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Investigating the severity of scoliosis and self-perception of the visible disfigurement as predictors of psychological distress.

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ABSTRACT

Scoliosis, is a complex curvature of the spine, that appears in otherwise healthy individuals, with the resulting skeletal disfigurement frequently having a negative psychological impact, in that previous research finds scoliosis to be a substantial risk factor for psychological distress. The presence of psychological distress is a cause for concern for specialists, relating to a patient's adjustment to treatment, in terms of a lack of compliance or the presence of psychosocial difficulties. The present study aimed to assess the extent to which there is a psychological impact associated with severity of scoliosis and self-perception of the disfigurement produced by scoliosis, in terms of body image concerns, health related quality of life, depression and anxiety, informing professionals in assessing whether psychological treatment is necessary in supporting clinical treatment. The study built on existing literature, through the use of adult participants, an area lacking in research. 165 adults with scoliosis, aged 18-65 completed multiple online-based self-report questionnaires measuring all variables. Relationships were established between variables using Pearson's correlation coefficients; findings demonstrated that both severity and self-perception significantly correlated with body image concerns, whilst self-perception also correlated with health related quality of life, depression, and anxiety, suggestive of the negative influence an individual's perception of their body and therefore self-worth has on psychological factors. Regression analyses assessed the extent of these relationships, finding the self-perception of disfigurement to be markedly influential in predicting all aspects of psychological distress, particularly body image concerns.

KEY WORDS:	SCOLIOSIS	PSYCHOLOGICAL DISTRESS	SELF-PERCEPTION	CORRELATIONAL	ADULT SAMPLE

Introduction

Scoliosis is defined as a complex three-dimensional spinal deformity, whereby the spine deviates from the typical sagittal and coronal positions (Weiss, et al., 2013), exhibiting different patterns of curvature and twisting, often causing the subsequent elevation of the rib cage on the convex side of the curve (Bradford, et al., 1987). Although scoliosis may be a symptom of certain illnesses, in many cases it is thought to be idiopathic, in that the underlying cause cannot be ascertained (Weiss, et al., 2013), the etiology of which is often poorly understood (Rivett, et al., 2009). Idiopathic scoliosis appears in otherwise healthy individuals, progressing in relation to multiple factors (D'Agata, 2014) and does not characteristically cause health problems, yet the resulting skeletal deformity, indicated by a change in back shape, often has a negative impact on patients. The perception of health, body image, and the participation in physical activities appears to be a significant issue for patients diagnosed with spinal deformities (Goldberg, et al., 1994); self-consciousness is thought to be instrumental in limiting social activities, accompanied by fear of injury (Danielsson, et al., 2001).

According to Payne (1997), the presence of scoliosis, irrespective of treatment status, is a substantial risk factor for psychological distress within the patient, indicated by suicidal thoughts and worry, as well as concern over body development and peer interactions. The initial diagnosis of scoliosis is a distressing experience for patients and their families, reflected by feelings of isolation and denial in around 40% of patients amidst the early stages of their treatment (MacLean, et al., 1989). Whether exhibited at birth or developed later in life, a visible disfigurement such as scoliosis, can have an extreme psychological impact upon the individual, due to concerns surrounding physical appearance, an uncertain prognosis, and efforts associated with treatment such as bracing and surgery (Freidel, et al., 2002). Spinal fusion surgery to correct the scoliosis is required if the curve progresses beyond around 40 to 45 degrees, causing the spine to be significantly unbalanced, cosmetically impaired, and often painful (Chang, et al., 2016), whilst bracing is likely to be used for patients who have a curvature of between 25 and 40 degrees; assessing the impact of these treatments is increasingly vital as healthcare costs continue to rise.

