.000

Note. SE: standard error. 95%CI: 95% confidence interval.
List of predictors: sociodemographic profile (sex, age, marital status, social position index), age of onset and duration of the gaming related problems, psychological state (SCL-90R scales), and personality profile (TCI-R scales).

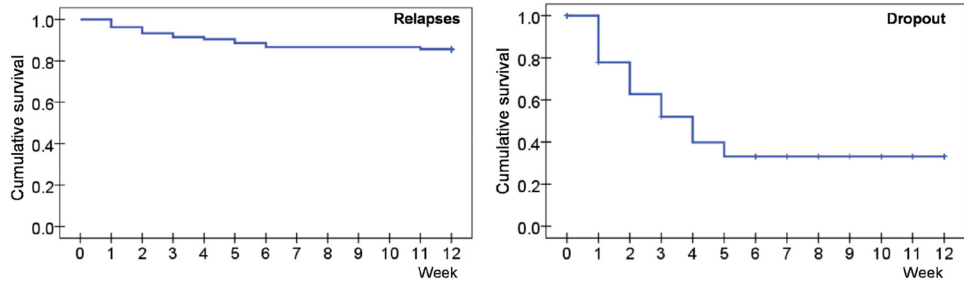


Fig. 3. Cumulative survival functions for the rate of relapses and dropout

more attractive to adolescents and young adults and this group tends to have a higher rate of unemployment (Mal-lorquí-Bagué, et al., 2017). Regarding other sociodemographic features, the young age of the individuals with IGD could also explain the higher proportion of unemployed patients and secondary education levels. In addition, and given the cross-sectional nature of the data analyzed for the baseline, we can only describe the associations between the variables, without attempting to establish causality. The high unemployment level and low socioeconomic status could be associated with IGD or with other variables such as education level and age of onset of the disorder. Researchers have found that the most problematic internet use tends to be in the younger population (Buil, Solé, & García, 2015; Carbonell, 2014; Ferguson, Coulson, & Barnett, 2011; Kuss, Van Rooij, Shorter, Griffiths, & Van de Mheen, 2013). Moreover, studies have emphasized that IGD has comorbidity with other psychiatric disorders and is also related to introversion and deficits in social skills (Şalvarlı & Griffiths, 2021), which could explain potential difficulties in obtaining a job. Be that as it may, since IGD typically develops among male gender in adolescence and in early adulthood, as other behavioral addictions (Macur & Pontes, 2021), secondary and university students should be considered a highly vulnerable group for preventing the onset and progression of video games use.

Related to the psychopathology levels, this study observed that IGD was associated to high scores in most psychiatric symptom dimensions, i.e., somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. This concurrence of IGD with other mental diseases has also been reported in previous studies (Han et al., 2018; Kim et al., 2016; Wang, Liu, & Nogueira, 2023). But our data does not allow a causal link between excessive gaming as predictor of worse psychopathology levels. On the contrary, reciprocal bidirectional relationships between IGD with other comorbid conditions (such as anxiety, depression or hyperactivity/inattention) have been observed, evidencing that people with IGD had a high risk of developing concurrent diseases and symptoms, and these disorders and symptoms could also increase the likelihood of onset (and even deteriorate) IGD (Meng et al., 2024; Shi et al., 2020).

Treatment outcome: relapse

The findings obtained showed that the subjects who relapse have higher interpersonal sensitivity, hostility, persistence, and lower self-directedness. These results are consistent with previous research, which has also found individuals who suffer from IGD to have difficulties with interpersonal



relationships (De Pasquale et al., 2020). In this vein, a higher risk of relapse is related to interpersonal sensitivity (i.e., feelings of inadequacy and inferiority when compared to others and discomfort in social interactions) (Granero, Fernández-Aranda, Castro-Calvo, et al., 2021). Previous research described that hostility present in IGD could be a means to handle emotional distress (Stavropoulos, Kuss, Griffiths, Wilson, & Motti-Stefanidi, 2017) which would be consistent with the present study. Therefore, hostility becomes an escape mechanism from distress in order to feel satisfied and emotionally regulated. Indeed, Kuss (2013) describes that the preference for online social relationships, escapism, and use of maladaptive coping strategies could be maintaining variables and useful in coping with everyday stressors.

Additionally, another factor related to risk of relapse was persistence, associated with more rigidity, which causes the patient to have difficulty in changing their habits, not allowing them to move their focus from gaming to another behavior and even though the individual may be tired, they continue gaming, and they may not be able to stop themselves from engaging in this behavior (Ayala-Rojas et al., 2022; Jiménez-Murcia et al., 2019).

