9

INDIVIDUAL DIFFERENCES IN PERCEPTION OF PROGNOSTIC RISK: THE ROLE OF NEUROTICISM AND PESSIMISM

Abstract

Objectives: The aim of the study was to investigate the impact of personality factors on perception of prognostic risk in multiple sclerosis (MS). We studied direct effects of neuroticism, optimism and pessimism as well as indirect effects through symptom perception. **Method:** Data on perceived prognostic risk, neuroticism (EPQ), optimism and pessimism (LOT) and symptom perception (IPQ) were obtained from 101 recently diagnosed MS patients. Perceived risk and seriousness were assessed for the 2-year, 10-year and lifetime prognosis of wheelchair dependence. Analyses were adjusted for differences in clinical disability status. **Results:** Neuroticism strengthened the impact of perceived symptoms on perception of risk (regression coefficient B = 0.20, p = 0.01) and was a predictor of perceived seriousness of wheelchair dependence (B = -1.04, p = 0.001). Patients who were more pessimistic had higher levels of symptom reporting, after adjustment for disability status (B = 0.85, p = 0.02), and considered wheelchair dependence to be more serious (B = 2.73, p = 0.003). Optimism and pessimism were not associated with perception of risk. **Conclusions:** We have demonstrated that neuroticism and pessimism affect perceived risk and seriousness of wheelchair dependence in patients with MS. These effects were either direct or indirect through modification of the impact of perceived symptoms and clinical disability.

Introduction

Communication about health risks is omnipresent in current medical practice. Still, numerous studies demonstrate that patients' understanding or perception of these risks often deviates considerably from the actual values.[e.g.[1-7]] For instance, individuals at high risk of breast cancer, prostate cancer or Huntington's disease overestimated [1-4] or underestimated [5-7] their own risk of developing the disease. This over- and underestimation of risk was associated with actual risk factors such as age and family history, but also with prior disease experience, prior health-related behavior and perceived health status.[2,5,8-10] Only a few studies have investigated the impact of personality factors on perception of risk.[5,11,12] In patients with rheumatoid arthritis, higher trait anxiety or neuroticism was associated with negative expectations about future health status.[12] This finding was in line with results from an experimental study, in which students with high neuroticism perceived their risks of negative events, such as being a victim of crime or having a financial crisis, to be higher than students with lower neuroticism scores.[11] In contrast, no significant relationship between trait anxiety and perception of risk of ovarian cancer was found among women attending a screening clinic.[5] The aforementioned experimental study also demonstrated that optimism was associated with higher perception of risk to encounter positive events and lower perception of risk to encounter (short-term) negative events.[11] There are a large number of studies on *unrealistic* optimism in perception of risk.[e.g.[13-15]] These studies are however beyond the scope of the present paper: optimism in that context denotes the finding that people, as a group, view their risk as more favorable compared to others rather than the personality characteristic.[13]

Neuroticism, optimism and pessimism can affect perception of risk through direct and indirect pathways. An association with neuroticism is suggested by the studies mentioned above. A direct relationship between optimism and perception of risk is expected because (dispositional) optimism is defined as a general tendency to hold positive expectancies about the future,[16] which may also apply to expectations about *specific* health outcomes. Another reason for a direct relationship is explained by the heuristic of availability.[17] According to this heuristic optimists will underestimate the risk of negative outcomes, because they are more focused on positive outcomes. Similarly, pessimists will overestimate risks of unfavorable prospects. In addition, personality may have an indirect impact on risk perception through its role on symptom reporting. There is consistent evidence that personality factors such as neuroticism and optimism – in opposite direction – affect symptom reporting,[18-24] which in turn may be extrapolated into expectations about future disease progression.[14]

In patients diagnosed with a chronic disease, perception of *prognostic* risk may be an important factor in the choice whether or not to start treatment, and in other major decisions about e.g. relationships, family planning, housing and work. For that reason, it is important to understand the factors that influence risk perception. In this study, we investigated to what extent neuroticism, optimism and pessimism had a direct impact on perceived risk and seriousness of wheelchair dependence or an indirect effect through symptom perception. We also investigated to what extent neuroticism, as a higher-order trait, could also explain eventual effects pessimism, because these personality factors are closely related.[16,22,25] The study was conducted in a cohort of patients who are recently diagnosed with multiple sclerosis (MS). MS is a chronic neurological disease affecting young adults between 20 and 40 years of age.[26] The course of disease is variable, unpredictable and poorly controllable by medication.[27] These disease characteristics in particular predict a role for personality factors to affect expectations about future symptom progression. We addressed patients' expectations with regard to the risk of wheelchair dependence, as this is the most widely known consequence of MS by patients. The estimated lifetime risk of wheelchair dependence is 70-80%.[28]

