

Research Report

Personality Affects Aspects of Health-Related Quality of Life in Parkinson's Disease via Psychological Coping Strategies

Stephanie R. Whitworth^{a,b}, Andrea M. Loftus^{b,c}, Timothy C. Skinner^d, Natalie Gasson^c, Roger A. Barker^{a,e}, Romola S. Bucks^{b,*,1} and Meghan G. Thomas^{a,f,1}

^a*Parkinson's Centre (ParkC), Edith Cowan University, Australia*

^b*School of Psychology, University of Western Australia, Australia*

^c*School of Psychology and Speech Pathology, CHIRI, Curtin University, Australia*

^d*Rural Clinical School, University of Tasmania, Australia*

^e*Department of Clinical Neuroscience, University of Cambridge, Addenbrooke's Hospital, Cambridge, UK*

^f*Experimental and Regenerative Neuroscience, School of Animal Biology, University of Western Australia, Australia*

Abstract.

Background: Personality traits influence health-related quality of life (HRQoL) in Parkinson's disease (PD). Further, an individual's personality traits can influence the strategies they use to cope with a particular stressful situation. However, in PD, the interplay between personality traits, choice of coping strategy, and their subsequent effect on HRQoL remains unclear.

Objective: The objective of this study was to examine whether personality (neuroticism and extraversion) indirectly affects HRQoL through the use of specific psychological coping strategies.

Methods: One hundred and forty-six patients with PD completed questionnaires on personality (Big Five Aspects Scale; BFAS), coping (Ways of Coping Questionnaire; WCQ), and mood-specific (Depression, Anxiety and Stress Scale; DASS-21) and disease-specific HRQoL (Parkinson's Disease Questionnaire; PDQ-39).

Results: After controlling for gender, age at diagnosis, and age at testing, the emotion-focused coping strategy of escape-avoidance was significantly correlated with neuroticism and certain aspects of HRQoL (cognitive impairment and social support). This suggests that neurotic personality traits may negatively impact on some aspects of HRQoL due to an increased use of escape-avoidance coping strategies. By contrast, planned problem-solving and escape-avoidance coping strategies were both significantly linked to extraversion and interpersonal and mood-related domains of HRQoL. This suggests that extraversion may positively impact on some aspects of HRQoL due to patients adopting greater planned, problem-solving coping strategies, and using fewer escape-avoidance coping mechanisms.

Conclusions: Psychological interventions aimed at targeting maladaptive coping strategies, such as the use of escape-avoidance coping, may be effective in minimising the negative impact of neuroticism on HRQoL in PD.

Keywords: Parkinson disease, coping skills, personality, extraversion (psychology), quality of life

INTRODUCTION

Parkinson's disease (PD) is a chronic, progressive, neurodegenerative disorder affecting up to 9.3 million individuals worldwide by 2030 [1]. It is characterised

¹Joint supervising last authors.

*Correspondence to: Professor Romola S. Bucks, School of Psychology, University of Western Australia, Australia. Tel.: +61 8 6488 3232; Fax: +61 8 6488 1006; E-mail: romola.bucks@uwa.edu.au.

by the motor features of tremor, rigidity, bradykinesia, and gait disturbance as well as psychiatric and cognitive features including depression, anxiety, and deficits in executive and visuospatial function [2–5].

Health-related quality of life (HRQoL) is a multi-dimensional construct encompassing physical (i.e. activities of daily living, pain, mobility, sleep), psychological (including mood, spirituality and cognitive deficits), social support, and environmental (i.e. finances, accessibility of services and transport, and opportunities for participation) features [6]. While the physical symptoms of PD are established predictors of poor HRQoL [7, 8], individual differences in factors such as personality and coping styles have recently also been shown to impact on HRQoL above and beyond the effects of physical symptoms [7, 9]. A greater understanding of how these individual differences influence the different aspects of HRQoL may be useful for better managing some aspects of this disease.

