Thirteen-year follow-up of long-term treated psychotic disorder: personality aspects

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Abstract

Objective: Personality is an aspect that can affect the symptoms and social function in individuals with psychotic disorders. Several studies have investigated personality in schizophrenia and other long-term psychotic disorders. No study has examined the stability of personality traits exceeding five years in patients with schizophrenia and related disorders. The aim of this study was to investigate the stability of personality traits over a 13-year period among patients with schizophrenia and related disorders and healthy individuals and to evaluate case-control differences.

Methods: At three occasions during a 13-year period patients with schizophrenia and related disorders (n = 28) and healthy individuals (n = 57) completed Swedish universities Scales of Personality (SSP). Mean-level change and case-control differences were investigated for all the individuals using within- and between-subject analyses, respectively. Analyses were performed on three occasions for all 13 subscales and the three overall factors of SSP. Also, correlations, means, and SDs were calculated.

Results: Tests of within-subject correlations showed differences in two subscales: Lack of Assertiveness, which were influenced by age, and Physical Trait Aggression, where patients’ ratings were stable, whereas controls rated themselves less aggressive at a higher age. Between-subjects correlations showed differences regarding diagnosis, time, age, gender, or age × gender in nine of the 13 subscales as well as in factor Neuroticism.

Conclusion: Long-term follow-up showed generally high stability of personality traits measured with SSP. Between-subject analyses over the 13 years showed that patients differed compared to controls for the SSP factor Neuroticism as well as the subscale Detachment, which is in accordance with previous studies within this population.

Introduction

Schizophrenia and related disorders affect 0.5–1 percent of the population during a lifetime worldwide [1,2]. Psychotic disorders are often known as chronic and severe. Schizophrenia has a lifetime prevalence of 1% [3]. Personality could be explained as a set of different emotional patterns, behaviours, and cognitions that evolve from genetic factors and learning. There are several different personality traits theories which all try to explain personality traits. The big five personality model is considered to have received more attention than other trait theories [4]. One of the reasons for this is that during the last 30 years there has been a common agreement that personality traits could be summarized in five dimensions, known as the big five personality factors [5]. However, there is no model that can capture the full range of human personality. Some other personality questionnaires also focus on the relation to psychopathology. Personality can affect both social functioning and symptoms in schizophrenia [6]. Several studies have investigated personality in schizophrenia [7–10]. However, only a few previous studies have analysed the stability of personality traits in patients with schizophrenia and related disorders.

Up to date, three studies have used various Five-Factor Model (FFM) questionnaires, i.e. NEO-Personality Inventory (NEO-PI), NEO-Five Factor Inventory (NEO-FFI), and NEO-Personality Inventory-Revised (NEO-PI-R), one the 168-item version of the Minnesota Multiphasic Personality Inventory (MMPI-168), and one the Swedish universities Scales of Personality (SSP) [11], which is a further development of the inventory Karolinska Scales of Personality (KSP) [12,13], to assess the stability of personality traits in this patient group. These studies provide the support that personality traits in patients with schizophrenia and related disorders remain...
relatively stable over time periods of three months to five years, although not as stable as among healthy control subjects [14–18].

From a wider perspective, the stability of personality over time has been extensively investigated and discussed. Some studies support the theory that personality traits are changeable over the course of life [19–22], other studies suggest stability of personality traits over the life course or stagnation of change regarding personality traits in young adulthood [23,24].

Consistencies of personality traits are most often analysed using rank-order stability or mean-level change. Some findings support the theory that personality traits are stable in a long-term perspective or at least stabilized from early adulthood, more clearly so when investigating rank-order stability. Roberts and Del Vecchio meta-analysed a multitude of longitudinal personality studies and reported that test-retest correlations were lower in childhood, but successively rose during adolescence and were relatively high and stable from about 50 years [25]. Ferguson meta-analysed later longitudinal studies and reported high stability during adulthood, more so after correction for measurement error [24]. Specht et al. followed almost 15,000 subjects over four years and found substantial rank-order stability of the five personality traits using the Big Five Inventory [21].

