

Self-reported Adherence Behavior in Adolescent Hypertensive Patients: The Role of Illness Representations and Personality

Urška Žugelj,¹ BS, Maja Zupančič,¹ PhD, Luka Komidar,¹ PhD, Rajko Kenda,² PhD, Nataša Marčun Varda,³ PhD, and Alojz Gregorič,³ PhD

¹Department of Psychology, Faculty of Arts, University of Ljubljana, ²Division of Paediatrics, Department of Nephrology, University Medical Centre Ljubljana, and ³Division of Paediatrics, Faculty of Medicine, University of Maribor

All correspondence concerning this article should be addressed to Urška Žugelj, Department of Psychology, Faculty of Arts, University of Ljubljana, Aškerčeva 2, SI-1000 Ljubljana, Slovenia.

E-mail: urska.zugelj@ff.uni-lj.si

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Objective This exploratory study examined the role that illness representations and personality play in the various adherence behaviors of adolescents diagnosed with essential hypertension. **Methods** The participants were 97 hypertensive adolescents. They completed self-report questionnaires pertaining to (1) demographic and medical data, (2) adherence, (3) illness representations, and (4) personality. Medical charts were also assessed. **Results** The hierarchical regression analyses indicated that: (1) conscientiousness, agreeableness, and perception of treatment effectiveness account for a significant amount of variance in general adherence; (2) perception of treatment effectiveness is predictive of overall specific adherence; and (3) for adherence to most of the individual specific regimen recommendations, illness representations are more predictive compared to personality dimensions. **Conclusions** The personality domains of conscientiousness, extraversion, agreeableness, and illness representation dimensions (treatment control, concern, and emotional burden) were shown to predict adherence behaviors in adolescent hypertensive patients differentially. Study implications and limitations are discussed.

Key words adherence; adolescent health; hypertension; illness representations; personality.

Introduction

The aim of the study was to explore the role of illness representation dimensions and personality in the adherence behavior of adolescents diagnosed with essential hypertension. To our knowledge, the present work is unique in its focus on these issues.

Adherence in the Management of Essential Hypertension

Essential or primary hypertension is a chronic condition characterized by elevated blood pressure with no identifiable physical origin (Lurbe & Rodicio, 2002; Varda & Gregorič, 2005). Even though not very common in

children and adolescents, it is recognized as one of the major risk factors for the development of several cardiovascular and renovascular diseases, that is, congestive heart failure, myocardial infarction, renal disease, and stroke (Cutler et al., 2004; Gregorič, 2004; Lurbe & Rodicio, 2002; Varda & Gregorič, 2005). Thus, early identification and intervention are crucial for preventing long-term complications (Finset & Gerin, 2008; Gregorič, 2004; Lurbe & Rodicio, 2002; Gathchel & Oordt, 2003). Since there is no cure for hypertension, patients are required to follow complex, lifelong treatment regimens consisting of non-pharmacologic and, in some adolescents, also pharmacologic components. Non-pharmacologic treatment includes lifestyle modifications addressing diet, weight

reduction, stress reduction, and/or regular physical activity. The implications for pharmacologic treatment in adolescents are severe hypertension or insufficient effectiveness of lifestyle modifications (Cutler et al., 2004; Finset & Gerin, 2008; Varda & Gregorič, 2005).

It has been shown that adherence to all components of a prescribed medical regimen is crucial for the effective management of hypertension (Cutler et al., 2004). Therefore enhancing adherence in hypertension is important given its lifelong nature and morbidity, and the related mortality (Finset & Gerin, 2008; Gregorič, 2004; Theunissen, de Ridder, Bensinga, & Rutten, 2003). This task is all the more challenging in adolescent patients, since adolescence is a period of development when long-standing health care behaviors are established (Greening, Stoppelbein, & Reeves, 2006; Williams, Holmbeck, & Greenley, 2002). However, there is strong evidence that many patients in various pediatric chronic conditions have difficulty adhering to their recommended regimen (Kahana, Drotar, & Fraizer, 2008; Quittner, Modi, Lemanek, Ievers-Landis, & Rapoff, 2008; WHO, 2003). Similarly, in hypertension, the adherence rates across age groups are relatively low, with only about one quarter to one-third of hypertension cases being managed adequately (Finset & Gerin, 2008; Frosch, Kimmel, & Volpp, 2008; WHO, 2003). The non-symptomatic and lifelong nature of hypertension is currently recognized as the most important factor for poor adherence. Other potentially contributing factors are demographic characteristics, patients' understanding and perception of hypertension, health care providers' mode of delivering treatment, relationships between patients and health care professionals, health system influences, and complex antihypertensive drug regimens (Meyer, Leventhal, & Gutman, 1985; WHO, 2003). Whilst these barriers are common to all age groups, developmental and family characteristics represent additional risk factors of poor adherence in pediatric patients (La Greca and Bearman, 2003). The present study focuses on the patient-related factors of adherence, namely, personality dimensions and illness representations.

