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The risk and development of work disability among individuals with gambling disorder: a longitudinal case–cohort study in Sweden

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Abstract

Background. This longitudinal register study aimed to investigate the association between gambling disorder (GD) and work disability and to map work disability in subgroups of individuals with GD, three years before and three years after diagnosis.

Methods. We included individuals aged 19–62 with GD between 2005 and 2018 ($n = 2830$; 71.1% men, mean age: 35.1) and a matched comparison cohort ($n = 28\,300$). Work disability was operationalized as the aggregated net days of sickness absence and disability pension. Generalized estimating equation models were used to calculate adjusted odds ratios (AORs) and 95% confidence intervals (CIs) for the risk of long-term work disability (>90 days of work disability/year). Secondly, we conducted Group-based Trajectory Models on days of work disability.

Results. Individuals with GD showed a four-year increased risk of long-term work disability compared to the matched cohort, peaking at the time of diagnosis (AOR = 1.89; CI 1.67–2.13). Four trajectory groups of work disability days were identified: *constant low* (60.3%, 5.6–11.2 days), *low and increasing* (11.4%, 11.8–152.5 days), *medium–high and decreasing* (11.1%, 65.1–110 days), and *constant high* (17.1%, 264–331 days). Individuals who were females, older, with prior psychiatric diagnosis, and had been dispensed a psychotropic medication, particularly antidepressants, were more likely to be assigned to groups other than the *constant low*.

Conclusion. Individuals with GD have an increased risk of work disability which may add financial and social pressure and is an additional incentive for earlier detection and prevention of GD.

Introduction

In recent years, growing attention has been given to problem gambling and its negative impact on individuals, their families, and society (Calado & Griffiths, 2016; Hodgins, Stea, & Grant, 2011). Survey studies report that between 0.12 and 5.8% of adults worldwide have identified as having problem gambling in the past year (Calado & Griffiths, 2016). During recent years, the availability of gambling opportunities has increased due to the transition towards online gambling (Pallesen et al., 2021); individuals who previously might not have entered traditional gambling arenas, such as casinos or betting shops, now have easy access to gambling through online sites and smartphones (Bowden-Jones et al., 2022).

The diagnosis corresponding to severe problem gambling – gambling disorder (GD) – is a psychiatric condition characterized by persistent and problematic past-year gambling that leads to financial and social consequences. Even though the incidence of GD diagnoses in healthcare has slowly increased during the past 5–10 years, fewer than 1% of individuals in the adult population who are potentially above the threshold for a GD diagnosis have received a diagnosis in specialized healthcare, e.g. psychiatry or addiction care (Grönroos, Salonen, Latvala, & Kouvonen, 2022; Larsson & Håkansson, 2022; Leino, Torsheim, Griffiths, & Pallesen, 2023). Hence, GD is severely underdiagnosed and undertreated in healthcare settings and has been described as a 'hidden addiction' often going undetected (Downs & Woolrych, 2010).

Individuals with GD are at increased risk of harm for a wide range of health and psychosocial issues (Langham et al., 2015), including premature mortality (Karlsson & Håkansson, 2018), suicide (Wardle & McManus, 2021), psychiatric comorbidity (Dowling et al., 2015),

financial stress (Koomson, Churchill, & Munyanyi, 2022; Muggleton et al., 2021), crime (Adolphe, van Golde, Gainsbury, & Blaszczynski, 2019), and functional disabilities (Jacob et al., 2022). GD has also been linked to gambling-related harms in the work-related areas, such as loss of productivity, fraud, and embezzlement (Adolphe et al., 2019; Binde, Cisneros Örnberg, & Forsström, 2022), and risk of unemployment (Castrén, Kontto, Alho, & Salonen, 2018). However, studies on whether GD is associated with work disability are sparse. A registered study reported that women diagnosed with GD had a five-fold increased risk of receiving sickness compensation than sex- and age-matched controls. The corresponding risk among men with GD was more than four-fold (Larsson & Håkansson, 2022). However, this study did not examine whether sickness absence was long-term, and associations were not adjusted for important socioeconomic and health-related confounders, which could lead to an overestimation of associations. In addition, individuals with GD are known as a heterogeneous population in terms of their developmental pathways (Blaszczynski & Nower, 2002) and clinical characteristics (Hodgins et al., 2011). Specific subgroups, such as women and socioeconomically marginalized individuals, may be more vulnerable to the harmful effects of GD (Abbott, 2020; Bowden-Jones et al., 2022), and work functioning may thus vary accordingly. This diversity needs to be considered, e.g. by applying statistical models that allow for richness and complexity in the data.

Having the ability to work is an essential indicator of well-being and functioning and forms a crucial part of many adults' everyday life and personal finances. A potential link between GD and work disability is thus a major concern, given that long-term work disability is linked to several adverse effects on psychological well-being and leisure activities (Floderus, Goransson, Alexanderson, & Aronsson, 2005), marginalization from the labour market (Hultin, Lindholm, & Möller, 2012), and an increased risk of mortality (Bryngelson, Åsberg, Nygren, Jensen, & Mittendorfer-Rutz, 2013).

Therefore, this study addressed the research gap by (1) comparing the risk of work disability among adults diagnosed with GD in specialized healthcare to a matched comparison group sampled from the general population; (2) exploring the heterogeneity and longitudinal development of work disability during the three years before and three years after a GD by identifying trajectory groups among individuals diagnosed with GD; and (3) examining which socioeconomic and health-related factors are associated with varying degrees of work disability among individuals with GD. Using several registers with national coverage that combine clinician-validated diagnoses with real-world data on work disability, offers opportunities to track changes over time and to control for potential confounders.