Personality traits influence the way in which an individual approaches and interprets life circumstances and, by so doing, how such events impact on satisfaction with life [10, 11]. Commonly explored personality traits in the PD literature include neuroticism and extraversion, where individuals high in neuroticism tend to see the negative or threatening features of situations, and extraverts are characterised by expressive and outgoing tendencies, and a tendency to actively approach problems [12]. These two types of personality are known to significantly influence HRQoL in older adults both with and without PD [7]. In particular, individuals with higher levels of neuroticism, report poorer global HRQoL and more severe physical symptoms [10]. In PD, some preliminary studies have also reported that higher levels of neuroticism are significantly associated with poorer psychological outcomes in the HRQoL domains of emotional well-being, social support, stigma, and communication [7]. Conversely, individuals with higher levels of extraversion have higher global HRQoL [10] and better interpersonal outcomes in the domain of communication [7].

Psychological coping strategy use also significantly predicts HRQoL outcomes in PD [13], and is defined as the cognitive and behavioural efforts to manage psychological stress [14]. Individuals cope with stress in a number of different ways, for example, by actively approaching the problem and seeking a solution to manage it (problem-focused coping, e.g. seeking information), or by trying to reduce their negative emotions (emotion-focused coping) in response to the problem (e.g. avoidance or distraction) [14, 15]. We have

demonstrated that the use of emotion-focused strategies, for example escape-avoidance coping (attempts to avoid a problem/situation), significantly predicts poorer psychological aspects of HRQoL including emotional well-being, stigma, and social support [9]. In contrast, use of problem-focused strategies, such as planned problem-solving (efforts to improve a situation using logic) reduce psychological distress and maximise HRQoL in the domains of bodily discomfort, cognitive impairment, and communication [9].

Despite their independent contribution to HRQoL in PD, the combined impact of personality and coping strategy selection on HRQoL in PD has not been explored. In the chronic disease literature it has been suggested that there may be a relationship between personality and HRQoL because of the coping strategies an individual adopts (i.e. that coping may be a mediator), because personality influences both coping choice and coping effectiveness [16, 17], which in turn impacts on HRQoL. In separate studies of patients with multiple sclerosis and healthy controls, individuals who reported more neurotic personality traits tended to use more emotion-focused, and fewer planned problem-solving coping strategies [17, 18]. Conversely, extraversion predicted greater use of problem-focused adaptive strategies [17, 18]. Exploration of these relationships in PD may offer significant insights into how to maximise HRQoL.

This study examined the relationship between coping strategies and personality and HRQoL in PD. Based on the findings of previous studies, we hypothesised that: 1) individuals high in neuroticism would have poorer mood-related, emotional well-being, social support and stigma HRQoL, due to their greater use of emotion-focused coping strategies and, 2) individuals high in extraversion would report better communication, stigma, and social support HRQoL, due to their greater use of problem-focused coping strategies.

METHOD

Participants

One hundred and sixty-four patients with idiopathic PD (as diagnosed by a neurologist or geriatrician using United Kingdom Parkinson's Disease Society Brain Bank Clinical Criteria (UKPDSBBC) for a diagnosis of PD [19]) participated in this study. Patients were excluded if they had significant cognitive impairment (Mini-Mental State Examination ≤ 23 [20]), did not meet UKPDSBBC criteria or were unable to complete cognitive assessments ($N = 18$). The final sample

Table 1
Sample characteristics of the PD cohort

	Mean (SD)	Range
Sex (M/F)	92M/54F	
Age at testing (years)	64.62 (9.59)	37–85
Disease duration (years)	5.22 (4.53)	0–21
Education (years)	12.48 (3.40)	3–22
Mini-Mental State Examination score	27.7 (1.70)	24–30
Taking medication:		
- Levodopa, <i>n</i> (%)	87 (60)	
- Anxiolytic and/or anti-depressant medication, <i>n</i> (%)	12 (10.8)	

Note. SD = standard deviation.

included 146 participants and their characteristics can be seen in Table 1. All participants reported some degree of depressive and anxious symptoms (mild to extremely severe, ≥ 10 ; (18)), with 20% reporting mild to extremely severe stress (≥ 10).

