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Abstract

The present study investigated how the Big Five personality traits were related to quality of life and perceived health in adolescents with congenital heart disease (CHD). 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) participated; 364 were matched on sex and age with community controls. Adolescents' personality was assessed using the Quick Big Five, quality of life was measured using a Linear Analogue Scale, and several domains of perceived health were assessed using the Pediatric Quality of Life Inventory. Adolescents with CHD displayed similar Big Five levels as controls, except for a lower score on Extraversion. Whereas disease-specific domains of perceived health were mainly related to Emotional Stability, several traits contributed to patients' quality of life and generic perceived health. Hence, the present findings demonstrate that the Big Five is a valuable framework for examining linkages between personality and disease adaptation in chronic disease populations. Moreover, these findings underscore the importance of examining patients' personality to shed light on their daily functioning. Future research should explore potential mechanisms detailing how personality influences disease adaptation over time in these patients.

Keywords: heart defects, congenital; Big Five; personality; quality of life; perceived health; chronic disease; adolescence.

Introduction

Congenital heart disease (CHD), comprising a wide spectrum of simple, moderate, and complex structural heart lesions, is the most common birth defect (9:1000 births) (van der Linde et al., 2011). Over the past decades, life expectancy has increased substantially due to advances in pediatric cardiology and cardiac surgery (Moons, Bovijn, Budts, Belmans, & Gewillig, 2010). However, research has demonstrated that some individuals with CHD struggle with the many medical, psychosocial, and behavioral challenges on the road to adulthood (Karsdorp, Everaerd, Kindt, & Mulder, 2007; Kovacs, Sears, & Saidi, 2005; Krol et al., 2003). Consequently, increasing attention is being paid to quality of life and perceived health in these patients. To understand why some patients show poor disease adjustment whereas others display signs of resilience, research on potential determinants of quality of life and perceived health is urgently needed. Previous research focusing on disease complexity as a potential determinant resulted in mixed findings (Kovacs et al., 2005). Hence, to increase our understanding of how quality of life and perceived health can be influenced, psychosocial determinants need to be investigated as well.

A potentially important determinant of both quality of life and perceived health is one's personality (Van De Ven & Engels, 2011). Having a mature personality can function as an internal resource which helps patients in dealing with various stressors, thereby playing favorably into their quality of life and perceived health. Conversely, certain personality traits may put patients at risk for poor disease adjustment. Unfortunately, research on the relationship between personality and disease adaptation in chronic disease populations is rather scarce. Moreover, previous research is characterized by important limitations.

First, most research has focused on adults with chronic diseases. However, studies investigating the relationship between personality and disease adaptation in adolescents with chronic diseases are needed as well. Adolescence is generally considered one of the most

critical life periods in which the foundations for adult life and functioning are laid (Luyckx, Schwartz, Goossens, Beyers, & Missotten, 2011). Several physical and neurocognitive changes occur during this period in life. For instance, due to maturation of the frontal lobe circuitry, adolescents generally show increased executive functioning (Giedd, 2008). In addition, role expectations change substantially: adolescents are expected to form more intimate friendships, establish a strong sense of identity, and develop into mature individuals (Luyckx et al., 2011). These changes in biological and psychosocial domains are generally found to be reflected by changes in personality traits (Klimstra, Hale, Raaijmakers, Branje, & Meeus, 2009). More specifically, adolescents tend to move towards a more mature personality, that is, they gain the capacity to become productive and involved contributors to society, by becoming more planful, deliberate, and decisive, but also more considerate and charitable (Hogan & Roberts, 2004). However, these developmental changes might be particularly challenging for adolescents with chronic diseases, because they also have to deal with several disease-specific challenges such as follow-up visits to physicians, changes in therapy, limitations of activity, and transitioning to different caregivers. Hence, more attention should be paid to patients' personality, quality of life, and perceived health during adolescence.

Second, research on personality in cardiovascular patient groups has focused exclusively on patients with acquired cardiovascular pathologies. The recent study by Schoormans and colleagues (2012) was the first to demonstrate the importance of personality in individuals with CHD. This study found patients with Type D personality (i.e., high negative affect combined with social inhibition) to feel more functionally impaired, to report poorer health status and a lower quality of life, and to use less health care. Although this study provided important insights into the association between personality and health outcomes, personality research in cardiac disorders should be expanded beyond Type D personality.