Materials and methods

Registers

We used data from linked high-quality health, demographic, and social insurance registers where the national personal identity number has been replaced with a serial number (Ludvigsson et al., 2016). A detailed description of the variables extracted and data preparation is available in online Supplementary Table S1 (pp. 1–2). The following registers were linked:

The longitudinal integrated database for health insurance and labour market studies (Ludvigsson, Svedberg, Olén, Bruze, & Neovius, 2019) was used for data on sex, age, highest educational attainment status of gainful employment, family status, disposable income, living area, and country of birth. *The National Patient Register* (NPR) provided data on diagnosed GD, psychiatric, and somatic disorders. The NPR includes diagnoses from hospital admissions and outpatient contacts within specialized care in Sweden. *Micro-data for analyses of the social insurance* (MiDAS) contains data on all sick-leave spells as well as disability pensions and their associated diagnoses.

Dispensed medications were extracted from the *Swedish Prescribed Drug Register*, which includes information on drugs prescribed from primary and secondary care, and dispensed at pharmacies in Sweden, with less than 0.3% missing data (Wettermark et al., 2007). We extracted data on dispensed antidepressants hypnotics, anxiolytics, drugs used in addictive disorders, and psychostimulants. Dispensed psychotropic medications were measured three years before GD diagnosis and three years after.

Study population

We included individuals of working age, i.e. 19–62 years, who received a GD diagnosis (defined as 'pathological gambling', code F63.0 in the International Classification of Diseases 10th revision, ICD-10) in specialized care (World Health Organization, 2018) between 2005 and 2018. The year 2005 was chosen as the starting point for GD due to the increased quality of psychiatric diagnoses in the NPR at this time (Håkansson, Karlsson, & Widinghoff, 2018), and the end-year to be able to track changes in work disability over three years, i.e. until 2021. For each patient with GD, 10 comparisons without GD in the registers between 2001 and 2020 were selected from the general population using exact matching: age (in years, at cohort entry), sex, highest educational attainment, country of birth, and living area. Matching variables were chosen based on their associations with both the exposure and the outcome in prior research (Moreira, Azeredo, & Dias, 2023; Salinas Fredricson et al., 2022). Individuals who emigrated or died during the study period were excluded.

Work disability

Work disability was defined as the net days of sickness absence and disability pension exceeding 14 days and was retrieved from the MiDAS register. During the first 14 days, sick leave benefits are paid by the employer, meaning that the MiDAS register contains all periods exceeding 14 days and shorter periods are not accounted for in the present study. Net work disability days were calculated by adding days on part-time sick leave, e.g. 20 days of 50% sick leave equalled 10 net days. An individual can receive a disability pension full-time, i.e. 100 or 75%, 50, or 25% of full-time. For the analysis of long-term work disability, we used a dichotomized outcome of 90 net days or more on sickness absence and disability pension during one year, as in previous studies (Floderus et al., 2005). We extracted six yearly points of work disability days in relation to the first registered GD diagnosis: GD − 3 (from −3 to −2 yr before GD), GD − 2 (from −2 to −1 yr before GD), GD − 1 (from −1 yr to the day before GD), GD + 1 (from the day of GD, to +1 yr after GD), GD + 2 (from +1 to +2 yr after GD) and GD + 3 (from +2 to +3 yr after GD).

Statistical analysis

A matched-cohort design was chosen as this design reduces confounding, improves comparability, and increases design efficiency,

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thus providing a more accurate estimate of the contribution of GD to the risk of work disability (Rothman, Greenland, & Lash, 2008). For the binary outcome of long-term work disability, we ran generalized estimating equations (GEE) (Liang & Zeger, 1986) with an autoregressive working correlation (AR1) and a logit link function. The AR1 structure was chosen after investigating fit statistics (Quasilikelihood Information Criterion) of correlation structures and an assumption that data points proximal in time will be highly correlated (online Supplementary material, p. 2 for fit statistics). We adjusted analyses for matching variables (i.e. sex, age, country of birth, education and degree of urbanization of the living area) to reduce bias that may be introduced by matching variables (Pearce, 2016; Sjölander & Greenland, 2013). We added covariates to the model in four steps. Model 1 was adjusted for age and sex. Model 2 added the highest educational attainment, status of gainful employment, family, living area, and country of birth. Model 3 added the number of prior somatic diagnoses, Model 4 added the number of prior psychiatric diagnoses, and Model 5 added dispensed psychotropic medications. Dispensed psychotropic medications were used to adjust for psychiatric symptoms treated outside of specialized care, as diagnoses from primary care are not included in the NPR. Psychiatric and somatic diagnoses in the GEE models were measured three years before GD up until the day of registered GD. Socioeconomic factors were measured the year before GD diagnosis. Models were checked for multicollinearity.

To map heterogeneity among the individuals with GD, we conducted zero-inflated Poisson Group-Based Trajectory Models (Nagin & Odgers, 2010). A zero-inflated Poisson model is appropriate when analysing count data with an excess of zero counts, as is the case with days of work disability. The model combines two components, a zero-inflated component modelling the odds of excess zero counts and a Poisson component models the remaining count process. The method identifies groups of individuals with similar patterns of net days of work disability per year over the study period. We then fitted models with one to eight trajectory groups with varying polynomial shapes (from linear to quartic). When selecting the optimal trajectory assignments, several diagnostic metrics were considered, including the Bayesian information criterion (BIC), the Akaike information criterion (AIC), the Average posterior probability of assignment (APPA), the mean squared error (MSE), relative entropy, and the and the odds of correct classification (OCC) (online Supplementary material, p. 3). Additionally, there was a focus on selecting trajectories that depicted a meaningful and parsimonious representation of data and provided sufficient power for the following analyses. Consequently, the choice of model was based on a combination of graphical presentations of trajectory groups and fit statistics that captured meaningful and interpretable trajectories (Nagin & Odgers, 2010). We then conducted multinomial logistic regression analyses to examine the associations between socioeconomic and health-related predictors (i.e. sex, age, family, country of birth, education, medication, psychiatric, and somatic diagnosis) and trajectory group assignment. Statistical analyses were conducted in R (R Core Team, 2019).

