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ORIGINAL RESEARCH

Personality Traits Associated with Treatment Choice with an Explicit Statistical Prediction After an Explanation in a Negative Context: A Study in Patients with Glaucoma

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Purpose: Over 50% of patients with early-stage glaucoma discontinue topical therapy within the first 6 months of treatment initiation. This risk of discontinuation could be reduced by how the ophthalmologist explains the treatment plan. Ophthalmologists can explain the treatment plan to patients in either positive or negative contexts. Although explanations in a negative context can be selected depending on the medical situation, identification of patients who will choose the treatment with explicit statistical prediction after an explanation in a negative context is important; personality traits are related to these emotional decisions. Therefore, in the present study, we examined the personality traits associated with choice of treatment with explicit statistical prediction after an explanation in a negative context.

Patients and Methods: A total of 147 patients with glaucoma were recruited for this study. The questionnaire booklets used contained positively framed or negatively framed versions of an "Asian disease problem" to enable examination of the influence of the way in which a problem is framed (framing effect) on the participants' decision-making. The Japanese version of the Ten-Item Personality Inventory was used to estimate the personality traits of the participants.

Results: Low conscientiousness was identified as the only variable that was strongly predictive of the choice of treatment with explicit statistical prediction ($\beta = -0.44$, $z = 2.19$, $p = 0.03$). In addition, while the association was not statistically significant, low neuroticism was found to be weakly predictive of the choice of uncertain treatment ($\beta = -0.37$, $z = 1.73$, $p = 0.08$).

Conclusion: In conclusion, we showed that low levels of conscientiousness predict the choice of treatment with explicit statistical prediction (ie, topical treatment) for glaucoma after an explanation in a negative context.

Keywords: conscientiousness, neuroticism, glaucoma, big five personality traits

Introduction

Glaucoma is the leading cause of irreversible blindness worldwide and the second most common cause of blindness. It is estimated that glaucoma affects more than 60 million individuals worldwide and that 10% of glaucoma patients eventually become blind.[1] Although visual field loss caused by glaucoma can start in middle age, a previous study reported that over 50% of patients with early-stage glaucoma discontinue topical therapy within the first 6 months of treatment initiation,[2] regardless of the class of medication used.[3]

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This risk of discontinuation could be reduced by how the ophthalmologist explains the treatment plan. Ophthalmologists can explain the treatment plan to patients in either positive ("You will not go blind if you receive this treatment") or negative ("You will go blind if you do not receive this treatment") contexts, depending on the patients.

It is difficult for ophthalmologists to determine when and/or for whom to use these contexts in real-world clinical settings. In the medical situation, a previous study suggested that explaining the treatment in a negative context increases compliance,[4] but when there is no assumption that the participant will be a patient, a previous psychological experiment reported that explaining in a negative context decreased the proportion of individuals choosing the statistically explicit alternative compared to explaining in a positive context. One of the causes of the inconsistency may be the fact that being a patient emotionally affects decision-making.

Therefore, although explanations in a negative context can be selected depending on the medical situation, identification of patients who will choose the statistically explicit treatment after an explanation in a negative context is important; personality traits are related to these emotional decisions. Previous studies have suggested that higher neuroticism scores are associated with treatment adherence in glaucoma patients,[5] and adherence to topical glaucoma medication use was positively correlated with levels of depression and hypochondriasis.[6]

Therefore, we hypothesized that specific personality traits would be associated with choice of treatment certainty after an explanation in a negative context. Therefore, in the present study, we examined the personality traits of patients who chose statistically explicit treatment after receiving an explanation in a negative context.

Materials and Methods

Study Design and Patients

The present study was performed as part of a prospective questionnaire survey (Questionnaire survey for understanding the actual situation in glaucoma patients). From December 2018 to March 2019, we recruited a total of 147 patients with glaucoma from the outpatient section of the Department of Ophthalmology, Jikei University Hospital, and enrolled all the patients in the study after obtaining their informed consent. All patients had been diagnosed with glaucoma.