Several studies have been conducted in relation to various aspects of mood disorders in patients with scoliosis, including depression and anxiety. A recent study carried out by Chang, et al (2016) denoted that patients suffering with scoliosis had a greater incidence of depression as well as lower freedom of depression than those without scoliosis, over a 5-year time period. The chronic back pain in scoliosis patients is thought to be a predicting factor in the development of depression, with studies demonstrating that the population involving individuals with chronic pain have an increased prevalence of depression and substance dependence (Dersch, et al., 2001). Depression has also been related to a magnification of medical symptoms, whereby patients with pain and comorbid depression are more prone to experience greater pain complaints, a greater amplification of symptoms as well as a longer duration of pain (Choi, et al., 2014). Furthermore, depression has been linked to less positive treatment outcomes (Burns, et al., 1998), indicating how vital it is to assess depression in patients with scoliosis, enabling an appropriate management of the depression to be provided, in order to achieve successful treatment outcomes (Choi, et al., 2014). However, despite widespread acknowledgement that depression is related to chronic

pain conditions, there are numerous issues in the production of research within this area, the first being the definition of depression itself, with the term being used to refer to a mood, a symptom and a syndrome (Banks & Kerns, 1996). On account of this, depression has been evaluated in multidisciplinary ways, meaning the variation within both the definition and assessment of depression renders the comparison of the results of different studies difficult. A further problem is the issue of 'criterion contamination' (Williams, 1998), referring to the coinciding of the symptomatology produced in both chronic pain and depression; the diagnostic criteria for depression includes a number of somatic symptoms that can also be associated with chronic pain such as sleep disturbance and loss of energy, therefore diagnosing depression within this population is not always simple (Dersch, et al., 2001).

Given that scoliosis influences trunk shape, it has the capability to negatively affect lifestyle, behavior, and self-esteem (Rivett, et al., 2009) preceding to a variety of responses such as body discontent, negative body image, and apprehension regarding the individual's body shape (Glowacki, et al., 2013). Body disfigurement generally coincides with a negative body image, which can in turn ensue decreased self-esteem, accompanied by increased anxiety and depression (Weiss et al., 2006). Emotional burden and anxiety are commonly reported in individuals with disfiguring conditions such as scoliosis (Misterska et al., 2013), though Tomaszewski and Janowska (2012), found patients often felt they were unable to express their feelings, and often kept their anxiety hidden. Hawes (2002) denoted that scoliosis related anxiety conveys the product of not knowing whether the spinal deformity, along with the resulting symptoms, will progress. Uncertainty produced by the patient's condition, may also result in a change in attitude within the individual in relation to themselves and their body; knowing that one will never have what they perceive to be a perfect body can promote anxiety within the individual, and consequently lead them to doubt their self-worth. The role of appearance-specific cognitions in inducing stress within individuals with disfiguring conditions such as scoliosis is vital since the disfigurement is often their greatest concern and a primary objective of the treatment they undertake (Misterska, et al., 2012).

A disturbance in body image relating to appearance amongst patients with scoliosis is a virtually universal finding across studies measuring the variable (Tones, et al., 2006), defined as a mental representation of an individual's own body, placing specific prominence on how an individual believes they appear to others (Clayson, 1979). Clayson and Levine (1976), found scoliosis to have a negative influence on an individual's self-worth and the self-perception of their value to other people. Individuals with scoliosis are more prone to be discontent with their appearance, fearing that their bodies are maturing atypically in comparison to those without scoliosis (Liskey-Fitzwater, et al., 1993). The psychological distress faced by individuals with scoliosis is often attributed to the progression of trunk disfigurement, with patients often being concerned about their body image before, during and after treatment (Carrasco and Ruiz, 2014). As a result, patients with scoliosis tend to lack self-confidence, emitting feelings of stress, fear, anger and even shame (Carrasco and Ruiz, 2014), this anxiety relating to aesthetics appearing to have an adverse impact on self-esteem, and consequently emotional and psychological health, leading to a deterioration of self-perceived quality of life (Zhang et al., 2011).