Procedure

Participants were mailed a questionnaire pack to complete at home prior to undertaking a neuropsychological and motor assessment at either the Parkinson's Centre (ParkC) at Edith Cowan University, or during a home visit, with the participant in the "on" state. Assessment took approximately 2–2.5 hours. Approval for this study was obtained from the Human Research Ethics Committee, Edith Cowan University, and all participants gave written, informed consent.

Measures

Participants completed a demographics questionnaire that included information on age, sex, employment status, marital status, education level, general medical history, smoking status, age at disease onset, disease duration, and current medication use.

Personality characteristics were assessed using the Big Five Aspects Scale (BFAS) [21], which identifies five major personality traits: 'neuroticism' (Cronbach's α in this study = 0.81; used in this study); 'extraversion' ($\alpha = 0.89$; used in this study); 'conscientiousness' ($\alpha = 0.81$); 'agreeableness' ($\alpha = 0.78$); and 'openness/intellect' ($\alpha = 0.84$).

The Revised Ways of Coping Questionnaire (WCQ) [22] assessed the degree to which an individual adopts certain thoughts and behaviours to cope with a stressful event experienced in the past week. 'Stressful' was defined as a situation that was difficult or troubling, because of the distress it caused or the effort required to deal with it. The WCQ includes eight coping domains, which can be split into emotion-focused coping strate-

gies: 'escape avoidance' coping (8 items; $\alpha = 0.73$); 'distancing' (6 items; $\alpha = 0.69$); and 'self-controlling' coping (7 items; $\alpha = 0.71$); problem-focused coping strategies: 'confrontive coping' (6 items; $\alpha = 0.68$) and 'planned problem-solving' (6 items; $\alpha = 0.80$); and other coping strategies: 'accepting responsibility' (4 items; $\alpha = 0.61$); and 'positive reappraisal' (7 items; $\alpha = 0.75$). The domain of 'seeking social support' falls under both problem- and emotion-focused strategies (6 items; $\alpha = 0.72$). Relative scores for each domain were computed by calculating the mean of raw scores and dividing this scale mean by the sum of the means for all other scales [23]. The final score indicates the proportion of effort for each coping process *in relation* to all scales combined. This controls for unequal numbers of items within scales and differences in the degree to which individuals report using coping across all the strategies [15, 23].

PD-specific aspects of HRQoL were assessed using the Parkinson's Disease Questionnaire (PDQ-39; [24]). This evaluates the degree to which a participant has experienced health-related difficulties across eight dimensions: mobility (10 items; $\alpha = 0.93$), activities of daily living (6 items; ADL; $\alpha = 0.80$), emotional well-being (6 items; $\alpha = 0.82$), stigma (4 items; $\alpha = 0.80$), social support (3 items; $\alpha = 0.72$), cognitive impairment (4 items; $\alpha = 0.67$), communication (3 items; $\alpha = 0.81$) and bodily discomfort (3 items; $\alpha = 0.75$).

The shortened form of the Depression, Anxiety and Stress Scale (DASS-21; [25]) was used as the primary index of mood-related HRQoL. It measures depression (7 items; $\alpha = 0.88$), anxiety (7 items; $\alpha = 0.69$) and stress (7 items; $\alpha = 0.73$) and provides a valid measure of negative affect (23). Total scores were doubled to be comparable to full-length DASS scores [25].