And finally, lower self-directedness is related to low self-esteem and lower self-regulatory capacity (Cloninger, Svrakic, & Przybeck, 1993; Hahn, Reuter, Spinath, & Montag, 2017). Some studies have found that low self-direction is a predictor of IGD, reflected in low regulation and adaptation of behavior to the fulfillment of personal goals and projects (Montag et al., 2012). Due to low self-esteem and self-acceptance, the subjects have less self-control and difficulties in planning their life according to meaningful personal and social goals. In line with this, research has found a positive association between IGD, low self-esteem and lack of social and interpersonal skills (González-Bueso, et al., 2020; Jiménez-Murcia, et al., 2014).

Treatment outcome: noncompliance

The results show patients have high levels of psychoticism, reward dependence and low cooperation, in relation to poor treatment compliance. Some studies have found a high association between low cooperation, paranoid traits and low conscientiousness (Li, Zou, Wang, & Yang, 2016; Schimmenti, Infanti, Badoud, Laloyaux, & Billieux, 2017).

Recently authors refer to a positive association between introverted people and addictive behaviors in general. Meaning that being immersed in an online environment allows one to hide their identity, where the probability of being embarrassed, ridiculed or rejected is decreased, and the ease of establishing new interpersonal relationships is increased, through a new lifestyle (Şalvarlı & Griffiths, 2021). IGD patients present with difficulties in social interactions, rejection sensitivity and empathy, these are deficient when trying to establish connections with their peer group and to trust others. In line with our findings, some authors mention that patients with IGD have low sociability (Festl, Scharnow, & Quandt, 2013), low openness to experiences (Wang, Ho,

Chan, & Tse, 2015) and a combination of low self-directedness and cooperation (Montag et al., 2012), which greatly impacts the lack of social relationships and in consequence a difficulty to adhere to treatment. A study conducted by Cook and collaborators (2017) has found that the formation of a positive therapeutic alliance is fundamental for effective psychotherapy. This could possibly explain that if there is low cooperation and a lack of trust towards the therapist, it may hinder treatment bonding (Cook, Schwartz, & Kaslow, 2017). Low cooperation, from the TCI-R scale, has been linked with low extroversion, unfriendliness and low perceived social support, whereas high cooperativeness has been seen to be associated with empathy, social acceptance and agreeableness (Bojanowska & Urbńska, 2021).

Additionally, it is observed that studies relating personality traits and internet addiction found high scores for conscientiousness and low scores for openness to novel experiences. Internet addiction was negatively related with conscientiousness, extraversion, openness to new experiences and agreeableness, and positively related with neuroticism (Kayaş et al., 2016).

Treatment outcome: dropout

When looking at the risk of dropout, only two factors were relevant in this study, sex and age of onset. Males presented higher risk of dropout, which is in line with epidemiological and clinical data that demonstrate that gaming disorder is overall more prevalent in males, due to several factors (e.g., psychological, social, cultural) (Granero, Fernández-Aranda, Castro-Calvo, et al., 2021; Kuss & Griffiths, 2012; Lopez-Fernandez, Williams, & Kuss, 2019). Also, an older age of IGD onset implied a higher risk of dropout. In this vein, previous studies have shown the significance of variables such as age of onset and chronological age, which have been associated with distinct patient profiles. For instance, one study identified two profiles in a sample of gaming disorder patients. The first group presented a lower psychological impact which was characterized by younger age, earlier age of onset of gaming, better psychopathological status and a more functional profile. On the other hand, the second group presented a higher psychological impact and was represented by older patients, with later age of onset of gaming and more marked psychopathological symptoms and dysfunctional personality profiles. Also, they were correlated with higher risk of alcohol consumption, and other behavioral addictions (Granero, Fernández-Aranda, Castro-Calvo, et al., 2021; Granero, Fernández-Aranda, Demetrovics, et al., 2021). Therefore, older age and later age of onset in gaming disorder are associated with greater severity of the disorder and with other concurrent disorders, and thus, with a higher risk of treatment dropout (Han et al., 2018).

Strengths and limitations

This study had several limitations, such as the cross-sectional design (concretely for data analyzed at baseline),

which does not allow us to determine the causality of the variables evaluated. The size of the clinical sample was unequal, since there were more men than women, and since it is a clinical sample, it is not possible to apply it to the general population. Future studies could include a more heterogeneous and diverse sample size in order to better understand the similarities and differences in the personality and psychopathological traits of patients with IGD and be able to replicate it in other social environments. Finally, the long recruitment period was also a limitation: since IGD evolves rapidly, it is quite possible that the patients' profiles and some treatment features might differ comparing the first and last participants, and these inconsistencies could have influenced the results.

On the other hand, there were many strengths in this study, the first one being that it was a clinical sample of individuals with IGD, made up of women and men. The second is the set of variables evaluated at the sociodemographic, psychopathological and clinical levels, based on the response to treatment (risk of dropout and relapse), and noncompliance, according to the number of sessions attended by the patients.