That said, research into body image disturbances thought to be caused by scoliosis

often involves adolescents, due to scoliosis being most commonly diagnosed within the adolescent years, therefore, as body dissatisfaction is common among adolescents, the body image questionnaires may neglect to expose the body image concerns specifically related to scoliosis; the presence of treatment is thought to be an added stressor for adolescents with scoliosis, who are already grappling with their body image (Tones, et al., 2006). Taking into the account, the sex distribution of scoliosis, it must also be emphasized that following childhood, scoliosis effects more females than males, with the sex ratio subsequent to the age of 10 being 6:1 (Lonstein, 1995); the results of Payne et al (1997) indicated differences between male and females in relation to reactions to body disfigurement due to scoliosis, therefore as more females suffer from scoliosis, it may be that the research into body image includes gender biases, though higher levels of severity occur more frequently in females, so the presence of body dissatisfaction among these individuals is perhaps to be expected.

Nonetheless, the physical appearance of the spine is often not thought to be the central issue, with the distress stemming more from the individual's perception of their appearance and the way in which others view them (Liskey-Fitzwater, et al., 1993). The individual's perception of body image may not be in agreement with the perception of other individuals, or correspond with objective evaluations of the body, with discrepancies often being found between the clinical evaluation of the severity of scoliosis and the individual's subjective evaluation of the esthetic disfigurement of the back (Misterska et al., 2013), though the effects of the individual's perception is extensive, regardless of accuracy. Individuals suffering from a disfigurement or deformity may also face struggles with social interactions, owing to possible adverse reactions in consequence of the visibility of their condition (Tones & Moss, 2007), in terms of stigmatization and social exclusion. Outcomes from health related quality of life studies denote that body image is a multifaceted and substantial problem for patients with scoliosis (Tones et al, 2006), appearing to be affected by both the treatment type and gender of the patient; bracing is largely linked with a poorer body image, whilst surgery generally associates with improvements in body image (Tones, et al., 2006). In addition, females experiencing issues with poor body image express feelings of unattractiveness, characterised by problems in finding clothes and a dissatisfaction with their appearance, whilst males with scoliosis are more likely to be troubled by a perceived lack of physical health and strength (Payne, et al., 1997). It has been suggested that individuals with scoliosis regularly suffer psychological conflicts, resulting primarily from the cosmetic effect of the disorder (Pineda et al., 2006); a clearer understanding of body perceptions can therefore participate in improving the care provided by professionals (Carrasco and Ruiz, 2014).

The psychological distress caused to scoliosis patients is of concern to specialists, as psychological distress can have a negative impact on the patient's adjustment to treatment, in relation to a lack of compliance with bracing or psychosocial difficulties following surgery (Koch et al, 2001). There is a significant body of research into scoliosis focusing on patients within the adolescent age range, prompting the need for more research into the psychological impact on those in adulthood and therefore over the age of 18; the study aimed to build on existing literature by using adult participants rather than adolescent participants, to assess more of a long term impact of scoliosis. The purpose of this study is therefore to assess the extent to which there is a psychological impact associated with having scoliosis, in terms of body image

concerns (research question 1), health related quality of life (research question 2), anxiety (research question 3), and depression (research question 4), helping to inform professionals in assessing whether psychological treatment is necessary to support clinical treatment.

Method

Design:
The study design comprised of a correlational study using previously established questionnaires, through the use of Qualtrics; the study assessed the predictor variables of severity and self-perception of the visible disfigurement produced by scoliosis, against the criterion variables of health related quality of life, depression and anxiety levels, and body image concerns.

Participants:
The current research expanded on previous research, reaching to a somewhat older audience than as is typical within scoliosis research, involving individuals between the age of 18 and 65 (M = 32.28, SD = 13.01), whilst 43% of participants were at the lower end of the scale, ranging between the ages of 18 and 25, including 10.3% being 18 and thus bordering on being classified within the standard adolescent age range. 165 respondents completed the study, in accordance with the required number of 106 participants required to enable the testing of each individual predictor involved in the study, as stated by Green (1991), following N>104 + *m*, with '*m*' being the number of predictor variables; the sample size of 165 is thus sufficient in representing the scoliosis population. There was a vast difference in gender distribution (Males N=4, Females N=161), though this was not of major concern due to a higher prevalence rate in females (Lonstein, 1995).