The inclusion criteria for patients in the study were as follows: 1) outpatients at the Department of Ophthalmology, Jikei University School of Medicine Hospital; 2) either sex; 3) over 20 years of age; and 4) diagnosed with glaucoma.

Two different types of questionnaire booklets, each containing either the positively framed or negatively framed version of an "Asian disease problem", were prepared to examine the effect of positive versus negative framing of a problem (framing effect) on the treatment decisions of the participants (Figure 1). Both booklets also contained the Japanese version of the Ten-Item Personality Inventory (TIPI-J), which was used to evaluate the personality traits of the participants.

After the questionnaire booklets were thoroughly shuffled, each participant was randomly handed a booklet from the top of the booklet pile. We classified the participants into two groups according to the version of the "Asian disease

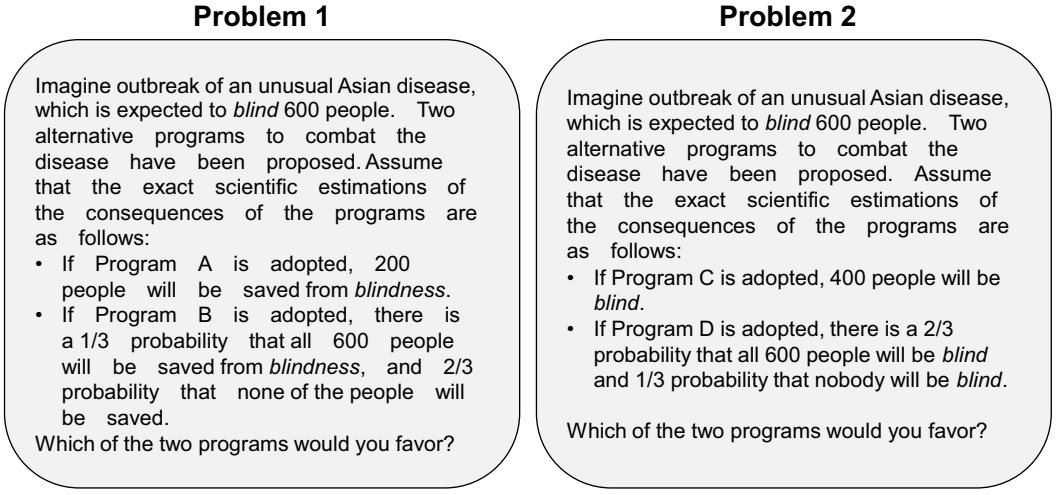

Figure 1 Details of the modified version of the "Asian disease problem".

problem" they received: the "positively framed problem presentation" (PF) group and the "negatively framed problem presentation" (NF) group. The PF group consisted of 75 subjects, while the NF group consisted of 72 subjects.

The present study was conducted with the approval of the Ethics Committee of the Jikei University School of Medicine (No. 9205) and in compliance with the principles of the Declaration of Helsinki.

Assessment

Asian Disease Problem (Manipulation of Positive/Negative Context)

To manipulate the context of treatment explanation, the Asian disease problem was used. The Asian disease problem is a sociopsychological problem administered to subjects to examine the framing effect. The framing effect is a psychological phenomenon that influences how people make decisions based on contexts (frames; ie, positive or negative frame). In the Asian disease problem, the subjects were asked to choose between two alternatives on policies to combat a disease that was going to potentially kill 600 people. The problem is presented using phrases framed in a positive or negative manner.

The use of different "frames" to present problems elicit different decisions from the subjects. In the positive framing, the subjects are presented with the alternative that 200 people will be saved (ie, the explicit statistical prediction option) or that there will be a one-third chance they will be saved but a two-thirds chance that they will not be saved (ie, the implicit statistical prediction option). In the negative framing, the subjects are presented with the alternative that 400 people could die (the explicit statistical prediction option) or that there will be a two-thirds chance that all 600 people will die but a one-third chance that none of the 600 patients will die (the implicit statistical prediction option). When the problem is presented in a positive frame, subjects prefer the explicit statistical prediction option, but when the problem is presented in a negative frame, subjects prefer the implicit statistical prediction option.[7] Because the implicit statistical prediction option has gamble-like characteristics, it is assumed that individuals are more likely to choose the implicit statistical prediction option when a problem is presented in a negative context. It suggests that when patients are explained an effective treatment with a certain probability in a negative context (eg, 30% of patients go blind), they may choose another implicit statistical prediction option, or gamble-like option due to fear of loss aversion.

