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Research paper

Longitudinal trajectories of sickness absence among young adults with a history of depression and anxiety symptoms in Sweden

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ABSTRACT

Background: Depression and anxiety are associated with increased risk of sickness absence (SA), yet the developmental patterns of SA remain unclear. We aimed to identify trajectories of SA in young adults with depression and/or anxiety, accounting for sociodemographic and occupational factors.

Methods: Longitudinal study of 1445 twin individuals with elevated depressive/anxiety symptoms in late adolescence or young adulthood (age range: 19–30), assessed in Swedish surveys completed in 2005. Through linkage to nationwide registries, individuals were prospectively followed from 2006 to 2018. The outcome included consecutive annual days of SA, which were analyzed using group-based trajectory modeling. Multinomial logistic regression estimating odds ratios (OR) with 95 % confidence intervals (CI) was used to examine associations of age, sex, and educational level with the resulting SA trajectories.

Results: Four distinct SA trajectories were identified in the total sample: 'high-increasing' (6 %), 'low-increasing' (12 %), 'high-decreasing' (13 %), and 'low-constant' (69 %). Increasing age was associated with higher odds of belonging to the low-increasing trajectory (OR = 1.07, 95 % CI = 1.02–1.12). Women had higher odds of belonging to the low-increasing trajectory (OR = 1.67, 95 % CI = 1.10–2.53), compared with men. Higher education was associated with lower odds of belonging to high-increasing (OR = 0.34, 95 % CI = 0.22–0.54) and high-decreasing (OR = 0.59, 95 % CI = 0.43–0.81) trajectories, compared with lower education. Few differences were observed in analyses stratified by occupational sector.

Limitations: Information on potential confounders (e.g., psychiatric comorbidity, work-environment factors) was not available.

Conclusions: Among young adults with prior depression/anxiety, close to every fifth showed rising SA trajectories over time. This calls for targeted strategies to improve public mental health already at young ages.

1. Introduction

Mental disorders such as depression and anxiety are among the top leading causes of the burden of disease in youths and adults worldwide (James et al., 2018; Reiner et al., 2019). There is growing recognition that mental disorders, including but not limited to depression and anxiety, are key contributory factors to problems with social and occupational functioning (Henderson et al., 2011; OECD, 2010, 2012). Cross-national comparative data suggest that mental disorders account for up to 50 % of all work disability benefits across several Western societies (Kaltenbrunner Bernitz et al., 2013; OECD, 2012), as many people afflicted with such disorders are less likely to be employed and, if employed, more likely to be sickness absent. The substantial cost burden associated with mental disorders was also recently acknowledged in a

Abbreviations: AIC, Akaike Information Criterion; APPA, Average Posterior Probability of Assignment; BIC, Bayesian Information Criterion; CI, Confidence Interval; CIDI-SF, Composite International Diagnostic Interview-Short Form; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition; GAD, Generalized Anxiety Disorder; GBTM, Group-based Trajectory Modeling; MDD, Major Depressive Disorder; MiDAS, Micro Data for the Analysis of Social Insurance; LISA, Longitudinal Integration Database for Health Insurance and Labor Market Studies; OCC, Odds of Correct Classification; OR, Odds Ratio; SA, Sickness Absence; STAGE, Study of Twin Adults: Genes and Environment; STODS, Swedish Twin project of Disability pension and Sickness Absence; TCHAD, Twin study of CHild and Adolescent Development.

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comprehensive mental health research agenda for Europe and worldwide (Wykes et al., 2015), further underscoring the major public health challenge posed by these conditions. Improving our understanding of the far-reaching consequences of mental disorders may thus be key to judicious policymaking for future generations to come.

In Sweden, the rates of sickness absence (SA) are among the highest reported in Europe, with public spending on SA and other work disability benefits totaling to about 4 % of the gross domestic product in recent years (OECD, 2022). Mental disorders lead to longer spells of SA as compared to other conditions, and the last decade has also witnessed an increase in the duration of SA due to those disorders specifically (Swedish Social Insurance Agency, 2020). The incidence of SA due to mental disorders is reported to be 30–40 % higher in women compared to men, and 10–15 % higher in young adults compared to those in midlife (Swedish Social Insurance Agency, 2020). In addition, SA due to mental disorders is more common among people employed in the public sector, for example, within administration, education, and healthcare (Swedish Social Insurance Agency, 2020). Overall, most disability claims for SA are attributable to depression, anxiety, and stress-related disorders (Swedish Social Insurance Agency, 2020).

