

Activities of Daily Living, Depression, and Quality of Life in Parkinson's Disease

Dissertation submitted by

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as partial fulfillment of the requirements for the Degree of Bachelor of Psychology with Honours in the School of Psychology and Speech Pathology at Curtin University, Western Australia.

### Declaration

I declare that this honours dissertation is my own work and has not yet been submitted in any form for another degree or diploma at any university or other institute of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

31<sup>st</sup> October 2013

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### Abstract

This study examined whether activities of daily living (ADL) mediated the relationship between depression and health-related quality of life (HR-QOL) in people with Parkinson's Disease (PD). A cross-sectional correlational research design examined data from 274 participants, who completed the Geriatric Depression Scale (GDS-15), Parkinson's Disease Questionnaire-39 (PDQ-39), and Unified Parkinson's Disease Rating Scale-section 2 (UPDRS-section 2 [ADL]). Multiple Regression Analysis (MRA) was used to examine the mediator model. Results found that ADL did not reduce the relationship between depression and HR-QOL to the extent at which a partial mediation effect could be declared. However, a significant ( $p <.001$ ) indirect effect of ADL on the depression and HR-QOL relationship remained evident. The magnitude of this effect was moderate  $R^2 = .13$ . This result suggests that people with PD, who experience depressive symptoms, also experience greater difficulty completing ADL, which impacts upon their HR-QOL. It is recommended that clinicians develop a clear understanding of the relationships between depression, ADL, and HR-QOL, to ensure that people with PD receive a multidisciplinary approach to care.

Parkinson's disease (PD) is one of the most prevalent neurological disorders in Australia, with over 64,000 people living with PD in 2011 (Access Economics, 2011). In addition to the cardinal motor symptoms of tremor, bradykinesia, rigidity, and gait disturbance, approximately 42% of people with PD experience comorbid depressive symptoms (Ishihara & Brayne, 2006). Research suggests that comorbid depression in PD adversely impacts a persons' health-related quality of life (HR-QOL) and may worsen their ability to complete activities of daily living (ADL) independently (Dissanayaka et al., 2011; Klepac et al., 2010).

Many people with PD experience poor motor function, body discomfort and pain, which can lead to social isolation and negatively impact HR-QOL (Schrag, 2006). The negative relationship between depression and HR-QOL in PD often surpasses the motor symptoms (Quelhas & Costa, 2009). Schrag et al. (2000) examined the impact of depression on HR-QOL in PD. Those with 'high levels' of depression demonstrated significantly lower HR-QOL than participants without depression (Schrag et al., 2000). This suggests that depression is a stronger predictor of HR-QOL in PD than motor symptoms alone (Schrag et al., 2000).

Carod-Artal, Ziolkowski, Mourao, and Martinez-Martin (2008) and Quelhas and Costa (2009) assessed the impact of depression on quality of life in PD. Both studies found that depressed participants scored worse on a measure of HR-QOL compared to non-depressed participants (Carod-Artal et al., 2008; Quelhas & Costa, 2009). Qin et al. (2009) examined the relationship between motor (e.g. tremor) and non-motor (e.g. depression) symptoms and HR-QOL in PD. Results indicated that non-motor symptoms accounted for 61.7% of the variance in HR-QOL scores, compared to motor symptoms which accounted for 18.9% (Qin et al., 2009). Soh et al. (2011) completed a systematic review of the most significant contributors to HR-QOL in PD. Nineteen of the 29 studies included examined the impact of depression on HR-QOL and all found that depression was the greatest significant predictor of HR-QOL (Soh et al., 2011). Furthermore, disability of daily functioning was identified in eight studies as a significant predictor of HR-QOL in PD (Soh et al., 2011). These findings suggest that depressive symptoms and the inability to complete ADL independently, significantly impact upon the HR-QOL of a person with PD (Soh et al., 2011).

Activities of Daily Living (ADL) are increasingly difficult for people with PD (Wichowicz, Slawek, Derejko, & Cubala, 2006). However, there has been limited research into the relationship between ADL and depression in PD (Dissanayaka et al., 2011). Papapetropoulos, Ellul, Argyriou, Chroni, and Lekka (2006) investigated whether there were any significant differences between the ADL of depressed and non-depressed people with PD. Participants who were depressed scored significantly worse on measures of ADL than non-depressed (Papapetropoulos et al., 2006). Dissanayaka et al. (2011) found a stronger negative relationship between impairment in ADL and depression than the severity of motor symptoms in PD. Indicating that when the severity of depressive symptoms increase people with PD experience greater difficulty completing ADL (Dissanayaka et al., 2011).

Piccinni et al. (2012) examined the relationship between depression in people with PD and their degree of functional disability. Participants who were depressed scored significantly worse on measures of ADL compared to non-depressed participants (Piccinni et al., 2012). Participants with severe depression scored significantly worse on ADL than participants with either mild or moderate depression. The same difference was found between participants with moderate depression and those with mild (Piccinni et al., 2012). This study shows that not only does depression have a significant negative impact on ADL but the impact is worse if people are more severely depressed (Piccinni et al., 2012). In addition to the relationship between ADL and depression, research has identified a significant relationship between ADL and HR-QOL (Behari, Srivastava, & Pandey, 2005).

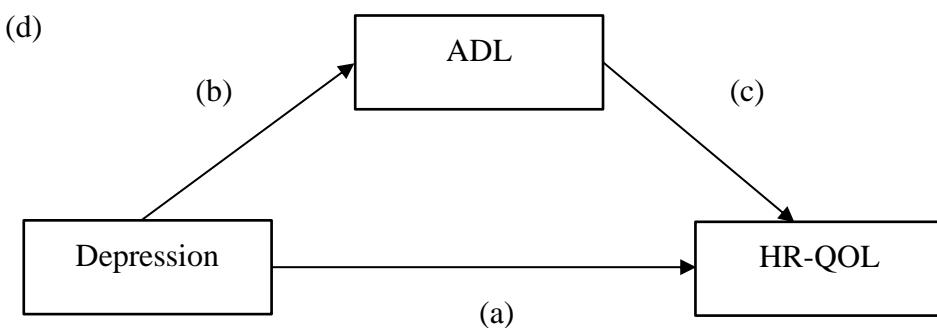
Carod-Artal, Vargas, and Martinez-Martin (2007) examined the determinants of HR-QOL in PD and found that participants with low ADL experience worse HR-QOL. Kleiner-Fisman, Stern, and Fisman (2010) evaluated the correlation between specific factors of PD and HR-QOL. The strongest relationship was between ADL and HR-QOL, suggesting that the loss of independence and inability to complete ADL independently may have a stronger negative relationship with HR-QOL than the motor symptoms of PD (Kleiner-Fisman et al., 2010).

Recent research has acknowledged the impact of motor and non-motor symptoms on everyday functioning in PD (Even & Weintraub, 2012). Rahman and colleagues (2008) examined the impact of PD symptoms on the HR-QOL of people with PD. Activities of Daily Living (ADL) were the only significant predictor of HR-QOL and depression

accounted for a significant 40.8% of the variance in HR-QOL (Rahman et al., 2008). These results indicate that ADL and depression independently predict poorer HR-QOL (Rahman et al., 2008).

Prior research has demonstrated that the negative relationship between depression and HR-QOL in PD often surpasses that of motor symptoms (Quelhas & Costa, 2009). Studies have identified the negative relationship between the severity of depressive symptoms and impairment in ADL and for people with PD, impairment in ADL often leads to poorer HR-QOL (Kleiner-Fisman, Stern, & Fisman, 2010; Piccinni et al., 2012). There has been limited research into the functional impact of ADL on HR-QOL in PD and no study to date has examined the impact of ADL on the relationship between depression and HR-QOL.

The present study examined whether ADL mediated the relationship between depression and HR-QOL in people with PD. The following hypotheses were proposed, (a) when controlling for age and gender, depression significantly predicts HR-QOL, (b) when controlling for age and gender, depression significantly predicts ADL, (c) when controlling for age and gender, ADL significantly predicts HR-QOL, and (d) when controlling for age and gender, ADL significantly mediates the relationship between depression and HR-QOL. This mediation model is presented in Figure 1.



*Figure 1.* A model of the relationship between depression and HR-QOL mediated by ADL.

## Method

### Research Design

A cross-sectional correlational research design examined the data previously collected at the Parkinson's Centre (ParkC) Cognitive and Motor Heterogeneity in

Idiopathic Parkinson's Disease Study at Edith Cowan University. A mediator model determined whether ADL mediates the relationship between depression and HR-QOL, after controlling for age and gender.

## Participants

People with idiopathic PD in Western Australia (WA) were invited to participate in the research project. Participants were recruited through advertising via Parkinson's WA, events such as the Parkinson's WA Unity Walk, community support groups, and referrals from neurologists and physicians. To be included in the research, the participants must have met the United Kingdom Parkinson's Disease Society Brain Bank Clinical Diagnostic Criteria which states that at least two of the three motor symptoms (bradykinesia, rigidity, tremor) must be present, combined with a response to levodopa medication to form a clinical diagnosis of PD (Bartels & Leenders, 2009; Hughes, Daniel, Kilford, & Lees, 1992). Participants were excluded from the study if they scored below 24 on the Mini Mental Status examination (MMSE; Folstein, Folstein, & McHugh, 1975). Based on previous research investigating depression, ADL, and HR-QOL in PD and a power analysis using G\*Power, an initial sample size of 107 participants was required to detect a medium effect size of .15 at an alpha level of .05 and power of .80 (Faul, Erdfelder, Buchner, & Lang, 2009). However, based upon Cohen's (1988) conventions a sample size greater than 200 participants would be ideal when predicting a moderate effect of .25 for the mediation effect. The final sample included 174 participants with 119 male and 55 female, ranging in age from 41 to 85 years ( $M = 65.96$ ,  $SD = 9.46$ ).

## Measures

The Geriatric Depression Scale (GDS-15), Parkinson's Disease Questionnaire-39 (PDQ-39), and Unified Parkinson's Disease Rating Scale-section 2 (UPDRS-section 2 [ADL]) measures were used in this study. Participants also completed a demographics questionnaire.

The GDS-15 is a self-report measure used to detect depression in older adults (Yesavage & Sheikh, 1986). The scale contains 15 questions which require the participants to answer "no" or "yes" and include items such as "*Do you feel pretty worthless the way you are now?*" (Yesavage & Sheikh, 1986). The GDS-15 is considered suitable for use in PD as it focuses on the social and psychological factors of depression and excludes the

shared somatic symptoms of PD, thereby removing some of the problems with symptom overlap (Schrag et al., 2007). Although each question can only be scored either “0” or “1” (so restricting the ability to distinguish a degree of depressive symptoms), the measure has successfully diagnosed minor and major depression in PD at a cut-off score of 4/5 (Schrag et al., 2007; Weintraub, Oehlberg, Katz, & Stern, 2006). Research has reported the internal consistency (Cronbach’s alpha) of the GDS-15 as high as .91 and a discriminant validity of .90 for sensitivity and .85 for specificity (Ertan, Ertan, Kızıltan, & Uygucgil, 2005; Weintraub, Saboe, & Stern, 2007).

The PDQ-39 contains 39 items across eight dimensions of HR-QOL (mobility, activities of daily living [ADL], emotional well-being, stigma, social support, cognitions, communication, and bodily discomfort; Peto, Jenkinson, & Fitzpatrick, 1998). Participants respond to each question by selecting either “never”, “occasionally”, “sometimes”, “often”, or “always (or cannot do at all)” with items including *“Felt worried about your future?”* and *“Had problems with your close personal relationships?”* (Peto, Jenkinson, Fitzpatrick, & Greenhall, 1995). Items are scored from “0 = never” to “4 = always (or cannot do at all)” and within each dimension the items are computed into a total score ranging from “0 = no problem” to “100 = maximum level of problem” (Peto et al., 1998). Higher scores indicate poorer HR-QOL. A summary index (SI) score (global measure of HR-QOL) is also calculated by summing the dimension scores and dividing by eight (Jenkinson, Fitzpatrick, Peto, Greenhall, & Hyman, 1997). In a recent review of HR-QOL measures in PD, Martinez-Martin et al. (2011) classified the PDQ-39 as a ‘recommended’ measure for use in both clinical trials and epidemiological studies. Research has reported Cronbach’s alpha for the eight dimensions ranging from .72 (bodily discomfort) to .85 (stigma) and .95 (mobility) (Hagell & Nygren, 2007). The internal consistency for the SI score has been reported as .82 (Tan, Luo, Nazri, Li, & Thumboo, 2004). Furthermore, Tan et al. (2004) established adequate discriminant and convergent validity correlations between the PDQ-39 items and their equivalent dimensions.

The UPDRS-section 2 (ADL) is the second subscale of the UPDRS which assesses ADL among people with PD (Goetz et al., 2008). The UPDRS-section 2 (ADL) is able to be completed by the participant or clinician during an interview and contains 13 items such as *“Over the past week, have people usually had trouble reading your handwriting?”* or *“Over the past week, have you had troubles with your speech?”* (Goetz et al., 2008). Each item is scored either “0 = normal”, “1 = slight”, “2 = mild”, “3 = moderate” and “4 =

severe”, with higher scores indicating greater severity of PD symptoms and greater interference with the participants’ ability to complete ADL independently (Martínez-Martín et al., 2003). The description given for each score within each item varies and is dependent upon the question being asked. Harrison et al. (2009) examined whether the UPDRS-section 2 (ADL) or the UPDRS-section 3 (motor) subscales were more accurate markers of disease progression in PD. The UPDRS-section 2 (ADL) subscale was found to be a more stable and sensitive measure of disease progression in both the cross-sectional and longitudinal samples (Harrison et al., 2009). Goetz et al. (2008) examined the psychometric properties of the UPDRS-section 2 (ADL) which reported an excellent Cronbachs alpha score of .90. Internal validity correlations indicate that the UPDRS-section 2 (ADL) subscale measures a distinct aspect of PD compared to the other subscales (Goetz et al., 2008).

### **Procedure**

After participants contacted ParkC, an information pack, including a cover letter and information sheet, was posted to them. Participants who then agreed to take part in the study were mailed a questionnaire pack and an assessment time was scheduled. Assessment times were scheduled during the participant’s ‘on’ stage of medication, which was one hour after they had taken their medication and they were feeling their best. On the day of assessment each participant was asked to bring the completed questionnaire pack and to allow approximately 2.5 hours for the cognitive and motor tasks. Each assessment was conducted by a trained research assistant who followed a transcript to maintain consistency across all participants. The motor task was recorded via video to check the accuracy of the scoring after the assessment. Participants were given a \$15 Coles/Myer gift card to thank them for contributing to the research. Only the GDS-15, PDQ-39 and UPDRS-section 2 (ADL) measures were used in the present study.

### **Results**

Bivariate correlations were conducted to determine whether age and gender significantly correlated with the variables of interest (depression, ADL, & HR-QOL). Gender yielded non-significant correlations and was excluded from subsequent analyses. Age significantly correlated with ADL and was included as a covariate. Descriptives and correlations are presented in Table 1.

Table 1

*Correlation Matrix for Study Variables*

| Variable                          | Mean  | SD    | 1     | 2      | 3      | 4 |
|-----------------------------------|-------|-------|-------|--------|--------|---|
| 1. Age                            | 65.96 | 9.46  | -     |        |        |   |
| 2. Depression                     | 3.20  | 2.86  | .049  | -      |        |   |
| 3. Activities of Daily Living     | .85   | .53   | .169* | .285** | -      |   |
| 4. Health-related Quality of Life | 19.25 | 12.44 | .046  | .633** | .597** | - |

Note. \* $p < .05$ . \*\* $p < .01$ . SD = Standard deviation.

Hierarchical Multiple Regression Analysis (MRA) was used to determine whether ADL mediates the relationship between depression and HR-QOL. All assumptions and prerequisite relationships for MRA were met (Baron and Kenny, 1986). Depression significantly correlated with HR-QOL and ADL. Activities of daily living (ADL) significantly correlated with HR-QOL. The mediation model is shown in Figure 2.

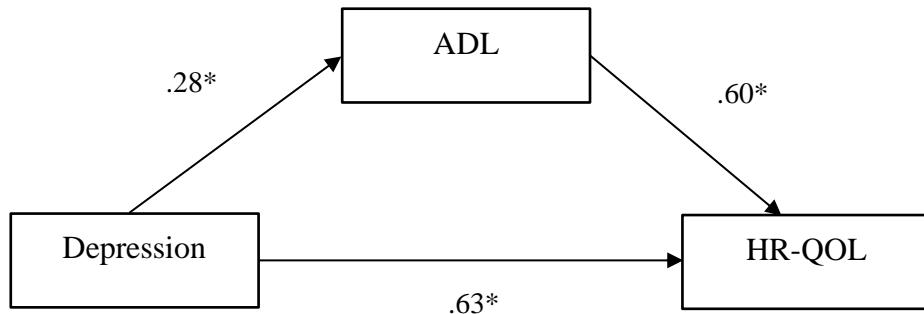


Figure 2. Proposed mediation model with corresponding pathway correlations.

Note. \* $p < .01$ .

The first MRA tested whether, when controlling for age, (a) depression significantly predicts HR-QOL and (c) ADL significantly predicts HR-QOL. Age was entered at step one and depression and ADL at step two. Age, depression, and ADL combined accounted for a significant 59.3% of the variance in HR-QOL,  $R^2 = .593$ , adjusted  $R^2 = .586$ ,  $F(3, 170) = 82.54$ ,  $p < .001$ . In support of hypothesis (a), depression accounted for a significant 23.33% of the variance in HR-QOL. Hypothesis (c) was also supported with ADL accounting for a significant 19.18% of the variance in HR-QOL. The respective path coefficients (beta) can be found in the Table 2.

Table 2

*Summary of Hierarchical Regression Model Analysis for Hypothesis A and C*

| Predictor                  | $\beta$ | B     | 95% CI     | Part Correlation |
|----------------------------|---------|-------|------------|------------------|
| Step 1                     |         |       |            |                  |
| Age                        | .046    | .061  | -.137-.258 | .046             |
| Step 2                     |         |       |            |                  |
| Age                        | -.057   | -.075 | -.204-.054 | -.056            |
| Depression                 | .504*   | 2.19  | 1.76-2.63  | .483             |
| Activities of Daily Living | .463*   | 10.82 | 8.43-13.21 | .438             |

Note. CI = Confidence interval \* $p < .001$ .

A second MRA tested whether, when controlling for age, depression significantly predicted ADL. Age was entered at step one and accounted for 2.9% of the variance in ADL,  $R^2 = .029$ , adjusted  $R^2 = .023$ ,  $F(1, 172) = 5.01$ ,  $p = .026$ . In support of hypothesis (b), depression was entered at step two and accounted for an additional 7.7% of the variance in ADL,  $\Delta R^2 = .077$ ,  $F(1, 171) = 14.62$ ,  $p < .001$ . Age and depression combined accounted for a significant 10.5% of the variance in ADL,  $R^2 = .105$ , adjusted  $R^2 = .095$ ,  $F(2, 171) = 10.05$ ,  $p < .001$ . The path coefficient (beta) for hypothesis (b) is in Table 3.

Table 3

*Summary of Hierarchical Regression Model Analysis for Hypothesis B*

| Predictor  | $\beta$ | B    | 95% CI    | Part Correlation |
|------------|---------|------|-----------|------------------|
| Step 1     |         |      |           |                  |
| Age        | .169*   | .010 | .001-.018 | .169             |
| Step 2     |         |      |           |                  |
| Age        | .156*   | .009 | .001-.017 | .155             |
| Depression | .277**  | .052 | .025-.078 | .277             |

Note. CI = Confidence interval \* $p < .05$ . \*\* $p < .001$ .

The previous MRAs showed the path coefficients for pathways (a, b, & c). A Sobel test was used to establish whether ADL has a significant indirect effect on the relationship between depression and HR-QOL (Baron & Kenny, 1986). The Sobel test returned a significant result,  $z = 3.576$  ( $p < .001$ ), indicating that ADL has a significant indirect effect on the relationship between depression and HR-QOL (Baron and Kenny, 1986).

A final MRA tested whether this mediation effect was complete or partial (see Table 4; Baron and Kenny, 1986). At step two age and depression accounted for 40.1% of the variance in HR-QOL,  $R^2 = .401$ , adjusted  $R^2 = .394$ ,  $F (2, 171) = 57.22, p <.001$ . ADL was entered at step three and accounted for an additional 19.2% of the variance in HR-QOL,  $\Delta R^2 = .192$ ,  $F (1, 170) = 80.18, p <.001$ . Depression accounted for a significant 39.9% of the variance of HR-QOL at step two. However, when ADL was entered at step three, the amount of unique variance accounted for by depression reduced to a significant 23.3%. Depression remained a significant predictor of HR-QOL at step three. Therefore, partial mediation can be inferred (Baron and Kenny, 1986). Figure 3 provides the path coefficients from the final MRA.