Methods

Participants and procedures

Patients were recruited through the Departments of Neurology of the Erasmus MC, three hospitals within the region of this academic hospital, and the VU Medical Center in the period of March 1999 – December 2000. Patients were diagnosed as having MS within two years before study entry, were between 18 and 55 years old, and had signed informed consent. Patients with serious comorbidity or with insufficient understanding of the Dutch language were excluded. Diagnoses were verified by senior neurologists of the academic hospitals. Of the 120 patients who met the criteria, 101 agreed to participate in the study. Patients who declined participation mentioned the emotional burden (n=3) or a lack of interest (n=3). Nine patients declined without additional comments and four never responded to our reminders. Mean age of the patients was 37.5 years (SD 9.5) and 70% were women. The mean time since diagnosis was only 7.8 months (SD 6.5), and the mean time since first symptoms 3.7 years (SD 4.6).

All patients filled out questionnaires and underwent a neurological examination. These examinations were done by physicians of the academic centers according to a standardized research protocol. Disability status was rated on the Expanded Disability Status Scale (EDSS).[29] The EDSS ranges from 0.0 (no

neurological symptoms) to 10.0 (death due to MS). In the study population, EDSS ranged from 0.0 to 7.0. Eleven percent of the patients experienced substantial problems in walking (EDSS ≥ 5.0), and another seven percent had difficulty in walking long distances (EDSS 4.0-4.5).[29] The study protocol was approved by the medical ethical committees of the participating hospitals.

Instruments

Perception of prognostic risk and seriousness were assessed for the risk of becoming wheelchair-dependent as a complication of MS. Wheelchair dependence was defined as the inability to walk beyond five meters, equaling a score of 7.0 on the EDSS.[29] We addressed patients' perception of the 2-year, 10-year and lifetime risk as an indication of their expectations about the short-, medium- and long-term prognosis. Patients were asked to what extent they thought they would become wheelchair-dependent for distances over five meters within these periods. Perception of risk was assessed by marking a 100mm visual analogue scale (VAS), which ends were anchored at 'Definitely not' (0) and 'Definitely' (100). Next, patients were asked for each period how serious they thought it would be to be wheelchair-dependent by that time. Perception of seriousness was scored on a VAS anchored at 'Not serious at all' (0) and 'The most serious thing I can imagine' (100). Detailed descriptive statistics of perceived risk and seriousness have been published elsewhere.[30]

Neuroticism is a dimension of personality consisting of negative emotions such as anxiety and anger, and cognitive and behavioral characteristics such as low self-esteem, preoccupation and insecurity.[22] Neuroticism was assessed by the 12-item neuroticism scale of the Eysenck Personality Questionnaire (EPQ).[31,32] This scale ranges from 0 to 12, with high scores indicating high neuroticism. Internal consistency reliability as assessed by Coefficient α was 0.64, which is below the 0.70 that is considered adequate for research purposes.[33] Yet, Coefficient α of the EPQ Neuroticism scale increased to 0.74 when the item with the weakest item-total correlation was removed and to 0.80 when the two 'weakest' items were excluded. The correlation coefficients between the latter scales and the original 12-item scale were 0.99 and 0.97, respectively, indicating that scale reduction only marginally improved measurement of neuroticism. This made us decide to use the original scale.

Dispositional optimism, a generalized tendency to believe in positive outcome expectancies, was assessed using the Life Orientation Test (LOT).[34,35] The LOT consists of four positively formulated items (optimism), four negatively formulated items (pessimism) and four filler items. The optimism and pessimism scales range

114

from 4 to 20, with higher values indicating higher levels of optimism and pessimism. The LOT has been validated for use in the Dutch population.[35] In our study, Coefficient α was 0.72 for the optimism and 0.68 for the pessimism scale.