An alternative framework that can be valuable for research aimed at understanding linkages between personality and disease adaptation is the Big Five of personality (Marshall, Wortman, Vickers, Kusulas, & Hervig, 1994). Throughout the last three decades, there has been a growing consensus on the higher-order structure of personality, as a majority of researchers now agree that personality can be subsumed in five broad traits (Caspi, Roberts, & Shiner, 2005). These traits include Extraversion (energy, sociability and experiencing frequent positive moods), Agreeableness (kindness, empathy, and cooperativeness), Conscientiousness (organizational and motivational aspects of behavior), Emotional Stability (the ability to deal with negative emotions), and Openness to Experience (the way an individual seeks and deals with new information). In community adolescents, low levels of Extraversion, Conscientiousness, and Emotional Stability each predicted internalizing problems, whereas low levels of Agreeableness, Conscientiousness, and Openness each predicted externalizing symptoms (Klimstra, Akse, Hale, Raaijmakers, & Meeus, 2010). Hence, focusing on such a broad framework could substantially expand our knowledge base on personality functioning in adolescents with cardiac disorders beyond what is already known from studies focusing on type D personality (which basically represents a combination of lowered scores on Extraversion and Emotional Stability; De Fruyt & Denollet, 2002).

In adolescents with chronic diseases (i.e., asthma or cancer), Big Five personality traits were found to relate to disease adaptation. Agreeableness was positively associated with patients' quality of life and perceived (physical and psychological) health (De Clercq, De Fruyt, Koot, & Benoit, 2004). Indeed, agreeable persons generally experience more positive consequences of their disease (e.g., closer family relationships) through the use of positive reappraisal and tend to hide their disease less for others (Van De Ven & Engels, 2011). Similarly, Emotional Stability was positively associated with quality of life and perceived health (De Clercq et al., 2004), probably because persons high in Emotional Stability have

more successful ways of coping with their disease and tend to focus less on their symptoms (Larsen, 1992; Van De Ven & Engels, 2011). Studies linking Extraversion, Conscientiousness, and Openness to quality of life and perceived health in adolescents with chronic diseases yielded rather inconsistent findings (De Clercq et al., 2004; Van De Ven & Engels, 2011). In sum, although these studies provided important insights, they were limited by their rather narrow assessment of disease adaptation, focusing exclusively on generic or disease-specific domains of adjustment.

The present study

The aims of the present study were twofold. First, we examined similarities and differences in levels of the Big Five personality traits between adolescents with and without CHD. This study was the first to address this issue in adolescents with CHD. Despite the fact that these adolescents face additional stressors that may impact upon their personality functioning, we tentatively hypothesized that they would display similar Big Five scores as compared to controls. Indeed, previous research found adolescents with CHD to be as competent as healthy peers in establishing a strong sense of self (Luyckx, Goossens, Van Damme, & Moons, 2011). Adolescents with a complex heart defect, however, could show a less adaptive personality profile due to potentially increased levels of disease-induced stress (Friedman, Holmbeck, DeLucia, Jandasek, & Zebracki, 2009).

Second, we investigated how the Big Five was related to quality of life and perceived health in adolescents with CHD. We accounted for the role of sex, age, and disease complexity because these variables have been demonstrated to relate to personality (Caspi et al., 2005; Klimstra et al., 2009) and disease adaptation (Chen et al., 2011; Friedman et al., 2009; Karsdorp et al., 2007). In contrast to previous research on personality functioning in adolescents with a chronic disease, both generic domains (i.e., physical, emotional, social, and school functioning) and disease-specific domains (i.e., cardiac symptoms, perceived physical

appearance, treatment anxiety, cognitive problems, and communication) of perceived health were included. Quality of life was defined as the degree of overall life satisfaction that is positively or negatively influenced by individuals' perception of certain important aspects of life, both related and unrelated to health (Moons, Van Deyk, Marquet, et al., 2006).

In line with previous research in community samples, we hypothesized that patients low in *Extraversion* would show poorer emotional functioning (Klimstra et al., 2010). These patients were also expected to show greater social (Asendorpf & van Aken, 2003) and communication problems (Schoormans et al., 2012), as they tend to be more socially inhibited (Caspi et al., 2005). The predictive role of Extraversion for patients' quality of life was less clear, due to previous inconsistent findings (De Clercq et al., 2004; Van de Ven & Engels, 2011) and, hence, no specific hypotheses were put forward.