All participants were recruited through opportunity sampling across 'Scoliosis UK', 'Scoliosis Ireland' and 'Scoliosis Awareness', all scoliosis support pages on Facebook, comprising of an abundance of people who have or have family with scoliosis; ethical issues of this recruitment method were acknowledged, though the researcher was not required to befriend participants, nor was either party able to see personal information posted on the other parties Facebook page, therefore confidentiality was kept for both the researcher and the participant. Permission was obtained from the admins to enable the researcher to post the questionnaire on this site; a vast body of people use this page to share their story, so were willing to participate and essentially share their story with the researcher. Recruiting participants through social media is advantageous in that it is a cost-effective and time efficient technique, having the capability to yield sizeable samples (Cassese et al., 2013) with Facebook also being the most popular social networking site (Child, 2014), providing a sufficient platform for the present study.

Materials:
WRVAS (see appendix 1) – the Walter Reed Visual Assessment Scale (Sanders et al, 2003) is a seven item scale, used to assess a patients' perception of their spinal disfigurement; the seven items focus on the visual factors of scoliosis, in terms of body curve, rib prominence, head pelvis, shoulder level, flank prominence, scapula rotation and head rib pelvis. Scores are acquired by calculating the responses to each question, with each item consisting of five graphics scaled to signify worsening

disfigurement; the participant is asked to choose the image that best describes their body. For each item, the minimum score is 1, signifying the picture with a small disfigurement, whilst the maximum is 5, signifying the picture with a large disfigurement, giving a highest score of 35 to indicate a high disfigurement. As found by Pineda et al (2006), the WRVAS is extremely reliable in that it is high in internal consistency, scoring 0.9 in relation to the Cronbach's alpha statistical test. They also found the WRVAS to correlate significantly with the patients Cobb angle, the clinical diagnosis of the degree of the curve, showing it to be an accurate predictor of the severity of scoliosis.

SRS-22 (see appendix 2) – the SRS-22, a questionnaire produced by the Scoliosis Research Society, is a scoliosis specific questionnaire, allowing for the simple and practical measurement of an individual's own perception of the effect of scoliosis, being the most commonly used instrument when assessing health related quality of life (Brewer et al, 2014). The SRS-22 contains 22 items, consisting of 5 domains: Function, Pain, Self-Image, Mental Health and satisfaction with treatment. All questions contain likert scales of 1-5, with a score of 1 indicating a good health related quality of life, whilst a score of 5 indicates poor health related quality of life. A total score was calculated, equated to the individual's health related quality of life. Though the most recent questionnaire, the SRS-24, now includes 24 items, the SRS-22 was chosen for the present study as it appears more versatile, as both non operative and operative patients can complete all questions, in comparison to the SRS-24 which includes questions targeted solely at those who have undergone surgery. The SRS-22 has been validated across many age groups and in many languages, and has also been shown to be high in internal consistency scoring 0.96 to 0.85 across all 5 domains in relation to a Cronbach's Alpha Analysis (Brewer et al, 2014).

DASS (see appendix 3) – The Depression, Anxiety and Stress Scale is a 42 item self-report scale, designed by Lovibond and Lovibond (1995) to measure the emotional states of depression, anxiety and stress. For the purpose of this study, only the depression and anxiety scales were used; with this in mind, the 42 item questionnaire was used as opposed to the shorter 21 item questionnaire. Each scale contains 14 items, containing a 4 point likert scale, whereby the participant was asked to subjectively indicate the severity of a symptom during the previous week; 0 represented 'did not apply to me at all' whilst 4 indicated 'applied to me very much or most of the time'. The DASS has been found to be high in internal consistency, measuring at 0.94, 0.88 and 0.93 for each subscale respectively, on the completion of a Cronbach's alpha test, as well as being high in criterion validity, with employees with a depression or anxiety disorder scoring significantly higher on the depression and anxiety scales (Nieuwenhuijsen et al, 2003).

