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Abstract

The objective of this meta-analysis was to study the relationships between apathy and depression in participants with Parkinson's disease (PD). To find relevant studies, the faculty advisor's personal files were searched, along with Medline, CINAHL, and the Science Citation Index. One raw data set that is currently unpublished was included as well. A stem and leaf plot for effect size *r* was designed for the three studies that provided continuous data, and a separate stem and leaf plot was constructed for all six studies reporting categorical data, as to whether their research subjects had or did not have apathy or depression. The meta-analysis combining the three studies reporting continuous data resulted in $z = 4.503$, $p = .000007$, with a moderate effect size $r = .374$. For the six reporting categorical data, $z = 5.308$, $p = .0000001$, with $r = .286$ (a small effect size). Coefficients of alienation displayed a mean of .851 ($SD = .108$) for the continuous data and .895 ($SD = .098$) for the categorical data; thus approximately 85% or 90% of one variable could not be predicted by the other variable. Two major conclusions were made from this study: a) apathy and depression are related, b) apathy and depression are not the same. The number of participants who displayed either apathy or depression without the other variable was greater than the number of participants who displayed both apathy and depression simultaneously. The levels of apathy in participants with PD are of particular importance to occupational therapy practitioners due to the motivation, interest, and effortful behavior necessary for occupational therapy participants. The lack of these characteristics in some persons with Parkinson's disease presents a special challenge to occupational therapy practitioners.

A Meta-Analytic Review:

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Parkinson's disease (PD) is a progressive neurological disorder, which can only be definitively diagnosed at autopsy (Christensen, 2005). The etiology of this disease is unknown; however it is believed to be linked to genetics. It is estimated that nearly half of people with PD have a relative with the disease (Christensen, 2005). The physical environment might also be a factor regarding the cause of Parkinson's disease (Dirette, 2007). At autopsy, PD is recognized by the depigmentation of the substantia nigra. It occurs in about 1% of the population, most commonly around the age of 60. Parkinson's disease is found to be spread evenly among races worldwide (Christensen, 2005); however, in the United States there is a higher incidence among Caucasians as compared to African-Americans (Dirette, 2007). There are many observable symptoms of PD, including deficits in movement speed and movement quality, postural stability, cognitive skills, and affective expression (Christensen, 2005). One of the first visible symptoms of PD is tremor, observed usually in the hand or foot. The type of tremor that is usually recognized in a patient with Parkinson's disease is called a resting tremor, meaning the tremors are less prominent when the person initiates movement, or during sleep. Tremor is often referred to as "pill rolling" if it is observed in the hand (Christensen, 2005). There are numerous secondary symptoms associated with PD, including sensory loss, sleep disturbances, and low blood pressure (Dirette, 2007).

Depression and Apathy

Another symptom that is associated with Parkinson's disease is depression (Sawabini, Juncos & Watts, 2005). Common characteristics of depression include:

sadness, loss of pleasure, excessive weight gain or loss, sleep disorders, fatigue, slowed speech, agitation, problems of concentration, thoughts of death or suicide, or an attempted suicide (Morrison, 2001). For depression to be diagnosed as a secondary symptom of Parkinson's disease, moods that are being experienced must be atypical for the person up until the onset of Parkinson's disease (Morrison, 2001). Past research has indicated that depression is more likely to be observed in patients with PD than in age- and gender-matched control participants who do not have PD (Leentjens, 2000). Parkinson's disease patients who have depression as a secondary diagnosis often are tearful, sad, and anxious. They may feel worthless, or have no thoughts of hope in regards to their current situation (Levy, 1998).

Researchers have also studied the occurrence of apathy in patients with PD. The word apathy derives from Greek, literally meaning "without feeling" (Encarta, 2007). Kirsch-Darrow (2006) described apathy as a primary loss of interest, loss of effortful behavior, and loss of motivation as seen in three domains: behavior, cognition, and affect. Levy (1998) suggested that apathy can exist in the absence of decreased level of consciousness, cognitive impairment, or emotional distress (Levy, 1998). Theoretically, apathy is the absence of emotion, feeling, or concern, and thus is different from the sadness and tearfulness seen in depression.

