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Abstract

***Purpose*.** This study aimed (1) to identify different personality types in adolescents with congenital heart disease (CHD); and (2) to relate these personality types to psychosocial functioning and several domains of perceived health, both concurrently and prospectively. Hence, this study aimed to expand previous research by adopting a person-centered approach to personality through focusing on personality types rather than singular traits.

***Methods*.** Adolescents with CHD were selected from the database of pediatric and congenital cardiology of the University Hospitals Leuven. A total of 366 adolescents (15-20 years old) with CHD participated at Time 1. These adolescents completed questionnaires on the Big Five personality traits, depressive symptoms, loneliness, and generic and disease-specific domains of health. Nine months later, 313 patients again completed questionnaires.

***Results*.** Cluster analysis at Time 1 revealed three personality types: Resilients (37%), Undercontrollers (34%), and Overcontrollers (29%), closely resembling typologies obtained in previous community samples. Resilients, Under- and Overcontrollers did not differ in terms of disease complexity, but differed on depressive symptoms, loneliness, and generic and disease-specific domains of perceived health at both time-points. Overall, Resilients showed the most favorable outcomes and Overcontrollers the poorest, with Undercontrollers scoring in-between.

***Conclusions*.** Personality assessment can help clinicians in identifying adolescents at risk for physical and psychosocial difficulties later in time. In this study, both Over- and Undercontrollers were identified as high risk groups. Our findings show that both personality traits and types should be taken into account to obtain a detailed view on the associations between personality and health.

Heart defects, congenital; Personality types; Big Five; Cluster analysis; Adolescence; Chronic disease.

Recent advances in pediatric medicine have led to a dramatic decrease in the mortality rate of many once fatal chronic diseases [1]. It is estimated that more than 90% of children born with a chronic disease now survive to the age of 20 [2]. The emergence of this population poses many new challenges to health care. Although major differences exist in how youngsters cope with their disease, a recent meta-analysis has shown that adolescents with a chronic disease report more depressive symptoms as compared to their healthy peers [3]. In addition, research has shown that young adults with a chronic disease have worse educational and vocational outcomes as compared to their peers [2]. In the present study, we focus on adolescents with congenital heart disease (CHD), being the most common birth defect (9:1000 births) and comprising a wide spectrum of simple, moderate, and complex structural heart lesions [4]. Adolescents with CHD are at increased risk for developing medical complications later in life, such as arrhythmias, pulmonary hypertension, or heart failure. Furthermore, many patients struggle to cope with the uncertainty regarding the course and prognosis of their disease, fitting into the peer group, symptom burden (e.g., cyanosis, lack of energy, and shortness of breath), and physical activity restrictions [5]. Hence, studies are increasingly focusing on these patients' physical and psychosocial functioning.

A potentially important determinant of patients' physical and psychosocial functioning that has not received much attention to date is patients' personality [6,7]. Extensive research has linked Type A (characterized by hostility, time-urgency, and competitiveness) and Type D personality (characterized by negative affect and social inhibition) to adverse health outcomes in individuals with acquired cardiovascular pathologies [8,9]. In contrast, the personality of individuals with CHD has received little to no attention in the literature. In a recent study by Schoormans and colleagues [10], patients with Type D personality were found to report poorer functional status, health status, and quality of life as compared to non-Type D patients. In addition, Type D patients tended to show less health-care utilization, even after

controlling for disease complexity, functional status, health status, and quality of life. Although this study provided important insights, personality traits beyond Type D should be taken into account as well.

A Variable-Centered Approach to Personality: The Big Five Personality Traits

Recent studies in both community and patient samples have demonstrated the importance of different personality traits for adolescents' physical and psychosocial functioning [11,12]. Indeed, nowadays, most researchers agree that the basic level of personality can be subsumed under five broad traits: extraversion (energy, sociability, and experiencing frequent positive moods), agreeableness (kindness, empathy, and cooperativeness), conscientiousness (self-discipline, organization, and responsibility), emotional stability (the ability to deal with negative emotions), and openness to experience (the way an individual seeks and deals with new information) [13]. Unfortunately, prior research in individuals with a chronic disease has focused mainly on isolated personality traits such as emotional stability or conscientiousness, thereby providing a too narrow perspective on personality functioning [14,15]. However, a recent study in adolescents with congenital heart disease uncovered important associations between all five traits, quality of life, and perceived health, even after controlling for the effects of sex, age, and disease complexity [16]. For instance, patients high in agreeableness reported better quality of life, emotional and social functioning, and less insecurities regarding their physical appearance. Hence, these findings demonstrate that the Big Five is a valuable framework for examining linkages between personality and health.