Table 4

*Summary of Hierarchical Regression Model Analysis for Hypothesis D*

| Predictor                  | $\beta$ | B     | 95% CI     | Part Correlation |
|----------------------------|---------|-------|------------|------------------|
| <b>Step 1</b>              |         |       |            |                  |
| Age                        | .046    | .061  | -.137-.258 | .046             |
| <b>Step 2</b>              |         |       |            |                  |
| Age                        | .015    | .02   | -.134-.174 | .015             |
| Depression                 | .632*   | 2.75  | 2.24-3.26  | .632             |
| <b>Step 3</b>              |         |       |            |                  |
| Age                        | -.057   | -.075 | -.204-.054 | -.056            |
| Depression                 | .504*   | 2.19  | 1.76-2.63  | .483             |
| Activities of Daily Living | .463*   | 10.82 | 8.43-13.21 | .438             |

Note. CI = Confidence interval \* $p <.001$ .

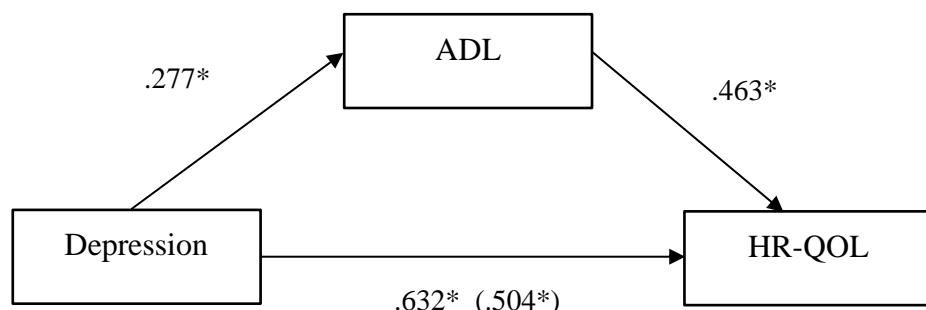


Figure 3. Path coefficients (beta) illustrating the mediation effect of ADL on depression.

Note: \* =  $p <.001$ . ( ) = Change in depression after inclusion of ADL.

To declare partial mediation the change in depression from step one to step two must be a *significant* change (MacKinnon, LockWood, Hoffman, West, & Sheets, 2002). A *z* test was conducted using the unstandardized beta coefficients and corresponding standard error values to determine the significance of the indirect effect (MacKinnon et al., 2002). A *z* test value greater than the critical value of 1.96 at an alpha level of .05 is necessary to conclude partial mediation (MacKinnon et al., 2002). The *z* test returned a value of 1.65, indicating no significant difference between the two path coefficients. In summary, the change in depression when ADL was entered into the model is not a *significant* change - indicating that ADL does not partially mediate the relationship between depression and HR-QOL and hypothesis (*d*) is rejected. However, the Sobel test result indicates that a significant indirect effect of ADL on the relationship between depression and HR-QOL remains evident. Based on Cohen's (1988) conventions the magnitude of this effect was moderate  $R^2 = .13$ .

### **Discussion**

This was the first study to examine whether ADL mediated the relationship between depression and HR-QOL in people with PD. Results found no mediation effect. However, a significant indirect effect of ADL on the depression and HR-QOL relationship was established.

In this study, hypothesis (*a*) was supported with depressive symptoms the strongest predictor of HR-QOL. This result parallels research by Schrag et al. (2000) and Qin et al. (2009) that reported depression as the most significant predictor of HR-QOL in PD. In addition, previous studies found that people with PD and depression scored significantly worse on measures of HR-QOL than people with PD without depression (Carod-Artal et al, 2008). The present result suggests that depression is a significant determinant of HR-QOL for Western Australian people with PD. Activities of daily living (ADL) accounted for a significant portion of variance in HR-QOL, therefore supporting hypothesis (*c*). Kleiner-Fisman et al. (2010) found a similar significant relationship between impairment in ADL and poorer HR-QOL for people with PD. As motor symptoms progress, people with PD experience difficulty completing simple tasks such as using eating utensils, dressing, and walking (Soh et al., 2011). Subsequently, these difficulties impact their HR-QOL (Soh et al., 2011). Although this study used a total index score for ADL which limits the ability to

distinguish between the impact of specific ADL on HR-QOL. It remains evident that participants who reported difficulty completing ADL also reported a poorer HR-QOL.

In support of hypothesis (*b*) and previous research by Dissanayaka et al. (2011), depression was found to significantly predict ADL. Demonstrating that participants with depressive symptoms reported greater impairment in ADL. The significant relationship between depression and ADL was highlighted by Piccinni et al. (2012), who found that impairment in ADL increased as the severity of depressive symptoms progressed. In addition, the loss of independence and reliance upon a caregiver to assist with ADL, often leads to worse self perception and the development of depressive symptoms for people with PD (Dissanayaka et al., 2011; Rahman et al., 2008).

The aforementioned results met the criteria for a possible mediating effect of ADL on the relationship between depression and HR-QOL in PD. Activities of daily living (ADL) demonstrated a significant indirect effect on the depression and HR-QOL relationship, but did not reduce the relationship to the extent at which a partial mediation effect could be declared (MacKinnon et al., 2002). Although this result did not support hypothesis (*d*), the size of the indirect effect was moderate (Cohen, 1988). This result suggests that people with PD, who experience depressive symptoms, also experience greater difficulty completing ADL, which impacts upon their HR-QOL.

There are several implications from this finding. Firstly, it may be valuable for clinicians to consider the factors related to HR-QOL in people with PD (Rahman et al., 2008). Individuals with PD and depressive symptoms may benefit from an assessment of ADL impairment. Conversely, people with PD who experience difficulty completing ADL may benefit from a screening for depressive symptoms. By implementing these procedures, clinicians will develop a clearer understanding of the relationships between depression, ADL, and HR-QOL in PD (Soh et al., 2011). For people with PD, a clearer understanding will promote a multidisciplinary approach to care (Rahman et al., 2008). Physicians can ensure appropriate pharmacological management (e.g., levodopa medication) for motor symptoms that impact ADL and psychologists can provide effective psychotherapy (e.g., cognitive-behavioural therapy [CBT]) for depression and other non-motor symptoms of PD (Rahman et al., 2008). In addition, occupational therapy (OT) has proven efficacious for people with PD (Keus, Bloem, Hendriks, Bredero-Cohen, &

Munneke, 2007). Research has found that OT reduces impairment in ADL and optimises independence of functioning for individuals with PD (Keus et al., 2007; Meek et al, 2010).

Secondly, this result highlights the complex interaction between non-motor symptoms and daily functioning in PD. Developing education programs to increase the understanding of depression and impairment in ADL, will assist people with PD in preparing for symptom progression and this impact on their HR-QOL (Dobkin, Menza, & Beinfair, 2008). Research has found that people with PD and more knowledge of the disease course are less likely to be depressed (Dissanayaka et al., 2011). Lastly, the present result suggests that in combination, depressive symptoms and impairment in ADL leads to worse HR-QOL for people with PD, than the impact of the two independently. Therefore, psychotherapy interventions (e.g., CBT) for people with PD and depression may have additional benefits for those who also experience difficulty with ADL. Cognitive-behavioural therapy (CBT) can promote acceptance of a care givers role to assist with ADL and combat feelings of dependence and helplessness for people with PD (Dobkin et al., 2008).

The present findings should be considered within some limitations. The participants' mean score for depressive symptoms was below the diagnostic cut off for depression, and the mean scores for ADL and HR-QOL were within the 'normal' to 'slightly impaired' range. (Martínez-Martín et al., 2003; Peto et al., 1998; Weintraub et al., 2006). This limited degree of impairment and symptom severity may have contributed to the lack of partial mediation. In addition, due to the cross-sectional design of this study it is difficult to determine the temporal precedence between depression, ADL, and HR-QOL (Frazier, Tix, & Barron, 2004).

Given the novel nature of the results opportunities exist for future research. Recruiting a sample with greater severity of depressive symptoms and impairment in ADL and HR-QOL, will increase the disparity between participants and allow for significant comparisons to be made. This may increase the likelihood of finding a partial mediation effect (MacKinnon et al., 2002). In addition, a sample that captures the spectrum of symptom severity will provide a more accurate representation of the heterogeneity in PD and increase the generalisability of the results to the wider PD population (Pagonabarraga, 2010). Furthermore, a longitudinal investigation gathering depression scores at Time 1,

ADL scores at Time 2, and HR-QOL scores at Time 3, will ensure causal inferences can be made when interpreting a mediation effect (Frazier et al., 2004).

In summary, this was the first study to demonstrate a significant indirect effect of ADL on the depression and HR-QOL relationship in PD. With a moderate effect size, this result suggests that people with PD and depressive symptoms, experience greater difficulty completing ADL, which impacts upon their HR-QOL. It is recommended that clinicians adopt a multidisciplinary approach to care for people with PD and consider the relationships between depression, ADL, and HR-QOL. Undoubtedly, this significant effect warrants further investigation and accentuates the relationship between depression and HR-QOL in PD.

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**Extended Literature Review**

Parkinson's disease (PD) is classified as a movement disorder and affects approximately 1 in 1200 people worldwide (The World Health Organisation [WHO], 2006). Early research into PD focussed on the impact of motor symptoms on quality of life (QOL); however more recent research has highlighted the negative impact of non-motor symptoms on QOL in PD (Schrag, 2006; Soh et al., 2011). Among the non-motor symptoms, depression is identified as having a greater impact on QOL than the motor symptoms in PD (Chor, 2012; Soh et al., 2011). In addition, activities of daily living (ADL) become increasingly difficult to complete as PD develops and this impairment in ADL has been significantly related to depression and QOL (Rahman, Griffin, Quinn, & Jahanshahi, 2008).

The aim of this study is to examine whether ADL mediates the established relationship between depression and health-related quality of life (HR-QOL) in PD. This literature review begins by providing an overview of PD, symptomology, diagnosis, and treatment. The review then discusses the dominant theories of the etiology of depression in PD and presents a critique of the current research into depression, ADL, and HR-QOL in PD. Quality of life and health-related quality of life will be referred to throughout this review, the following definitions will assist in distinguishing between the two: Quality of life (QOL) is described as the way an individual perceives themselves in comparison to their cultural context and value systems of their society, and how their culture and values relate to their ambitions, prospects, and principles (Kuyken et al., 1995; Soh, Morris, & McGinley, 2011). Health-related quality of life (HR-QOL) is a more specific form of QOL, which incorporates aspects of an individual's physical health, emotional well-being, social functioning, and cognition (Carod-Artal, Ziolkowski, Mourão, & Martínez-Martin, 2008; Schrag, 2006; Soh et al., 2011).

## **1. Overview of Parkinson's Disease.**

Parkinson's disease (PD) is one of the most prevalent neurological disorders in Australia, with over 64,000 people living with PD in 2011 (Access Economics, 2011). The prevalence rate is also likely to increase due to Australia's ageing population; 80% of people with PD are over the age of 65 (Access Economics, 2011). Most Parkinson's disease (PD) is described as idiopathic meaning *cause unknown* (Bartels & Leenders, 2009). However, research supports the dopamine-depletion theory as a contributor to the development of PD (Bartels & Leenders, 2009). Biochemical post-mortem studies have

identified depletion of dopamine in the substantia nigra pars compacta (SNc) as a common factor among people with PD (Bartels & Leenders, 2009; Hornykiewicz, 2006). In addition, researchers have come to a general understanding that the etiology of PD is a complex interaction of both environmental and genetic factors (Bartels & Leenders, 2009; Pagonabarraga, 2010).

The United Kingdom Parkinson's Disease Society Brain Bank Clinical Diagnostic Criteria state that at least two of three motor symptoms (bradykinesia, rigidity, tremor) must be present, and combined with a response to levodopa medication to form a clinical diagnosis of PD (Bartels & Leenders, 2009; Hughes, Daniel, Kilford, & Lees, 1992). The initial diagnosis of PD can often be difficult for clinicians due to the subtle onset of symptoms (Chou, 2012). In addition, majority of people with PD are over the age of 60 and early symptoms (e.g., pain and stiffness) can be misattributed to normal ageing or arthritis (Chou, 2012). Anti-parkinson medications (e.g., levodopa, dopamine agonists, and monoamine oxidase B inhibitors) are the most common form of treatment and found to reduce morbidity and improve motor symptoms in the early stages of PD (Chou, 2012; Fung, Herawati, & Wan, 2009). Due to the diversity of PD symptoms, the combinations and dose of anti-parkinson medication are dependent upon the individual. However, levodopa has proven to be the most effective treatment for motor symptoms and as the disease course progresses most people with PD will end up taking levodopa medication (Chou, 2012; Fung et al., 2009).

### **1.1 Motor Symptoms**

The four main symptoms of PD are tremor, rigidity, bradykinesia (slowness of involuntary movement), and gait disturbance (postural instability) which initially present unilaterally and remain stronger on this side throughout the disease course (Haaxma et al., 2010; Pagonabarraga, 2010). Tremor is due to involuntary movements of the muscles in the limbs and can also be present in the jaw and lips (Carr, 2002). Although tremor is the most common symptom, the heterogeneity of PD has led to subtyping of the clinical symptom variations which are commonly referred to as tremor-predominant or postural-instability/gait disorder (PIGD)-predominant (Lewis et al., 2005). Over the disease course tremor is often seen to subside with rigidity and bradykinesia severity increasing (Bartels & Leenders, 2009). Rigidity is the stiffness and tensing of muscles and experienced throughout the body (Bartels & Leenders, 2009). Rigidity affects an individual's ability to

complete continuous actions which often involve broken movements with irregular pausing (Bartels & Leenders, 2009). Bradykinesia is an overall slowness in initiating spontaneous movements and a decrease in amplitude and speed of movement (Pagonabarraga, 2010). Gait disturbance is the development of short shuffling steps which impact upon an ability to make turns and move through narrow spaces when walking, this increases the likelihood of falls and resultant bone fractures (Pagonabarraga, 2010).

The Hoehn and Yahr (HY) scale is a well-established measure of PD which outlines five progressive stages of symptom severity (Maetzler, Piepelt, & Berg, 2009). At stage one the person with PD has unilateral rigidity and tremor, including slowness of movement (Goetz et al., 2004). Stage two involves bilateral rigidity and tremor, a loss of facial expression with an increase of slowness of movement (Goetz et al., 2004). At stage three the severity of dominant symptoms increases combined with a loss of balance, and stage four leads to the loss of physical independence as symptoms progress (Maetzler, Piepelt, & Berg, 2009). Stage five ends with the person with PD wheelchair bound or bedridden (Goetz et al., 2004). The impact of motor symptoms on HR-QOL for people with PD is significant and often results in total dependence upon a care giver to assist with daily activities (Carod-Artal, Vargas, & Martinez-Martin, 2007).

## **1.2 Non-motor Symptoms.**

The progression of PD is not confined to motor symptoms with non-motor symptoms often impacting the QOL of people with PD to a greater extent (Bartels & Leenders, 2009; Pagonabarraga, 2010). Non-motor symptoms are heterogeneous for people with PD and can include sleep disturbances, emotional disorders, psychotic disturbances (e.g., hallucinations and delusions), and visual problems (e.g., blurred vision and colour deficits; Bartels & Leenders, 2009; Pagonabarraga, 2010). Non-motor symptoms can present themselves during early stages of the disease course, such as olfactory dysfunction which is known to develop among people with early onset PD (Chand & Litvan, 2007; Pagonabarraga, 2010). Among the non-motor symptoms, dementia and depression have been identified as the most significant predictors of QOL among people with PD (Burn, 2002; Frisina, Borod, Foldi, & Tenenbaum, 2008; Pagonabarraga, 2010; Poewe, 2007). In a recent systematic review of 47 studies, Martinez-Martin (2011) assessed the impact of non-motor symptoms on HR-QOL in PD. Twenty-two of the studies examined depression

and all found that depression was the most important predictor of HR-QOL in PD (Martinez-Martin, 2011).

## **2. Depression in PD.**

Approximately 42% of people with PD experience depressive symptoms (Ishihara & Brayne, 2006; Rojo et al., 2003; Slaughter, Slaughter, Nichols, Holmes, & Martens, 2001). There are two fundamental theories behind the etiology of depression in PD, 1) it is a ‘reactive’ depression due to the onset of the disease and the psychosocial effects of developing a chronic and irreversible illness; or 2) it is pre-morbid and depressive symptoms develop due to neurodegeneration before the onset of PD (Even & Weintraub, 2012; Ishihara & Brayne, 2006; Kanner & Barry, 2003; Klepac, Hajnšek, & Trkulja, 2010; McDonald, Richard, & DeLong, 2003). Estimated rates of major depression in PD were identified in a recent literature review with approximately 8.8% identified as pre-morbid and 10.2% identified as reactive (Even & Weintraub, 2012; Reijnders, Ehrt, Weber, Aarsland, & Leentjens, 2007).

The reactive depression position argues that people with PD begin to experience depressive symptoms as a reaction to their PD diagnosis (McDonald et al., 2003). People with PD are aware there is no cure and that treatment options are palliative and become less effective over time (McDonald et al., 2003). Psychosocial issues such as self-perception and social support also impact on the development of depression in PD (Kanner & Barry, 2003). Often the visible motor symptoms are a source of stress and social anxiety for people with PD and this impacts on their emotional wellbeing and results in increased depressive symptoms (Bartels & Leenders, 2009). The dopaminergic system has been identified as a contributor to reactive depression in PD (Even & Weintraub, 2012). Dopamine is a neurotransmitter that regulates a range of bodily functions including the pleasure and pain responses (Bartels & Leenders, 2009). The degeneration of dopamine neurons is common to PD and depression and this overlap of neurodegeneration has been found between the reactive depressive symptoms and the onset of PD (Kanner & Barry, 2003; McDonald et al., 2003). This finding suggests that as dopamine neurons deplete due to the onset of PD, the likelihood of experiencing depressive symptoms increases (Bartels & Leenders, 2009).

Post-mortem studies have found evidence to support the occurrence of premorbid depression in PD. Fearnley and Lees (1991) conducted a post-mortem neural count in the

substantia nigra of people with PD who had depression and found that neurodegeneration developed more than four years before the PD symptoms (Fearnley & Lees, 1991). Also, post-mortem imaging research assessing the neurodegenerative process within the subcortical nuclei (component of the cerebrum) found that people with PD who were diagnosed with depression had significantly reduced subcortical nuclei. This has been also found in people with depression who do not have PD (Lisanby et al., 1993; Ranga Krishnan et al., 1990). Furthermore, a study using positron emission tomography (PET) scanning reported that the underlying disease process of depression predates the onset of PD motor symptoms by seven years (Morrish, Rakshi, Bailey, Sawle, & Brooks, 1998). Research has also demonstrated an inconsistent relationship between depression and the severity of PD symptoms (Kanda et al., 2008). Ravina et al. (2009) used two treatment trials on people with PD and an early diagnosis of depression. In only six months, approximately half of the participants showed a significant reduction in depressive symptoms despite progression of their PD symptoms (Ravina et al., 2009).

Ishihara and Brayne (2006) conducted a literature review assessing depression as a preceding disorder of PD. Among the 14 articles included in their review, six were case control studies investigating the relationship between premorbid depression and PD (Ishihara & Brayne, 2006). Five of those studies found a significant increase in the prevalence of PD among people with premorbid depression compared to those who were not depressed (Ishihara & Brayne, 2006). Farabaugh et al. (2009) were also interested in depressive symptoms preceding PD onset and found that participants who reported a history of depression preceding PD were significantly more depressed than participants without a history of depression. Klepac et al. (2010) assessed PD participants with premorbid depression and whether they experience worse HR-QOL. An extensive screening process involving an assessment by a neurologist, medical history review and a structured interview was used to identify the PD participants with premorbid depression (Klepac et al., 2010). The results indicated that participants with premorbid depression were significantly more depressed and experienced a poorer HR-QOL than the participants without premorbid depression (Klepac et al., 2010).