Statistical analysis

A series of mediation models examined the effect of coping processes on the relationship between personality and HRQoL, using Preacher & Hayes' (2008) indirect regression method. Bootstrapping analysis was used to calculate 95% bias corrected confidence intervals (CI) using 5000 bootstrap samples [26]. Demographic variables which correlated significantly with HRQoL, or for which there were significant group differences, were entered as a covariate into each model. Statistical significance was set at 0.05. As the relationships between personality, coping and HRQoL were predicted *a priori*, no adjustments were made for multiple comparisons. Coping processes were selected for inclusion as mediator variables if they were

Table 2
Descriptive statistics for coping processes, personality and HRQoL variables in PD cohort

Variable	Mean (SD)	Range
Coping (WCQ)		
Confrontative	9.7 (5.4)	0–26.6
Distancing	13.6 (6.2)	0–40.5
Self-controlling	15.2 (5.7)	4.1–49.9
Seeking social support	14.1 (8.2)	0–45.5
Accepting responsibility	10.8 (6.6)	0–33.9
Escape-avoidance	7.9 (5.7)	0–34.4
Planned problem solving	17.1 (8.0)	0–38.8
Positive reappraisal	11.6 (6.5)	0–49.9
PD specific HRQoL (PDQ-39)		
Mobility	21.0 (21.3)	0–85
ADL	20.7 (17.8)	0–88.3
Emotional well-being	20.5 (17.6)	0–75
Stigma	14.1 (18.2)	0–93.8
Social support	10.7 (15.2)	0–58.3
Cognitive impairment	23.7 (17.6)	0–75
Communication	18.3 (18.6)	0–75
Bodily discomfort	34.1 (23.3)	0–100
Total HRQoL	20.5 (12.9)	1.3–71.0
Personality (BFAS)		
Neuroticism	26.4 (5.9)	14–41.5
Extraversion	31.8 (5.1)	19–44
Mood-related HRQoL (DASS)		
Total negative affect	21.5 (18.0)	0–106
Depression	6.3 (6.8)	0–34
Anxiety	7.2 (5.8)	0–34
Stress	8.0 (7.4)	0–38

Note. SD = standard deviation; WCQ = Ways of Coping Questionnaire [22], higher scores indicate more use of that coping process; PDQ-39 = Parkinson's Disease Questionnaire [24], higher scores indicate worse HRQoL; ADL = activities of daily living; BFAS = Big 5 Aspects Scale [21], higher scores indicate more presence of that personality trait; DASS = Depression, Anxiety and Stress Scale [25].

significantly associated at the bivariate level with a) neuroticism and/or extraversion, and b) HRQoL.

RESULTS

Descriptive statistics for personality, coping and HRQoL measures are presented in Table 2.

Significant sex differences were found in PDQ-39 scores for activities of daily living (ADL), males = 23.19 ± 18.46 , females = 16.51 ± 15.85 , $t(140) = 2.19$, $p = 0.030$; emotional well-being, males = 16.85 ± 16.20 , females = 27.08 ± 18.18 , $t(140) = -3.47$, $p = 0.001$; and bodily discomfort, males = 29.64 ± 21.17 , females = 42.5 ± 24.64 , $t(136) = -3.23$, $p = 0.002$. Those taking dopaminergic medications reported significantly poorer mobility HRQoL (20.03 ± 20.72) than those not taking dopaminergic medications (10.8 ± 11.56), $t(94) = -2.69$, $p = 0.009$; as well as greater cognitive impairment, on meds = 25.96 ± 18.2 , no meds = 10.8 ± 11.56 ,

$t(94) = -2.69$, $p = 0.009$ and, not surprisingly, those taking dopaminergic medications had significantly longer disease duration ($5.40 \text{ years} \pm 4.60$) than those not on medication ($1.39 \text{ years} \pm 0.98$), $t(96) = -2.88$, $p = 0.005$. There were no significant sex or medication differences for mood HRQoL (DASS scales) or for any coping strategy.

Participants who were older at diagnosis reported significantly better stigma and communication HRQoL (Table 3). Similarly, older age at testing was significantly associated with lower self-reported stigma HRQoL. In contrast, participants with longer disease duration reported significantly poorer HRQoL in the domains of mood, ADL, mobility, cognitive impairment, communication, and bodily discomfort.

Pearson's correlations assessed the relationships between personality, coping processes and HRQoL outcome measures and identified potential confounding variables (Table 3).

