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Big Five personality traits may inform public health policy and preventive medicine: Evidence from a cross-sectional and a prospective longitudinal epidemiologic study in a Swiss community

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ABSTRACT

Background: Some evidence documents the importance of personality assessments for health research and practise. However, no study has opted to test whether a short self-report personality inventory may comprehensively inform health policy.
Methods: Data were taken from a population-based epidemiologic survey in Zurich, Switzerland, conducted from 2010–2012. A short form of the Big Five Inventory was completed by n = 1155 participants (54.4% women; mean age = 29.6 years), while health-related outcomes were taken from a comprehensive semi-structured clinical interview. A convenience subsample averaging n = 171 participants additionally provided laboratory measures and n = 133 were subsequently followed-up at least once over a maximal period of 6 months.
Results: Personality traits, in particular high neuroticism and low conscientiousness, related significantly to poor environmental resources such as low social support ($R^2 = 0.071$), health-impairing behaviours such as cannabis use ($R^2 = 0.071$), and psychopathology, including negative affect ($R^2 = 0.269$) and various mental disorders ($R^2 = 0.060$–0.195). The proportion of total variance explained was $R^2 = 0.339$ in persons with three or more mental disorders. Personality significantly related to some laboratory measures including total cholesterol ($R^2 = 0.095$) and C-Reactive Protein ($R^2 = 0.062$). Finally, personality prospectively predicted global psychopathological distress and vegetative symptoms over a 6-month observation period.
Conclusions: Personality relates consistently to poor socio-environmental resources, health-impairing behaviours and psychopathology. We also found some evidence for an association with metabolic and immune functions that are assumed to influence health. A short personality inventory could provide valuable information for preventive medicine when used as a means to screen entire populations for distinct risk exposure, in particular with respect to psychopathology.

1. Introduction

Personality traits are important predictors of psychosocial functioning, psychopathology, physical health and mortality [25,51,58]. Specifically, previous studies have demonstrated that personality significantly relates to job strain and burnout [6,61,70], sexual problems [24,43], psychosis-spectrum disorders [60,62,72], major depression [26,34], health-impairing behaviours such as substance use [40,71], stress reactivity and resilience [3,27,46], and health-promoting socio-environmental resources such as relationship quality and social support [2,13,59]. Moreover, personality relates substantially to physical health problems [21,29,32] and consequently to longevity and all-cause mortality [16,31,36].

Another important line of evidence emerged from the very proliferous contemporary research in animal personalities. In biological specialities such as ecology, ethology, or behavioural biology, it is now widely acknowledged that personality trait variation is among the driving forces behind adaptations to environments and its influences on fitness, including health, survival, and fecundity [19,37,75,76]. Most importantly, those findings from animal research can also inform personality research in humans and foster the understanding of human health and functioning [22,37,48]. Currently the main conclusion drawn from the literature on human and animal personality is that successful adaptations to the environment, thereby increasing health and longevity, are an interaction between personality and environmental conditions [15,47,53,76]. In accord with that it has been shown that selection processes, that is, one's propensity to create,

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shape or move into environments that match with one's trait disposition, are powerful determinants of human life-histories, for better or for worse [49,57,59,64]. An important research question is therefore to quantify to which degree environmental resources that impact on health and wellbeing are influenced by personality traits. Such data could help to set priorities and to define specific target areas, where benefits from personality-centred interventions are most likely to be expected.

Despite some promising evidence stating that personality traits are crucial for human health and wellbeing, they have not been considered a major target in preventive medicine yet [29,44]. That is, personality traits are mainly overlooked in health research and practise, although strong and convincing cases for their public health significance have been made [12,25,41]. Arguably the concept of personality is unfamiliar to many health experts with biomedical orientation. One purported argument against the inclusion of personality is for instance the widely held misbelief that personality traits are mostly immutable. However, there is a compelling body of evidence that personality traits and disorders can be treated effectively [9,73,78]; with both psychological [8] and pharmacological interventions [67]. Another reason for the neglect of personality variation in public health and preventive medicine could be that a thorough and comprehensive assessment of personality is time-consuming and therefore no option for most health practitioners with tight time schedules. It is thus necessary to validate short self-report instruments for their application in the field, as health policy and practise could certainly benefit from a delineation of vulnerable at-risk populations based on specific personality characteristics [25]. For instance, primary prevention could specifically target the increased risk of substance abuse in persons scoring low on conscientiousness [12], while secondary prevention and therapeutic interventions could be aimed at maladaptive neuroticism to prevent relapses and chronification of depression [41].