Patient-Related Factors of Adherence: Personality Dimensions and Illness Representation Dimensions

Literature suggests that certain personality characteristics may be linked to health and illness through overt behaviors. Specifically, the recognition of health threats and the attainment of health-protecting actions (i.e., adherence) represent a possible behavioral pathway where personality

may influence the initiation, course, and final outcome of one's illness (Contrada & Goyal, 2004). The Big Five model of robust personality dimensions (i.e., extraversion, agreeableness, conscientiousness, neuroticism, and openness) employed in our study offers an integrative framework to assess the role of personality in the above-mentioned processes. Among the Big Five dimensions, conscientiousness, which is characterized by specific traits such as self-discipline, self-control, reliability, and perseverance, seems to be consistently related to different kinds of health-related behavior (Friedman, 2001; Skinner et al., 2002), and relevant for achieving health-related goals (Friedman, 2001; McCrae & Costa, 1987). Specifically, conscientiousness was linked to self-care of renal dialysis patients (Christensen & Smith, 1995) and it showed indirect (through illness representations) associations with self care of adolescents and young adults with diabetes (Skinner et al., 2002).

Another trait often related to adherence is neuroticism. It refers to an individual's tendency to experience negative emotions (fear, worry, anxiety) and to display moodiness, irritability, distress, caution, apprehension, lack of self-confidence, low self-esteem, and withdrawn behavior. This dimension is frequently associated with health and health-related behavior, such as sensitivity to and frequency in reporting illness symptoms, increased medical encounters, and poor self-reported health (Costa & McCrae, 1987; Friedman, 2001; McCrae & Costa, 1987; Skinner et al., 2002). Literature on other personality dimensions in relation to adherence is rather ambiguous (Friedman, 2001). Hitherto, there are no studies exploring personality and illness representations in relation to anti-hypertensive regimens for adolescents. We also found no research evaluating more narrow personality traits, at lower levels of the personality hierarchy, in terms of predicting adolescent patients' adherence.

Illness representations are another factor increasingly recognized as important to the field of adherence research. The well-recognized common sense self-regulation model (SRM) of illness by Leventhal and his colleagues (Leventhal, Halm, Horowitz, Leventhal, & Ozakinci, 2004; Meyer et al., 1985) contends that the way in which a person conceptualizes his/her illness is a proximal contributor to coping behavior. Individuals' appraisal of the result of their coping in turn affects further conceptualization of the health problem (feedback loop). The conceptualization of illness is referred to as an illness representation, whereas adherence to medical regimen is considered a form of coping behavior. The illness

representation as defined in SRM is a complex system organized around different themes: nature of illness, likely time course, personal impact of illness, perceived amenability to control or to cure, casual factors, and emotional aspects (Broadbent, Petrie, Main, & Weinman, 2006). Another feature of the model is a multilevel perspective: illness representations are dependent on the multilevel context in which they emerge, with the characteristics of self on the first level, and the broader social and cultural context on a higher level. The levels are again interconnected via the feedback loop (Leventhal et al.). From a self-regulation perspective, personality can be conceptualized as an intrapersonal context in which illness representations emerge, and these are further predictive of adherence behavior.

The role of illness representations in adherence behavior was tested across different illness and age groups. In adult hypertensive patients, certain aspects of illness representation (emotional responses, perceived consequences, cure/control representations and beliefs about medications) were predictive of adherence (Ross, Walker, & MacLeod, 2004). Similarly, adherence was predicted by different aspects of illness representation in: (1) asthma, by perceived consequences of the condition and treatment beliefs (Horne & Wienman, 2002); (2) hemophilia, by perceived identity and consequences of the illness, and the perceived specific necessity of medications (Llewellyn, Miners, Lee, Harrington, & Weinman, 2003); (3) adolescent and young adult diabetes patients, by perceived consequences and treatment effectiveness (Skinner et al., 2002); and (4) adolescents with cystic fibrosis, by treatment beliefs (Bucks et al., 2009). Furthermore, in their meta-analysis of research employing SRM, Hagger and Orbell (2003) found perceived controllability of illness to be predictive of adherence behavior across different conditions.

