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Research paper

Working life patterns after sickness absence due to depression: A 15-year register-based prospective cohort study

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ABSTRACT

Aim: To identify working life patterns after sickness absence (SA) due to depression and sociodemographic, work, and health-related factors associated with them.

Methods: The study cohort included 9139 Swedish residents, aged 25–40, with a new SA spell due to depression in 2005. We followed the cohort for 15 years analyzing their yearly dominant labor market outcomes. Sequence analysis was used to identify distinct labor market sequences and cluster analysis – to group similar sequences into working life typologies. For the sociodemographic, work, and health-related factor analysis, we used multinomial logistic regression.

Results: We identified 4373 sequences and seven typologies: 1) “Predominant Economic Activity (EA)” (70.7 %), 2) “Predominant EA with Intermittent SA/Disability Pension (DP)” (14.4 %), 3) “Predominant Long-Term SA/DP” (8.0 %), 4) “Long-Term SA/DP Followed by No EA” (2.2 %), 5) “SA/DP with Some EA” (1.6 %), 6) “Emigration” (1.7 %), and 7) “Death” (1.4 %). Factors associated with the predominant long-term SA/DP typology included birth outside Sweden (OR = 1.61, 95 % CI: 1.29–2.01), lower educational attainment (OR = 3.20, 95 % CI: 2.42–4.22), prolonged index SA spell due to depression (OR = 4.81, 95 % CI: 3.71–6.25), prior long-term SA (OR = 3.60, 95 % CI: 2.87–4.50) and unemployment (OR = 2.00, 95 % CI: 1.61–2.48). Living with children (OR = 0.68, 95 % CI: 0.56–0.82) was associated with lower odds of belonging to this typology.

Conclusions: Most individuals after SA due to depression maintained their engagement in the labor market suggesting that Sweden’s welfare system is supportive of their workforce participation. However, some individuals belonged to long-term SA, DP, and lack of EA typologies indicating a potential path to labor market marginalization.

1. Introduction

Depression is a leading cause of disability affecting approximately 280 million people worldwide, or 5 % of the global adult population (Institute for Health Metrics and Evaluation, 2021; World Health Organization (WHO), 2023). The symptoms of depression can significantly disrupt one’s daily life, including the ability to form and maintain interpersonal relationships and fulfill work or school responsibilities (Hammer-Helmich et al., 2018; Kupferberg and Hasler, 2023; Stewart, 2003). In 2019, depression accounted for 3.5 % of disability-adjusted life years (DALYs) among individuals aged 25–49, making it the sixth leading cause of disability in this age group (Vos et al., 2020).

In the workplace, depression can disrupt the execution of mental-interpersonal tasks and result in diminished time management, communication, and other essential skills (Adler et al., 2006). Depression is also associated with absenteeism, or missed workdays, and

Abbreviations: ADHD, Attention-Deficit Hyperactivity Disorder; ASW, Average Silhouette Width; CI, Confidence Interval; CMD(s), Common Mental Disorder(s); CPI, Consumer Price Index; DALY(s), Disability-Adjusted Life Year(s); DP, Disability Pension; EA, Economic Activity; ICD-10, International Classification of Diseases, 10th Edition; LMM, Labor Market Marginalization; OECD, Organization for Economic Co-operation and Development; OM, Optimal Matching; OR, Odds Ratio; PBA, Price Base Amount; RTW, Return-to-Work; SA, Sickness Absence; SD, Standard Deviation; UE, Unemployment.

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presenteeism, or reduced productivity and effectiveness at work (Burton et al., 2004; Evans-Lacko and Knapp, 2016; OECD, 2012). Even mild depressive symptoms can adversely affect job performance and lead to productivity loss, and more severe symptoms result in greater declines in productivity (Beck et al., 2011).

Depression also presents important challenges in the labor market at the societal level. Specifically, it is associated with higher rates of unemployment, sickness absence, disability pension, and early retirement (Amiri and Behnezhad, 2021; Helgesson et al., 2017; Helgesson et al., 2018; Jarl et al., 2020; OECD, 2012; Riihimäki et al., 2015). Mental illness, including depression and other common mental disorders (CMDs), is the leading cause of sickness absence in Sweden and other OECD countries (Försäkringskassan, 2024b; OECD, 2012). In 2020, for instance, depression accounted for 31 % of all sickness absence spells related to psychiatric conditions lasting longer than 14 days among men and 24 % among women residing in Sweden (Försäkringskassan, 2023). Such reductions in an individual's work capacity and the resulting lost work hours have significant economic consequences both nationally and internationally (Försäkringskassan, 2023; Caballero-Martínez et al., 2014; OECD, 2010).

On one hand, a sickness absence period can provide temporary financial assistance and time off from work for individuals affected by depression. On the other hand, it is important for these individuals to return to work (RTW) and maintain their employment because employment not only ensures long-term financial stability but also fosters social connections and a sense of identity and purpose (Fleuren et al., 2016). Moreover, some studies have found that a sickness absence period itself may contribute to future exclusion from the labor market (Alexanderson et al., 2011; Helgesson et al., 2015a; Hultin et al., 2012). Individuals receiving sickness absence benefits, particularly for a prolonged time, often report poorer health and well-being (Staland Nyman et al., 2009). Similarly, unemployment can lead to reduced social status, diminished support networks, a weakened sense of identity, and engaging in unhealthy behaviors, which, in turn, can result in declining mental and physical health (Gedikli et al., 2022; Janlert and Hammarström, 2009). In contrast, having a job is associated with better overall health and well-being (Fleuren et al., 2016).

The social insurance perspective expands the labor market marginalization (LMM) concept beyond being away from work due to reasons mainly related to the labor market, such as unemployment, to include health-related reasons, measured by sickness absence and disability pension (Helgesson et al., 2018). Studies have found that more severe depression symptoms, longer durations of illness, a history of prior sickness absence and unemployment, mental and somatic comorbidities, and sociodemographic factors, such as older age and lower education, are associated with an increased risk of LMM among individuals with depression and other CMDs (Cornelius et al., 2010; Helgesson et al., 2018; Lagerveld et al., 2010; Mittendorfer-Rutz et al., 2014; Rose et al., 2023). Similarly, among individuals on sickness absence due to CMDs, those with lower socioeconomic status and prior sickness absence, particularly if the previous spells are due to CMDs, have a higher risk of recurrent sickness absence and disability pension (Helgesson et al., 2015b; in't Hout et al., 2024; Karlsson et al., 2008; Koopmans et al., 2010).

Nevertheless, many studies examining labor market outcomes among individuals with sickness absence due to CMDs, including depression, have produced inconsistent results, often lacked long-term follow-up, focused on limited population subsets, or examined only a single outcome—unemployment, sickness absence, or disability pension—rather than considering multiple health and employment-related labor market outcomes for a broader view of LMM (Cornelius et al., 2010; in't Hout et al., 2024; Karlsson et al., 2008). Therefore, there is a need for studies using methods able to capture the complexity of labor market patterns followed by individuals with sickness absence due to depression. Sequence analysis allows us to expand beyond single outcomes and examine not only multiple health-related and labor market-driven events but also their order, duration, and distribution over time (Studer and Ritschard, 2015). Moreover, covering a substantial period of an individual's working life with a long follow-up could advance the current understanding of the long-term impact of depression on labor market outcomes and potential LMM.

Therefore, in this study, we employ sequence analysis using national-level data to investigate labor market patterns of individuals after sickness absence due to depression over 15 years. This approach can help identify vulnerable groups at risk of LMM and inform future policy initiatives to facilitate their RTW process.

2. Methods

2.1. Study design and cohort

This longitudinal register-based prospective cohort study included all individuals residing in Sweden, aged 25–40, who were in gainful employment and started a new sickness absence (SA) spell due to depression longer than 14 days in 2005, and who had lived in Sweden for at least two years before the start of the study in 2005. We chose the lower age limit of 25 to include individuals who have likely completed their education and gained some stability in the labor market, and the upper limit of 40 – to ensure an extended follow-up without the included individuals reaching retirement age. In cases where individuals had multiple SA spells due to depression in 2005, the earliest spell was designated as the index spell. Depressive disorder diagnoses for the index SA spell were defined according to the 10th version of the International Classification of Diseases (ICD-10) codes, F32-F33.

Individuals diagnosed with a severe psychiatric or neurological disorder and receiving specialized outpatient or inpatient care within two years of the study start, or during the study's follow-up period ending 2020.12.31, were excluded ($n = 589$). These conditions were psychosis spectrum disorders (ICD-10: F20–29), bipolar disorder (ICD-10: F30-F31), early-onset neurodegenerative disorders (ICD-10: F00-F03 or G30-G32), mental retardation (ICD-10: F70-F79), and anorexia nervosa (ICD-10: F50.0).

2.2. Data sources

We used pseudonymized individual-level data from several nationwide Swedish registers, linked by a unique identification number assigned to each individual:

- The "Micro-Data for Analyses of Social Insurance (MiDAS)" (Österlund, 2011) for diagnoses, dates, and grades (part-time versus full-time) of SA and disability pension (DP) benefits.
- The "Longitudinal Integration Database for Health Insurance and Labor Market Studies (LISA)" (Ludvigsson et al., 2019) for sociodemographic and work-related factors.
- The National Patient Register (NPR) (Ludvigsson et al., 2011) for primary and secondary diagnoses from inpatient stays and specialized outpatient visits to identify mental and somatic comorbidities.
- The Causes of Death Register (Brooke et al., 2017) for dates of death.