Sensitivity analysis

Due to a new legislative act in force from 1 January 2018, treatment accessibility for GD significantly expanded in Sweden (Berman, 2019), a circumstance that probably contributed to the increase in registered diagnoses during that year (registered diagnoses in 2018, $n = 585$, as compared to $n = 423$ during 2017 and $n = 328$ in 2016; see online Supplementary Fig. S2 for more details). To examine if individuals diagnosed in 2018 were differentially associated with work disability, five GEE models were run without the 2018 cohort. This yielded only marginal changes, and these individuals were included in the main analyses. Because over-adjustment could be an issue, additional GEE models were run. The sample showed an overall high prevalence of psychiatric disorders. We, therefore, ran additional models; one where each diagnostic category was entered separately (Model 6), one where prior substance use disorders and prior psychotropic medications were added (Model 7), and one where we repeated the full model (Model 5) but excluded the most common psychiatric disorders among individuals with GD, i.e. anxiety and mood disorders (Model 8) (online Supplementary material, p. 3).

Results

The study included 2830 individuals with GD and 28 300 in the unaffected matched cohort (Table 1). Individuals with GD were more commonly from single households compared to the matched cohort, and fewer were gainfully employed at baseline. The most common psychiatric diagnoses leading to sickness absence among individuals with GD were depressive episodes ($n = 474$), followed by reactions to severe stress and adjustment disorders ($n = 298$) and anxiety disorders ($n = 283$). The most common diagnoses behind disability pension were personality disorders ($n = 61$), behavioral and emotional disorders with onset usually occurring in childhood and adolescence ($n = 59$), and pervasive developmental disorders ($n = 53$).

Individuals with GD had a higher prevalence of all psychiatric disorders (Table 2). Among individuals with GD, 72.5% had been diagnosed with a psychiatric disorder during the three years leading up to GD, compared to 9.7% among the matched cohort. Anxiety disorders were the most common diagnostic category (41%), followed by mood disorders (36.2%) and alcohol use disorders (19.1%). Rates of dispensed psychotropic medications were also higher among individuals with GD, with antidepressants being the most common medication prior to GD, both among individuals with GD (48.4%) and the matched cohort (12.4%). Having any somatic disorder prior to GD was also more common among individuals with GD (75.5% *v.* 56.1%), and individuals with GD presented a higher prevalence rate of injuries (30.8% *v.* 16.8%) prior to their GD diagnosis.

Prevalence rates of somatic and psychiatric diagnoses remained similar after the incident GD diagnosis, except for a slight decrease in suicide attempts (from 10% to 7.7%), an increase in ADHD diagnoses (from 10% to 12.9%), dispensed psychostimulants (from 8.2% to 11.8%), and dispensed medications for treating substance use disorders (from 8.6% to 14.6%). Prevalence rates of somatic disorders remained similar, while the proportion of injuries among individuals with GD decreased after GD diagnosis (from 30.9% to 25.8%).

Work disability

Among individuals with GD, the proportion with long-term work disability increased steadily during the years leading up to diagnosis, from 20.9% three years prior to 22.0% two years prior to GD and peaking the year before the incident GD diagnosis (33.6%). In the years following GD, long-term work disability remained elevated (28.9% two years post-GD, and 28.3% three years

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Table 1. Characteristics of individuals with gambling disorder (GD) and controls matched on sex, age, country of birth, education, and degree of urbanization of the living area

	GD individuals *n* (%)	Controls *n* (%)
N	2830	28 300
Sex*		
Women	649 (22.9%)	6490 (22.9%)
Men	2181 (77.1%)	21 810 (77.1%)
Age* – mean (s.d.)	35.1 (10.4)	35.1 (10.4)
19–24	459 (16.2%)	4590 (16.2%)
25–34	1056 (37.3%)	10 560 (37.3%)
35–44	732 (25.9%)	7320 (25.9%)
45–54	446 (15.8%)	4460 (15.8%)
>55	137 (4.8%)	1370 (4.8%)
Country of birth*		
Sweden	2221 (78.5%)	22 210 (78.5%)
Europe (not Sweden)	268 (9.5%)	2680 (9.5%)
Outside of Europe	341 (12.0%)	3410 (12.0%)
Education*		
0–9 years	733 (25.9%)	7330 (25.9%)
10–12 years	1610 (56.9%)	16 100 (56.9%)
>12 years	487 (17.2%)	4870 (17.2%)
Degree of urbanisation of living area*		
Cities	1301 (46.0%)	13 010 (46.0%)
Towns and suburbs	1134 (40.1%)	11 340 (40.1%)
Rural areas	395 (14.0%)	3950 (14.0%)
Disposable income, median (IQR) in SEK	194 300 (127 250–270 600)	219 700 (133 600–293 100)
Has gainful employment at baseline	1891 (66.8%)	21 851 (77.2%)
Family		
Married or cohabiting without children	594 (21.0%)	9272 (32.8%)
Married or cohabiting with children	124 (4.4%)	2433 (8.6%)
Single without children	1954 (69.0%)	15 464 (54.6%)
Single with children	158 (5.6%)	1131 (4.0%)
⩾ one long-term WD (>90 days/year) during the study period	1325 (46.8%)	4492 (15.9%)

post-GD). Among the matched cohort, long-term work disability remained stable throughout the study period, with about 8% with long-term work disability each year (online Supplementary Tables S6 for cases and S7 for the matched cohort).