BSSQ (see appendix 4) – The Bad Sobernheim Stress Questionnaire, developed by Botens-Helmus (2006) consists of eight likert scale items, measuring body image concerns caused by the disfigurement, in relation to the effect on social interaction, mood, and consequently the level of stress in relation to appearance experienced. Each question contains a likert scale of 1-4, asking individuals to indicate the extent to which they agree to statements such as 'I feel self-conscious about the appearance of my back', with 1 indicating 'completely true' and 4 indicating 'not true at all', on all questions, other than 2 questions stating positive statements such as 'I don't feel embarrassed when people see my back', whereby 1 indicated 'not true at all' and 4

indicated 'completely true', The maximum score of 24 indicates a lower level of psychological stress in terms of body image concerns, whilst a score of 0 indicates the highest level of stress. The original German version of the questionnaire had sufficient criterion validity and has a high reliability with D'Agata et al (2014) finding a Cronbach's Alpha of 0.88.

Procedure:

The present study was conducted in accordance with the Code of Ethics and Conduct of the British Psychological Society, also being ethically approved by Manchester Metropolitan University (appendix 5), with no participants being vulnerable in that they were all be over the age of eighteen. Participants were invited to take part in the study through the social media site 'Facebook'; though the Facebook page consists of individuals of all ages, only those over the age of 18 were considered to take part in the study, to diminish ethical issues. Participants received a detailed 'Information Sheet' (see appendix 6), outlining information on the aims of the study, as well as information regarding their anonymity and right to withdraw, before the participant gave their consent (see appendix 7). Participants then completed a succession of questionnaires, encompassing measures of self-perception of the visible impairment (WRVAS), Health Related Quality of Life (SRS-22), Depression and Anxiety (DASS), and Body Image (BSSQ). In addition, the cobb angle was taken as a measure of the severity of the individual's scoliosis, being the most common method of assessment of spinal deformities in both the coronal and sagittal planes (Shaw et al., 2011), involving the angle between the most tilted vertebrae at both ends of the curve. Though agreeable that being two-dimensional, an X-Ray may not fully reflect a three-dimensional disfigurement, it has the benefit of being simple to determine and understand, thus becoming the standard of scoliosis assessment, easily lending itself to statistical manipulation (Goldberg et al., 2007).

All questions were compulsory, though with regards to the severity of scoliosis, participants were informed to enter 'unknown' if they were unaware of this. All participants were fully debriefed and assured of their right to withdraw, being required to generate a unique identification code to maintain anonymity, ensuring a simple withdrawal process if necessary. As considering their feelings surrounding the disorder may have prompted unpleasant feelings in the participant, making them think more about how much they are effected by their condition, all participants were provided with sufficient contact details of organisations to provide them with help and advice, such as MMU Counselling Service and Mental Health Foundation. Following data collection, a regression analysis was carried out involving two predictor variables. All participants were debriefed at the end of the study (see appendix 8).

Results

Raw data was downloaded from Qualtrics and input into Statistical Package for the Social Sciences (SPSS) version 24.0, allowing the data to be appropriately analysed. Invalid data was discarded, leaving data from 165 individuals with scoliosis available for analysis. Several items of the srs-22 were also recoded, before calculating the scale totals for each variable.

Internal Consistency

An internal consistency analysis was carried out to determine the reliability of all measures used, ensuring that all items measure a common underlying construct. Table 1 provides both the alpha coefficients and confidence intervals for all measures.