Study Goals

Since nonadherence is recognized as an important barrier to the effective management of hypertension (see Cutler et al., 2004), the main goal of the present study¹ was to examine the predictive validity of illness representation dimensions and the Big Five personality dimensions for different forms of adherence in hypertensive adolescents. In addition, mid-level personality traits were considered. We believe that understanding the psychological

underpinnings of adherence in adolescents with hypertension is understudied and deserves more research attention. Scientifically driven knowledge could be used to tailor specific recommendations for researchers in the field and clinical practitioners in intervention planning. In line with previous research, personality and illness representations as predictors of different adherence behaviors were examined. Due to limited studies in this field and the lack of a well-developed theoretical framework for adolescent adherence in hypertension, we relied on a similar study by Skinner and colleagues (2002) conducted on adolescents with diabetes. We expected neuroticism and conscientiousness to be significant predictors of adherence. Based on previous reports (Hagger & Orbell, 2003; Horne, Clatworthy, Polmear, & Weinman, 2001; see also Horne & Weinman, 2002; Ross et al., 2004), we also hypothesized that illness representations concerning treatment effectiveness are important predictors of adherence behavior.

Method

Participants

The participants were 97 adolescents with essential hypertension, aged 13–23 years ($M = 17.34$ years, $SD = 2.28$), undergoing outpatient treatment at two pediatric clinics in Ljubljana and Maribor, Slovenia. About 34% of the participants were females. As regards education or employment status, 15% of the adolescents were enrolled in one of the last two grades of a nine-grade elementary school, 55% were secondary school students, 21% were university students, 3% were employed (not attending school), and 6% were neither enrolled in any kind of education nor employed at the time of data collection. About half of the sample came from urban areas, while the remaining participants lived in a non-urban environment.

Besides the data on the existing diagnosis, we examined the duration of the diagnosis, the body mass index (BMI), and recommendations for illness management in individual participants. With respect to diagnosis duration, most of the participants, regardless of gender, had had their diagnosis for 1–4 years ($M = 27.89$ months, $SD = 23.52$). The participants were assigned to normal and overweight groups on the basis of CDC growth charts (National Center for Health Statistics & National Center for Chronic Disease Prevention and Health Promotion, 2000a, 2000b). The participants whose BMI exceeded the 85th percentile for their respective age group and gender were categorized as overweight ($N = 31$), whereas others were categorized as normal

¹ This contribution is part of a larger doctoral study on the psychosocial adjustment of adolescent hypertensive patients.

($N = 63$). We were not able to categorize three of the adolescents due to missing data. The participants also had different instructions and recommendations for managing their illnesses. They all received recommendations from their doctors to change their lifestyle in at least one way (i.e., low salt intake, low fat intake, regular exercise, or stress reduction). In addition, medical therapy was prescribed to 63% of the adolescents. A total of 29% of participants were recommended to follow all four of the lifestyle changes, and were additionally prescribed medication.

Since our sample was diverse with regard to demographic and biomedical characteristics, we tested for potential effects of these characteristics on the constructs under study; that is, illness perception, personality, and adherence. Controlling for age, the regression analyses suggested no systematic effects of age, gender, diagnosis duration, or BMI on illness representations, personality, or adherence.

Recruitment

The research was approved by *The National Medical Ethics Committee of the Republic of Slovenia*. Informed written consent was obtained for all participants. Parents' consent was provided for underage adolescents.

Recruitment took place between September 2006 and September 2008. A specialist doctor was invited to identify potential participants according to the following criteria: (1) diagnosis of essential hypertension, (2) diagnosis established at least 4 months prior to participation, and (3) no co-morbid chronic condition. A total of 163 adolescents meeting the criteria were selected. Next, we took the following steps: (1) potential participants were sent a written invitation to participate in the study or were approached personally during their regular visit at the clinic (adolescents who could not be reached by mail or at their clinic were telephoned); (2) participants whose regular visits were scheduled at the time of assessment provided reports at the clinic. Others who agreed to participate, but were not scheduled for regular visits at the time of data collection, were sent the assessment materials by mail; (3) all participants received a battery of self-report questionnaires and were asked to return the completed forms to the principal author of the study in person or by mail in case of home assessment (a pre-paid envelope was attached).

Out of the 163 potential participants, 32 could not be contacted by any means and one person had died, resulting in 130 (80%) contacted potential respondents. Of the 130 contacted adolescents, 16 refused to participate

(3 of them claimed they had had no blood pressure-related problems at the time), and 16 initially agreed to participate, but did not return the questionnaires. Thus, 98 completed data sheets were received (75% return rate). Of these, one respondent was excluded due to missing data, so that the final sample included 97 participants. With regard to age, the participants did not significantly differ from nonparticipants ($\Delta M = 4.94$ months, $t(159) = 0.91$, $p = .36$), and the gender structure was almost identical (34% females among participants and 33% females among nonparticipants). We were not able to collect any other data on nonparticipants.