2.3. The Swedish social insurance context

In Sweden, all residents receiving a certain level of work income or benefits related to parental leave or unemployment (UE) are entitled to SA benefits if their work capacity is impaired due to illness or injury (Försäkringskassan, 2021; Försäkringskassan, 2024b). The employer pays SA benefits, comprising 80 % of lost earnings, during the initial 14 days of sickness. The Swedish Social Insurance Agency disburses subsequent benefits, reaching up to 80 % of the lost qualifying income (Försäkringskassan, 2021; Försäkringskassan, 2024b). In this study, only SA spells lasting longer than 14 days were included. Additionally, all SA days were counted as full days. For example, two half-days were counted as one full day.

Swedish residents aged 19 to 65 with an illness or disability impairing their capacity to work for an extended period may qualify for DP benefits (Försäkringskassan, 2021; Försäkringskassan, 2024b). Individuals aged 19–29 may receive temporary activity compensation either due to decreased work ability or because they could not complete compulsory education in time, while those above 29 may receive permanent compensation (Försäkringskassan, 2021; Försäkringskassan, 2024b).

Individuals can receive either full (100 %) or partial (75 %, 50 %, or 25 %) SA and DP benefits (Försäkringskassan, 2021; Försäkringskassan, 2024b).

2.4. Annual labor market states

We followed the cohort for 15 years (2006.01.01–2020.12.31) examining their annual labor market outcomes. Eight mutually exclusive dominant labor market states were constructed based on accumulated UE days, full SA or DP days per calendar year, and a predefined "Price Base Amount" (PBA) (Swedish: "prisbasbelopp") provided by Statistics Sweden (Table S1) (Försäkringskassan, 2024a).

The PBA is an economic indicator used in Sweden for taxation, social insurance, and other purposes, including determining SA benefits (Statistikmyndigheten, 2025). It is set annually by the Swedish government and calculated by Statistics Sweden, based on the Consumer Price Index (CPI), to account for inflation and the changing cost of living (Försäkringskassan, 2024a). We used these amounts to determine individuals' attachment to the labor market by comparing their work income and work-related benefits to the PBA for the specific year.

A decision tree with detailed information on state assignment is shown in Fig. S1. The states are summarized below.

- "**Long-Term UE**":
  - >182.5 UE days.
- "**Long-Term SA/DP**":
  - 182.5 or fewer UE days *and*
  - SA, DP, or both SA and DP lasting longer than 182.5 full days.
- "**SA/DP and Economic Activity (EA)**":
  - 182.5 or fewer UE days *and*
  - SA, DP, or both SA and DP lasting between 91 and 182.5 full days *and*
  - Work income or work-related benefits equal to or greater than the PBA for the calendar year.
- "**SA/DP and No EA**":
  - 182.5 or fewer UE days *and*
  - SA, DP, or both SA and DP lasting between 91 and 182.5 full days *and*
  - Wok income or work-related benefits less than the PBA for the calendar year.
- "**EA**":
  - 182.5 or fewer UE days *and*
  - SA, DP, or both SA and DP lasting for 90 full days or shorter *and*
  - Work income or work-related benefits equal to or greater than the PBA for the calendar year.
- "**No EA**":
  - 182.5 or fewer UE days *and*
  - SA, DP, or both SA and DP lasting for 90 full days or shorter, *and*
  - Work income or work-related benefits less than the PBA for the calendar year.
- "**Dead**" – defined as having died before the end of the calendar year.
- "**Emigrated**" – defined as having emigrated before the end of the calendar year.

2.5. Covariates

Table 1 shows the sociodemographic, work, and health-related

Table 1
Population baseline characteristics (n = 9139).

Characteristic	n	%
Sex:		
Female	6254	68.4
Male	2885	31.6
Age (end of 2004):		
25–29	2133	23.3
30–34	2842	31.1
35–40	4164	45.6
Place of birth:		
Sweden	7856	86.0
Other Nordic	217	2.4
Other European	489	5.3
Rest of the World	577	6.3
Education level (end of 2004):		
Elementary[1] (<10 years)	1096	12.0
High school (10–12 years)	5216	57.1
University or college (>12 years)	2827	30.9
Family composition (end of 2004):		
Living without a partner and without children	3456	37.8
Living with a partner and without children	318	3.5
Living with a partner and with children	3967	43.4
Living without a partner and with children	1398	15.3
Type of living area (end of 2004):		
City	3724	40.8
Town or suburban area	3697	40.4
Rural area	1718	18.8
Occupational sector (end of 2004):		
Private	5277	57.8
Public	3422	37.4
Other[2]	440	4.8
Occupational industry (end of 2004):		
Agriculture, forestry, and fishing	68	0.7
Manufacturing and extraction	1325	14.5
Energy production, water supply, and waste management	48	0.5
Construction	245	2.7
Trade and communication	1646	18.0
Financial operations and business services	1125	12.3
Education and research	1168	12.8
Health and social care	2232	24.4
Personal and cultural services	746	8.2
Public administration	418	4.6
Unspecified activity	118	1.3
Unemployment days (end of 2004):		
Yes	1268	13.9
No	7871	86.1
SA history (within 2 years of the index SA start):		
0 days (no SA history)	5033	55.1
0 days < SA history ≤ 30 days	827	9.0
30 days < SA history ≤ 90 days	1282	14.0
90 days < SA history ≤ 180 days	853	9.3
180 days < SA history	1144	12.6
DP history (within 2 years of the index SA start):		
Yes	25	0.3
No	9114	99.7
Index SA diagnosis:		
Depressive disorder (F32)	8536	93.4
Recurrent depressive disorder (F33)	603	6.6
Index SA grade:		
Full-time (100 %)	7601	83.2
Part-time (75 %)	181	2.0
Part-time (50 %)	1054	11.5
Part-time (25 %)	303	3.3
Full index SA days:		
SA days ≤ 30 days	1795	19.7
30 days < SA days ≤ 90 days	3221	35.2
90 days < SA days ≤ 180 days	1540	16.9
180 days < SA days	2582	28.2
Mental comorbidities (within 2 years of the index SA start):		
Neurotic disorder (F40-F42)	254	2.8
Stress-related disorders (F43, Z.73.0)	214	2.3
Substance use disorders (F10-F19)	131	1.4
Other affective disorders (F34, F38, F39)	29	0.3
Personality disorders (F60-F69)	57	0.6
Attention-deficit hyperactivity disorder (ADHD) (F90.0)	<5	0.0

(*continued on next page*)

Table 1 (*continued*)

Characteristic	n	%
Other behavioral, emotional disorders (F50-F59 (excl. F50.0), F90.1-F98)	53	0.6
Other psychological developmental disorders (F80-F83, F84.2-F89)	<5	0.0
Other mental comorbidities (F04-F09, F44-F48, F99)	25	0.3
Somatic comorbidities (within 2 years of the index SA start):		
Cancer (C00-D48)	318	3.5
Endocrine, nutritional, and metabolic disorders (E00-E90)	238	2.6
Neurological disorders (G00-G99, excl. G30-G32)	271	3.0
Circulatory system disorders (I00-I99)	184	2.0
Respiratory disorders (J00-J99)	398	4.4
Musculoskeletal disorders (M00-M99)	612	6.7
Other chronic somatic disorders[3]	2235	24.5

[1] Missing information was classified as the lowest education level – “elementary education (<10 years)”.

[2] The occupational sector category “Other” contains individuals whose occupational codes could not be assigned to either the public or private sector, including the Church of Sweden.

[3] Other chronic somatic disorders: infectious and parasitic diseases (A00-B99), diseases of the blood and blood-forming organs (D50-D89), diseases of the eye and ear (H00-H95), diseases of the digestive system (K00-K93), diseases of the skin and subcutaneous tissue (L00-L99), and diseases of the genitourinary system (N00-N99).

factors included in the analysis. Factors assessed before the start of the index SA spell (end of 2024) included sex, age, place of birth, education level, family composition, living area type, occupational sector and industry, and UE days. Factors assessed within two years of the start of the index SA spell included SA and DP history and somatic and mental comorbidities. For mental comorbidities, we included: neurotic (ICD-10: F40-F42), stress-related (ICD-10: F43, Z73.0), substance use (ICD-10: F10-F19), and personality (ICD-10: F60-F69) disorders, attention-deficit hyperactivity disorder (ADHD) (ICD-10: F90.0), and other mental disorders (Tables 1 and 3). For somatic comorbidities, we included: cancer (ICD-10: C00-D48), endocrine, nutritional, and metabolic (ICD-10: E00-E90), neurological (ICD-10: G00-G99, excluding G30-G32), circulatory system (ICD-10: I00-I99), respiratory (ICD-10: J00-J99), and musculoskeletal (ICD-10: M00-M99) disorders, and other chronic somatic disorders (Tables 1 and 3). Finally, our analysis included the diagnosis, grade (full-time or part-time), and duration of the index SA spell.