Symptom reporting was included as the perceived intensity of symptoms that are experienced as a consequence of MS. Perceived symptoms were assessed by the illness identity scale of the Illness Perception Questionnaire (IPQ).[36] As recommended by the constructors,[36] disease-specific symptoms were added to the original list for use in this MS population, resulting in a scale of 23 symptoms. Frequency was scored on a four-point scale: all of the time (4), frequently (3), occasionally (2) and never (1). Answers summed into a total score ranging from 23 to 92. High scores on the IPQ identity scale indicate that patients report a higher intensity of symptoms due to their disease. In this study, Coefficient α of the 23-item IPQ symptom scale was 0.87.

Statistical analysis

Pearson correlation coefficients were calculated to examine the relationships between the study variables. SAS Proc mixed was used to investigate the independent relation of disability status, perceived symptoms and personality with perception of risk and seriousness of wheelchair dependence. This MANOVA-like procedure allows for simultaneous analysis of the determinants of perceived 2-year, 10-year and lifetime risk while taking into account their significant intercorrelations. The following strategy was adopted for the selection of independent variables of the final model. The analyses were started with a full model including the main effects (disability status, perceived symptoms, optimism, pessimism, neuroticism and prognosis), covariates (age, sex, time since diagnosis and time since first symptoms), all first-order interactions with prognosis and all first-order interactions between personality factors on the one hand and disability status and perceived symptoms on the other. Dummy variables were created for prognosis, which allows differentiating between the impact of the main effects on perceived 2-year, 10-year and lifetime risk or seriousness. To simplify the model, this saturated model was reduced by eliminating non-significant covariates and interaction effects. Elimination was based on the significance of the difference in −2 log likelihood goodness of fit between the reduced and the saturated model. If the p-value was greater than 0.05 (χ^2-test), the parsimonious model was considered not significantly different from the saturated model, and used for further simplification. Regression coefficients (B) of the final model were estimated using the restricted maximum likelihood procedure (REML). For the ease of interpretation of the parameters, results of the final model were presented without the main

115

effects of significant interaction terms. By doing this, the coefficients of the interaction effects indicate the regression coefficient of the determinant for each prognosis (2-year, 10-year and lifetime). P-values of the differences *between* the interaction effects will be presented in the text.

To determine the influence of personality factors on perceived symptoms, a multivariate regression analysis was performed. The full model included main effects (disability status, optimism, pessimism and neuroticism), covariates (age, sex, time since diagnosis and time since first symptoms) and all interaction effects between disability status and the personality factors. A backward selection strategy was used to remove non-significant (p > 0.10) covariates and interaction effects from the model. P-values lower than 0.05 were considered statistically significant, unless indicated otherwise. SAS 8.0 (www.sas.com) and SPSS 11.0 (www.spss.com) for Windows were used for the statistical analyses.

Results

Correlations between the study variables

Table 1 shows the correlation coefficients of the relations between personality factors, clinical disability status and perceived symptoms. As expected, patients with higher disability also reported significantly more symptoms due to their disease (r = 0.53, p < 0.001). Higher neuroticism (r = 0.31, p = 0.002) and pessimism (r = 0.40, p < 0.001) scores were associated with increased symptom reporting.

Personality factors and perceived risk

Patients who reported more symptoms due to their disease had a higher perception of the 2-year (B = 1.00, p = 0.0001) and 10-year risk (B = 0.98, p = 0.001) of wheelchair dependence, independent of clinical disability status (Table 2). This

Table 1 Means (SD) and correlations between personality characteristics, perceived symptoms and disability status

	Mean (SD)	Optimism	Pessimism	Neuroticism	Disability status
Perceived symptoms	39.5 (8.8)	-0.18	0.40***	0.31**	0.53***
Optimism	13.7 (2.5)		-0.41***	-0.35***	-0.04
Pessimism	9.0 (2.4)			0.39***	0.27**
Neuroticism	6.3 (2.5)				0.20*

Pearson correlation coefficients * p < 0.05, ** p < 0.01, *** p < 0.001.