Table 1: Internal Consistency and Confidence Intervals for all measures

	Number of items	Cronbach's Alpha	95% Confidence Interval	
			Lower	Upper
Srs-22	22	.94**	.93	.95
WRVAS	7	.89**	.86	.91
BSSQ	8	.88**	.85	.91
DASS - Anxiety	14	.92**	.90	.94
DASS - Depression	14	.97**	.96	.98

*** significant at the .001 level*

Following internal consistency analysis, all scales demonstrated a Cronbach's Alpha value significantly above .7, indicating a significant level of reliability for each scale ($p<.001$) in exceeding the acceptable level of internal reliability Nunnally (1978). Both measures of the DASS scale, in terms of anxiety, displaying a Cronbach's alpha of .92, 95% CI [.90, .94] and depression, demonstrating a Cronbach's alpha of .97, 95% CI [.96,.98], showed excellent internal consistency, where $p<.001$, this being in line with previous clinical research (Nieuwenhuijsen et al, 2003). The Srs-22 also displayed an excellent level of internal consistency, whereby a Cronbach's alpha of .94, 95% CI [.93, .95] was found ($p<.001$).

Table 2
Means and Standard Deviations for the Total Scores of all Variables

	N	*Mean*	*SD*
Severity	131*	64.38	21.64
Self-Perception of Disfigurement	165	21.01	5.92
Health Related Quality of Life	165	66.71	11.48
Body Image	165	19.73	6.33
Anxiety	165	25.52	9.09
Depression	165	26.65	11.01

For this sample, the average degree of curvature was 64°, whilst the average self-perception of disfigurement was 21.01, both indicating a noteworthy degree of scoliosis. The mean body image was 19.73, indicating a slight concern in the appearance of their back. Depression and Anxiety scores indicate the participants generally have severe levels of psychological symptoms for depression, and extremely severe levels of anxiety, as stated by Lovibond and Lovibond (1995).

For severity, N is lower (N=131) as a small minority of participants were unaware of the clinical degree of curvature to the spine, and were thus unable to complete the

relevant question when asked to state their severity of their scoliosis in terms of the cobb angle.

Correlations

A series of Pearson bivariate correlations were carried out between all variables to assess the extent to which there were relationships between each predictor variable and each of the criterion variables, revealing a number of significant correlations (Table 2).

Table 2
Pearson Correlation Coefficients between all variables

	1	2	3	4	5	6
Cobb Angle	-	.47**	.16	-.24**	.11	.10
Self-Perceived Disfigurement		-	.38**	-.40**	.21**	.21**
Health Related Quality of Life			-	-.60**	.59**	.63**
Body Image				-	-.43**	-.46**
Anxiety					-	.79**
Depression						-

** correlation is significant at the 0.01 level

The severity of scoliosis significantly negatively correlated with body image (r(131) = -.24, p<.01), as did the individual's self-perception of the visible disfigurement (r(165) = -.40, p<0.01), indicating that both variables relate to a poorer body image. The individuals self-perception of the visible disfigurement also significantly correlated with all other measures of psychological factors; 'health related quality of life' (r(165) = .38, p<.01), 'anxiety' (r(165) - .21, p<.01) and 'depression' (r(165) = .21, p<.01), signifying the negative psychological impact that the perception of spinal disfigurement has. Correlations also showed that both depression and anxiety, both being subscales of the DASS, significantly correlate with each other (r(165) = .79, p<.01).

Regression Analysis

As significant correlations were found between a number of variables, a series of regression analyses were conducted to explore a number of research questions, investigating whether the predictor variables of severity and perception of visible disfigurement sufficiently predicted the criterion variables of health related quality of life, depression, anxiety and body image.

Research Question 1: to what extent do the variables of severity and self-perception of visible disfigurement predict a poor body image?

A multiple linear regression was carried out using the enter method, to determine the capacity to which both the cobb angle and an individual's perception of spinal disfigurement are predictive of poor body image. A multiple regression is beneficial in the present study in that it allows for the prediction of more than one variable to measure the effect of several factors concurrently; there are many different factors to having scoliosis, and variations exist amongst individuals, so a multiple regression allowed for the identification of the most substantial and common predictor variable.