Associations between GD and long-term work disability

Table 3 displays GEE models for long-term sick leave by pairwise comparisons between individuals with GD and the matched cohort with stepwise adjustments for sociodemographic and health factors. Adjusted odds ratios (AORs) are presented for each of the six time points. In the first three models, Model 1 (adjusted for age and gender), Model 2 (added adjustment for education, gainful employment, and living area), and Model 3 (added adjustment for the number of somatic diagnostic categories), we found an increased risk for work disability across all time points in the cohort with GD. AORs for long-term work disability were the highest in the year following GD diagnosis (an approximate five-fold increased risk) and remained increased up to three years after (an approximate four-fold increased risk). In Model 4 (added adjustment for the number of psychiatric comorbidities), a two-fold increased risk of work disability remained in the year following GD (AOR = 2.04 [1.81–2.31]), and associations remained similar in the two years after. In the fully adjusted Model 5 (added adjustment for dispensed psychotropic medications), we found an elevated risk for work disability starting from the year prior to GD diagnosis (AOR = 1.89 = [1.67–2.13]).

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Table 2. Diagnoses and dispensed psychotropic medications during the three years prior and three years after registered gambling disorder (GD)

	Before		After	
	GD	Controls	GD	Controls
	n (%)	*n* (%)	*n* (%)	*n* (%)
Somatic diagnoses (ICD code)				
Any somatic diagnosis excluding childbirth (−O80 to O84)	2137 (75.5%)	15 865 (56.1%)	2056 (72.7%)	14 716 (52.0%)
Cancer (C00–C97, D00–D48)	127 (4.5%)	1263 (4.5%)	133 (4.7%)	1182 (4.2%)
Diabetes (E10–E14, O24, R73)	56 (2.0%)	443 (1.6%)	71 (2.5%)	505 (1.8%)
Cardiovascular diseases (I05–I15, I20–I28, I30–I52, I60–I89, I95–I99)	167 (5.9%)	1097 (3.9%)	197 (7.0%)	1216 (4.3%)
Injuries (S00–T98)	873 (30.8%)	4747 (16.8%)	730 (25.8%)	4097 (14.5%)
All other somatic diagnoses (excl. childbirth; O80–O84)	1069 (37.8%)	9171 (32.4%)	1133 (40.0%)	8598 (30.4%)
Psychiatric diagnoses (ICD code)				
Any psychiatric diagnosis except F63.0, i.e. GD (F00–F99)	2052 (72.5%)	2757 (9.7%)	1844 (65.2%)	2731 (9.7%)
Anxiety disorders (F40–F48)	1161 (41.0%)	1270 (4.5%)	1053 (37.2%)	1256 (4.4%)
Mood disorders (F30–F39)	1024 (36.2%)	958 (3.4%)	983 (34.7%)	943 (3.3%)
Alcohol use disorder (F10)	541 (19.1%)	428 (1.5%)	455 (16.1%)	405 (1.4%)
Drug use disorders (except nicotine) (F11–F16, F18, F19)	401 (14.2%)	513 (1.8%)	430 (15.2%)	485 (1.7%)
Personality disorders (F60–F69, not F63.0)	312 (11.0%)	238 (0.8%)	358 (12.7%)	221 (0.8%)
Suicidal attempts and self harm (X6, X7, X80–X84, Y1, Y2, Y30–Y34)	282 (10.0%)	253 (0.9%)	219 (7.7%)	193 (0.7%)
ADHD (F900)	282 (10.0%)	552 (2.0%)	366 (12.9%)	607 (2.1%)
Psychotic disorders (F20–F29)	145 (5.1%)	262 (0.9%)	160 (5.7%)	282 (1.0%)
Other (F00–F09, F50–F59, F70–F79, F80–89, F99)	225 (8.0%)	508 (1.8%)	258 (9.1%)	516 (1.8%)
Number of psychiatric diagnoses by category (0–9), mean (S.D.)	1.46 (1.34)	0.17 (0.60)	1.45 (1.46)	0.17 (0.60)
Dispensed drugs (ATC code)				
Antidepressants (N06A)	1370 (48.4%)	3509 (12.4%)	1567 (55.4%)	3735 (13.2%)
Hypnotics (N05C)	946 (33.4%)	2622 (9.3%)	1117 (39.5%)	2804 (9.9%)
Anxiolytics (N05B)	911 (32.2%)	2582 (9.1%)	912 (32.2%)	2523 (8.9%)
Drugs used in addictive disorders (N07B)	244 (8.6%)	457 (1.6%)	414 (14.6%)	518 (1.8%)
Psychostimulants (N06B)	233 (8.2%)	500 (1.8%)	333 (11.8%)	550 (1.9%)

Note. ICD, International Statistical Classification of Diseases; ATC, The Anatomical Therapeutic Chemical Code.
Sorted from most to least common among individuals with GD.

We carried out a sub-analysis where we examined the contribution of each covariate to the risk of long-term work disability (Fig. 1; see online Supplementary Table S4 for details on AORs, CIs and *p* values). Results showed that female sex, being born outside of Sweden, lower education, and living outside of a city increased the risk of long-term work disability, while being married/co-habiting and having children decreased this risk. Furthermore, all prior psychiatric disorders and psychotropic medications, except substance use disorders and having medicated for addictive disorders, contributed to an increased risk of long-term work disability.

Trajectory groups of work disability among individuals with GD

We conducted zero-inflated Poisson Group-Based Trajectory Models to identify clusters of individuals with similar patterns of net days of work disability. After inspection of BIC, AIC, APPA, MSE, relative entropy, and OCC, we selected a quadratic-quadratic model with four trajectory groups for a parsimonious and distinct data description (see Fig. 2 and online Supplementary material, p. 5 for count model and probability of certain zero model components). The trajectory groups can be described as *constant low*, *low and increasing*, *medium–high and decreasing*, and *constant high work disability*, see below. Figure 2 displays the trajectory groups with net days of work disability as the dependent variable and time as the independent variable.