Instruments

Demographics and Medical Data

Age, gender, educational status, and place of residence were obtained by a short questionnaire developed for the purpose of this research. Diagnosis duration and information on other potential coexisting conditions were obtained from patient charts. Data on body weight and body height were obtained from patient charts for adolescents whose regular appointments were scheduled at the time of recruitment. In other cases, the participants themselves provided such data for assessment of their current state. Also, the recommended treatment regimen was reported by adolescents in order to assess the recommendations registered by participants.

Illness Representations

The 9-item Brief Illness Perception Questionnaire (BIPQ; Broadbent et al., 2006) was translated and adapted to Slovene to assess illness representations. The questionnaire is a short version of the well-established Illness Perceptions Questionnaire—Revised (Moss-Morris et al., 2002), which was designed to address different illnesses. The term “illness” in the original questionnaire was replaced with “my high blood pressure” for the purpose of our study. In BIPQ, single items are used to represent each of the nine dimensions of illness perceptions as listed below. Only the first 8 items were used in our data analysis, because item 9, labeled Cause, is a qualitative measure. The 8 items are rated along a 10-point Likert-type response scale, and evaluate the following dimensions: (1) consequences: perception of consequences in everyday life; (2) timeline: expectations about the duration of illness; (3) personal control: perception of the degree of personal control over illness; (4) treatment control: perception of the degree of control over illness due to received treatment; (5) identity: perceived symptoms of illness; (6) concern: concern over

illness; (7) comprehension: understanding of illness; and (8) emotional burden: experiencing emotional burden due to illness. Broadbent and colleagues reported good test-retest reliability after 3 weeks (mean $r = .62$; range from .48 to .70) and after 6 weeks (mean $r = .66$; range from .42 to .75), concurrent validity with relevant measures (i.e., IPQ-R), sound predictive validity in patients recovering from myocardial infarction, and the questionnaire's ability to discriminate among different illness groups (for details see the original article: Broadbent et al., 2006).

Personality

Personality was assessed using The Inventory of Child/Adolescent Individual Differences (ICID) in a self-report format (Halverson et al., 2003; Slovene version Zupančič & Kavčič, 2009²). ICID is an age and culture neutral measure of child/adolescent personality traits. It features 108 items that are assessed along a 7-point Likert-type rating scale ranging from 1 (much less than the average peer or not at all) to 7 (much more than the average peer). The items are based on common parental natural language descriptions of their children across 7 countries, and they form several mid-level personality scales measuring specific traits. The scales are hierarchically organized into five robust dimensions; that is, the Big Five: (1) extraversion (comprising Sociable, Positive Emotion and Activity Level mid-level scales), (2) neuroticism (capturing Fearful/Insecure, Shy and Negative Affect scales), (3) conscientiousness (Achievement Orientation, Organized and Distractible-reversed), (4) agreeableness (Antagonism and Strong Willed scales with reversed coding—a high score indicates a low level of the trait), and (5) openness (Intelligent, Open to Experience scales). Sound psychometric properties have been demonstrated for the robust and the mid-level scales across ages, informants, and cultures, including factor congruence, internal consistency, cross-observer reliability, temporal stability, concurrent and longitudinal predictive validity against measures of social adjustment/problems, academic motivation and achievement (Halverson et al., 2003; Knyazev, Zupančič, & Slobodskaya, 2008; Zupančič, 2008). The internal consistency measures obtained in our sample for the five personality dimensions were good, and ranged from .76 to

.91. The same holds true for the mid-level scales with a mean $\alpha = .75$ (range from .63 to .87).

Adherence

The Medical Outcomes Study Adherence Questionnaire (MOSAQ; DiMatteo et al., 1993) was translated and adapted to Slovene following a rigorous double blind back-translation procedure. Two parts of the questionnaire were retained, the General Adherence scale and the Specific Adherence scale (reduced to items relevant for hypertension). The General Adherence scale assesses the general tendencies to adhere to a medical regimen over a period of 4 weeks prior to assessment. The participants respond to 5 items along a 6-point scale ranging from 1 (none of the time) to 6 (all of the time). They are asked to indicate how often a particular statement held true for them in the past 4 weeks (e.g., "I had a hard time doing what the doctor suggested I do"). The internal consistency for the General Adherence scale was $\alpha = .85$ in our sample, while ranging from .79 (DiMatteo et al., 1993) to .81 (Hays, n.d.) across other studies. The temporal stability obtained over a 2-year time span was $r = .39$ (DiMatteo et al., 1993). The Specific Adherence scale is administered using two parallel lists of 5 items: (1) the first list asks whether specific behaviors were recommended to the participant; (2) the second list asks participants to rate how often they followed these specific recommendations over the last 4 weeks. Again, an identical 6-point rating scale is employed. Five potentially recommended behaviors were included, representing five specific adherence scores: (1) low salt diet, (2) low fat diet, (3) medication taking, (4) exercise, and (5) stress reduction. Each of the five specific adherence scores was calculated only for those participants who indicated that their health provider had recommended the behavior in question. As a result, up to five specific scores were obtained for an individual participant, with an additional score named Specific Adherence, representing an average score across recommended behaviors for an individual participant. The internal consistency estimates for the Specific Adherence scale for different illness groups generally exceeded the minimal standards for group comparisons (Hays, n.d.). For our sample, the internal consistency of the scale was $\alpha = .68$.