The conflicting theories, symptom overlap, and the similar neurodegenerative pathways underlying depression in PD led Even and Weintraub (2012) to review the literature using four types of diagnostic validity (face, descriptive, construct, predictive) to assess whether depression is a specific entity in PD. The face validity (whether expert

clinicians agree about the existence of depression in PD) and the descriptive validity (the degree of diagnostic specificity) were identified as presenting subtle differences within reactive and comorbid depression in PD (Even & Weintraub, 2012). However, the pathophysiological differences were too subtle to distinctly subtype. Even and Weintraub (2012) argue that the descriptive validity (how well the dopaminergic processes are understood) and the predictive validity (the extent to which a natural course or treatment response exists) do support depression in PD as a specific syndrome for some people. However due to the heterogeneity of PD, it is not possible to apply this diagnostic criteria to all cases (Even & Weintraub, 2012).

The theoretic arguments about depression in PD highlight the complexity of depression in PD. Dissanayaka et al. (2011) examined the relationships between depression, disease stage and severity, medication, sleep disturbances, and memory problems in PD. The results suggested that complications with levodopa medication, disease onset at a younger age, longer disease duration, and memory problems were all positively associated with depression (Dissanayaka et al., 2011). As well as the impact of depression on specific factors of PD, research has found a significant relationship between depressive symptoms and emotional, social, and physical functioning (Schrag, 2006). These in turn impact HR-QOL.

## **2.1 Depression and Health-related Quality of Life in PD.**

The effect of PD on HR-QOL is strong and impacts on motor functioning, body discomfort/pain, daily energy levels, and social functioning (Schrag, 2006). In addition to the cardinal motor symptoms, research has identified depression as one of the main predictors of poor HR-QOL in PD (Quelhas & Costa, 2009; Schrag, 2006; Schrag, Jahanshahi, & Quinn, 2000; Slaughter et al., 2001; Sławek, Derejko, & Lass, 2005). In a study by Schrag et al. (2000) a population based sample of 97 participants with PD were assessed on a number of measures to determine the effects of depression and other PD specific factors on their HR-QOL. Participants who were classified with 'high levels' (18.5%) of depression scored significantly worse on the Parkinson's Disease Questionnaire (PDQ-39; a measure of HR-QOL) than participants without depression (Schrag et al., 2000). These results suggest that depression is a stronger predictor of HR-QOL in PD, than the motor symptoms alone (Schrag et al., 2000).

In two recent cross-sectional studies by Carod-Artal et al. (2008) and Quelhas and Costa (2009), the relationship between depression and QOL was assessed. Although the mean age of participants in the study by Quelhas and Costa (2009) was approximately 10 years older (72 years) than the participants in the Carod-Artal et al. (2008) study (62.5 years), the Hoehn and Yahr (H&Y) rating of PD severity was similar, with participants in both samples rated less than three (mild to moderate symptom severity; Carod-Artal et al., 2008; Quelhas & Costa, 2009). In a sub group analysis, Carod-Artal et al. (2008) found that participants who were depressed scored significantly worse on the HR-QOL measure than participants who were not depressed. Quelhas and Costa (2009) found that depression scores correlated negatively with QOL scores.

Qin et al. (2009) examined the impact of motor (tremor, bradykinesia, rigidity, dyskinesia) and non-motor (depression, sleep disorder, fatigue, memory function) symptoms on the HR-QOL of 391 Chinese people with PD (Qin et al., 2009). When motor symptoms were entered into the regression model, poorer motor function (measured by the Unified Parkinson's Disease Rating Scale [UPDRS]), H&Y disease severity, and rigidity explained 18.9% of the variance in HR-QOL scores (Qin et al., 2009). However, when non-motor symptoms (depression and sleep disorders) were included in the model 61.7% of variance in HR-QOL scores was accounted for (Qin et al., 2009).

Naismith, Hickie, and Lewis (2010) investigated the contribution of depression and disease severity to QOL. It was found that the greatest predictor of QOL was depression accounting for a significant 20.8% of the variance and motor scores accounting for a significant 5.7% of the variance (Naismith, Hickie, & Lewis, 2010). The findings of Qin et al. (2009) and Naismith et al. (2010) indicate that non-motor symptoms (including depression) have a more significant impact on HR-QOL than the cardinal motor symptoms of PD (Qin et al., 2009). In addition, the results from previous studies emphasise the strong depression and HR-QOL relationship across differing samples and suggest a somewhat homogenous experience of depressive symptoms irrespective of the heterogeneous subtypes of PD.

In a systematic literature review, Soh et al. (2011) evaluated the contributors to HR-QOL in PD. Twenty-nine studies were included in the review and the impact of both motor and non-motor factors were investigated. The motor factor of disease severity as measured by the UPDRS was identified in 13 studies as a predictor of HR-QOL, also

motor impairment (as measured by the UPDRS) was found in six studies as a significant predictor of poorer HR-QOL (Soh et al., 2011). In comparison to the studies assessing the impact of motor symptoms, 19 studies examined the impact of depression and all found depression as the greatest significant predictor of HR-QOL in PD (Soh et al., 2011).

### **3. Activities of Daily Living in PD.**

The World Health Organisation (WHO) outlines disability (due to a neurological disorder) as a limitation to an individual's normal behaviours which develop into dependence upon a caregiver (Wade, 1996). As the severity of symptoms progress, people with PD begin to lose their ability to complete daily activities independently (Martínez-Martín et al., 2003; WHO, 2006). The motor fluctuations (brought by "on-off" periods of medication use) and dyskinesias (involuntary movements) can have a significant impact on the activities of daily living for a person with PD (WHO, 2006). Although the heterogeneity of PD symptoms means there is variability between the functional limitations of people with PD, most people face difficulties with ADL over the disease course (WHO, 2006). The second subscale of the UPDRS was developed to assess common ADL that people with PD experience difficulty (Martínez-Martín et al., 2003). The scale contains 13 items that range from speech and salivation to turning in bed and walking, each of which can be scored from "0 = normal" to "4 = severe" (Martínez-Martín et al., 2003).

#### **3.1 Activities of Daily Living and Depression in PD.**

Activities of daily living (ADL) become more difficult for people with PD, however there has been limited research into the relationship between ADL and depression in PD (Dissanayaka et al., 2011; Papapetropoulos, Ellul, Argyriou, Chroni, & Lekka, 2006). Wichowicz, Slawek, Derejko, and Cubala (2006) investigated depression and PD severity in a cross-sectional study of Polish people with PD. Thirty-five per cent of the participants were diagnosed with depression using the Diagnostic and Statistical Manual (DSM-IV) criteria (Wichowicz et al., 2006). The ADL subscale (part two) of the UPDRS was used to measure disease severity (Wichowicz et al., 2006). Activities of daily living (ADL) scores were significantly worse for the participants who were depressed, compared to participants who were not depressed (Wichowicz et al., 2006).

In a similar study by Papapetropoulos et al. (2006), a group of people with PD and depression (diagnosed via the DSM-IV criteria) were compared to a group of people with PD without depression, to identify any significant differences in disability and disease severity. Participant groups were matched for gender, age of disease onset, and disease duration (Papapetropoulos et al., 2006). Results showed that the mean scores for the depressed group were significantly higher than the mean scores for the non-depressed group (Papapetropoulos et al., 2006). Indicating that people with PD and depression experience greater difficulty with ADL than people with PD without depression (Papapetropoulos et al., 2006).

Recent research by Piccinni et al. (2012) investigated the relationship between different severity levels of depression in people with PD and their degree of functional disability (Piccinni et al., 2012). Initial results supported the findings of Wichowicz et al. (2006) and Papapetropoulos et al. (2006), indicating that people with PD who were depressed scored significantly worse on ADL (UPDRS-section 2) when compared to people with PD who were not depressed (Piccinni et al., 2012). Post-hoc analyses were then completed within the depressed group after the participants were categorised into three levels of depression severity (29 mild, 30 moderate, 6 severe) according to the DSM-IV criteria (Piccinni et al., 2012). Participants with severe depression were found to have significantly worse scores on ADL when compared to participants with mild or moderate depression. The same significant result was found when participants with moderate depression were compared to the mild depression group (Piccinni et al., 2012). This was the first study to examine the differences of depression severity and its relationship with functional disability (Piccinni et al., 2012). The results show that not only does depression have a significant negative impact on ADL but the impact is worse if people are more severely depressed.

### **3.2 Activities of Daily Living and Health-related Quality of Life in PD.**

The negative relationship between disease severity and QOL for people with PD has been well established (Findley, 2002; Karlsen, Tandberg, Årsland, & Larsen, 2000; Schrag, 2006). Towards the end of the disease course, a person with PD often uses a wheelchair or becomes bedridden which impacts upon their ability to complete ADL independently (Behari, Srivastava, & Pandey, 2005). Behari et al. (2005) examined the QOL of participants with PD by assessing a range of disease severity factors including

ADL. Participants ADL scores were found to correlate significantly and negatively with QOL scores, indicating that the participants who struggle the most with ADL also experience significantly worse QOL (Behari et al., 2005).

The determinants of HR-QOL in people with PD were also assessed by Carod-Artal et al. (2007). Results indicated that participants who performed poorly on ADL experienced a worse HR-QOL (Carod-Artal et al., 2007). The relationship between ADL and HR-QOL was further confirmed by Kleiner-Fisman, Stern and Fisman (2010) who evaluated the correlation between specific factors of PD and HR-QOL. Motor impairment and ADL scores were used to rate disease severity and analysed against HR-QOL (Kleiner-Fisman, Stern, & Fisman, 2010). The strongest significant relationship was identified between ADL and HR-QOL, suggesting that the loss of independence and inability to complete ADL may have a stronger negative relationship with HR-QOL than the motor symptoms of PD (Kleiner-Fisman et al., 2010).

#### **4. Rationale.**

Initial research in PD focused on the pattern and severity of motor symptoms to determine appropriate treatment plans (Rahman et al., 2008; Schrag et al., 2000). However, recent studies have begun to acknowledge the impact of motor symptoms on everyday functioning and this relationship with non-motor symptoms (e.g.: depression; Even & Weintraub, 2012; Rahman et al., 2008; Wichowicz et al., 2006). Rahman and colleagues (2008) conducted a study to determine the impact of specific PD factors on the HR-QOL of people with PD. Regression analyses were used to determine whether age of onset, disease severity and ADL scores accounted for significant variance in HR-QOL (Rahman et al., 2008). Activities of daily living scores were the only predictor to account for significant variance (Rahman et al., 2008). In a separate analysis, depression scores accounted for a significant 40.8% of the variance in HR-QOL (Rahman et al., 2008). These results indicate that when examined independently, ADL and depression were significant predictors of poorer HR-QOL (Rahman et al., 2008). In a more recent study by Arun, Bharath, Pal, and Singh (2011) the relationship between depression and ADL, and depression and QOL were assessed in people with PD. Depression and ADL scores were both significantly correlated with QOL scores (Arun, Bharath, Pal, & Singh, 2011).

Previous research has established that the negative relationship between depression and HR-QOL in PD is often greater than the impact of the motor symptoms. Studies have

identified the negative relationship between the severity of depressive symptoms and impairment in ADL, and when people with PD are not able to complete ADL independently many experience poorer HR-QOL (Kleiner-Fisman, Stern, & Fisman, 2010; Piccinni et al., 2012). There has been limited research into the functional impact of ADL on HR-QOL in PD and no study to date has examined the impact of ADL on the relationship between depression and HR-QOL. Therefore, the present study will examine whether ADL mediates the relationship between depression and HR-QOL in people with PD.

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**Supplementary Material**

### Extended Results Section

Data analysis was completed using IBM SPSS statistics, Version 21.

#### Existing Data Set, Screening, and Manipulation

The initial data set contained 257 participants. Twenty four participants were removed due to scoring below 24 on the Mini Mental Status Examination (MMSE). A further seven participants were removed due to a diagnosis other than PD, including; Essential Tremor, Motor Neurone Disease, Multiple System Atrophy, and Cerebellar Degeneration. Missing values analysis was completed with Little's Missing Completely at Random (MCAR) test, returning a significant result,  $\chi^2 (N = 226) = 2432.57, p = .015$ . This result indicated that data was not missing at random. Fifty two participants had not completed the UPDRS-section 2 (ADL) measure and one participant had not completed the PDQ-39 (HR-QOL) and GDS-15 (depression) measures. These cases were removed and a second Little's MCAR test provided a non-significant result,  $\chi^2 (N = 174) = 1684.38, p = .302$ . Missing values were replaced using Expectation Maximisation (EM). A total score for ADL was computed by calculating an average of the 13 items, this ensures the scale is uni-factorial and appropriate for the mediation model (Howell, 2010). Total scores for depression and HR-QOL were previously computed within the existing data set.

Standardized scores were calculated to detect univariate outliers. A score greater than 3.29 standard deviations away from the mean is regarded as an extreme score and may impact upon the data normality (Tabachnick & Fidell, 2007). Four scores across three participants were identified as univariate outliers, however analyses were completed including and excluding the outliers and no substantial differences were found. Based on this result the outliers remained in the final data set. Mahalanobis Distance's and their corresponding Cook's Distances were assessed to determine the presence and influence of multivariate outliers (Tabachnick & Fidell, 2007). For regression one and three, two Mahalanobis Distance's greater than the critical  $\chi^2$  value of 16.266 for  $df = 3$  at  $\alpha = .001$  were identified (Howell, 2010). However, the corresponding Cook's Distances were less than one, indicating no influence on the data set. In addition, regression two identified one Mahalanobis Distance greater than the critical  $\chi^2$  value of 13.816 for  $df = 2$  at  $\alpha = .001$ . Cook's distance was also less than one (Howell, 2010).

## Data Analysis

Hierarchical Multiple Regression Analysis (MRA) was used to establish whether ADL mediates the relationship between depression and HR-QOL.

## Assumption Testing

According to Tabachnick and Fidell (2007) a number of assumptions need to be met before regression analyses can be completed. Firstly, histograms were examined and indicated that the data was positively skewed (Howell, 2010). However, Skewness and Kurtosis values were equal to or less than two which supports the assumption of normality (Howell, 2010). Before the regression analyses were conducted assumptions of normality, linearity, and homoscedasticity of residuals were examined (Tabachnick & Fidell, 2007). For regression one, two, and three the scatterplot of standardised Studentised residuals against standardised predicted values indicated no clear pattern which meets these assumptions (Tabacknick and Fidell, 2007). To ensure multicollinearity was not a concern, tolerance statistics were examined. The three regression analyses produced tolerance statistics greater than .2 which rejects the presence of multicollinearity (Tabachnick & Fidell, 2007).

## Initial Correlations

Significant bivariate correlations between the predictor variable (depression), mediator variable (M; ADL) and the criterion variable (HR-QOL) must exist before a mediation model can be assessed (Baron & Kenny, 1986). Age and gender have been identified as predictors of HR-QOL and were therefore included as possible control variables (Soh et al., 2011). Depression significantly correlated with HR-QOL ( $r = .63, p <.01$ ) and ADL ( $r = .28, p <.01$ ). Activities of Daily Living (ADL) significantly correlated with HR-QOL ( $r = .60, p <.01$ ) and age significantly correlated with ADL ( $r = .17, p <.05$ ). Age was therefore included as a covariate and gender was removed as it did not significantly correlate with the variables of interest. Table 1 provides the age, bivariate correlations, mean scores, and standard deviations for the participants.

Table 1

*Correlation Matrix for Study Variables*

| Variable                          | Mean  | SD    | 1     | 2      | 3      | 4 |
|-----------------------------------|-------|-------|-------|--------|--------|---|
| 1. Age                            | 65.96 | 9.46  | -     |        |        |   |
| 2. Depression                     | 3.20  | 2.86  | .049  | -      |        |   |
| 3. Activities of Daily Living     | .85   | .53   | .169* | .285** | -      |   |
| 4. Health-related Quality of Life | 19.25 | 12.44 | .046  | .633** | .597** | - |

Note. \* $p < .05$ . \*\* $p < .01$ . SD = Standard deviation.

**Hypothesis A and C**

The first MRA tested whether, when controlling for age, depression significantly predicts HR-QOL and whether, when controlling for age, ADL significantly predicts HR-QOL. Age was entered at step one and depression and ADL at step two. In combination, age, depression, and ADL accounted for a significant 59.3% of the variance in HR-QOL,  $R^2 = .593$ , adjusted  $R^2 = .586$ ,  $F(3, 170) = 82.54$ ,  $p < .001$ . In support of hypothesis (a), depression accounted for a significant 23.33% of the variance in HR-QOL. Hypothesis (c) was also supported with ADL accounting for a significant 19.18% of the variance in HR-QOL. The respective path coefficients (beta) can be found in the Table 2.

Table 2

*Summary of Hierarchical Regression Model Analysis for Hypothesis A and C*

| Predictor                  | $\beta$ | B     | 95% CI     | Part Correlation |
|----------------------------|---------|-------|------------|------------------|
| <b>Step 1</b>              |         |       |            |                  |
| Age                        | .046    | .061  | -.137-.258 | .046             |
| <b>Step 2</b>              |         |       |            |                  |
| Age                        | -.057   | -.075 | -.204-.054 | -.056            |
| Depression                 | .504*   | 2.19  | 1.76-2.63  | .483             |
| Activities of Daily Living | .463*   | 10.82 | 8.43-13.21 | .438             |

Note. CI = Confidence interval \* $p < .001$ .

### Hypothesis B

A second MRA was conducted to test whether, when controlling for age, depression significantly predicted ADL. Age was entered at step one and accounted for 2.9% of the variance in ADL,  $R^2 = .029$ , adjusted  $R^2 = .023$ ,  $F(1, 172) = 5.01$ ,  $p = .026$ . In support of hypothesis (b), depression was entered at step two and accounted for an additional 7.7% of the variance in ADL,  $\Delta R^2 = .077$ ,  $F(1, 171) = 14.62$ ,  $p < .001$ . In combination, age and depression accounted for a significant 10.5% of the variance in ADL,  $R^2 = .105$ , adjusted  $R^2 = .095$ ,  $F(2, 171) = 10.05$ ,  $p < .001$ . The path coefficient (beta) for hypothesis (b) can be found in the Table 3.

Table 3

*Summary of Hierarchical Regression Model Analysis for Hypothesis B*

| Predictor  | $\beta$ | B    | 95% CI    | Part Correlation |
|------------|---------|------|-----------|------------------|
| Step 1     |         |      |           |                  |
| Age        | .169*   | .010 | .001-.018 | .169             |
| Step 2     |         |      |           |                  |
| Age        | .156*   | .009 | .001-.017 | .155             |
| Depression | .277**  | .052 | .025-.078 | .277             |

Note. CI = Confidence interval \* $p < .05$ . \*\* $p < .001$ .

### Sobel Test of Mediation

The previous MRAs showed the path coefficients for pathways ( $a$ ,  $b$ , &  $c$ ). A Sobel test was conducted to establish whether ADL has a significant indirect effect on the relationship between depression and HR-QOL (Baron & Kenny, 1986). The Sobel test returned a significant result,  $z = 3.576$  ( $p < .001$ ), indicating that ADL has a significant indirect effect on the relationship between depression and HR-QOL (Baron and Kenny, 1986).

### Hypothesis D

A final MRA tested whether this mediation effect was complete or partial (see Table 4; Baron and Kenny, 1986). At step two age and depression accounted for 40.1% of

the variance in HR-QOL,  $R^2 = .401$ , adjusted  $R^2 = .394$ ,  $F (2, 171) = 57.22$ ,  $p <.001$ . ADL was entered at step three and accounted for an additional 19.2% of the variance in HR-QOL,  $\Delta R^2 = .192$ ,  $F (1, 170) = 80.18$ ,  $p <.001$ . Depression accounted for a significant 39.9% of the variance of HR-QOL at step two. However, when ADL was entered at step three, the amount of unique variance accounted for by depression reduced to a significant 23.3%. Depression remained a significant predictor of HR-QOL at step three. Therefore, partial mediation can be inferred (Baron and Kenny, 1986). Figure 3 provides the path coefficients from the final MRA.

Table 4

*Summary of Hierarchical Regression Model Analysis for Hypothesis D*

| Predictor                  | $\beta$ | B     | 95% CI     | Part Correlation |
|----------------------------|---------|-------|------------|------------------|
| <b>Step 1</b>              |         |       |            |                  |
| Age                        | .046    | .061  | -.137-.258 | .046             |
| <b>Step 2</b>              |         |       |            |                  |
| Age                        | .015    | .02   | -.134-.174 | .015             |
| Depression                 | .632*   | 2.75  | 2.24-3.26  | .632             |
| <b>Step 3</b>              |         |       |            |                  |
| Age                        | -.057   | -.075 | -.204-.054 | -.056            |
| Depression                 | .504*   | 2.19  | 1.76-2.63  | .483             |
| Activities of Daily Living | .463*   | 10.82 | 8.43-13.21 | .438             |

Note. CI = Confidence interval \* $p <.001$ .

