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ORIGINAL PAPER

Personality disorders are important risk factors for disability pensioning

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Abstract
Purpose To determine whether personality disorders (PDs) are associated with increased risk of disability pensioning in young adults, independent of other common mental disorders.
Methods 2,770 young adults from the general population were assessed for PDs by the Structured Interview for DSM-IV Personality, and for common mental disorders by the Composite of International Diagnostic Interview. These data were linked to the Norwegian National Insurance Administration's recordings of disability benefits for a 10-year period. Logistic regression analyses were applied to investigate the association between PDs and disability pensioning. The analyses were conducted for three types of PD measures: categorical diagnoses (any PD), dimensional scores of individual PDs and higher order components retrieved by principal component analyses.
Results Having any PD was strongly associated with disability pensioning, regardless of disability diagnosis. The estimated odds ratio (OR) was substantially higher for PDs [OR 4.69 (95 % confidence interval (CI) 2.6–8.5)] than for mood disorders [OR 1.3 (CI 0.7–2.3)] and anxiety disorders [OR 2.3 (CI 1.3–4.3)]. Measured dimensionally, all PD traits except antisocial traits were significantly associated with disability pensioning. After adjusting for co-occurring traits of other PDs, only schizoid, dependent and borderline PD traits showed a significant positive association with disability pension, while antisocial traits showed a significant negative association. The principal component analyses showed that negative affectivity, psychoticism, and detachment was associated with an increased risk of disability pensioning, while antagonism/disinhibition and obsessivity were not.
Conclusions PDs are strongly associated with disability pensioning in young adults, and might be more important predictors of work disability than anxiety and depressive disorders. Certain aspects of pathologic personalities are particularly important predictors of disability.

Keywords Disability pension · Personality disorder · Public health

Abbreviations

OR	Odds ratio
CI	Confidence interval
PD	Personality disorder
SES	Socioeconomic status
NIA	(The Norwegian) National Insurance Administration
OCD	Obsessive–compulsive disorder
PTSD	Post traumatic stress disorder

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Introduction

Many OECD countries (Organisation for Economic Co-operation and Development) provide disability benefits at substantial governmental expense [1, 2]. Common mental disorders are among the most important predictors of disability pensioning [3–6]; especially, in the younger age groups [7], and associations are significant regardless of whether the pensions are awarded for somatic or psychiatric disorders [8].

Personality disorders (PDs) are now being accepted as important conditions in mainstream psychiatry and have been associated with similar or higher costs to society than mood and anxiety disorders [9–11], but still very little is known about the role of PDs in relation to disability pensioning. PDs as currently classified in the DSM-IV system affects about 6 % of the world's population [9, 11] and have an age of onset in adolescence or early adulthood. They are characterized by an enduring pattern of inner experience and behaviour that leads to distress or impairment in social, occupational, or other important areas of functioning [12, 13]. During the past two decades, effective therapies have become available for the treatment of several PDs [14–16].

Although PDs have a well-known association with functional impairment [17–20], only one population-based study has been published on the association between PDs and disability pensioning [21]. Using data from the British National Survey of Psychiatric Morbidity, the authors found that individuals screening positive for probable PDs were significantly more likely to receive disability benefits; especially, in the presence of co-morbid psychiatric disorders. Because assessments of PDs were based on screening questionnaires rather than diagnostic interviews, the study included less severe cases of PDs. This probably led to an underestimation of the association.

Because the impact of work related disability is more dramatic in the lives of young individuals, and the economic burden on society is greater with early onset, PDs might be particularly important risk factors in the younger age groups. Studies focusing on this particular age group are; therefore, needed.

In the period 1999–2004, a population-based sample of young adult Norwegian twins was assessed with personal interviews for DSM-IV PDs as well as other common mental disorders. In 2011, these data were linked with official information on disability pensioning.

The primary aim of this study was to use this unique longitudinal population-based data to investigate whether PDs in young adults are associated with an increased risk of disability pensioning. Because PDs can also be regarded as dimensional phenomena, and there is a large degree of overlap between the individual PDs, we also used dimensional measures of individual PDs to study their unique contributions to disability pensioning, and a principal component analysis to study the effects of higher order structures of personality pathology [22] on disability pensioning.