The major objective of this work was thus to explore, whether a short 15-item self-report personality questionnaire could inform public health policy and practise. Specifically, we wanted to determine the relevance of personality by evaluating whether personality traits would relate to a broad range of important living conditions, environmental resources and health outcomes. In order to validate our cross-sectional epidemiologic findings we additionally included laboratory measures and conducted a longitudinal study of the prospective impact of personality traits on the repeated assessments of subsequent global psychopathological distress and vegetative symptoms.

2. Methods

2.1. Study design and sampling

This study was conducted with data from the Epidemiology Survey of the Zurich Programme for Sustainable Development of Mental Health Services (ZInEP; in German: "**Z**ürcher **I**mpulsprogramm zur **n**achhaltigen **E**ntwicklung der **P**sychiatrie") [1], a research and health care programme involving several psychiatric research divisions and mental health services from the canton of Zurich, Switzerland. The Epidemiology Survey is one of various ZInEP subprojects and consists of four components: 1) a short telephone screening, 2) a comprehensive semi-structured face-to-face interview followed by self-report questionnaires, 3) tests in the socio-physiological laboratory, and 4) a longitudinal survey. For the present study we used comprehensive data from all four components. For a graphical illustration see Fig. 1. The telephone screening and semi-structured interviews started in August 2010, the tests at the socio-physiological laboratory in February 2011, and the longitudinal survey in April 2011. The screening ended in May 2012 and all other components in September 2012. Detailed information about the ZInEP Epidemiology Survey is provided elsewhere [1].

First, a total of 9829 Swiss males and females aged 20–41 years at the onset of the survey and considered representative of the general

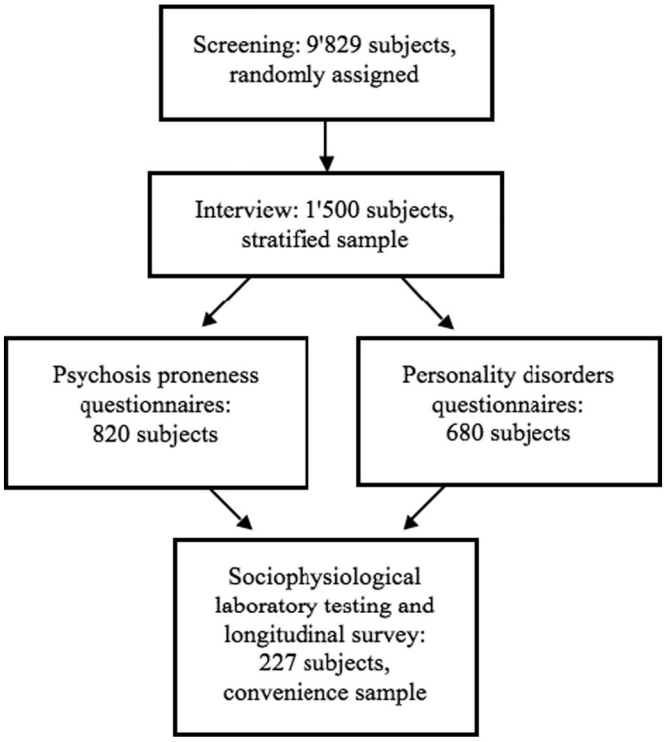

Fig. 1. The sampling procedure of the ZInEP Epidemiology Survey.

population of that age range in the canton of Zurich, Switzerland, were screened by computer assisted telephone interview (CATI) using the Symptom Checklist 27 (SCL-27) [23]. All participants were randomly chosen through the resident registration offices of all municipalities in the canton of Zurich. Residents without Swiss nationality were excluded from the survey. The CATI was conducted by GfK (Growth for Knowledge), a major market and field research institute, in accordance with instructions from the ZInEP research team. The overall response rate was 53.6%. Reasons for non-response were only telephone responder, incorrect telephone number, unavailability during the study period and refusal by a third person or the target person. In cases where potential subjects were available by telephone, the response rate was 73.9%. The discrepancy between overall and availability response rates is due to the fact that in Switzerland increasingly more young adults first, do not have an entry in a telephone number registry and second, do not respond to calls from a call centre.