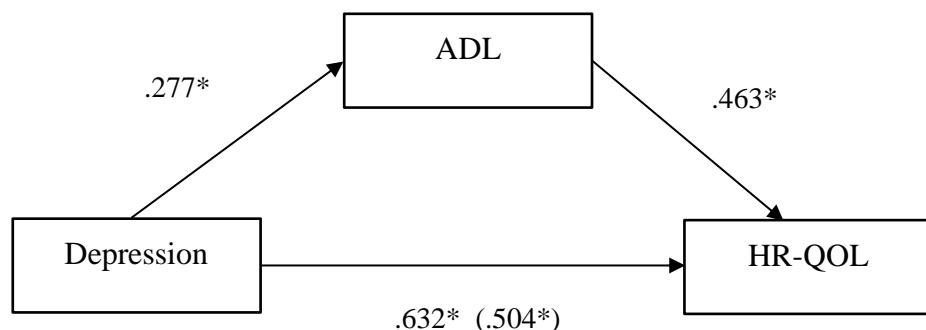


Figure 3. Path coefficients (beta) illustrating the mediation effect of ADL on depression.

Note: \* =  $p <.001$ . ( ) = Change in depression after inclusion of ADL.

To declare partial mediation the change in depression from step one to step two must be a *significant* change (MacKinnon, LockWood, Hoffman, West, & Sheets, 2002). A *z* test was conducted using the unstandardized beta coefficients and corresponding standard error values to determine the significance of the indirect effect (MacKinnon et al., 2002). A *z* test value greater than the critical value of 1.96 at an alpha level of .05 is necessary to conclude partial mediation (MacKinnon et al., 2002). The *z* test returned a value of 1.65, indicating no significant difference between the two path coefficients. In summary, the change in depression when ADL was entered into the model is not a *significant* change - indicating that ADL does not partially mediate the relationship between depression and HR-QOL and hypothesis (*d*) is rejected. However, the Sobel test result indicates that a significant indirect effect of ADL on the relationship between depression and HR-QOL remains evident. Based on Cohen's (1988) conventions the magnitude of this effect was moderate  $R^2 = .13$ .

**SPSS Output**

First Missing Values Analysis:  $\chi^2 (N = 226) = 2432.57, p = .015$

|                | N   | Mean | Std.<br>Deviation | Missing |         | No. of Extremes <sup>a,b</sup> |      |
|----------------|-----|------|-------------------|---------|---------|--------------------------------|------|
|                |     |      |                   | Count   | Percent | Low                            | High |
| Cog1_GDS1      | 222 | .85  | .357              | 4       | 1.8     | .                              | .    |
| Cog1_GDS2      | 222 | .40  | .490              | 4       | 1.8     | 0                              | 0    |
| Cog1_GDS3      | 222 | .13  | .333              | 4       | 1.8     | .                              | .    |
| Cog1_GDS4      | 222 | .22  | .413              | 4       | 1.8     | .                              | .    |
| Cog1_GDS5      | 222 | .91  | .293              | 4       | 1.8     | .                              | .    |
| Cog1_GDS6      | 220 | .24  | .426              | 6       | 2.7     | .                              | .    |
| Cog1_GDS7      | 220 | .87  | .334              | 6       | 2.7     | .                              | .    |
| Cog1_GDS8      | 221 | .13  | .338              | 5       | 2.2     | .                              | .    |
| Cog1_GDS9      | 222 | .45  | .498              | 4       | 1.8     | 0                              | 0    |
| Cog1_GDS10     | 219 | .21  | .411              | 7       | 3.1     | .                              | .    |
| Cog1_GDS11     | 220 | .87  | .339              | 6       | 2.7     | .                              | .    |
| Cog1_GDS12     | 220 | .12  | .329              | 6       | 2.7     | .                              | .    |
| Cog1_GDS13     | 216 | .26  | .439              | 10      | 4.4     | 0                              | 0    |
| Cog1_GDS14     | 220 | .10  | .295              | 6       | 2.7     | .                              | .    |
| Cog1_GDS15     | 221 | .13  | .338              | 5       | 2.2     | .                              | .    |
| Cog1_PDQ39_Q1  | 222 | 1.39 | 1.216             | 4       | 1.8     | 0                              | 0    |
| Cog1_PDQ39_Q2  | 221 | 1.21 | 1.199             | 5       | 2.2     | 0                              | 0    |
| Cog1_PDQ39_Q3  | 223 | .90  | 1.179             | 3       | 1.3     | 0                              | 0    |
| Cog1_PDQ39_Q4  | 221 | 1.03 | 1.328             | 5       | 2.2     | 0                              | 0    |
| Cog1_PDQ39_Q5  | 221 | .55  | 1.029             | 5       | 2.2     | 0                              | 17   |
| Cog1_PDQ39_Q6  | 222 | .77  | 1.059             | 4       | 1.8     | 0                              | 21   |
| Cog1_PDQ39_Q7  | 222 | .87  | 1.094             | 4       | 1.8     | 0                              | 0    |
| Cog1_PDQ39_Q8  | 223 | .57  | 1.050             | 3       | 1.3     | 0                              | 17   |
| Cog1_PDQ39_Q9  | 222 | .73  | 1.085             | 4       | 1.8     | 0                              | 23   |
| Cog1_PDQ39_Q10 | 222 | .72  | 1.139             | 4       | 1.8     | 0                              | 29   |
| Cog1_PDQ39_Q11 | 221 | .33  | .711              | 5       | 2.2     | .                              | .    |
| Cog1_PDQ39_Q12 | 222 | .62  | .888              | 4       | 1.8     | 0                              | 12   |
| Cog1_PDQ39_Q13 | 222 | .65  | 1.089             | 4       | 1.8     | 0                              | 17   |
| Cog1_PDQ39_Q14 | 223 | 1.77 | 1.355             | 3       | 1.3     | 0                              | 0    |
| Cog1_PDQ39_Q15 | 222 | .89  | 1.072             | 4       | 1.8     | 0                              | 26   |
| Cog1_PDQ39_Q16 | 222 | .70  | .938              | 4       | 1.8     | 0                              | 13   |
| Cog1_PDQ39_Q17 | 222 | .95  | 1.195             | 4       | 1.8     | 0                              | 20   |
| Cog1_PDQ39_Q18 | 222 | .61  | .910              | 4       | 1.8     | 0                              | 14   |
| Cog1_PDQ39_Q19 | 222 | .71  | .916              | 4       | 1.8     | 0                              | 13   |
| Cog1_PDQ39_Q20 | 223 | .43  | .693              | 3       | 1.3     | 0                              | 4    |

|                     |     |       |       |    |      |   |    |
|---------------------|-----|-------|-------|----|------|---|----|
| Cog1_PDQ39_Q21      | 223 | 1.01  | .954  | 3  | 1.3  | 0 | 0  |
| Cog1_PDQ39_Q22      | 222 | 1.18  | 1.034 | 4  | 1.8  | 0 | 0  |
| Cog1_PDQ39_Q23      | 222 | .77   | 1.107 | 4  | 1.8  | 0 | 25 |
| Cog1_PDQ39_Q24      | 223 | .42   | .806  | 3  | 1.3  | 0 | 11 |
| Cog1_PDQ39_Q25      | 223 | .57   | .960  | 3  | 1.3  | 0 | 14 |
| Cog1_PDQ39_Q26      | 220 | .56   | .927  | 6  | 2.7  | 0 | 11 |
| Cog1_PDQ39_Q27      | 219 | .67   | 1.064 | 7  | 3.1  | 0 | 14 |
| Cog1_PDQ39_Q28      | 200 | .37   | .752  | 26 | 11.5 | 0 | 7  |
| Cog1_PDQ39_Q29      | 219 | .41   | .793  | 7  | 3.1  | 0 | 9  |
| Cog1_PDQ39_Q30      | 223 | .88   | .989  | 3  | 1.3  | 0 | 16 |
| Cog1_PDQ39_Q31      | 223 | 1.10  | 1.017 | 3  | 1.3  | 0 | 0  |
| Cog1_PDQ39_Q32      | 221 | 1.10  | 1.026 | 5  | 2.2  | 0 | 0  |
| Cog1_PDQ39_Q33      | 223 | .62   | .959  | 3  | 1.3  | 0 | 17 |
| Cog1_PDQ39_Q34      | 222 | 1.02  | .995  | 4  | 1.8  | 0 | 0  |
| Cog1_PDQ39_Q35      | 223 | .83   | .984  | 3  | 1.3  | 0 | 14 |
| Cog1_PDQ39_Q36      | 222 | .47   | .735  | 4  | 1.8  | 0 | 5  |
| Cog1_PDQ39_Q37      | 219 | 1.30  | 1.169 | 7  | 3.1  | 0 | 0  |
| Cog1_PDQ39_Q38      | 222 | 1.83  | 1.186 | 4  | 1.8  | 0 | 0  |
| Cog1_PDQ39_Q39      | 221 | .93   | 1.070 | 5  | 2.2  | 0 | 26 |
| UPDRS1_Q2.1         | 175 | .99   | 1.053 | 51 | 22.6 | 0 | 0  |
| UPDRS1_Q2.2         | 175 | 1.17  | 1.260 | 51 | 22.6 | 0 | 0  |
| UPDRS1_Q2.3         | 174 | .43   | .638  | 52 | 23.0 | 0 | 3  |
| UPDRS1_Q2.4         | 174 | .68   | .736  | 52 | 23.0 | 0 | 0  |
| UPDRS1_Q2.5         | 174 | .86   | .851  | 52 | 23.0 | 0 | 6  |
| UPDRS1_Q2.6         | 175 | .49   | .677  | 51 | 22.6 | 0 | 2  |
| UPDRS1_Q2.7         | 174 | 1.22  | 1.172 | 52 | 23.0 | 0 | 0  |
| UPDRS1_Q2.8         | 175 | 1.02  | .947  | 51 | 22.6 | 0 | 0  |
| UPDRS1_Q2.9         | 175 | .75   | .697  | 51 | 22.6 | 0 | 3  |
| UPDRS1_Q2.10        | 175 | 1.07  | .884  | 51 | 22.6 | 0 | 0  |
| UPDRS1_Q2.11        | 174 | .98   | .880  | 52 | 23.0 | 0 | 11 |
| UPDRS1_Q2.12        | 174 | .96   | 1.005 | 52 | 23.0 | 0 | 21 |
| UPDRS1_Q2.13        | 174 | .48   | .923  | 52 | 23.0 | 0 | 10 |
| Age_at_CogStudy1_YE | 226 | 65.48 | 9.683 | 0  | .0   | 2 | 0  |
| ARS                 |     |       |       | 0  | .0   |   |    |
| Cog1_Sex            | 226 |       |       |    |      |   |    |

a. Number of cases outside the range (Q1 - 1.5\*IQR, Q3 + 1.5\*IQR).

b. . indicates that the inter-quartile range (IQR) is zero.

Second Missing Values Analysis:  $\chi^2 (N = 174) = 1684.38, p = .302$

Univariate Statistics

|                | N   | Mean | Std.<br>Deviation | Missing |         | No. of Extremes <sup>a,b</sup> |      |
|----------------|-----|------|-------------------|---------|---------|--------------------------------|------|
|                |     |      |                   | Count   | Percent | Low                            | High |
| Cog1_GDS1      | 173 | .86  | .347              | 1       | .6      | .                              | .    |
| Cog1_GDS2      | 173 | .38  | .487              | 1       | .6      | 0                              | 0    |
| Cog1_GDS3      | 173 | .12  | .328              | 1       | .6      | .                              | .    |
| Cog1_GDS4      | 173 | .22  | .415              | 1       | .6      | .                              | .    |
| Cog1_GDS5      | 173 | .91  | .282              | 1       | .6      | .                              | .    |
| Cog1_GDS6      | 171 | .25  | .435              | 3       | 1.7     | 0                              | 0    |
| Cog1_GDS7      | 171 | .88  | .322              | 3       | 1.7     | .                              | .    |
| Cog1_GDS8      | 173 | .11  | .314              | 1       | .6      | .                              | .    |
| Cog1_GDS9      | 173 | .43  | .497              | 1       | .6      | 0                              | 0    |
| Cog1_GDS10     | 171 | .22  | .413              | 3       | 1.7     | .                              | .    |
| Cog1_GDS11     | 173 | .87  | .334              | 1       | .6      | .                              | .    |
| Cog1_GDS12     | 173 | .11  | .314              | 1       | .6      | .                              | .    |
| Cog1_GDS13     | 169 | .27  | .443              | 5       | 2.9     | 0                              | 0    |
| Cog1_GDS14     | 171 | .08  | .266              | 3       | 1.7     | .                              | .    |
| Cog1_GDS15     | 173 | .10  | .306              | 1       | .6      | .                              | .    |
| Cog1_PDQ39_Q1  | 172 | 1.34 | 1.211             | 2       | 1.1     | 0                              | 0    |
| Cog1_PDQ39_Q2  | 171 | 1.06 | 1.152             | 3       | 1.7     | 0                              | 0    |
| Cog1_PDQ39_Q3  | 173 | .81  | 1.138             | 1       | .6      | 0                              | 19   |
| Cog1_PDQ39_Q4  | 171 | 1.00 | 1.320             | 3       | 1.7     | 0                              | 0    |
| Cog1_PDQ39_Q5  | 171 | .54  | 1.036             | 3       | 1.7     | 0                              | 13   |
| Cog1_PDQ39_Q6  | 172 | .74  | 1.056             | 2       | 1.1     | 0                              | 16   |
| Cog1_PDQ39_Q7  | 173 | .85  | 1.105             | 1       | .6      | 0                              | 17   |
| Cog1_PDQ39_Q8  | 173 | .46  | .968              | 1       | .6      | .                              | .    |
| Cog1_PDQ39_Q9  | 172 | .66  | 1.093             | 2       | 1.1     | 0                              | 19   |
| Cog1_PDQ39_Q10 | 172 | .67  | 1.114             | 2       | 1.1     | 0                              | 19   |
| Cog1_PDQ39_Q11 | 171 | .28  | .616              | 3       | 1.7     | .                              | .    |
| Cog1_PDQ39_Q12 | 172 | .54  | .833              | 2       | 1.1     | 0                              | 6    |
| Cog1_PDQ39_Q13 | 172 | .62  | 1.078             | 2       | 1.1     | 0                              | 12   |
| Cog1_PDQ39_Q14 | 173 | 1.80 | 1.312             | 1       | .6      | 0                              | 0    |
| Cog1_PDQ39_Q15 | 172 | .85  | 1.041             | 2       | 1.1     | 0                              | 19   |
| Cog1_PDQ39_Q16 | 172 | .65  | .876              | 2       | 1.1     | 0                              | 7    |
| Cog1_PDQ39_Q17 | 172 | .88  | 1.215             | 2       | 1.1     | 0                              | 13   |
| Cog1_PDQ39_Q18 | 172 | .53  | .875              | 2       | 1.1     | 0                              | 9    |
| Cog1_PDQ39_Q19 | 172 | .62  | .893              | 2       | 1.1     | 0                              | 7    |
| Cog1_PDQ39_Q20 | 173 | .40  | .671              | 1       | .6      | 0                              | 3    |
| Cog1_PDQ39_Q21 | 173 | .92  | .937              | 1       | .6      | 0                              | 13   |
| Cog1_PDQ39_Q22 | 172 | 1.09 | .999              | 2       | 1.1     | 0                              | 0    |

|                     |     |       |       |    |      |   |    |
|---------------------|-----|-------|-------|----|------|---|----|
| Cog1_PDQ39_Q23      | 172 | .73   | 1.060 | 2  | 1.1  | 0 | 17 |
| Cog1_PDQ39_Q24      | 173 | .34   | .726  | 1  | .6   | . | .  |
| Cog1_PDQ39_Q25      | 173 | .49   | .860  | 1  | .6   | 0 | 8  |
| Cog1_PDQ39_Q26      | 171 | .49   | .870  | 3  | 1.7  | 0 | 8  |
| Cog1_PDQ39_Q27      | 169 | .59   | 1.020 | 5  | 2.9  | 0 | 9  |
| Cog1_PDQ39_Q28      | 155 | .34   | .742  | 19 | 10.9 | . | .  |
| Cog1_PDQ39_Q29      | 171 | .37   | .758  | 3  | 1.7  | . | .  |
| Cog1_PDQ39_Q30      | 173 | .98   | 1.056 | 1  | .6   | 0 | 1  |
| Cog1_PDQ39_Q31      | 173 | 1.13  | 1.003 | 1  | .6   | 0 | 0  |
| Cog1_PDQ39_Q32      | 171 | 1.06  | 1.007 | 3  | 1.7  | 0 | 0  |
| Cog1_PDQ39_Q33      | 173 | .56   | .898  | 1  | .6   | 0 | 10 |
| Cog1_PDQ39_Q34      | 172 | .97   | .982  | 2  | 1.1  | 0 | 0  |
| Cog1_PDQ39_Q35      | 173 | .77   | .967  | 1  | .6   | 0 | 10 |
| Cog1_PDQ39_Q36      | 173 | .43   | .717  | 1  | .6   | 0 | 4  |
| Cog1_PDQ39_Q37      | 171 | 1.24  | 1.151 | 3  | 1.7  | 0 | 0  |
| Cog1_PDQ39_Q38      | 172 | 1.76  | 1.184 | 2  | 1.1  | 0 | 0  |
| Cog1_PDQ39_Q39      | 172 | .87   | 1.068 | 2  | 1.1  | 0 | 18 |
| UPDRS1_Q2.1         | 174 | .99   | 1.053 | 0  | .0   | 0 | 0  |
| UPDRS1_Q2.2         | 174 | 1.16  | 1.262 | 0  | .0   | 0 | 0  |
| UPDRS1_Q2.3         | 173 | .43   | .640  | 1  | .6   | 0 | 3  |
| UPDRS1_Q2.4         | 173 | .69   | .736  | 1  | .6   | 0 | 0  |
| UPDRS1_Q2.5         | 173 | .84   | .838  | 1  | .6   | 0 | 5  |
| UPDRS1_Q2.6         | 174 | .49   | .678  | 0  | .0   | 0 | 2  |
| UPDRS1_Q2.7         | 173 | 1.21  | 1.168 | 1  | .6   | 0 | 0  |
| UPDRS1_Q2.8         | 174 | 1.02  | .946  | 0  | .0   | 0 | 0  |
| UPDRS1_Q2.9         | 174 | .75   | .698  | 0  | .0   | 0 | 3  |
| UPDRS1_Q2.10        | 174 | 1.07  | .887  | 0  | .0   | 0 | 0  |
| UPDRS1_Q2.11        | 173 | .98   | .879  | 1  | .6   | 0 | 11 |
| UPDRS1_Q2.12        | 173 | .97   | 1.005 | 1  | .6   | 0 | 21 |
| UPDRS1_Q2.13        | 173 | .48   | .925  | 1  | .6   | 0 | 10 |
| Age_at_CogStudy1_YE | 174 | 65.96 | 9.457 | 0  | .0   | 0 | 0  |
| ARS                 |     |       |       |    |      |   |    |
| Cog1_Sex            | 174 |       |       | 0  | .0   |   |    |

a. Number of cases outside the range (Q1 - 1.5\*IQR, Q3 + 1.5\*IQR).

b. . indicates that the inter-quartile range (IQR) is zero.