Results

Adherence Behavior

All means of adherence to specific recommendations (range for each of the scales from 1 to 6) are at mid-point

² The ICID is normed in Slovenia only (ages 3–18). It is available in nearly identical other-report and self-report forms (e.g., 'The child is easily upset' vs. 'I am easily upset'). The self-report version used in the present study is normed on a representative sample of Slovene adolescents aged 2–18 years (Zupančič & Kavčič, 2009).

or higher on the scale, namely: low salt diet ($M = 3.73$, $SD = 1.41$), low fat diet ($M = 3.58$, $SD = 1.35$), medication taking ($M = 5.56$, $SD = 1.23$), exercise ($M = 4.23$, $SD = 1.36$), and stress reduction ($M = 3.44$, $SD = 1.28$). Among the treatment recommendations, adolescents reportedly adhere best to medication taking. Relatively high adherence rates were also obtained for the general ($M = 4.35$, $SD = 0.97$, range from 1.00 to 6.00) and specific ($M = 4.07$, $SD = 1.00$, range from 1.20 to 6.00) domain of adherence behavior.

Predicting Different Aspects of Adherence

In studying adherence, we were interested in how different attributes of illness representations and personality traits predict general adherence, specific adherence, and adherence to all five specific recommendations. Hierarchical multiple regression analyses were conducted in order to explore these relationships. We used the forward selection procedure, in which variables are sequentially entered into the model. The first variable considered for entry into the equation is the one with the largest correlation with the dependent variable. If the first variable satisfies the criterion for entry, the next independent variable with the largest partial correlation is considered for entry into the equation. The procedure stops when there are no variables that meet the entry criterion. Because multiple partial F tests (as many as there were independent variables to be tested for inclusion) were performed at each step, the significance levels obtained from the F distribution were not appropriate. We therefore used the Bonferroni correction to control Type I (family-wise) error rates (Myers & Well, 2003). We used $\alpha_c = \alpha/m$ as the criterion for significance, where α is the probability of at least one Type I error (we set it to $\alpha = .100$), and m is the number of partial F tests (e.g., in case of 13 predictors, α_c was .008). For any of the Big Five personality dimensions that significantly predicted a certain adherence variable, we performed a regression analysis with mid-level personality scales captured by the respective dimension.

Table I summarizes the results of the analysis predicting general adherence based on the Big Five and eight illness representation dimensions. The predicted variability in general adherence was best accounted for by conscientiousness and treatment control. Those participants scoring higher on conscientiousness and/or those having higher expectations about the effectiveness of their treatment generally adhered better to medical instructions than their less conscientious counterparts and peers expecting less effectiveness from the treatment. Agreeableness is also

Table 1. Summary of Hierarchical Multiple Regression for Big Five personality Dimensions and Eight Illness Representation Dimensions Predicting General Adherence Score

Predictor	ΔR^2	B	95% CI for B	β
Step 1	.16***			
Conscientiousness		1.01	[0.54, 1.48]	.40***
Step 2	.08**			
Conscientiousness		0.85	[0.38, 1.31]	.34***
Treatment Control		0.09	[0.03, 0.15]	.29**
Step 3	.06**			
Conscientiousness		0.86	[0.42, 1.31]	.34***
Treatment Control		0.08	[0.02, 0.14]	.25**
Agreeableness		0.39	[0.67, -0.12]	.25**
Total R^2	.30***			
R^2 one-tailed 90% LB	.18			

Note. $N = 97$. LB = lower bound.

** $p < .01$, *** $p < .001$.

predictive of general adherence—the adolescents who scored higher on agreeableness achieved higher scores on the General Adherence scale than participants reporting to be less agreeable. Next, the two personality dimensions were investigated in more detail by performing regression analysis with conscientiousness and agreeableness narrow constituent personality scales (the mid-level scales). Organized (conscientiousness domain) and Strong-Willed (agreeableness domain) mid-level scales met the entry criterion: the model accounted for 17% of variance (one-tailed 90% lower bound for $R^2 = .08$) in the General Adherence scale, with Organized ($\beta = .30$; $p = .003$) and Strong-Willed scale scores ($\beta = -.29$; $p = .003$) having almost the same relative importance in the prediction. This implies that the more organized and the less strong-willed participants generally adhere better to medical instructions than their less orderly, less careful and more stubborn, bossy, and headstrong peers.