Similarly, we hypothesized that patients low in *Agreeableness* would show poorer emotional functioning, generally using more dysfunctional coping (Van De Ven & Engels, 2011). These patients were also expected to show greater social problems, as they tend to be more aggressive, rude, and manipulative, thereby evoking interpersonal conflict (Asendorpf & Van Aken, 2003; Caspi et al., 2005). Finally, patients low in Agreeableness were expected to show poorer quality of life, which would be in line with previous research in adolescents with chronic diseases (De Clercq et al., 2004; Van de Ven & Engels, 2011).

Additionally, in line with previous research in community samples, we hypothesized that patients low in *Conscientiousness* would show poorer emotional functioning (Klimstra et al., 2010). These patients were also expected to experience greater school-related problems (Judge, Higgins, Thoreson, & Barrick, 1999), as the trait of Conscientiousness comprises many characteristics that may contribute to one's academic performance, such as attention, goal-orientation, and achievement motivation (Caspi et al., 2005). Relatedly, these patients were expected to experience greater cognitive problems, due to their lower levels of attention

and organization (Caspi et al., 2005). Furthermore, we hypothesized that patients low in Conscientiousness would report poorer physical functioning, as they tend to show more health-damaging behaviors (Mitt & Kämpfe, 2008). The predictive role of Conscientiousness for patients' quality of life was less clear, due to previous inconsistent findings (De Clercq et al., 2004; Van de Ven & Engels, 2011) and, hence, no specific hypotheses were put forward.

Finally, we hypothesized that patients low in *Emotional Stability* would show poorer emotional functioning, due to their tendency to experience negative affect (Caspi et al., 2005; Klimstra et al., 2010). These patients were also expected to show greater social problems, as they tend to be rather moody, anxious, and frustrated, making them less attractive to peers (Caspi et al., 2005). Moreover, patients low in Emotional Stability generally report more functional impairments (Schoormans et al., 2012), which might interfere with their social activities. Furthermore, in line with previous research (Larsen, 1992; Van De Ven & Engels, 2011), we hypothesized that patients low in Emotional Stability would report more physical problems and cardiac symptoms. These patients were also expected to report more treatment anxiety and poorer perceived physical appearance, due to their rather anxious and insecure nature (Caspi et al., 2005). Finally, we hypothesized that Emotional Stability would be strongly related to patients' quality of life, which would be in line with previous research in adolescents with chronic diseases (De Clercq et al., 2004; Van De Ven & Engels, 2011).

With regard to *Openness*, no specific hypotheses were put forward, as it is the most debated and least understood of the Big Five traits (Caspi et., 2005) and previous research on this topic showed mixed results (De Clercq et al., 2004; Van De Ven & Engels, 2011).

Method

Participants and procedure

Patients were selected from the database of pediatric and congenital cardiology of the University Hospitals Leuven (Belgium) using the following criteria: confirmed CHD, defined

as structural abnormalities of the heart and/or great intrathoracic vessels that are actually or potentially of functional significance (Mitchell, Korones, & Berendes, 1971); aged 14-18 years; last cardiac outpatient visit at our tertiary care center performed ≤ 5 years ago; being able to read and write Dutch; and the availability of valid contact details. A total of 366 patients (47.8% girls) participated, ranging from 15 to 20 years ($M = 17.43$; $SD = 1.21$). The primary heart defect was obtained from medical records and categorized using a modified version of the scheme developed by the CONCOR (CONgenital COR Vitia) project (Van der Velde et al., 2005). The complexity of heart lesions was determined based on Task Force 1 of the 32nd Bethesda conference as simple, moderate, or complex (Warnes et al., 2001). Clinical information on the patient sample is detailed in Table 1.

A sample of 664 individuals without chronic diseases, consisting of high school students ($N = 481$), college-attending ($N = 152$), employed ($N = 27$), and unemployed ($N = 4$) individuals, was used to select control participants. Matching (1:1) was performed based on sex and age, resulting in 364 patients being matched with a control participant (99.4%). The study was approved by the Institutional Review Board of the University Hospitals Leuven and performed according to the 2002 Declaration of Helsinki.

Questionnaires

Personality was measured using the Quick Big Five (Vermulst & Gerris, 2005). 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 in the patient sample and between .76 and .90 in the control sample.

The generic and disease-specific domains of perceived health were assessed using the Pediatric Quality of Life Inventory™ 4.0 (PedsQL 4.0), which was originally developed to measure health-related quality of life. However, researchers often use the term quality of life when they are actually discussing health status or functional ability (Moons, 2004). Therefore, the PedsQL more likely expresses generic and disease-specific domains of perceived health. The generic module comprises four subscales: physical, emotional, social, and school functioning. The cardiac module consists of five subscales: cardiac symptoms, perceived physical appearance, treatment anxiety, cognitive problems, and communication (Varni, Seid, & Rode, 1999). A five 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, in which higher scores indicated better perceived health. In the patient sample, Cronbach's alphas ranged between .73 and .83 for generic perceived health, and between .74 and .89 for disease-specific perceived health.