Analysing mean-level change, the other major investigation method in the analyses of personality stability over time, Roberts et al. meta-analysed longitudinal studies adapting them to the five-factor model [20]. Of the six trait categories, dividing extraversion into social dominance and social vitality, four demonstrated a significant change in middle and old age. Individuals increased in measures of conscientiousness, social dominance, and emotional stability, especially in young adulthood. In contrast, individuals increased on measures of openness and social vitality in adolescence, which later decreased in old age. Agreeableness changed only in old age. Longer studies and studies based on younger cohorts showed greater change. Gender and attrition had minimal effects on change. In the study of Specht et al. who investigated a sample covering the whole age range of adulthood mean-level change during four years was significant, but relatively modest (d = 0.10–0.17) for the Big Five traits [21].

Srivastava et al. studied a sample of 132,515 individuals aged between 21 and 60 years who completed a Big five personality measure to analyse the plaster theory of the Five-factor theory, stating that personality changes up to the age of 30 years, and thereafter remains stable [22]. In this cross-sectional study the results were in favour of theories proposing a change of personality also during adulthood, such as a continuous increase in conscientiousness and agreeableness, and among women a continuous decline in neuroticism during the ages 21–60 years [22]. However, none of the previous meta-analyses found any significant male-female rank-order [24,25] or mean-level stability differences [20]. Furthermore, Roberts et al. meta-analysed the effect of interventions on personality and found substantial changes in emotional stability (average d = 0.59) but did not find any significant effect of gender [26], suggesting that male-female differences of personality stability are minimal, if at all present.

The stability of personality traits in patients with psychotic disorder has not earlier been investigated at total time intervals longer than five years. The overreaching aim of this investigation was to fill a knowledge gap through investigating personality traits over long-time follow-up in individuals with schizophrenia and related disorders by using a personality inventory focused on psychopathology rather than a personality as a whole. In addition to this, the aim of the present study was to investigate the stability of personality traits analysing mean-level change and rank-order stability among patients with long-term treated schizophrenia and related disorders and healthy control subjects at three occasions during 13 years using Swedish universities Scales of Personality (SSP) [11]. The aim was also to investigate if patients with schizophrenia and related disorders differ from healthy individuals. We hypothesized that stability of personality traits among patients with established schizophrenia and related disorders would be similar to control individuals irrespective of gender during the investigated age range 39–55 years, with rank-order correlations commuting 0.6–0.7 and none or modest mean-level change (0 < z < 0.3), the latter being most likely to appear in Aggressiveness-related scales [20,24,25]. Given this we hypothesized that personality differences between patients and controls would not change over time, displaying higher ratings in Neuroticism-related scales among patients of all ages.

Material and methods

Subject description

All participants were recruited as part of the Human Brain Informatics (HUBIN) study at Karolinska Hospital and Institutet in Stockholm, Sweden. Patients diagnosed with schizophrenia and related disorders were recruited through outpatient clinics specializing in the treatment of psychoses with a geographical catchment in the North-Western part of Stockholm County. The patients were diagnosed according to DSM-III-R and DSM-IV as previously described [27,28].

Control subjects were recruited among hospital staff and students, or from a population register. Also, healthy siblings of patients with psychosis were asked to participate when their relative with a psychotic disorder had agreed to participate. All subjects were given a complete description of the study and participated after being given informed written consent. There was no significant difference between control subjects and siblings of patients with schizophrenia and related disorders [18] and therefore, siblings were pooled with controls, and these two subject groups are from here on denoted as control subjects. The same control subjects had previously participated in clinical studies at Karolinska Institutet [29–32]. None of the controls had any psychotic diagnosis according to DSM-III-R and DSM-IV. Only subjects who participated both at a baseline investigation performed 1999–2003 and at the two follow-up investigations at about five and 13 years later were included.
The HUBIN study was approved by the Research Ethics committee at the Karolinska Hospital and is consistent with the principles of medical research involving human subjects as outlined in the Declaration of Helsinki. The study was approved by the Swedish Data Inspection Board (Datainspektionen) and the Stockholm Regional Ethics Committee (2015/1214-32).