2.6. Statistical analyses

We used the TraMineR package in R to analyze the yearly dominant labor market states over the 15-year follow-up (Gabadinho et al., 2010). First, we identified and visualized a complete set of labor market sequences, after which we identified the unique and most frequent sequences. We then computed and plotted the distribution of the states across each year, along with the mean time spent in each state. Additionally, we computed transition probabilities between the annual states.

Next, we applied the optimal matching (OM) with constant substitution costs technique to compute a sequence dissimilarity matrix (Gabadinho et al., 2011). The obtained dissimilarity matrix was used for cluster analysis with the Ward method (Ward, 1963). Since no universally accepted method for measuring sequence dissimilarities or selecting a clustering technique exists, we performed and compared multiple methods, following common practice in sequence analysis studies (Table S2) (Gabadinho et al., 2011). We assessed the quality of clusters using Average Silhouette Width (ASW) and other cluster partition quality measures (Table S3) (Studer and Ritschard, 2015).

We also computed descriptive statistics for the entire study population and the distribution of covariates across the identified clusters.

Finally, we conducted a multinomial logistic regression analysis to examine the associations between selected covariates and specific cluster memberships, using the largest cluster as the reference group. Covariates with low observation counts, such as place of birth, family composition, occupational industry, index SA grade, and mental and somatic comorbidities, were grouped into larger, meaningful categories (Table 4). We computed both crude and covariate-adjusted models. In the covariate-adjusted model, we excluded individuals missing occupational industry information ($n = 118$, 1.3 %), assuming this exclusion would not substantially affect the results. To verify this, we conducted a sensitivity analysis in which we treated those without information on the occupational industry as a separate category (unspecified occupational industry). Odds ratios (ORs) with 95 % confidence intervals (CIs) were calculated for the associations between cluster memberships and each covariate.

2.7. Ethical approval

The approval was granted by the Regional Ethical Review Board of Stockholm, Sweden (2007/5:6) and the Swedish Ethical Review Authority (Dnr. 2021–06441-02), who also waived the need for informed consent.

3. Results

3.1. Descriptive characteristics

The final study population included 9139 individuals, with an average age of 33.4 years (standard deviation (SD) = 4.5) (Table 1). The majority were female (68.4 %) and born in Sweden (86.0 %). Over half of the individuals had completed high school (57.1 %) and were employed in the private sector (57.8 %). Nearly all (86.1 %) were active in the labor market throughout the entire year before the start of the index SA spell due to depression in 2005.

In the two years before the index SA, more than half of the individuals (55.1 %) had SA due to any condition, and 0.3 % had a history of DP. The index SA spell was predominantly due to the depressive disorder diagnosis (F32) (93.4 %) as opposed to a recurrent depressive disorder (F33), which accounted for 6.6 % of the spells. Additionally, the index spell was mostly full-time (83.2 %) and lasted longer than 30 full days (80.3 %).

3.2. Sequence analysis

We identified 4373 distinct labor market sequences followed by individuals after an SA spell due to depression in 2005. The most common sequence, observed in 2227 (24.4 %) instances, was characterized by EA. All sequences, state distributions for each follow-up year, and the ten most common sequences, with a cumulative frequency of 34.4 %, are displayed in Fig. S2.

Throughout the 15-year follow-up, individuals spent the longest mean time in the “EA” state (10.8 years), while the “SA/DP + No EA” state had the shortest mean time of 0.05 years. On average, individuals spent 1.7 years in the “Long-Term SA/DP” state and 0.9 years in the “SA/DP + EA” state. Additionally, the mean time spent in the “No EA” state was 0.7 years, whereas, on average, individuals spent 0.5 years in the “Long-Term UE” state.

The state transition probabilities (Table 2) showed varying levels of stability across the labor market states. The following probability estimates refer to the probabilities of remaining in the same state unless specified otherwise. With a probability of 0.91, “EA” was the most stable state. The probabilities for “Long-Term SA/DP” and “No EA” were 0.67 and 0.59, respectively. The states “SA/DP + EA” and “Long-Term UE” both had probabilities of 0.27. The “SA/DP + No EA” state was the least stable, with a 0.15 probability. Regarding transitions to other states, the “Long-Term UE” state had a 0.43 probability of transitioning to the “EA” state. Finally, the transition probabilities from the “SA/DP + No EA” state to “Long-Term SA/DP” and “No EA” were 0.31 and 0.24,

Table 2
Probability matrix for transitions between the annual labor market states. Abbreviations used (in alphabetical order): EA – economic activity, SA/DP – sickness absence and/or disability pension, UE – unemployment.

States	Death	Emigration	Long-term UE	Long-term SA/DP	SA/DP + EA	SA/DP + No EA	EA	No EA
Death	1.000	0	0	0	0	0	0	0
Emigration	0	0.924	0.007	0.001	0	0.001	0.034	0.033
Long-term UE	0.002	0.004	0.266	0.062	0.028	0.011	0.432	0.195
Long-term SA/DP	0.004	0.001	0.026	0.674	0.108	0.012	0.148	0.026
SA/DP + EA	0.002	0.001	0.032	0.174	0.269	0.004	0.500	0.017
SA/DP + No EA	0.000	0.002	0.069	0.309	0.081	0.150	0.152	0.238
EA	0.001	0.001	0.018	0.020	0.036	0	0.909	0.015
No EA	0.003	0.014	0.057	0.030	0.012	0.008	0.287	0.588

respectively.

3.3. Cluster analysis

We identified seven distinct working life typologies followed by individuals after SA due to depression (Figs. 1 and S3). The cluster partition quality measures used to determine the number of typologies are detailed in Table S3. After analyzing the representative sequences of each typology (Fig. S4), we named them as follows:

1) “**Predominant EA**” (*n* = 6457, 70.7 %),
2) “**Predominant EA with Intermittent SA/DP**” (*n* = 1316, 14.4 %),
3) “**Predominant Long-Term SA/DP**” (*n* = 730, 8.0 %),
4) “**Long-Term SA/DP Followed by No EA**” (*n* = 199, 2.2 %),
5) “**SA/DP with Some EA**” (*n* = 152, 1.6 %),
6) “**Emigration**” (*n* = 154, 1.7 %),
7) “**Death**” (n = 131, 1.4 %).

Typologies characterized by long-term SA, DP, and no EA—specifically “Long-Term SA/DP Followed by No EA” and “Predominant Long-Term SA/DP”—had more individuals with UE days in the year preceding the study (22.6 % and 20.0 %, respectively) compared to the “Predominant EA” typology (11.2 %) (Table 3). Additionally, more individuals had SA history in typologies characterized by long-term SA, DP, and no EA compared to the “Predominant EA” typology (39.9 %): 54.3 % in the “Long-Term SA/DP Followed by No EA” and 65.3 % in the “Predominant Long-Term SA/DP” typology.

The duration of previous SA spells also varied: most individuals in the “Predominant EA” typology had spells lasting between 30 and 90 full days (13.6 %), while most in the “Long-Term SA/DP Followed by No EA” and “Predominant Long-Term SA/DP” typologies had spells longer than 180 full days (17.0 % and 27.1 %, respectively).