Personality and HRQoL

Higher levels of neuroticism significantly correlated with poorer HRQoL in the domains of mood, emotional well-being, stigma, and social support (Table 3). Higher neuroticism scores also significantly correlated with decreased mobility, poorer ADL, greater cognitive impairment, poorer communication, and greater bodily discomfort HRQoL. Higher extraversion scores significantly correlated with better interpersonal HRQoL in the domains of social support and communication as well as with better mood-related HRQoL, greater emotional well-being, less stigma, and better cognitive impairment HRQoL.

Coping strategies and HRQoL

Greater use of escape-avoidance coping strategies significantly correlated with poorer emotional HRQoL in the domains of emotional well-being, stigma, and social support (Table 3) as well as poorer mobility and cognitive impairment HRQoL. Unexpectedly, greater use of planned problem-solving coping strategies correlated with reduced psychological distress, as indexed by mood-related and emotional well-being HRQoL, as well as with greater bodily discomfort HRQoL measures.

Personality and coping strategies

Higher levels of neuroticism significantly correlated with greater use of escape-avoidance coping strategies

Table 3

Correlations between demographic/physical variables, BFAS personality domains, coping processes, and HRQoL outcome measures in PD cohort

	Mood-related QoL		Health-related QoL (PDQ-39)						
	DASS total	Mobility	ADL	Emotional well-being	Stigma	Social support	Cognitive impairment	Communication	Bodily discomfort
Demographic/physical									
Age at testing	-0.08	0.11	0.08	-0.15	-0.26	-0.11	0.04	-0.16	-0.05
Age at diagnosis	-0.18	-0.06	-0.06	-0.16	-0.29	-0.15	-0.11	-0.28	-0.12
Disease duration	0.25	0.36	0.33	0.07	0.14	0.13	0.33	0.32	0.20
MMSE	-0.05	-0.06	-0.07	0.01	-0.05	0.04	-0.12	-0.10	0.01
Personality (BFAS)									
Neuroticism	0.65	0.22	0.18	0.58	0.34	0.31	0.35	0.34	0.24
Extraversion	-0.36	-0.12	-0.14	-0.30	-0.22	-0.19	-0.29	-0.33	-0.13
Coping processes (WCQ)									
Confrontative	-0.04	-0.07	0.08	-0.13	-0.01	0.08	-0.11	0	0
Distancing	0.09	0.08	0.03	0.06	0.08	0.02	0	0.02	0.06
Self-controlling	-0.12	-0.05	-0.14	-0.14	-0.11	0	-0.04	0	0.03
Social support	-0.15	-0.06	-0.04	-0.02	-0.03	-0.12	-0.04	-0.11	-0.03
Accepting responsibility	0.30	0.12	0.17	0.20	-0.05	-0.04	0.17	0.10	0.07
Escape-avoidance	0.35	0.22	0.13	0.34	0.26	0.33	0.27	0.25	0.14
Problem solving	-0.29	-0.19	-0.18	-0.21	-0.03	-0.17	-0.16	-0.11	-0.21
Positive reappraisal	-0.02	0	0	-0.08	-0.08	0.03	-0.06	-0.08	0.04

Note. DASS = Depression, Anxiety and Stress Scale [25], higher scores indicate more depression; PDQ-39 = Parkinson's Disease Questionnaire [24], higher scores indicate worse HRQoL; ADL = activities of daily living; BFAS = Big 5 Aspects Scale [21]; WCQ = Ways of Coping Questionnaire [22], higher scores indicate more use of that coping process. All significant correlations are in bold. Correlations significant at $p < 0.01$ (two tailed) are also in italics.

and less use of problem-solving strategies (Table 4). Higher levels of extraversion significantly correlated with the greater use of problem-solving strategies (positive reappraisal) and less use of escape-avoidance and self-controlling coping strategies.