**Instrument**

In connection with a research interview with a psychiatrist, patients filled out the personality inventory SSP. The self-report questionnaire SSP consists of 91 items grouped into 13 different scales. There are four possible answers; not true at all, does not match particularly well, agree somewhat, and exactly right, and the participants need to select one of the answers for each item. The 13 different scales are as follow: Somatic Trait Anxiety (STA), Psychotic Trait Anxiety (PsTA), Stress Susceptibility (SS), Lack of Assertiveness (LA), Detachment (D), Embitterment (E), Mistrust (M), Physical Trait Aggression (PhTA), Verbal Trait Aggression (VTA), Adventure Seeking (AS), Impulsiveness (I), Social Desirability (SD), and Trait Irritability (TI). The 13 scales have been factor analysed and grouped into three different factors, Neuroticism, Aggressiveness, and Extraversion [11]. The Neuroticism factor is comprised of six scales (STA, PsTA, SS, LA, E, M), the Aggressiveness factor includes PhTA, VTA, SD (negative loading), and TI and the Extraversion factor includes AS, I, and D (negative loading).

SSP is applicable in different social and cultural contexts [29,33]. SSP is constructed to evaluate the personality traits known to correlate with psychopathology rather than evaluate personality as a whole [11].

At the baseline investigation, control subjects were asked to complete an extended version of the Karolinska Scales of Personality (KSP-196), used during the construction of SSP and other personality constructs [11,29,33,39,40]. KSP-196 includes all the 91 items contained in the SSP. At the two follow-up investigations controls filled in the SSP questionnaire.

Reliability and validity of SSP by repeated measures within the same individual with similar results has earlier been investigated [33,35–38], similar factor loadings between different samples [11,29,33,39,40] and similar internal consistencies [11,29,33,35] has also been documented.

**Data analyses**

Based on the 91 items that are common to the SSP and KSP-196, the 13 different personality scales were calculated according to the SSP manual. Subjects were divided into two groups: patients (n = 28) and healthy controls (n = 57). To assess mean-level change statistical analysis of the 13 SSP-scales and SSP’s three factors was performed using analysis of covariance (ANCOVA). ANCOVA was done with diagnosis (psychosis vs non-psychosis) and gender (male vs female) as between-subject factors, time (baseline vs. follow-up during two times) as a within-subject factor and age as a covariate. Tests of within-subject effects, which explain the time aspect and tests of between-subject effects, which compare the groups were calculated. ANCOVA correlates within each analysis for mass significance, which means that it would be expected 16 * 0.05 = 0.8 numbers of significance by chance (CI 95%).

To further illustrate the effect of time rank-order stability was examined using linear correlations according to Pearson (r). Calculations were made between scores of the different time-points for each of the 13 SSP scales and the three SSP factors for patients with schizophrenia and related disorders, and healthy individuals. The statistical analysis was made using SPSS version 17.0.1 for Windows, the IBM software.

**Results**

**Characterisation of subjects**

There were 28 patients (25% women, mean age at baseline 39.0 years, mean age at onset of illness 21.7 years) and 57 controls (40.4% women, mean age at baseline 41.7 years). Patients had a significantly lower level of functioning than controls (Table 1). Patients were diagnosed with schizophrenia (n = 19), schizoaffective disorder (n = 6), and psychotic disorder not otherwise specified (n = 3).