Several authors have concluded through research that there is a distinction between apathy and depression. Kirsch-Darrow, Fernandez, Marsiske, Oksun, and Bowers (2006) compared the apathy and depression scores of patients with Parkinson's disease to the scores of patients diagnosed with dystonia. The authors used the Beck Depression Inventory (BDI) to measure depression and the Apathy Evaluation Scale

(AES) to measure apathy. Results showed that half of the PD patients had apathy, while only about a quarter of the dystonia patients had apathy. Among the patients who had apathy, about a quarter of the PD patients showed apathy in the absence of depression, whereas no dystonia patients showed this result.

Levy et al. (1998) collected apathy and depression data among patients with Alzheimer's disease, frontotemporal dementia, Huntington's disease, and Parkinson's disease. The measurement used was the Neuropsychiatric Inventory (NPI), which includes a both depression and apathy subtests. It was found that apathy did not correlate with depression when including all diagnostic categories. However, apathy and depression were weakly, yet significantly correlated within the PD sample (r = .34). Levy et al. (1998) were the only researchers who computed correlations between the two variables among the articles that were reviewed.

Pluck & Brown (2002) compared patients with Parkinson's disease to patients with osteoarthritis in terms of apathy and depression; they concluded that apathy is more likely to occur in PD patients than in osteoarthritis patients. Measurements included the AES for apathy and the BDI and the Hospital Anxiety and Depression Scale (HADS) to measure depression.

Also reviewed was an article by Starkstein et al. (1992). These authors analyzed the presence of apathy and/or depression in persons with PD. They used a modified version of the AES for apathy and a psychiatric diagnosis for depression. Both conditions were found to occur in the presence or absence of the other. Starkstein et al (1992) reported a different way of differentiating apathy and depression by considering their relationships with timed visual, conceptual, and visuomotor tracking abilities. Results

showed that apathy was associated with significantly slow, yet accurate performance, while depression was associated with inaccurate performance, not with slowness (1992).

The fifth set of authors identified to measure both apathy and depression in PD, Isella et al. (2002), compared normal controls to persons with PD. The authors utilized the AES to measure apathy and the GDS to measure depression. It was found that those with PD scored higher than controls on depression and apathy and lower on cognitive testing.

There is a sixth set of data identified, with data collection completed by Hill (2008). This research study was not complete at the time of this article, but data on the first 54 subjects were available at the Parkinson's disease Interdisciplinary Clinic at the University of Toledo Health Science Campus. The authors used the 14-item AES to measure apathy and the BDI-2 to measure depression. Data were collected as part of a clinical evaluation by volunteers who are registered nurses. Assessments were completed when the participants arrived for their scheduled appointment before actually seeing the physician. The data were then entered into a de-identified data base for research application with the approval of the Institutional Review Board (IRB).

Assessments of Depression and Apathy

The depression measurements used in the six studies include the Geriatric Depression Scale (GDS), the Beck Depression Inventory (BDI), the Center for Epidemiologic Studies- Depression scale (CES-D), the Neuropsychiatric Inventory (NPI), and Hospital Anxiety and Depression Scale (HADS), the Hamilton Rating Scale for Depression (HRS-D), and clinical diagnosis from a psychiatrist. The BDI is used in three

of the six articles reviewed. All assessments are completed by using 4-point likert scales with the exception of the GDS, which requires a yes/no response.

The apathy instruments used in the six studies include only a sub-scale of the Neuropsychiatric Inventory (NPI) and the Apathy Evaluation Scale (AES). However, the AES has been administered in various ways (questionnaire, interview, clinician rated), and multiple versions of the original AES have been used. The NPI is completed by the patient's caregiver. As described in the AES's instructions, the examiner reads the question, and the patient responds with the most appropriate answer. There is also a modified version of this instrument that is completed entirely by the clinician.

Among the six studies identified, various depression and apathy instruments were used. See Table 1. This presents a problem when considering the entirety of research completed on this topic because the questions asked and the manner in which they are answered varied.