A Person-Centered Approach to Personality: The Role of Personality Types

To complement this variable-centered approach towards personality, studies in community samples have also looked at how different personality traits combined relate to youngsters' functioning. Personality types refer to configurations of personality traits that

characterize an individual. Many studies on personality distinguish among three types, based on the theory of ego-control and ego-resiliency by Block and Block [17]. Ego-control refers to the tendency to contain versus express motivational impulses, whereas ego-resiliency refers to the tendency to respond flexibly to environmental demands. Three personality types can be constructed as specific combinations of ego-control and ego-resilience [18]: Resilients (high on ego-resiliency and moderate on ego-control), Undercontrollers (low on ego-resiliency and ego-control), and Overcontrollers (low on ego-resiliency and high on ego-control). Although this personality typology is not without its critics [19], these types have been replicated in different age groups, with different instruments, and using different statistical procedures.

Importantly, prior research has demonstrated that each personality type has a unique and replicable Big Five profile [18, 20-23]. Resilients score relatively high on all Big Five traits. Overcontrollers score especially low on extraversion and emotional stability and relatively high on conscientiousness and agreeableness. Undercontrollers, on the other hand, score especially low on agreeableness and conscientiousness. Research in community samples has shown that Overcontrollers are typically at risk for internalizing difficulties such as depressive symptoms, feelings of loneliness, lowered self-esteem, and peer victimization [20,21]. Undercontrollers are especially at risk for poor academic achievement and externalizing difficulties such as peer aggression, substance use, and delinquent behavior [20,24,25].

Unfortunately, most studies to date have focused on independent associations among the Big Five traits and functioning in adolescents with a chronic disease. However, by adopting a typological approach to personality, one can take into account that the meaning of one personality dimension partially depends on the scores of other dimensions [20]. For instance, a high extraversion score combined with a high agreeableness score has a different meaning than a high extraversion score combined with a low agreeableness score. Hence, we

believe that by taking into account both personality traits and types, researchers can obtain a detailed view on the associations between personality and functioning.

The Present Study

Our study had three main objectives. A first objective was to identify specific personality types, each having a unique Big Five profile, in a large sample of adolescents with CHD through the use of cluster analysis. We hypothesized that the same three personality types typically found in community samples would emerge in adolescents with CHD (i.e., Resilients, Undercontrollers, and Overcontrollers), although specific subtypes may be observed as well [20]. Second, we investigated whether these different personality types could be differentiated in terms of sex and disease complexity. Previous research has found that Overcontrollers were more often girls, whereas Undercontrolles were more often boys [20]. No specific hypotheses were put forward regarding the role of disease complexity. A last objective was to relate these personality types to patients' functioning and perceived health, both concurrently and prospectively. We expected that Resilients would report the most favorable outcomes over time. Furthermore, Overcontrollers were expected to report more internalizing difficulties than both Resilients and Undercontrollers. Finally, we hypothesized that, for most outcomes, Undercontrollers would be situated in-between Resilients and Overcontrollers.

Method

Participants and Procedure

As part of the i-DETACH project (Information technology Devices and Education programme for Transitioning Adolescents with Congenital Heart disease), patients were selected from the database of pediatric and congenital cardiology of the University Hospitals Leuven using the following criteria: confirmed CHD [26]; aged 14-18 years at baseline; last cardiac outpatient visit at the tertiary care center performed ≤ 5 years ago; being able to read

and write Dutch; and the availability of contact details. Exclusion criteria were: cognitive or physical limitations inhibiting filling out questionnaires; prior heart transplantation; and absence of consent to participate by patients or their parents. Eligible patients (*N*=498) received a questionnaire, information letter, informed consent form, and pre-stamped return envelope by mail. Patients were invited to participate at four time-points, each of them separated by an interval of nine months. The primary heart defect was obtained from medical records and categorized using a modified version of the scheme developed by the CONCOR project [27]. The complexity of the heart defect was determined based on Task Force 1 of the 32nd Bethesda conference as simple, moderate, or complex [28].