From a clinical point of view, depression and anxiety comprise a heterogeneous constellation of mental disorders, ranging in symptom severity, duration, and related functional impairment (Otte et al., 2016; Penninx et al., 2021). These disorders frequently have their first onset in childhood or adolescence (Kessler et al., 2005; Xiang et al., 2022), and are also known to be relapsing conditions that can recur many years after an earlier episode (Costello and Maughan, 2015; Hovenkamp-Hermelink et al., 2021; Johnson et al., 2018). Both depression and anxiety are highly prevalent in the general population; the lifetime prevalence rates are estimated to be 32–48 % for major depression (Angst et al., 2016; Schaefer et al., 2017), and 32–57 % for anxiety disorders (Beesdo-Baum et al., 2015; Schaefer et al., 2017) in Western societies. While there is no clear evidence of any sharp increase in the prevalence of these disorders (Baxter et al., 2014; Gosmann et al., 2016; Sawyer et al., 2018; Wiens et al., 2017), there is growing concern that symptoms of depression, anxiety, stress, and self-harm are on the rise among youths (Askari et al., 2022; Blomqvist et al., 2019; Cooper et al., 2018; Niederkrotenthaler et al., 2019; Twenge et al., 2019). Clearly, this speaks to the importance of adopting a life-course approach to better understand the long-term health and functioning of young people impacted by various mental health conditions at subclinical or clinical levels (Bültmann et al., 2020).

Increasing longitudinal research demonstrates that early-onset depression and anxiety are associated with a myriad of poor long-term outcomes, such as various health issues, intimate relationship problems, educational underachievement, unemployment, and economic hardships (Clayborne et al., 2019; Copeland et al., 2014, 2021; Hale et al., 2015). To date, there are only a few prospective cohort studies, mainly originating from the Nordic countries, reporting on work disability specifically (Alaie et al., 2022; Harkko et al., 2018; Homlong et al., 2015; Narusyte et al., 2017; Pape et al., 2012; Sagatun et al., 2015). These studies consistently find increased risks of future SA among young people who have experienced depression and/or anxiety, and these findings appear to hold even after adjustment for potential confounders, although considerable methodological variability exists in sampling and measurement across studies. However, less is known about the presumed heterogeneity in the longitudinal patterns of SA (Helgesson et al., 2018), especially when focusing solely on young people with a history of depression/anxiety symptoms. Methodologically, this entails the use of statistical methods applied in latent trajectory analysis (Herle et al., 2020; Nguena Nguefack et al., 2020; Serra et al., 2022), such as group-based trajectory modeling (GBTM) (Nagin and Odgers, 2010), which has the capability to identify subpopulations of people who follow distinct trajectories during the time of observation and explore the patterns of variation over time. Consequently, as a supplement to previous research in this field, the assessment of group-based trajectories may provide a deeper understanding of the longitudinal patterns of SA among young people who have experienced depression/anxiety. Gaining such insights may help to identify and support vulnerable groups at risk of future work disability.

The aim of this study was first to identify trajectories of SA in young adults with a history of elevated depression/anxiety symptoms, while accounting for the role of age, sex, and educational level. Secondly, to identify trajectories of SA relevant to the main type of gainful employment in terms of private and public sector.

2. Methods

2.1. Study population and procedure

Data were drawn from the Swedish Twin project Of Disability pension and Sickness absence (STODS) (e.g., Mather et al., 2020; Svedberg et al., 2018). All participants were originally included in either of two prospective cohort studies conducted by the Swedish Twin Registry (Zagai et al., 2019); the Twin study of CHild and Adolescent Development (TCHAD) (Lichtenstein et al., 2007) and the Study of Twin Adults: Genes and Environment (STAGE) (Furberg et al., 2008).

The source population of TCHAD comprised all twins born in Sweden in 1985–1986 (N = 2960). The twins and/or their parents were contacted on four waves of data collection across childhood and adolescence; when the twins were aged 8–9, 13–14, 16–17, and 19–20 years. At each wave, the participants were mailed a comprehensive battery of questionnaires on physical health as well as emotional and behavioral problems. The present study included only those who took part in the fourth wave (i.e., at age 19–20). While the response rates for each consecutive wave have been reported elsewhere (Narusyte et al., 2017), there was a total of 1698 participants (59 %) providing self-reports at the fourth wave.

The source population of STAGE comprised all twins born in Sweden between 1959 and 1985 (N = 42,582), when those eligible were between 20 and 46 years of age. The twins were invited to a web-based survey including a comprehensive battery of questionnaires on, for example, physical health, mental health, and lifestyle. As an option, the participants could choose to complete the survey as a telephone interview with a trained interviewer. The response rate was close to 60 % when combining web- and telephone-based answers (Furberg et al., 2008).