CONCLUSION

As this study has shown, compliance with IGD treatment is very poor, it is imperative to have treatments, which are more specifically tailored to IGD. Especially in terms of the traits which are most prevalent in this group, such as, interpersonal sensitivity, hostility and persistence (in terms of rigidity and difficulty in changing from one activity to another). Future studies may focus on the identification of possible components (personal, familial and social) that hinder the successful development of treatment in order to prevent the risk of relapse and/or dropout. Special attention should be paid to risk and protective factors that empirical research has related to the progression of IGD (Ropovik et al., 2023), such as coping strategies, self-esteem, emotion regulation capacities, presence of other physical and/or psychological problems, social support, family functioning, and motives for gaming. It is also essential to attend impairing parenting styles and school-related stress among young age individuals. In the same vein, precise treatment plans should be developed for patients with concrete characteristics that might hinder treatment success, valuing the benefits of alternative or complementary treatment approaches (such as family-based plans, or augmented psychotherapy with additional cognitive/emotional bias modification sessions, motivation and relapse prevention sessions) (Sharma & Weinstein, 2024). Interestingly, studies have observed a strong link between the inclusion of the family members in the treatment plans with the patients' responses to treatment, particularly for improve affectation and gaming cues among adolescents with (Pallesen, Lørvik, Bu, & Molde, 2015) and decreasing dropout rates (González-Bueso et al., 2018). Finally, continued research in IGD is encouraged in order to increase clinical knowledge and to

help assess IGD as a disorder that impedes the favorable development of individuals.

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SUPPLEMENTARY MATERIAL

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Biopsychological markers of gambling disorder: a path analysis approach

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Abstract

Background and objectives. Gambling disorder (GD) is a complex multiple-faceted maladaptive gambling behavior that involves a combination of neurobiological, psychological, genetic and contextual factors. The aim of this study was to assess the underlying mechanism contributing to the presence of GD, considering a set of variables including sociodemographic, neuropsychological and endocrine factors.

Method. The sample included N=297 adult individuals with GD and N=41 healthy controls (problematic gambling). They were evaluated through a semi-structured clinical interview, self-reported psychometric assessments, and a protocolized neuropsychological battery aimed at assessing working memory, cognitive flexibility, inhibition, decision making, and premorbid intelligence. The endocrine measures (ghrelin, liver antimicrobial peptide 2 [LEAP-2], leptin, and adiponectin) were obtained of the plasma concentrations through peripheral blood after an overnight fast.

Results. A profile including younger age, higher impulsivity, neuropsychological deficits and low LEAP-2 scores showed a higher predisposition for the onset of GD. Indirect links were identified, showing that neuropsychological characteristics and impulsivity play an important role in the pathogenesis of GD.

Conclusion. Our findings reinforce the heterogeneous nature of GD and provide updated information about the direct and indirect effects of neuroendocrine, sociodemographic and neuropsychological characteristics. Future research should explore the role of possible endophenotypic traits in GD with the aim of increasing clinical knowledge and characterisation of GD profiles, in order to contribute to the optimisation and precision of preventive and therapeutic interventions.

Keywords: Gambling disorder, Endocrine, Neuropsychology, Path analysis.

INTRODUCTION

Gambling disorder (GD) is an addictive disorder characterized by high levels of persistence and lack of control over gambling behaviour despite consequential distress and functional harm (including social isolation, financial problems, and concurrence with other physical and mental conditions). Nosology of this mental condition has largely changed during the last decade, and the last version of the *Diagnostic and Statistical Manual of Mental Disorders* DSM-5 (APA, 2013) reclassified GD in the same category as substance related disorders based on the similarities in the aetiology (neurobiological and other clinical features) and treatment outcomes (Potenza et al., 2019). The World Health Organization's *International Classification of Diseases* ICD-11 (WHO, 2021) also reclassified GD from an impulse control disorder to an addictive disorder, based on the empirical evidence providing support for the syndrome model of addiction (Kim & Hodgins, 2019; Kim et al., 2020; Shaffer et al., 2004). These taxonomies (DSM and ICD) recognize the dimensionality of excessive gambling in terms of severity: define clinically impaired gambling as GD and use the broader term "problem gambling" for subclinical states (gambling with some markers and harm consequences related to the disorder but without reaching the threshold for diagnosis). GD is also classified categories based on the number of endorsed symptoms (i.e. in mild-moderate-severe), although controversies persist regarding the diagnostic threshold (Weinstock et al., 2017).