Methods

Participants

The Norwegian Institute of Public Health Twin Panel includes information on all twins born in Norway between 1967 and 1979 ($n = 15{,}370$) [23]. The twins are identified through the Norwegian Medical Birth Registry, which receives mandatory notification of all live- and stillbirths of at least 16 weeks of gestation. In 1998, 8,045 twins (3,334 pairs and 1,377 single twins) participated in a questionnaire based study on mental disorders. All complete twin pairs were then invited to participate in two interviews for the assessment of common mental disorders. A total of 2,801 twins participated in the interviews that were carried out between 1999 and 2004. Owing to either being incomplete or withdrawal of consent to further participation, 31 interviews were excluded from the study. The remaining 2,770 interviews were in 2011 linked to registries on disability pensioning and constituted the final study sample.

Measures

Disability pension

Using personal identification numbers issued to all Norwegians at time of birth, the interview data from the twin panel was linked to the Norwegian National Insurance Administration's (NIAs) records from 1998 to 2008. These registries hold comprehensive data on disability pensions, including ICD-10 diagnoses as well as demographic and socioeconomic information. The registries of NIA are updated annually, and their accuracies are well documented [24]. Disability pensions were treated as a dichotomous variable, counting any occurrence of temporary or permanent disability pensioning recorded in the period.

Personality disorders

PDs were assessed by administering a Norwegian version of the Structured Interview for DSM-IV personality (SIDP-IV) [25]. SIDP is a comprehensive semi-structured diagnostic interview for the assessment of personality disorders [12] and includes non-pejorative questions organized into

topical sections to produce a natural flow in the interview. The 10 DSM-IV PDs each comprises 7–9 criteria, and each criterion is scored as 0 (no symptoms present), 1 (subthreshold), 2 (symptom present), or 3 (symptom strongly present). A score of 2 or more on at least 3–5 criteria (depending on the PD in question) is required for a diagnosis of PD. For antisocial PD, the presence of childhood conduct disorder is also required. The SIDP questions address behaviours, cognitions, and feelings that have been predominant for most of the past 5 years, and thus are considered representative for the individual's long-term personality functioning. The interviews were mainly conducted by clinical psychology students in final part of their training and by experienced psychiatric nurses. The interviewers received a standardized training program and were followed up closely during the data collection. Inter-rater reliability was assessed by two raters scoring 70 audiotaped interviews. Intra-class correlations for the number of endorsed criteria at the subthreshold level ranged from +0.81 to +0.96. The prevalence of categorical diagnoses of individual PDs were too low to conduct separate analyses for each PD individually. Therefore, we created dimensional representations of all ten PDs by calculating the total score on all criteria constituting a specific PD. Because numbers of criteria varies between PDs, mean scores and standard deviations would vary. To better be able to compare scores between PDs, sum scores were standardized by z transformation. In the analyses, these standardized scores were treated as dimensional measures of the individual PDs, and will be referred to as PD traits below. Another common approach in studies of PDs is to focus on higher order structure of personality pathology [22], and for this we used principal component analysis to extract uncorrelated components from the sum score variables for the individual PDs.

Common mental disorders

Mental disorders were assessed using a computerized version of the Composite of International Diagnostic Interview (CIDI) [26]. CIDI was developed by WHO and has been used in major epidemiological studies worldwide. CIDI is a structured interview providing lifetime DSM-IV diagnoses for mental disorders. For mood disorders, we defined a dichotomous variable coding for lifetime occurrence of either major depressive disorder or dysthymic disorder. For anxiety disorders, we defined a dichotomous variable measuring lifetime occurrence of at least one of the following: generalized anxiety disorder, panic disorder, social phobia, agoraphobia, obsessive–compulsive disorder (OCD) and post-traumatic stress disorder (PTSD). Specific phobias were not included because they were very common and unlikely to cause disability pensioning.

Potential confounders

Socioeconomic status (SES) was calculated based on parents' level of education. The highest level of education reached by either of the participant's parents, at the participant's age of 16, was coded as an ordinal variable ranging from 1 to 4, with 1 being highest. We chose to measure SES based on the parents' educational attainment rather than on the subject's own, as disability pensioning early in life may interfere with education and income. For 24 participants (out of which 1 had a disability pension) we had no recorded parental education. For these, we conducted a simple mean imputation, rounding off to the nearest integer.