A controversy surrounding the relationship between apathy and depression is that apathy is thought of by some as a symptom of depression. Pluck (2002) reasoned that apathy overlaps conceptually and clinically with depression. For example, the Geriatric Depression Scale (GDS) has been shown to include six items that load together as apathy within a factor analysis (Adams, Motto, & Sanders, 2002). Although no similar research has been found pertaining to other depression instruments, there appears to be at least one item testing apathy in the Beck Depression Inventory (BDI), the Hamilton Rating Scale for Depression (HRS), and the Hospital Anxiety and Depression Scale (HADS). This makes it especially difficult to attempt to isolate apathy from depression. People who are apathetic may score higher than they should on the depression instrument due to positive

scores on the apathy-related items. Apathy is even presented as a symptom of depression in the DSM-IV (Levy, 1998). In the DSM-IV, one symptom of depression is a diminished interest in activities, which is also identified as a symptom of apathy (Kirsch-Darrow et al., 2006). Levy et al. (1998) reported that apathy and depression are correlated to some extent in Parkinson's disease; it remains unclear, however, if this correlation is due to genuine co-occurrence or due to the overlap in items measuring the two conditions.

Implications for Occupational Therapy

Apathy is important to study in relation to occupation as conceptualized in the profession of occupational therapy. Occupational therapy requires active participation on the part of the patient; he or she does not merely *receive* therapy (Nelson & Thomas, 2003; Crepeau, Cohn, & Schell, 2003). An occupational therapist provides the opportunity for therapy by synthesizing an occupational form external to the person, who makes a choice of actual participation. In occupational therapy patients have input on goals and interventions. If a patient suffers from losses of motivation, interest, or effortful behavior, or has indifference in regards to the therapeutic process, the patient will not be a full participant in the occupational therapy process.

Meta-analysis: Depression and Apathy in Parkinson's Disease

A meta-analysis is the most appropriate approach to summarize what is known by research on this topic. A meta-analysis analyzes multiple sets of data (Ottenbacher, 2006). The power behind this approach lies in minimizing Type I and Type II errors that may have been present in the original findings of the individual studies.

Authors who are investigating various articles with hopes to complete meta-analyses rely on the sharing of data to complete their research. The thought of sharing

one's final research data is a topic that is discussed often by numerous research organizations. In 1986 the National Research Council of the National Academy of Sciences issued a report stating that "sharing data should be a regular practice." There are several justifications for data sharing. For instance, when one's data sets are provided in conjunction with the finalized article, the information is especially well supported. Making this information available encourages a more exact replication when the replication of a study is desired. All relevant information regarding the exact way that data were collected surfaces. The National Institute of Health (NIH) provides several reasons to share data.

> "Sharing data reinforces open scientific inquiry, encourages diversity of analysis and opinion, promotes new research, makes possible the testing of new or alternative hypotheses and methods of analysis, supports studies on data collection methods and measurement, facilitates the education of new researchers, enables the exploration of topics not envisioned by the initial investigators, and permits the creation of new data sets when data from multiple sources are combined." (Office of Extramural Research [OER] Web site, Frequently asked questions on data sharing, 2007.)

The NIH currently requires grant applicants of more than or equal to $500,000 to include a plan to share his or her final research data. Final research data are defined by the NIH as "recorded factual material commonly accepted in the scientific community as necessary to document and support research findings" (OER NIH data sharing policy and implementation guidance, 2007) This does not mean summary statistics or tables; rather,

it means the data on which summary statistics are based. By signing the NIH grant application, the principal investigator (PI) declares fulfillment of this requirement.

The American Psychological Association also encourages the sharing of data, stating that authors should not withhold the data upon which their conclusions are drawn from professionals who intend to use such data for re-analysis (Principle 6.25) (p. 396). Some organizations, such as the American Medical Association (AMA), require authors publishing in The Journal of the American Medical Association, to include data sharing as required criteria for publication (Kastner, 2000). However, the association that governs occupational therapy, the American Occupational Therapy Association, has no such policy for its journal.

No meta-analyses of the relationship between apathy and depression have been found. The objective of this meta-analysis was to study the relationships between apathy and depression in participants with Parkinson's disease. This study also examined the relationship between apathy and depression primarily by examining correlations of continuous scales of apathy and depression.