## Multivariate Outlier Statistics for Hypothesis A and C.

**Residuals Statistics<sup>a</sup>**

|                                   | Minimum   | Maximum  | Mean    | Std. Deviation | N   |
|-----------------------------------|-----------|----------|---------|----------------|-----|
| Predicted Value                   | 2.7937    | 57.8037  | 19.2525 | 9.58323        | 174 |
| Std. Predicted Value              | -1.717    | 4.023    | .000    | 1.000          | 174 |
| Standard Error of Predicted Value | .657      | 2.698    | 1.155   | .375           | 174 |
| Adjusted Predicted Value          | 2.7803    | 58.4660  | 19.2461 | 9.57662        | 174 |
| Residual                          | -24.12299 | 22.49450 | .00000  | 7.94063        | 174 |
| Std. Residual                     | -3.011    | 2.808    | .000    | .991           | 174 |
| Stud. Residual                    | -3.099    | 2.821    | .000    | 1.005          | 174 |
| Deleted Residual                  | -25.54139 | 22.69267 | .00640  | 8.16980        | 174 |
| Stud. Deleted Residual            | -3.181    | 2.880    | .001    | 1.012          | 174 |
| Mahal. Distance                   | .170      | 18.636   | 2.983   | 2.966          | 174 |
| Cook's Distance                   | .000      | .144     | .007    | .018           | 174 |
| Centered Leverage Value           | .001      | .108     | .017    | .017           | 174 |

a. Dependent Variable: PDQ39 - Single Index Score

## Multivariate Outlier Statistics for Hypothesis B.

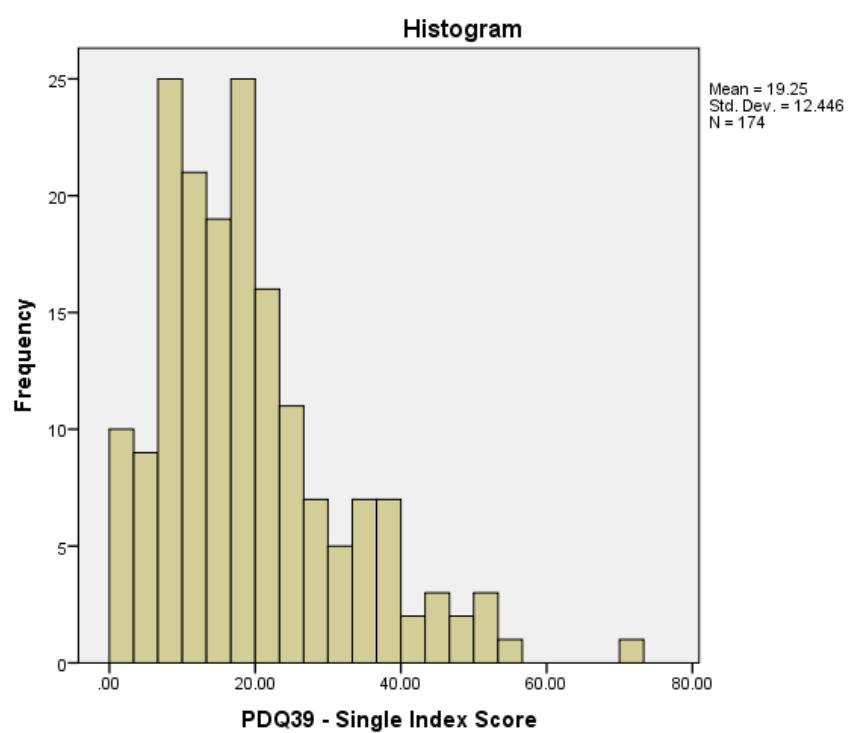
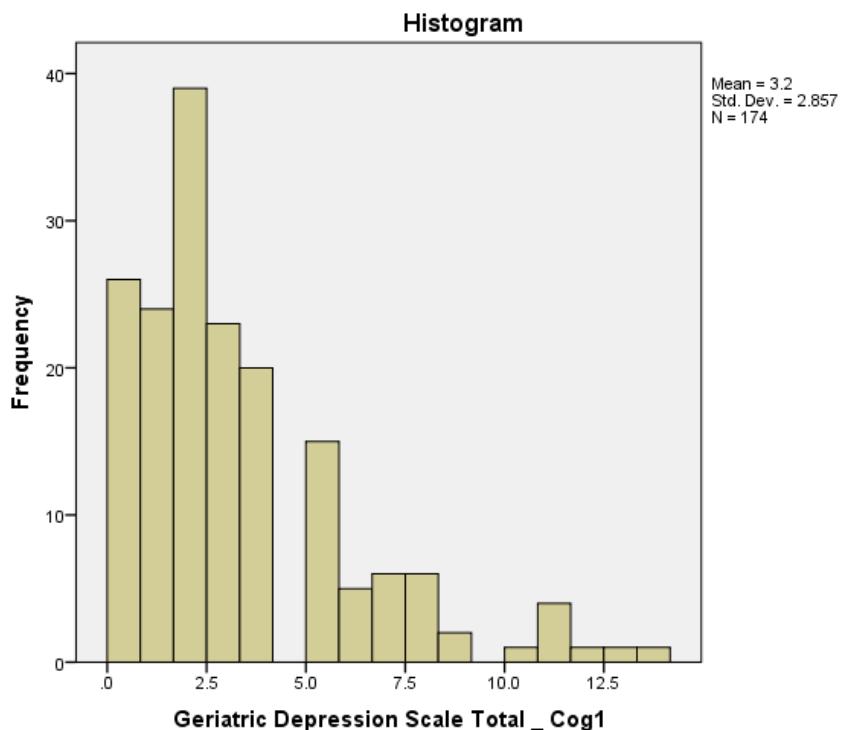
**Residuals Statistics<sup>a</sup>**

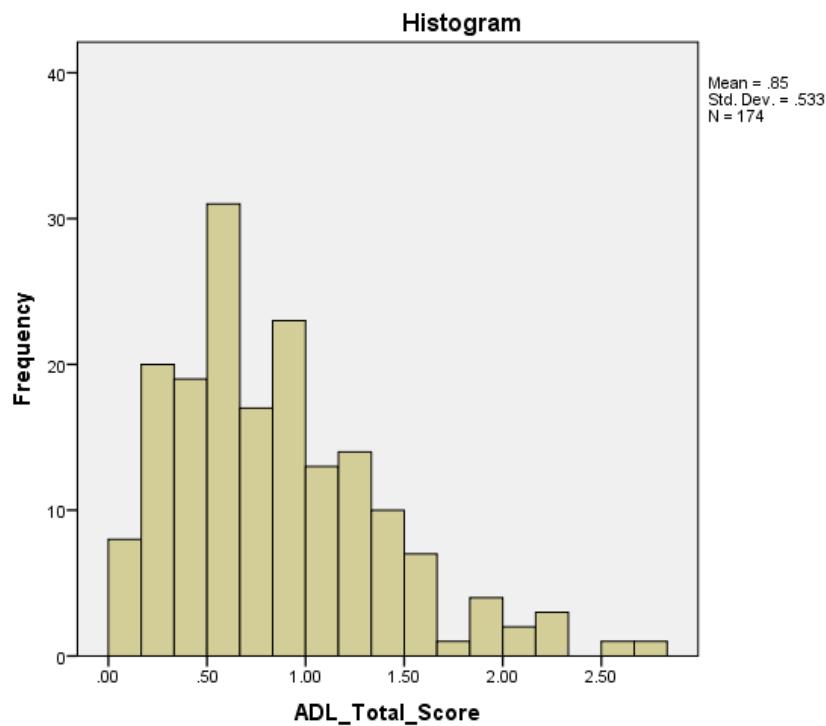
|                                   | Minimum  | Maximum | Mean   | Std. Deviation | N   |
|-----------------------------------|----------|---------|--------|----------------|-----|
| Predicted Value                   | .4930    | 1.4012  | .8510  | .17275         | 174 |
| Std. Predicted Value              | -2.072   | 3.185   | .000   | 1.000          | 174 |
| Standard Error of Predicted Value | .039     | .158    | .063   | .021           | 174 |
| Adjusted Predicted Value          | .5005    | 1.3654  | .8508  | .17204         | 174 |
| Residual                          | -1.07480 | 2.10181 | .00000 | .50396         | 174 |
| Std. Residual                     | -2.120   | 4.146   | .000   | .994           | 174 |
| Stud. Residual                    | -2.146   | 4.173   | .000   | 1.003          | 174 |
| Deleted Residual                  | -1.10105 | 2.12934 | .00011 | .51309         | 174 |
| Stud. Deleted Residual            | -2.169   | 4.391   | .003   | 1.014          | 174 |
| Mahal. Distance                   | .015     | 15.822  | 1.989  | 2.325          | 174 |
| Cook's Distance                   | .000     | .107    | .006   | .013           | 174 |
| Centered Leverage Value           | .000     | .091    | .011   | .013           | 174 |

a. Dependent Variable: ADL\_Total\_Score

### Assumptions

Histograms inspected for normality.

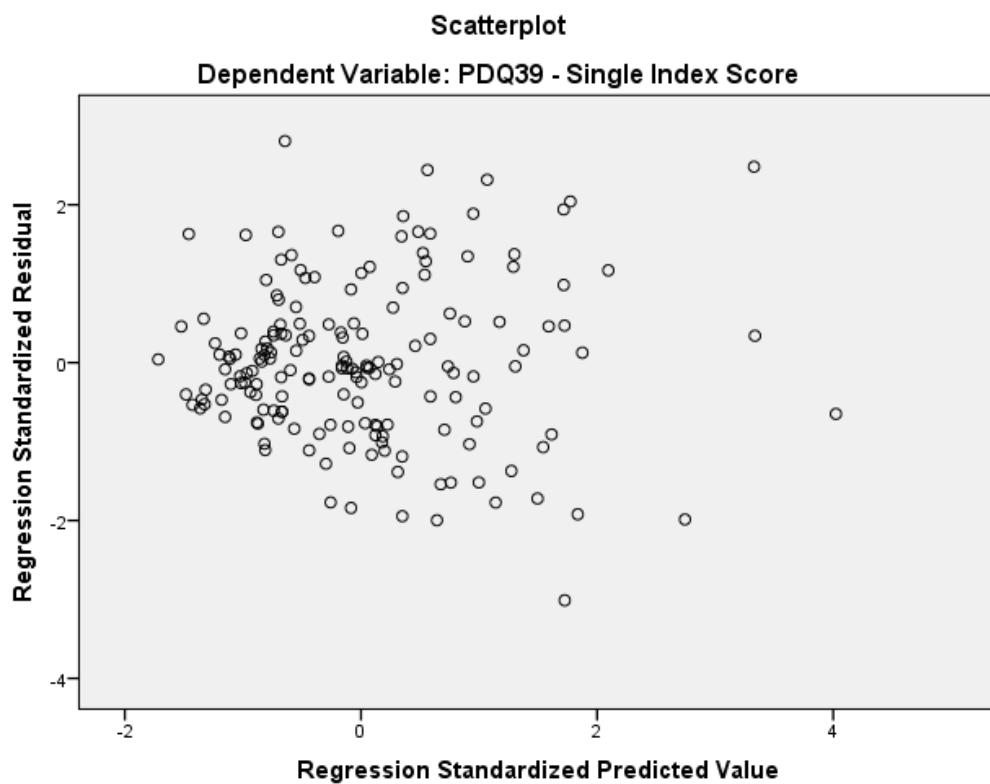




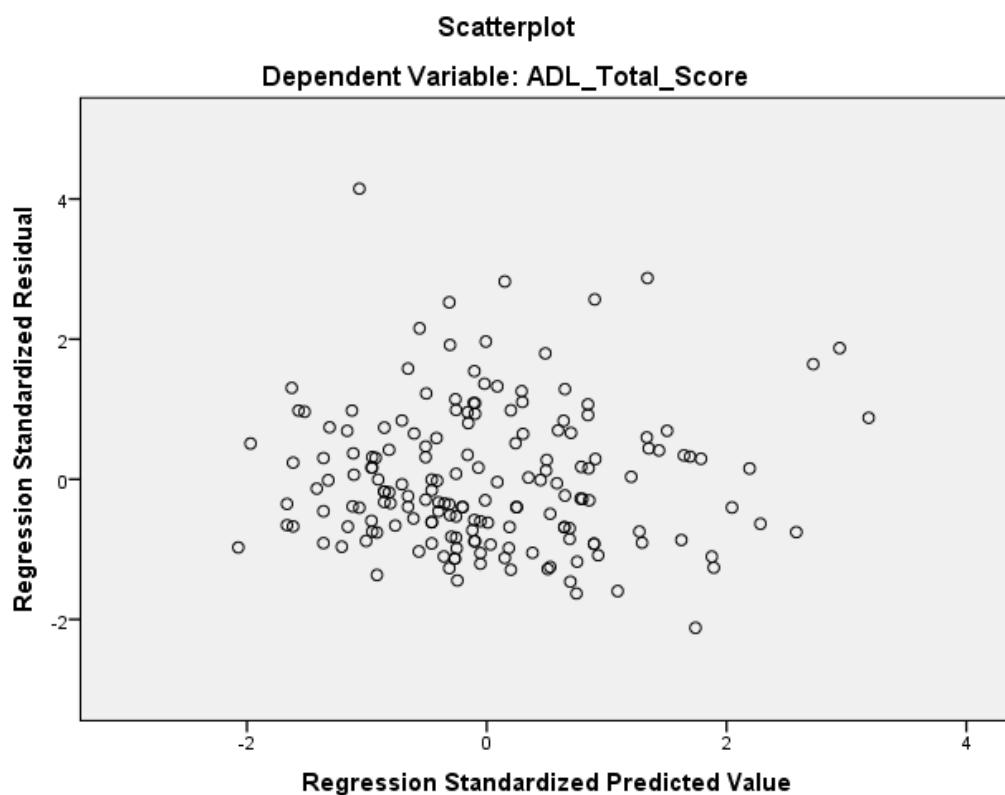
### Skewness and Kurtosis Statistics

|   | Skewness  |            | Kurtosis  |            |
|---|-----------|------------|-----------|------------|
|   | Statistic | Std. Error | Statistic | Std. Error |
| Age at participation in Cognitive Study 1 | -.216     | .184       | -.396     | .366       |
| Cog1- Sex                                 | .798      | .184       | -1.379    | .366       |
| Geriatric Depression Scale Total _ Cog1   | 1.380     | .184       | 2.002     | .366       |
| PDQ39 - Single Index Score                | 1.146     | .184       | 1.520     | .366       |
| ADL_Total_Score                           | .993      | .184       | .987      | .366       |

Normality, linearity, and homoscedasticity of residuals for Hypothesis A and C.



Normality, linearity, and homoscedasticity of residuals for Hypothesis B.



Tolerance Statistics for Multicollinearity of Hypothesis A and C.

| Collinearity Statistics |       |
|-------------------------|-------|
| Tolerance               | VIF   |
| 1.000                   | 1.000 |
| .971                    | 1.029 |
| .919                    | 1.088 |
| .895                    | 1.118 |

Tolerance Statistics for Multicollinearity of Hypothesis B.

| Collinearity Statistics |       |
|-------------------------|-------|
| Tolerance               | VIF   |
| 1.000                   | 1.000 |
| .998                    | 1.002 |
| .998                    | 1.002 |

### Descriptive Statistics

|   | N         | Minimum   | Maximum   | Mean      | Std. Deviation |
|---|-----------|-----------|-----------|-----------|----------------|
|   | Statistic | Statistic | Statistic | Statistic | Statistic      |
| Age at participation in Cognitive Study 1 | 174       | 41        | 85        | 65.96     | 9.457          |
| Cog1- Sex                                 | 174       | 1         | 2         | 1.32      | .466           |
| Geriatric Depression Scale                | 174       | 0         | 14        | 3.20      | 2.857          |
| Total _ Cog1                              |           |           |           |           |                |
| PDQ39 - Single Index Score                | 174       | 1.30      | 71.04     | 19.2525   | 12.44556       |
| ADL_Total_Score                           | 174       | .00       | 2.77      | .8510     | .53275         |
| Valid N (listwise)                        | 174       |           |           |           |                |

|        | Frequency | Percent | Valid Percent | Cumulative Percent |
|--------|-----------|---------|---------------|--------------------|
| Male   | 119       | 68.4    | 68.4          | 68.4               |
| Female | 55        | 31.6    | 31.6          | 100.0              |
| Total  | 174       | 100.0   | 100.0         |                    |

## Bivariate Correlations

|   |                     | Correlations                            |           |   |                             |                   |  |
|---|---------------------|---|-----------|---|-----------------------------|-------------------|--|
|   |                     | Age at participation in Cognitive Study | Cog1- Sex | Geriatric Depression Scale Total - Cog1 | PDQ 39 - Single Index Score | ADL_Total_Scor e  |  |
| Age at participation in Cognitive Study | 1                   |   |           |   |                             |                   |  |
|   | Pearson Correlation |   |           |   |                             |                   |  |
|   | Sig. (2-tailed)     |   |           |   |                             |                   |  |
|   | N                   | 174                                     | 174       | 174                                     | .046                        | .169 <sup>*</sup> |  |
| Cog1- Sex                               |                     |   |           |   |                             |                   |  |
|   | Pearson Correlation |   |           |   |                             |                   |  |
|   | Sig. (2-tailed)     |   |           |   |                             |                   |  |
|   | N                   | -133                                    | 1         | .012                                    | .546                        | .026              |  |
|   |                     | .079                                    | .079      | .870                                    | .174                        | .174              |  |
|   |                     | 174                                     | 174       | .870                                    | .033                        | -.123             |  |
| Geriatric Depression Scale Total _ Cog1 |                     |   |           |   |                             |                   |  |
|   | Pearson Correlation |   |           |   |                             |                   |  |
|   | Sig. (2-tailed)     |   |           |   |                             |                   |  |
|   | N                   | .049                                    | .049      | .012                                    | 1                           | .667              |  |
|   |                     | .522                                    | .522      | .870                                    | .174                        | .107              |  |
| PDQ39 - Single Index Score              |                     |   |           |   |                             |                   |  |
|   | Pearson Correlation |   |           |   |                             |                   |  |
|   | Sig. (2-tailed)     |   |           |   |                             |                   |  |
|   | N                   | .046                                    | .046      | .033                                    | .633 <sup>*</sup>           | .285 <sup>*</sup> |  |
| ADL_Total_Score                         |                     |   |           |   |                             |                   |  |
|   | Pearson Correlation |   |           |   |                             |                   |  |
|   | Sig. (2-tailed)     |   |           |   |                             |                   |  |
|   | N                   | .546                                    | .546      | .667                                    | .000                        | .000              |  |
|   |                     | 174                                     | 174       | .174                                    | .174                        | .174              |  |
|   |                     | .169 <sup>*</sup>                       | 1         | -.123                                   | .285 <sup>*</sup>           | .597 <sup>*</sup> |  |
|   |                     |   |           | .107                                    | .000                        | .000              |  |
|   |                     |   |           | 174                                     | 174                         | 174               |  |

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).