Table 2 Linear model of perceived risk of wheelchair dependence including disability status, perceived symptoms and personality factors

		B [95% CI]	p
Disability status		3.12 [0.89, 5.35]	0.01
Perceived symptoms†	2 years	1.00 [0.51, 1.49]	0.0001
	10 years	0.98 [0.41, 1.55]	0.001
	lifetime	0.20 [-0.40, 0.80]*	0.51
Optimism		-0.14 [-1.47, 1.20]	0.84
Pessimism		0.00 [-1.49, 1.50]	1.00
Neuroticism		-1.25 [-2.58, 0.09]	0.07
Perceived symptoms * Neuroticism		0.20 [0.05, 0.34]	0.01

Linear model (SAS Proc Mixed) with B = regression coefficient and CI = confidence interval. Non-significant covariates and interaction terms were removed from the model using a backward selection strategy (see Methods). † B indicates the regression coefficient of perceived symptoms for the 2-year, 10-year and lifetime prognosis (interaction effect) with accompanying p-value. * The interaction effect of perceived symptoms with perceived lifetime risk was significantly lower than the interaction effect with perceived 2-year risk (reference, p < 0.01).

impact of perceived symptoms was stronger in patients with higher neuroticism scores, as indicated by the significant interaction effect (B = 0.20, p = 0.01, see Figure 1). The interaction between neuroticism and prognosis was not significant indicating that the influence of neuroticism did not differ for the 2-year, 10-year and lifetime prognosis. Optimism and pessimism did not significantly influence perception of risk, nor did they modify the effect of other variables.

Table 3 Linear model of perceived seriousness of wheelchair dependence including disability status, perceived symptoms and personality factors

	B [95% CI]	p
Disability status	-4.44 [-7.14, -1.73]	0.002
Perceived symptoms	-0.22 [-0.76, 0.31]	0.41
Optimism	-1.14 [-2.76, 0.48]	0.17
Pessimism	2.73 [0.94, 4.52]	0.003
Neuroticism	-1.04 [-2.64, 0.56]	0.20
Perceived symptoms * Neuroticism	-0.32 [-0.51, -0.13]	0.001
Disability status * Pessimism	1.40 [0.39, 2.41]	0.01

Linear model (SAS Proc Mixed) with B = regression coefficient and CI = confidence interval. Non-significant covariates and interaction terms were removed from the model using a backward selection strategy (see Methods).

Personality and perceived seriousness

Patients who were more pessimistic considered wheelchair dependence to be more serious (B = 2.73, p = 0.003; Table 3). A significant interaction effect was found between pessimism and disability status: patients who had higher disability status *and* were more pessimistic considered wheelchair dependence to be more serious (B = 1.40, p = 0.01; Figure 2). Neuroticism tended to be associated with lower perception of seriousness (B = -1.04, p = 0.20), but this association was significant only in interaction perceived symptoms (B = -0.32, p = 0.001).

Personality factors and perceived symptoms

To investigate whether personality factors may affect perception of risk through their role in symptom reporting, we conducted a linear regression analysis on the
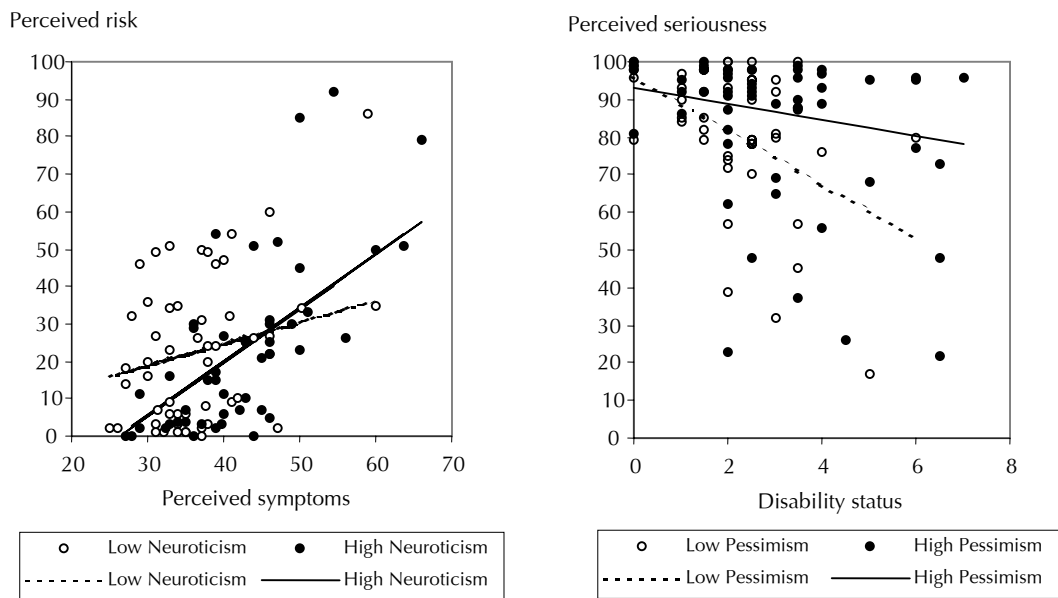

Figure 1 Perceived 2-year risk of wheelchair dependence as a function of perceived symptoms in patients with high and low neuroticism

Lines are based on predicted values obtained by regression analysis on neuroticism and perceived symptoms.