To examine therapeutic decision-making in the ophthalmologic field, we substituted the term "die" with "(become) blind" in the cover story and the alternatives (Figure 1).

The Japanese Version of the Ten-Item Personality Inventory (TIPI-J)

The Ten-Item Personality Inventory (TIPI) is a questionnaire that is specifically used to evaluate the Big Five personality traits.[8] The "Big Five" personality traits consist of extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience.[9]

The TIPI seems to be suitable for large-scale research, as it contains very few items compared to authorized questionnaires such as the Revised NEO Personality Inventory (NEO PI-R), which includes 240 items, and the Five Factor Personality Questionnaire 50 (FFPQ-50), which includes 50 items. The Japanese version of the TIPI (TIPI-J) has concurrent validity with the FFPQ-50,[10] indicating that the questionnaire is useful for specifically evaluating the "Big Five" personality traits. Participants are requested to rate their responses to each of the items of the TIPI on a scale from 1 (strongly disagree) to 7 (strongly agree). The TIPI consists of the following items:

1. Extraverted, enthusiastic
2. Critical, quarrelsome
3. Dependable, self-disciplined
4. Anxious, easily upset
5. Open to new experiences, complex
6. Reserved, quiet
7. Sympathetic, warm
8. Disorganized, careless
9. Calm, emotionally stable
10. Conventional, uncreative

To evaluate the score for each of the "Big Five" personality traits, we adopted the following calculations [13]: extraversion = Item 1 score + (8 – Item 6 score); agreeableness = (8 – Item 2 score) + Item 7 score; conscientiousness = Item 3 score + (8 – Item 8 score); neuroticism = Item 4 score + (8 – Item 9 score); and openness to new experience: Item 5 score + (8 – Item 10 score).

Data Analysis

All data analyses were performed using SPSS version 27.0 (IBM, Chicago, IL). The statistical significance threshold was set at p =0.05.

Comparison of Decisions Made by Patients with Glaucoma Between the Positively-Framed and Negatively Framed Groups

To compare the treatment decisions elicited by presentation of a problem in a positive or negative frame among patients with glaucoma, the percentage of individuals who chose the statistically explicit option relative to both options (ie, the % statistically explicit treatment option) and the percentage of individuals who chose the statistically implicit option relative to both options (ie, the % statistically implicit treatment option) were calculated for the PF and NF groups. The chi-square test was performed to compare the % statistically implicit treatment option between the PF and NF groups.

Association of the Big Five Personality Traits with Therapeutic Decisions

To examine the relationships between the personality traits and the decision of treatment certainty, exploratory logistic regression analysis was performed for the PF and NF groups. Scores for extraversion, agreeableness, conscientiousness, neuroticism, and openness to new experiences calculated from the TIPI-J were adopted as the independent variables. The type of choice (ie, the statistically explicit treatment vs the statistically implicit treatment option) was used as the dependent variable.

Results

Demographic Characteristics

All 147 patients recruited were enrolled after providing informed consent to participate (age, 61.4 ± 11.6 years, mean ± SD). However, the data of 125 patients were included in the final analysis after listwise deletion due to missing values (Figure 2). Finally, the PF group consisted of 64 participants, and the NF group consisted of 61 participants.

No significant differences were found in the age (61.1 ± 12.2 and 61.7 ± 11.1 years), sex ratio, expressed as the % male (62.5% and 62.3%), or distribution of any of the Big Five personality traits between the PF and NF groups (Table 1). The scores for the traits on the TIPI-J were almost identical between the PF and NF groups (8.50 ± 2.49 and 8.33 ± 2.71 for extraversion, 10.7 ± 1.85 and 11.0 ± 1.59 for agreeableness, 9.50 ± 2.07 and 9.57 ± 2.22 for conscientiousness, 7.47 ± 2.47 and 7.62 ± 2.32 for neuroticism, and 8.59 ± 2.29 and 8.84 ± 2.40 for openness to experience, respectively).