Table II presents the results of regression analyses for predicting the Specific Adherence scale and individual specific adherence behaviors by the Big Five personality dimensions and eight illness representation dimensions. The score for the Specific Adherence scale was predicted relatively well by a single variable, that is, treatment control that accounts for 16% of the variance. The patients considering treatment as more effective score higher on the Specific Adherence scale than those who perceive treatment as less effective. The variation in adherence to medication-taking behavior could be well accounted for by three (almost equally important) illness representations: treatment control, emotional burden, and concern (43% of the variance explained). The participants who feel they are

Table II. Summary of Hierarchical Multiple Regression for the Big Five Personality Dimensions and Eight Illness Representation Dimensions Predicting Specific Adherence Score and Individual Specific Recommendations

Predictor	ΔR^2	<i>B</i>	95% CI for <i>B</i>	β
Specific adherence				
Step 1	.16***			
Treatment control		0.14	[0.54, 1.48]	.43***
R^2 one-tailed 90% LB	.10			
Medication taking				
Step 1	.19***			
Treatment control		0.22	[0.10, 0.34]	.44***
Step 2	.10**			
Treatment control		0.27	[0.15, 0.38]	.54***
Emotional burden		-0.13	[-0.23, -0.04]	-.32**
Step 3	.14***			
Treatment control		0.23	[0.12, 0.34]	.46***
Emotional burden		-0.18	[-0.27, -0.09]	-.44***
Concern		0.19	[0.09, 0.29]	.40***
Total R^2	.43***			
R^2 one-tailed 90% LB	.31			
Exercise				
Step 1	.13***			
Extraversion		0.67	[0.28, 1.07]	.35**
R^2 one-tailed 90% LB	.06			
Stress reduction				
Step 1	.17***			
Treatment control		0.18	[0.08, 0.28]	.41***
Step 2	.14***			
Treatment control		0.23	[0.13, 0.32]	.52***
Concern		-0.18	[-0.28, -0.07]	.38**
Total R^2	.31***			
R^2 one-tailed 90% LB	.20			

Note. LB = lower bound.

in control of their illness (given their recommended treatments) exhibit more concern about their illness and experience lower emotional burden, adhere better to their medication regimen compared to their peers, who either feel less in control, are less concerned about their illness, or are less successful in coping with negative emotions accompanying their condition. Adherence to exercise recommendations was significantly predicted by extraversion only: more extraverted participants follow exercise recommendations better than less extraverted ones. A detailed analysis accounting for the mid-level scales of extraversion showed that 32% (one-tailed 90% lower bound for $R^2 = .22$) of variability in the Exercise scale is explained by adolescents' Activity Level scores ($\beta = .57$; $p < .001$). More energetic and physically active participants tend to have fewer barriers to following exercise recommendations.

When predicting stress reduction behavior, treatment control and (low) concern were significant predictors explaining 31% of the variance. As in predicting medication-taking behavior, trusting in the effectiveness of treatment resulted in better adherence to this recommendation. However, having more concerns was contraindicative for stress reduction behavior. When predicting dieting behavior (low fat and low salt diet), none of the predictors met the entry criterion.

Discussion

The present study explored the role of personality and illness representations in the adherence behavior of adolescent hypertensive patients. To our knowledge, the present work is unique in its focus on these issues.

The Role of Personality

Our hypothesis, based on the findings of Skinner and colleagues (2002), who reported on the significant contributions of both conscientiousness and neuroticism to self-care behavior, was partly supported. Conscientiousness, but not neuroticism, was identified as a significant predictor of general adherence behavior. In addition, agreeableness was an important predictor of general adherence. Similarly to our results, conscientiousness was shown to be consistently related to lower levels of risky behavior and higher levels of healthy and self-care behaviors, consequently leading to better health outcomes in other illnesses (Bogg & Roberts, 2004; Friedman, 2001; Skinner et al., 2002). The somewhat different findings of our study compared to those of Skinner and his colleagues regarding the role of neuroticism may be due to methodological issues (i.e., different measures, sample age spans, and sizes). The differences may also indicate an interaction between personality and the type of chronic health condition under investigation. Neuroticism is associated with greater sensitivity to bodily sensations and increased reporting of symptoms and their severity (Costa & McCrae, 1987; Skinner et al., 2002). We speculate that in illnesses characterized by explicit symptoms (i.e., most chronic conditions), neuroticism can affect health behavior indirectly through illness representations, whereas in an asymptomatic condition such as hypertension, this link may not be established. Alternatively, Wiebe and Christensen (1996) propose a curvilinear relationship between neuroticism and adherence, and argue that linear models cannot

capture the real extent of the relationship between the two constructs.