## Regression One for Hypothesis A and C

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate | Model Summary <sup>c</sup> |          |     |     |
|-------|-------------------|----------|-------------------|----------------------------|----------------------------|----------|-----|-----|
|       |                   |          |                   |                            | R Square Change            | F Change | df1 | df2 |
| 1     | .046 <sup>a</sup> | .002     | -.004             | 12.46845                   | .002                       | .365     | 1   | 172 |
| 2     | .770 <sup>b</sup> | .593     | .586              | 8.01039                    | .591                       | 123.361  | 2   | 170 |

- a. Predictors: (Constant), Age at participation in Cognitive Study 1  
 b. Predictors: (Constant), Age at participation in Cognitive Study 1, Geriatric Depression Scale Total \_ Cog1, ADL\_Total\_Score  
 c. Dependent Variable: PDQ39 - Single Index Score

ANOVA<sup>a</sup>

| Model | Sum of Squares | df        | Mean Square | F        | Sig.              |
|-------|----------------|-----------|-------------|----------|-------------------|
| 1     | Regression     | 56.786    | 1           | 56.786   | .365              |
|       | Residual       | 26739.513 | 172         | 155.462  | .546 <sup>b</sup> |
|       | Total          | 26796.299 | 173         |          |                   |
| 2     | Regression     | 15888.014 | 3           | 5296.005 | 82.536            |
|       | Residual       | 10908.284 | 170         | 64.166   | .000 <sup>c</sup> |
|       | Total          | 26796.299 | 173         |          |                   |

- a. Dependent Variable: PDQ39 - Single Index Score  
 b. Predictors: (Constant), Age at participation in Cognitive Study 1  
 c. Predictors: (Constant), Age at participation in Cognitive Study 1, Geriatric Depression Scale Total \_ Cog1, ADL\_Total\_Score

| Model | Coefficients <sup>a</sup>                 |            |                            |       |        |                                 | Correlations |            |         |       | Collinearity Statistics |       |
|-------|---|------------|----------------------------|-------|--------|---------------------------------|--------------|------------|---------|-------|-------------------------|-------|
|       | Unstandardized Coefficients               |            | Standardize d Coefficients | t     | Sig.   | 95.0% Confidence Interval for B |              | Zero-order | Partial | Part  | Tolerance               | VIF   |
|       | B   | Std. Error | Beta                       |       |        | Lower Bound                     | Upper Bound  |            |         |       |                         |       |
|       | (Constant)                                | 15.256     | 6.679                      |       | 2.284  | .024                            | 2.072        | 28.440     |         |       |                         |       |
| 1     | Age at participation in Cognitive Study 1 | .061       | .100                       | .046  | .604   | .546                            | -.137        | .258       | .046    | .046  | 1.000                   | 1.000 |
|       | (Constant)                                | 7.958      | 4.319                      |       | 1.842  | .067                            | -.569        | 16.484     |         |       |                         |       |
|       | Age at participation in Cognitive Study 1 | -.075      | .065                       | -.057 | -1.147 | .253                            | -.204        | .054       | .046    | -.088 | .971                    | 1.029 |
| 2     | Geriatric Depression Scale Total _ Cog1   | 2.195      | .222                       | .504  | 9.873  | .000                            | 1.757        | 2.634      | .633    | .604  | .483                    | .919  |
|       | ADL_Total_Score                           | 10.821     | 1.208                      | .463  | 8.954  | .000                            | 8.435        | 13.206     | .597    | .566  | .438                    | .895  |
|       |   |            |                            |       |        |                                 |              |            |         |       |                         | 1.118 |

a. Dependent Variable: PDQ39 - Single Index Score

| Model                                      | Excluded Variables <sup>a</sup> |        |      |                     |                   |                         |
|--|---------------------------------|--------|------|---------------------|-------------------|-------------------------|
|  | Beta In                         | t      | Sig. | Partial Correlation | Tolerance         | Collinearity Statistics |
|  |                                 |        |      | VIF                 | Minimum Tolerance |                         |
| Geriatric Depression Scale Total<br>- Cog1 | .632 <sup>b</sup>               | 10.669 | .000 | .632                | .998              | .998                    |
| ADL Total Score                            | .607 <sup>b</sup>               | 9.768  | .000 | .598                | .971              | .971                    |

a. Dependent Variable: PDQ39 - Single Index Score

b. Predictors in the Model: (Constant), Age at participation in Cognitive Study 1

| Model | Dimension | Eigenvalue | Condition Index | Collinearity Diagnostics <sup>a</sup> |   |                            |
|-------|-----------|------------|-----------------|---------------------------------------|---|----------------------------|
|       |           |            |                 | (Constant)                            | Age at participation in Cognitive Study 1 | Variance Proportions       |
|       |           |            |                 | Total                                 | Cog1                                      | Geriatric Depression Scale |
| 1     | 1         | 1.990      | 1.000           | .01                                   | .01                                       | .02                        |
|       | 2         | .010       | 14.061          | .99                                   | .99                                       |                            |
|       | 1         | 3.465      | 1.000           | .00                                   | .00                                       |                            |
|       | 2         | .333       | 3.223           | .01                                   | .01                                       |                            |
| 2     | 2         | .192       | 4.253           | .01                                   | .01                                       | .01                        |
|       | 3         | .010       | 18.608          | .98                                   | .98                                       |                            |
|       | 4         |            |                 |                                       |   | .00                        |

a. Dependent Variable: PDQ39 - Single Index Score

## Regression Two for Hypothesis B

Model Summary<sup>c</sup>

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate | Model Summary <sup>c</sup> |          |     |     |
|-------|-------------------|----------|-------------------|----------------------------|----------------------------|----------|-----|-----|
|       |                   |          |                   |                            | R Square Change            | F Change | df1 | df2 |
| 1     | .169 <sup>b</sup> | .029     | .023              | .52660                     | .029                       | 5.067    | 1   | 172 |
| 2     | .324 <sup>a</sup> | .105     | .095              | .50690                     | .077                       | 14.625   | 1   | 171 |

a. Predictors: (Constant), Age at participation in Cognitive Study 1

b. Predictors: (Constant), Age at participation in Cognitive Study 1, Geriatric Depression Scale Total\_Cog1

c. Dependent Variable: ADL\_Total\_Score

ANOVA<sup>a</sup>

| Model | Sum of Squares | df     | Mean Square | F     | Sig.              |
|-------|----------------|--------|-------------|-------|-------------------|
| 1     | Regression     | 1.405  | 1           | 1.405 | 5.067             |
|       | Residual       | 47.696 | 172         | .277  | .026 <sup>b</sup> |
|       | Total          | 49.101 | 173         |       |                   |
| 2     | Regression     | 5.163  | 2           | 2.581 | 10.047            |
|       | Residual       | 43.938 | 171         | .257  | .000 <sup>c</sup> |
|       | Total          | 49.101 | 173         |       |                   |

a. Dependent Variable: ADL\_Total\_Score

b. Predictors: (Constant), Age at participation in Cognitive Study 1

c. Predictors: (Constant), Age at participation in Cognitive Study 1, Geriatric Depression Scale Total\_Cog1

| Model      | Coefficients <sup>a</sup>                 |            |                           |      |       |                                 | Correlations |             |            |         | Collinearity Statistics |           |
|------------|---|------------|---------------------------|------|-------|---------------------------------|--------------|-------------|------------|---------|-------------------------|-----------|
|            | Unstandardized Coefficients               |            | Standardized Coefficients | t    | Sig.  | 95.0% Confidence Interval for B | Lower Bound  | Upper Bound | Zero-order | Partial | Part                    | Tolerance |
|            | B   | Std. Error | Beta                      |      |       |                                 |              |             |            |         |                         |           |
|            |   |            |                           |      |       |                                 |              |             |            |         |                         |           |
| (Constant) | .222                                      | .282       |                           | .788 | .432  | -.334                           | .779         |             |            |         |                         |           |
| 1          | Age at participation in Cognitive Study 1 | .010       | .004                      | .169 | 2.251 | .026                            | .001         | .018        | .169       | .169    | .169                    | 1.000     |
|            | (Constant)                                | .107       | .273                      |      | .393  | .695                            | -.432        | .647        |            |         |                         |           |
|            | Age at participation in Cognitive Study 1 | .009       | .004                      | .156 | 2.149 | .033                            | .001         | .017        | .169       | .162    | .155                    | .998      |
| 2          | Geriatric Depression Scale Total Cog1     | .052       | .014                      | .277 | 3.824 | .000                            | .025         | .078        | .285       | .281    | .277                    | .998      |
|            |   |            |                           |      |       |                                 |              |             |            |         |                         |           |

a. Dependent Variable: ADL\_Total\_Score

| Model   | Excluded Variables <sup>a</sup> |       |      |                     | Collinearity Statistics |       |                   |
|---|---------------------------------|-------|------|---------------------|-------------------------|-------|-------------------|
|   | Beta In                         | t     | Sig. | Partial Correlation | Tolerance               | VIF   | Minimum Tolerance |
| 1<br>Geriatric Depression Scale Total<br>Cog1 | .277 <sup>b</sup>               | 3.824 | .000 | .281                | .998                    | 1.002 | .998              |

a. Dependent Variable: ADL\_Total\_Score

b. Predictors in the Model: (Constant), Age at participation in Cognitive Study 1

| Model | Dimension | Eigenvalue | Condition Index | Collinearity Diagnostics <sup>a</sup> |   |  |
|-------|-----------|------------|-----------------|---------------------------------------|---|--|
|       |           |            |                 | (Constant)                            | Age at participation in Cognitive Study 1 | Variance Proportions<br>1<br>Geriatric Depression Scale Total_Cog1 |
| 1     | 1         | 1.990      | 1.000           | .01                                   | .01                                       | .99<br>.00<br>.01  |
|       | 2         | .010       | 14.061          | .99                                   | .99                                       |  |
|       | 1         | 2.660      | 1.000           | .00                                   | .00                                       |  |
| 2     | 2         | .330       | 2.839           | .01                                   | .01                                       | .95<br>.01<br>.99  |
|       | 2         | .010       | 16.265          | .99                                   | .99                                       |  |
|       | 3         |            |                 |                                       |   |  |

a. Dependent Variable: ADL\_Total\_Score

## Regression Three for Hypothesis D

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate | Model Summary <sup>d</sup> |          |     |     |               |
|-------|-------------------|----------|-------------------|----------------------------|----------------------------|----------|-----|-----|---------------|
|       |                   |          |                   |                            | R Square Change            | F Change | df1 | df2 | Sig. F Change |
| 1     | .046 <sup>a</sup> | .002     | -.004             | 12.46845                   | .002                       | .365     | 1   | 172 | .546          |
| 2     | .633 <sup>b</sup> | .401     | .394              | 9.68907                    | .399                       | 113.832  | 1   | 171 | .000          |
| 3     | .770 <sup>c</sup> | .593     | .586              | 8.01039                    | .192                       | 80.180   | 1   | 170 | .000          |

a. Predictors: (Constant), Age at participation in Cognitive Study 1

b. Predictors: (Constant), Age at participation in Cognitive Study 1, Geriatric Depression Scale Total \_ Cog1

c. Predictors: (Constant), Age at participation in Cognitive Study 1, Geriatric Depression Scale Total \_ Cog1, ADL\_Total\_Score

d. Dependent Variable: PDQ39 - Single Index Score

| ANOVA <sup>a</sup> |            |                |     |             |        |                   |
|--------------------|------------|----------------|-----|-------------|--------|-------------------|
| Model              |            | Sum of Squares | df  | Mean Square | F      | Sig.              |
| 1                  | Regression | 56.786         | 1   | 56.786      | .365   | .546 <sup>b</sup> |
|                    | Residual   | 26739513       | 172 | 155.462     |        |                   |
|                    | Total      | 26796299       | 173 |             |        |                   |
| 2                  | Regression | 10743.141      | 2   | 5371.571    | 57.219 | .000 <sup>c</sup> |
|                    | Residual   | 16053.157      | 171 | 93.878      |        |                   |
|                    | Total      | 26796299       | 173 |             |        |                   |
| 3                  | Regression | 15888.014      | 3   | 5296.005    | 82.536 | .000 <sup>d</sup> |
|                    | Residual   | 10908.284      | 170 | 64.166      |        |                   |
|                    | Total      | 26796299       | 173 |             |        |                   |

a. Dependent Variable: PDQ39 - Single Index Score

b. Predictors: (Constant), Age at participation in Cognitive Study 1

c. Predictors: (Constant), Age at participation in Cognitive Study 1, Geriatric Depression Scale Total\_Cog1

d. Predictors: (Constant), Age at participation in Cognitive Study 1, Geriatric Depression Scale Total\_Cog1, ADL\_Total\_Score

| Model | Coefficients <sup>a</sup>                 |            |                             |                           |        |       | Correlations |             |            | Collinearity Statistics |       |           |       |
|-------|---|------------|-----------------------------|---------------------------|--------|-------|--------------|-------------|------------|-------------------------|-------|-----------|-------|
|       | B   | Std. Error | Unstandardized Coefficients | Standardized Coefficients | t      | Sig.  | Lower Bound  | Upper Bound | Zero-order | Partial                 | Part  | Tolerance | VIF   |
| 1     | (Constant)                                | 15.256     | 6.679                       | .046                      | 2.284  | .024  | 2.072        | 28.440      | .258       | .046                    | .046  | 1.000     | 1.000 |
|       | Age at participation in Cognitive Study 1 | .061       | .100                        | .604                      | .546   | -.137 |              |             |            |                         |       |           |       |
|       | (Constant)                                | 9.118      | 5.222                       | .015                      | 1.746  | .083  | -1.190       | 19.427      | .174       | .046                    | .020  | .015      | .998  |
|       | Age at participation in Cognitive Study 1 | .020       | .078                        | .255                      | .799   | -.134 |              |             |            |                         |       |           |       |
| 2     | Geriatric Depression Scale Total _ Cog1   | 2.754      | .258                        | .632                      | 10.669 | .000  | 2.245        | 3.264       | .633       | .632                    | .632  | .998      | 1.002 |
|       | (Constant)                                | 7.958      | 4.319                       | .1842                     | .067   | -.569 | 16.484       |             |            |                         |       |           |       |
|       | Age at participation in Cognitive Study 1 | -.075      | .065                        | -.057                     | -1.147 | .253  | -.204        | .054        | .046       | -.088                   | -.056 | .971      | .029  |
| 3     | Geriatric Depression Scale Total _ Cog1   | 2.195      | .222                        | .504                      | 9.873  | .000  | 1.757        | 2.634       | .633       | .604                    | .483  | .919      | 1.088 |
|       | ADL Total Score                           | 10.821     | 1.208                       | .463                      | 8.954  | .000  | 8.435        | 13.206      | .597       | .566                    | .438  | .895      | 1.118 |

a Dependent Variable: PDQ39 - Single Index Score

| Model |                                  | Beta In           | t      | Sig. | Excluded Variables <sup>a</sup> |           | Collinearity Statistics |                   |      |
|-------|----------------------------------|-------------------|--------|------|---------------------------------|-----------|-------------------------|-------------------|------|
|       |                                  |                   |        |      | Partial Correlation             | Tolerance | VIF                     | Minimum Tolerance |      |
| 1     | Geriatric Depression Scale Total | .632 <sup>b</sup> | 10.669 | .000 |                                 | .632      | .998                    | 1.002             | .998 |
|       | - Cog1                           |                   |        |      |                                 |           |                         |                   |      |
|       | ADL_Total_Score                  | .607 <sup>b</sup> | 9.768  | .000 |                                 |           |                         |                   |      |
| 2     | ADL_Total_Score                  | .463 <sup>c</sup> | 8.954  | .000 |                                 | .598      | .971                    | 1.029             | .971 |
|       |                                  |                   |        |      |                                 |           |                         |                   |      |
|       |                                  |                   |        |      |                                 | .566      | .895                    | 1.118             | .895 |

a. Dependent Variable: PDQ39 - Single Index Score

b. Predictors in the Model: (Constant), Age at participation in Cognitive Study 1

c. Predictors in the Model: (Constant), Age at participation in Cognitive Study 1, Geriatric Depression Scale Total \_ Cog1

| Model | Dimension | Eigenvalue | Condition Index | Collinearity Diagnostics <sup>a</sup> |  |   |
|-------|-----------|------------|-----------------|---------------------------------------|--|---|
|       |           |            |                 | (Constant)                            | Age at participation<br>in Cognitive Study | Variance Proportions                        |
|       |           |            |                 | 1                                     | .1   | ADL_Total_Score                             |
| 1     | 1         | 1.990      | 1.000           | .01                                   | .99  | Geriatric<br>Depression Scale<br>Total_Cog1 |
|       | 2         | .010       | 14.061          | .99                                   | .00  |   |
| 2     | 1         | 2.660      | 1.000           | .00                                   | .01  | .05<br>.95<br>.00                           |
|       | 2         | .330       | 2.839           | .01                                   | .99  |   |
| 3     | 1         | .010       | 16.265          | .99                                   | .00  | .03<br>.94<br>.00                           |
|       | 2         | .010       | 3.465           | 1.000                                 | .00  |   |
| 3     | 1         | .333       | 3.223           | .01                                   | .01  | .02<br>.01<br>.96<br>.00                    |
|       | 2         | .333       | 4.253           | .01                                   | .98  |   |
| 3     | 3         | .192       | 18.608          | .98                                   | .98  | .04<br>.00                                  |
|       | 4         | .010       |                 |                                       |  |   |

a Dependent Variable: PDQ39 - Single Index Score

### Ethics Approval

**From:** Research Ethics  
**Sent:** Monday, 30 May 2011 11:28 AM  
**To:** Meghan THOMAS  
**Cc:** Stephanie WHITWORTH  
**Subject:** RE: ParkC Ethics Extension?

Hi Meghan

**Project 2736 - Cognitive and motor heterogeneity in idiopathic Parkinson's disease**

Is this the project you mean? If so, ethics approval is until 31 December 2014.

Cheers  
Kim

**Kim Gifkins, Research Ethics Officer, Office of Research & Innovation, Edith Cowan University, 270 Joondalup Drive, Joondalup, WA 6027 [research.ethics@ecu.edu.au](mailto:research.ethics@ecu.edu.au) Tel: +61 08 6304 2170 | Mobile: 0428 035 397 | Fax: +61 08 6304 5044 | CRICOS IPC 00279B**

**From:** Meghan THOMAS  
**Sent:** Monday, 30 May 2011 9:02 AM  
**To:** Kim GIFKINS  
**Cc:** Stephanie WHITWORTH  
**Subject:** ParkC Ethics Extension?

Hi Kim,

Stephanie has been working on some amendments to our ParkC Ethics application and noticed that our approval is until July 2011.

We have been successful in securing a further 3 years worth of funding, so the study will be continuing.

Could we please extend our ethics approval until March 2014?

Kind regards  
Meghan

Dr Meghan Thomas (PhD)

Director Parkinson's Centre (ParkC)/  
Postdoctoral Research Fellow (Neurological Cell Replacement Therapies)

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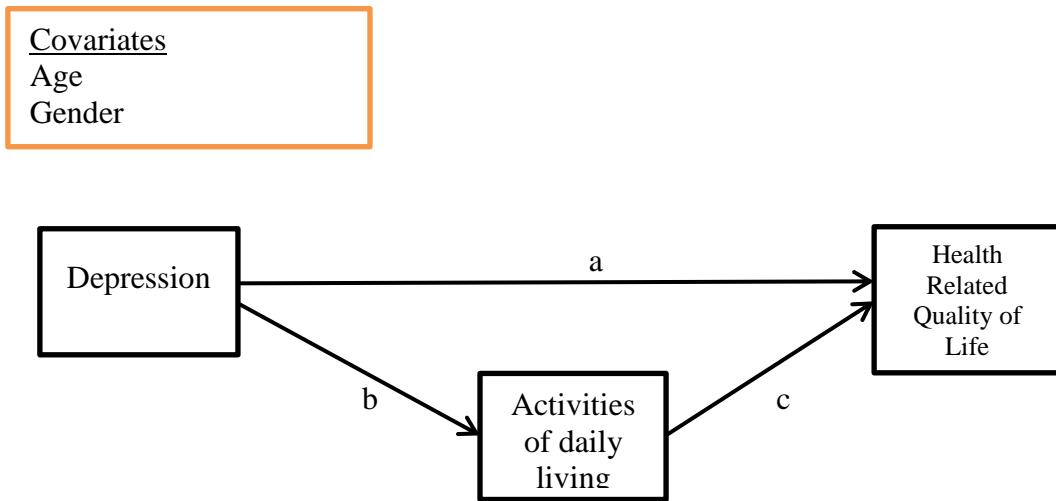
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## Statistical Consultation

### STATISTICAL CONSULTATION FOR HONOURS STUDENTS 2012

You propose the following mediation model:



The *regression* approach to testing mediation models consists of five steps. All your hypotheses can be addressed by following these steps.

#### **Step 1**

The mediation model depicted above assumes that the three scales (GDS, UPDRS, HRQOL) are uni-factorial; in which case their total scores can be used to represent their respective constructs (depression, activities of daily living, and health-related quality of life). The psychometric properties of *established* scales will have been evaluated in previous studies. You merely need to review these studies to determine the dimensionality of the scale. For *new* scales, or established scales that have been *modified* in some way, you'll need to conduct a confirmatory factor analysis (CFA) to show that the inter-item correlations in your data can be adequately explained in terms of a one-factor solution. Multi-factorial scales can be incorporated into the mediation model, but they'll increase the complexity of the model. If a two-factor solution fits the mediator measure significantly better than a one-factor solution, for instance, then two mediators should be included in the model – one for each of the factors. Alternatively, mediation models incorporating multi-factorial scales can be analysed with structural equation modelling (SEM).

#### **Step 2**

Ensure that the bivariate correlations among the three measures are all significant. If this is not the case, then the analysis terminates and the mediation hypothesis is rejected.

#### **Step 3**

Compute the path coefficient a, b, and c. The two regression models described below will estimate all three path coefficients.

|                     | DV                         | Step 1<br>(Covariates) <sup>1</sup> | Step 2<br>(IV and/or mediator)           |
|---------------------|----------------------------|-------------------------------------|--|
| <b>Regression 1</b> | HR quality of life         | Age<br>Gender                       | Depression<br>Activities of daily living |
| <b>Regression 2</b> | Activities of daily living | Age<br>Gender                       | Depression                               |

1: If the potential covariate is not significantly correlated with at least one of the two DVs, then by definition it is not a covariate and should not be included as such in the regression models.

The standardised regression coefficients (beta weights) for depression and activities of daily living from Regression 1 will provide the path coefficients for the a and c pathways; and the standardised regression coefficient for depression from Regression 2 will provide the path coefficient for the b pathway. Check that the path coefficients for b and c are both significant. If this is not the case, then the analysis terminates and the mediation hypothesis is rejected.

#### **Step 4**

The significance of the path coefficients for b and c does not guarantee that the mediation effect is significant. The significance of the mediation effect can be evaluated with the Sobel test. You can use the attached Excel spread sheet to conduct a Sobel test on your data. You'll recall that the path coefficients for the b and c pathways are the standardised regression coefficients (beta weights) for depression (Regression 2) and activities of daily living (Regression 1) respectively. All you need to do is input these beta weights into the appropriate cells on Row 17 of the spread sheet. You'll see that you also need to input the corresponding *t*-values for the beta weights. These can be obtained from the SPSS regression output. Once you've input the required values, click anywhere on the spread sheet to conduct the Sobel test. Check the *p*-value on Row 22 for significance.