Method

Selection of Articles

To be included in this meta-analysis, studies had to meet the following criterion: provision of measurements of apathy and depression in people with Parkinson's disease. In order to locate relevant studies, multiple search methods were used. Articles were found a) among the personal files of faculty at the University of Toledo Health Science Campus, b) by computer searches in databases including Medline and the Cumulative Index to Nursing & Allied Health Literature (CINAHL), c) tracking the reference lists in

relevant articles, both manually and through the Science Citation Index database searcher, and d) Hill's data set being constructed at the time of this article. The keywords used for searching were as follows: Parkinson disease OR Parkinson's disease AND depression AND apathy. The strategy used for the Science Citation Index was to find relevant articles that had cited articles that were being included in the analysis. The Cochrane library was searched in order to locate meta-analyses that specifically focus on the current topic; however, no reviews were located. The strategy involved when searching this library was as follows: Parkinson disease OR Parkinson's disease AND depression AND apathy. The six studies included are listed in Table 1.

Seeking Data

Originally the intent of this meta-analysis was to examine the original raw data of each of the six studies included. Unfortunately, it was not possible to retrieve the data from four of the authors from whom data was requested. See Table 2 for an explanation of the communications regarding requests for data. In this table, a summary of the attempts to be provided with each authors' raw data set is provided, along with any explanations for not sharing data for the current study. Although a reply was eventually received from each author contacted, Dr. Graham Pluck was the only author who was both willing and able to send the data.

The raw data set that was provided by Pluck in October of 2007 contained de-identified data from Pluck and Brown (2002). More specifically, the data set included the following for each participant: age, gender, total score regarding depression on the BDI and on the HADS depression scale, total score regarding anxiety on the HADS depression scale, total score regarding apathy provided by the AES researcher- rated and

the AES self - rated. The AES researcher- rated represents the data collected from a researcher or clinician when completing the AES for the participant. For all data analysis, the data utilized from Pluck derives from the AES – researcher rated reports.

Of the five published articles reviewed, four provided the proportions of participants who had depression in the absence of apathy, apathy in the absence of depression, both apathy and depression, or neither apathy nor depression (Kirsch-Darrow, 2006; Levy, 1998; Starkstein, 1992, Isella, 2002). A cross-break could be determined in the remaining article due to the provision of raw data scores (Pluck, 2002). Data from the sixth study were available through the research project of a fellow student investigation (Hill, 2008).

Results

The effect size *r* was provided in the texts of the three studies that conducted correlations: the articles published by Pluck et al. and Levy et al., and the study by Hill. An effect size measures the strength of association between variables (Rosenthal, 1991). The effect size (*r*) is considered small if it is between or equal to .10-.29, moderate if it is between or equal to .30-.49, and large if *r* is greater than or equal to .50. These data were first analyzed by using a stem and leaf plot. This displays the frequency distribution of each of the effect sizes in a graph format (Rosenthal & Rosnow, 1991). See Table 3. This table represents the stem and leaf plot of the effect sizes for the three studies from which we were able to obtain continuous data. The data were then interpreted in terms of Cohen's (1988) criteria to examine the significance of effect sizes. Effect sizes for the individual studies range from small (0.25) to large (0.52). All studies show positive effect sizes, and the mean effect size was 0.369 (*SD* = .139).

Data were examined in a second way. See Table 4. From each set of data provided, the student investigator was able to create 2 X 2 cross-breaks of cut-off scores to examine results. The cross-breaks illustrate the proportions of participants with a) neither depression nor apathy b) apathy only, c) depression only, and d) both apathy and depression. Table 4 represents the cross-break information for each set of data. Frequencies that display no depression with the presence of apathy (top right cell) and no apathy with the presence of depression (bottom left cell) are important because these frequencies help to show that apathy can be separated from depression (one can occur in the absence of the other). When examining the cross-break information, it was found that the number of participants who displayed either apathy without depression or depression without apathy (n = 125) almost doubled the number of participants who displayed both apathy and depression together (n = 64).

By using the cross-break information, researchers were able to establish the effect size *r* for each set of variables. The effect sizes from all individual studies included a range from small to large, as judged using Cohen's (1988) criteria. Also included in Table 4 are the *z* scores, each of which represents the strength of the association between apathy and depression. The *z* score is a transformation from *r* that allows the effect sizes of all studies to be combined to find the overall meta-analytic significance. One-tailed probabilities (*p)* ranged widely, from .000066 to .4771, indicating that not all studies individually had statistical significance. The z_r score is provided in this table as well. This score is based on Fisher's r-to-*z* transformation, a system for normalizing the *r* distribution (Rosenthal, 1991). This statistic is used in studying the overall order effect of multiple studies.