Finally, participants were asked to rate their quality of life using a Linear Analogue Scale, which is a vertically oriented, 10-centimeter line graded with indicators ranging from 0 (*worst imaginable quality of life*) to 100 (*best imaginable quality of life*). Validity and reliability have been detailed elsewhere (Moons, Van Deyk, De Bleser, et al., 2006).

Results

Mean-level personality differences between patients and controls

Table 2 presents Big Five mean levels for the patient and control sample. Paired-samples *t*-tests indicated that both groups differed significantly on Extraversion, with adolescents with CHD scoring lower than controls did. No significant differences emerged for the other traits.

Preliminary analyses in patients

Univariate analyses of variance (ANOVA) were conducted to investigate whether sex and disease complexity were related to the Big Five, quality of life, and generic and disease-specific health (Table 3). Girls scored higher than boys on Conscientiousness, whereas boys scored higher on Emotional Stability. Further, girls scored lower on two domains of generic perceived health (physical and emotional functioning) and four domains of disease-specific health (cardiac symptoms, perceived physical appearance, treatment anxiety, and communication), indicative of poorer perceived health among girls. Additionally, adolescents with a complex heart defect scored lower on all domains of generic health and one domain of disease-specific health (cardiac symptoms) than adolescents with a simple defect. Finally, adolescents with a moderate heart defect showed poorer physical and social functioning compared to those with a simple defect, and less cardiac symptoms and emotional problems compared to those with a complex defect.

Correlations are presented in Table 4 between brackets. All of the Big Five traits, except for Conscientiousness, were positively related to quality of life. Emotional Stability, Extraversion, and Agreeableness were positively associated with most of the generic and disease-specific domains of perceived health. Conscientiousness was positively related to patients' social and school functioning. Finally, Openness was positively associated with patients' physical and social functioning, perceived physical appearance, (low) cognitive problems, and communication. No significant correlations emerged between age and any of the variables under study.

Hierarchical regression analyses in patients

Next, we examined whether the Big Five uniquely predicted quality of life and perceived health above and beyond sex, age, and disease complexity, which were entered in Step 1 of the regression models. In Step 2, all the Big Five traits were entered simultaneously. Standardized regression coefficients are presented in Table 4.

Extraversion was found to positively predict patients' quality of life, emotional and social functioning, and (to a lesser extent) perceived physical appearance. Similarly, Agreeableness positively predicted patients' quality of life, physical, emotional and social functioning, and perceived physical appearance. Furthermore, Conscientiousness was found to be positively related to patients' emotional and school functioning, and (to a lesser extent) lower cognitive problems. Finally, Emotional Stability positively predicted patients' quality of life as well as all domains of generic and disease-specific perceived health.

To assess whether these relationships were similar across different categories of disease complexity, a multi-group analysis with Structural Equation Modelling (SEM) was performed in Mplus 4.0 (Muthén & Muthén, 2002). We compared a constrained model (with all path coefficients between the Big Five, quality of life, and the domains of perceived health set equal across the different categories of disease complexity) against an unconstrained model (with all path coefficients between the Big Five, quality of life, and the domains of perceived health allowed to vary across the different categories). This was done separately for quality of life and each domain of perceived health. Relationships were considered to be invariant if the difference in χ^2 ($\Delta\chi^2$) relative to the degrees of freedom, between both models would be non-significant ($p > .05$) (Steiger, Shapiro, & Brown, 1985). None of the relationships between the Big Five, quality of life, and perceived health were moderated by disease complexity, as the difference in $\chi^2(10)$ varied between 5.15 ($p > .05$) and 15.44 ($p > .05$).

