Clustering of social disadvantage with attention-deficit/hyperactivity disorder in young adults: a register-based study in Sweden

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Research Article

Abstract

Background

Whether clustering of social disadvantage in young adulthood is associated with attention-deficit/hyperactivity disorder (ADHD) is poorly understood. We examined clustering of ADHD with low educational attainment and unemployment in young adulthood; whether such clustering is stronger when unemployment was prolonged; and whether further clustering of disability pensioning, low education and unemployment occurs among those with ADHD.

Methods

Data were obtained from Swedish health, demographic and social security registers from which 8990 individuals with recorded ADHD diagnoses at the age of 10 to 35 and their 44387 matched references without mental disorders. Social disadvantage was measured using data on educational attainment, unemployment and disability pension from the diagnosis year or age 19 if diagnosed at younger age. Clustering was examined by comparing observed and expected occurrence (O/E ratio) of all possible combinations of ADHD, low education and unemployment, and, among those with ADHD, additional combinations with new-onset disability pension.

Results

The likelihood of having neither ADHD, low education nor unemployment was increased (O/E ratio = 1.20, 95% confidence interval 1.19−1.20 at baseline; 1.18, 1.17−1.18 at follow-up), as well as having all three characteristics (O/E ratio = 3.99, 3.89−4.10 at baseline; 5.68, 5.47−5.89 at follow-up). This clustering was stronger among women than men and when unemployment was prolonged. Among individuals with ADHD, clustering of low education with disability pension and unemployment was observed.

Conclusions

Low education and unemployment appear to cluster remarkably with ADHD among young adults, more so among women and when unemployment is prolonged.

Background

Attention-deficit/hyperactivity disorder (ADHD) is an early-onset neurodevelopmental disorder characterised by cognitive and behavioural symptoms, such as abnormal attention, impulsiveness, hyperactivity, disorganization, and time management problems, which can substantially impair functional capacity [1, 2] and work capacity [3−5] if the condition persists into adulthood. The prevalence of ADHD is about 3% among adults [2, 6] although underdiagnosis is a common problem in many countries [2].

Among young adults, ADHD has been associated with higher risk of social disadvantage, such as poor educational attainment and unemployment [7–11] and poor educational attainment has been suggested to be an important factor linking ADHD to unemployment [11] and depression [12] in adulthood. Because much of the literature has focused on one risk factor at a time, the extent to which ADHD, low education, unemployment and work disability pension co-occur, i.e., cluster within individuals, is poorly understood. Better understanding of the interrelations among risk factors would help identify high-risk groups and develop effective interventions for the prevention of social disadvantage and labour market marginalisation.

Observed-expected (O/E) ratio is a simple summary estimate of clustering, that is, whether combinations of risk factors occur more (or less) often than would be expected if the risk factors were independent [13]. In the present study, we used nationwide linked register data of individuals diagnosed with ADHD at the age between 10 and 35 and a matched reference group without any recorded mental disorders, to examine (1) whether ADHD, unemployment and low educational attainment clustered; (2) whether clustering was stronger when unemployment was prolonged; and (3) whether further clustering of disability pension, low education and unemployment occurred among the group diagnosed with ADHD.

Methods

Sample and procedure

We obtained the data for this study from the nationwide registers in Sweden. Data on inpatient hospitalizations (1987–2011) and specialized outpatient healthcare (2001–2013) were obtained from the National Board of Health and Welfare's registers (dates and International Classification of Diseases, ICD-10 diagnoses), from which we identified the onset date occurring 2001–2010 for the first recorded ADHD (diagnosis F90) for individuals aged 10 to 35 years. Individuals with ADHD were included in the analyses if they had lived in Sweden at least five years prior to the register record of ADHD and if they were not on disability pension at study baseline, a total of 8990 individuals with ADHD. For each individual with ADHD, we randomly selected five matched references from the general population register that had not any indication of mental disorders (F-diagnoses) during the study period (1987–2011, $N = 44387$). They were matched to cases on age, sex, area of residence and country of birth, and their follow-up began at the same time as ADHD patient's. A one-year follow-up began from the date of diagnosis, except when age at diagnosis was less than 19 years, in which case the follow-up began at the age of 19.