Table 4 also presents the coefficient of alienation. The coefficient of alienation represents the proportion of variance for either apathy or depression that cannot be accounted for by the other variable. These ranged from .73 to .99 in the six articles included. Between 73% to 99% of the variance in either apathy or depression could not be predicted by the other variable.

Table 5 represents the stem and leaf plot for the effect sizes of all six studies in terms of categorical data. Effect sizes ranged from small (0.01) to large (0.52), as interpreted from Cohen's (1988) criteria regarding the significance of the calculations. All six studies showed positive effects sizes, and the mean effect size was calculated to be 0.28 (*SD* = .25). This effect size is determined to be small.

Table 6 displays meta-analyses for both types of analysis completed: continuous (K = 3) and categorical (K = 6). The mean correlations indicate one way of showing the level of relationship between the two variables of depression and apathy for all studies combined. The effect sizes for both continuous and categorical data are positive (z = 4.503, and z = 5.308 respectfully). These indicate a statistically significant relationship between apathy and depression in Parkinson's disease. For the continuous data, p = .000007, and for the categorical data, p = 0000001. Although the p values were very small, the effect size r was shown to be moderate for the three studies combined when considering the continuous data (r = .374), and small for all studies combined when using the categorical data (r = .286).

Even though apathy and depression were clearly correlated, the mean coefficient of alienation shows that for the three studies with continuous data most of the variance of one variable cannot be accounted for by the other variable (*M* = .851, *SD* = .108). For the

six studies with categorical data, the mean coefficient of alienation also shows that most of the variance of one variable cannot be accounted by the other variable (M = .895, SD = .098).

This table also includes the chi square test for both continuous and categorical variables. This test examines whether there were differences among the studies. For the continuous variables $\chi^2(2) = 3.2$, $p = .201$, while for the categorical variables $\chi^2(5) = 12.1$, $p = .034$)

Discussion

Through careful consideration of all results, three statements can be made. First, apathy and depression are related in some way. This conclusion is based both on meta-analyses of the three studies providing continuous data, as well as the six studies providing categorical statistics. The combined z tests provided in Table 6 show a positive, statistically significant relationship between apathy and depression (p = .00007 and p = .0000001).

Secondly, apathy and depression are not the same thing. The results of this meta-analysis suggest a moderate, not strong, effect size for the studies combined using the continuous data (r = .374) and a small effect size for the categorical data (r = .286) regarding the strength of association between apathy and depression. Although some studies report effect sizes classified as strong (Tables 3 and 5), the mean effect sizes do not approach the strong classification.

The coefficient of alienation also shows that apathy and depression are not the same thing. A very large proportion of the variance of either apathy or depression cannot be predicted by the remaining variable. For the continuous data, 85% of the variance in

either apathy or depression cannot be predicted by the other variable, and for the categorical data, the same is true for 90% of the variance. Even when considering the studies' individual coefficients of alienation (Table 4), the lowest percentage of the amount that one variable cannot be predicted by the other is .726. This means that less than 73% of the variance of apathy is predictable by depression. Hence, apathy and depression, though related to each other, cannot be considered the same thing.

Lastly, it is important to consider the number of participants who displayed a) neither apathy nor depression, b) apathy without depression, c) depression without apathy, and d) both apathy and depression, shown in Table 4. In five of six studies included in the meta-analysis, the total number of participants who displayed symptoms of apathy without depression or depression without apathy was more than the amount of participants who displayed both apathy and depression (Levy et al., 1998, Kirsch-Darrow et al., 2006, Hill, 2008, Starkstein et al., 1992, and Pluck & Brown, 2002). Only in Isella et al., 2001was the total number of participants who displayed symptoms of both apathy and depression greater than the total number of participants who displayed apathy without depression or depression without apathy . When all the studies are summed, participants who displayed the presence of one condition without the other were almost twice as common as participants with both apathy and depression.

The chi-square tests provided in Table 6 provide some evidence that the studies vary from each other. For the three studies with continuous data, there are not statistically significant differences among the studies ($\chi^2 = 3.208$, $p = .201$). But for all six studies using categorical data, the studies differ from each other in a statistically significantly way ($\chi^2 = 12.079$, $p = .034$). One possible reason for this apparent discrepancy is that

there might have been a significant difference among the six studies in terms of continuous data if the continuous data had been available for all six studies.