Statistical analyses

SPSS version 17.0 for Windows was used for the statistical analyses. Binary logistic regression analyses were applied to test the associations between disability pensions and PDs. As our sample consisted of twins and included phenotypes well known to be correlated within twin pairs, we corrected for the dependency using generalized estimating equations (GEE) with exchangeable covariance structure [27]. Analyses were first conducted for categorically measured PDs (any PD). To control for possible confounding, the analyses were adjusted for gender and socioeconomic status and for mood- and anxiety disorders. Similar analyses were conducted for dimensional measures of each of the ten specific PDs. Because there is an extensive co-morbidity between PDs, all PD traits were then adjusted for co-morbid traits of every other PD making it possible to look at unique contributions from the different PDs. Multiple regression analyses can give incorrect estimates if the predictor variables are highly correlated. To check for multicollinearity, we calculated the Pearson's correlations and variance inflation factor (VIF) for each set of PD traits before conducting the multiple regression analyses with all PDs as predictors.

Finally, using principal component analyses with varimax orthogonal rotation, we extracted perfectly uncorrelated components from the sum score variables for the individual PDs, which were used as independent factors in binary logistic regression analyses with disability pensioning as outcome.

Results

The final sample consisted of 2,770 subjects aged 19–36 years (mean 28.2, standard deviation 3.9) at the time of the interview, out of which 63.3 % were women, and 20.3 % married (Table 1). The prevalence of disability

Table 1 Study population

	Total study population (n = 2,770)	Population with disability benefits (n = 76)
Mean age (range)	28.2 (19–36)	29.5 (21–36)
	% of column (n)	% of column (n)
Gender		
Male	36.7 (1,017)	15.8 (12)
Female	63.3 (1,753)	84.2 (64)
Married	20.3 (563)	27.6 (21)
Socioeconomic status		
1—highest level	12.8 (354)	5.3 (4)
2	23.8 (658)	13.2 (10)
3	53.1 (1,472)	63.2 (48)
4—lowest level	10.3 (286)	18.4 (14)
Any personality disorder	5.1 (142)	26.3 (20)
Mood disorder[a]	15.1 (418)	32.9 (25)
Anxiety disorder[b]	10.8 (298)	35.5 (27)
Lifetime alcohol abuse/dependency	9.4 (261)	7.9 (6)
Comorbidity		
PD + mood disorder[a]	2.2 (60)	18.4 (14)
PD + anxiety disorder[b]	2.2 (61)	18.4 (14)
PD + alcohol abuse/dep	1.0 (27)	2.6 (2)
PD + any axis 1 disorder[c]	3.0 (84)	22.4 (17)

[a] Life time occurrence of any of: dysthymic disorder or major depressive disorder

[b] Life time occurrence of any of: generalized anxiety disorder, panic disorder, social phobia, agoraphobia, OCD or PTSD

[c] Mood disorder[a]/anxiety disorder[b]/alcohol abuse/alcohol dependency

pension was 2.7 % (N = 76). Diagnoses for the benefit were available on 68.5 % (N = 52). In 44.3 %, of the cases with known diagnoses, disability pension was awarded due to a psychiatric diagnosis and in 55.7 %. due to a somatic diagnosis In the highest SES group 1.1 % received disability pension, compared to 4.9 % in the lowest SES group. The prevalence of having at least one PD was 5.1 %, which is similar to what have been found in previous studies [17]. Measured categorically, the prevalence of the ten individual PDs varied greatly, with the least frequent being schizotypal (n = 1) and the most frequent being obsessive–compulsive (n = 66). Among those with a disability pension, 26.3 % had at least one PD. Likewise, life time prevalences of mood and anxiety disorders were also higher among those with a disability pension (15.1 % mood disorders and 10.8 % anxiety disorders in total population as compared to 32.9 and 35.5 % among disability pensioned), while the prevalence of alcohol dependence and/or abuse was slightly lower (9.4 % in total population and 7.9 % among disability pensioned).

The results from the logistic regression analyses are shown in Table 2. The first column (model 1) shows the unadjusted associations for PDs, mood disorders and anxiety disorders (OR 7.44, 2.61 and 4.68, respectively). In the second model, adjustments were made for gender and SES, both which were significantly associated with predictor and outcome variables. In the third column (model 3), all predictor variables were adjusted for each other. PDs (OR 4.69, CI 2.58–8.54) and anxiety disorders (OR 2.33, CI 1.25–4.33), remained significantly associated with disability pension, whereas mood disorders were not (OR 1.28, CI 0.70–2.33).