The easy accessibility to multiple platforms for gambling facilitated by new technologies has contributed to a significant increase in the prevalence of GD, especially in highly vulnerable populations that find on the Internet a common means of communication and services (such as adolescence and young adulthood; Montiel et al., 2021). The current epidemiological research shows that cross-sectional prevalence for GD in developmental countries range between 0.12% to 5.8% and lifetime prevalence between 0.2% to 10.6% (Calado y Griffiths, 2016). These values are highly increased among highly vulnerable populations, such as homeless people (with rates of clinically significant pathological gambling and GD from 11.3% to 31.3%; Deutscher et al., 2023), and young age (young demographic between 18 50 35 years have shown 1.51 times higher likelihood; Dellosa & Browne, 2024).

In the etiological framework, GD is defined as a complex disorder in which multiple biological, psychological and social variables dynamically interact (Allami et al., 2021; Browne et al., 2019; Moreira et al., 2023). Most studies in the neurobiology area have concluded that the most similar patterns observed comparing GD to substance use disorders are the activation of brain areas related reward processes and lower functional connectivity in areas related to executive functions (such as those that contribute to attention, impulse control, cognitive

flexibility and decision making) (Fauth-Bühler and Mann, 2017; Lee et al., 2018; Palaus et al., 2017; Pan et al., 2018; Rash et al. 2016; Solé-Morata et al., 2022). These neurological deficits contribute to the onset of problematic gambling, the escalation to severe forms of GD, and to chronicity (Brevers et al., 2012; Grant et al., 2016; Takeuchi et al., 2022; Yücel et al., 2017).

Recent research also observed an overlap between neural systems implied in the motivation to consume food and alcohol/drugs abuse (Nestor & Ersche, 2024). It seems that the impact of the peripheral endocrine signals performing eating regulation processes could also exert effects on the mesolimbic dopamine transmission mediating the reward value of drugs (Cryan et al., 2019; Mayer et al., 2022). Moreover, since the hormones implicit in energy homeostasis have receptors across multiple neural structures, the endocrine system could contribute directly or indirectly to critical psychoneurological processes, and dysregulation across these neural circuits of the brain seems involved in critical stages of addictive behaviours (Koob & Volkow, 2016): a) reward processes, memory, learning and goal-relevant cues in the basal ganglia; b) craving and repetitive concerns (including obsessive thoughts) controlled by the prefrontal cortex and the insula; and c) negative moods and withdrawal involving the amygdala. This assumption is in the basis of current research assessing the links between endocrine and neurological markers involved in GD (Etxandi et al., 2023; Iovino et al., 2022; Mora-Maltas et al., 2024).

Firstly, ghrelin, whose fundamental function is to stimulate the secretion of growth hormone in the pituitary gland and promote the regulation of energy metabolism, could act in the reinforcement system in response to natural (food) and non-natural rewards. It is known that ghrelin could stimulate brain regions involved in attention, anticipation of pleasure, memory, motivation to perform certain behaviours, and impulsivity (Anderberg et al., 2016, Farokhnia et al., 2018, Vengeliene, 2013). Ghrelin has been related to alcohol craving (Simon et al., 2017), suggesting that this hormone may play a role in global reward processes. Current research has observed that ghrelin has predictive capacity on the severity of GD (Etxandi et al., 2022) and on the persistence in gambling despite losses (Sztainert, et al., 2018).

Secondly, it has also been observed that the liver-expressed antimicrobial peptide-2 (LEAP-2), an endogenous antagonist of the receptor for the growth hormone secretagogue receptor (GHSR; Ge et al., 2018) which biological property is blocking ghrelin's effects on food intake and hormonal secretion (Islam et al., 2020; Lu et al., 2021; Mani et al., 2019), could be related with processes related with executive functioning among animal and human models (Simon et al., 2017; Tian et al., 2023; Tufvesson-Alm et al., 2024a; Tufvesson-Alm et al., 2024b; Zhang et al., 2024). This has raised the likelihood that impairing interactions between

LEAP-2 and ghrelin may achieve a potential target for regulating addictive behaviors (with and without substances), through the key regulation role of the GHSR on the mesocorticolimbic pathway that modulates reward-related behaviors via ligand-dependent and ligand-independent actions (Cornejo et al., 2021). So far, LEAP-2 levels have been correlated with reaction times, responses during attentional control tasks, and impulsivity (Voight et al., 2021).

And thirdly, the adipocytokines (leptin and adiponectin) are cell signalling molecules produced by adipose tissue and distributed throughout different brain areas (mainly hippocampus and neocortex), that seem to play a role in impulsive responses, cognitive functioning and mood regulation (Cao et al., 2018). These molecules have also been related to cognitive functioning and mood regulation. Studies suggest that they could be biomarkers of disorders associated with substance use, and specifically with craving behaviour (Martinotti et al., 2017; Mehta et al., 2020). Associations between adipocytokines with severe physical and mental diseases have been reported (Clemente-Suárez et al., 2023), including addictive behaviours have been suggested (Sutin et al., 2013).