The majority (60.3%) were assigned to the *constant low* group with low levels of work disability days before and after the GD diagnosis (μ work disability days = 5.6 GD − 3, 11.2 work disability days at the time of GD and 7.3 work disability-days GD + 3). The *low and increasing* group (11.4%) started with low numbers of work disability days (μ work disability days = 11.8) GD − 3, which increased to μ 152.5 work disability days at the time of the GD diagnosis and increased further (μ work disability days

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Table 3. Pairwise comparisons of long-term sick leave between individuals with gambling disorder (GD; $N = 2830$) and matched controls ($n = 28\,300$) across six time points (three years before the incident GD diagnosis and three years after)

	Model 1	Model 2	Model 3	Model 4	Model 5
Timepoint	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
GD − 3	3.24 (2.93–3.59)	3.05 (2.74–3.39)	2.69 (2.41–3.00)	0.99 (0.86–1.13)	0.92 (0.81–1.05)
GD − 2	3.23 (2.92–3.57)	3.08 (2.78–3.42)	2.73 (2.45–3.03)	1.01 (0.88–1.15)	0.94 (0.83–1.06)
GD − 1	4.19 (3.81–4.60)	4.06 (3.67–4.49)	3.62 (3.27–4.01)	1.42 (1.25–1.61)	1.32 (1.17–1.48)
GD + 1	5.66 (5.17–6.20)	5.48 (4.95–6.05)	4.92 (4.45–5.45)	2.04 (1.81–2.31)	1.89 (1.67–2.13)
GD + 2	4.52 (4.11–4.96)	4.23 (3.83–4.67)	3.78 (3.42–4.19)	1.51 (1.34–1.71)	1.40 (1.24–1.58)
GD + 3	4.27 (3.88–4.69)	3.91 (3.54–4.32)	3.50 (3.16–3.87)	1.39 (1.22–1.57)	1.28 (1.13–1.44)

Note. AOR, adjusted odds ratios; Model 1, adjusted for age and gender; Model 2, Model 1 + education, status of gainful employment, degree of urbanization of living area, family, country of birth; Model 3, Model 2 + number of somatic diagnoses categories; Model 4, Model 3 + number of psychiatric diagnoses; and Model 5 = Model 4 + prior psychotropic medication.

= 211.1 at GD + 3). The *medium high and decreasing* group (11.1%) started at a medium-high level of work disability (μ work disability days = 97.9), with a slight increase at the time of GD diagnosis (μ work disability days = 110) and after that, a decrease to μ 65.1 work disability at GD + 3. Lastly, the *constant high* group (17.1%) had high levels of work disability three years prior to GD (μ work disability days = 264) and remained high throughout the study period, μ work disability days = 331 at GD + 1, and μ work disability days = 321 at GD + 3.

Table 4 describes the characteristics of each trajectory group and the AORs and 95% CIs for predictors of group assignment, using the *constant low* as a reference group (online Supplementary material, p. 5 for a crude model). The constant low group was characterized by a large proportion of males (84.2%), younger individuals (mean age: 33.4), and a higher proportion of individuals with high educational attainment (>12 years) compared to the other trajectory groups. Compared to the *constant low*, the *low and increasing* group included slightly older individuals, more females, and a smaller proportion of individuals with high educational attainment. The *medium high and decreasing* group contained 33.2% females with more prior diagnoses and medications compared to the *constant low* but did not differ on educational level.

Individuals in the *constant low* group included more males of younger age, lower proportions of psychiatric and somatic comorbid diagnoses and psychotropic medications than the other three trajectory groups. The *low and increasing* group had the highest proportion of individuals with dispensed medications for treating addictive disorders before their GD diagnosis (14.3% *v.* 8.6% overall). About half of the individuals in this group had been diagnosed with a mood disorder (51.9% *v.* 36.2%) or anxiety disorder (55% *v.* 41% overall) before their GD diagnosis. The *constant high* group showed higher proportions of all health-related covariates, psychiatric, somatic diagnoses, and prior psychotropic medications.

Discussion

The current longitudinal case–cohort study using Swedish national registers found that individuals with a GD diagnosis had an increased risk of long-term work disability. The risk was elevated from the year before the individuals received their incident GD diagnosis, peaked at the year of the diagnosis, and showed only a slight decrease in the subsequent two following years. However, the patterns of work disability were heterogeneous in the cohort. We identified four distinct trajectory groups with differing patterns of work disability, where the *constant low* was the largest group at 60.3%. The *low and increasing* group demonstrated a slight increase in work disability throughout the study period. In contrast, the increase of the *constant high* and *medium-high and decreasing* slopes was interrupted after the GD diagnosis was registered.

Prior psychiatric diagnoses were a predictor of long-term work disability and for assignment to a work disability trajectory group other than the *constant low*. Moreover, female sex, older age, and use of psychotropic medications – in particular, antidepressants – were covariates associated with an increased risk of long-term work disability and for not being assigned to the *constant low* group. Having fewer years of education was strongly associated with being assigned to the *low and increasing* or the *constant high* work disability groups.

The peak of work disability at the time of the incident GD diagnosis may reflect an accumulation of impairment and mental health problems until a tipping point. Previous research shows that individuals with GD can present in healthcare settings for other psychiatric problems, downplaying the role of their GD (Bijker, Booth, Merkouris, Dowling, & Rodda, 2022; Bowden-Jones et al., 2022). Financial and relationship problems often drive help-seeking due to GD, and seeking treatment can sometimes be the last resort after many years of gambling problems (Bijker et al., 2022; Medeiros, Redden, Chamberlain, & Grant, 2017).