Second, 1500 subjects were randomly selected from the initial screening sample for subsequent face-to-face interviews. We applied a stratified sampling procedure including 60% high-scorers (scoring above the 75th percentile of the global severity index of the SCL-27) and 40% low-scorers (scoring below the 75th percentile of the global severity index). The basic sampling design was adapted from the longitudinal Zurich cohort-study [5] and was chosen to enrich the sample with subjects at high-risk of mental disorders. Such a two-phase procedure with initial screening and subsequent interview with a stratified subsample is fairly common in epidemiological surveys [20]. Face-to-face interviews were conducted by experienced and extensively trained clinical psychologists. The interviews took place either at the participants' homes or at the University Hospital of Psychiatry in Zurich. Upon completion of the semi-structured interviews participants received a 20 CHF coupon for a Swiss hypermarket. All participants who completed the semi-structured interview were required to complete additional questionnaires. Complete personality assessments were obtained from 1155 persons (77% of the total sample).

Third, a convenience sample comprising 227 subjects was selected for the longitudinal survey based on the outcome on two scales of

psychoticism, that is, high-scorers and controls with low overall psychopathological impairment (participation rate 53.8%). These participants additionally provided saliva, urine and blood samples and performed a set of neuropsychological tests. The biological tests were conducted in the laboratory of the Zurich University Hospital of Psychiatry. Out of the 227 persons selected for the longitudinal survey, personality assessments were completed by totally $n = 184$ persons. Starting with the laboratory day these participants were subsequently interviewed bimonthly over a maximum period of 6 months with a brief telephone-screening which also included the SCL-27. The number of participants with complete data on personality and psychopathologic outcomes at 2-month, 4-month and 6-month follow-up was $n = 133$, $n = 101$, and $n = 63$. Only persons who completed at least the 2-month follow-up were included in the longitudinal analysis. Attrition was due to participants' refusal to participate in further assessments or to unanswered contacting by telephone and by mail. Subjects who participated in the laboratory testing and the longitudinal survey additionally received a 100 CHF payout in cash to recompense their time and effort. For detailed information see [1].

The ZInEP Epidemiology Survey was approved by the ethics committee of the canton of Zurich (KEK) as fulfilling all ethical, legal and data privacy protection requirements and is in strict accordance with the declaration of Helsinki of the World Medical Association. All participants gave their written informed consent.

2.2. Instruments and measures

The Big Five Inventory short form (BFI-S) [63] is a German adaptation of the popular Big Five Inventory by John et al. [30]. The questionnaire consists of 15 items divided into the five broad domains *neuroticism*, *extraversion*, *openness*, *agreeableness*, and *conscientiousness*, each of whom rated on a 7-point Likert scale. Neuroticism assesses being frequently worried, tense and fearful. Extraversion measures being talkative, outgoing and sociable. Openness assesses being inventive, imaginative and experience seeking. Agreeableness captures being gentle, forgiving and cordial, whereas conscientiousness measures being thorough, diligent and efficient. The BFI-S has shown good reliability and validity [63]. In the present study mean Cronbach's α of the subscales was 0.67.

Psychopathology was assessed with the SCL-27 [23], which contains the six subscales *depressive*, *dysthymic*, *vegetative*, *agoraphobic*, *sociophobic symptoms*, and *symptoms of mistrust*. A total distress score similar to the global severity index (GSI) of the SCL-90-R is also available and comprises the sum-score of all six subscales. Since these subscales are highly interrelated (mean correlation across subscales $r = 0.48$) we included only the GSI for global psychopathological impairment and the vegetative subscale for psychosomatic complaints in the longitudinal study. Cronbach's α for the subscales are all greater than 0.70 and Cronbach's α for the GSI is 0.93. The correlation between the GSI of the SCL-27 and the GSI of the SCL-90-R is $r = 0.95$ [23]. In the present study Cronbach's α of the GSI and the vegetative symptoms subscale, respectively, were 0.90 and 0.68. We chose to differentiate global psychopathology from vegetative symptoms as only the latter comprise pure somatic symptoms. Such a distinction could be worthwhile in psychosomatic research and practise.