In the present study, we focused on the third and fourth measurement wave of i-DETACH, referred to as Time 1 and Time 2 for the remainder of the manuscript. At Time 1, 366 patients (48% girls) participated, ranging from 15 to 20 years old (*M*=17.43; *SD*=1.21). Of these patients, 313 (86%) again participated at Time 2. A total of 40% of patients had a simple heart defect, 48% had a heart defect of moderate complexity, and 12% of patients had a complex heart defect. About 47% of patients underwent cardiac surgery in the past. Nearly all patients were still studying (96%) at Time 1. Patients that participated at both time-points did not differ on age [$F(1,364)=0.13$, $p=.724$, $\eta^2=.00$], sex [$\chi^2(1)=0.49$; $p=.486$], complexity of the heart defect [$\chi^2(2)=2.77$; $p=.250$], or any of the study variables at Time 1 [$F(16,326)=0.69$, $p=.808$, $\eta^2=.03$] from participants that dropped-out. Furthermore, patients with and without complete data at Time 2 were compared using Little's [29] Missing Completely At Random test. This test revealed a normed chi-square of 1.11 [30]. Accordingly, to deal with missing values, we used the Expectation-Maximization algorithm provided in SPSS 20.0 [31].

Questionnaires

Personality. Personality was measured at Time 1 using the Quick Big Five [32]. Participants rated themselves on 30 adjectives using a 7-point Likert scale, ranging from 1

(completely untrue) to 7 (completely true). Each personality trait was assessed with six items, such as "withdrawn" (Extraversion, inverse coded), "careful" (Conscientiousness), "sympathetic" (Agreeableness), "nervous" (Emotional Stability, inverse coded), and "creative" (Openness). Cronbach's alphas ranged between .75 and .89.

Perceived health. Generic and disease-specific domains of perceived health were measured at Times 1 and 2 using the Pediatric Quality of Life Inventory™ 4.0 (PedsQL) [33,34]. The generic module of the PedsQL comprises four subscales: physical (e.g., "I have low energy"), emotional (e.g., "I feel afraid or scared"), social (e.g., "I have trouble getting along with other teenagers"), and school-related functioning (e.g., "It is hard to pay attention in class"). The cardiac module of the PedsQL consists of five subscales: cardiac symptoms (e.g., "I get out of breath when I do sports activity or exercise"), perceived physical appearance (e.g., "I don't like other people to see my scars"), treatment anxiety (e.g., "I get scared when I have to go to the doctor"), cognitive problems (e.g., "It is hard for me to remember what I've read"), and communication (e.g., "It is hard for me to tell the doctors and nurses how I feel"). A 5-point scale ranging from 0 (*never*) to 4 (*almost always*) evaluated the degree to which individuals experienced problems during the past month. Items were inversed coded, summed across all items of the respective subscales, and transformed to range between 0 and 100 (with higher scores indicating better functioning). Cronbach's alphas ranged between .74 and .90 at Time 1 and between .71 and .94 at Time 2.

Depressive symptoms. Depressive symptoms were measured at Times 1 and 2 with the 20-item Center for Epidemiologic Studies Depression Scale [35]. Each item asks how often participants had experienced symptoms of depression during the past week, using a 4-point scale from 0 (seldom) to 3 (most of the time or always). A sample item reads "During the last week, I felt depressed". Cronbach's alphas at Times 1 and 2 were .91 and .90, respectively.

Loneliness. Loneliness was assessed with the 8-item version of the UCLA Loneliness Scale [36]. Participants responded to each item using a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). A sample item reads: "I feel isolated from others". Cronbach's alphas at Times 1 and 2 were .87 and .86, respectively.