In summary, there is solid empirical evidence regarding the involvement of neurological factors in GD. It has also been suggested that certain endocrine factors could contribute to the presence and severity of GD, although this research area is still in a preliminary phase. Additionally, there is a significant need to comprehend the mechanisms and interactions between the diverse neuroendocrine variables implied on GD. The objective of this study was to identify the mediating links that contribute to the presence of GD, including neuropsychological and endocrine variables into a path analysis model.

METHOD

Participants

The groups were recruited for the study: a) a clinical sample including $n=297$ patients seeking treatment for GD related problems; and b) a population-based sample including $n=41$ healthy controls. The patients included in the clinical group were voluntarily attended at the Behavioural Addictions Unit of the Bellvitge University Hospital (Barcelona, Spain). The control group was composed of voluntarily attended patients of other services of the same hospital, concretely in podiatry and dentistry units.

Exclusion criteria were the presence of an organic mental disorder, an intellectual disability, a neurodegenerative disorder (such as Parkinson's disease) or an active psychotic disorder.

Assessments

Clinical variables

Diagnostic Questionnaire for Pathological Gambling According to DSM criteria (Stinchfield, 2003). This is a 19-items self-report questionnaire, used to assess the diagnosis of GD according to the DSM-5 criteria (APA, 2013). The Spanish adaptation of the questionnaire obtained satisfactory psychometric properties ($\alpha = 0.81$ for a population-based sample and $\alpha = 0.77$ for a clinical sample) (Jiménez-Murcia et al., 2009). The internal consistency calculated in this study was excellent ($\alpha = 0.893$).

Symptom Checklist-90-Revised (SCL-90-R) (Derogatis, 1994). This is a 90-item self-report questionnaire used to obtain a broad range of psychological symptoms. The validation in Spanish population provided adequate psychometric evidence (Derogatis, 2002). This study analyzed the Global Severity Index (GSI), the overall most widely used measurement of psychological distress. The internal consistency in the study for this scale was excellent ($\alpha = 0.980$).

Impulsive Behavior Scale (UPPS-P) (Whiteside et al., 2005). This is a 59-item self-report scale that measures impulsive behavior. The Spanish validation of the scale showed good reliability and external validity (Verdejo-García et al., 2010). This study analyzed the total score. The internal consistency in the study was excellent ($\alpha = 0.933$).

Neuropsychological variables

Iowa Gambling Task (IGT) (Bechara et al., 1994): is a computerized task to evaluate decision-making, risk, and reward as well as punishment value. The participant must select 100 cards from four decks (i.e., A, B, C and D) and after each card selection, an output is given either a gain or a loss of money. The participant is instructed that the final aim of the task is to win as much money as possible. This test is scored by subtracting the number of cards selected from decks A and B from the number of cards selected from decks C and D. While decks A and B are not advantageous as the final loss is higher than the final gain, decks C and D are advantageous since the punishments are smaller. Higher scores point to better performance while negative scores point to persistently choosing disadvantageous decks.

Wisconsin Card Sorting Test (WCST) (Grant & Berg, 1948): is a task for assessing cognitive flexibility and inhibition control. It is compound by four stimulus cards and 128 response cards showing different shapes, colors, and numbers of figures in each one. The participant must match response cards with the stimulus cards in a way that it seems justifiable before receiving the feedback (i.e., correct, or incorrect). After ten sequential, correct answers

the categorization criteria changes. The number of complete categories, the percentage of perseverative errors and the percentage of non-perseverative errors are recorded.

Stroop Colour and Word Test (SCWT) (Golden, 1978): consists of three different lists. To begin with a word list containing the names of colours printed in black ink. After that a colour list that comprises letter “X” printed in colour. Finally, a colour-word list constituted of names of colours in a colour ink that does not match the written name. Three final scores are obtained based on the number of items that the participant can read on each of the three lists in a time of 45 seg. It assesses the ability to inhibit cognitive interference, which occurs when the processing of a stimulus feature affects the simultaneous processing of another attribute of the same stimulus.

Trail Making Test (TMT) (Reitan, 1958): consists of 25 circles spread out over two sheets of paper (Parts A and B). The participant is told to connect these circles drawing a line between consecutive numbers (part A) and alternating numbers and letters following a sequential order (part B). The task assesses visual conceptual and visual-motor tracking, entailing motor speed, attention, and the capacity to alternate between cognitive categories (set-shifting). Each part is scored according to the time spent to complete the task.

Wechsler Adult Intelligence Scale, 3rd edn (WAIS-III) (Wechsler, 1999). This is a widely used test, designed to measure cognitive ability in several areas (vocabulary, comprehension, arithmetic and reasoning skills). Two subtests were employed in this study: digits and vocabulary. The digits task provides a measure of attention and working memory, based on a sequence of numbers verbally presented by the examiners that individuals must repeat in sequential order. Vocabulary task assesses verbal comprehension and knowledge of words, based on a list of words presented orally and administered with increasing difficulty, that individuals must describe.