Relationship between coping strategies

There was a significant, moderate, negative correlation between the relative use of escape-avoidance and the ability to adopt a problem-solving coping strategy, $r(105) = -0.53, p < 0.001$. This indicates that those individuals who adopted more problem-solving strategies were less likely to report escape-avoidance coping processes when dealing with stressful life events.

Extraversion, problem-solving coping strategy use and mood-related HRQoL

A mediation model examined the role of planned problem solving in the relationship between extraversion and mood-related HRQoL (Table 5a). After controlling for gender, the model explained 26% of the variance in mood-related HRQoL, $F(4, 104) = 9.26, p < 0.001$. That is, extraversion was a significant, independent predictor of mood-related HRQoL measures. Bootstrapping then revealed a significant, negative indirect effect (*path ab*; bootstrapped indirect path = $-1.37, CI = -3.72$ to -0.28), indicating

Table 4

Correlation matrix for predicted relationships between personality and coping processes in PD cohort.

	Neuroticism	Extraversion
Confrontative	-0.02	0.14
Distancing	0.05	-0.17
Self-controlling	-0.08	-0.28
Social support	-0.09	0.10
Accepting responsibility	0.12	-0.11
Escape-avoidance	0.43	-0.22
Problem solving	-0.30	0.20
Positive reappraisal	-0.03	0.21

Note. All significant correlations are in bold. Correlations significant at $p < 0.01$ (two tailed) are also in italics.

that greater use of planned problem-solving coping strategies partially explains the relationship between extraversion and mood-related HRQoL.

Extraversion, escape-avoidance coping strategy use and HRQoL

A series of mediation models assessed how escape-avoidance coping strategies relate to extraversion and aspects of HRQoL. After controlling for gender, 23% of the variance in emotional well-being HRQoL was explained, $F(3, 108) = 11.14, p < 0.001$. That is, extraversion was a significant, independent predictor of emotional well-being HRQoL. Bootstrapping then revealed a significant, negative, indirect

Table 5
Mediation models for predicted relationships between personality, coping, and HRQoL in PD

Model	Covariate	Predictor	Mediator	DV	<i>a</i>	<i>b</i>	<i>c</i>	<i>c'</i>
A	Age at diagnosis, disease duration	Extraversion	Problem-solving	Mood-related	B = 3.40 [†]	B = -0.42 [†]	B = -14.19 [‡]	B = -12.78 [‡]
B	Gender	Extraversion	Escape-Avoidance	Emotional well-being	B = -2.55 [†]	B = 0.85 [‡]	B = -10.67 [‡]	B = -8.51 [‡]
C	Age at diagnosis, age at testing	Extraversion	Escape-avoidance	Stigma	B = -2.50 [†]	B = 0.64 [†]	B = -6.52 [†]	B = 0.15, <i>ns</i>
d		Extraversion	Escape-avoidance	Social support	B = -2.42 [†]	B = 0.80 [‡]	B = -4.53, <i>ns</i>	B = -2.59, <i>ns</i>
e	Age at diagnosis, disease duration	Extraversion	Escape-avoidance	Communication	B = -2.35 [†]	B = 0.56 [†]	B = -9.96 [‡]	B = -8.64 [‡]
f		Extraversion	Escape-avoidance	Mood-related	B = -2.51 [†]	B = 0.92 [‡]	B = -13.53 [‡]	B = -11.23 [‡]
g		Neuroticism	Escape-avoidance	Social support	B = 4.53 [‡]	B = 0.57 [†]	B = 9.28 [‡]	B = 6.71 [†]
h	Disease duration, medication use	Neuroticism	Escape-avoidance	Cognitive impairment	B = 4.36 [‡]	B = 0.91 [‡]	B = 10.56 [‡]	B = 6.60, <i>ns</i>

Note. DV = dependent variable; *ns* = non-significant; [†] = significant at $p < 0.05$, [‡] = significant at $p < .01$; *a* = path between the predictor and the mediator; *b* = path between the mediator and the dependent variable, controlling for the predictor; *c* = direct path between the predictor and the dependent variable; *ab* = indirect path (via the mediator) between the predictor and the dependent variable; *c'* = path between the predictor and the dependent variable, controlling for the mediator.

effect (*path ab*; bootstrapped indirect path = -2.28, CI = -5.42 to -0.53), indicating that greater use of escape-avoidance coping partially accounts for the relationship between extraversion and emotional well-being HRQoL. Greater extraversion significantly correlated with less use of escape-avoidance coping, which in turn was associated with greater emotional well-being HRQoL.