Statistical Analyses

Two-step cluster analysis was performed on the Big Five scores at Time 1 to identify specific personality profiles or types. Cluster analysis aims to group patients into relatively homogeneous clusters in such a way that patients within one cluster have more in common than they do with patients assigned to other clusters [37]. Big Five scores were standardized and three univariate and multivariate outliers were removed. First, a hierarchical cluster analysis was carried out using Ward's method based on squared Euclidian distances. Three- to six-cluster solutions were evaluated. The number of clusters was selected based on parsimony, interpretability, theory (i.e., the personality types forwarded by Block and Block [17]), and explanatory power. Second, these initial cluster centers were used as non-random starting points in *k*-means clustering, resulting in an optimized cluster solution. Third, we differentiated these clusters by relating them to external variables at Times 1 and 2 using multivariate analysis of variances (MANOVAs).

Results

Correlational Analyses

Table 1 presents all Pearson correlations among the Big Five at Time 1 and the outcome variables at Times 1 and 2. At both time points, extraversion, agreeableness, and emotional stability were negatively related to depressive symptoms and loneliness and positively related to various generic and disease-specific domains of perceived health. Conscientiousness and Openness were also related to various outcome measures at Time 1 but several of these associations disappeared at Time 2.

Cluster Analysis

Cluster analysis on the Big Five scores resulted in a solution with three clusters, explaining between 25% and 38% of the variance in the Big Five scores. This solution was selected based on parsimony, interpretability, theory, and explanatory power. Resilients (37%) scored moderately high to high on all Big five traits. Overcontrollers (29%) scored moderately high on agreeableness, high on conscientiousness, but low on emotional stability and extraversion. In contrast, Undercontrollers (34%) scored low on agreeableness, conscientiousness, and openness, moderately low on extraversion, and moderately high on emotional stability. Figure 1 presents the final three-cluster solution. No significant between-cluster differences were obtained for adolescent age [$F(2,360)=0.62$; $p=.537$; $\eta^2=.00$] and complexity of the heart defect [$\chi^2(4)=0.28$; $p=.991$]. However, girls and boys were differently distributed among these three clusters [$\chi^2(2)=26.83$; $p<.001$]. Standardised residuals in the chi-square analysis indicated that girls were underrepresented in the Undercontrollers cluster (26% versus 41%) and were overrepresented in the Overcontrollers cluster (42% versus 18%).

Two MANOVAs were conducted with cluster membership as independent variable and depressive symptoms, loneliness, generic and disease-specific health at Times 1 and 2 as dependent variables. In both MANOVAs, we controlled for the effects of sex and complexity of the heart defect. Significant multivariate cluster differences emerged at Times 1 [$F(22,662)=3.19$, $p<.001$, $\eta^2=.10$] and 2 [$F(22,662)=2.07$, $p=.003$, $\eta^2=.06$]. Subsequent univariate analyses are presented in Tables 2 and 3, respectively. No significant interactions between cluster membership and sex [Time 1: $F(22,662)=0.43$, $p=.990$, $\eta^2=.01$; Time 2: $F(22,662)=0.98$, $p=.488$, $\eta^2=.03$] or cluster membership and disease complexity [Time 1: $F(44,1268)=1.22$, $p=.153$, $\eta^2=.04$; Time 2: $F(44,1268)=0.87$, $p=.714$, $\eta^2=.03$] emerged. Ancillary MANCOVAs controlling for the dependent variables at Time 1 yielded non-significant findings for the dependent variables at Time 2

At Time 1, Resilients reported fewer depressive symptoms, feelings of loneliness, insecurities regarding their physical appearance, and communication problems, and better physical, emotional, social, and cognitive functioning as compared to both Under- and Overcontrollers. In addition, they reported better school-related functioning, fewer cardiac symptoms, and less treatment anxiety as compared to Overcontrollers. Finally, Overcontrollers reported more depressive symptoms, emotional problems, cardiac symptoms, and communication problems as compared to Undercontrollers.