Neuroendocrine variables

A blood smear (peripheral blood test) was performed by venous aspiration with ethylenediamine tetraacetic acid (EDTA) (25 mM final concentration), requiring fasting for the previous eight hours. The blood was centrifuged at 1700g in a refrigerated centrifuge (4°C) for 20 minutes. Plasma was immediately separated from serum and stored at -80°C until analysis. Specific commercial kits were employed for the parameter determinations, in a single analysis to reduce inter-assay variability. The absorbances of each sample were measured in duplicate using a spectrophotometric microplate reader at a corresponding wavelength (Versamax microplate reader; Associates of Cape Cod Incorporated, East Falmouth, MA, EEUU).

Other clinical variables

The sociodemographic variables were registered with a semi-structured face-to-face clinical interview (Jiménez et al., 2006). The Hollingshead Four Factor Index measured the socioeconomic status of the participants, based on the marital status, retired/employed status, education level and occupational prestige (Hollingshead, 2011). The clinical interview also included items to assess gambling related variables such as the age of onset and duration of GD were also assessed and the gambling preferences.

Procedure

All participants were evaluated at the arrival to the treatment unit of the hospital. Clinicians with high experience in the assessment and therapy of GD (including psychologist, psychiatrist and nurses) carried out the semi-structured clinical interview. Next, during a second session, the extraction of the biological samples took place, and participants completed the complete neuropsychological and clinical assessment. All the variables analyzed in this work were obtained at the baseline, prior to the treatment.

The biological samples were subsequently analyzed at the Singular Centre for Research in Molecular Medicine and Chronic Diseases, University of Santiago de Compostela-Institute for Health Research, Santiago de Compostela-CIMUS.

Statistical analysis

Path analysis was performed with Structural Equation Models (SEM), using STATA.18 for Windows. The robust procedure was employed for the parameter estimations, the rationale for the model specification was based in the theoretical background (empirical evidence, as summarized in the introduction section), and all the parameters were freely estimated. With the aim of achieving a more parsimonious model and maximizing statistical power, parameters without significant tests were removed and the model was respecified and refitted (Kline, 2005). In addition, and due the large number of psycho-neurological measures, a latent variable was defined for the global indexes obtained in the cognitive tasks. Adequate fit was considered for (Barret, 2007): root mean square error of approximation $RMSEA < 0.08$, comparative fit index $CFI > 0.90$, Tucker-Lewis index $TLI > 0.90$, and standardised root mean square residual $SRMR < 0.10$. The overall predictive capacity of the model was measured using the coefficient of determination (CD).

RESULTS

Descriptive for the sample

Table 1 displays the descriptives for the sample. Most participants were men, with low education levels, single and within mean-low to low social position indexes. The mean age was 49.3 years (SD=15.2). Among the clinical subsample, mean age of the onset of the GD was 29.1 years (SD=12.4), and the mean duration of the problematic gambling 5.2 years (SD=6.0).

--- Insert Table 1 ---

Path analysis

Figure 1 displays the path diagram with the standardized results of the SEM (complete results are showed in Table 2). Adequate fitting was obtained: RMSEA=0.02, CFI=0.998, TLI=0.995, and SRMR=0.057. The global predictive capacity was 0.422.

--- Insert Figur3 1 ---

--- Insert Table 2 ---

The latent variable achieved significantly contribution for all the global psychoneurological measures, and the signal of the coefficients indicated that higher scores in this latent construct are obtained for participant with the more difficulties in the cognitive performance.

The increased risk for the presence of GD was directly associated with younger age, higher impulsivity levels, more deficit in the neurological tests and lower level in the LEAP2. Disordered gambling also was correlated with higher global psychopathological distress.

Indirect-mediational links associated to increased likelihood of GD were also identified. First, younger age and lower social position indexes were related to higher impulsivity levels, and these profiles next contributed to increased risk for GD. Second, older age and lower social position indexes contributed to worse performance on the neurological tests, which were also two additional profiles contributing to the presence of GD. Third, younger age and being women decrease the leptin levels, and the lowest leptin values increased the impulsivity with the next contribution on increased risk of disordered gambling. Younger age also registered lower LEAP2 values, a profile that was also associated to higher risk of GD.

DISCUSSION

The mediating role of ghrelin in hedonic responses to alcoholic rewards has been previously observed (Lee et al., 2020). More specifically, ghrelin increase has been associated with alcohol use (Farokhnia et al., 2018), while ghrelin receptor antagonists could reduce

1 alcohol intake (Richardson et al., 2023). These effects have also been identified in other drugs,
2 such as cocaine use (You et al., 2022). This evidence suggests that dysregulation of ghrelin
3 across mesolimbic networks could impact on reward and motivational processes contributing
4 to craving and relapse in addictive behaviors. In addition, since ghrelin administration have
5 been related to decreases sensitivity to negative consequences of actions (Pietrzak et al., 2024),
6 this failure could contribute increasing the negative consequences of clinically impairing
7 gambling (such as poor work performance, absenteeism, loss of social relationships, financial
8 problems, and even illegal acts to finance gambling).