Research in chronic illnesses other than hypertension usually failed to reveal a relationship between agreeableness and adherence (Christensen & Smith, 1995; Galluccio, 2003; Spence-Jones, 1999), with the exception of a study on adult liver transplant candidates (Telles-Correia, Barbosa, Mega, & Monteiro, 2009), and findings on the negative links between agreeableness and risk-taking behavior (Booth-Kewley & Vickers, 1994). In accordance with the latter, our results indicate better overall adherence in more agreeable adolescents than in less agreeable ones. As shown by our analysis with the mid-level traits of agreeableness, it is reasonable to assume that more adherent patients are less strong-willed (less prone to do things their own way, take charge and manipulate others) and more cooperative with their care providers. From this point of view, the significance of agreeableness in predicting adherence of hypertensive adolescents seems sensible.

In contrast to general adherence, personality dimensions were not shown to significantly predict specific adherence behaviors. However, there was one exception; a substantial proportion of the variance in adherence to exercising instructions was predicted solely by extraversion (mostly due to individual differences in adolescents' self-reported activity level). Similarly, extraversion was demonstrated as the only predictor of exercise adherence in cancer survivors (Courneya & Hellsten, 1998). Given that activity level is one of the specific constituents of extraversion, it is perhaps self-explanatory that more energetic adolescents who are constantly on the move and are always busy doing something more easily follow exercise recommendations, and/or would be physically active even without the specific instruction in mind.

The otherwise low predictive value of personality in specific adherence behaviors may be explained by Cervone's (2005; see also Leventhal, Weinman, Leventhal, & Philips, 2008) arguments that personality traits as indicators of inter-individual differences may not be sufficient in explaining differences in everyday health-relevant behavior (i.e., specific adherence), which is highly intra-individual specific. Namely, specific adherence behaviors seem to be more amenable to "self-perceptions and strategies that control the temporal variation in intra-person problem solving" (Leventhal et al., 2008, pp. 482).

The Role of Illness Representations

Treatment control beliefs referring to the extent to which adolescents believe that the received treatment regimen is

effective in controlling their illness (Broadbent et al., 2006) were the most promising predictor of several aspects of adherence under our consideration, that is, general adherence, overall specific adherence, medication taking, and stress reduction. The results are consistent with findings in adolescents with other chronic conditions (diabetes: Skinner et al., 2002; cystic fibrosis: Bucks et al., 2009). In contrast, stronger treatment control beliefs were related to poor blood glucose control in adult diabetes patients, and a delayed return to work in adult myocardial infarction patients (Broadbent et al., 2006). The authors presumed treatment control beliefs to be linked with the external locus of control, which is usually related to lower levels of adherence in adults. But in adolescent diabetes patients, external locus of control was associated with better adherence and illness control. This may reflect the adolescents' acknowledgement of their own limitations in executing complex health-related recommendations (Greening et al., 2006). Having an understanding of their own limitations and the possible gains of collaborating with parents and medical staff, adolescents are thus supposed to be more amenable to following medical recommendations. Considering the locus of control as an aspect of beliefs, we speculate that adolescents' perceptions of treatment effectiveness may be related to adherence in a different way than in adults.

Alongside treatment beliefs, variation in some specific adherence behaviors was predicted by adolescents' concern over their illness and by experiencing emotional burden as a result of their condition. While treatment control represents a cognitive aspect, concern and emotional burden refer to emotional aspects of illness representations (Broadbent et al., 2006). It seems that both aspects of illness conceptualization play a role in the adherence behavior of adolescent hypertensive patients, which is consistent with SRM (Leventhal et al., 2004). Our results further imply that the role of illness representations is specific to the behavior in question. While more concern about one's illness was predictive of medication-taking adherence, the opposite was true for adherence to stress reduction recommendations. In line with the feedback loop hypothesis of SRM, in which altering one aspect of the model causes changes in other aspects (Leventhal et al.), the latter may indicate that patients who effectively control their stress levels exhibit fewer concerns over illness or vice versa. However, our measurement design and the analyses performed do not allow any casual conclusions.