Measures

Statistics Sweden's Longitudinal Integration Database for Health Insurance and Labour Market Studies (LISA)[14] provided linked data on sociodemographic factors (sex, age, educational level, birth country and area of residence). Annual number of unemployment days was obtained from Swedish Employment Agency. We calculated the following three dichotomous unemployment variables at baseline and at follow-up: (1) any unemployment (> 0 days); (2) medium-to-long-term (> 90 days); and (3) long-term (>

180 days) unemployment. Baseline included the year before and during the year when the follow-up started, and the follow-up included the year after the follow-up started.

The Swedish Social Insurance Agency registers (MiDAS: MikroData för Analys av Socialförsäkringen) comprise information on disability pension, from which a variable (yes/no) was calculated to exclude people on disability pension at baseline and to analyse occurrence of new disability pension at follow-up. Ethical approval for the project was granted by the Regional Ethical Review Board, Stockholm, Sweden (Diary number: 2007/5:6, 2016/1533-32).

Statistical analyses

Descriptive statistics (means, standard deviations [SDs]), numbers and proportions) of covariates were calculated for the ADHD cases and the reference group. The expected prevalence for a combination of indicators of social disadvantage was calculated by multiplying the individual probabilities of each risk factor, based on their observed prevalence in the data. A measure of clustering was calculated as the observed prevalence (O) divided by the expected prevalence (E) and expressed as O/E ratio [13]. 95% confidence intervals (CI) were obtained using bootstrapping. Co-occurrence (clustering) is indicated when individuals are more likely than expected to have either no risk factors or many risk factors and are less likely to have a single risk factor. When the risk factors are clustered, an O/E ratio of < 1 indicates having a single risk factor, and > 1 indicates having either no risk factors or several risk factors [15].

Clustering analyses were performed to examine clustering of ADHD, low education and unemployment, and, among the people with ADHD, to examine clustering of low education, unemployment and disability pensioning. Clustering was examined at the baseline year and during the 1-year follow-up. The SAS 9.4 statistical software (SAS Institute Inc., Cary, NC, USA) was used in all analyses.

Results

Of the 8990 individuals with ADHD and their 44387 matched referents, 66% were men, 94% were born in Sweden and 32% lived in big cities (Table 1). The mean age at baseline was 21.7 years. Individuals with ADHD had lower educational level than the referents (57% *vs* 16% with primary school level or less) and higher prevalence of unemployment at baseline (60% *vs* 36%) and at 1-year follow-up (39% *vs* 17%).

Table 1
Descriptive statistics of young adults diagnosed with ADHD and their matched reference group

	All (*N* = 53377)	ADHD group (*N* = 8990)	Matched reference group[a] (*N* = 44387)
Mean (SD) age at the beginning of follow-up	21.7 (4.6)	21.7 (4.6)	21.7 (4.6)
Sex: Men	35411 (66.3)	5962 (66.3)	29449 (66.4)
Women	17966 (33.7)	3028 (33.7)	14938 (33.7)
Birth country: Sweden	50044 (93.8)	8423 (93.7)	41621 (93.8)
Other	3333 (6.2)	567 (6.3)	2766 (6.2)
Area of residence: Big city	17088 (32.0)	2871 (31.9)	14217 (32.0)
Medium-sized town	19869 (37.2)	3350 (37.3)	16519 (37.2)
Small town or village	16420 (30.8)	2769 (30.8)	13651 (30.8)
Education: Low	12066 (22.6)	5161 (57.4)	6905 (15.6)
Intermediate	35061 (65.7)	3381 (37.6)	31680 (71.4)
High	6250 (11.7)	448 (5.0)	5802 (13.1)
Unemployment at baseline (yes)	21301 (39.9)	5427 (60.4)	15874 (35.8)
Unemployment at follow-up (yes)	9365 (20.9)	2978 (39.4)	6387 (17.1)

[a]Matched by age, sex, birth country and area of residence.

Figure 1 shows O/E ratios and their 95% CIs for the combination of ADHD, unemployment (≥ 1 days) and low education at baseline (Panel A), and at 1-year follow-up (Panel B). The O/E ratio was higher for the occurrence of none of the characteristics (1.20 at baseline, 1.18 at follow-up) and for the occurrence of all three characteristics (3.99 at baseline, 5.68 at follow-up). The O/E ratio was smaller than 1.00 for the combinations that included one or two risk factors, with the exception of 'ADHD + low education + no unemployment' (at baseline and at follow-up) and 'no ADHD + unemployment + low education' (at follow-up). Separate analyses for women and men, respectively, are presented in Supplementary material S1

and S2, suggesting that clustering of ADHD, unemployment and low education may be stronger among women than men.