The lower part of Table 2 shows the associations for PDs co-morbid with mood disorders and with anxiety disorders. Having such co-morbidity naturally resulted in a higher risk, but the ORs were not higher than what was to be expected from the combined effects.

Table 3 shows the associations between disability pensioning (due to any diagnosis) and each set of PD traits. As these ORs are based on standardized scores, it means that an increase in SIDP score equal to one standard deviation of a particular PD would result in the given OR. The SIDP score corresponding to one standard deviation is given in the leftmost column of Table 3 for each PD. So for instance, an increase of one standard deviation in borderline traits corresponds to 2.23 points increase on the SIDP score, and would give an OR of 1.76 for a disability pension when compared to a participant with the mean score for borderline traits. The odds ratio between two groups differing in SIDP scores by more than one standard deviation equals the original OR exponentiated. For example, two groups differing by 3 SDs in borderline traits have an OR of disability pensioning of $1.76^3 = 5.45$.

The first model in Table 3 shows the unadjusted associations, while the second model shows the associations after adjusting for gender and SES. In the third model all sets of PD traits have additionally been adjusted for co-occurring traits of all other PDs. In the fourth model we additionally adjusted for lifetime occurrence of mood disorders and anxiety disorders. All sets of PD traits, except antisocial traits, showed an initial significant positive association with disability pensioning. Adjusting for gender and SES did not change these relations notably, but when we also adjusted for co-occurring traits of other PDs, only schizoid (OR 1.41), borderline (OR 1.63) and dependent (OR 1.24) PD traits remained significantly positively associated with disability pensioning. This adjustment also brought out a significant negative association between antisocial traits and disability pensioning

Table 2 Odds ratios (95 % CI) for disability pensioning

	Model 1 Unadjusted	Model 2 Model 1 +SES and gender	Model 3 Model 2 +other predictors[c]
Any personality disorder	7.44 (4.31–12.82)**	7.00 (3.98–12.31)**	4.69 (2.58–8.54)**
Mood disorder[a]	2.61 (1.55–4.39)**	2.36 (1.39–4.00)**	1.28 (0.70–2.33)
Anxiety disorder[b]	4.68 (2.86–7.66)**	3.79 (2.28–6.30)**	2.33 (1.25–4.33)*
PD + mood disorder[a]	12.35 (6.32–24.14)**	11.43 (5.65–23.13)**	6.62 (2.94–14.93)**
PD + anxiety disorder[b]	12.31 (6.66–22.76)**	10.11 (5.29–19.35)**	9.35 (4.73–18.50)**

* $p < 0.05$

** $p < 0.001$

[a] Life time occurrence of any of: dysthymic disorder or major depressive disorder

[b] Life time occurrence of any of: generalized anxiety disorder, panic disorder, social phobia, agoraphobia, OCD, PTSD

[c] Each predictor is adjusted for the other predictor variables (i.e. PDs are adjusted for mood and anxiety disorders, mood disorders are adjusted for PDs and anxiety disorders, anxiety disorders are adjusted for PDs and mood disorders, PD + mood disorders are adjusted for anxiety disorders, PD + anxiety disorders are adjusted for mood disorders)

Table 3 Odds ratios (95 % CI) for disability pensioning by type of PD (dimensionally measured PD traits with standardized scores)