For the present study, the data collected in TCHAD and STAGE were collapsed together, but only for those participants who were aged ≤30 years upon completion of the relevant survey. As part of the general procedure in STODS, extensive de-identified data were obtained from several nationwide population-based registries kept by government agencies. These registry-based data were linked to the twin individuals using the unique personal identification number assigned to all Swedish residents (Ludvigsson et al., 2009). In all, 12,725 twin individuals were eligible for inclusion in this study. The final analytic sample of participants comprised only those who had reported elevated depression/anxiety symptoms in either TCHAD or STAGE (n = 1445). Due to the small number of complete twin pairs, no twin design adjusting for familial factors was applied.

2.2. Exposure variable

Both in TCHAD and STAGE, exposure to depression and/or anxiety was measured using self-report questionnaires with recommended cut-off scores.

For participants of TCHAD, symptoms of depression/anxiety were measured with the Child Behavior Checklist (CBCL) (Achenbach and Ruffle, 2000), which is a widely used instrument for assessment of child adaptive behaviors and problem behaviors, based on a Likert-scale response format. In terms of problem behaviors, the CBCL comprises items that load onto three broad-band scales; Internalizing,

Externalizing, and Total problems. In this study, the Internalizing scale, comprising three narrow-band scales referred to as Anxious-Depressed, Withdrawn-Depressed, and Somatic Complaints, was used for exposure classification. An adapted self-report version of the questionnaire was used to classify cases presenting with elevated depression/anxiety symptoms, defined as ≥65 T-scores on the Internalizing scale of the CBCL Youth Self-Report.

For participants of STAGE, lifetime history of Major Depressive Disorder (MDD) and Generalized Anxiety Disorder (GAD) was measured using the computerized Composite International Diagnostic Interview–Short Form (CIDI-SF) (American Psychiatric Association, 2000; Kessler et al., 1998). The CIDI-SF was modified from its original design for 12-month prevalence to assess lifetime prevalence of MDD and GAD, respectively. The items of CIDI-SF reflect the formal criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) (American Psychiatric Association, 2000). In this study, for MDD, the DSM-IV criteria A, C, and E had to be fulfilled in order for the participant to be classified as having had depression, whereas for GAD, criteria A and C had to be fulfilled in order to be classified as having had anxiety, in line with previous work on the STAGE cohort (Mather et al., 2016).

2.3. Outcome measure

Consecutive annual net days of SA, spanning from 2006 to 2018, were used as the outcome measure. In Sweden, part-time (25, 50, 75 %) or full-time (100 %) SA can be granted. Hence, part-time SA was converted to full-time, e.g. two days on half-time SA equaled one (net) day of full-time SA. These registry-based data on SA were obtained from the Micro Data for the Analysis of Social Insurance (MiDAS) database, held by Swedish Social Insurance Agency, covering the entire Swedish population (Ludvigsson et al., 2019; Swedish Social Insurance Agency, 2020).

In Sweden, all residents aged 16–65 years who have an income from work, unemployment or other social benefits are eligible for SA benefits if there is a reduced work capacity due to disease or injury. However, for the initial 14 days of a sick-leave spell, an employee receives sick pay from the employer, though there is one qualifying day (more for self-employed) without any pay. If the work capacity is still reduced after 14 days, the employee can apply for SA benefits from the Swedish Social Insurance Agency. Therefore, the data retrieved from MiDAS cover only those SA days exceeding the initial sick-leave period.

2.4. Covariate and stratification variables

Sociodemographic factors, including age, sex, and educational level, were included as covariates. *Age* at baseline was measured as a continuous variable (years). *Sex* was measured as a categorical variable (man vs. woman). *Educational level* was measured as a categorical variable (low/medium with <14 years of education vs. high with ≥14 years of education), reflecting the highest level of education achieved across the follow-up (i.e., up to year 2018), based on data retrieved from the Longitudinal Integration Database for Health Insurance and Labor Market Studies (LISA), administrated by Statistics Sweden (Ludvigsson et al., 2019).

Occupational sector was included when stratifying the sample by the main sector of gainful employment (private vs. public sector), based on data from LISA (Ludvigsson et al., 2019). Private sector comprised those employed in private companies, whereas public sector comprised those employed by the state, county councils, or municipalities. Participants were classified as employed in private or public sectors after being employed in either sector for at least three years in total during the follow-up (i.e., 2006–2018). If a participant had worked in both sectors for an equal number of years, the most recent sector by the end of follow-up was chosen.

2.5. Statistical analysis

The statistical analyses were conducted in three sequential steps, both for the total analytic sample (n = 1445) and, if participants had entered the workforce, grouped by occupational sector in terms of private (n = 669) and public (n = 579) sectors.