Discussion

The main goal of the present study was to investigate how Big Five personality traits were related to quality of life and both generic and disease-specific domains of perceived health in adolescents with CHD. First, the general picture suggested normalcy rather than deviance in patients' personality profiles as compared to healthy controls. Patients were, however, found to score lower on Extraversion as compared to healthy controls. As activity

level constitutes a central feature of Extraversion (Costa & McCrae, 1992), patients' lower levels of Extraversion might be partially explained by their lower activity level, resulting from the physical complaints accompanying their disease (e.g., dyspnea). Similarly, positive affectivity is generally considered one of the central features of Extraversion (Costa & McCrae, 1992). Possibly, adolescents with CHD experience less positive affect, having to deal with the worries and challenges of their disease, further lowering their Extraversion scores. However, little systematic knowledge is available on the extent to which adolescents with chronic diseases experience positive affect. Moreover, although many studies demonstrated a significant positive relationship between Extraversion and positive affect (e.g., Wang, Shi, & Li, 2009), some studies did not (e.g., Rigby & Huebner, 2005). Furthermore, other Big Five traits such as Emotional Stability and Agreeableness have been related to certain aspects of positive affect as well (Mitte & Kämpfe, 2008; Rigby & Huebner, 2005). Hence, this hypothesis remains to be investigated empirically.

An alternative explanation for patients' lower Extraversion scores could be found in the process of normalization, which is commonly observed in adolescents with CHD and refers to patients' struggle with themselves and their environment to be accepted as 'normal' (Claessens et al., 2005). Rigby and Huebner (2005) pointed out that the desire not to stand out might reduce the advantages of Extraversion among certain adolescents. Hence, from this point of view, an extraverted personality might be less warranted for patients with CHD who do not want to stand out and just want to be like everybody else.

Second, the present study found important associations between the Big Five, quality of life, and perceived health in adolescents with CHD above and beyond the effects of sex, age, and disease complexity. *Emotional Stability* turned out to be the strongest predictor of quality of life and both generic and disease-specific domains of perceived health (De Clercq et al., 2004; Van De Ven & Engels, 2011). This finding can be partially explained by the tendency

of persons low in Emotional Stability to experience negative affect (Caspi et al., 2005) and to focus on and report more symptoms (Larsen, 1992; Van De Ven & Engels, 2011). Additionally, these persons tend to use dysfunctional coping when confronted with stress (Van De Ven & Engels, 2011), making them more vulnerable for poor disease adaptation. Moreover, because persons low in Emotional Stability are more likely to be moody, anxious, and frustrated (Caspi et al., 2005), others might be less willing to support them, further affecting their quality of life and perceived health. Previous research indeed demonstrated that social relationships are important determinants of quality of life in patients with CHD (Moons, Van Deyk, Marquet, et al., 2006).

Next, both *Agreeableness* and *Extraversion* were found to be unique predictors of patients' quality of life, emotional and social functioning (generic perceived health), and perceived physical appearance (disease-specific perceived health) (Van De Ven & Engels, 2011). Persons high in Agreeableness are generally found to show superior coping skills, that is, they tend to hide their disease less for others and use more positive reappraisal (Van De Ven & Engels, 2011). Moreover, their cooperative and altruistic behaviors make them more attractive as potential friends, resulting in more social support (Branje, van Lieshout, & van Aken, 2004). Similarly, Extraverted patients not only have a higher tendency to experience positive emotions (Masthoff, Trompenaars, Van Heck, Hodiamont, & De Vries, 2007), they also show more adaptive coping skills (e.g., less activity avoidance) (Van De Ven & Engels, 2011). Moreover, extraverted persons tend to engage more in peer relationships and are, therefore, more likely to receive social support (Caspi et al., 2005).

Conscientiousness appeared to be a unique predictor for both emotional and school functioning (generic perceived health) as well as cognitive problems (disease-specific perceived health) (De Clerq et al., 2004). Conscientiousness encompasses many characteristics that may contribute to one's academic and cognitive performance, such as

attention, organization, and goal-orientation (Caspi et al., 2005; Judge et al., 1999). Moreover, Conscientiousness can affect one's emotional well-being, as individuals low in Conscientiousness may fail to disengage their attention from negative thoughts and feelings (Verstraeten, Vasey, Raes, & Bijttebier, 2009). Interestingly, however, Conscientiousness did not predict patients' quality of life. Extensive research has found Conscientiousness to affect people's health and adjustment through relationships with both harmful and protective health behaviors (Bogg & Roberts, 2004), including self-management in individuals with a chronic disease (Skinner, Hampson, & Fife-Schaw, 2002). Although self-management may help adolescents with CHD to prevent the occurrence of cardiac complications and coronary heart disease later in life (Van Deyk, Moons, Gewillig, & Budts, 2004), it is less central for obtaining favorable outcomes in the short run compared to other chronic diseases in which daily self-management is particularly critical (e.g., Type 1 diabetes). Indeed, the majority of patients with simple or moderate heart lesions are asymptomatic with no exercise or lifestyle limitations (Kovacs et al., 2005). Hence, the less central role of self-management in most CHD patients might partially explain the quite limited predictive value of Conscientiousness for these patients' quality of life. Nonetheless, previous research in other chronic disease populations also found rather inconsistent findings regarding the role of Conscientiousness for several domains of quality of life and perceived health (De Clercq et al., 2004; Van De Ven & Engels, 2011). Finally, although *Openness* was found to relate to quality of life and some domains of generic and disease-specific perceived health, none of these associations remained significant after controlling for the other Big Five traits.