You'll notice that Row 17 is labelled 'unstandardised', whereas Row 1 is labelled 'standardised'. This is an error. The labels should of course be the other way around.

If you get this far and fail the Sobel test, make an appointment to see me and we'll try a less conservative test of the mediation effect.

#### **Step 5**

Once you've established a significant mediation effect, Regression 3 (described below) will help you determine whether the mediation effect is complete or partial.

|                     | DV                 | Step 1<br>(Covariates) | Step 2<br>(IV) | Step 3<br>(mediator)       |
|---------------------|--------------------|------------------------|----------------|----------------------------|
| <b>Regression 3</b> | HR quality of life | Age<br>Gender          | Depression     | Activities of daily living |

If the path coefficient (beta weight) for depression goes from significant on Step 2 to non-significant on Step 3, then you can infer complete mediation. If it's significant on both

steps, but the Step 3 value is *significantly* less than the Step 2 value, then you can infer partial mediation.

If you're unsure how to statistically compare two beta weights, then make an appointment to see me. Incidentally, the Step 3 beta weights from Regression 3 will provide the path coefficients for the a and c pathways. You could therefore drop Regression 1 if you wish. For ease of exposition, however, it's probably better to keep it.

### ***Assumptions***

For each regression analyses, you'll need to test the three regression assumptions of linearity, homoscedasticity, & normality. The scatterplot of the standardised Studentised residuals against standardised predicted values can be examined for violations of these assumptions (see Tabachnick & Fidell, 2001, p. 119). In addition, the Cook's Distance statistic will identify influential points (including univariate and multidimensional outliers). Finally, tolerance values for each predictor can be examined for evidence of multicollinearity.

### ***Sample size (assuming a power of .8, an alpha of .05, and a moderate mediation effect)***

The effect size for the mediation effect (IV→Mediator→DV) is the product of the effect sizes for the two mediating pathways (IV→Mediator; Mediator→DV). Assuming a 'moderate' effect size for each of the two mediating pathways (reflected by partial correlations of .3 in the aforementioned regression analyses), then the effect size for the mediation effect would be .09 (i.e., .3 x .3). This represents a 'small' mediation effect and would require a sample size of 614 to attain statistical significance – which is probably outside of your reach.

Assuming a 'large' effect size for each of the two mediating pathways (reflected by partial correlations of .5 in the aforementioned regression analyses), then the effect size for the mediation effect would be .25 (i.e., .5 x .5). This represents a 'moderate' mediation effect and would require a sample size of around 200 to attain statistical significance. If you predict a 'large' effect size for each of the two mediating pathways, and a 'moderate' effect size for the mediation effect, then anything above 200 participants would be a bonus.

### ***Limitations***

The mediation model is a causal model. You therefore need to recognise the limitations of testing causal models with *cross-sectional* data. Ideally, the IV should be measured at Time 1, the mediator at Time 2, and the DV at Time 3.

## Participant Information Sheet



1

### INFORMATION SHEET

#### JOONDALUP CAMPUS

270 Joondalup Drive, Building 21; Level 5

Joondalup, Western Australia 6027

¶ (08) 6304 3560

ParkC@ecu.edu.au

[www.ParkC.org.au](http://www.ParkC.org.au)

ABN 54 361 465 361 CRICOS IPC 00279B

**Project titled: COGNITIVE AND MOTOR HETEROGENEITY  
IN IDIOPATHIC PARKINSON'S DISEASE.**

**Chief Investigator(s):** Dr Meghan Thomas, PhD (*Director and Postdoctoral Research Fellow, ParkC, School of Medical Sciences, Faculty of Health, Engineering and Science, Edith Cowan University*), Miss Caitlin Timms (*Research Assistant, ParkC, School of Medical Sciences, Faculty of Health, Engineering and Science, Edith Cowan University*). **Co-Investigator(s):** Dr Romola Bucks, PhD (*UK Trained Clinical Neuropsychologist and Lecturer, School of Psychology, University of Western Australia*), Dr Andrea Loftus, PhD (*Lecturer, School of Psychology and Speech Pathology, Curtin University*), Dr Natalie Gasson, PhD (*Undergraduate co-ordinator, Lecturer, School of Psychology and Speech Pathology, Curtin University*).

We would like to invite you to participate in the following research which will investigate the relationship between motor (i.e. balance, walking, tremor, rigidity), and non-motor (i.e., problems with memory, thinking, and mood) symptoms of Parkinson's disease (PD). Information regarding the relationship between the motor and non-motor symptoms will be used to identify subtypes of PD.

Currently, the cause of PD is unknown. It is possible that some (but not all) individuals may have a genetic predisposition to developing PD and the current research aims to explore this further.

Please take time to read the following information carefully and discuss it with others if you wish.

**What are the possible benefits of taking part?**

The information we gain from your participation will help us better to understand the motor (balance, walking, tremor, rigidity) cognitive (thinking and memory) and affective (mood) problems that can occur as a result of PD. The information we gain from your participation will help us to identify subtypes of PD and the identification of subtypes will have implications for the clinical management of future patients with PD.

**Why have I been invited to participate in this research?**

You have been invited to participate in this research because you have been diagnosed with PD or Parkinsonism.

**What will I be asked to do?**

There are three parts to this study: Part 1) involves the completion of questionnaires or surveys; Part 2) involves some computer and paper-based assessments; and Part 3) involves an assessment of motor (i.e. balance, walking, tremor, rigidity) symptoms.

**Part 1:** We will provide you with a questionnaire package via post and ask that you complete some surveys

regarding your mood, memory, and personality, how sleepy you are during the day and possible sleep difficulties, how your Parkinson's symptoms influence your everyday life, and how you cope with things in general. All of these surveys are designed to be self-completed; therefore, you may complete the surveys at home and bring them with you to your appointment at ParkC, if you decide to participate in Part 2 of the study. You are also free to complete all or part of the questionnaires at the end of your appointment at ParkC if you wish. A research staff member from ParkC will sit with you and discuss any questions you may have regarding the questionnaires. If you do not wish to take part in Part 2 of this research, you may still complete the questionnaires and we will provide you with a reply paid envelope to return your questionnaires.

A questionnaire will be included which is to be completed by a relative/ friend. Completion of this questionnaire will be taken to indicate that you consent for the information that is provided by the relative/ friend to be used in the study.

**Part 2:** If you are happy to participate in Part 2 of this research, we will go over the information sheet with you when you arrive at ParkC, explain what is going to happen during the appointment, and answer any questions you might have. You will then be asked to participate in some tasks that are designed to look at your memory and thinking skills. These will be both paper-based and computer-based tasks. The session will be made as enjoyable as possible for you; however some of these tasks can be challenging. If you feel at any point during the assessment that you would like to stop, please tell the research staff and they will end the session immediately. You do not have to give a reason why and you will not be asked any further questions.

**Part 3:** Lastly, you will be asked to perform some simple motor (i.e. balance, walking, tremor, rigidity) tasks as part of the Unified Parkinson's Disease Rating Scale (UPDRS), a standardised assessment for the motor symptoms of PD. These motor tasks will include: finger tapping, hand rotations, fist clenching/opening, finger to nose movements, leg and toe tapping, rising from a chair, and a 10 meter walk. The investigator will also give you a slight pull on the shoulders to assess your balance and will stand behind you to provide support should you become unbalanced. Assessments of speech, facial expression, rigidity (stiffness of neck, arms and legs), and tremor will be made via observation during this assessment period. You will also be asked some questions regarding dyskinesias (involuntary movements), fluctuations in functioning due to medications cycles and dystonia (painful cramps and/or muscle spasms) which you may or may not experience. All of these assessments will be videotaped to allow for independent review and rating by experts in the field of Parkinson's, although you can decline to have the session videotaped. We will also take a measurement of your height, weight and waist circumference.

**The motor assessment requires manipulation of the hips and legs. Please wear comfortable clothing; trousers are preferred.**

Throughout the appointment you will be encouraged to ask questions and while the testing is anticipated to take no more than 2 hours, you will be given regular breaks.

#### **Blood sample for Genetic Analysis**

There is a fourth optional part of this project. As part of the appointment at ParkC, we ask participants if they would be happy to donate a small sample of blood so that we can look at genetic make-up (i.e. your DNA). Please note that the decision to have a blood sample taken is completely optional and forms a different part of the study. You can decide not to have a blood sample without affecting any other data we collect about you for the study. Your participation will be of equal value, with or without the blood sample.

Blood and DNA samples will be stored for the length of this research project and will be analysed for a range of DNA markers.

Initially we will screen for the known genetic mutations that cause familial PD. These mutations occur in the SNCA, LRRK2, Parkin, PINK1, DJ-1 and Parkin 9 genes. Familial PD occurs in only 10% of PD cases so is uncommon. If we find a known genetic cause of PD we will (with your consent) inform your treating physician who will be able to arrange appropriate Genetic Screening to confirm our research findings.

We also intend to screen for a range of genetic measures that may be associated with the various aspects of PD. The technology for genotyping DNA is changing rapidly and is producing more and more complex data. Further the known genetic influences that may affect different aspects of PD are still unclear. Therefore we would like to screen for a range of as yet unspecified markers, with your consent. In the short term this research is more about trying to find associations between your DNA and your PD symptoms. It is very experimental and at this stage not able to influence any treatment approaches although we hope that in the future it will have clear treatment implications.

If you provide written consent, indicating that you are happy to provide a blood sample, a qualified phlebotomist will take your blood sample. We are grateful to everyone who agrees to give a sample.

**What about my medication?**

We would ask you to take your medication as normal. No changes will be made to your medication and you will not be asked to stop taking your current medication at any point during this study.

**What will happen when the research study stops?**

This is a longitudinal study and so it does not have a specific end date. At the end of your appointment, we will ask whether you might like to participate in a further follow-up appointment scheduled for approximately two years later.

**What are the possible disadvantages and risks of taking part in this research?**

There are no foreseeable risks or disadvantages associated with taking part in this study, aside from the possibility of becoming a little tired as a result of undertaking these assessments. However, you will be provided with regular breaks to help avoid becoming fatigued.

There are no foreseeable risks or disadvantages associated with Part 3 (motor assessment), aside from the minimal risk of a fall during the balance assessment. The investigator conducting the balance assessment will stand behind you to support you in the case that you become unbalanced. The balance assessment conducted as part of the UPDRS is standard in clinical practice for PD.

The discomforts associated with taking a blood sample are minimal. There is a risk that sometimes bruising and minor infection may occur and the arm might become sore. Risk of bruising or infection will be minimised because all blood samples will be performed by an experienced phlebotomist (lab technician). The total amount of blood we need is small (10-40ml).

**Confidentiality – who will have access to the data?**

ParkC complies with the requirements of the National Health and Medical Research Council (NHMRC) guidelines with regard to collection, storage, processing, and disclosure of personal information and is committed to upholding the Act's core data protection principles. All information that is collected about you during the course of the research will be kept strictly confidential. Some of your data may include personal information such as your name, date of birth and/or a reference number. This information will be held in secure, locked filing cabinets at ParkC, or on a password protected computer database held on a secure system, which allows access to authorized individuals only. On completion of the study, all data will be stored for a period of 5 years before being destroyed by secure shredding facilities and permanent deletion of video files.

The video files and data collected during Part 3 of the research may be used in future research projects conducted at ParkC which are in the same general area of research interest, if you agree. These data will only be accessed by research staff and individuals affiliated with ParkC, Edith Cowan University.

Although the researchers at ParkC are not qualified to comment on the clinical implications of individual test performance, we are able to forward the results of your assessment to your treating specialist, with your consent.

**Do I have to take part?**

Participation in this study is completely voluntary. We will describe the study and go through this information sheet with you. If you do decide to take part you will be given this information sheet to keep and will be asked to sign a consent form, of which you will get a copy. If you decide to take part you are still free to withdraw at any time and you do not need to give a reason. A decision to withdraw from this research will not affect the standard of care you receive and there will be no effect on your legal rights, medical care, or your relationship with the hospital or your doctors. You are also welcome to participate in other research projects conducted by ParkC if you decide to withdraw from this particular study.

If you do decide to withdraw, we will ask you whether you are happy for us to use the data that we might have already collected from you. If you are not happy for us to use any of the data collected from you, any data relating to your participation in this study will be destroyed.

**Who is organising and funding the research?**

ParkC is funded by Edith Cowan University (ECU), donations from the McCusker Foundation, the Rotary Club of Morley, and donations from members of the public and Parkinson's community.

**Who has approved the study?**

This research has been approved by Edith Cowan University's Human Research Ethics Committee, Parkinson's Western Australia (PWA) Inc., Joondalup Health Campus Human Research Ethics Committee and the Sir Charles Gairdner Group Human Research Ethics Committee.

**Who can I contact about this study?**

If you have any questions about this study or would like more information, please contact either Miss Caitlin Timms or Dr Meghan Thomas on (08) 6304 3560 or email [ParkC@ecu.edu.au](mailto:ParkC@ecu.edu.au)

**What if there is a problem and I want to make a complaint?**

This study has been approved by several institutions. If you have any concerns about the ethics or code of practice of the study, please contact:

- Kim Gifkins (Research Ethics Officer) of ECU's Human Research Ethics Committee on: (08) 6304 2170 or email [research.ethics@ecu.edu.au](mailto:research.ethics@ecu.edu.au). OR
- Joondalup Health Campus Human Research Ethics Committee through the Executive Office on (08) 9400 9404. OR
- Executive Officer of the Sir Charles Gairdner Group Human Research Ethics Committee on (08) 9346 2999

Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

**What will happen to the study results?**

We will let you know the results of the study in our annual newsletter which will be posted via mail and on the ParkC website ([www.ParkC.org.au](http://www.ParkC.org.au)). However, if you would like to know anything further please feel free to contact the research team at ParkC before then and we will be happy to share the findings with you.

The results of this study will also be communicated via presentations at National and International conferences as well as being written into manuscripts which will be submitted to peer-reviewed journals. All of your identifying features will be removed in such cases.

**Do I get to keep a copy of the Information Sheet and Consent form?**

You will be given a copy of this Information Sheet to keep. If you decide to take part in this research and sign the consent form, you will be given a copy of this signed consent form for your records also.



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Dr Meghan Thomas  
Director, Postdoctoral Research Fellow  
Parkinson's Centre (ParkC)  
Edith Cowan University  
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## Participant Consent Form



### CONSENT FORM

**Project titled: COGNITIVE AND MOTOR HETEROGENEITY  
IN IDIOPATHIC PARKINSON'S DISEASE.**

JOONDALUP CAMPUS

270 Joondalup Drive, Building 21; Level 5  
Joondalup, Western Australia 6027

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ParkC@ecu.edu.au

[www.ParkC.org.au](http://www.ParkC.org.au)

ABN 54 361 465 361 CRICOS IPC 00279B

#### Please tick box

1. I have read and understood the 'Information Sheet' for this study.
2. The nature and the possible effects of this study have been explained to me.
3. Any questions that I have asked have been answered to my satisfaction.
4. I understand that this research involves a number of computer and paper-based tasks.
5. I understand that the UPDRS, a standardised assessment of the motor symptoms of Parkinson's will be administered and that this assessment involves a number of simple motor tasks, an assessment of balance, and various observations of speech, tremor, rigidity, and posture.
6. I understand that I will be videotaped undertaking the assessment of motor (i.e. balance, walking, tremor, rigidity) symptoms
  - a. I consent for the video files of my UPDRS assessment to only be used in this study for the purposes of confirming my diagnosis of Parkinson's and that the recording will be deleted upon completion of the study.
  - b. I consent for the video file of my UPDRS assessment to be used in future approved research projects conducted at ParkC which are in the same general area of Parkinson's research.
7. I consent to my results being released to my treating physician/neurologist if requested.
8. I understand that all research data will be securely stored at ParkC, Edith Cowan University, for a minimum period of five years following the study end date. I also understand that the data will be securely stored on password protected computers and locked cabinets at ParkC until no longer required, at which time it will be destroyed.
9. I understand that there are no foreseeable risks associated with this research, aside from the possibility of fatigue and minimal risk of falls associated with the balance assessment conducted in Part 3 of the research.

10. I agree that research data for the study may be published and that I will not be identified as a participant.
11. I understand that my identity will be kept confidential and that any information I supply to the researchers will be used only for the purposes of this research and/or research in the same general area.
12. I agree to participate in this investigation and understand that I may withdraw at anytime without giving a reason, and without my medical care or legal rights being affected. I also understand that if I so wish, I may request that any personal data gathered be withdrawn from the research.
13. I agree to donate a sample of blood for research purposes. I understand that this sample will be used for the purpose of genetic tests.
- a. I consent for my blood samples to only be used in this study and that they will be destroyed at the completion of the study
  - b. I consent for my blood sample to be used as explained so far and for any other analysis that may arise during the course of the study.
  - c. I consent for my blood samples to be held for future studies that may or may not be related to Parkinson's but that have received ethics approval from a recognised institution.
  - d. I consent for ParkC to inform my treating physician if a mutation in a known familial PD gene is found

Name of Participant \_\_\_\_\_

Signature of Participant \_\_\_\_\_ Date \_\_\_\_\_

**For the Investigator**

I have explained this project and the implications of participation to this volunteer and believe that the consent is informed and that he/she understands the implications of participation.

Name of Investigator \_\_\_\_\_

Signature of Investigator \_\_\_\_\_ Date \_\_\_\_\_



## CONSENT FORM

JOONDALUP CAMPUS

270 Joondalup Drive, Building 21; Level 5  
Joondalup, Western Australia 6027

T (08) 6304 3560

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[www.ParkC.org.au](http://www.ParkC.org.au)

ABN 54 301 485 361 CRICOS IPC 00279B

**Project titled: COGNITIVE AND MOTOR HETEROGENEITY  
IN IDIOPATHIC PARKINSON'S DISEASE.**

ParkC is happy to share clinically appropriate test results with the doctor who treats your Parkinson's, should this be helpful for your care. This also streamlines assessment of your Parkinson's. If your treating doctor contacts us, do you consent to your assessment results being forwarded to them?

*Please circle:*

I DO / DO NOT consent to the release of my results to my treating doctor.

A very small percentage of people with Parkinson's go on to develop cognitive problems (i.e. thinking and memory), including dementia. Our Human Research Ethics Committee prefers that we ask you, in advance, for permission to approach you regarding follow-up assessment in the event of cognitive decline at some stage in the future. This does not affect your right to change your mind.

*Please circle:*

In the event of cognitive decline, I DO / DO NOT consent to participating in a follow-up assessment.

Name of Participant \_\_\_\_\_

Signature of Participant \_\_\_\_\_ Date \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### For the Investigator

I have explained this project and the implications of participation to this volunteer and believe that the consent is informed and that he/she understands the implications of participation.