First, descriptive characteristics of the analytic sample were calculated. The number and proportion of participants were summarized for the covariates and the SA outcome. For ease of presentation and description, SA was categorized into three mutually exclusive levels for the first year of follow-up (i.e., 2006), covering those not being sickness absent, those being sickness absent <180 days, and those being sickness absent ≥181 days; however, the subsequent analysis with GBTM was conducted using the actual net days of SA in each year from 2006 to 2018 (i.e., count-based data with integer values ranging from 0 to 365).

Second, GBTM was used to identify groups of participants who follow distinct developmental trajectories of SA over time (Nagin and Odgers, 2010). A zero-inflated Poisson model was fitted to the annual SA data as an excess of zero counts was observed at each year of follow-up, due to the heterogeneity in the risk for SA. At this step, only SA days were included in the estimation process (i.e., no covariates entered). The optimal number of trajectory groups and the degrees of the polynomial function were determined using model fit statistics, including the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC), along with the average posterior probability of group membership (APPA) and the odds of correct classification (OCC). In addition, a conventional criterion was introduced as each trajectory group had to include at least 5 % of the analytic sample, to ensure adequate statistical power in the subsequent regression analysis (Serra et al., 2022). After selecting the best-fitted model, the posterior probabilities of belonging to each latent trajectory group were computed and, consequently, participants were assigned to the group for which they had the highest posterior probability. An APPA of ≥70 for a given trajectory group was used an indication of goodness of fit, in line with previous work (Côté et al., 2002). Similarly, an OCC ≥5.0 was deemed indicative of high assignment accuracy (Nagin and Odgers, 2010).

Third, the association between the covariates and the SA trajectories was examined by multinomial logistic regression models using the 'low-constant' trajectory group (with least SA) as the reference throughout all analyses. At this step, all covariates (i.e., age, sex, education) were entered simultaneously into the models and any between-groups difference was estimated as an odds ratio (OR) with a 95 % confidence interval (CI). Statistical significance was set at $p < 0.05$. A log-likelihood test was used to test differences between trajectory groups regarding all covariates. Nagelkerke's pseudo-R^2 was used to evaluate the strength of these associations, i.e. how much the included covariates were able to explain of the total variance. Also, differences in R^2 were calculated for each covariate by consecutively excluding one covariate from the full model.

There were two sources of complete or intermittent missingness in the follow-up data: death (n = 13) and resettling abroad (n = 88). The mean total time of missingness in the registries among those who had emigrated was 6.6 years (SD 4.2). Analyses were based on all available data. All data management and analyses were performed using SAS version 9.4 and R version 4.1.3. GBTM analyses were performed using the 'crimCV' package (Nielsen et al., 2014).

3. Results

Descriptive characteristics of the sample are presented in Table 1. About three of four participants were women in the total sample, with women being in majority in both private (65 %) and public (86 %) sectors. The mean age of participants at the start of the follow-up was 24.6 years (SD 3.5), with virtually the same age composition across both private and public sectors. In the total sample, the proportion with a high educational level was slightly higher (56 %) than the proportion

Table 1
Sociodemographic factors and sickness absence in young adults with a history of elevated depression/anxiety symptoms, shown for the total sample and by main sector of employment.

Characteristics	Total sample (n = 1445)		Private sector (n = 669)		Public sector (n = 579)	
	n	%	n	%	n	%
Sex						
Female	1083	74.9	435	65.0	499	86.2
Male	362	25.1	234	35.0	80	13.8
Age (M, SD)	24.6	3.5	24.6	3.5	24.8	3.5
Educational level[a]						
Low/mid	619	42.8	339	50.7	158	27.3
High	810	56.1	330	49.3	421	72.7
Collar color[b]						
Blue collar	676	46.8	391	58.4	212	36.6
White collar	666	46.1	272	40.7	365	63.0
Sickness absence[c]						
No days	1263	87.4	589	88.0	497	85.8
1–180 days	138	9.6	65	9.7	63	10.9
>180 days	44	3.0	15	2.2	19	3.3

[a] The highest level of education achieved by the end of follow-up (n = 1429).
[b] The main designation of employees by collar color (n = 1342).
[c] The number of net days at first year of follow-up in 2006 (n = 1445).

with low/medium educational level (43 %). While these numbers were quite balanced in the private sector (51 % vs. 49 %), the vast majority in the public sector had a high educational level (73 % vs. 27 %).

3.1. Identification of trajectories of sickness absence

The model fit statistics in terms of BIC and AIC values indicated the superiority of a five-group model, and this was also implied by the APPA and OCC values, as shown in Supplementary Tables S1-S3. After considering the most parsimonious model and assessing the relative changes in model fit depending on the polynomial orders used, we decided on a four-group model with cubic polynomials. Also, this decision was consistent with the criterion defined a priori for the study, as the resulting trajectory groups each had to comprise ≥5 % of the sample. Therefore, the four-group model was chosen both for the total sample and when stratifying into subsamples by occupational sector.