In sum, these findings demonstrate that the Big Five is a valuable framework for examining linkages between personality and disease adaptation. Whereas disease-specific domains of perceived health were mainly related to Emotional Stability, several traits contributed to patients' quality of life and generic perceived health. Therefore, future research

in adolescents with chronic diseases should not exclusively rely on rather narrow personality perspectives, such as Type D-personality, as the present study has shown that also Agreeableness and Conscientiousness can be considered important predictors of disease adaptation.

Practical implications

Provided that continued research efforts identify personality as an important determinant of prognosis and disease adaptation in individuals with CHD, these findings can have important practical implications. First, personality assessment can help clinicians in identifying patients at risk for poor disease adaptation later in life. As adolescence constitutes a critical formative period for personality development (Klimstra et al., 2009), this period might be particularly suitable for assessing patients' personality. Although enduring personality traits may be difficult to change, certain behavior patterns instigated by these traits can be modified through interventions (McCrae & Costa, 1999). For instance, cognitive-behavioral programs aimed at reducing anxiety and depressive symptoms in individuals with emotional problems can be used to modify the behavioral tendencies of individuals low in Emotional Stability (e.g., the tendency to ruminate) (Munoz-Solomando, Kendall, & Whittington, 2008).

Second, our findings call for individualized intervention programs which take into account the personality of the individual patient. By assessing the personality of patients (e.g., through short self-reported questionnaires), health professionals are not only provided with a context for understanding the problems that patients report, it can also help them to approach and communicate with patients in a manner that is sensitive to their individual strengths and weaknesses (Matthews, Saklofske, Costa, Deary, & Zeidner, 1998). For instance, the present findings show that patients low in Emotional Stability generally experience more treatment anxiety and have difficulty in disclosing their feelings to clinicians. Hence, if personality

assessment shows patients to be low in Emotional Stability, clinicians might need to invest more strongly in a trusting and open doctor-patient relationship in order to facilitate patients' disclosure. Moreover, clinicians might need to be more attentive to how they provide certain information about the disease and its treatment to these patients to prevent them from getting even more anxious. In sum, personality assessment enables health professionals to have a view on the enduring dispositions of the patient, which places health professionals in a much better position to select appropriate interventions and to frame these interventions to the patient (Hall, 2011; Matthews et al., 1998).

Limitations and suggestions for future research

This study has some limitations that need to be taken into account. First, although the Big Five has proven to be a valuable framework in examining linkages between personality and health (Marshall et al. 1994), it represents only one of several possible frameworks. It might be interesting, for instance, to relate Cloninger's psychobiological model of personality, which has been extensively used among community adolescents to investigate relationships with subjective well-being (e.g., Garcia & Moradi, 2011), to different domains of quality of life and perceived health in chronic disease populations. Similarly, recent research has demonstrated the value of studying personality traits beyond the Big Five such as Religiosity (Saucier & Goldberg, 1998) for patients' disease adaptation (e.g., Dezutter, Luyckx, Büssing, & Hutsebaut, 2009). Hence, future research on the relationship between personality and disease adaptation should also use personality traits and frameworks beyond the Big Five. Second, data were gathered through self-report questionnaires only. Although self-report is the most valid measure to assess personality, quality of life, and perceived health, future research would be strengthened by using data from multiple sources. Third, 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. Fourth, because of the cross-sectional design, we were unable to determine the degree to which personality actually influenced, or was influenced by, quality of life and perceived health. Assessing these study variables longitudinally would allow us to examine the developmental interplay of these variables. Finally, future research should explore potential mechanisms detailing how personality influences disease adaptation over time in adolescents with CHD. Both coping and disease perceptions have been found to mediate the relationship between personality on the one hand and disease adaptation and health outcomes on the other hand in adolescents with chronic diseases (Skinner, Hampson, & Fife-Schaw, 2002; Van De Ven & Engels, 2011). However, no study to date has examined these topics in individuals with CHD.