Table 1. Characteristics of patients and controls.

|                  | Patients (n = 28) | Controls (n = 57) |
|------------------|-------------------|-------------------|
|                  | Baseline          | 5-year follow-up  | 13-year follow-up | Baseline          | 5-year follow-up | 13-year follow-up |
| Gender (n, women/men) | 7/21              | NA                | NA                | 23/34             | NA                | NA                |
| Age at onset (year)  | 21.7              | NA                | NA                | NA                | NA                | NA                |
| Education (year) | 13.6              | NA                | NA                | 13.9              | NA                | NA                |
| Age at baseline/follow up | 39.0              | 44.0              | 52.0              | 41.7              | 46.9              | 54.7              |
| Voc WAIS IQ | 94.2 (n = 24)     | NA                | 94.0 (n = 4)      | 103.6 (n = 50)   | NA                | 104.0 (n = 15)    |
| GAF | 50.7              | 50.4              | 46.3              | 86.9             | 82.5             | 80.8             |
| SANS composite score | 26.9              | (n = 22)          | 29.8              | 32.1              | NA                | NA                |
| SPS composite score | 6.93 (n = 22)     | 8.49              | 8.97              | 8.97              | NA                | NA                |
| Medication (mg, CPZ-equivalents) | 225.8 (n = 24) | 289.5 (n = 23) | 394.7 (n = 24) | NA                | NA                | NA                |
| Medication-no antipsychotics (n) | 4                 | 5                 | 4                 | 4                 | NA                | NA                |
| Medication-1st gen antipsychotics (n) | 11                | 7                 | 8                 | 8                 | NA                | NA                |
| Medication-2nd gen antipsychotics (n) | 12                | 12                | 11                | 11                | NA                | NA                |
| Medication-1st and 2nd gen antipsychotics (n) | 1                | 4                 | 5                 | 5                 | NA                | NA                |

NA: not applicable or not assessed; WAIS: Wechsler adult Intelligence Scales; IQ: intelligent quotient; GAF: Global Assessment of Functioning; SANS: Scale for the Assessment of Negative Symptoms; SAPS: Scale for the Assessment of Positive Symptoms; CPZ: chlorpromazine; gen, generation; All values in mean except for distribution of gender and medication. *p < 0.05, **p < 0.01.
Table 2. Tests of within-subjects effects using listwise deletion using ANCOVA showing p-values for the effect of time within individuals on personality traits (scale) taking age, diagnosis (patient or control), and gender into account.

| SSP factor/scale          | Intercept Mean | Scale Mean | Scale × Age at Baseline Mean | Scale × Diagnosis Mean | Scale × Gender Mean |
|---------------------------|----------------|------------|-------------------------------|------------------------|---------------------|
| Neuroticism               | 0.000 ± 0.757  | 0.654 ± 0.643 | 0.721                         |                        |
| Assertiveness             | 0.000 ± 0.693  | 0.972 ± 0.149 | 0.784                         |                        |
| Extraversion              | 0.000 ± 0.742  | 0.858 ± 0.555 | 0.964                         |                        |
| Somatotypic trait anxiety | 0.000 ± 0.570  | 0.607 ± 0.555 | 0.492                         |                        |
| Psychotic trait anxiety   | 0.000 ± 0.808  | 0.364 ± 0.800 | 0.492                         |                        |
| Stress susceptibility     | 0.000 ± 0.779  | 0.656 ± 0.943 | 0.182                         |                        |
| Lack of assertiveness     | 0.000 ± 0.004** | 0.005**  | 0.585                         |                        |
| Impulsiveness             | 0.000 ± 0.236  | 0.375 ± 0.289 | 0.457                         |                        |
| Adventure seeking         | 0.000 ± 0.638  | 0.576 ± 0.266 | 0.262                         |                        |
| Detachment                | 0.000 ± 0.209  | 0.295 ± 0.396 | 0.621                         |                        |
| Social desirability       | 0.000 ± 0.925  | 0.889 ± 0.965 | 0.704                         |                        |
| Embitterment              | 0.000 ± 0.997  | 0.867 ± 0.468 | 0.375                         |                        |
| Trait irritability        | 0.000 ± 0.700  | 0.582 ± 0.532 | 0.124                         |                        |
| Mistrust                  | 0.000 ± 0.475  | 0.537 ± 0.139 | 0.469                         |                        |
| Verbal trait aggression   | 0.000 ± 0.146  | 0.317 ± 0.506 | 0.654                         |                        |
| Physical trait aggression | 0.000 ± 0.410  | 0.625 ± 0.036* | 0.201                        |                        |

*p < 0.05, **p < 0.01.