The results of the final GBTM analysis are shown in Fig. 1, illustrating the counts of the annual net days of SA while accounting for zero-inflation. As regards the total sample, the latent trajectories of SA were labeled according to their visual shapes: 'High-increasing' (6 %), 'Low-increasing' (12 %), 'High-decreasing' (13 %), and 'Low-constant' (69 %).

For participants employed in the private sector, the latent trajectories of SA were labeled: 'Medium-increasing' (6 %), 'High-decreasing' (7 %), 'Medium-fluctuant' (14 %), and 'Low-constant' (72 %).

For participants employed in the public sector, the latent trajectories of SA were labeled: 'Low-increasing' (7 %), 'High-fluctuant' (10 %), 'Medium-constant' (18 %), and 'Low-constant' (65 %).

Both for the total sample and stratified by occupational sector, Figs. S1-S3 show the count process only for those having any SA across the follow-up, with the average trajectories highlighted along with the individual trajectories colored in black. In addition, Figs. S4-S6 show the zero-inflation process for the probability of having no SA, ranging from 0 to 1, for each trajectory group (see Supplementary Information).

3.2. Sociodemographic factors by trajectories of sickness absence

As noted earlier, the low-constant trajectory group was used as the reference in all analyses.

For the total sample, the results of the multinomial logistic regression model are provided in Table 2. Each one-year increase in age was found to be associated with higher odds of belonging to the low-increasing trajectory group (OR 1.07, 95 % CI 1.02–1.12). Compared to men, women had higher odds of belonging to the low-increasing trajectory group (OR 1.67, 95 % CI 1.10–2.53). High educational level was associated with lower odds of belonging to the high-increasing (OR 0.34, 95 % CI 0.22–0.54) and high-decreasing (OR 0.59, 95 % CI 0.43–0.81) trajectory groups, as compared with low/medium educational level.

For private sector employees, the results of the multinomial logistic regression model are provided in Table 3. Each one-year increase in age was associated with higher odds of belonging to the medium-fluctuant trajectory group (OR 1.07, 95 % CI 1.00–1.14). Compared to men, women had higher odds of belonging to the medium-fluctuant trajectory group (OR 1.66, 95 % CI 1.01–2.74). High educational level was associated with lower odds of belonging to the medium-increasing (OR 0.35, 95 % CI 0.18–0.70), high-decreasing (OR 0.23, 95 % CI 0.11–0.48), and the medium-fluctuant (OR 0.60, 95 % CI 0.38–0.94) trajectory groups, as compared with low/medium educational level.

For public sector employees, the results of the multinomial logistic regression model are shown in Table 4. Compared to men, women were at higher odds of belonging to the low-increasing trajectory group (OR 7.80, 95 % CI 1.05–58.00). However, there was no evidence of any statistically significant effect of age or educational level.

Additional descriptive characteristics of the resulting SA trajectory groups in the total sample and by occupational sector are provided in Tables S4-S6 (see Supplementary Information).

4. Discussion

This longitudinal study sought to identify latent trajectories of SA among young adults with a history of depression/anxiety symptoms. In

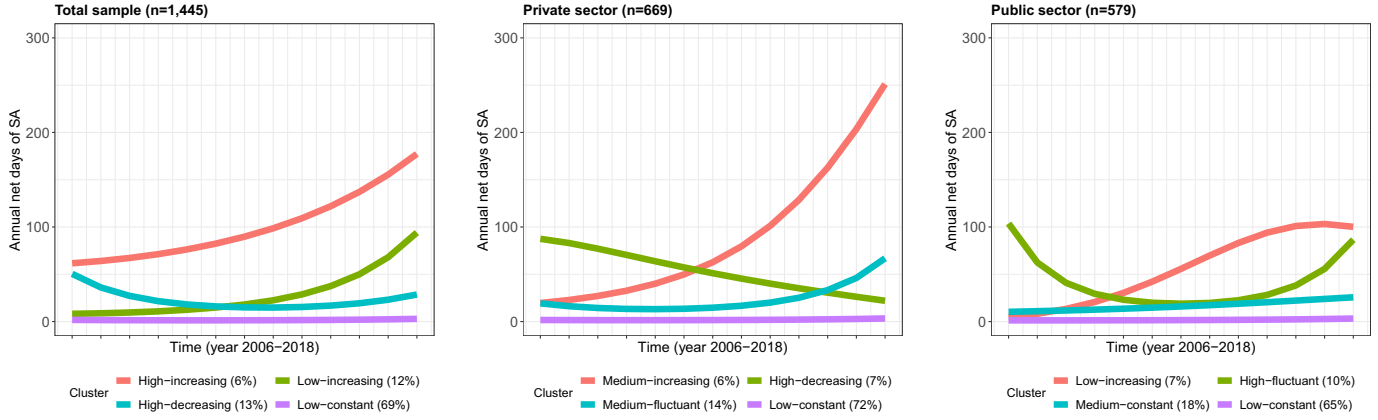

Fig. 1. Trajectories of sickness absence days among young adults with a history of depression/anxiety, shown for the total sample and stratified by occupational sector, across the years 2006–2018.