The Positive and Negative Affect Schedule (PANAS) [74] is a short self-report questionnaire that measures broad positive and negative affect according to a 5-point Likert scale. The PANAS has shown good reliability and validity [39,74]. In the present study Cronbach's α of the positive and negative subscale, respectively, were 0.90 and 0.86.

Education level (high vs. low) was assessed during the CATI by asking the participants to indicate their highest educational degree. These qualifications were subsequently categorized as low (if the highest attainment corresponded to a high school diploma) and high (if it corresponded to a qualification above high school). All other socio-demographics, health care problems, substance use variables as well as psychiatric diagnoses were assessed during the comprehensive semi-structured interview with the "Structured Psychopathological Interview and Rating of the Social Consequences of Psychological Disturbances for Epidemiology" (SPIKE) [4]. This instrument was developed for epidemiological surveys in psychiatric research and assesses data about socio-demography, somatic syndromes, psychopathology, substance use, medication, health services, and social impairment. Its reliability and validity have been reported elsewhere [5]. Twelve-month prevalence diagnoses of mental disorders according to DSM-IV criteria comprised major depression episode, agoraphobia, simple phobia, social phobia, obsessive–compulsive disorder (OCD), panic disorder, and alcohol use disorder (abuse or dependence). In addition, a measure of co-occurrence was computed by adding up the number of co-occurring disorders.

The participants of the longitudinal survey provided blood samples in the morning between 08:55 am and 10:34 am at the Zurich University Hospital of Psychiatry. The blood samples were centrifuged (10 min; 30,000 rpm) 30 min after the sample was taken and stored at −80 °C until delivered to the CYTOLAB for biochemical analysis. C-Reactive Protein (CRP) was derived by a bead-based multiplex assay using a kit from R&D Systems (Oxon, UK), whereas total cholesterol levels and low-density lipoprotein cholesterol were measured with a enzymatic colorimetric assay analysis using a kit from Roche (Mannheim, Germany). CRP is a biomarker in the blood plasma that is responsive to infections, inflammatory and cardiovascular diseases [52,54]. Cholesterol is an organic molecule with various metabolic effects. Although it has been suggested that total cholesterol levels increase the risk of cardiovascular diseases, the evidence is yet inconclusive [10]. For the present study those biomarkers were chosen a-priori based on face validity, as they were supposed to capture metabolic and immune functions related to trait-specific lifestyles and environmental adaptations.

3. Statistical analysis

All continuous variables were beforehand standardized using the z-transformation. We then conducted a series of multiple regression analyses, applying either binary logistic or linear regression depending on whether the outcome was dichotomous or continuous. Big Five personality traits were always included as the independent variables. We applied a stepwise approach, carefully evaluating the contribution of a given personality trait to the outcome and its influence on the effects of the other traits included in the model. Traits that did not impact on either the outcome or on the regression coefficients of other traits were removed from the equation, because otherwise they would artificially increase the proportion of total variance explained without improving the goodness of model fit. Since all continuous variables were z-transformed, the regression coefficients (B) of the binary logistic regression correspond to Cohen's d, whereas the standardized regression coefficients of the multiple linear regressions compare to a correlation coefficient r. In any case the proportion of total variance explained in the outcome (R^2) may additionally serve as an effect size. Based on Cohen's f^2 metric [17], $R^2 > 0.015$ denotes a small effect, $R^2 > 0.125$ a medium effect and $R^2 > 0.255$ a large effect. In order to provide estimates representative for the general population, analyses using the full population-based sample were weighted to adjust for sample stratification.