Drop-out analysis was performed. Reasons for drop-out among the 85 patients who did not participate at 13-year follow-up were as follow: no contact or declined to participate (n = 26), emigrated or changed residence to another region (n = 3), not completed SSP at 5-year follow-up (n = 4), not asked about participation (n = 29), the participants were part of a larger study (n = 24), emigrated or changed residence to another region (n = 6), not completed SSP at 5-year follow-up (n = 27), not asked about participation (n = 29). The participants were part of a larger study where it was required to do more investigations than just SSP, therefore the dropout rate with individuals who were not asked about participation at follow-up was relatively large.

For an overview of the personality data at baseline, 5-year follow-up and 13-year follow-up, SSP raw scores, means, and standard deviations of the differences between baseline and follow-ups in patients with psychotic illness and healthy controls were calculated. Data are shown by diagnosis (patient vs. control) in all subjects, gender in all subjects, gender among patients, and gender among controls (Supplementary Table 5).

Stability estimates during a 13-year time period

To investigate mean-level changes during 13-year follow-up within-subjects analyses were done between the 13 subscales, the three main factors and age at baseline, diagnosis, and gender (Table 2). Stability over time did not vary with the following exceptions: time influenced Lack of Assertiveness (p = 0.004), time × age influenced Lack of Assertiveness (p = 0.005), and time × diagnosis influenced Physical Trait Aggression (p = 0.036). To investigate rank-order stability simple correlations regarding the 13 subscales and the three main factors between baseline, five-year follow-up, and 13-year follow-up in patients with schizophrenia and related disorders and control subjects were calculated (Table 3).

Case-control differences

To investigate changes between patients with schizophrenia and related disorders and healthy individuals mean-level differences were calculated. These between-subjects analyses over the 13-years period showed that patients differed compared to controls for the SSP factor Neuroticism and its subscales Somatic Trait Anxiety, Psychic Trait Anxiety, Stress Susceptibility, Lack of Assertiveness, Embitterment, and Mistrust (all p < 0.003 or less) as well as Detachment (p = 0.005). Age influenced factor Neuroticism (p = 0.019), its subscales Psychic Trait Anxiety, Lack of Assertiveness, and Mistrust (all p < 0.05) and Trait Irritability (p = 0.023). Gender influenced Detachment and Physical Trait Aggression (both p < 0.05). Diagnosis × gender had a significant influence on Somatic Trait Anxiety (p = 0.006) (Table 4).

Discussion

The main findings of the present study, investigating patients with schizophrenia and related disorders, and controls over 13 years were an overall high rank-order stability and low mean-level change of the personality measures. There was only Lack of Assertiveness, a subscale of Neuroticism that indicated change taking diagnosis, age, and gender into account, although this association would fall short of significance if applying a strict Bonferroni correction. This is in accordance with our previous 5-year follow-up study using SSP [18] and in agreement with a previous 3-year follow-up study using the five-factor model for the assessment of personality among patients with schizophrenia and related disorders and controls [16]. In these studies, as well as in the present, there were generally lower rank-order stability and mean-level change among patients than controls, although not without exceptions. Case-control analyses over the 13 years showed that patients differed compared to controls for the SSP factor Neuroticism and its subscales as well as the scale Detachment. This is in agreement with previous cross-sectional and long-term follow-up studies using SSP.
Several studies have shown substantial changes in the long-term development of personality disorder (PD) [41–45]. PDs have a severe impact on function and health utilization, partly at frequencies similar to that among schizophrenia and related disorders. Therefore, it may at a glance seem surprising that no major personality changes were seen in a patient with schizophrenia and related disorders in the present study. However, the substantial changes in the different studies of PDs, especially borderline personality disorder, have been observed when diagnostic criteria have been investigated at different time points. Rank-order reliability estimates for PD diagnosis over ten years was in the range \( r = 0.25–0.55 \), whereas correlations of PD personality traits were considerably higher (about 0.60–0.90) [46], indicating that the rank-order stability of personality traits in PD patients are relatively stable, in contrast to the diagnosis of PD, for which stability seem to be influenced by several non-personality trait factors including comorbid Axis-I disorders [47]. It may be noticed that the correlations of the participants in the present study are of about the same range (patients \( r = 0.55–0.70 \); controls \( r = 0.75–0.80 \)) as reported among PD patients [46].