Table 2
Results from multinomial logistic regression on the total sample (n = 1445), with sickness absence trajectories regressed on covariates using the low-constant trajectory (n = 1007) as the reference.

Covariates	High-increasing (n = 90)			Low-increasing (n = 165)			High-decreasing (n = 183)			Log-likelihood test (*p*-value)[a]	R^2 difference[b]
	OR	95 % CI	*p*	OR	95 % CI	*p*	OR	95 % CI	*p*		
Age	1.05	0.99-1.12	0.098	1.07	1.02–1.12	0.008	1.02	0.97–1.07	0.405	8.93 (0.03)	0.007
Sex											
Male (ref.)	–	–		–	–		–	–			
Female	1.64	0.96–2.80	0.071	1.67	1.10–2.53	0.016	1.34	0.92–1.95	0.133	9.79 (0.02)	0.008
Educational level											
Low/mid (ref.)	–	–		–	–		–	–			
High	0.34	0.22–0.54	<0.001	0.76	0.55–1.07	0.113	0.59	0.43–0.81	0.001	30.36 (<0.001)	0.025

OR = Odds Ratio, CI = Confidence Interval.
[a] Derived from multinomial logistic regression with all analyses mutually adjusted for all covariates.
[b] Difference in Nagelkerke R^2 between full model (R^2 = 0.036) including tested covariate and model without tested covariate.

Table 3
Results from multinomial logistic regression based on private sector employees (n = 669), with sickness absence trajectories regressed on covariates using the low-constant trajectory (n = 487) as the reference.

Covariates	Medium-increasing (n = 43)			High-decreasing (n = 45)			Medium-fluctuant (n = 94)			Log-likelihood test (*p*-value)[a]	R^2 difference[b]
	OR	95 % CI	*p*	OR	95 % CI	*p*	OR	95 % CI	*p*		
Age	1.01	0.92–1.10	0.888	1.06	0.97–1.16	0.222	1.07	1.00–1.14	0.049	4.88 (0.18)	0.008
Sex											
Male (ref.)	–	–		–	–		–	–			
Female	1.14	0.58–2.22	0.708	1.19	0.62–2.30	0.601	1.66	1.01–2.74	0.045	4.29 (0.23)	0.007
Educational level											
Low/mid (ref.)	–	–		–	–		–	–			
High	0.35	0.18–0.70	0.003	0.23	0.11–0.48	<0.001	0.60	0.38–0.94	0.025	28.41 (<0.001)	0.05

OR = Odds Ratio, CI = Confidence Interval.
[a] Derived from multinomial logistic regression with all analyses mutually adjusted for all covariates.
[b] Difference in Nagelkerke R^2 between full model (R^2 = 0.064) including tested covariate and model without tested covariate.

Table 4
Results from multinomial logistic regression based on public sector employees (n = 579), with sickness absence trajectories regressed on covariates using the low-constant trajectory (n = 379) as the reference.

Covariates	Low-increasing (n = 40)			High-fluctuant (n = 56)			Medium-constant (104)			Log-likelihood test (*p*-value)[a]	R^2 difference[b]
	OR	95 % CI	*p*	OR	95 % CI	*p*	OR	95 % CI	*p*		
Age	1.07	0.97-1.18	0.165	1.05	0.97–1.14	0.247	1.04	0.98–1.11	0.202	3.86 (0.28)	0.008
Sex											
Male (ref.)	–	–		–	–		–	–			
Female	7.80	1.05–58.0	0.045	1.64	0.67–4.01	0.279	1.34	0.70–2.56	0.370	8.78 (0.03)	0.017
Educational level											
Low/mid (ref.)	–	–		–	–		–	–			
High	0.56	0.28–1.10	0.093	0.66	0.36–1.21	0.178	0.97	0.59–1.60	0.914	4.08 (0.25)	0.008

OR = Odds Ratio, CI = Confidence Interval.
[a] Derived from multinomial logistic regression with all analyses mutually adjusted for all covariates.
[b] Difference in Nagelkerke R^2 between full model (R^2 = 0.03) including tested covariate and model without tested covariate.

the total sample, we identified four distinct group-based trajectories of SA across the follow-up period. Likewise, we identified four distinct SA trajectories when stratifying the sample by occupational sector. The vast majority followed the low-constant SA trajectories; estimated as 69 % of the total sample, 72 % of private sector employees, and 65 % of public sector employees. About a fifth of the total sample followed rising SA trajectories over time, which seems to reflect the results from other studies on young adults with common mental disorders (Di Thiene et al., 2019; Helgesson et al., 2018). Further, our results suggest that age, sex, and educational level may be of importance to the development of SA over time, although there were somewhat varying results when looking at the total sample and by occupational sector.