Limitations

First, the lack of raw data sets from some of the studies prevented the researcher from analyzing continuous variables. Continuous data were only available for only three of the six studies. Although statistics were run on the categorical variables on all the studies together, this type of analysis is unlikely to be precise and is likely to underestimate the results. Generally speaking, continuous data will lead to more precise and stronger correlations than categorical data, where subtle differences are ignored. For example, in Hill's 2008 study the *r* value when utilizing her continuous data was .52, but it was only .26 when the data were categorized by cut-off scores. For Pluck and Brown's 2002 article, the *r* value for continuous data was .25. The *r* value when using the categorical data was .01. Levy et al. provided an exception to the general rule, with an *r* value of .34 for continuous data and .52 for categorical data.

An additional limitation that can be identified is that different authors used different tests, and some used different versions of the same tests. Varying cut-off scores and the varying ways in which the AES was administered from study to study (self report vs. clinician) also serve as limitations.

It is essential to reiterate the importance of sharing data in research. Investigators with hopes of completing meta-analytic reviews depend on raw data sets in order to minimize possible Type I and Type II errors that are possible within research. The National Institutes of Health has identified numerous reasons why data sharing should be a regular practice; one very important reason specific to a meta-analysis is that it allows

for the commencement of new data sets when multiple data sets are combined (Office of Extramural Research [OER] Web site, Frequently asked questions on data sharing, 2007.) Without these sets of raw data, it is impossible to examine similarities and differences among various studies.

This meta-analysis provides a source of evidence for occupational therapists and other health care professionals who treat patients with Parkinson's disease. In order for a patient to be a full participant in the occupational therapy process, it is imperative that he or she sustains motivation, interest, and effortful behavior. Therefore, the level of apathy in participants with PD is of the utmost importance.

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Table 1. Depression and Apathy Instruments Utilized in Each of Six Studies

	N=	Apathy Instrument(s)	Depression Instrument(s)	Method of Analysis
Kirsch-Darrow (2006)	80	AES* 14 item scale, 0-3 score for each item	BDI 21 item scale, 0-3 score for each item. CES-D Cut-off score >20 No total items or scoring system reported	Cross-breaks of presence/absence of depression and apathy in patients with PD
Levy (1998)	40	NPI subscale (caregiver rated) No cut-off score or total items reported	NPI subscale (caregiver rated) No cut-off score or total items reported	Correlation Cross-breaks of presence/absence of depression and apathy in patients with PD
Pluck	45	AES-C (clinician rated) AES-S (self rated) 18 item scale, 1-4 score for each item 1-4 score for each item Cut-off score > 37	BDI Cut-off score >15 No total items or scoring system reported HADS Cut-off score >10 No total items of scoring system reported	Cross-breaks of presence/absence of depression and apathy in patients with PD Received raw data set via email 10/04/07
Starkstein (1992)	50	AES 14 item scale 0-3 score for each item Cut-off score > 13	PSE Cut-off score: Psychiatric Diagnosis items not distinguished HRS-D “completed by interviewer” No cut-off score or total items reported	Cross-breaks of presence/absence of depression and apathy in patients with PD
Isella (2001)	30	AES 14 item scale, 0-3 for each item Cut-off score >16	GDS No cut-off score or total items reported yes/no response for each item	Cross-breaks of presence/absence of depression and apathy in patients with PD
Hill (2008)	54	AES 14 item scale, 0-3 for each item Cut-off score >13	BDI-2 21 item scale, 0-3 for each item Cut-off score >13	Raw data set provided on 2/15/08. Correlations and cross-breaks possible.

*AES: rated by participant unless otherwise noted.