The longitudinal associations between personality and repeated measures of health problems were estimated using generalized estimating equations (GEE). These statistical models were introduced to fit regression analyses that account for within-subject correlation, which is an inherent part of longitudinal studies that rely on repeated measures [77]. Their application has been recommended specifically for use in longitudinal studies with repeated outcomes [7]. GEE uses all available data and imputes missing values under the assumption of Missing Completely at Random (MCAR). Therefore a missing value analysis was conducted beforehand, which revealed that all outcomes

of interest met the criteria of MCAR according to Little's MCAR test. Owing to the standardized continuous dependent variables we fitted all models with a normal distribution and identity link-function. The within-subject covariance was specified with the "unstructured" correlation type to avoid having any constraints on the covariance structure, and a robust estimator was used to reduce the effects of outliers and influential observations. All analyses were performed with SPSS 23 for Windows.

4. Results

The associations of Big Five personality traits with socio-environmental resources and substance use are indicated in Table 1. Personality accounted for a significant proportion of total variance explained in all outcomes, although in association with alcohol frequency no single predictor of practical significance (i.e., $b > 0.2$) emerged. Corresponding point estimates were all within the range of small-to-medium effect sizes ($R^2 = 0.010$–0.071). The overall most important multiple predictor was conscientiousness, which related to 8 of 13 outcomes and which revealed substantial effect sizes of $d = 0.43$ for cannabis use compared to no use) and $d = 0.42$ for other drug use compared to no use.

Next we examined associations between personality and mental health (see Table 2). Here personality related significantly to all outcomes included in the analysis. Associations between personality and both the global severity index of the SCL-27 ($R^2 = 0.235$) and the positive affect subscale of the PANAS ($R^2 = 0.246$) corresponded to medium-to-large effect sizes, whereas for PANAS negative affect ($R^2 = 0.269$) the effect size was large according to Cohen's f^2. The proportion of total variance explained in DSM-IV diagnoses of mental disorders ranged from $R^2 = 0.027$ (small effect) in specific phobia to $R^2 = 0.195$ (medium effect size) in agoraphobia. The variance in comorbid disorders accounted for by personality traits increased linearly with the number of co-occurrent disorders, ranging from $R^2 = 0.092$ for at least one disorder (small-to-medium effect size) to $R^2 = 0.339$ for three and more disorders (large effect size). The predominant multiple predictor across outcomes was neuroticism, revealing a strong effect in agoraphobia ($d = 1.14$) and in persons with three and more mental disorders compared to persons without any disorder ($d = 1.69$).

Though evaluated carefully through semi-structured interviews, so far all findings relied on participants' self-reports. To explore possible underlying psychophysiological processes we additionally included objective laboratory measures drawn from a convenience subsample (see Table 3). Those analyses showed that personality significantly relates to C-reactive protein ($R^2 = 0.062$), systolic blood pressure ($R^2 = 0.022$), LDL cholesterol, and total cholesterol ($R^2 = 0.049$ and 0.095, respectively), though no significant effects were found in diastolic blood pressure, HDL cholesterol and BMI (all $R^2 < 0.020$). A notable association was found between neuroticism and total cholesterol ($\beta = 0.308$).

Finally, a third analysis step was to replicate the cross-sectional associations between personality and health using a prospective longitudinal study, where Big Five traits served to predict the subsequent occurrence of bimonthly assessed global psychopathological impairment and vegetative symptoms over a maximal observation period of 6 months (see Table 4). Various models with differing covariates were computed and evaluated. In model 1 we entered all Big Five traits simultaneously. With respect to global impairment according to the GSI only neuroticism ($\beta = 0.390$) emerged as a significant predictor, whereas in relation to vegetative symptoms both neuroticism ($\beta = 0.353$) and to a lesser extent openness ($\beta = 0.180$) demonstrated a significant contribution. In model 2 we adjusted the effects of neuroticism and openness for sex and education level. Openness was forced into the equation because it captures aspects of critical introspection and the ability for differentiated evaluation, which are crucial to self-reports. With respect to both global psychopathological impairment and vegetative symptoms, neuroticism was the predominant predictor ($\beta = 0.480$ and 0.352, respectively). In model 3 we adjusted neuroticism and openness for concurrent psychopathological impairment and vegetative symptoms. This model provides a very conservative test, since

Table 1
Associations of Big Five personality traits with socio-environmental resources and substance use in a Swiss community. Only both practically ($B > 0.2$) and statistically ($p < 0.05$) significant predictors are shown. The lower outcome category always serves as the reference. Results were weighted and representative of the general population.