Findings from this study contribute in several novel ways to current literature on young adult mental health and future work disability. First,

the latent SA trajectories presented herein give a more complete picture of the heterogeneous SA outcome than what has been reported in previous longitudinal studies on SA among young people with a history of depression/anxiety (Alaie et al., 2022; Harkko et al., 2018; Homlong et al., 2015; Narusyte et al., 2017; Pape et al., 2012; Sagatun et al., 2015). Most research on this topic has been designed as regular association studies examining whether mental health conditions at young ages may be predictive of subsequent SA, by comparing exposed subjects (i.e., those with depression/anxiety) to unexposed subjects (i.e., those without depression/anxiety) in relation to later SA outcome. To date, however, there has been rather limited research addressing the development of SA over time among those exposed early on. The few exceptions to this overall dearth of research include some large-scale studies on young patients with psychiatric diagnoses recorded in hospital-based settings in Sweden (Di Thiene et al., 2019; Helgesson et al., 2018). Although informative, these studies may nonetheless have limitations in terms of generalizability, given that a substantial proportion of people afflicted with depression and anxiety tend to go undiagnosed or untreated (Costello et al., 2014; Thornicroft et al., 2017), or seek treatment within primary care only (Sundquist et al., 2017). Therefore, the data gathered in the national patient registries most likely underestimate the true prevalence of these disorders in the general population (Schaefer et al., 2017), which makes it an open question whether the trajectories of SA reported previously may be general to all young people with depression/anxiety, or perhaps specific to those with clinically ascertained diagnoses only (Di Thiene et al., 2019; Helgesson et al., 2018). Our study may thus provide a complementary perspective by more generally portraying the substantial heterogeneity in the long-term SA outcome associated with early depression/anxiety.

Second, we found that sociodemographic factors including age, sex, and educational level were associated with diverse SA trajectories. This finding is consistent with the accumulating literature on work disability (OECD, 2010, 2012), yet this has not been adequately demonstrated in previous studies on young people with depression and anxiety. Overall, we observed that increasing age was associated with unfavorable SA trajectories, and similarly, women were found to be at higher odds of worse SA trajectories as compared with men. As noted earlier, women constituted a clear majority of participants in this study, presumably reflecting the strong female preponderance seen for depression and anxiety in the general population (Otte et al., 2016; Penninx et al., 2021). The more pronounced overrepresentation of women among the public sector employees approximates the gender imbalance in jobs across various domains of this sector, for example, in education, care services, and healthcare (Statistics Sweden, 2018). Further, higher education was found to protect against unfavorable SA trajectories, which resonates well with cross-national data showing that young people with higher education do much better in the labor market than those with lower education (OECD, 2012). In terms of the role of educational attainment, it has been reported that higher education may be protective against adverse labor market outcomes, including SA, although this may possibly only apply to those with episodic depression, since youths with persistent depression may be at increased risks of poor labor market outcomes regardless of adulthood educational level (Alaie et al., 2022). In the present study, however, it was not possible to test whether the persistence of depressive/anxious symptomatology may exert an influence on the latent SA trajectories observed, or if the protective effect of higher education may depend on the duration of subclinical or clinical-level symptoms.