Results from the analysis of unemployment duration are shown in Fig. 2, which shows that with unemployment of one or more days, the O/E ratio of having all three characteristics (ADHD, unemployment and low education) was 3.99 at baseline and 5.68 at follow-up. The corresponding O/E ratios for > 90 days and > 180 days of unemployment were 4.19 and 6.08, and 5.87 and 6.84, respectively (see details of the analyses in Supplementary material S3 and S4). Thus, clustering strengthened when the duration of unemployment was longer and between the baseline and follow-up assessments.

Figure 3 shows results from a cluster analysis of low education, unemployment and new-onset disability pension at follow-up when the sample was restricted to those with an ADHD diagnosis. O/E ratio of having none of the risk factors was 1.18 (1.16–1.19); however, O/E of having all three risk factors was 0.84 (0.71–0.97). A combination of low education and disability pension (without unemployment) produced an O/E ratio of 1.62 (1.52–1.73), and a combination of low education and unemployment (without disability pension) produced an O/E ratio of 1.17 (1.15–1.19).

Discussion

The results of this large longitudinal register-based study of young adults in Sweden suggest that individuals with ADHD are at increased risk of the co-occurrence of low education and unemployment. Clustering of these indicators of social disadvantage was stronger the longer the unemployment had lasted. Clustering also seemed to be more pronounced among women than men and strengthened over time. An analysis among people with ADHD further indicated that low education separately clustered with unemployment and with new-onset disability pension.

To our knowledge, this is the first study investigating clustering of ADHD and social disadvantage in young adulthood. Our findings are in line with previous investigations which have shown associations of ADHD with poor educational attainment and unemployment [7–12]. One study suggested that poor educational attainment may actually be the link between ADHD and unsuccessful labour market outcomes [11]. Other studies have shown that accumulated social disadvantage in childhood environment, such as financial difficulties, are associated with a higher risk of ADHD [16, 17]. Our results add to these findings by showing that social disadvantage may continue accumulating throughout young adulthood among individuals with ADHD.

Our findings suggest that the clustering of ADHD, low education and unemployment may increase over time. Because the study cohort comprised young adults, some of them might have ongoing education. However, information was not available to show if some of them completed schooling during follow-up. However, it is more likely that individuals with ADHD were those who dropped out of school, thus, the clustering estimates may be underestimates of the actual levels of clustering.

We also found that in this cohort, the clustering was stronger among women (4.71 at baseline; 6.62 at follow-up) than men (3.71 at baseline; 5.28 at follow-up). This is a novel finding which needs to be explored in further studies. The prevalence of ADHD is higher among men than women and there are also sex-differences in the symptom profiles. Women tend to demonstrate more inattention-type symptomatology whereas symptoms among men are typically characterized by externalizing behaviour, such as hyperactivity or impulsivity [18]. Because inattention-type symptoms are less evident in classroom settings than e.g., hyperactivity and impulsivity, girls are less likely to be referred to healthcare services and are typically diagnosed later than boys [18]. This may reduce their possibilities to receive effective, early treatment interventions. There is also some evidence that women with ADHD have a higher risk of developing substance abuse disorders than men with ADHD [18]. ADHD is also associated with early single parenthood [2] which is more common among women than men with ADHD [19, 20]. This may further reduce these young women's opportunities in education and paid work.

When we restricted the data to individuals with ADHD, we found that at follow-up, a combination of having low education and disability pension without unemployment was clustered (O/E ratio = 1.62). Similarly, a combination of having low education and unemployment without disability pension was clustered (O/E ratio = 1.17). Having all three in combination was less likely than expected (O/E ratio = 0.84). These findings can be interpreted from the social security system perspective. If a person is granted a disability pension or is long-term sickness absent from work for a long period of time, it is less likely that he/she seeks unemployment benefits. Moreover, individuals with ADHD who receive unemployment benefits are probably fit enough to continue seeking job and do not claim for disability pension. However, there was also clustering of advantage among individuals with ADHD; the observed prevalence of having none of the three (low education, unemployment and disability pension) was greater than the expected prevalence. Thus, higher education may protect young adults with ADHD from early labour market marginalization. A previous study has shown that the association between externalizing problems and high-school drop-out may be mediated by poor school grades [21]. Individuals with ADHD and high education may also represent those with high functional capacity enabling them to attain higher education. It is also possible that high education gives them means to cope and adapt to work-related demands.