Outcome	Outcome category	Model		Significant predictors	
		R^2	p	Trait	B
Marital status	Unmarried (N = 825) Married (N = 314)	0.041	<0.001	Openness Conscientiousness	0.225 −0.317
Housing situation	Alone (N = 187) With others (N = 949)	0.010	<0.001	Openness	0.201
Children	No (N = 867) Yes (N = 286)	0.032	<0.001	Conscientiousness	−0.288
Partner	No (N = 370) Yes (N = 784)	0.039	<0.001	Extraversion Conscientiousness	−0.241 -0.238
Close friends	0–2 (N = 200) >2 (N = 954)	0.052	<0.001	Neuroticism Extraversion	0.211 −0.424
Social support	Low (N = 162) High (N = 987)	0.071	<0.001	Neuroticism Extraversion	0.235 −0.468
Education level	Low (N = 689) High (N = 463)	0.047	<0.001	Neuroticism Conscientiousness	0.278 −0.291
Unemployment	Yes (N = 115) No (N = 1040)	0.037	<0.001	Neuroticism Openness Conscientiousness	0.247 0.234 -0.242
Smoking	Daily (N = 246) Occasional/no (N = 909)	0.012	<0.001	Agreeableness	−0.210
Alcohol frequency	≥1 per week (N = 725) <1 per week (N = 429)	0.019	<0.001	–	
Alcohol quantity	≥3 st. drink (N = 381) 0–2 st. drink (N = 774)	0.038	<0.001	Conscientiousness	−0.308
Cannabis use	Yes (N = 251) No (N = 904)	0.071	<0.001	Extraversion Openness Conscientiousness	0.225 0.295 -0.425
Other drug use	Yes (N = 49) No (N = 1106)	0.038	<0.001	Neuroticism Conscientiousness	0.267 −0.423

Table 2
Associations of Big Five personality traits with mental health in a Swiss community. Only both practically (β > 0.1 or B > 0.2) and statistically (p < 0.05) significant predictors are shown. Results were weighted and representative of the general population.

		Model		Significant predictors	
		R^2	p	Trait	β
SCL-27	Global severity index (N = 1148)	0.235	<0.001	Neuroticism	0.416
				Openness	0.138
PANAS	Positive affect (N = 1125)	0.246	<0.001	Neuroticism	−0.262
				Extraversion	0.249
				Openness	0.129
				Conscientiousness	0.186
	Negative affect (N = 1127)	0.269	<0.001	Neuroticism	0.445
				Agreeableness	−0.150
		R^2	p	Trait	B
SPIKE	Major depression (N = 305)	0.105	<0.001	Neuroticism	0.685
	No major depression (N = 850)				
	Agoraphobia (N = 42)	0.195	<0.001	Neuroticism	1.142
	No agoraphobia (N = 1113)			Extraversion	−0.311
				Openness	0.494
				Agreeableness	−0.281
	Specific phobia (N = 175)	0.027	<0.001	Neuroticism	0.277
	No specific phobia (N = 980)			Openness	0.206
	Social phobia (N = 110)	0.172	<0.001	Neuroticism	0.799
	No social phobia (N = 1045)			Extraversion	−0.632
	OCD (N = 86)	0.085	<0.001	Neuroticism	0.633
	No OCD (N = 1069)			Openness	0.416
				Conscientiousness	0.222
	Panic disorder (N = 42)	0.060	<0.001	Neuroticism	0.578
	No panic disorder (N = 1113)			Openness	0.450
	Alcohol use disorder (N = 106)	0.062	<0.001	Extraversion	0.551
	No alcohol use disorder (N = 1049)			Conscientiousness	−0.341
				Agreeableness	−0.276
	≥1 disorder (N = 550)	0.092	<0.001	Neuroticism	0.528
	No disorder (N = 605)				
	≥2 disorder (N = 225)	0.170	<0.001	Neuroticism	0.843
	No disorder (N = 605)			Openness	0.296
	≥3 disorder (N = 69)	0.339	<0.001	Neuroticism	1.686
	No disorder (N = 605)			Extraversion	−0.306
				Openness	0.520
				Agreeableness	−0.285

Note. SCL: Symptom Checklist; PANAS: Positive Affect Negative Affect Scale; SPIKE: Semi-Structured Clinical Interview; OCD: Obsessive–Compulsive DIsorder.

psychopathological and vegetative symptoms are inherent features of neuroticism. Nevertheless, even when baseline impairment was accounted for, neuroticism prospectively predicted both global psychopathological impairment (β = 0.206) and vegetative symptoms (β = 0.275).