Figure 2 Perceived seriousness of wheelchair dependence within two years as a function of disability status in patients with high and low pessimism

Lines are based on predicted values obtained by regression analysis on pessimism and disability status.

Table 4 Regression model for the relation between perceived symptoms on disability status and personality characteristics

	B [95% CI]	p
Disability status	2.45 [1.50, 3.39]	< 0.001
Optimism	-0.10 [-0.76, 0.55]	0.75
Pessimism	0.85 [0.14, 1.56]	0.02
Neuroticism	0.39 [-0.27, 1.04]	0.25

$R^2 = 0.36$ (Adjusted $R^2 = 0.33$)

Linear regression analyses (SPSS GLM). B = regression coefficient, CI = confidence interval, R^2 = Percentage of variance in perceived symptoms explained by the model. Non-significant covariates and interaction terms were removed from the model using a backward selection strategy (see Methods).

determinants of perceived symptoms. Table 4 shows that patients who were more pessimistic reported more symptoms due to their disease (B = 0.85, p = 0.02) after adjustment for clinical disability status. In contrast to the findings of the unadjusted analyses presented in Table 1, in the simultaneous analysis of all disability and personality factors, we found no evidence for a relationship between neuroticism and symptom reporting (B = 0.39, p = 0.25).

Effects of pessimism explained by neuroticism?

To determine whether neuroticism, as a higher-order trait, could also explain the significant relationships of pessimism with perceived symptoms and perceived seriousness, we repeated the analyses excluding pessimism. We found that neuroticism did not become a significant predictor of perceived symptoms (B = 0.58, p = 0.08). Also, the main effect of neuroticism on perceived seriousness was still not significant (B = -0.48, p = 0.57) and the interaction effect of perceived symptoms and neuroticism became less significant (B = -0.19, p = 0.05).

Discussion

The aim of the present study was to investigate the direct and indirect impact of personality characteristics on the perception of prognostic risk and seriousness in patients with MS. Five findings of this study will be commented upon.

First, we found that perceived symptoms had a stronger impact on risk perception in patients with higher EPQ neuroticism scores (Figure 1). The finding that neuroticism modified the impact of perceived symptoms extends previous correlational findings of Radanov *et al.* (1997). Contrary to our expectations and the results of experimental studies,[11] there was no evidence for a significant

impact of optimism and pessimism on perception of risk. Even though optimism is defined as a tendency to hold positive expectations, this does not appear to apply to *specific* prognostic outcomes. Apparently, the contribution of other determinants prevails when it comes to specific health-related prospects.

Second, we found that patients with higher disability and those scoring lower on pessimism evaluated wheelchair dependence as less serious. Moreover, patients who had more physical limitations *and* were less pessimistic considered wheelchair dependence even less serious (see Figure 2). This lower perception of seriousness in patients with higher levels of disability is likely due to successful coping with the altered prospects of having a progressive disorder.[30] A question that emerges from these findings is: why is *low pessimism* rather than *high optimism* associated with lower perception of seriousness? A possible answer may be the congruence in the valence of pessimism and unfavorable prognostic outcomes such as wheelchair dependence. Affect congruence predicts that pessimism and neuroticism will be associated with biases in judgment of negative events, and optimism with biases in positive events.[e.g.][37] Such effects have been demonstrated for neuroticism in several experimental studies,[11,37,38] and may also apply to pessimism. For example, Lipkus *et al.* (1993) found that pessimistic students and not those with low optimism had higher perception of risk of negative events.

Third, we found a significant interaction effect of neuroticism and perceived symptoms on perception of seriousness. A lower perception of seriousness among patients who reported more symptoms is not surprising given the similar impact of perceived symptoms and disability status (see above). However, the finding that this relationship was stronger among patients with higher neuroticism scores is counter-intuitive. The same significant interaction effect was found in the analysis of perception of risk. A possible explanation is that lower perception of seriousness in high-neuroticism patients reflects minimization of the threat of wheelchair dependence.[39] By reducing the perceived impact of the outcome, these patients are able to handle the prospects of their unfavorable prognosis. Minimization may be an effective coping strategy on the short term, but can lead to inadequate adaptation on the long run. This finding may have brought to light an important clinical problem, which needs to be studied further in future studies.