At Time 2, Resilients reported fewer feelings of loneliness and better social and cognitive functioning as compared to both Under- and Overcontrollers. In addition, they reported fewer depressive symptoms, cardiac symptoms, insecurities regarding their physical appearance, and communication problems and better physical and emotional functioning as compared to Overcontrollers. Finally, Overcontrollers reported more depressive symptoms, emotional problems, cardiac symptoms, and communication problems as compared to Undercontrollers.

Discussion

Identification of Personality Types

As expected, based on the Big Five personality traits, three personality types emerged in our sample of adolescents with CHD: Resilients, Undercontrollers, and Overcontrollers. Our typology closely resembles typologies obtained in previous community samples, with Resilients having high scores on virtually all Big Five traits, Undercontrollers scoring low on conscientiousness and agreeableness, and Overcontrollers scoring low on emotional stability and extraversion, and relatively high on agreeableness and conscientiousness [18, 20-23]. In line with previous research, girls were overrepresented in the group of Overcontrollers, whereas boys were overrepresented in the group of Undercontrollers [20].

Resilients, Overcontrollers, and Undercontrollers did not differ in terms of the complexity of their heart defect. According to a recently forwarded model of person-environment transactions, changes in an individual's personality can be triggered by changing roles, life events, and/or daily challenges [38,39]. Hence, one might hypothesize that adolescents with a more complex heart defect would face additional stressors that make it more difficult for these adolescents to reconcile their disease with their self-definition [40], potentially impacting their personality functioning. However, in the present study, no evidence was found for this hypothesis. As discussed elsewhere [41], measures of disease complexity relying on CHD diagnosis (such as the classification used in the present study) might be less strongly associated with patients' psychological functioning as compared to measures of disease complexity relying on patients' functional status. Indeed, it can be expected that the impact of the heart defect on daily life is more important towards patients' personality (and broader psychological) functioning than the diagnosis itself. Future research should look more closely at the impact of disease complexity on patients' psychological functioning, given that current research findings tend to be inconsistent.

Link Between Personality Types and Physical and Psychosocial Functioning

Substantial differences in depressive symptoms, loneliness, and generic and disease-specific domains of health were observed among these three personality types. This pattern of findings is important given that perceived health has been shown to predict various objective health outcomes – including mortality – in both community and patient samples, even after accounting for objective health status, health behaviors, and socio-demographic factors [42]. First, at both time-points, Overcontrollers were found to report more depressive symptoms and feelings of loneliness, and to score lower on virtually all domains of generic and disease-specific health as compared to Resilients. Furthermore, they reported more depressive symptoms, emotional problems, cardiac symptoms, and communication problems as

compared to Undercontrollers, both concurrently and prospectively. These findings are in line with previous research which has shown that Overcontrollers are typically at risk for internalizing difficulties such as depressive symptoms, feelings of loneliness, lowered self-esteem, and peer victimization [20,21]. Furthermore, Overcontrollers tend to be more shy and socially withdrawn [20], which might keep them from talking about their disease to others and hinder the establishment of a trusting doctor-patient relationship, resulting in more communication problems. In addition, their inherent insecurity and anxious nature might explain their higher levels of treatment anxiety, insecurities regarding their physical appearance, and stronger focus on somatic symptoms [12,43].

Second, Undercontrollers were found to report more depressive symptoms, feelings of loneliness, insecurities regarding their physical appearance, and communication problems, and poorer physical, emotional, social, and cognitive functioning as compared to Resilients. Nine months later, Undercontrollers still reported stronger feelings of loneliness and poorer social and cognitive functioning as compared to Resilients. This is in line with previous research which found Undercontrollers to report more interpersonal conflict across virtually all types of relationships and to be judged as less sociable by their parents than Resilients [20,23]. Furthermore, Undercontrollers have been found to show poorer academic performance and lower intelligence scores as compared to Resilients and Overcontrollers, which may partially explain their poorer cognitive outcomes [20,24,25]. Future research in adolescents with CHD should also examine associations between these personality types and externalizing outcomes, given that Undercontrollers have been found to be especially at risk for externalizing difficulties such as peer aggression, substance use, and delinquent behavior [20,24,25]. In sum, the present findings demonstrate that by taking into account both personality traits and types researchers can have a detailed view on the associations between personality and health.