Third, our results support quite differential patterns of SA among private sector employees as compared with public sector employees. This is arguably one important reason why trajectory analyses of SA should not be restricted to providing results from the total sample only, but also by employment-related sector, especially when the aim is exploratory and hypothesis-generating. Here, we found a somewhat lower proportion of participants following the low-constant SA trajectory in the public sector than the corresponding trajectory in the private sector, which is consistent with recent data suggesting that SA is more prevalent among people employed in the public sector (Swedish Social Insurance Agency, 2020). Further, we observed a decreasing trajectory in the private sector, but no evidence of any similar trajectory in the public sector. Likewise, a high-fluctuant trajectory was observed in the public sector, but there was no equivalent in the private sector. This may be relevant to examine further in future research, preferably using larger samples to increase statistical power. More important, it is noteworthy that the proportion of participants following the rising trajectories were similar in the private (6 %) and public (7 %) sectors, albeit with some apparent differences in the starting values of these trajectories. Our results showed that the medium-increasing SA trajectory among private sector employees began to rise steeply upwards about midway through the follow-up, whereas the low-increasing SA trajectory among public sector employees did not rise as steeply but rather reached a plateau towards the end of follow-up. The majority of those following the medium-increasing SA trajectory had blue-collar jobs (77 %) and low/medium educational level (70 %) among the private sector employees, as shown in Table S5. The corresponding proportions for those following the low-increasing SA trajectory among the public sector employees were clearly lower, both in terms of blue-collar jobs (55 %) and low/medium educational level (38 %), shown in Table S6. This raises questions about any potential differences between private and public sector employees in the clinical characteristics of depression/anxiety (e.g., severity or duration of symptoms), and to what extent such factors may influence both the selection process into the labor market and the subsequent SA outcome. Again, we were not able to address such questions herein, yet it might be asked whether young adults manifesting more severe or persistent depression/anxiety are more likely to be hired in less qualified jobs within the private sector, where educational requirements for employment often are lower than are the requirements within many public sector domains (e.g., jobs in administration, education, healthcare). On a speculative note, it could perhaps be the case that emotionally distressed young adults with low educational attainment and blue-collar jobs may have a heightened susceptibility to stress and/or repeated exposures to stressful contexts, which hypothetically may be more commonly experienced within private sector domains (e.g., jobs in manufacturing, sales, services, hotels). Potentially, this may explain the steeply rising trajectory of SA seen among the private sector employees. However, while the contribution of psychosocial stressors at the workplace to the subsequent risk of SA due to a mental disorder has been well established (Duchaine et al., 2020), there is still scarce research addressing whether psychosocial working conditions may differ by occupational sector (Janssens et al., 2014), further underscoring the need for more research addressing these issues.

Some strengths of this study include the combination of survey and registry-based data from two population-based prospective cohort studies. The long follow-up, spanning over a decade's worth of data, enhanced the chances to capture any temporal changes in the longitudinal trajectories of SA. Further, we included SA days from 2006 to 2018 ascertained from high-quality national registries covering virtually all individuals who have been granted SA benefits. This should be contrasted with the many cohort studies that solely rely on self-reported outcome data (Clayborne et al., 2019), which are prone to potential biases (Patten et al., 2012; Takayanagi et al., 2014). Overall, our results should apply to the general population of young adults with depression/anxiety, as Swedish twins are representative of the general population (Zagai et al., 2019), even in terms of work disability (Samuelsson et al., 2012); however, our results may not be representative of other populations or age cohorts. A limitation of the study is that due to the small sample size, the analyses were not adjusted for familial confounding as no twin design was applied, which calls for future studies using larger twin samples. Furthermore, only few covariates were included in the regression analyses, such that important factors were not available to control for (e.g., psychiatric comorbidities, work-environment factors). The rather imprecise estimates from the regression analyses by

occupational sector should be interpreted with caution, as the study may have been statistically underpowered, thereby increasing the risk of type II errors.

To conclude, this study provided further understanding of the heterogeneity in the longitudinal patterns of SA in young adults with a history of depression/anxiety symptoms. Most participants followed the low-constant SA trajectories (65–72 %), but roughly a third followed less favorable SA trajectories. Importantly, close to every fifth participant showed rising SA trajectories over time. Considering the elevated risks of adverse long-term outcomes following early depression/anxiety, there is clearly a need of timely and targeted strategies to improve public mental health already at young ages. Such efforts may, in effect, help to reduce SA in the long run.

Ethical approval

The ethical vetting was performed and approved by the Regional Ethical Review Board of Stockholm, Sweden (Dnr: 2007/524-31, 2010/1346-32/5, 2014/311-32, 2015/1809-32, 2017/128-32). The study has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Role of the funding source

The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript, or decision to submit the manuscript for publication.

CRediT authorship contribution statement

Iman Alaie: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. **Pia Svedberg:** Conceptualization, Data curation, Funding acquisition, Methodology, Project administration, Writing – review & editing. **Annina Ropponen:** Conceptualization, Data curation, Methodology, Writing – review & editing. **Jurgita Narusyte:** Conceptualization, Data curation, Funding acquisition, Methodology, Project administration, Writing – review & editing.

Declaration of competing interest

None.

Data availability

The data that support the findings of this study are available from the original sources: the Swedish Twin Registry, Statistics Sweden, Swedish Social Insurance Agency, and the National Board of Health and Welfare. Restrictions apply to the availability of the data used in this study based on the Swedish Twin project Of Disability pension and Sickness absence (STODS), which were used with ethical permission for the current study and therefore are not publicly available. 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, this type of sensitive data can be made available only after legal review, for researchers who meet the criteria for access to this type of sensitive and confidential data. Readers may contact the last author regarding the details.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2023.07.014.

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