Strengths and limitations

The strengths of our study include high-quality detailed register data that cover the entire population in Sweden and a prospective study design which allowed us to examine how clustering of social disadvantage changes over time. The Swedish healthcare registers have been proven to have good coverage and high validity [22] although the coverage of outpatient care was not completely accurate during the first years of observation. The used healthcare data include specialised inpatient and outpatient healthcare, that is, secondary care, but not primary healthcare. It means that children and young adults diagnosed in primary health care are not included. However, most would at least at some point in the disease trajectory have had assessment and/or treatment in specialized care. Further studies could also include diagnosis-specific disability pension to examine whether mood disorders are the main

diagnoses of disability in ADHD [23]. Finally, further research is needed to examine the generalisability of our findings to other countries with different social security and health care systems.

Conclusions

The findings of this study suggest that young adults with ADHD are at an increased risk of the clustering of low education and unemployment, more so among women and when unemployment is prolonged. Among individuals with ADHD, clustering of low education with unemployment on one hand and low education with disability pension on other hand suggest increased risk of labour market marginalisation associated with low education. These findings emphasize the need of further research to develop measures that prevent clustering of social disadvantage among children and adolescents with ADHD. Our findings also support the development of educational systems that support children and young people with ADHD and learning difficulties. Further research should also compare welfare policies to identify interventions effective in preventing trajectories that lead to labour market marginalization due to ADHD.

Abbreviations

ADHD
Attention-deficit/hyperactivity disorder
CI
Confidence interval
LISA
Longitudinal Integration Database for Health Insurance and Labour Market Studies
MiDAS
MikroData för Analys av Socialförsäkringen
O/E ratio
Observed-expected ratio
SD
Standard deviation

Declarations

Ethics approval and consent to participate: The project was approved by the Regional Ethical Review Board, Stockholm, Statistics Sweden, the National Board of Health and Welfare and the National Social Insurance Agency, according to the Public Access to Information and Secrecy Act, the Personal Data Act, and the Administrative Procedure Act in Sweden. The Regional Ethical Review Board can waive the requirement to consult in these type of large register studies and for this project stated that the consent to participate was not applicable. All register data were anonymised and de-identified and linked prior to analysis by Statistics Sweden; researchers only had access to de-identified data. All methods were performed in accordance with the relevant guidelines and regulations.

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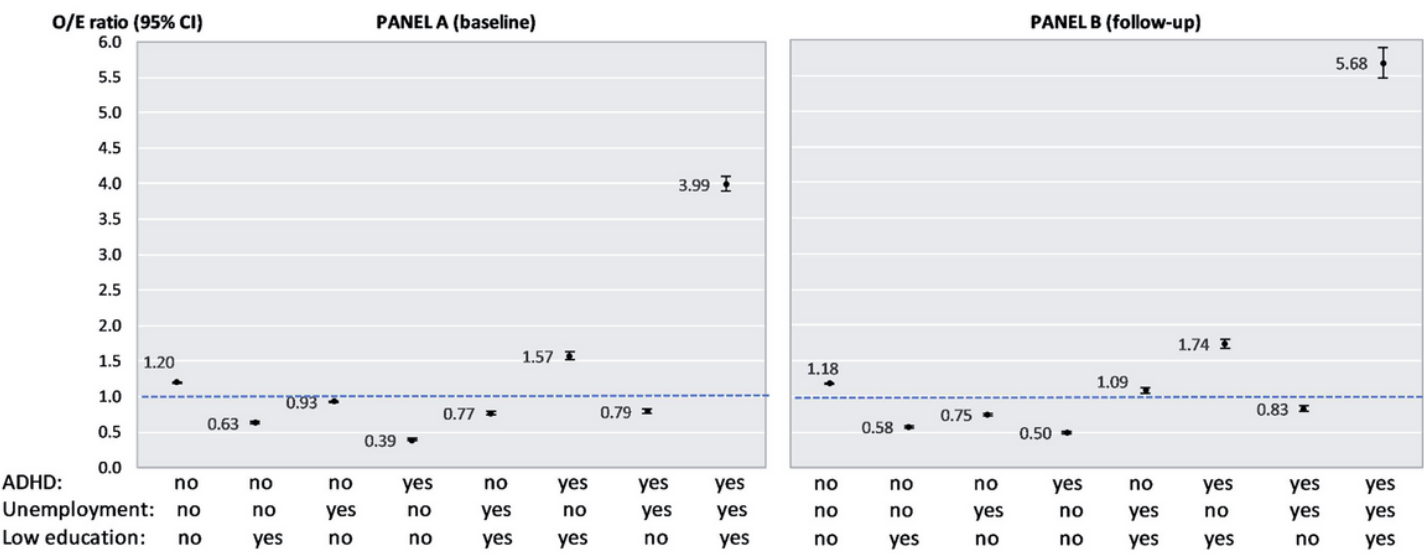
Figures