5. Discussion

5.1. Summary

The present study tested whether a short self-report personality inventory may provide valuable data to inform health policy with respect to possible targets for research and practise in preventive medicine. Based on our results we believe that personality traits could constitute an important target of prevention and intervention programmes, in particular with respect to mental health, as evidenced by medium to large effect sizes in these outcomes. Moreover, Big Five traits prospectively predicted both global psychopathological impairment and vegetative symptoms in a prospective longitudinal study over a maximal observation period of 6 months, even when adjusted for important covariates such as sex, education, and baseline psychopathological and vegetative symptoms. Besides, personality moderately related to a multitude of major psychosocial public health factors. Personality traits, specifically neuroticism, conscientiousness and agreeableness, also significantly correlated with some, but not all, laboratory measures of psychophysiological processes underlying general health. In line with the literature, two major lines of evidence emerged: first, broad psychosocial health problems are mainly related to high neuroticism and low

Table 3
Associations of Big Five personality traits with laboratory measures in a Swiss community between. Only both practically (β > 0.1) and statistically (p < 0.05) significant predictors are shown.

	Properties	Model		Significant predictors	
	Mean (SD)	R^2	p	Traits	β
CRP (N = 160)	1.69 mg/l (2.51)	0.062	0.006	Neuroticism	0.187
				Conscientiousness	0.195
Diastolic blood pressure (N = 184)	84.06 mm Hg (10.84)	0.011	0.228	–	
Systolic blood pressure (N = 184)	126.83 mm Hg (14.80)	0.022	0.046	Agreeableness	−0.147
HDL cholesterol (N = 162)	1.53 nmol/l (0.39)	<0.001	0.462		
LDL cholesterol (N = 162)	2.84 nmol/l (0.84)	0.049	0.005	Neuroticism	0.221
Total cholesterol (N = 162)	4.89 nmol/l (0.97)	0.095	<0.001	Neuroticism	0.308
BMI (N = 181)	24.46 kg/m^2 (4.40)	0.019	0.141	–	

Note. CRP: C-Reactive Protein; HDL: High Density Lipoprotein; LDL: Low Density Lipoprotein; BMI: Body Mass Index.

Table 4
Prospective effects of Big Five personality traits and various covariates assessed at baseline on subsequent repeated measures of psychopathological distress at 2-month, 4-month, and 6-month follow-up in a Swiss community between 2011 and 2012. A total of $n = 133$ participants were included in the analysis.

Model	SCL GSI		SCL vegetative symptoms	
	β	p	β	p
Model 1:				
Neuroticism	0.390	<0.001	0.353	<0.001
Extraversion	−0.131	0.047	−0.032	0.645
Openness	0.118	0.112	0.180	0.025
Conscientiousness	−0.084	0.228	−0.055	0.539
Agreeableness	−0.001	0.985	0.009	0.901
Model 2:				
Female sex	0.226	0.107	0.062	0.677
Low education level	0.133	0.361	0.113	0.416
Neuroticism	0.408	<0.001	0.352	<0.001
Openness	0.109	0.159	0.182	0.023
Model 3:				
Baseline impairment	0.528	<0.001	0.476	<0.001
Neuroticism	0.206	0.002	0.275	<0.001
Openness	0.076	0.243	0.126	0.060

Note. SCL: Symptom Checklist; GSI: Global Severity Index.

conscientiousness, with a predominant effect of neuroticism in general mental health [14,38,69] and low conscientiousness (which captures lack of self-control, carelessness and impulsivity) apparently being the most important single trait with respect to health-impairing behaviours and poor socio-environmental resources [11,29,44].