In the second model, after controlling for age at diagnosis and age at cognitive testing, 15% of the variance in stigma HRQoL was explained by extraversion measures, $F(4, 102) = 4.52$, $p = 0.002$. Bootstrapping revealed a significant, negative indirect effect (*path ab*; bootstrapped indirect path = -1.74, CI = -5.14 to -0.19). When escape-avoidance coping was added, extraversion no longer significantly predicted stigma HRQoL, indicating full mediation. That is, greater extraversion significantly correlated with less use of escape-avoidance coping, which in turn was associated with greater stigma HRQoL and this entirely accounted for the impact of extraversion on stigma HRQoL.

In the third model, extraversion accounted for 11% of the variance in social support HRQoL, $F(2, 99) = 6.29$, $p = 0.003$. Bootstrapping revealed a

significant, negative, indirect effect (*path ab*; bootstrapped indirect path = -2.14, CI = -5.79 to -0.27). As with stigma, extraversion negatively impacts on social support entirely through its influence on the use of more escape-avoidance coping strategies. Greater extraversion significantly predicted less use of escape-avoidance coping, which in turn was associated with greater social support HRQoL.

In a fourth model, after controlling for age at diagnosis and disease duration, 23% of the variance in communication HRQoL was explained by extraversion, $F(4, 104) = 7.90$, $p < 0.001$. Bootstrapping revealed a significant, negative, indirect effect (*path ab*; bootstrapped indirect path = -1.42, CI = -4.26 to -0.08). When escape-avoidance coping was added into the model, extraversion remained a significant predictor of HRQoL, indicating partial mediation. That is, greater extraversion significantly predicted less use of escape-avoidance coping, which in turn partially accounted for better communication HRQoL.

Finally, extraversion explained 28% of the variance in mood-related HRQoL, $F(3, 109) = 14.09$, $p < 0.001$. Bootstrapping revealed a significant, negative indirect

effect (*path ab*; bootstrapped indirect path = -2.43 , CI = -5.59 to -0.56). When escape-avoidance coping was added, extraversion remained a significant predictor of mood-related HRQoL, indicating partial mediation. Thus, higher levels of extraversion significantly predicted less use of escape-avoidance coping, which in turn partially accounted for better mood-related HRQoL.

Neuroticism, escape-avoidance coping strategy use and HRQoL

The first mediation model showed that neuroticism accounted for 16% of the variance in social support HRQoL, $F(2, 99) = 9.14$, $p < 0.001$. Bootstrapping revealed a significant, positive indirect effect (*path ab*; bootstrapped indirect path = 2.79 , CI = 0.10 to 6.47). When escape-avoidance coping was added, neuroticism significantly predicted HRQoL, indicating partial mediation. Higher levels of neuroticism significantly predicted greater use of escape-avoidance coping strategies, which in turn partially accounted for poorer perceived social support HRQoL.

In the second model, after controlling for disease duration and medication use, 38% of the variance in cognitive impairment HRQoL was explained by neuroticism, $F(4, 70) = 10.62$, $p < 0.001$. Bootstrapping revealed a significant, positive indirect effect (*path ab*; bootstrapped indirect path = 4.18 , CI = 0.28 to 8.34). When escape-avoidance coping was added, neuroticism no longer significantly predicted cognitive impairment HRQoL, indicating full mediation. Greater neuroticism was significantly associated with greater use of escape-avoidance coping, which in turn was associated with poorer cognitive impairment HRQoL and this entirely accounted for the impact of neuroticism on cognitive impairment HRQoL.