PD traits (SIDP score eq. to 1 SD)	Model 1 Unadjusted	Model 2 Model 1 +SES and gender	Model 3 Model 2 + all PD traits	Model 4 Model 3 +mood[a] and anxiety[b] disorders
Schizoid (1.22)	1.66 (1.48–1.87)**	1.66 (1.46–1.88)**	1.41 (1.17–1.69)**	1.41 (1.18–1.68)**
Schizotyp (1.14)	1.57 (1.38–1.79)**	1.53 (1.33–1.76)**	1.02 (0.81–1.29)	1.02 (0.82–1.29)
Paranoid (1.69)	1.55 (1.37–1.75)**	1.51 (1.33–1.73)**	1.05 (0.85–1.29)	1.03 (0.84–1.27)
Narcissistic (1.66)	1.24 (1.04–1.48)*	1.34 (1.12–1.60)**	0.99 (0.74–1.31)	1.00 (0.76–1.33)
Borderline (2.23)	1.76 (1.53–2.03)**	1.69 (1.45–1.98)**	1.63 (1.27–2.08)**	1.61 (1.26–2.07)**
Histrionic (1.82)	1.20 (1.00–1.43)*	1.20 (0.99–1.45)	0.83 (0.62–1.11)	0.82 (0.61–1.11)
Antisocial (1.45)	0.97 (0.79–1.20)	1.06 (0.88–1.28)	0.61 (0.40–0.94)*	0.62 (0.40 - 0.94)*
Avoidant (2.47)	1.69 (1.48–1.92)**	1.63 (1.41–1.87)**	1.02 (0.80–1.30)	1.02 (0.80–1.29)
Dependent (1.80)	1.67 (1.47–1.89)**	1.63 (1.44–1.84)**	1.24 (1.01–1.53)*	1.23 (1.00–1.52)*
Obs.compulsive (2.74)	1.43 (1.17–1.74)**	1.43 (1.16–1.76)**	1.03 (0.76–1.39)	1.01 (0.75–1.37)

* $p < 0.05$

** $p < 0.001$

[a] Life time occurrence of any of: dysthymic disorder or major depressive disorder

[b] Life time occurrence of any of: generalized anxiety disorder, panic disorder, social phobia, agoraphobia, OCD, PTSD

(OR 0.61). Further adjustments for mood and anxiety disorders did not change any of these associations.

Before conducting the multiple regression analyses with all PDs as predictors, we estimated the Pearson's correlations and the VIF for all sets of PD traits. The mean correlation between two PD trait variables was 0.30, ranging from 0.10 (histrionic/schizoid) to 0.53 (avoidant/dependant). All VIFs were below 2.0, indicating that we did not have a problem with multicollinearity in our analyses.

In the principal component analysis, the most meaningful model with the fewest cross loadings had five components (Table 4). The Kaiser–Meyer–Olkin measure for this model was 0.82, and the Eigenvalues for the five components were 3.78, 1.34, 0.95, 0.86, and 0.68, with a cumulative explained variance of 76 %. Component 1 was labelled negative affectivity and comprised mainly dependent traits (component loading 0.86), avoidant traits (0.76) and borderline traits (0.42). Component 2, labelled psychoticism, comprised paranoid (0.80), schizotypal (0.74) and borderline (0.45) traits. Component 3, labelled antagonism/disinhibition comprised antisocial (0.95) and borderline (0.51) traits. Component 4, labelled detachment, comprised schizoid (0.84) and schizotypal (0.41) traits. Component 5, labelled obsessivity, comprised obsessive–compulsive (0.79), narcissistic (0.73) and histrionic (0.63) traits.

The negative affectivity, psychoticism and detachment components were positively and significantly associated

Table 4 Principal component analysis with loadings

	Rotated component matrix[a]				
	Negative affectivity	Psychoticism	Antagonism/ disinhibition	Detachment	Obsessivity
Schizoid	0.169	0.214	0.078	**0.844**	0.098
Schizotypal	0.173	**0.740**	0.074	**0.409**	0.098
Paranoid	0.183	**0.795**	0.087	0.072	0.256
Narcissistic	0.171	0.142	0.254	0.010	**0.731**
Borderline	**0.424**	**0.450**	**0.513**	0.029	0.247
Histrionic	0.094	0.399	0.183	−0.276	**0.633**
Antisocial	0.015	0.065	**0.948**	0.067	0.132
Avoidant	**0.795**	0.152	0.031	0.354	0.008
Dependent	**0.863**	0.174	0.066	−0.036	0.189
Obs.compulsive	0.034	0.091	−0.051	0.321	**0.790**

[a] Rotation method: varimax with Kaiser normalization. Rotation converged in seven iterations

Component loadings > 0.4 are highlighted in bold

Table 5 Principal components and odds ratios (95 % CI) for disability pensioning

	Model 1 Unadjusted	Model 2 Model 1 +SES and gender
Negative affectivity	1.62 (1.43–1.86)**	1.57 (1.36–1.81)**
Psychoticism	1.40 (1.21–1.61)**	1.33 (1.14–1.56)**
Disinhib./antagon.	0.94 (0.74–1.20)	0.99 (0.76–1.28)
Detachment	1.41 (1.21–1.64)**	1.42 (1.21–1.67)**
Obsessivity	1.07 (0.85–1.34)	1.11 (0.87–1.41)

* $p < 0.05$

** $p < 0.001$

with disability pensioning (Table 5), while obsessivity and antagonism/disinhibition showed no significant association.