Notwithstanding these limitations, the present study generated important information on the relationship between personality, quality of life, and perceived health in adolescents with CHD. More specifically, Big Five personality traits were found to predict patients' quality of life and several domains of perceived health above and beyond the effects of sex, age, and disease complexity. Hence, our findings underscore the importance of examining personality traits in adolescents with chronic diseases to shed light on their daily functioning.

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Table 1

Clinical Characteristics of the Patient Sample

Clinical characteristics	<i>n</i> (%)
Complexity of heart defect (<i>n</i> = 366)	
Mild	151 (41.3%)
Moderate	172 (47.0%)
Complex	43 (11.7%)
Primary CHD diagnosis (<i>n</i> = 363)	
Hypoplastic left heart syndrome	1 (0.3%)
Univentricular physiology	4 (1.1%)
Tetralogy of Fallot	9 (2.5%)
Double outflow right ventricle	11 (3.0%)
Double inlet left ventricle	1 (0.3%)
Truncus arteriosus	1 (0.3%)
Transposition of great arteries (TGA)	21 (5.8%)
Congenitally corrected TGA	5 (1.4%)
Coarctation of the aorta	37 (10.2%)
Atrioventricular septal defect	6 (1.7%)
Atrial septal defect type I	4 (1.1%)
Ebstein malformation	1 (0.3%)
Pulmonary valve abnormality	33 (9.1%)
Aortic valve abnormality	58 (16.0%)
Aortic abnormality	9 (2.5%)
Left ventricle outflow tract obstruction	4 (1.1%)

Atrial septal defect type II	48 (13.2%)
Ventricular septal defect	67 (18.5%)
Mitral valve abnormality	33 (9.1%)
Pulmonary vein abnormality	4 (1.1%)
Other	6 (1.7%)
Prior heart surgery for CHD (<i>n</i> = 363)	
Yes	172 (47.4%)
No	191 (52.6%)
Frequency of follow-up (<i>n</i> = 366)	
More than once in a year	20 (5.5%)
Every year	117 (32.0%)
Every 2 years	59 (16.1%)
Every 3 years	36 (9.8%)
Every 4 years	20 (5.5%)
Every 5 years	65 (17.8%)
Other (e.g., less frequent, irregular,...)	49 (13.4%)

Note. CHD = Congenital heart disease.

Table 2

Paired-Samples t-Tests for Mean-level Personality Differences

	Patients	Controls		
Variable	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	95% CI of difference	<i>t</i> -value
Extraversion	3.55 (1.31)	3.80 (1.20)	(-0.44 – -0.07)	-2.71**
Agreeableness	4.68 (0.71)	4.65 (0.68)	(-0.06 – 1.14)	0.72
Conscientiousness	3.22 (1.24)	3.10 (1.34)	(-0.07 – 0.31)	1.25
Emotional stability	3.03 (1.24)	3.10 (1.09)	(-0.23 – 0.09)	-0.86
Openness	3.69 (1.04)	3.74 (0.97)	(-0.19 – 0.10)	-0.64

Note. CI = Confidence Interval; *M* = Mean; *SD* = Standard Deviation. All variables have a possible range of 0 – 6.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Univariate ANOVAs, Means, and F-Values for Sex and Disease Complexity

Variables	Total	Sex		F-value (η^2)	Disease complexity			F-value (η^2)
		Boy	Girl		Simple	Moderate	Complex	
<u>Big Five</u>								
1. Extraversion	3.52 (1.31)	3.60 (1.24)	3.43 (1.38)	1.60 (.01)	3.52 (1.18)	3.47 (1.37)	3.70 (1.49)	0.55 (.00)
2. Agreeableness	4.68 (0.70)	4.63 (0.76)	4.74 (0.63)	2.13 (.01)	4.72 (0.67)	4.64 (0.73)	4.72 (0.70)	0.66 (.00)
3. Conscientiousness	3.21 (1.23)	3.07 (1.22)	3.36 (1.22)	5.07* (.01)	3.31 (1.17)	3.21 (1.23)	2.88 (1.36)	1.97 (.01)
4. Emotional stability	3.01 (1.24)	3.41 (1.13)	2.59 (1.22)	42.55*** (.11)	3.02 (1.26)	3.06 (1.17)	2.76 (1.46)	0.98 (.01)
5. Openness	3.69 (1.04)	3.70 (1.07)	3.68 (1.01)	0.02 (.00)	3.70 (1.04)	3.64 (1.04)	3.85 (1.02)	0.69 (.00)
<u>Disease adaptation</u>								
6. <i>Quality of life</i>	81.20 (10.54)	81.43 (11.08)	80.96 (9.99)	0.17 (.00)	82.37 (9.72)	80.77 (10.86)	78.80 (11.62)	2.10 (.01)
7. <i>Generic health</i>								
a. Physical functioning	87.54 (12.85)	90.09 (12.42)	85.00 (12.80)	13.94*** (.04)	90.25 ^a (10.48)	86.47 ^b (13.68)	82.21 ^b (14.92)	7.30** (.04)
b. Emotional functioning	74.36 (18.27)	79.22 (16.78)	69.53 (18.39)	26.05*** (.07)	76.52 ^a (16.93)	74.42 ^a (18.74)	66.28 ^b (19.12)	4.91** (.03)