DISCUSSION

This study examined how coping strategies may account for the relationship between personality and a range of domains of HRQoL in PD. As was predicted, personality significantly correlated with HRQoL, thus supporting and extending previous studies in PD [7, 27]. Importantly, we have demonstrated that neuroticism and extraversion significantly predict the use of psychological coping strategies in PD.

These results confirm and extend previous studies which have shown that individuals who are more extraverted or who are less emotionally stable (neu-

rotic) differ in their coping strategies [17, 18, 28]. Thus, personality characteristics appear to influence both coping choice and coping effectiveness for the alleviation of this stress [16], as well as how adaptive or maladaptive these choices prove to be [14]. Escape-avoidance and problem-solving coping strategies differentially mediate the relationship between personality and HRQoL. That is, coping strategy use either wholly or partially explained the relationships between neuroticism or extraversion and all domains of HRQoL examined.

Greater extraversion was consistently associated with better emotional or mood-related HRQoL through greater use of planned problem-solving coping (accounting for some of the relationship, but not all) and through less use of escape-avoidance coping (accounting for some of the relationship for both mood-related and emotional well-being HRQoL). Contrary to our prediction of wholly mediated effects, these findings show that whilst some of the impact of personality on emotional well-being is because of the type of coping strategies used by individuals with that personality, some of the effect is direct. Similarly, individuals who were more extravert reported better HRQoL related to communication with others, partly because of their lower use of escape-avoidance coping. Likewise, individuals who were more neurotic had poorer social support HRQoL, partly because of their greater use of escape-avoidance coping. Again, we had predicted wholly mediated relationships. By contrast, and as predicted, greater use of escape-avoidance coping entirely explained the fact that more extravert individuals had lower stigma, and better social support HRQoL, as well as entirely explaining the fact that more neurotic individuals had lower cognitive impairment HRQoL.

Critically, the effect of extraversion on emotional well-being, stigma, social support, communication, and mood-related HRQoL was via less use of escape-avoidance coping. This is particularly important, as this coping strategy can be both an emotion-focused coping strategy (regulating emotional responses to stressors) and an avoidant strategy (avoidance of the stressful situation) [14]. Thus, the effects of escape-avoidance coping on various aspects of HRQoL can differ.

The finding that coping strategy use wholly or partially mediates the relationship between personality and HRQoL has important clinical implications. By targeting maladaptive coping strategies or by facilitating the use of existing, adaptive coping strategies, interventions such as problem-solving skills training or mindfulness training, may be effective in maximising HRQoL in different personalities affected by PD.

Some limitations of our study should be noted. Firstly, the results presented in this manuscript are of a cross-sectional nature and therefore the direction of the effects found could be reversed. However, we are following this cohort longitudinally which will allow for clarification of the direction of the relationships between personality, coping, and HRQoL. This will enable us to determine if personality impacts on HRQoL through coping strategy use rather than, those with poorer HRQoL becoming more neurotic because they have greater negative emotional experiences. Secondly, an area of great interest is in determining if the relationship between personality, coping, and HRQoL remains stable over the disease course [29], given that there is preliminary evidence to suggest that the health burden of the disease may fundamentally affect personality [29]. Finally, this study measured situation-specific psychological coping strategies and the effectiveness of such strategies is known to be dependent not only on the individual, but also on the type of stressful situation experienced [14]. Therefore, the context in which individuals apply coping strategies may differentially impact HRQoL, and a minor modification of the WCQ to assess both disease-specific and situation-specific stressors would help clarify this relationship.

CONCLUSIONS

This study considered the combined role of personality and coping strategies when evaluating HRQoL outcomes in PD. We demonstrated that personality indirectly influenced HRQoL partially or wholly via the selection of specific coping strategies adopted by those individuals. These results suggest that psychological interventions aimed at targeting maladaptive coping strategies may be effective in improving HRQoL in PD. Further research exploring this possibility is required.

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CONFLICT OF INTEREST

The authors have no conflict of interest to report.

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