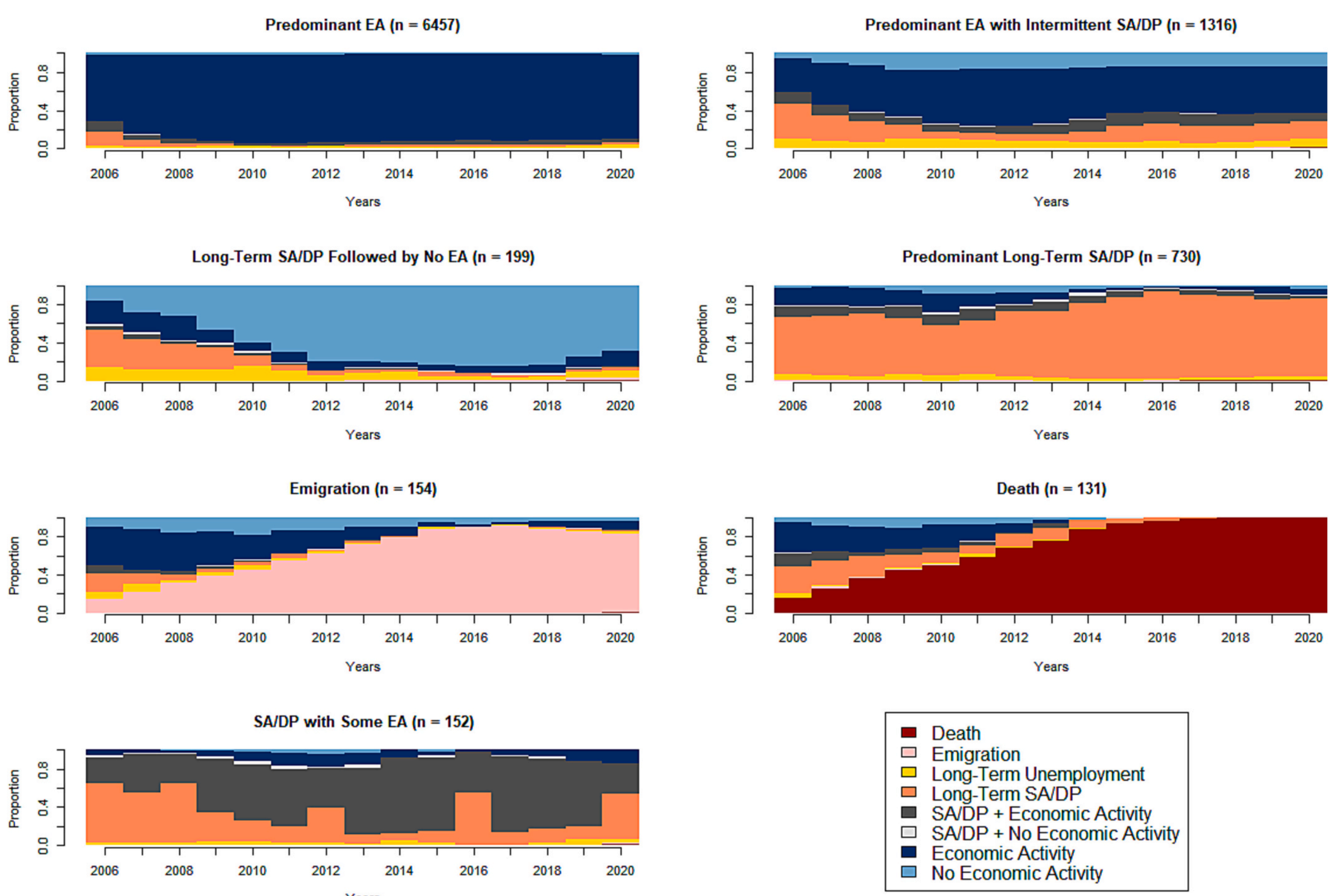

Fig. 1. Labor market state distributions for each of the seven clusters identified in cluster analysis (*n* = 9139). Abbreviations used (in alphabetical order): EA – economic activity, SA/DP – sickness absence and/or disability pension, UE – unemployment.

Table 3
Baseline characteristic distribution among the seven identified clusters (n = 9139).

Characteristic/cluster membership	Predominant EA	Predominant EA with intermittent SA/DP	Long-term SA/DP followed by no EA	Predominant long-term SA/DP	SA/DP with some EA	Emigration	Death
n (%)	6457 (70.7 %)	1316 (14.4 %)	199 (2.2 %)	730 (8.0 %)	152 (1.6 %)	154 (1.7 %)	131 (1.4 %)
Sex:							
Female	4490 (69.5 %)	880 (66.9 %)	109 (54.8 %)	524 (71.8 %)	118 (77.6 %)	79 (51.3 %)	54 (41.2 %)
Male	1967 (30.5 %)	436 (33.1 %)	90 (45.2 %)	206 (28.2 %)	34 (22.4 %)	75 (48.7 %)	77 (58.8 %)
Age (end of 2004):							
25–29	1557 (24.1 %)	321 (24.4 %)	46 (23.1 %)	124 (17.0 %)	22 (14.5 %)	44 (28.6 %)	19 (14.5 %)
30–34	2032 (31.5 %)	422 (32.1 %)	53 (26.6 %)	206 (28.2 %)	38 (25.0 %)	51 (33.1 %)	40 (30.5 %)
35–40	2868 (44.4 %)	573 (43.5 %)	100 (50.3 %)	400 (54.8 %)	92 (60.5 %)	59 (38.3 %)	72 (55.0 %)
Place of birth:							
Sweden	5676 (87.9 %)	1085 (82.5 %)	156 (78.5 %)	597 (81.7 %)	138 (90.8 %)	88 (57.2 %)	116 (88.6 %)
Other Nordic	137 (2.1 %)	23 (1.7 %)	–[1]	21 (2.9 %)	–	18 (11.7 %)	–
Other European	292 (4.5 %)	97 (7.4 %)	18 (9.0 %)	53 (7.3 %)	–	19 (12.3 %)	–
Rest of the World	352 (5.5 %)	111 (8.4 %)	–	59 (8.1 %)	–	29 (18.8 %)	–
Education level (end of 2004):							
Elementary (<10 years)[2]	652 (10.1 %)	197 (14.9 %)	48 (24.1 %)	132 (18.0 %)	18 (11.8 %)	28 (18.1 %)	21 (16.0 %)
High school (10–12 years)	3616 (56.0 %)	791 (60.2 %)	114 (57.3 %)	447 (61.3 %)	91 (59.9 %)	73 (47.5 %)	84 (64.2 %)
University or college (>12 years)	2189 (33.9 %)	328 (24.9 %)	37 (18.6 %)	151 (20.7 %)	43 (28.3 %)	53 (34.4 %)	26 (19.8 %)
Family composition (end of 2004):							
Living with a partner and without children	240 (3.7 %)	38 (2.9 %)	–	18 (2.5 %)	–	–	–
Living with a partner and with children	2974 (46.1 %)	510 (38.8 %)	52 (26.1 %)	287 (39.3 %)	62 (40.8 %)	40 (26.0 %)	42 (32.1 %)
Living without a partner and without children	2318 (35.9 %)	535 (40.7 %)	113 (56.8 %)	271 (37.1 %)	60 (39.5 %)	89 (57.8 %)	70 (53.4 %)
Living without a partner and with children	925 (14.3 %)	233 (17.1 %)	–	154 (21.1 %)	–	–	–
Type of living area (end of 2004):							
City	2617 (40.5 %)	544 (41.3 %)	90 (45.2 %)	274 (37.5 %)	60 (39.5 %)	81 (52.6 %)	58 (44.2 %)
Town or suburban area	2632 (40.8 %)	518 (39.4 %)	70 (35.2 %)	317 (43.5 %)	56 (36.8 %)	59 (38.3 %)	45 (34.4 %)
Rural area	1208 (18.7 %)	254 (19.3 %)	39 (19.6 %)	139 (19.0 %)	36 (23.7 %)	14 (9.1 %)	28 (21.4 %)
Occupational sector (end of 2004):							
Private	3658 (56.6 %)	807 (61.3 %)	135 (67.8 %)	409 (56.0 %)	72 (47.4 %)	106 (68.8 %)	90 (68.7 %)
Public	2498 (38.7 %)	446 (33.9 %)	53 (26.6 %)	286 (39.2 %)	66 (43.4 %)	–	–
Other[3]	301 (4.7 %)	63 (4.8 %)	11 (5.5 %)	35 (4.8 %)	14 (9.2 %)	–	–
Occupational industry (end of 2004):							
Primary industries[4]	998 (15.6 %)	222 (17.1 %)	–	111 (15.6 %)	20 (13.4 %)	–	36 (27.7 %)
Construction and trade	1323 (20.7 %)	290 (22.3 %)	46 (24.1 %)	137 (19.3 %)	–	38 (25.0 %)	–
Services	1283 (20.1 %)	286 (22.0 %)	58 (30.4 %)	149 (21.0 %)	33 (22.1 %)	39 (25.7 %)	23 (17.7 %)
Public and social services	2786 (43.6 %)	500 (38.5 %)	58 (30.4 %)	314 (44.2 %)	72 (48.3 %)	50 (32.9 %)	38 (29.2 %)
Unspecified activity	67 (1.04 %)	18 (1.37 %)	–	19 (2.60 %)	–	–	–
Unemployment days (end of 2004):							
Yes	722 (11.2 %)	275 (20.9 %)	45 (22.6 %)	146 (20.0 %)	21 (13.8 %)	30 (19.5 %)	29 (22.1 %)
No	5735 (88.8 %)	1041 (79.1 %)	154 (77.4 %)	584 (80.0 %)	131 (86.2 %)	124 (80.5 %)	102 (77.9 %)
SA history (within 2 years of the index SA start):							
Yes	2575 (39.9 %)	717 (54.5 %)	108 (54.3 %)	477 (65.3 %)	101 (66.4 %)	61 (39.6 %)	67 (51.1 %)
No	3882 (60.1 %)	599 (45.5 %)	91 (45.7 %)	253 (34.7 %)	51 (33.6 %)	93 (60.4 %)	64 (48.9 %)
SA history in days (within 2 years of the index SA start):							
0 days < SA history ≤ 30 days	569 (8.8 %)	129 (9.8 %)	21 (10.6 %)	74 (10.1 %)	15 (9.9 %)	–	–
30 days < SA history ≤ 90 days	875 (13.6 %)	200 (15.2 %)	30 (15.1 %)	111 (15.2 %)	28 (18.4 %)	16 (10.4 %)	22 (16.8 %)
90 days < SA history ≤ 180 days	529 (8.2 %)	161 (12.2 %)	23 (11.6 %)	94 (12.9 %)	21 (13.8 %)	–	–
180 days < SA history	602 (9.3 %)	227 (17.3 %)	34 (17.0 %)	198 (27.1 %)	37 (24.3 %)	19 (12.4 %)	27 (20.6 %)
Index SA diagnosis:							
Depressive disorder (F32)	6100 (94.5 %)	1220 (92.7 %)	183 (92.0 %)	647 (88.6 %)	128 (84.2 %)	141 (91.6 %)	117 (89.3 %)
Recurrent depressive disorder (F33)	357 (5.5 %)	96 (7.3 %)	16 (8.0 %)	83 (11.4 %)	24 (15.8 %)	13 (8.4 %)	14 (10.7 %)