Finally, it should be noted that, when controlling for psychosocial functioning and perceived health at baseline, all prospective associations with personality turned non-significant, probably due to the strong stability of these outcome variables. Future research should adopt a wider temporal window for examining the moderating role of personality traits and types in the development of psychosocial functioning and perceived health over longer periods of time.

Clinical implications

Provided that continued research efforts identify personality as a determinant of health in individuals with CHD, these findings can have important implications. Personality assessment can help clinicians in identifying adolescents at risk for physical and psychosocial difficulties later in time. Based on the present findings, both Over- and Undercontrollers can be considered high-risk groups. Previous research in adolescents with a chronic disease has convincingly shown that a personality profile characterized by low emotional stability and extraversion, as seen in Overcontrollers but also in Type D-personality, increases the risk for internalizing problems. However, in the present study, also Undercontrollers – characterized by relatively low levels of agreeableness and conscientiousness – were found to be at risk for both generic (e.g., social problems) and disease-specific difficulties (e.g., difficulties in communicating with clinicians) and, thus, should be closely monitored by the medical team. Although personality has typically been conceptualized as stable and relatively unchangeable, emerging research has demonstrated that personality can be changed through interventions [44,45]. According to a recently developed framework [46], personality traits can be modified by targeting the core behaviors that underlie these traits. Through repeated practice of new target behaviours, behavioral changes may become more automatic and ingrained over time, ultimately manifesting themselves in trait-level changes. However, more research is needed before implementing such interventions in clinical practice.

Limitations and Suggestions for Future Research

This study has some limitations that need to be taken into account. First, data were gathered through self-report questionnaires only. Although self-report is the most valid measure to assess patients' psychosocial functioning, future research would be strengthened by using data from multiple sources. In addition, future research may also want to look at associations with other potentially important outcomes such as patients' health behaviors, disease knowledge, and actual functional status, all constructs with specific relevance towards patients with CHD.

Second, the specific nature of the study population and the single-center setting reduced the generalizability of our findings. However, the proportion of patients with a simple, moderate, or complex heart defect in the present study corresponds to the reported prevalence in the literature. Furthermore, patients were recruited from the database of one university hospital, but received follow-up in different hospitals across the country.

Third, although it is typically assumed that certain personality profiles may put patients at risk for physical and psychosocial difficulties, the reverse might be true as well. Indeed, according to the scar model [47], psychosocial difficulties may lead to changes, or so-called *scars*, in an individual's personality. This view fits with the model of person-environment transactions which emphasizes the malleability of the self [38,39]. Hence, one could hypothesize that when patients struggle to cope with their disease, this might also impact their personality development. Hence, longitudinal studies in which adolescents with CHD are assessed at multiple time-points over longer periods in time are needed to investigate the directionality of effects.

Finally, future research should explore potential mechanisms detailing how personality influences patients' physical and psychosocial functioning over time. Both coping and illness perceptions have been found to mediate the relationship between personality and health

outcomes in adolescents with other chronic diseases such as Type 1 diabetes and asthma [12,48,49]. Although a recent study demonstrated the predictive value of patients' illness perceptions for their quality of life two years later [50], very few studies to date have focused on the illness perceptions and coping strategies of individuals with CHD.

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Compliance with ethical standards

The authors declare that they have no conflict of interest. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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Table 1.

Pearson Correlations Among the Study Variables

	Extraversion T1	**Agreeableness T1**	**Conscientiousness T1**	**Emotional stability T1**	**Openness T1**
Depressive symptoms	-.32***/-.27***	-.21***/-.22***	-.11*/-.05	-.46***/-.44***	-.05/-.03
Loneliness	-.53***/-.45***	-.36***/-.36***	-.07/-.04	-.36***/-.32***	-.18**/-.08
Generic health					
Physical functioning	.17**/.10	.19***/.11*	.11*/.09	.27***/.27***	.13*/.07
Emotional functioning	.29***/.17**	.21***/.17**	.12*/.06	.51***/.49***	.04/.02
Social functioning	.32***/.26***	.32***/.24***	.13*/.04	.21***/.20***	.15**/.13*
School functioning	.11*/.06	.20***/.15**	.19***/.25***	.30***/.23***	.05/.04
Disease-specific health					
Cardiac symptoms	.15**/.15**	.14**/.08	.03/.04	.40***/.35***	-.01/-.04
Physical appearance	.26***/.20***	.23***/.20***	.08/.09	.38***/.32***	.13*/.10
Treatment anxiety	.04/.05	.09/.04	.01/.02	.35***/.30***	.06/.09
Cognitive functioning	.22***/.18**	.19***/.15**	.13*/.16**	.39***/.33***	.10/.12*
Communication	.21***/.25***	.13*/.08	-.01/-.02	.31***/.32***	.11*/.09