9 This study observed that younger individuals with higher levels of impulsivity,
10 neuropsychological deficits, and lower levels of LEAP2 are at greater risk of GD. Current
11 research has reported a positive relationship between endocrine and neurological markers
12 implicated in pathological gambling (Etxandi et al., 2023; Iovino et al., 2022; Mora-Maltas et
13 al., 2024). It is known that hormones involved in energy homeostasis have receptors in multiple
14 neuronal structures, so the endocrine system could contribute directly or indirectly to the
15 dysfunction of neuropsychological processes that would be implicated in addictive behaviors
16 (Koob and Volkow, 2016).

18 **Limitations and strengths**

19 One of the difficulties in interpreting the results is the cross-sectional nature of the data,
20 which prevents to determine the causality of the relationships. Furthermore, the clinical sample
21 was composed primarily of men (although it should be noted that the representation of women
22 in the study is consistent with prevalence estimates in clinical samples seeking treatment for
23 GD).

24 The main strengths are the use of path analysis and the inclusion of a large set of
25 predictors, including sociodemographic, neuropsychological, and neuroendocrine factors. Any
26 case, future longitudinal studies are needed with more heterogeneous samples and analyzing
27 larger datasets with variables from different functional areas. These works will allow for more
28 realistic models of the aetiology of GD.

30 **Conclusion**

31 This study provides empirical evidence on the explanatory mechanisms of GD,
32 including sociodemographic, neuropsychological, and endocrine characteristics. The results
33 reinforce the role of the endocrine system in GD, and suggest its target for more precise

interventions, with new promising scenarios that complement psychological with pharmacological treatments.

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1 **Table 1** Descriptive for the sample

		Clinical (<i>n</i> =41)		Community Clinical (<i>n</i> =297)		<i>p</i>
		<i>n</i>	%	<i>n</i>	%	
Sex	Women	4	9.8%	19	6.4%	.423
	Men	37	90.2%	278	93.6%	
Education	Primary	7	17.1%	157	52.9%	<.001*
	Secondary	15	36.6%	112	37.7%	
	University	19	46.3%	28	9.4%	
Marital status	Single	17	41.5%	158	53.2%	<.014*
	Married	23	56.1%	103	34.7%	
	Divorced	1	2.4%	36	12.1%	
Social index	High	0	0.0%	8	2.7%	<.005*
	Mean-high	2	4.9%	19	6.4%	
	Mean	3	7.3%	24	8.1%	
	Mean-low	28	68.3%	113	38.0%	
	Low	8	19.5%	133	44.8%	
		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
Chronological age		49.27	15.23	39.58	14.16	<.001*

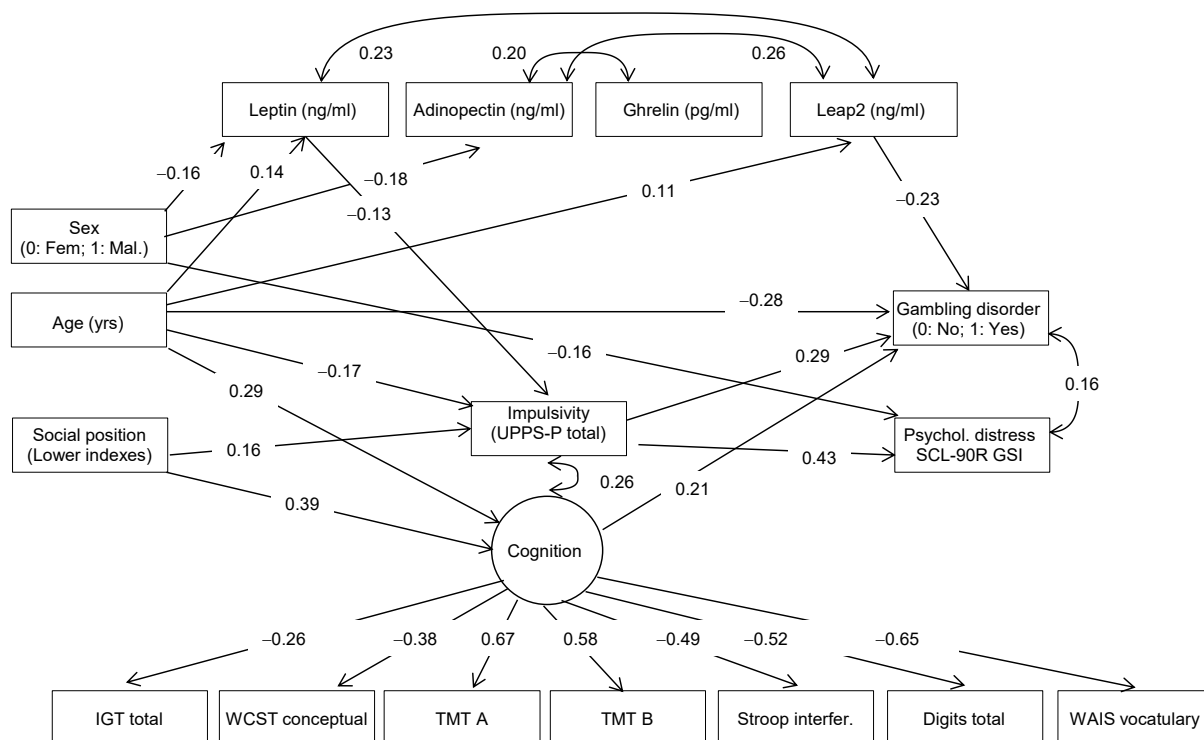
2 Note. GD: gambling disorder. SD: standard deviation.