(*continued on next page*)

Table 3 (*continued*)

Characteristic/cluster membership	Predominant EA	Predominant EA with intermittent SA/DP	Long-term SA/DP followed by no EA	Predominant long-term SA/DP	SA/DP with some EA	Emigration	Death
Index SA grade:							
Full-time (100 %)	5371 (83.2 %)	1128 (85.7 %)	178 (89.5 %)	585 (80.1 %)	83 (54.6 %)	137 (89.0 %)	119 (90.8 %)
Part-time (75 %, 50 %, and 25 %)	1086 (16.8 %)	188 (14.3 %)	21 (10.5 %)	145 (19.9 %)	69 (45.4 %)	17 (11.0 %)	12 (9.2 %)
Full index SA days:							
SA days ≤ 30 days	1415 (21.9 %)	176 (13.4 %)	38 (19.1 %)	89 (12.2 %)	24 (15.8 %)	34 (22.1 %)	20 (15.3 %)
30 days < SA days ≤ 90 days	2492 (38.6 %)	385 (29.3 %)	50 (25.1 %)	157 (21.5 %)	38 (25.0 %)	62 (40.3 %)	37 (28.2 %)
90 days < SA days ≤ 180 days	1122 (17.4 %)	232 (17.6 %)	31 (15.6 %)	95 (13.0 %)	13 (8.6 %)	19 (12.3 %)	28 (21.4 %)
180 days < SA days	1428 (22.1 %)	523 (39.7 %)	80 (40.2 %)	389 (53.3 %)	77 (50.6 %)	39 (25.3 %)	46 (35.1 %)
Mental comorbidities:							
Yes	604 (9.4 %)	175 (13.3 %)	26 (13.1 %)	138 (18.9 %)	27 (17.8 %)	20 (13.0 %)	38 (29.0 %)
No	5853 (90.6 %)	1141 (86.7 %)	173 (86.9 %)	592 (81.1 %)	125 (82.2 %)	134 (87.0 %)	93 (71.0 %)
Mental comorbidities by type:							
Neurotic disorders (F40-F42)	146 (2.3 %)	39 (3.0 %)	<10 (<5 %)	37 (5.1 %)	<10 (<6.6 %)	<10 (<6.5 %)	11 (8.4 %)
Stress-related disorders (F43, Z.73.0)	117 (1.8 %)	43 (3.3 %)	<10 (<5 %)	30 (4.1 %)	<10 (<6.6 %)	<10 (<6.5 %)	<10 (<7.6 %)
Substance use disorders (F10-F19)	68 (1.1 %)	25 (1.9 %)	<10 (<5 %)	16 (2.2 %)	0 (0.0 %)	<5 (<3.2 %)	11 (8.4 %)
Other affective disorders (F34, F38, F39)	12 (0.2 %)	<10 (<0.8 %)	0 (0.0 %)	<10 (<1.4 %)	<5 (<3.3 %)	<5 (<3.2 %)	<5 (<3.8 %)
Personality disorders (F60-F69)	23 (0.4 %)	<10 (<0.8 %)	0 (0.0 %)	17 (2.3 %)	<5 (<3.3 %)	<5 (<3.2 %)	<10 (<7.6 %)
Attention-deficit hyperactivity disorder (ADHD) (F90.0)	<5 (<0.08 %)	<5 (<0.4 %)	0 (0.0 %)	<5 (<0.7 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
Other behavioral and emotional disorders[5]	37 (0.6 %)	<10 (<0.8 %)	0 (0.0 %)	<5 (<0.7 %)	<5 (<3.3 %)	0 (0.0 %)	<5 (<3.8 %)
Other psychological developmental disorders[6]	<5 (<0.08 %)	<5 (<0.4 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
Other mental comorbidities (F04-F09, F44-F48, F99)	13 (0.2 %)	<10 (<0.8 %)	0 (0.0 %)	<5 (<0.7 %)	<5 (<3.3 %)	<5 (<3.2 %)	0 (0.0 %)
Somatic comorbidities:							
Yes	2222 (34.4 %)	508 (38.6 %)	70 (35.2 %)	328 (44.9 %)	70 (46.1 %)	62 (40.3 %)	43 (32.8 %)
No	4235 (65.6 %)	808 (61.4 %)	129 (64.8 %)	402 (55.1 %)	82 (53.9 %)	92 (59.7 %)	88 (67.2 %)
Somatic comorbidities by type:							
Cancer (C00-D48)	231 (3.6 %)	43 (3.3 %)	<10 (<5 %)	22 (3.0 %)	<10 (<6.6 %)	<5 (<3.2 %)	<10 (<7.6 %)
Endocrine, nutritional, and metabolic disorders (E00-E90)	143 (2.2 %)	48 (3.6 %)	<10 (<5 %)	26 (3.6 %)	<10 (<6.6 %)	<10 (<6.5 %)	<10 (<7.6 %)
Neurological disorders (G00-G99, excl. G30-G32)	155 (2.4 %)	51 (3.9 %)	<5 (<2.5 %)	38 (5.2 %)	<10 (<6.6 %)	<10 (<6.5 %)	<10 (<7.6 %)
Circulatory system disorders (I00-I99)	128 (2.0 %)	27 (2.1 %)	<10 (<5 %)	17 (2.3 %)	<5 (<3.3 %)	<5 (<3.2 %)	<5 (<3.8 %)
Respiratory disorders (J00-J99)	254 (3.9 %)	69 (5.2 %)	<10 (<5 %)	46 (6.3 %)	12 (7.9 %)	<10 (<6.5 %)	<5 (<3.8 %)
Musculoskeletal disorders (M00-M99)	397 (6.1 %)	94 (7.1 %)	12 (6.0 %)	74 (10.1 %)	12 (7.9 %)	14 (9.1 %)	<10 (<7.6 %)
Other chronic somatic disorders[7]	1518 (23.5 %)	328 (24.9 %)	57 (28.6 %)	215 (29.5 %)	48 (31.6 %)	41 (26.6 %)	28 (21.4 %)

[1] This and all following empty lines (–) are due to small numbers of observations, which were hidden using data protection techniques.
[2] Missing information is included in the lowest education level (elementary education).
[3] The occupational sector category "Other" contains individuals whose occupational codes could not be assigned to either the public or private sector, including the Church of Sweden.
[4] Primary industries: 1) Agriculture, forestry, and fishing, 2) Manufacturing and extraction, and 3) Energy production, water supply, and waste management. Construction and Trade: 1) Construction, and 2) Trade and communication. Services: 1) Financial operations and business services, and 2) Personal and cultural services. Public and Social Services: 1) Education and research, 2) Health and social care, and 3) Public administration.
[5] Other behavioral, emotional disorders: F50-F59 (excl. F50.0), F90.1-F98.
[6] Other psychological developmental disorders: F80-F83, F84.2-F89.
[7] Other chronic somatic disorders: Infectious and parasitic diseases (A00-B99), diseases of the blood and blood-forming organs (D50-D89), diseases of the eye and ear (H00-H95), diseases of the digestive system (K00-K93), diseases of the skin and subcutaneous tissue (L00-L99), diseases of the genitourinary system (N00-N99).

Moreover, mental and somatic comorbidities were less common among those in the “Predominant EA” typology (9.4 % with mental and 34.4 % with somatic comorbidities) compared to those in the long-term SA, DP, and no EA typologies, with “Predominant Long-Term SA/DP” having the highest rates (18.9 % with mental and 44.9 % with somatic comorbidities).

3.4. Multinomial logistic regression analysis

The results of the crude multinomial logistic regression analysis are presented in Table S4. Mutually adjusting the model for all tested covariates did not substantially change the results (Fig. 2, Table 4). The reference group in all models was the “Predominant EA” typology.

The results of the sociodemographic factor analysis showed that individuals born outside Sweden had nearly twice the odds of belonging to the “Long-Term SA/DP Followed by No EA” typology compared to those born in Sweden (OR = 1.84, 95 % CI: 1.27–2.66). Similarly, being born outside Sweden was associated with higher odds of belonging to the “Predominant Long-Term SA/DP” typology (OR = 1.61, 95 % CI: 1.29–2.01). Additionally, lower educational attainment, especially having completed only elementary education, was associated with higher odds of belonging to the typologies characterized by long-term SA, DP, and no EA: those with elementary-level education had the OR of 4.44 (95 % CI: 2.76–7.16) for “Long-Term SA/DP Followed by No EA” and 3.20 (95 % CI: 2.42–4.22) for “Predominant Long-Term SA/DP.” Moreover, individuals living with children had lower odds of belonging to the long-term SA, DP, and no EA typologies, particularly the “Long-Term SA/DP Followed by No EA” typology (OR = 0.37, 95 % CI: 0.27–0.52).