In addition to deteriorating financially and socially, long-term work disability is, at worst, linked to increased suicidal behaviour (Wang et al., 2014). Periods off-work might also impact gambling habits. A Norwegian study (Pallesen et al., 2021) showed that having a disability pension or work assessment allowances predicted participating in online gambling, adding to the risk of work disability. However, the prevalence of work disability was unevenly distributed in our study. The heterogeneous patterns identified showed that certain groups, e.g. individuals with psychiatric and somatic comorbidities or use of psychotropic medications, females, and individuals with lower education, were more at risk of a constant high or increasing work disability. Epidemiological research has shown that having a substance use disorder and being male were the strongest predictors of problem gambling (El-Guebaly et al., 2006). In the present study, however, these factors were not associated with an increased risk of subsequent work disability, tentatively due to restrictive practices for sick leave spells for individuals with substance use disorders. It

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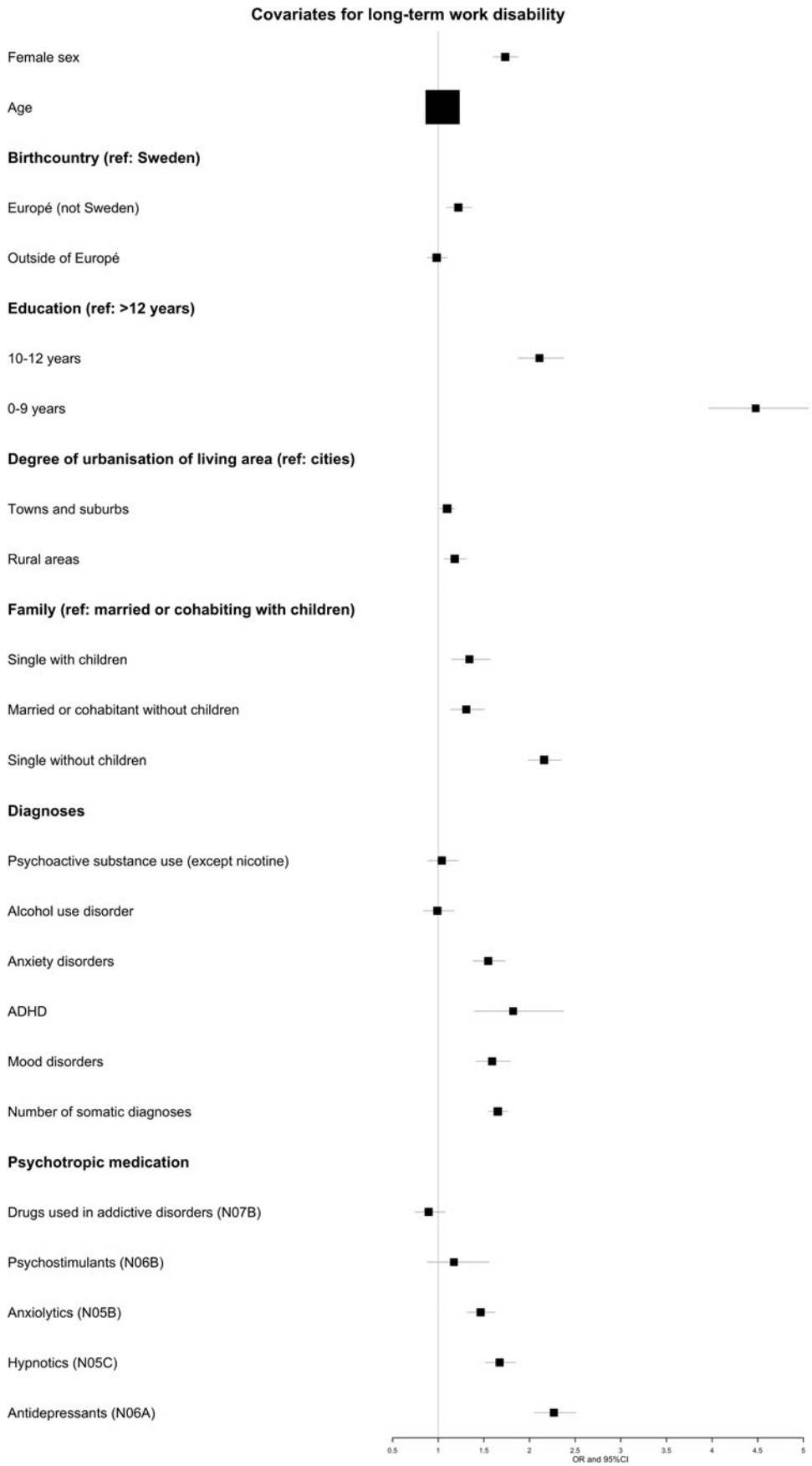

Figure 1. Forest plot of covariates for long-term work disability (>90 days/year).