Name of Investigator \_\_\_\_\_

Signature of Investigator \_\_\_\_\_ Date \_\_\_\_\_

### Demographics Questionnaire

#### **“Cognitive and motor heterogeneity in idiopathic Parkinson’s”**

##### Medical History and Demographic

**FOR OFFICE USE ONLY:** to be completed by administrator

|                               |                         |
|-------------------------------|-------------------------|
| Time of last medication dose: | Session Commenced _____ |
|-------------------------------|-------------------------|

|  |  |
|--|--|
| First Name:  | Last Name:   |
| Date of Birth:   | Sex: M <input type="checkbox"/> F <input type="checkbox"/> (please tick) |
| Handedness: Right <input type="checkbox"/> Left <input type="checkbox"/> Ambidextrous <input type="checkbox"/>                 | (please tick)  |
| Marital Status: Single <input type="checkbox"/> Married <input type="checkbox"/> De Facto/Co-habiting <input type="checkbox"/> | (please tick)  |
| Divorced/Separated <input type="checkbox"/> Widowed <input type="checkbox"/> Declined to Say <input type="checkbox"/>          |  |

|                           |            |
|---------------------------|------------|
| <b>Contact Details:</b>   |            |
| Address:                  |            |
| Suburb:                   |            |
| State:                    | Post Code: |
| <b>Contact Number:</b>    |            |
| Home Phone:               | Mobile:    |
| Email:                    |            |
| <b>Emergency Contact:</b> |            |
| Name:                     |            |
| Phone:                    |            |
| Relationship:             |            |

|   |                                      |
|---|--------------------------------------|
| <b>Diagnosis Information: Parkinson's</b> |                                      |
| Diagnosis date (month/year):              |                                      |
| Who were you diagnosed by?                | Neurologist <input type="checkbox"/> |
|   | NAME: _____                          |
|   | GP <input type="checkbox"/>          |
|   | NAME: _____                          |
| Other <input type="checkbox"/>            |                                      |

|   |
|---|
| Are you currently seeing a neurologist? Yes <input type="checkbox"/> No <input type="checkbox"/> (please tick)  |
| What is the name of your neurologist?   |
| Are you a member of Parkinson's Western Australia Inc (PWA)? Yes <input type="checkbox"/> No <input type="checkbox"/> (please tick)   |
| Is your Parkinson's thought to be caused by medications ?<br>Yes <input type="checkbox"/> No <input type="checkbox"/><br>If yes, do you know the class of drug or the medication which caused your Parkinsonism?<br>Yes <input type="checkbox"/> No <input type="checkbox"/><br>What was/is it? _____ |

| <b>Medication History</b>   |             |                |                         |                             |
|---|-------------|----------------|-------------------------|-----------------------------|
| What Medications (including anti-Parkinson's) do you currently take?  | Dosage (mg) | Number Tablets | Number of times per day | When (e.g., 7am, 11am, 3pm) |
| 1.  |             |                |                         |                             |
| 2.  |             |                |                         |                             |
| 3.  |             |                |                         |                             |
| 4.  |             |                |                         |                             |
| 5.  |             |                |                         |                             |
| 6.  |             |                |                         |                             |
| When did you start taking anti- Parkinson's medication? (e.g., years/months)  |             |                |                         |                             |
| What are the reason/s and/or medical conditions requiring you to take other medication aside from your anti-Parkinson's medications   |             |                |                         |                             |
| Wearing-off is a complication that can occur after a few years of using levodopa to treat Parkinson's. During wearing-off, symptoms of Parkinson's start to return or worsen before the next dose of levodopa is due, and improve when the next dose is taken |             |                |                         |                             |
| Do you experience symptoms of 'wearing off' Yes <input type="checkbox"/> No <input type="checkbox"/> (please tick)  |             |                |                         |                             |
| If 'YES', What times of the day do you feel 'at your best' _____  |             |                |                         |                             |
| _____   |             |                |                         |                             |
| If 'YES' how many 'on' hours do you typically experience 'at your best' _____   |             |                |                         |                             |

**MEDICAL HISTORY****1) Smoking**

- (a) Are you or have you ever been a smoker? Yes  No
- (b) Past / Current smoker? \_\_\_\_\_
- (c) Age you started smoking: \_\_\_\_\_
- (d) Age you quit smoking (for past smokers only): \_\_\_\_\_
- (e) Average number of cigarettes smoked per day: \_\_\_\_\_

**2) Drinking (alcohol)**

- (a) How many drinks do you usually have per week? \_\_\_\_\_

**3) Body weight**

- (a) Has your weight fluctuated more than a few kilos in the last 12 months? Yes  No
- (b) If 'Yes', approximately how many kilograms? \_\_\_\_\_

**4) Physical activity**

- (a) What is your current level of physical activity? Active  Inactive  Details:
- 
- 

- 5) Do you have, or have a family history of any of the following neurological conditions?**  
 (Check all/any boxes that apply)

|   | You                      | Family                   |                  | You                      | Family                   |
|---|--------------------------|--------------------------|------------------|--------------------------|--------------------------|
| Parkinson's                                     | <input type="checkbox"/> | <input type="checkbox"/> | Migraines        | <input type="checkbox"/> | <input type="checkbox"/> |
| Dementia (e.g, Alzheimer's)                     | <input type="checkbox"/> | <input type="checkbox"/> | Epilepsy         | <input type="checkbox"/> | <input type="checkbox"/> |
| Multiple Sclerosis                              | <input type="checkbox"/> | <input type="checkbox"/> | Huntington's     | <input type="checkbox"/> | <input type="checkbox"/> |
| Progressive Supranuclear Palsy                  | <input type="checkbox"/> | <input type="checkbox"/> | Motor Neurone    | <input type="checkbox"/> | <input type="checkbox"/> |
| Cortico-basillar degeneration                   | <input type="checkbox"/> | <input type="checkbox"/> | Essential Tremor | <input type="checkbox"/> | <input type="checkbox"/> |
| Stroke or Transient Ischemic Attacks<br>(TIA's) | <input type="checkbox"/> | <input type="checkbox"/> | Other            | <input type="checkbox"/> | <input type="checkbox"/> |

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- 6) Do you have, or have you had any of the following medical conditions?  
 (Check all/any boxes that apply)

|                                      | You                      | Family                   |                  | You                      | Family                   |
|--------------------------------------|--------------------------|--------------------------|------------------|--------------------------|--------------------------|
| Diabetes (Type I or Type II)         | <input type="checkbox"/> | <input type="checkbox"/> | Arthritis        | <input type="checkbox"/> | <input type="checkbox"/> |
| Tumour or Cancer affecting the brain | <input type="checkbox"/> | <input type="checkbox"/> | Heart Disease    | <input type="checkbox"/> | <input type="checkbox"/> |
| Other Cancer (please specify below)  | <input type="checkbox"/> | <input type="checkbox"/> | Colour Blindness | <input type="checkbox"/> | <input type="checkbox"/> |

- 7) Do you have any other medical conditions? (chronic or serious illness) Yes /No. Details:

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- 8) Have you ever lost consciousness as a result of a head injury Yes  No

How long for? \_\_\_\_\_

What happened to you? \_\_\_\_\_

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- 9) Have you ever been diagnosed as suffering from a mental health condition?

Yes  No

If so, was it:

Depression  Anxiety

Schizophrenia  BiPolar Disorder

Personality Disorder  Other \_\_\_\_\_

When were you diagnosed? \_\_\_\_\_

What type of treatment were/are you receiving (psychotherapy, medications etc)? \_\_\_\_\_

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**DEMOGRAPHIC INFORMATION**

- (a) Which of the following best describes your ethnic background?  
(Check any boxes that apply, or complete the section marked 'Other')

Australian

Australian Aboriginal/Torres Strait Islander

North-Western European

Southern or Eastern European

Asian

African

Other (please specify)  \_\_\_\_\_

Decline to say

(b) Country of origin

In which country were you born? \_\_\_\_\_

If you were not born in Australia, in what year did  
you arrive in Australia? / /

In which country were your parents and  
grandparents born?

Mother \_\_\_\_\_

Grandmother \_\_\_\_\_

Grandfather \_\_\_\_\_

Father \_\_\_\_\_

Grandmother \_\_\_\_\_

Grandfather \_\_\_\_\_

Decline to say

- (c) Is English your first language? Yes  No

If no, at what age did you learn to speak English? \_\_\_\_\_

How would you rate your English?

Excellent  Very Good  Good  Poor

(d) Are you retired: Yes  No

(e) What is your current occupation? If retired, what was your previous occupation?

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(f) How many years of formal education have you completed?

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(g) What is your highest level of education? (i.e., year 10, year 11-12, undergraduate degree, postgraduate degree, trade certificate, other)

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(h) Impact of Parkinson's on work/employment

I gave up job/retired early

I reduced hours at work

I did not change my hours at work

I was already retired

Other

(i) Impact of Parkinson's upon driving

How would you rate your current driving ability (compared to an average road user)?

Excellent  Better  Neither Better nor Worse  Worse  Much Worse

Has having Parkinson's affected your ability to drive? Yes  No

Please provide further details if appropriate \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**The Geriatric Depression Scale (GDS-15)**

Participant ID \_\_\_\_\_ Date\_\_\_\_\_

Please circle yes or no for each of the following statements to indicate how you have felt over the **past week**.

- |  |          |
|--|----------|
| 1. Are you basically satisfied with your life?                               | Yes / No |
| 2. Have you dropped many of your activities and interests?                   | Yes / No |
| 3. Do you feel that your life is empty?                                      | Yes / No |
| 4. Do you often get bored?   | Yes / No |
| 5. Are you in good spirits most of the time?                                 | Yes / No |
| 6. Are you afraid that something bad is going to happen to you?              | Yes / No |
| 7. Do you feel happy most of the time?                                       | Yes / No |
| 8. Do you feel helpless?   | Yes / No |
| 9. Do you prefer to stay at home rather than going out and doing new things? | Yes / No |
| 10. Do you feel you have more problems with memory than most?                | Yes / No |
| 11. Do you think it is wonderful to be alive?                                | Yes / No |
| 12. Do you feel pretty worthless the way you are now?                        | Yes / No |
| 13. Do you feel full of energy?  | Yes / No |
| 14. Do you feel that your situation is hopeless?                             | Yes / No |
| 15. Do you think that most people are better off than you are?               | Yes / No |

Total score \_\_\_\_\_

**The Parkinson's Disease Questionnaire (PDQ-39)****Please complete the following*****Please tick one box for each question***

***Due to having Parkinson's disease,  
how often during the last month  
have you....***

|   | Never                    | Occasionally             | Sometimes                | Often                    | Always<br>or cannot do<br>at all |
|---|--------------------------|--------------------------|--------------------------|--------------------------|----------------------------------|
| 1 Had difficulty doing the leisure activities which you would like to do? | <input type="checkbox"/>         |
| 2 Had difficulty looking after your home, e.g. DIY, housework, cooking?   | <input type="checkbox"/>         |
| 3 Had difficulty carrying bags of shopping?                               | <input type="checkbox"/>         |
| 4 Had problems walking half a mile?                                       | <input type="checkbox"/>         |
| 5 Had problems walking 100 yards?   | <input type="checkbox"/>         |
| 6 Had problems getting around the house as easily as you would like?      | <input type="checkbox"/>         |
| 7 Had difficulty getting around in public?                                | <input type="checkbox"/>         |
| 8 Needed someone else to accompany you when you went out?                 | <input type="checkbox"/>         |
| 9 Felt frightened or worried about falling over in public?                | <input type="checkbox"/>         |
| 10 Been confined to the house more than you would like?                   | <input type="checkbox"/>         |
| 11 Had difficulty washing yourself?                                       | <input type="checkbox"/>         |
| 12 Had difficulty dressing yourself?                                      | <input type="checkbox"/>         |
| 13 Had problems doing up your shoe laces?                                 | <input type="checkbox"/>         |

| <i><b>Due to having Parkinson's disease,<br/>how often during the last month<br/>have you....</b></i> |   | <i><b>Please tick one box for each question</b></i> |                          |                          |                          |                                  |
|---|---|---|--------------------------|--------------------------|--------------------------|----------------------------------|
|   |   | Never   | Occasionally             | Sometimes                | Often                    | Always<br>or cannot do<br>at all |
| 14  | Had problems writing clearly?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 15  | Had difficulty cutting up your food?  | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 16  | Had difficulty holding a drink without spilling it?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 17  | Felt depressed?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 18  | Felt isolated and lonely?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 19  | Felt weepy or tearful?  | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 20  | Felt angry or bitter?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 21  | Felt anxious?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 22  | Felt worried about your future?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 23  | Felt you had to conceal your Parkinson's from people?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 24  | Avoided situations which involve eating or drinking in public?  | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 25  | Felt embarrassed in public due to having Parkinson's disease?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 26  | Felt worried by other people's reaction to you?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 27  | Had problems with your close personal relationships?  | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 28  | Lacked support in the ways you need from your spouse or partner?<br><i>If you do not have a spouse or partner tick here</i> | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |
| 29  | Lacked support in the ways you need from your family or close friends?  | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>         |

| <i>Due to having Parkinson's disease,<br/>how often <u>during the last month</u><br/>have you....</i> |   | <i>Please tick <u>one</u> box for each question</i> |                          |                          |                          |                          |
|---|---|---|--------------------------|--------------------------|--------------------------|--------------------------|
|   |   | Never   | Occasionally             | Sometimes                | Often                    | Always                   |
| 30  | Unexpectedly fallen asleep during the day?                              | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31  | Had problems with your concentration, e.g. when reading or watching TV? | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 32  | Felt your memory was bad?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33  | Had distressing dreams or hallucinations?                               | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34  | Had difficulty with your speech?  | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 35  | Felt unable to communicate with people properly?                        | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36  | Felt ignored by people?   | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 37  | Had painful muscle cramps or spasms?                                    | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 38  | Had aches and pains in your joints or body?                             | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39  | Felt unpleasantly hot or cold?  | <input type="checkbox"/>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

*Please check that you have ticked **one** box for each question before going on to the next page*

*Thank you for completing the PDQ 39 questionnaire*

### The Unified Parkinson's Disease Rating Scale –section 2 (ADL)

|  |  |
|--|--|
| <p><b>2.2 SALIVA &amp; DROOLING</b></p> <p>Over the past week, have you usually had too much saliva during when you are awake or when you sleep?</p> <p>0: Normal: Not at all (no problems).<br/>     1: Slight: I have too much saliva, but do not drool.<br/>     2: Mild: I have some drooling during sleep, but none when I am awake.<br/>     3: Moderate: I have some drooling when I am awake, but I usually do not need tissues or a handkerchief.<br/>     4: Severe: I have so much drooling that I regularly need to use tissues or a handkerchief to protect my clothes.</p> | <p style="text-align: center;"><b>SCORE</b></p> <input type="text"/> |
|--|--|

|   |                      |
|---|----------------------|
| <b>Part II: Motor Aspects of Experiences of Daily Living (M-EDL)</b>  |                      |
| <p><b>2.1 SPEECH</b></p> <p>Over the past week, have you had problems with your speech?</p> <p>0: Normal: Not at all (no problems).<br/>     1: Slight: My speech is soft, slurred or uneven, but it does not cause others to ask me to repeat myself.<br/>     2: Mild: My speech causes people to ask me to occasionally repeat myself, but not everyday.<br/>     3: Moderate: My speech is unclear enough that others ask me to repeat myself every day even though most of my speech is understood.<br/>     4: Severe: Most or all of my speech cannot be understood.</p> | <input type="text"/> |

**2.3 CHEWING AND SWALLOWING**

Over the past week, have you usually had problems swallowing pills or eating meals? Do you need your pills cut or crushed or your meals to be made soft, chopped or blended to avoid choking?

- 0: Normal: No problems.
- 1: Slight: I am aware of slowness in my chewing or increased effort at swallowing, but I do not choke or need to have my food specially prepared.
- 2: Mild: I need to have my pills cut or my food specially prepared because of chewing or swallowing problems, but I have not choked over the past week.
- 3: Moderate: I choked at least once in the past week.
- 4: Severe: Because of chewing and swallowing problems, I need a feeding tube.

**2.4 EATING TASKS****SCORE**

Over the past week, have you usually had troubles handling your food and using eating utensils? For example, do you have trouble handling finger foods or using forks, knives, spoons, chopsticks?

- 0: Normal: Not at all (No problems).
- 1: Slight: I am slow, but I do not need any help handling my food and have not had food spills while eating.
- 2: Mild: I am slow with my eating and have occasional food spills. I may need help with a few tasks such as cutting meat.
- 3: Moderate: I need help with many eating tasks but can manage some alone.
- 4: Severe: I need help for most or all eating tasks.

**2.5 DRESSING**

Over the past week, have you usually had problems dressing? For example, are you slow or do you need help with buttoning, using zippers, putting on or taking off your clothes or jewelry?

- 0: Normal: Not at all (no problems).
- 1: Slight: I am slow but I do not need help.
- 2: Mild: I am slow and need help for a few dressing tasks (buttons, bracelets).
- 3: Moderate: I need help for many dressing tasks.
- 4: Severe: I need help for most or all dressing tasks.

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**2.6 HYGIENE**

Over the past week, have you usually been slow or do you need help with washing, bathing, shaving, brushing teeth, combing your hair or with other personal hygiene?

- 0: Normal: Not at all (no problems).
- 1: Slight: I am slow but I do not need any help.
- 2: Mild: I need someone else to help me with some hygiene tasks.
- 3: Moderate: I need help for many hygiene tasks.
- 4: Severe: I need help for most or all of my hygiene tasks.

**SCORE****2.7 HANDWRITING**

Over the past week, have people usually had trouble reading your handwriting?

- 0: Normal: Not at all (no problems).
- 1: Slight: My writing is slow, clumsy or uneven, but all words are clear.
- 2: Mild: Some words are unclear and difficult to read.
- 3: Moderate: Many words are unclear and difficult to read.
- 4: Severe: Most or all words cannot be read.

**2.8 DOING HOBBIES AND OTHER ACTIVITIES**

Over the past week, have you usually had trouble doing your hobbies or other things that you like to do?

- 0: Normal: Not at all (no problems).
- 1: Slight: I am a bit slow but do these activities easily.
- 2: Mild: I have some difficulty doing these activities.
- 3: Moderate: I have major problems doing these activities, but still do most.
- 4: Severe: I am unable to do most or all of these activities.

**2.9 TURNING IN BED**

Over the past week, do you usually have trouble turning over in bed?

- 0: Normal: Not at all (no problems).
- 1: Slight: I have a bit of trouble turning, but I do not need any help.
- 2: Mild: I have a lot of trouble turning and need occasional help from someone else.
- 3: Moderate: To turn over I often need help from someone else.
- 4: Severe: I am unable to turn over without help from someone else.

**SCORE****2.10 TREMOR**

Over the past week, have you usually had shaking or tremor?

- 0: Normal: Not at all. I have no shaking or tremor.
- 1: Slight: Shaking or tremor occurs but does not cause problems with any activities.
- 2: Mild: Shaking or tremor causes problems with only a few activities.
- 3: Moderate: Shaking or tremor causes problems with many of my daily activities.
- 4: Severe: Shaking or tremor causes problems with most or all activities.



**2.11 GETTING OUT OF BED, A CAR, OR A DEEP CHAIR**

Over the past week, have you usually had trouble getting out of bed, a car seat, or a deep chair?

- 0: Normal: Not at all (no problems).
- 1: Slight: I am slow or awkward, but I usually can do it on my first try.
- 2: Mild: I need more than one try to get up or need occasional help.
- 3: Moderate: I sometimes need help to get up, but most times I can still do it on my own.
- 4: Severe: I need help most or all of the time.

**2.12 WALKING AND BALANCE**

Over the past week, have you usually had problems with balance and walking?

- 0: Normal: Not at all (no problems).
- 1: Slight: I am slightly slow or may drag a leg. I never use a walking aid.
- 2: Mild: I occasionally use a walking aid, but I do not need any help from another person.
- 3: Moderate: I usually use a walking aid (cane, walker) to walk safely without falling. However, I do not usually need the support of another person.
- 4: Severe: I usually use the support of another persons to walk safely without falling.

**SCORE****2.13 FREEZING**

Over the past week, on your usual day when walking, do you suddenly stop or freeze as if your feet are stuck to the floor?

- 0: Normal: Not at all (no problems).
- 1: Slight: I briefly freeze but I can easily start walking again. I do not need help from someone else or a walking aid (cane or walker) because of freezing.
- 2: Mild: I freeze and have trouble starting to walk again, but I do not need someone's help or a walking aid (cane or walker) because of freezing.
- 3: Moderate: When I freeze I have a lot of trouble starting to walk again and, because of freezing, I sometimes need to use a walking aid or need someone else's help.
- 4: Severe: Because of freezing, most or all of the time, I need to use a walking aid or someone's help.

### **Questionnaire Pack**

Questionnaire pack that is posted to participants includes:

1. Introductory Letter
2. Study Information Sheet
3. Appointment Reminder Slip
4. Map (if required)
5. Medical/demographic Questionnaire
6. Big Five Aspect Scale (BFAS)
7. Epworth Sleepiness Scale (ESS)
8. Ways of Coping Questionnaire (WAYS)
9. Cambridge Behavioural Inventory (CBI)
10. Depression, Anxiety, and Stress Scale (DASS)
11. MetaMemory Questionnaire (MMQ)
12. Parkinson's Disease Questionnaire (PDQ-39)
13. Geriatric Depression Scale (GDS-15)
14. Parkinson's Disease Sleep Scale (PDSS)
15. UPDRS Patient Questionnaire

**Assessment Schedule**

Cognitive and motor tasks completed by participants during the assessments include:

1. Mini-Mental State Examination (MMSE)
2. Australian National Adult Reading Test (AUSNART)
3. Hopkins Verbal Learning Test-Revised (HVLT-R)
4. Cube Analysis
5. Number Location
6. Star Cancellation
7. Line Bisecton
8. HVLT Delayed Recall and Recognition
9. Verbal Fluency – Phonetic
10. Verbal Fluency – Semantic
11. Cambridge Neuropsychological Test Automated Battery (CANTAB) tests
  - a. Spatial Working Memory (SWM)
  - b. Pattern Recognition Memory (PRM)
  - c. Spatial Recognition Memory (SRM)
  - d. Stocking of Cambridge (SOC)
  - e. COWA Verbal Fluency and Category Fluency
12. UPDRS Motor Assessment