In addition, personality traits show the greatest change during the formative years, early adulthood, and during the latter part of life, whereas mid-life seem to constitute a mainly stable part of personality development [21,22,25]. The investigated age range for individuals included in this study was between 39 and 55 years. Previous studies have shown stability in personality traits in this age range [21,24] and therefore it was expected generally high stability of personality traits in this study.

In order to look more closely into the results of the present study, we compared with the literature of studies that have used the same personality instrument, i.e. SSP or its closely related predecessor KSP. We are aware of two previous studies that have used SSP for long-term follow-up [18,48] and 14 studies that investigated long-term follow-up (22 months or longer) using KSP [12,49–62].

#### Table 3. Correlations between baseline, five-year follow up and 13-year follow-up in patients with schizophrenia and related disorders and control subjects, using Swedish universities Scales of Personality (SSP).

| SSP factor/scale | Patients | Baseline/ Five-year follow-up | Baseline/13-year follow-up | Controls | Baseline/ Five-year follow-up | Baseline/13-year follow-up | Mean all | Mean patients | Mean controls |
|-----------------|----------|-------------------------------|---------------------------|----------|-------------------------------|---------------------------|---------|--------------|--------------|
| Neuroticism     | 0.584    | 0.753                         | 0.651                     | 0.788    | 0.756                         | 0.784                     | 0.737   | 0.657        | 0.776        |
| Aggressiveness  | 0.751    | 0.665                         | 0.661                     | 0.809    | 0.780                         | 0.832                     | 0.769   | 0.692        | 0.807        |
| Extraversion    | 0.273    | 0.439                         | 0.478                     | 0.772    | 0.740                         | 0.740                     | 0.708   | 0.547        | 0.788        |
| Somatic trait anxiety | 0.242 | 0.501                         | 0.136                     | 0.613    | 0.583                         | 0.631                     | 0.505   | 0.293        | 0.609        |
| Psychotic trait anxiety | 0.672 | 0.850                         | 0.742                     | 0.740    | 0.730                         | 0.770                     | 0.749   | 0.755        | 0.747        |
| Stress susceptibility | 0.605 | 0.598                         | 0.560                     | 0.573    | 0.602                         | 0.695                     | 0.612   | 0.588        | 0.623        |
| Lack of assertiveness   | 0.460    | 0.670                         | 0.573                     | 0.727    | 0.692                         | 0.826                     | 0.689   | 0.568        | 0.748        |
| Impulsiveness     | 0.726    | 0.413                         | 0.455                     | 0.675    | 0.639                         | 0.750                     | 0.636   | 0.531        | 0.688        |
| Adventure seeking | 0.643    | 0.424                         | 0.517                     | 0.818    | 0.761                         | 0.788                     | 0.703   | 0.528        | 0.789        |
| Detachment        | 0.694    | 0.766                         | 0.877                     | 0.690    | 0.691                         | 0.722                     | 0.727   | 0.779        | 0.701        |
| Social desirability | 0.550   | 0.684                         | 0.694                     | 0.803    | 0.619                         | 0.712                     | 0.689   | 0.643        | 0.711        |
| Embitterment      | 0.699    | 0.733                         | 0.777                     | 0.613    | 0.635                         | 0.615                     | 0.659   | 0.736        | 0.621        |
| Trait irritability | 0.756    | 0.635                         | 0.805                     | 0.694    | 0.644                         | 0.697                     | 0.696   | 0.732        | 0.678        |
| Mistrust          | 0.761    | 0.491                         | 0.522                     | 0.684    | 0.654                         | 0.685                     | 0.647   | 0.591        | 0.674        |
| Verbal trait aggression | 0.580 | 0.498                         | 0.621                     | 0.573    | 0.640                         | 0.773                     | 0.630   | 0.566        | 0.662        |
| Physical trait aggression | 0.663 | 0.497                         | 0.560                     | 0.755    | 0.721                         | 0.772                     | 0.702   | 0.607        | 0.749        |
| Mean SSP scales   | 0.619    | 0.605                         | 0.603                     | 0.689    | 0.662                         | 0.726                     |                |              |              |
| Mean SSP factors  | 0.686    | 0.613                         | 0.597                     | 0.790    | 0.770                         | 0.811                     |                |              |              |