Discussion

In this population-based study of young adults, PDs showed a strong and significant association with disability pensioning, both when measured categorically and dimensionally. The association with disability pensioning was significantly stronger for PDs than for mood disorders. The ORs were also higher for PDs than for anxiety disorders, but the confidence intervals were overlapping. The association between PDs and disability pensioning found in this sample of young adults (OR 4.69) is considerably higher than the association between probable PD and disability pension that was found in a general population sample from the UK (OR 1.34 after adjustments for symptoms of mood- and anxiety disorders) [21]. This discrepancy might partly be explained by the importance of mental disorders in general, and PDs in particular, for disability pensioning in younger age groups. It could also be due to the different methods used for assessment of PDs. The prevalence estimate of 29.2 % for probable PDs in the UK study is considerably higher than prevalence rates usually reported for PDs, both in the UK (4.4 %) [17] and in other countries (6.1 %) [9, 11]. The inclusion of cases with less severe PD psychopathology in the UK study is the most plausible explanation for their weaker associations. Given that the prevalence of PDs in our study was 5.1 %, we believe that our risk estimate gives a more correct picture of the association between PDs and disability pension in young adulthood.

All the dimensional measures of the individual PD traits, except antisocial, showed a significant positive association with disability pensioning before adjustments (Table 3, model 1). This is similar to results from the general population sample from the UK [21]. Borderline traits showed the strongest association (OR 1.76), consistent with previous studies indicating that impairment in borderline PD is particularly severe [13, 16, 19].

There is significant co-morbidity between different PDs [28, 29]. To evaluate the unique effect of each PD we adjusted for co-occurring traits of other PDs (Table 3, model 3). After adjustments, only schizoid, borderline and dependent PD traits were positively and significantly associated with disability pensioning, while antisocial traits showed a significant negative association (OR 0.61).

These findings are consistent with the UK study [21] in that antisocial PD seems to stand out from the other PDs in its relation to disability pensioning. Unadjusted, antisocial traits are not associated with an increased risk for disability pensioning, despite being significantly correlated with borderline traits that have the strongest association with disability pensioning. Post hoc analyses showed that adjusting for borderline traits was enough to bring out the negative association between antisocial traits and disability pensioning, also when analysing each gender separately.

This indicates that antisocial and borderline traits are pulling in opposite directions with regard to disability pensioning. One might speculate that having a few antisocial traits might actually be advantageous in some work environments, and thereby reducing your risk of becoming disability pensioned. Antisocial traits are typically characterized by manipulative and dishonest behaviour. If one assumed that abuse of disability benefits were widespread, one might have expected to find a positive association between antisocial traits and disability pensioning, but we found no support for such an association in our study.

Interestingly, four out of the five components extracted in the principal component analyses resembled the pathological personality trait domains described as the "Alternative DSM-5 model for personality disorders" in section III of DSM-5 [30]. Three out of the five components (negative affectivity, psychoticism and detachment) were associated with disability pensioning (Table 5), while two were not (obsessivity and antagonism/disinhibition).

Negative affectivity was dominated by dependent, avoidant and borderline traits, and is characterized by negative emotions. The strongest loading of this component came from dependent PD, which also remained significantly associated with disability pensioning after adjustments in the multiple regression analyses (OR 1.24). Dependent PD is characterized by a marked lack of self-confidence and by difficulties with making everyday decisions without an excessive amount of advice and reassurance, with expressing disagreement, and with initiating projects or doing things on his or her own [12]. All these characteristics are likely to be problematic when adapting to modern workplace environments, and lack of self-confidence might be particularly crucial. Having not much belief in one's own capabilities might make one more prone to giving up when facing work-related adversities, and could result in a lower threshold for seeking disability pension.

Psychoticism was dominated by paranoid, schizotypal and borderline traits, and is characterized by cognitive dysregulation and strange or uncommon thoughts or beliefs. Fitting into a work place environment might be problematic if you struggle with deviant thoughts or excessive scepticism towards your co-workers, and all of these three PDs have been shown to be associated with workplace conflicts [19]. Of the three PDs with a loading on this component, only borderline traits were significantly associated with disability after adjustments in the multiple regression analyses (OR 1.63).