Table 2. Summary- Contacts with 5 Authors

Author	Attempt 1	Attempt 2	Attempt 3	Attempt 4
Kirsch- Darrow	06/05/07 No reply	Replied 7/25/07; said that data was being utilized in a follow-up study - unable to share with us.		
Levy	06/05/07 No reply	Reply 7/25/07 from Dr. Cummings (second author). They no longer have this data.		
Pluck	06/05/07 No reply from Brown (second) author)	Auto-Reply from Brown on 7/25/07 (second author) –on vacation. No further reply.	Contacted G. Pluck 9/26/07 he replied 9/26/07, he would be happy to comply with our request. Sent data set 10/04/07.	
Starkstein	06/05/07 No reply	No reply	9/26/07. Starkstein replied same day. He has no access to the data we need; offers to share new data that he is collecting.	We replied 2/14/08: to request an update on the new data being collected. No following reply.
Isella	06/05/07 Replied 06/06/07 Stated data had been lost in disc breakdown.	We replied 06/07/07, suggested that data may be recovered from a hard copy.	Replied 6/14/07, asked for amount of payment. We replied 07/25/07, we would Pay US $50. Replied- data cannot be differentiated from larger data set.	

Table 3. Stem and Leaf Plot of *r* values for continuous data

Stem	Leaf	Author	N = 3
.5	2	[1]	Maximum = .52
.4			Minimum = .25
.3	4	[2]	Mean = .369
.2	5	[3]	*SD* = .139
.1			Proportion of positive signs = 3/3
.0			

Authors:

[1] Hill (2008)

[2] Levy et al (1998)

[3] Pluck and Brown (2002)

Table 4. Apathy by depression as categorical variables generated by cut-off scores. According to Rosenthal (1991), z is used to compute overall meta-analytic significance, and z_r is used to compare effect size. The coefficient of alienation is the amount of variance in one variable not predicted by the other.

Cross-break			r	z	1- tailed p	z_r	Coefficient of Alienation
Kirsch-Darrow (N= 80)							
	No Apathy	Apathy					
No Depression	36 (45%)	23 (29%)	.4114	4.0917	.00002	.437	.831
Depression	18 (22%)	3 (4%)					
Levy (N= 60)							
	No Apathy	Apathy					
No Depression	36 (45%)	2 (5%)	.5233	3.8225	.000066	.577	.726
Depression	11 (28%)	11 (28%)					
Starkstein (N= 50)							
	No Apathy	Apathy					
No Depression	16 (32%)	6 (12%)	.2645	1.9613	.0249	.271	.930
Depression	13 (26%)	15 (30%)					
Isella (N= 30)							
	No Apathy	Apathy					
No Depression	5 (17%)	7 (23%)	.2079	1.1214	.1311	.210	.957
Depression	4 (13%)	14 (47%)					
Pluck (N= 44)							
	No Apathy	Apathy					
No Depression	16 (36%)	9 (20%)	.0087	.0575	.4771	.009	.999
Depression	12 (27%)	7 (16%)					
Hill (N= 54)							
	No Apathy	Apathy					
No Depression	20 (37%)	12 (22%)	.2570	1.9469	.0258	.263	.934
Depression	8 (15%)	14 (26%)					

Table 5. Stem and Leaf Plot of *r* values for nominal data

Stem	Leaf			Author	N = 6
.5	2			[1]	Maximum = .52
.4	1			[2]	Minimum = .01
.3					Mean = .28
.2	1	6	6	[3, 4, 5]	*SD*= .25
.1					Proportion of
.0	1			[6]	positive signs = 6/6

Authors:

[1] Levy et al. (1998)

[2] Kirsch Darrow et al. (2006)

[3] Isella et al. (2001)

[4] Hill (2008)

[5] Starkstein et al. (1992)

[6] Pluck and Brown (2002)

Table 6. Meta-analyses combining and contrasting continuous and categorical data to test overall relationship between apathy and depression

		Combining Three Studies[1]: Continuous Data	Combining Six Studies[2]: Nominal Data Based on Cut-off Scores
r	M	.369	.279
	SD	.139	.177
Combined *z*		4.503	5.308
2- tailed *p*		.000007	.0000001
Effect size *r*		.374	.286
Coefficient of Alienation	M	.851	.895
	SD	.108	.098

	Testing Differences Among Three Studies[1]: Continuous Data	Testing Differences Among Six Studies[2]: Nominal Data Based on Cut-off Scores
χ^2	3.208	12.079
df	2	5
2-tailed *p*	.201	.034

[1] Hill (2008), Pluck and Brown (2002), and Levy et al (1998).

[2] Hill (2008), Pluck and Brown (2002), Levy et al (1998), Kirsch-Darrow et al (2006), Starkstein (1992), and Isella (2001).