Comparison of Decisions by Patients with Glaucoma Between the PF and NF Groups

The % statistically implicit treatment option was significantly lower in the PF group than in the NF group (17.2% vs 82.0%, $p < 0.01$), while the % statistically *explicit* treatment option was significantly higher in the PF group than in the NF group (82.8% and 18.0%, $p < 0.01$) (Table 2).

Association of the "Big Five" Personality Traits with Therapeutic Decisions

No significant associations between personality traits and decision-making were found in the PF group. In the NF group, low levels of conscientiousness (ie, individuals who were unlikely to identify with the traits organized, careful, and avoidance of counterproductive options) were the only variable that was strongly predictive of the choice of treatment certainty ($\beta = -0.44$, $z = -2.19$, $p = 0.03$). In addition, although the association was not statistically significant, low levels of neuroticism were found to be weakly predictive of the choice of treatment certainty ($\beta = -0.37$, $z = -1.73$, $p = 0.08$) (Table 3).

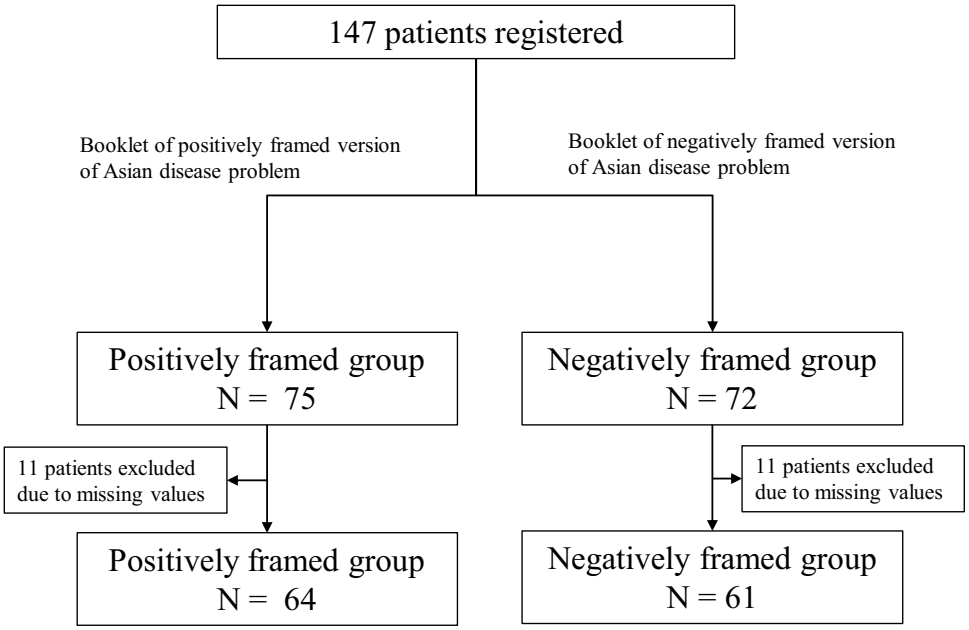

Figure 2 Flow diagram.

Discussion

In the present study, we showed that low levels of conscientiousness (a personality trait) predicted the choice of treatment certainty. Although the association was not statistically significant, low levels of neuroticism were also found to weakly predict the choice of certainty treatment.