Note. The first coefficient represents the correlation between each Big Five trait and outcome variable at Time 1. The second coefficient represents the correlation between each Big Five trait at Time 1 and outcome variable at Time 2. *$p < .05$; **$p < .01$; ***$p < .001$.

Table 2.

Differences in Outcome Variables at Time 1 for the Final Three-Cluster Solution

Variables at Time 1	**Total sample**	**Personality types Time 1**			***F*(2,341)**	**η^2**
		Resilients	**Overcontrollers**	**Undercontrollers**		
Depressive symptoms	10.76 (9.57)	7.40 (6.28)[a]	14.76 (10.99)[b]	11.00 (9.95)[c]	9.41***	.05
Loneliness	1.77 (0.70)	1.41 (0.45) [a]	2.06 (0.76)[b]	1.93 (0.70)[b]	20.73***	.11
Generic health						
Physical functioning	87.27 (13.00)	91.19 (9.34)[a]	83.76 (14.93)[b]	86.00 (13.64)[b]	4.81**	.03
Emotional functioning	74.00 (18.11)	80.50 (15.21)[a]	65.24 (18.54)[b]	74.43 (17.68)[c]	15.60***	.08
Social functioning	85.68 (14.56)	90.66 (11.03)[a]	83.30 (16.50)[b]	82.27 (14.80)[b]	9.24***	.05
School functioning	78.92 (14.48)	81.69 (13.76)[a]	76.92 (15.64)[b]	77.59 (13.84)	1.42	.01
Disease-specific health						
Cardiac symptoms	80.41 (14.78)	84.03 (13.22)[a]	75.14 (17.52)[b]	80.97 (12.45)[a]	4.87**	.03
Physical appearance	78.11 (20.42)	83.91 (16.28)[a]	71.63 (22.35)[b]	77.33 (21.12)[b]	7.79***	.04
Treatment anxiety	86.37 (18.12)	88.99 (15.62)[a]	82.15 (20.85)[b]	87.14 (17.64)	2.10	.01
Cognitive functioning	74.26 (19.09)	80.67 (16.33)[a]	68.83 (21.65)[b]	71.90 (17.64)[b]	5.51**	.03
Communication	10.76 (9.57)	85.50 (17.80)[a]	72.18 (24.41)[b]	79.44 (18.66)[c]	5.57**	.03

Note. For personality type, a mean is significantly different from another mean if they have different superscripts (based on post hoc Tukey HSD tests). Means without superscripts do not differ from any other mean. *$p < .05$; **$p < .01$; ***$p < .001$.

Table 3.