Figure 1

Clustering of ADHD, unemployment and low education among young adults at baseline (Panel A) and at follow-up (Panel B); before and after the diagnosed ADHD/age 19
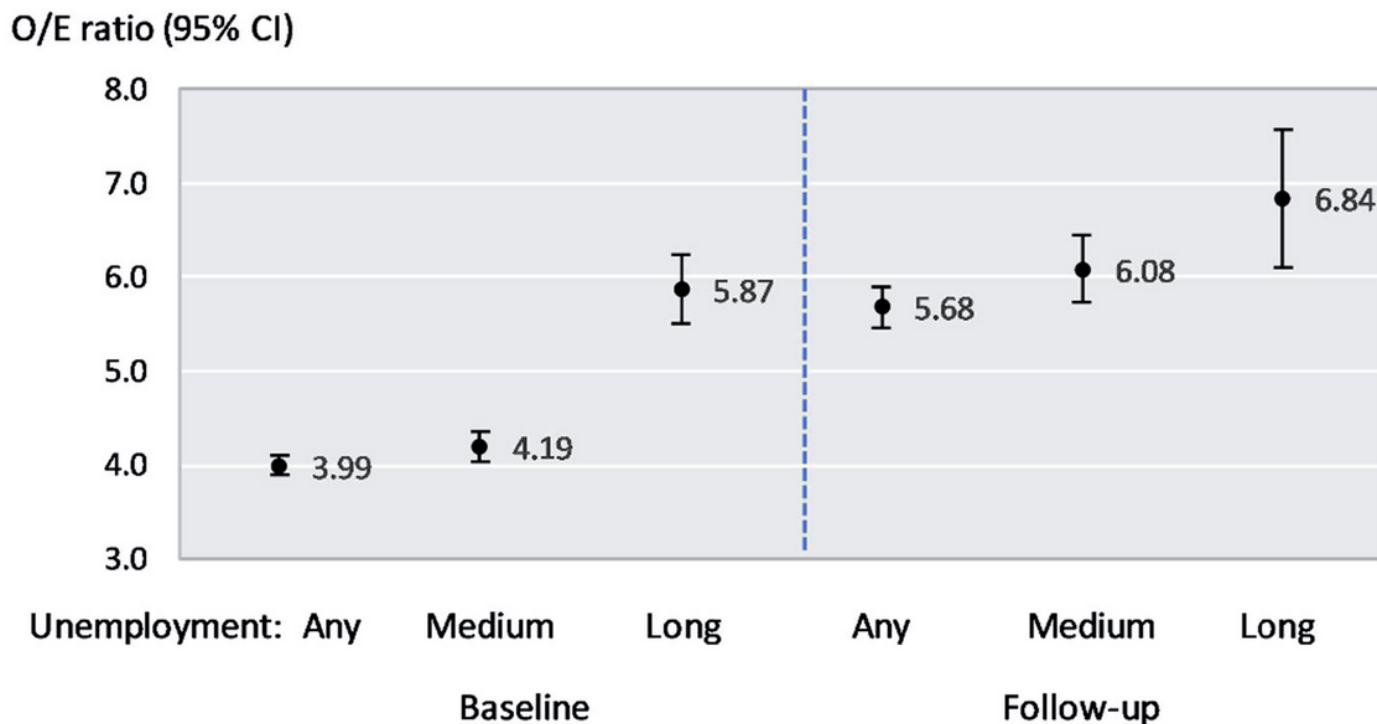
Figure 2