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1 **Table 2** Complete results obtained in the SEM

Structural		<i>Std. Coeff.</i>	<i>SE</i>	<i>z-stat</i>	<i>p</i>	<i>95%CI</i>	<i>Std. Coeff</i>
SCL-90R GSI	UPPS-P total	0.4291	0.0411	10.43	<0.001	0.3485	0.5098
	Sex (0:female; 1:male)	-0.1588	0.0583	-2.72	.006	-0.2730	-0.0446
Leptin	Sex (0: female; 1:male)	-0.1551	0.0762	-2.04	.042	-0.3044	-0.0058
	Age	0.1361	0.0595	2.29	.022	0.0194	0.2528
Adiponectin	Sex (0: female; 1:male)	-0.1772	0.0670	-2.64	.008	-0.3086	-0.0458
UPPS-P total	Leptin	-0.1252	0.0563	-2.22	.026	-0.2356	-0.0148
	Age	-0.1655	0.0478	-3.46	.001	-0.2593	-0.0718
	Social position	0.1585	0.0524	3.02	.002	0.0558	0.2613
GD (0:no; 1:yes)	UPPS-P total	0.2867	0.0438	6.55	<0.001	0.2009	0.3725
	LEAP2	-0.2321	0.0503	-4.61	<0.001	-0.3308	-0.1335
	Cognition	0.2100	0.0503	4.18	<0.001	0.1114	0.3085
	Age	-0.2806	0.0576	-4.87	<0.001	-0.3934	-0.1678
LEAP-2	Age	0.1056	0.0506	2.09	.037	0.0063	0.2049
Cognition	Age	0.2890	0.0711	4.06	<0.001	0.1496	0.4284
	Social position	0.3857	0.0468	8.24	<0.001	0.2940	0.4774
Measurement		<i>Std. Coeff.</i>	<i>SE</i>	<i>z-stat</i>	<i>p</i>	<i>95%CI</i>	<i>Std. Coeff</i>
	IGT total	-0.2657	0.0634	-4.19	<0.001	-0.3901	-0.1414
	WCST conceptual	-0.3785	0.0686	-5.52	<0.001	-0.5130	-0.2440
	TMT A	0.6871	0.0752	9.13	<0.001	0.5397	0.8345
	TMT B	0.5777	0.0643	8.99	<0.001	0.4517	0.7037
	Stroop interference	-0.4951	0.0627	-7.89	<0.001	-0.6181	-0.3722
	Digits total	-0.5234	0.0702	-7.45	<0.001	-0.6610	-0.3857
	Wais vocabulary	-0.6483	0.0573	-11.31	<0.001	-0.7607	-0.5360
Covariances		<i>Std. Coeff.</i>	<i>SE</i>	<i>z-stat</i>	<i>p</i>	<i>95%CI</i>	<i>Std. Coeff</i>
	SCL-90R GSI, GD	0.1577	0.0416	3.79	<0.001	0.0761	0.2393
	Ghrelin, Adiponectin	0.1970	0.0489	4.03	<0.001	0.1012	0.2929
	Leptin, LEAP2	0.2294	0.0567	4.05	<0.001	0.1183	0.3405
	Adiponectin, LEAP2	0.2611	0.0513	5.09	<0.001	0.1606	0.3617
	UPPS-P total, Cognition	0.2569	0.0638	4.03	<0.001	0.1318	0.3820

2 *Note.* Std.Coeff.: Standardized coefficients. SE: standard error. 95%CI: 95% confidence interval.3
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1 **Figure 1** Path diagram with the standardized coefficients2 **Note.** Only significant coefficients retained in the final model. Results adjusted by body mass index.

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