Table 3
Summary of multiple linear regression for the severity of scoliosis and self-perception of visible disfigurement in predicting poor body image

Variable	B	β	t	Sig (p)
Constant	29.44			
Severity	-.02	-.06	-.66	.51
Perceived visible severity	-.40	-.38	-4.11	$p<.001$

Note: $R^2 = 0.17$

A significant model emerged ($F_{(2,128)}$ = 12.73, $p<.001$), whereby the relationship between the variables was moderate (R=.41), with both variables explaining 17% of the variance in body image scores in combination. It can be seen from table 2 that both severity and perception of disfigurement are related to body image, both negatively, signifying that as severity and self-perception rise, body image declines, though only perceived visible severity made a significant contribution to the model, explaining a significant amount of the variance alone (*t = -4.11, p<0.001: 95% CI -.59 - .20)*. Figure 1 shows the negative correlation between perception of visible disfigurement and body image, with the analysis indicating that for every 1 standard deviation that perception of visible severity increases, the body image score decreases by .38 to show a lower satisfaction of body image.

The scatterplot shows the regression line equation $y = 28.8 - 0.43 * x$ with $R^2\ \text{Linear} = 0.163$. The y-axis is labelled bssq_total (5.00 to 35.00) and the x-axis is labelled wrvas_total (5.00 to 35.00).
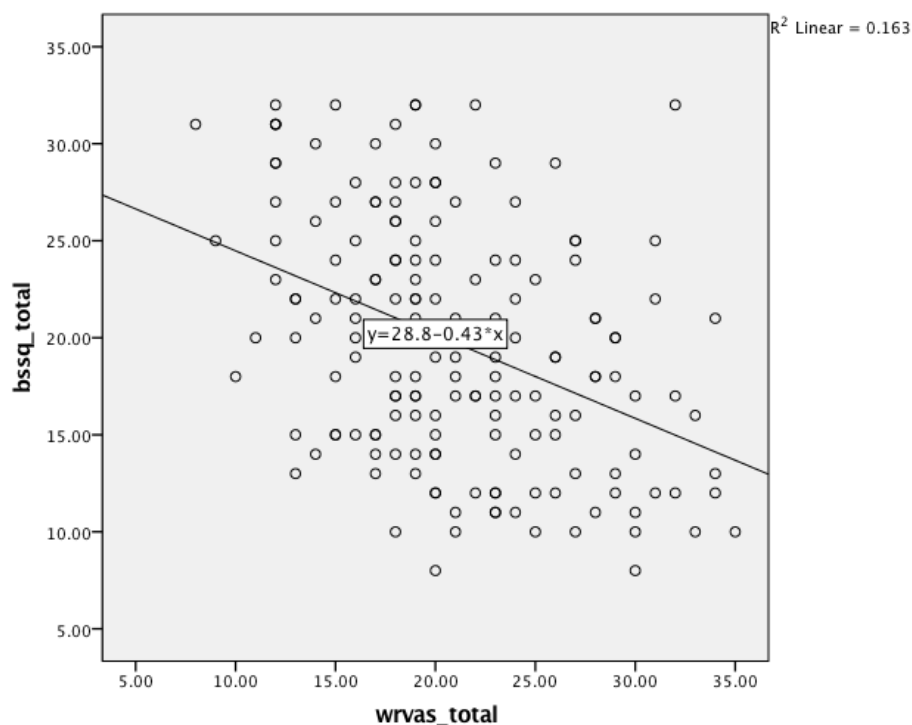
Figure 1: Scatterplot with a regression line to show the significant negative relationship between perception of visible disfigurement (WRVAS) and body image (BSSQ)

Additionally, three simple linear regressions were conducted to explore relationships between the perception of visible severity and health related quality of life, anxiety and depression respectively.

Research Question 2: to what extent does the perception of visible disfigurement predict health related quality of life?