Differences in Outcome Variables at Time 2 for the Final Three-Cluster Solution

Variables at Time 2	**Total sample**	**Personality types Time 1**			***F*(2,341)**	**η^2**
		Resilients	**Overcontrollers**	**Undercontrollers**		
Depressive symptoms	10.47 (8.50)	8.10 (6.91)[a]	13.77 (9.97)[b]	10.22 (7.84)[a]	7.28**	.04
Loneliness	1.83 (0.67)	1.56 (0.48) [a]	2.08 (0.76)[b]	1.91 (0.66)[b]	11.38***	.06
Generic health						
Physical functioning	86.46 (13.14)	89.01 (11.37)[a]	83.39 (14.84)[b]	86.32 (12.92)	2.02	.01
Emotional functioning	73.04 (17.63)	77.48 (14.96)[a]	66.51 (20.45)[b]	73.79 (16.11)[a]	6.73**	.04
Social functioning	85.42 (14.15)	89.44 (11.81)[a]	82.60 (16.34)[b]	83.45 (13.58)[b]	6.20**	.04
School functioning	78.09 (14.31)	80.13 (14.30)	77.31 (15.92)	76.51 (12.58)	1.52	.01
Disease-specific health						
Cardiac symptoms	79.55 (15.63)	82.76 (13.59)[a]	74.23 (18.33)[b]	80.60 (14.06)[a]	4.46*	.03
Physical appearance	78.09 (19.31)	82.04 (16.87)[a]	73.11 (20.32)[b]	78.07 (20.07)	4.06*	.02
Treatment anxiety	85.46 (18.91)	87.25 (16.98)	82.47 (22.23)	86.06 (17.61)	1.21	.01
Cognitive functioning	73.26 (18.93)	78.49 (16.56)[a]	69.50 (21.20)[b]	70.77 (18.14)[b]	4.48*	.03
Communication	79.45 (19.70)	84.77 (16.62)[a]	72.10 (22.65)[b]	79.96 (18.19)[a]	7.75**	.04

Note. For personality type, a mean is significantly different from another mean if they have different superscripts (based on post hoc Tukey HSD tests). Means without superscripts do not differ from any other mean. *$p < .05$; **$p < .01$; ***$p < .001$.

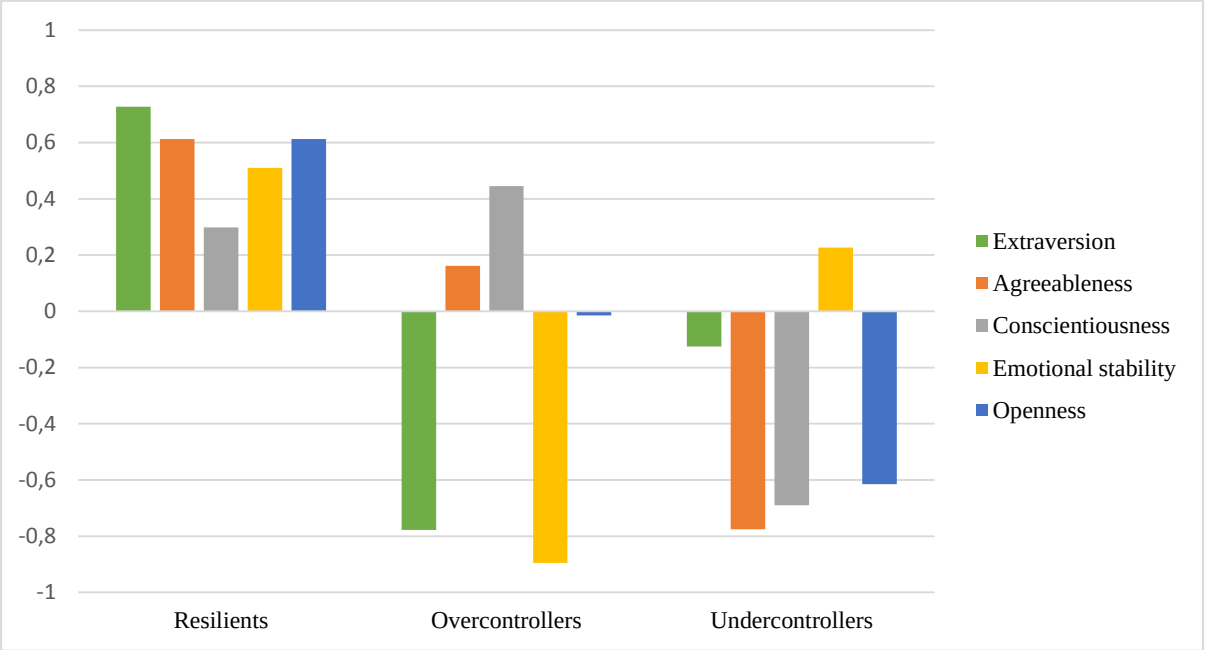

Figure 1. Standardized Big Five scores for the final three-cluster solution.