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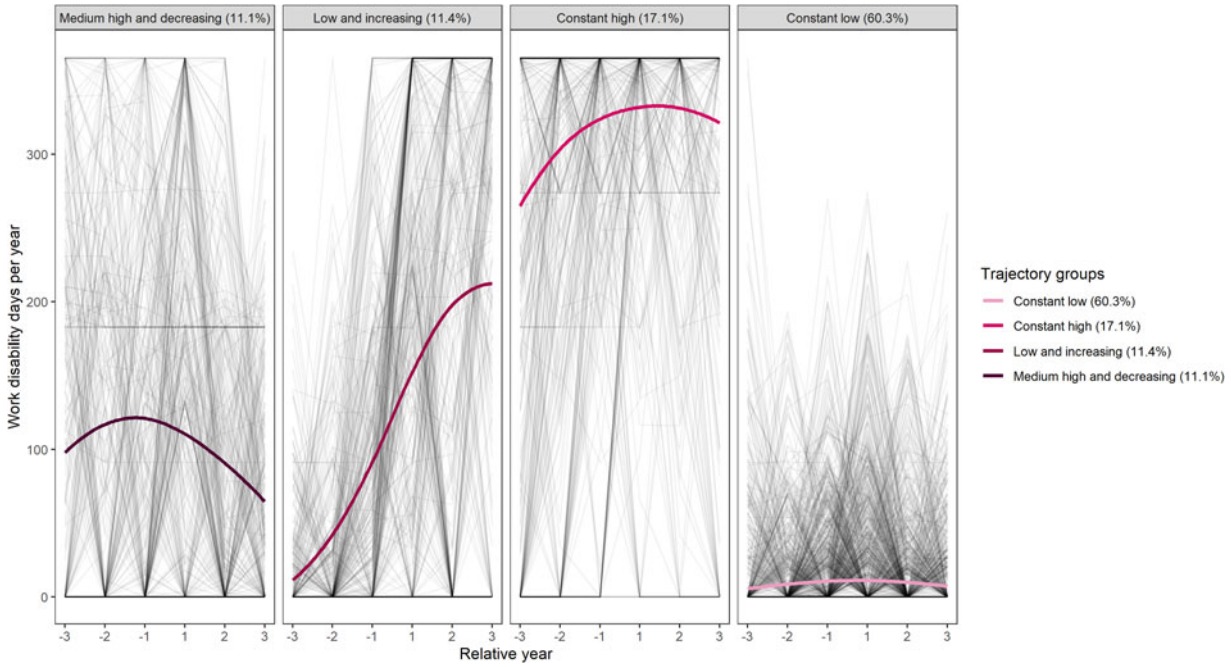

Figure 2. Four trajectory groups with work disability days on the *y*-axis and years relative to GD diagnosis on the *x*-axis. $N = 2830$.

is worth noting that the risk of long-term work disability increased in less urbanized areas (Fig. 1), perhaps due to lower access to specialized healthcare or other area-level risk factors, such as neighborhood deprivation. A study from the UK reported that problem gambling tends to cluster in socioeconomically deprived areas (Carrà, Crocamo, & Bebbington, 2017); however, data on neighbourhood deprivation was not available in the present study.

Our results showed that females were more common in all trajectory groups other than the *constant low and* were particularly over-represented in the *constant high* group (37.7%). Recent prevalence studies show a slight increase in middle-aged women with GD (Public Health Agency, 2019). GD among females has been associated with more psychological distress, psychiatric comorbidity, childhood trauma, and unemployment (Merkouris et al., 2016; Petry, Stinson, & Grant, 2005). In addition, females tend to engage more in high-risk gambling formats, e.g. online casino games (Håkansson, Mårdhed, & Zaar, 2017) that allow for quick and continued play and are associated with problem gambling (Binde, Romild, & Volberg, 2017). This could result in increased gambling-related harms among females, including work disability.

On the other hand, most individuals in the GD cohort demonstrated low work disability throughout the study and were assigned to the *constant low* group (60%). In addition, except for the *low and increasing* group, the increasing slope of work disability was interrupted among the *constant high* and *medium-high and decreasing* groups at the point of registered GD, indicating a positive shift in the trend. There was also a reduction in suicidal attempts and injuries after a GD diagnosis, which could result from GD being recognized and addressed in specialised care. Other actions coinciding with treatment-seeking could also have an impact, such as self-exclusion from gambling (Håkansson & Widinghoff, 2020), taking financial measures, and being more open to peers and family about GD.

Strengths and limitations

The study has several strengths: We used validated high-quality registries with nationwide coverage and adjusted associations for important health-related and sociodemographic confounders. We included all working-age individuals in Sweden diagnosed with GD in specialized care and observed their work disability for six years. However, some limitations need to be addressed. Firstly, there are no data on the first 14 days of sickness absence of employed individuals in the MiDAS register, since sickness benefits are paid by the employer for sick leave periods shorter than 14 days. This yields an underestimation of work disability, and individuals with sick leave periods below 14 days may be misclassified as having no work disability. Secondly, individuals with GD in specialized healthcare represent a selected cohort. Overall, an estimated 7–12% of individuals with GD seek help (Suurvali, Cordingley, Hodgins, & Cunningham, 2009), and a much smaller fraction do so within specialized healthcare, which impacts the generalizability of the results. The present study does not include primary care or individuals seeking help outside the healthcare system, e.g. via social services, self-help groups, or anonymous gambling helplines. Nevertheless, the risk of misclassification of GD is likely very low since the GD diagnosis is mainly registered by medical doctors specialized in psychiatry, working in settings where GD is diagnosed and treated.

On the other hand, the study captured information on healthcare contacts and long-term work disability among those who seek treatment, reflecting real-world outcomes that consume measurable resources. Finally, disentangling the role of comorbid psychiatric conditions in the analyses is a challenge. In the present study, the actual onset of gambling problems was not known, but only when the GD was first diagnosed; therefore, assuming a directionality in the association is not possible, despite the temporal relationship in the register data. Psychiatric comorbidity could theoretically be a mediator on a causal path, e.g. GD could be

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Table 4. Work disability trajectory groups among individuals with gambling disorder (GD; *N* = 2830) and predictors of trajectory assignment using the *Constant low* as reference group