Regarding work-related factors, having any UE days in the year before the index SA was associated with nearly double the odds of belonging to typologies characterized by long-term SA, DP, and no EA (OR = 1.84, 95 % CI: 1.28–2.65 for the “Long-Term SA/DP Followed by No EA” typology and OR = 2.00, 95 % CI: 1.61–2.48 for the “Predominant Long-Term SA/DP” typology).

Finally, the analysis of health-related factors showed that a history of long-term SA was associated with belonging to both the “Long-Term SA/DP Followed by No EA” typology (OR = 2.49, 95 % CI: 1.63–3.81) and the “Predominant Long-Term SA/DP” typology (OR = 3.60, 95 % CI: 2.87–4.50). The odds of belonging to these typologies were also higher for individuals whose index SA spells due to depression lasted longer than 180 full days (OR = 2.08, 95 % CI: 1.36–3.17 for the first typology; OR = 4.81, 95 % CI: 3.71–6.25 for the second). Recurrent depressive disorder (OR = 1.85, 95 % CI: 1.40–2.44), part-time spells (OR = 1.47, 95 % CI: 1.19–1.83), and mental (OR = 1.56, 95 % CI: 1.24–1.95) and somatic (OR = 1.31, 95 % CI: 1.11–1.55) comorbidities were associated with the “Predominant Long-Term SA/DP” typology, specifically.

The sensitivity analysis, which included individuals with unspecified occupational industry (n = 118, 1.3 %) as a separate group, produced results consistent with the main analyses (Table S5).

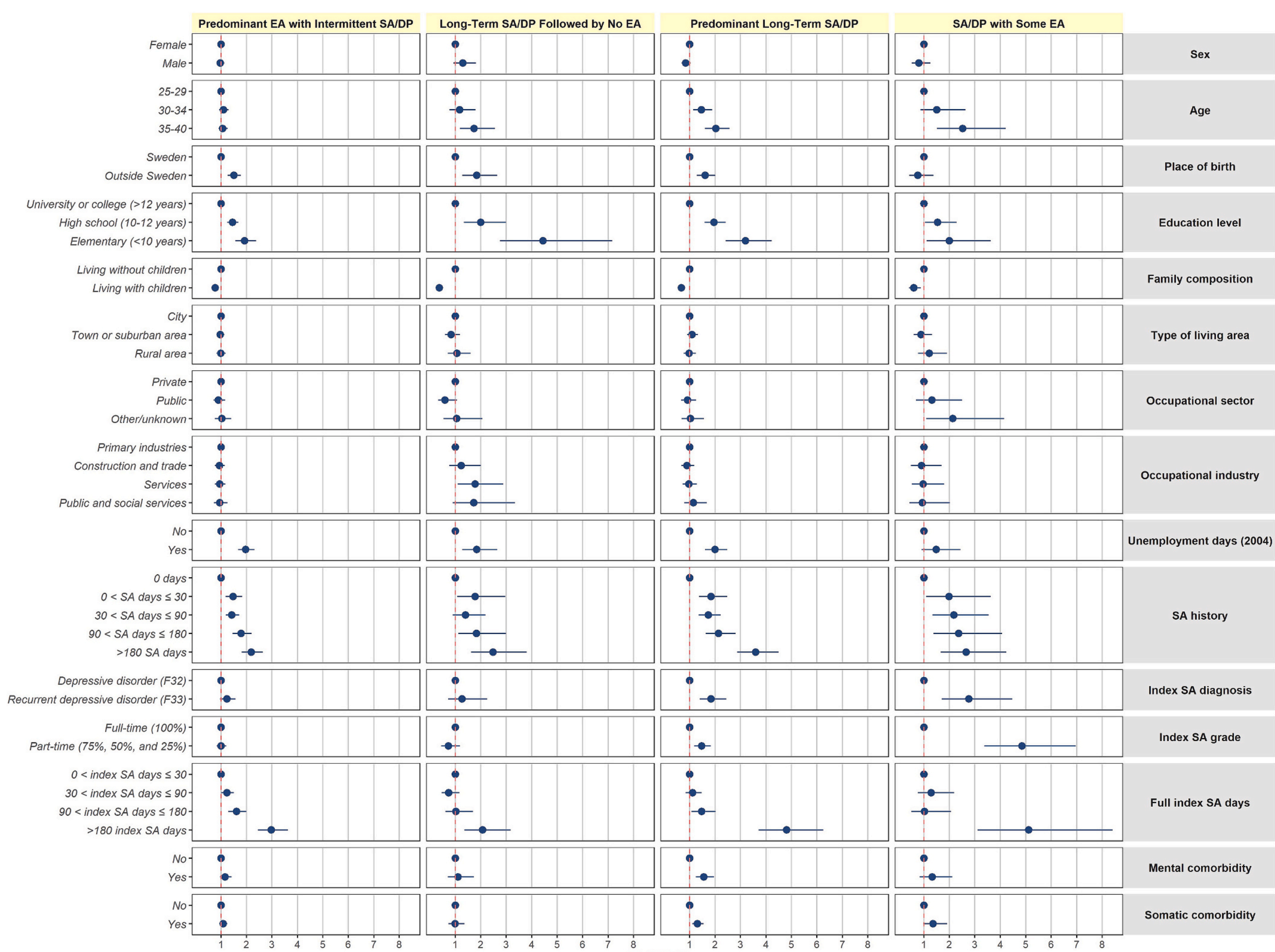

Fig. 2. Odds ratio (OR) plots of the covariate-adjusted multinomial logistic regression model (n = 9021). Reference group – the “Predominant Economic Activity” cluster.

Table 4
Adjusted multinomial logistic regression results without individuals with unspecified occupational industry activity (n = 9021). Reference group – the "Predominant Economic Activity" cluster.