c. Social functioning	86.02 (14.49)	86.15 (14.62)	85.98 (14.38)	0.01 (.00)	89.04 ^a (12.82)	84.76 ^b (15.17)	80.38 ^b (15.15)	6.87** (.04)
d. School functioning	79.03 (14.34)	79.50 (13.66)	78.63 (15.04)	0.31 (.00)	81.45 ^a (13.76)	77.97 (14.87)	74.74 ^b (12.87)	4.27* (.02)
<i>8. Disease-specific health</i>								
a. Cardiac symptoms	80.36 (14.85)	84.49 (13.05)	75.95 (15.46)	30.25*** (.08)	81.54 ^a (14.23)	80.84 ^a (15.04)	76.06 ^b (15.03)	4.00* (.02)
b. Physical appearance	78.27 (20.64)	83.14 (16.74)	73.21 (23.05)	20.75***(.06)	81.09 (19.07)	76.85 (21.05)	74.56 (23.33)	2.28 (.01)
c. Treatment anxiety	86.26 (18.19)	90.64 (14.46)	81.48 (20.52)	22.76***(.06)	87.13 (17.94)	87.05 (17.27)	79.77 (21.91)	2.76 (.02)
d. Cognitive problems	74.17 (19.09)	76.05 (17.59)	72.21 (20.49)	3.43 (.01)	75.48 (19.49)	74.25 (18.80)	69.21 (16.62)	1.60 (.01)
e. Communication	79.55 (21.10)	82.19 (20.14)	76.89 (21.74)	5.41* (.02)	81.65 (21.41)	78.89 (20.20)	75.00 (23.41)	1.64 (.01)

Note. Standard deviations in parentheses. For disease complexity, 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 4

Standardized Betas for the Regression Analyses of Quality of Life and Perceived Health on Sex, Age, Disease Complexity, and Big Five Traits

Criterion	Sex	Age	Complexity	Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness
1. Quality of life	.04	-.05	-.10*	.17** (.26***)	.15** (.24***)	.08 (.10)	.19** (.25***)	.09 (.18**)
2. Generic health								
a. Physical functioning	-.15**	-.06	-.18***	.06 (.16**)	.12* (.18**)	.08 (.10)	.17** (.26***)	.07 (.13*)
a. Emotional functioning	-.13**	.04	-.11*	.15** (.28***)	.14** (.19***)	.15** (.09)	.42*** (.51***)	-.08 (.03)
b. Social functioning	.02	.00	-.18***	.24*** (.32***)	.22*** (.31***)	.06 (.11*)	.11* (.21***)	.02 (.14**)
c. School functioning	.05	.03	-.13*	-.01 (.09)	.10 (.17**)	.18** (.19***)	.30*** (.28***)	.02 (.09)
3. Disease-specific health								
a. Cardiac symptoms	-.19***	-.01	-.13**	.03 (.14*)	.07 (.10)	.07 (.02)	.32*** (.40***)	-.07 (-.03)
b. Physical appearance	-.16**	-.05	-.11*	.12* (.26***)	.16** (.23***)	.06 (.06)	.29*** (.40***)	.05 (.13*)
c. Treatment anxiety	-.15**	-.04	-.11*	-.10 (.03)	.05 (.07)	.03 (.02)	.33*** (.36***)	.03 (.03)
d. Cognitive problems	.02	.00	-.05	.08 (.21***)	.09 (.18**)	.11* (.10)	.36*** (.38***)	.04 (.11*)
e. Communication	-.02	.02	-.10	.11 (.22***)	.09 (.15**)	-.04 (-.03)	.27*** (.32***)	.06 (.11*)

Note. Pearson correlations between brackets. * $p < .05$. ** $p < .01$. *** $p < .001$.