	Constant low (ref)	Medium high and decreasing		Low and increasing		Constant high	
	N = 1713	*N* = 310		*N* = 322		*N* = 485	
Attributes	*n* (%)	*n* (%)	AOR (95% CI)	*n* (%)	AOR (95% CI)	*n* (%)	AOR (95% CI)
Female sex	270 (15.8%)	103 (33.2%)	**1.92 (1.43–2.58)**	91 (28.9%)	**1.65 (1.22–2.23)**	183 (37.7%)	**2.14 (1.62–2.81)**
Age, mean (s.d.)	33.4 (9.5)	36.8 (10.6)	**1.64 (1.21–2.22)**	36.0 (10.5)	**1.03 (1.01–1.04)**	39.5 (11.5)	**1.06 (1.05–1.08)**
Country of birth							
Sweden (reference)	1353 (79.0%)	254 (81.9%)	–	241 (74.8%)	–	373 (76.9%)	–
Europe	144 (8.4%)	32 (10.3%)	1.17 (0.76–1.79)	36 (11.2%)	1.36 (0.90–2.05)	56 (11.5%)	1.44 (0.97–2.14)
Other	216 (12.6%)	24 (7.7%)	0.64 (0.40–1.01)	45 (14.0%)	1.22 (0.84–1.77)	56 (11.5%)	1.06 (0.73–1.53)
Family							
Married or cohabitant with children (reference)	399 (23.3%)	70 (22.6%)	–	84 (26.1%)	–	41 (8.5%)	–
Married or cohabitant without children	63 (3.7%)	16 (5.2%)	0.94 (0.49–1.79)	13 (4.0%)	0.74 (0.37–1.46)	32 (6.6%)	**2.53 (1.37–4.64)**
Single without children	1172 (68.4%)	202 (65.2%)	0.96 (0.70–1.31)	203 (63.0%)	0.77 (0.57–1.04)	377 (77.7%)	**2.68 (1.84–3.89)**
Single with children	79 (4.6%)	22 (7.1%)	0.96 (0.54–1.70)	22 (6.8%)	0.85 (0.48–1.49)	35 (7.2%)	**2.10 (1.17–3.75)**
Education							
>12 years (reference)	337 (19.7%)	56 (18.1%)	–	43 (13.4%)	–	51 (10.5%)	–
10–12 years	976 (57.0%)	184 (59.4%)	1.26 (0.90–1.78)	180 (55.9%)	**1.66 (1.14–2.40)**	270 (55.7%)	**2.18 (1.50–3.16)**
0–9 years	400 (23.4%)	70 (22.6%)	1.13 (0.75–1.69)	99 (30.7%)	**2.02 (1.35–3.04)**	164 (33.8%)	**3.02 (2.02–4.51)**
Prior psychotropic medication	829 (48.4%)	232 (74.8%)	**1.64 (1.21–2.22)**	242 (75.2%)	**1.75 (1.30–2.36)**	408 (84.1%)	**1.97 (1.46–2.66)**
N of prior psychiatric diagnoses by category (0–9)	1.0 (1.1)	1.8 (1.3)	**1.63 (1.46–1.82)**	1.9 (1.3)	**1.67 (1.50–1.86)**	2.5 (1.5)	**2.22 (2.01–2.46)**
N of prior somatic diagnosis by category(0–5)	0.7 (0.5)	0.9 (0.5)	**1.41 (1.09–1.82)**	0.9 (0.5)	**1.23 (0.95–1.59)**	1.0 (0.6)	**1.49 (1.18–1.89)**

Values in bold indicate significant at $p < 0.001$. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) presented.

followed by anxiety or depressive symptoms, which would impact work disability.

Clinical implications

These findings highlight how prevention efforts could be effectively introduced on indicated and selected levels. Currently, preventive actions in Sweden are available at a universal level through the national self-exclusion tool (www.spelpaus.se), which allows all individuals to self-exclude for self-selected periods, a measure that covers gambling operators licensed for Sweden. In addition, all operators are subject to a *duty of care* (Forsström & Cisneros Örnberg, 2019) requiring them to inform all users of gambling risks, offer self-tests for risky gambling, and refer to the national gambling helpline. Prevention on the indicated level is available through the gambling helpline, self-help services, and municipal units offering counselling for addictive behaviours. GD in isolation might not be an indicator of sick leave, but in combination with comorbid psychiatric disorders, it seems to affect work disability synergistically. For individuals with GD unable to work due to anxiety or depression, it could be essential to include preventive actions directed at gambling while on sick leave. Long periods away from work can imply more unstructured time, less social contact, and increased opportunities to gamble. Therefore, preventive efforts at the selected level via the healthcare system could be improved by early detection of GD among individuals in treatment for depressive symptoms or being on sick leave due to anxiety or mood disorders. Given the absence of widespread, systematic screening for problem gambling, recognition of the increased risk of GD among individuals with the comorbid disorders identified in this study should optimally lead to screening within psychiatry, e.g. with a recently developed screening instrument (Molander, Wennberg, & Berman, 2023).

Prevention efforts could and should also be delivered at the workplace. Previous literature on GD and functioning at work has focused mainly on reduced performance and career opportunities due to absenteeism, cognitive disengagement in work tasks, and embezzlement at work (Binde, 2016; Downs & Woolrych, 2010; Eby, Robertson, Williamson, & Maupin, 2020). Since prevention and treatment directed at the workplace suffer from the same obstacles as approaching healthcare for treatment – e.g. stigma, embarrassment, and not wanting to disclose the reason for being absent are reasons cited for not seeking help (Suurvali et al., 2009) – systematic screening via health check-ups regularly conducted at the workplace could increase early detection. Recent research suggests that managers would benefit from a skills-development program to address problem gambling concerns in employees (Rafi et al., 2022).

Conclusions

Individuals with GD are at significant risk of work disability before GD is identified, and for a prolonged period which may further compound the financial and social pressures. The study also shows that comorbid anxiety, depression, and ADHD, prior use of psychotropic medication (e.g. antidepressants), female sex, and having fewer years of education increase the risk of work disability among individuals with GD. These findings highlight the importance of early detection and prevention of GD.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0033291723003288

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Data sharing. The data used in this study cannot be made publicly available due to privacy regulations. According to the General Data Protection Regulation, the Swedish law SFS 2018:218, the Swedish Data Protection Act, the Swedish Ethical Review Act, and the Public Access to Information and Secrecy Act, these types of sensitive data can only be made available for specific purposes, including research, that meets the criteria for access to this sort of sensitive and confidential data as determined by a legal review. Readers may contact Professor Kristina Alexanderson (kristina.alexanderson@ki.se) regarding the data.

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