Detachment was dominated by schizoid and schizotypal traits, but also had a considerable loading from avoidant PD. This component is characterized by social withdrawal, and schizoid PD had the strongest loading on this component. Schizoid traits were also significantly associated with disability in the multiple regression analyses (OR 1.41). This PD is characterized by a pattern of detachment from social relationships and a restricted range of emotions in interpersonal settings, which may include, among other factors, a preference for solitary activities [12].

Antagonism/disinhibition was not associated with an increased risk of disability pensioning. Antisocial PD dominated this component with a component loading of 0.95, while borderline PD had a loading of 0.51. This combination might explain why this component showed no significant association with disability pensioning.

The component labelled obsessivity did also not increase the risk of disability pensioning, and was loaded by obsessive–compulsive, narcissistic and histrionic traits. This supports the findings from our multiple regression analyses, where all these three PDs had an initial positive association with disability pensioning that disappeared when adjusting for co-morbid traits of other PDs (Table 3, model 3).

Strengths and limitations

This study has several strengths. First of all, it is a population based study with a focus on young adults, a demographic group that may be at particular risk for disability pensioning due to mental disorders. In addition, it utilizes accurate and objective data from official Norwegian registries on disability pensioning, and uses diagnostic interviews for measures of psychiatric disorders. However, our results must still be viewed in light of some limitations. Firstly, this was a study of young adult Norwegian twins. For the study of both personality and somatic health, twins have been shown to be representative for the general population [31, 32], but our results may not apply to other age- and ethnic groups. In addition, with a young adult sample, a longer follow-up time would have been better for registering disability pensions as possible long-term consequences of PDs.

Second, disability pensioning is a hard but relatively rare endpoint. With only 76 disability pensioned participants, it is difficult to conduct analyses with high enough statistical power. For this reason, it was not possible to study the ten categorical PDs individually, and we instead utilized dimensional measures for the ten individual PDs. Dimensional representations of PDs have been shown to outperform categorical diagnoses in predicting external variables [28, 33], but still, some of our findings for individual sets of PD traits might not apply to people with severe personality pathology.

Third, occurrences of disability pensioning were recorded throughout the decade of 1998–2008, while PDs, mood and anxiety disorders were assessed cross sectionally

between 1999 and 2004. Most twins were interviewed early in this period, and the mean time span from interview to end of 2008 was 7.5 years. For some, symptoms of PDs may have deteriorated in the follow-up period, and some participants had received a disability pension before their participation in the diagnostic interview. However, symptoms of PDs are thought to be present from early adulthood, and the interview intends to measure symptoms of PDs from the past 5 years. We therefore assume that symptoms of PD lead to disability pensioning, not the other way around. To check this assumption, we tested the associations for disability pensions granted both before and after 2004, and found significant associations with PDs for both time periods.

Fourth, all twins in the current sample have been invited to participate in questionnaire and interview studies in several rounds, resulting in some attrition between. However, detailed analyses of the predictors of non-response in this twin panel revealed that further participation was strongly predicted by sex, zygosity, age and education, but not by psychiatric symptoms [34].

Fifth, the decision to adjust for mood- and anxiety disorders is not an obvious one. PDs are highly co-morbid with anxiety and depression [35–38], and these disorders are known to be associated with an increased risk of disability pensioning [3–6]. This should justify the adjustments, but still, PDs often include symptoms of both anxiety and depression. The symptoms might therefore work as mediators instead of confounders, making the adjustments overly conservative and underestimating the true effects of PDs. We therefore present both adjusted and unadjusted associations in the tables.

Conclusions

PDs are strongly associated with disability pensioning in young adults and might be more important predictors than anxiety and depression. As PDs are relatively common in the community, and effective treatment is available for some, health care workers should be aware of the strong link between PDs and work force exclusion. Particular attention should be paid to patients with traits of negative affectivity, cognitive dysregulation and detachment.

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Ethical standard The interview was based on informed, written consent from all participants. The study protocol and the linking of health data with the registries of NIA was approved by the Regional Ethical Committee.

Conflict of interest All authors have completed the Unified Competing Interest form at http://www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years no other relationships or activities that could appear to have influenced the submitted work.

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