Fourth, we found that pessimistic patients reported significantly more symptoms due to their disease than patients who were less pessimistic. This relationship was found after adjustment for differences in clinical disability status, and could not be explained by neuroticism. This finding adds to the existing literature in that no earlier study of perceived symptoms had included optimism,

pessimism and neuroticism all together while taking into account differences in actual physical limitations. Many previous studies reported significant associations between neuroticism and symptom reporting, but these had not simultaneously considered pessimism and clinical health status.[19-21,23,24] In line with these studies, we also found a significant crude correlation between neuroticism and perceived symptoms when not adjusting for other variables (Table 1). When adjusting for pessimism the effect of neuroticism was not significant in our study. This suggests that pessimism instead of neuroticism could also have been a major predictor of symptom reporting in these aforementioned studies. Two other studies reported significant associations between total LOT scores and symptom reporting, but did not discriminate between effects of optimism and pessimism.[18,22] In the light of our findings, it is expected that these effects of bipolar optimism could have been explained by pessimism alone.

Fifth, there was partial overlap between pessimism and neuroticism (r = 0.39, p < 0.001), but significant effects of pessimism on symptom reporting and perceived seriousness could not be explained by neuroticism. Neuroticism is conventionally viewed as a higher-order trait and multifaceted construct that in part consists of the absence of optimism (i.e. pessimism).[e.g.[16]] Smith *et al.* (1989), however, have suggested that pessimism is merely a weaker instrument for the assessment of neuroticism. Our findings contradict the suggestion of Smith *et al.* (1989). We conclude that in our study pessimism and neuroticism are distinguishable psychological constructs, with shared and unique impact on psychological outcome variables.

Three methodological issues remain to be elucidated. First, we have investigated the impact of personality, disability status and perceived symptoms *as determinants* of perception of risk and seriousness. The data used to test this hypothesis were derived from a cross-sectional study, which cannot prove the direction of these relationships. Yet, given the relative stability of personality traits and the short duration of disease, we think it is valid to assume that personality had affected symptom perception and perception of risk, and that disability status preceded symptom reporting as well as perception of risk in the causal pathway. Also, we considered it likely that perceived current symptoms influenced perception of future disease progression. The direction of this relationship may be subject for debate. It can be argued that patients, who do not want to face their unfavorable prognosis, may underestimate or ignore the presence of their symptoms.

Second, *objective* clinical disability status was significantly associated with pessimism (r = 0.27) and neuroticism (r = 0.20). In this study, disability status was

assessed using the EDSS, a physician-assessed rating scale for the ranking of MS-related functional limitations.[29] The EDSS scores are based on the results of neurological examinations, some of which rely on patient symptom reporting and may thus be determined by personality explaining the association of the EDSS to personality in our study and that of others.[18-23] Though the scale has been criticized for this subjectivity,[40] it is still the most widely used disability scale.

And third, personality factors determine the usual way a person thinks, behaves, and reacts to everything in the environment. Therefore, we interpreted the interaction effects as that personality factors modify the influence of perceived symptoms and disability status on perception of risk and seriousness. Yet, these interaction effects can also be explained in another way: e.g. perceived symptoms and disability status may modify the impact of neuroticism and pessimism. For example, the influence of pessimism may be stronger in patients with higher disability and may not play a role when patients have no physical limitations. Although we can not exclude such alternative interpretation of the interaction effects, we considered this to be less likely.

In conclusion, we have demonstrated that personality characteristics play a significant role in perceived risk and seriousness of wheelchair dependence in patients recently diagnosed with MS. The most pronounced role for personality may be in modifying the influence of other determinants such as perceived symptoms, or prior disease experience, prior health-related behavior and perceived health status.[2,5,8-10] To our knowledge, this is the first study that simultaneously addressed several personality characteristics and investigated their interaction effects with other determinants. Therefore, our findings are awaiting replication by other studies. Further studies of unavoidable health outcomes such as prognostic and genetic risks may help to gain a better understanding of the role of personality factors on risk perception.

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123

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