Predictor/cluster membership	Predominant EA	Predominant EA with intermittent SA/DP			Long-term SA/DP followed by No EA			Predominant long-term SA/DP			SA/DP with some EA		
	n (%)	n (%)	OR	95 % CI	n (%)	OR	95 % CI	n (%)	OR	95 % CI	n (%)	OR	95 % CI
Sex:													
Female	4438 (69.5 %)	871 (67.1 %)	ref		104 (54.5 %)	ref		510 (71.7 %)	ref		115 (77.2 %)	ref	
Male	1952 (30.5 %)	427 (32.9 %)	0.97	0.84–1.13	87 (45.5 %)	1.30	0.93–1.82	201 (28.3 %)	0.85	0.69–1.04	34 (22.8 %)	0.81	0.52–1.26
Age:													
25–29	1542 (24.1 %)	317 (24.4 %)	ref		44 (23.0 %)	ref		118 (16.60 %)	ref		21 (14.09 %)	ref	
30–34	2012 (31.5 %)	416 (32.1 %)	1.10	0.93–1.30	52 (27.2 %)	1.18	0.77–1.79	201 (28.27 %)	1.47	1.14–1.89	38 (25.50 %)	1.51	0.87–2.63
35–40	2836 (44.4 %)	565 (43.5 %)	1.07	0.91–1.27	95 (49.8 %)	1.74	1.18–2.56	392 (55.13 %)	2.03	1.60–2.57	90 (60.40 %)	2.53	1.51–4.21
Place of birth:													
Sweden	5627 (88.1 %)	1074 (82.7 %)	ref		149 (78.0 %)	ref		581 (81.72 %)	ref		136 (91.3 %)	ref	
Outside Sweden	763 (11.9 %)	224 (17.3 %)	1.51	1.268–1.786	42 (22.0 %)	1.84	1.27–2.66	130 (18.28 %)	1.61	1.29–2.01	13 (8.72 %)	0.77	0.42–1.38
Education level (2004):													
Elementary (<10 years)	646 (10.1 %)	194 (14.9 %)	1.93	1.56–2.38	45 (23.6 %)	4.44	2.76–7.16	126 (17.72 %)	3.20	2.42–4.22	18 (12.08 %)	2.00	1.11–3.63
High school (10–12 years)	3567 (55.8 %)	780 (60.1 %)	1.45	1.25–1.69	111 (58.1 %)	2.00	1.34–2.99	438 (61.60 %)	1.96	1.59–2.41	88 (59.06 %)	1.54	1.04–2.28
University or college (>12 years)	2177 (34.1 %)	324 (25.0 %)	ref		35 (18.3 %)	ref		147 (20.68 %)	ref		43 (28.86 %)	ref	
Family composition (2004):													
Living without children	2533 (39.6 %)	564 (43.5 %)	ref		114 (59.7 %)	ref		279 (39.24 %)	ref		61 (40.94 %)	ref	
Living with children	3857 (60.4 %)	734 (56.5 %)	0.77	0.67–0.89	77 (40.3 %)	0.37	0.27–0.52	432 (60.76 %)	0.68	0.56–0.82	88 (59.06 %)	0.60	0.42–0.88
Type of living area (2004):													
City	2596 (40.6 %)	538 (41.4 %)	ref		89 (46.6 %)	ref		271 (38.12 %)	ref		59 (39.60 %)	ref	
Town or suburban area	2600 (40.7 %)	510 (39.3 %)	0.98	0.85–1.13	64 (33.5 %)	0.84	0.60–1.18	307 (43.18 %)	1.10	0.92–1.33	55 (36.91 %)	0.89	0.60–1.32
Rural area	1194 (18.7 %)	250 (19.3 %)	0.99	0.83–1.18	38 (19.9 %)	1.07	0.71–1.61	133 (18.71 %)	0.98	0.77–1.24	35 (23.49 %)	1.21	0.77–1.91
Occupational sector (2004):													
Private	3639 (56.9 %)	805 (62.0 %)	ref		135 (70.6 %)	ref		405 (56.96 %)	ref		71 (47.65 %)	ref	
Public	2451 (38.4 %)	430 (33.1 %)	0.90	0.71–1.16	45 (23.6 %)	0.60	0.33–1.07	271 (38.12 %)	0.92	0.67–1.26	64 (42.95 %)	1.32	0.69–2.50
Other	300 (4.7 %)	63 (4.9 %)	1.03	0.76–1.40	11 (5.8 %)	1.06	0.54–2.07	35 (4.92 %)	1.04	0.69–1.56	14 (9.40 %)	2.14	1.10–4.15
Occupational industry (2004):													
Primary industries	998 (15.6 %)	222 (17.1 %)	ref		29 (15.2 %)	ref		111 (15.61 %)	ref		20 (13.42 %)	ref	
Construction and trade	1323 (20.7 %)	290 (22.3 %)	0.94	0.77–1.15	46 (24.0 %)	1.23	0.76–2.00	137 (19.27 %)	0.90	0.68–1.18	24 (16.11 %)	0.91	0.49–1.70
Services	1283 (20.1 %)	286 (22.0 %)	0.95	0.77–1.17	58 (30.4 %)	1.78	1.10–2.88	149 (20.96 %)	0.97	0.73–1.29	33 (22.15 %)	0.97	0.53–1.80
Public and social services	2786 (43.6 %)	500 (38.6 %)	0.95	0.72–1.26	58 (30.4 %)	1.73	0.90–3.34	314 (44.16 %)	1.16	0.80–1.67	72 (48.32 %)	0.94	0.43–2.03
Unemployment days (2004):													
No	5683 (88.9 %)	1030 (79.4 %)	ref		149 (78.0 %)	ref		569 (80.03 %)	ref		129 (86.6 %)	ref	
Yes	707 (11.1 %)	268 (20.6 %)	1.97	1.68–2.32	42 (22.0 %)	1.84	1.28–2.65	142 (19.97 %)	2.00	1.61–2.48	20 (13.42 %)	1.49	0.91–2.44
SA history (within 2 years of the index SA start):													
0 days	3845 (60.1 %)	593 (45.6 %)	ref		88 (46.1 %)	ref		248 (34.88 %)	ref		49 (32.89 %)	ref	
0 days < SA history ≤ 30 days	563 (8.8 %)	128 (9.9 %)	1.48	1.19–1.84	20 (10.5 %)	1.79	1.08–2.97	69 (9.70 %)	1.84	1.37–2.47	15 (10.07 %)	1.99	1.09–3.63
30 days < SA history ≤90 days	867 (13.6 %)	197 (15.2 %)	1.43	1.19–1.72	27 (14.1 %)	1.40	0.90–2.19	110 (15.47 %)	1.74	1.36–2.22	28 (18.79 %)	2.18	1.34–3.54
90 days < SA history ≤ 180 days	522 (8.2 %)	157 (12.1 %)	1.79	1.46–2.20	22 (11.5 %)	1.83	1.12–2.99	91 (12.80 %)	2.14	1.63–2.81	21 (14.09 %)	2.37	1.39–4.06
180 days < SA history	593 (9.3 %)	223 (17.2 %)	2.19	1.82–2.64	34 (17.8 %)	2.49	1.63–3.81	193 (27.14 %)	3.60	2.87–4.50	36 (24.16 %)	2.66	1.67–4.24
Index SA diagnosis:													
Depressive disorder (F32)	6037 (94.5 %)	1204 (92.8 %)	ref		177 (92.7 %)	ref		630 (88.61 %)	ref		125 (83.9 %)	ref	
Recurrent depressive disorder (F33)	353 (5.5 %)	94 (7.2 %)	1.23	0.96–1.58	14 (7.3 %)	1.27	0.7–2.245	81 (11.39 %)	1.85	1.40–2.44	24 (16.11 %)	2.77	1.71–4.48
Index SA grade:													
Full-time (100 %)	5314 (83.2 %)	1113 (85.7 %)	ref		170 (89.0 %)	ref		568 (79.89 %)	ref		80 (53.69 %)	ref	
Part-time (75 %, 50 %, and 25 %)	1076 (16.8 %)	185 (14.3 %)	1.00	0.84–1.20	21 (11.0 %)	0.73	0.45–1.18	143 (20.11 %)	1.47	1.19–1.83	69 (46.31 %)	4.85	3.38–6.97
Full index SA days:													

(*continued on next page*)

Table 4 (*continued*)

Predictor/cluster membership	Predominant EA	Predominant EA with intermittent SA/DP			Long-term SA/DP followed by No EA			Predominant long-term SA/DP			SA/DP with some EA		
	n (%)	n (%)	OR	95 % CI	n (%)	OR	95 % CI	n (%)	OR	95 % CI	n (%)	OR	95 % CI
SA days ≤ 30 days	1396 (21.9 %)	175 (13.5 %)	ref		35 (18.3 %)	ref		87 (12.24 %)	ref		24 (16.11 %)	ref	
30 days < SA days ≤ 90 days	2465 (38.5 %)	381 (29.4 %)	1.24	1.02–1.50	49 (25.7 %)	0.74	0.4–1.16	154 (21.66 %)	1.12	0.84–1.48	38 (25.50 %)	1.29	0.76–2.19
90 days < SA days ≤ 180 days	1116 (17.5 %)	226 (17.4 %)	1.61	1.29–2.00	31 (16.2 %)	1.03	0.62–1.70	93 (13.08 %)	1.47	1.08–2.02	13 (8.72 %)	1.03	0.51–2.07
180 days < SA days	1413 (22.1 %)	516 (39.7 %)	2.98	2.45–3.62	76 (39.8 %)	2.08	1.36–3.17	377 (53.02 %)	4.81	3.71–6.25	74 (49.66 %)	5.11	3.11–8.41
Mental comorbidity:													
No	5793 (90.7 %)	1126 (86.7 %)	ref		166 (86.9 %)	ref		576 (81.01 %)	ref		123 (82.5 %)	ref	
Yes	597 (9.3 %)	172 (13.3 %)	1.16	0.96–1.41	25 (13.1 %)	1.11	0.71–1.73	135 (18.99 %)	1.56	1.24–1.95	26 (17.5 %)	1.33	0.84–2.11
Somatic comorbidity:													
No	4194 (65.6 %)	798 (61.5 %)	ref		124 (64.9 %)	ref		391 (54.99 %)	ref		81 (54.36 %)	ref	
Yes	2196 (34.4 %)	500 (38.5 %)	1.09	0.96–1.24	67 (35.1 %)	0.99	0.73–1.36	320 (45.01 %)	1.31	1.11–1.55	68 (45.64 %)	1.36	0.97–1.91

4. Discussion

4.1. Main findings

Our study identified 4373 distinct labor market sequences and seven working life typologies followed by individuals after SA due to depression: 1. "Predominant EA," 2. "Predominant EA with Intermittent SA/DP," 3. "Predominant Long-Term SA/DP," 4. "Long-Term SA/DP Followed by No EA," 5. "SA/DP with Some EA," 6. "Emigration," and 7. "Death". Most individuals (70.7 %) belonged to a typology with predominant EA. However, 11.8 % belonged to typologies characterized by long-term SA, DP, and no EA.

Being born outside Sweden, lower educational attainment, a history of UE and SA spells, especially long-term spells, and longer index spells due to depression were associated with higher odds of belonging to typologies characterized by long-term SA, DP, and no EA. In contrast, living with children was associated with lower odds of belonging to these typologies.

4.2. Yearly labor market pathways

Using sequence analysis, we identified year-by-year patterns of potential LMM among individuals with SA due to depression. Specifically, we distinguished between labor market states suggesting health-related marginalization, measured by prolonged SA and DP, and labor market-driven marginalization, characterized by long-term UE and no EA. This distinction is important because, even though depression is a risk factor for both types of marginalization, the sociodemographic, work, and health-related factors associated with each type may differ, requiring different interventions.

The observed state transition probabilities indicated a higher likelihood of reintegration into the labor market from states involving short-term SA/DP combined with EA ("SA/DP + EA") compared to those with long-term SA/DP spells ("Long-Term SA/DP"). This finding aligns with research suggesting that a shorter SA spell can serve as a necessary break from potentially stressful work environments and allow for financial stability without significantly hindering long-term reintegration into the labor market (Helgesson et al., 2015b). On the other hand, previous studies have found that greater depression severity is associated with poorer labor market attachment after SA (Hakulinen et al., 2020; Rose et al., 2023). Therefore, it is possible that the observed higher likelihood of transitioning to EA states among individuals with short-term SA/DP was due to their milder forms of depression.