#### Table 4. Tests of between-subjects effects using listwise deletion using ANCOVA showing \( p \)-values for the differences of personality traits (scale) over time between individuals taking age, diagnosis (patient or control), and gender into account.

| SSP scale       | Intercept | Age at baseline | Diagnosis | Gender | Diagnosis x Gender |
|-----------------|-----------|-----------------|-----------|--------|--------------------|
| Neuroticism     | 0.000     | 0.019*          | 0.000***  | 0.741  | 0.108              |
| Aggressiveness  | 0.000     | 0.090           | 0.728     | 0.530  | 0.987              |
| Extraversion    | 0.000     | 0.220           | 0.813     | 0.226  | 0.404              |
| Somatic trait anxiety | 0.000 | 0.069           | 0.002**   | 0.982  | 0.006**            |
| Finnish trait anxiety | 0.000 | 0.035*          | 0.000***  | 0.975  | 0.178              |
| Stress susceptibility | 0.000 | 0.152           | 0.000***  | 0.881  | 0.091              |
| Lack of assertiveness   | 0.000    | 0.046*          | 0.003**   | 0.655  | 0.148              |
| Impulsiveness     | 0.000     | 0.088           | 0.342     | 0.314  | 0.977              |
| Adventure seeking | 0.000     | 0.244           | 0.174     | 0.487  | 0.125              |
| Detachment        | 0.000     | 0.072           | 0.005**   | 0.021* | 0.992              |
| Social desirability | 0.000    | 0.894           | 0.685     | 0.437  | 0.711              |
| Embitterment      | 0.000     | 0.158           | 0.000***  | 0.677  | 0.389              |
| Trait irritability | 0.000    | 0.032*          | 0.236     | 0.515  | 0.930              |
| Mistrust          | 0.000     | 0.032*          | 0.000***  | 0.421  | 0.681              |
| Verbal trait aggression | 0.000 | 0.088           | 0.866     | 0.325  | 0.815              |
| Physical trait aggression | 0.000 | 0.333           | 0.756     | 0.042* | 0.912              |

\( * p < 0.05 \), \( ** p < 0.01 \), \( *** p < 0.001 \).
**Rank-order stability in studies using SSP or KSP**

Seven of the long-term KSP studies provided stability estimates, with overall mean correlations for nine of the 15 scales varying between 0.63 and 0.76, whereas for three (Social Desirability, Irritability, Guilt) the correlations were at or below 0.50 (Supplementary Table 6). The present study, using SSP, showed as hypothesized overall similar stability estimates (Table 3) as the comparable ancestor KSP scales in the studies mentioned above, with some exceptions. When controls from the present study were compared to the mean KSP estimates there were lower correlations in the KSP studies than the SSP studies regarding KSP Irritability (0.47) vs. SSP Trait Irritability (0.77) and KSP Social Desirability (0.50) vs. SSP Social Desirability (0.71).