Clustering of ADHD, unemployment and low education among young adults at baseline and at follow-up (before and after the diagnosed ADHD/age 19), by length of unemployment
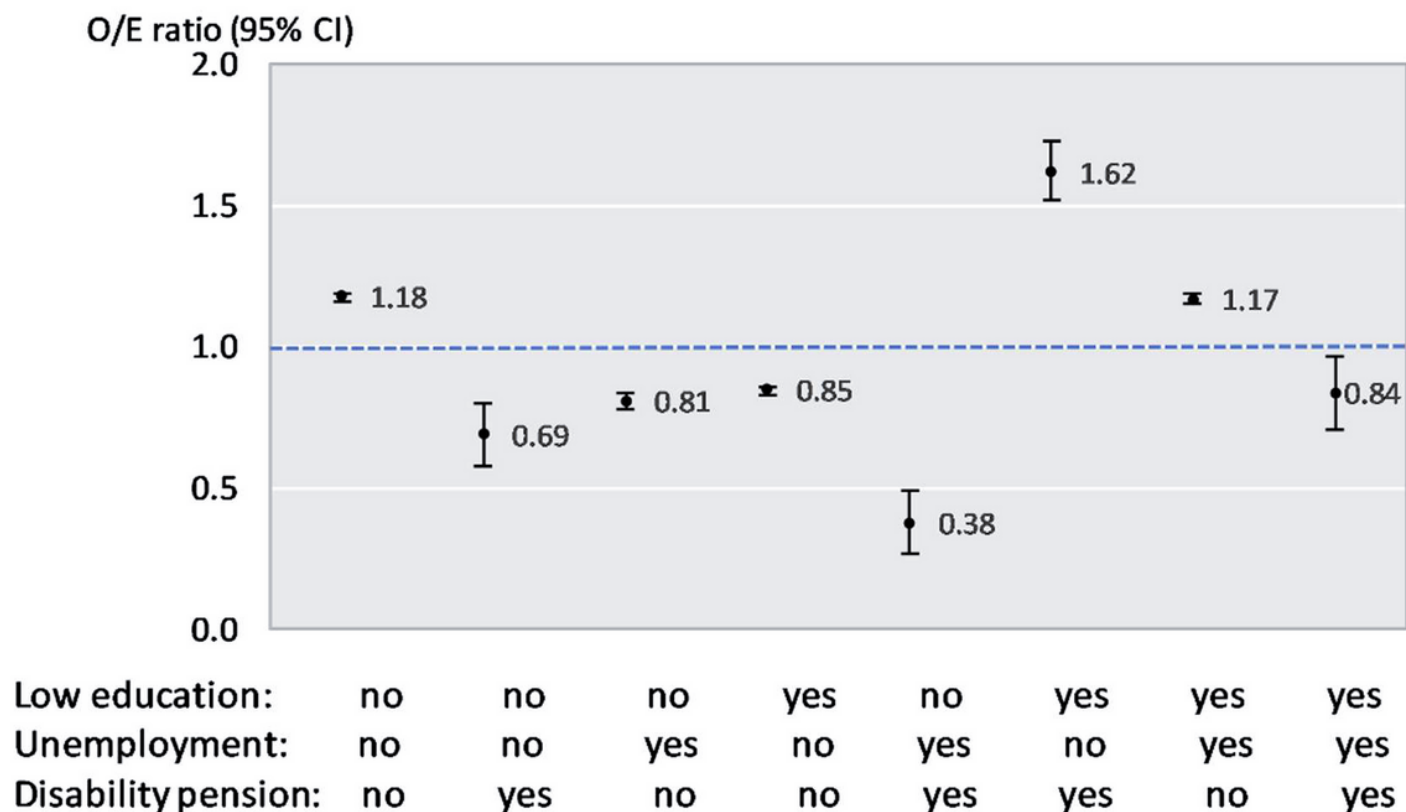

Low education:	no	no	no	yes	no	yes	yes	yes
Unemployment:	no	no	yes	no	yes	no	yes	yes
Disability pension:	no	yes	no	no	yes	yes	no	yes

Figure 3

Clustering of low education, unemployment and disability pension among young adults with ADHD after the diagnosed ADHD/age 19

Supplementary Files

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