In contrast, the likelihood of labor market re-entry was significantly lower for individuals in states with prolonged SA/DP spells ("Long-Term SA/DP") or SA/DP without EA ("SA/DP + No EA"), putting them at a higher risk of LMM. These results align with those of previous studies suggesting that SA and DP periods themselves can negatively impact work participation and lead to LMM (Alexanderson et al., 2011; Helgesson et al., 2015a; Hultin et al., 2012). This may result from deteriorating job skills or the stigma associated with being away from work for prolonged periods (Lännerström et al., 2013). Additionally, longer SA and DP spells might indicate greater depression severity, which can require long-lasting treatment and recovery times, further hindering RTW (Ervasti et al., 2017; Hakulinen et al., 2020; Rose et al., 2023). Overall, our results highlight the importance of preventing short-term SA and DP spells from extending into long-term spells, as suggested by previous studies (Ejeby et al., 2014; Helgesson et al., 2015b; Hultin et al., 2012).

4.3. Determinants of working life typologies

Regarding sociodemographic factors, we found that individuals with lower education levels, both elementary and high school, were less likely to remain in the labor market after SA due to depression than those with university-level education. This finding is consistent with several previous studies showing that higher education and, more broadly, socioeconomic status can serve as protective factors against the recurrence of SA among individuals with depression and other CMDs (Helgesson et al., 2015b; in't Hout et al., 2024; Karlsson et al., 2008). This association is unsurprising as higher education often leads to increased job security and improved working conditions, including having more control over one's schedule and the ability to work from home (Hultin et al., 2010). In contrast, jobs with low control, limited flexibility, and high job strain have been associated with higher SA rates among individuals with CMDs (Helgesson et al., 2023). Additionally, individuals with lower education levels might hold more physically demanding jobs, which may contribute to poorer labor market outcomes (Laaksonen et al., 2009). It is also important to note that early-onset mental disorders, including depression, can lead to lower subsequent educational attainment (Breslau et al., 2008; Wickersham et al., 2020). In that case, the observed association between lower educational levels and labor market typologies indicating potential LMM could be attributed to the underlying and potentially more severe depressive disorder. Thus, future studies assessing this relationship independently are warranted.

Regarding health-related factors, the association between previous SA spells, particularly long-term ones, and future SA, DP, and decreased RTW has been established in both the general population and among individuals with depression and other CMDs (Fisker et al., 2022; Helgesson et al., 2015b; in't Hout et al., 2024; Karlsson et al., 2008). Our study further supports this relationship, specifically among those with depression-related SA. Previous SA can be considered an indicator of depression severity, suggesting that individuals with more severe depressive symptoms are at a higher risk of labor market exclusion (Ervasti et al., 2017; Hakulinen et al., 2020; Rose et al., 2023). This may result from the ongoing mental health challenges requiring extended SA or DP spells, or from the difficulties these symptoms create in finding and maintaining employment. Nevertheless, a study that controlled for both physical and mental health showed that an SA spell itself was associated with future long-term SA (Hultin et al., 2012). The possible mechanisms for this relationship could be related to skill deterioration, social isolation, and the increased risk of job loss (Lännerström et al., 2013). It is important to note that our analysis included data on mental and somatic comorbidities diagnosed only in inpatient and specialized outpatient settings. Unaccounted comorbidities could have contributed to prior SA spells, which could potentially result in subsequent long-term SA, DP, and no EA.

Moreover, consistent with some existing studies, we observed that prior UE days were associated with future long-term SA, DP, and no EA among individuals with depression-induced SA (Helgesson et al., 2012). Similar to the effects of SA history, the observed association could be due to the potential deterioration of skills needed to stay active in the labor market and reduced employability following UE (Lännerström et al., 2013). Many studies point to the negative effects of UE on one's mental health (Jefferis et al., 2011; Paul and Moser, 2009), which could have led to worsened depression and, in turn, to subsequent long-term SA, DP, and no EA. However, a substantial body of literature also presents evidence for the selection of the unhealthy into UE highlighting the lack of association between UE and worsened mental health in longitudinal data (Böckerman and Ilmakunnas, 2009; Browning et al., 2006; Stauder, 2018). While it was not possible to investigate the causal directionality between UE and depression with our study design, future research is needed to better understand this relationship.

Furthermore, our findings align with those of previous research supporting the association between immigrant backgrounds and outcomes indicating LMM after an SA spell due to depression and other CMDs (Helgesson et al., 2015b; Helgesson et al., 2018; Werlen et al., 2017). One reason for this may be greater depression severity and overall morbidity among immigrants, potentially due to differential access to care, unfamiliarity with the healthcare system, stigma associated with seeking help, and limited transcultural understanding of healthcare workers (Bäärnhielm et al., 2013; Helgesson et al., 2017). Additionally, structural discrimination in the labor market might force immigrants into low-skilled positions, potentially contributing to higher LMM (Knocke, 2000). On the other hand, several studies examining labor market outcomes among individuals with a CMD diagnosis—as opposed to gainfully employed individuals with an SA spell due to depression and other CMDs—have found comparable or even lower SA and DP rates in immigrants compared to Swedish-born individuals (Di Thiene et al., 2019; Helgesson et al., 2017). Our study could have found higher rates because it examined gainfully employed individuals, and previous work income is often a prerequisite for SA benefits in Sweden. Also, our analysis might have generated more insightful findings if we had included more specific birth countries, which was not possible due to the limited number of observations in certain categories.

Finally, the analysis of the duration and grade of depression-induced SA spells produced inconclusive results. We found that individuals whose SA due to depression lasted longer than 180 full days were more likely to belong to both the "Predominant Long-Term SA/DP" and "Long-Term SA/DP Followed by No EA" typologies. The association between long-term SA spells and future labor market exclusion has been established, and it reflects higher work disability due to a more severe illness (Fisker et al., 2022; Helgesson et al., 2015b; Karlsson et al., 2008). However, we also found that part-time SA spells were associated with higher odds of belonging to the "Predominant Long-Term SA/DP" typology but not with other typologies characterized by no EA. Such finding aligns with those reported in the study by Farrants et al. (2018), which investigated work disability trajectories after SA spells due to depression lasting 21 days or longer and found that part-time spells were associated with a "decrease and a high increase in work disability" trajectory during the 13-month follow-up (Farrants et al., 2018). While part-time SA spells, in general, often indicate a certain level of work ability, these individuals may return to work too early before fully recovering, leading them to long-term SA/DP. Overall, our findings highlight the need for further research on how SA spell length and grade affect future labor market participation.

4.4. Strengths and limitations

One of the main strengths of this study is our use of high-quality national-level registries with data on all Swedish residents with SA benefits due to depression in 2005. This resulted in a large and representative sample that enhances the generalizability of the findings to the broader population eligible for SA benefits.

Another important strength of this study is our use of sequence analysis to examine diverse labor market outcomes. Beyond more conventional outcomes like UE that often underestimate LMM among individuals with CMDs (Helgesson et al., 2018), we also considered SA, DP, and time spent without work income or work-related benefits, which allowed us to distinguish between health-related pathways to LMM and those primarily driven by the labor market. Using sequence analysis, we were also able to assess the order of the outcomes, their duration, and distribution over time. Finally, the 15-year follow-up allowed us to capture long-term working life trends as opposed to short-term and potentially less detrimental trends.

On the other hand, our study has some limitations. First, while sequence and cluster analyses are tools to meaningfully describe and visualize distinct labor market pathways over a prolonged time, the results produced by these methods are dependent on researchers' choices of state definitions, clustering techniques, and the number of cluster solutions. In this study, we motivated these choices based on the existing literature, cluster partition quality measures, properties of the data, and the interpretability of the findings in the real-world context.

Second, national-level primary care data was unavailable and, therefore, not included in this study, which prevented us from assessing mental and somatic comorbidities diagnosed in those settings. Similarly, due to the lack of data, we were unable to include personality traits, workplace conditions, and psychological treatments and interventions in our study, which could have meaningfully informed our analysis. Future research with appropriate data and methods is necessary to assess the effect of such factors unmeasured in our study. Additionally, the data from the Social Insurance Agency only covers SA spells lasting longer than 14 days, meaning that shorter spells were not included in our study. This limitation prevented us from studying individuals with potentially less severe depression, not requiring 14 days of SA. Finally, our results have limited generalizability to individuals outside of the studied age and countries with different healthcare and social protection systems from those in Sweden.

5. Conclusions

Most individuals after sickness absence due to depression were able to maintain their long-term attachment to the labor market. However, certain groups might face a higher risk of labor market marginalization. These vulnerable groups include individuals with lower education, foreign-born individuals, and those with a history of unemployment and sickness absence, especially long-term sickness absence. While generally, Sweden's current welfare system supports the workforce participation of individuals with sickness absence due to depression, future public health policies and return-to-work interventions should be tailored to the specific needs of vulnerable groups to prevent marginalization.

CRediT authorship contribution statement

Gerda Stutaite: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Ellenor Mittendorfer-Rutz:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Magnus Helgesson:** Writing – review & editing, Methodology, Conceptualization. **Alexander Kautzky:** Methodology, Conceptualization. **Anna Finnes:** Writing – review & editing. **Katalin Gémes:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Formal analysis, Conceptualization.

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Declaration of competing interest

The authors have no competing interests to declare.

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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.2025.03.073.

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