**Mean-level change in studies using SSP or KSP**

Mean-level change measured with KSP in these long-term follow-up studies gave various results (Supplementary Table 7). Studies of adults investigating non-psychiatric samples [56,58,62,63] and a study of chronic depressive patients [50], did not show any substantial (|z|≥0.5) mean-level change. The most prominent changes were seen among anxiety patients before and after capsulotomy, showing very large reductions in Somatic Anxiety, Muscular Tension, and Psychasthenia [57]. There were also substantial changes in other studies including different kinds of significant intervention after a suicide attempt [55], criminal acts [59], psychiatric disorder [54], somatic disorder [49,53], or psychological difficulties [61]. For six of these studies, there were substantial changes in Somatic Anxiety. KSP scales Psychic Anxiety, Muscular Tension, Psychasthenia and Guilt were also substantially changed in four, four, two, and two of these studies, respectively, whereas for five KSP scales (Inhibition of Aggression, Impulsivity, Detachment, Indirect Aggression, and Irritability) there were substantial changes in only one of the studies. This may point to difficulties in separating traits from the state, especially in aspects of neuroticism. However, the present results are well in accordance with a previous meta-analysis finding changes in five-factor traits, especially Neuroticism, after different kinds of interventions [26], suggesting that personality can indeed change and casting doubt on trait vs state aspects with regard to personality. The changes noted in a study of adolescents (age interval 15–20 years) with reduced Detachment and Suspicition and increased Social Desirability are likely to mirror a maturation phase [51] and mean-level personality changes in this age range are anticipated [20].

The results when a long-term mean-level change of personality traits using SSP in a clinical psychiatric sample was investigated showed that individuals affected by more severe symptoms showed higher stability in personality than individuals with milder symptoms [48]. Individuals with psychotic disorders often show a more severe disease state. Provided this assumption, the results in the present study agree well with the two previous studies on long-term outcomes measured with SSP [18,48]. When compared to the mean-level change of the KSP studies, the present study is in agreement in that the studies analysing non-psychiatrically adult individuals did not show any substantial change similar to the controls of the present report [56,58,62,63]. Also, a study of chronic depressive patients, who may be considered severely ill, and where no specific intervention was performed did not display any substantial mean-level change [50] similar to the patients of the present report. Considering studies where prominent interventions were performed, makes the picture more complex. The relatively well-functioning individuals treated with long-term psychotherapy displayed substantial changes in several personality traits after the treatment [61], which seems partly similar to the less anxious and depressed patients in the study of Spangenberg et al. [48]. How to classify individuals undergoing forensic investigation [59], suicide attempters [55], patients treated for epilepsy with frontal resections [49], and patients successfully treated for epilepsy [53], who all displayed substantial reductions in one or two of the neuroticism-related KSP scales at follow-up, is less obvious. The two first studies were composed of a mix of psychiatric patients, whereas the two latter included non-psychiatric patients having a long-term neurological disease, with a potential impact on their mental state. Patients treated with capsulotomy because of anxiety [57] or obsessive symptoms [54] are indeed among the most severely ill, but still, in contrast to the present study, these patients showed substantial personality changes, especially in neuroticism-related traits. Taken together, studies using SSP and KSP may indicate that the personality among adults aged 23–55 years usually shows both rank-order and mean-level stability among non-psychiatric samples and stable severely chronically ill patients. However, therapeutic interventions of severe life events may induce a prominent change in different neuroticism-related personality aspects among non-chronically patients, and if the interventions are sufficiently targeted and prominent even among chronically ill patients [54,57]. This is under a previous meta-analysis [26]. Still, many of these studies rely on few subjects, and their results should therefore be treated with caution.

**Limitations**

Demanding follow-up investigations many years apart tends to limit the numbers of participants and this study includes a relatively small number of individuals. There is also a low proportion of women participating. Another weakness of this study is the difficulty to know how the medication affects the participants during the study period. All collected personality data of the present study stems from self-report instruments, which may lower its validity. On the other hand, the chosen procedure ensured that there was no bias from interviewer expectations based on the previous history. The main strength of this study is the length between the three study points.

**Conclusion**

The results in this study support the theory that SSP personality traits are relatively stable over time in the upper young
and middle adulthood. This is in agreement with the overall results from studies using KSP, although some small studies indicate that Neuroticism-related scales may change substantially following targeted interventions. Case-control analyses over the 13 years showed that patients differed compared to controls for the SSP factor Neuroticism as well as the subscale Detachment, which is in agreement with previous research.

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Declaration statement

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