Table 1 Demographic Characteristics of Patients with Glaucoma Presented with Positively Framed and Negatively Framed Problems

	Positively Framed Group (N=64)	Negatively Framed Group (N=61)	p value
Age (years)	61.1 ± 12.2	61.7 ± 11.1	0.80
Sex (% male)	62.5	62.3	0.84
Items from the TIPI-J			
Extraversion	8.50 ± 2.49	8.33 ± 2.71	0.71
Agreeableness	10.7 ± 1.85	11.0 ± 1.59	0.37
Conscientiousness	9.50 ± 2.07	9.57 ± 2.22	0.85
Neuroticism	7.47 ± 2.47	7.62 ± 2.32	0.72
Openness to experience	8.59 ± 2.29	8.84 ± 2.40	0.56

Notes: No significant differences were found in the sex ratio, age or scores on items of the TIPI-J between the two groups. A two-sample *t*-test was performed to compare age and scores on items of the TIPI-J between groups, and the chi-square test was used to compare the sex ratio between the positively framed group and negatively framed group. The statistical significance threshold in both tests was set at 5%.

Table 2 Decisions Made by the Positively Framed and Negatively Framed Groups of Patients with Glaucoma

	Positively Framed Group	Negatively Framed Group	p value
% statistically explicit option	82.8	18.0	0.01>*
% statistically implicit option	17.2	82.0	

Notes: Significant differences were observed in the percentage of patients selecting the statistically explicit treatment and statistically implicit treatment options between the positively framed and negatively framed groups. *The statistical significance threshold was set at less than 5%.

Table 3 Association of the Big Five Personality Traits with the Choice of Statistically Explicit Treatment in the Negatively Framed Group

	β	z value	p value
Extraversion	0.30	1.61	0.11
Agreeableness	0.17	0.61	0.54
Conscientiousness	−0.44	−2.19	0.03 *
Neuroticism	−0.37	−1.73	0.08
Openness to experience	0.01	0.04	0.97

Notes: Of the independent variables, low conscientiousness was the only variable that strongly predicted the choice of statistically explicit treatment in the negatively framed group (β = −0.44, z = −2.19, p = 0.03). *The statistical significance threshold was set at 5%.

The % uncertain treatment option was significantly higher in the NF group than in the PF group. These findings are consistent with previous reports of differences in the option selected by healthy individuals presented with positively or negatively framed medical problems. Tversky et al reported that participants more frequently tended to choose the uncertain treatment option when presented with a negatively framed version of the Asian disease problem than when presented with a positively framed version of the same problem.[7] Bigman et al also reported that positively framed and negatively framed explanations about the effectiveness of the human papillomavirus virus (HPV) vaccine (effective in 70% vs ineffective in 30% of individuals) elicited different decisions in healthy individuals.[11] In that study, a negatively framed explanation led to a lack of willingness for HPV vaccination, indicating that uncertain options tend to be chosen if medical problems are presented in a negative frame.

Our logistic regression analysis showed that low levels of conscientiousness were the strongest predictor of the choice of treatment certainty (β = −0.44, z = −2.19, p = 0.03), indicating that individuals with low levels of conscientiousness more readily chose certain treatment options. Individuals with high levels of conscientiousness are organized, careful, and avoid counterproductive decisions.[12,13] Among the Big Five personality traits, individuals with high scores on agreeableness and conscientiousness have been reported to be the least likely to choose uncertain treatment,[14,15] whereas individuals with high scores on neuroticism, extraversion, and openness to experience have been reported to be more likely to choose uncertain treatment.[15,16] However, the results of our present study suggest that individuals who make adaptive decisions in normal daily life may paradoxically make maladaptive decisions, such as choosing uncertain treatment options. Our findings are consistent with the results of our previous functional magnetic resonance imaging study.[17] We believe that such studies offer clues to the psychological mechanisms underlying therapeutic decision-making.

There were several limitations of the current study. Among other issues, all the data were obtained from a single hospital with a small sample size, so the results may not be generalizable.

In conclusion, we showed that low levels of conscientiousness (a personality trait) predicts the choice of certain (topical) treatment of glaucoma after an explanation in a negative context.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

Dr Fumitoshi Kodaka reports grants and/or personal fees from Janssen Pharmaceutical K.K., Lundbeck, MEIJI Seika Pharma Co., Ltd., Santen Pharmaceutical, and Mochida Pharmaceutical Co., Ltd., outside the submitted work. KH is an employee of Santen Pharmaceutical Co., Ltd. The authors report that they have no other conflicts of interest in this work.

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