Of particular importance for public health policy and research is the substantial and consistent association between low conscientiousness and substance use, including alcohol and drug use, which are among the leading causes of premature mortality [11,12]. These health-impairing behaviours are at least in part mediating the associations between conscientiousness and physical diseases and mortality, which are commonly reported in the literature [16,29,32,36]. Moderate associations were found between low extraversion (i.e., introversion) and both having few close friends and low social support, which accords to the literature [2,13,33]. That, too, are important findings with clear public health significance, since both the quality and quantity of social relationships ultimately relate to lower mortality risk [28]. Though the cross-sectional associations were of small-to-medium effect sizes in the present study, they could have large public health significance if they accumulate over time through selection and socialisation processes [15]. For instance, Robins et al. [59]) showed that high neuroticism predicts future relationship problems (selection process), while repeated relationship problems further increase neuroticism (socialisation process). In the same vein it was found that changes in substance use habits over time correlate with personality trait change [71].

Also consistent with previous research is the strong association between neuroticism and psychopathology [38,50], which is why neuroticism is the predominant trait emerging from mental health research [25]. The substantial association between neuroticism and mental health also hold in our prospective analysis, which conforms to previous longitudinal studies in both community [18,26,40] and clinical samples [45,56,68]. Compelling evidence for a crucial role of neuroticism in the aetiopathology of mental disorders also comes from both phenomenological [14] and genetic [69] research on the correlation between neuroticism and the general factor of psychopathology, which captures the broad polygenic vulnerability to global psychopathological impairment (see also [42,55]. Finally, we found some evidence for physiological processes underlying the pervasive impact of personality on general health and wellbeing. The association between personality and physiology is probably best explained through the influence of personality traits on risk-exposure and stress reactivity [27,35,46]. As a result, personality traits relate to metabolic and immune functions that mediate many diseases and health problems [12,41]. Though still inconclusive and not well understood, in accordance with a majority of the literature on the impact of trait anger and hostility on cardiovascular diseases (see review by [66]) we found that low agreeableness relates significantly to hypertension. In turn, neuroticism related significantly to C-reactive protein (CRP), an inflammatory marker, and to low-density lipoprotein cholesterol as well as total cholesterol, which are metabolic markers of unhealthy diet. In contrast, no significant associations were found with respect to diastolic blood pressure, HDL cholesterol and body mass index. More research is certainly required to better understand the relationship between trait dispositions and physiology. Important new insights could for instance emerge from research in animal personality trait variation [37,76].

5.2. Conclusions and future directions

The major limitation of the present study is that no data on physical diseases and no official medical records were available. Replication of these findings including various disease markers and medical records is thus necessary. Moreover, the sample size for the prospective study and the laboratory measures was rather modest and not representative of the general population, which constrains its external validity and generalisability. Despite these limitations we conclude that personality stands out as an important correlate of severe mental health problems, low psychosocial resources, health-impairing behaviours, as well as, with reservation, adverse immune function and metabolism. Those findings help to explain, why personality, in particular high neuroticism and low conscientiousness, predicts disease mortality [16,32,65] and poor mental health and functioning [12,25,41]. We therefore advocate that a short Big Five inventory provides much valuable information for health practise and research. Most importantly, an integration of personality in public health policy offers many benefits at almost no costs. A short personality assessment may easily and cost-effectively screen entire populations for increased risk for probable health-impairing behaviours, poor environmental resources and, in particular, proneness to mental disorders. These data may then help to guide programmes in preventive medicine, as specific personality traits are differentially related to risk exposure. Treatment of personality traits [8] and personality disorders [9] could then help to improve mental health and functioning and to minimize risk exposure and health-impairing behaviours. Based on the present study we suggest that mental health and psychosocial functioning would benefit the most from personality-focused prevention and intervention. The next step would then be to move from observational studies to interventional studies and back again to large epidemiologic studies to evaluate the effectiveness of such interventions in relation to mental health and functioning in the general population. Here, various approaches are conceivable. For instance, prospective community studies could compare the trajectories of common mental and physical disorders in settings where health care practise is focused on personality trait variation compared to settings where it is not. Given that once such personality-centred approaches have been applied in various public health policies and clinical guidelines, large retrospective population studies could then evaluate trends in annual prevalence rates of diverse public health outcomes across districts or nations where personality traits had stringently been integrated compared to regions where no special emphasis on personality had been made.

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7. Conflict of interest

There is no conflict of interest.

8. Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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