General Versus Specific Aspects of Adherence

Different patterns of the relations of personality dimensions and illness representations with the individual adherence behaviors obtained in the present study support the claim that adherence is not a unitary construct, as the adherence rates for an individual patient vary across different components of his/her recommended regimen for the management of disease (Cutler et al., 2004; Glasgow & Anderson, 1995; La Greca & Bearman, 2001; Patino, Sanchez, Eidson, & Delamater, 2005). The differential links of personality and illness representations with specific adherence behaviors may have appeared due to various obstacles and burdens placed by specific recommendations on the adolescents' resources (see Modi and Quittner, 2006). For example, dieting may be amenable to other demands not investigated here, and medication taking may be perceived as less burdensome, whereas exercising may be appealing to extraverted adolescents who favor elevated levels of physical activity.

Study Limitations

The results of our research provide a new contribution to understanding adolescent hypertension management, but should be interpreted with caution due to several limitations. The first issue refers to the assessment of observed constructs. Due to the small number of potential participants and resource limitations, we were unable to assess the BIPQ and MOSAQ questionnaires' psychometric properties thoroughly and thus had to rely on data from the original validation studies. Further examination of these instruments in hypertensive adolescents will therefore be needed. Also, the recommended hypertension management behaviors and measurements of adherence were both self-reported by the participants. Our goal was to capture only the behaviors that participants registered as recommended. In future research, these should be compared with doctor-reported recommendations to assure objectivity. Likewise, the inclusion of more objective measures of adherence alongside self-reports would be beneficial, since self-reports may be susceptible to overestimation of adherence rates and there may be problems with recall (Quittner et al., 2008). Given the limited resources and the lack of a golden standard for measuring adherence, self-reported adherence was considered an appropriate choice because it is recognized as noninvasive, inexpensive, and comprehensive (Cutler et al., 2004).

Furthermore, though strongly recommended in literature (Leventhal et al., 2008), our study limitations did not

allow us to control for illness outcomes (e.g., blood pressure levels, severity of illness). However, the beneficial effects of good adherence on illness control are well documented in hypertension literature. Another shortcoming refers to one-time-point data collection. Consequently, the results do not imply causation and do not capture the dynamic nature of the constructs observed. Finally, including other informants would widen the perspective on adolescent personality and adherence, and enable us to control for the same-rater bias, while illness representations of significant others would offer an insight into the social context in which adolescents adapt to their illness. Built on our findings, further research employing longitudinal and multiple-informant design, and controlling for illness outcomes, is recommended to support potential interventions in clinical practice.

Study Implications

Our study has important implications for research and clinical practice. Several research implications were already addressed throughout the "Discussion" section. To summarize, researchers are encouraged to (1) further assess the instrumentation used in this study to assure reliability and validity of the obtained results; (2) refine the assessment of adherence by adding more objective measures; (3) include an extended model of treatment beliefs (see Horne & Weinman, 2002); (4) employ prospective and multiple-informant designs; and (5) include the assessment of illness outcomes.

Concerning the clinical implications of our study, the results offer support for SRM by showing that illness representations are predictive of adherence in an adolescent hypertensive sample. Additional support of these relations from prospective studies would lead practitioners to include illness representations in their interventions. For example, in adult hypertensive samples, adherence was improved even by short interventions of trained practitioners addressing individual aspects of SRM (illness representations and/or action plans for implementing medical recommendations) during their consultations with patients (Theunissen et al., 2003). Considering the personality profiles of patients, practitioners could identify adolescents at risk for non-adherence and those who may, due to their personality, benefit from different types of interventions. A differential, individually based behavioral intervention accounting for relevant moderating variables (e.g., personality traits) was shown to lead to more favorable treatment outcomes than using common methods for all patients (Kreamer, Willson, Fairbourn, & Agrad, 2002).

For example, conscientious patients benefit from short interventions aimed at improving self-regulation skills, whereas patients high in neuroticism are more likely to benefit from frequent therapeutic and supportive interventions (Skinner et al., 2002). We also presume that exercise focused intervention would be especially suitable for highly extraverted hypertensive adolescents. Nevertheless, the conditions under which such differential interventions could be adapted to practical service within adolescent hypertension management should be carefully assessed for effectiveness and efficiency.

Conclusions

Enhancing adherence in hypertension is important given its life-long nature and morbidity, and the related mortality (Finset & Gerin, 2008; Gregorič, 2004; Theunissen et al., 2003). This task is especially challenging in adolescent patients who establish long-standing health care behaviors in this particular developmental period (Greening et al., 2006; Williams et al., 2002). We have demonstrated that illness representations and personality traits play an important role in predicting adolescents' adherence to antihypertensive treatment. While conscientiousness, agreeableness, and treatment control beliefs were related to general adherence, the psychological variables under consideration predicted different aspects of specific adherence, implying that adherence research should focus not only on the general aspects of adherence, but also on the specific behaviors recommended to patients.

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