Table 4
Summary of simple linear regression for perception of visible disfigurement to predict health related quality of life

Variable	B	β	t	Sig (p)
Constant	51.19			
Perceived visible severity	.74	.38	5.25	p<.001

Note: R^2 = 0.15

The variable perception of visible disfigurement predicted 15% of the variance in health related quality of life, signifying a significant proportion of the variance $(F(1,163) = 27.59, p<.001)$, indicating that the worse an individual's perception of the visible severity of their spine, the worse their health related quality of life, as indicated in figure 2. The regression analysis indicated that for every one standard deviation the perception of severity increases, the health related quality of life score increases by .38, signifying a poorer quality of life.
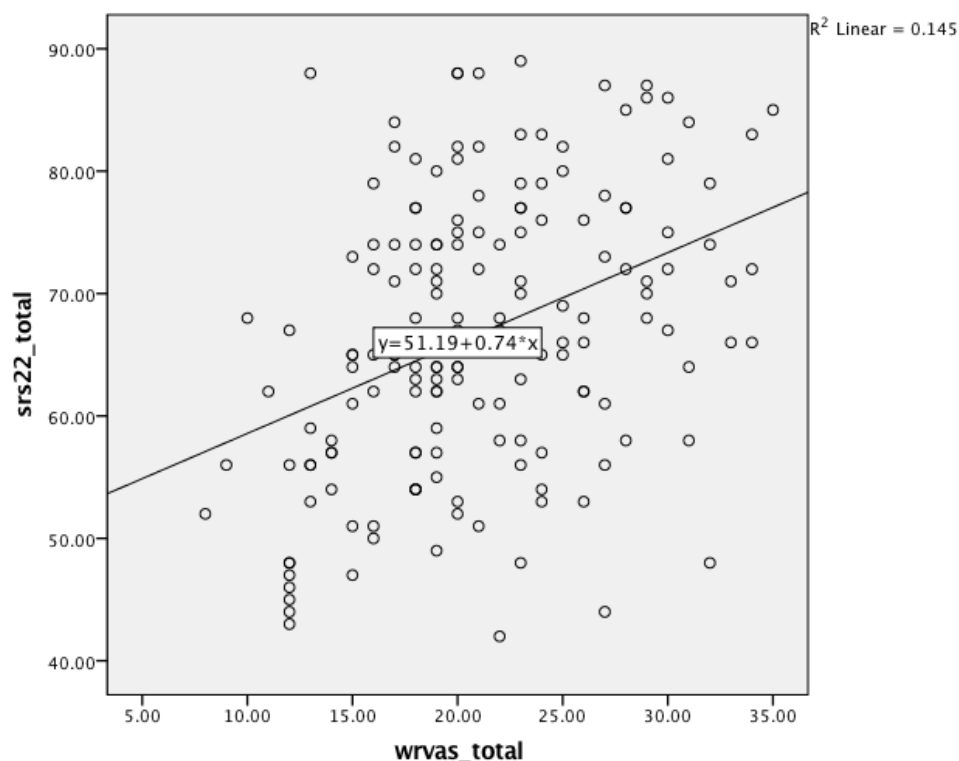
Figure 2: Scatterplot with a regression line to show the significant relationship between self-perception of disfigurement (WRVAS) and Health Related Quality of Life (srs-22)

Research Question 3: to what extent does the perception of visible severity predict anxiety?

Table 5
Summary of simple linear regression for the perception of disfigurement to predict anxiety

Variable	B	β	t	Sig (p)
Constant	18.73			
Perceived visible severity	.32	.21	2.75	.01

Note: R^2 = 0.04

Perception of visible disfigurement significantly explained variance in anxiety ($F_{(1,164)}$ = 7.55, p=.01), indicating that the worse an individual's perception of the visible severity of their spine, the higher their levels of anxiety, shown in figure 3; though significant, the model explained only 4% of anxiety within individuals, showing an extremely weak model, although seemingly understandable given the broad nature of the variable anxiety. The regression analysis indicated that for every one standard deviation the perception of severity increases, anxiety increases by .21.
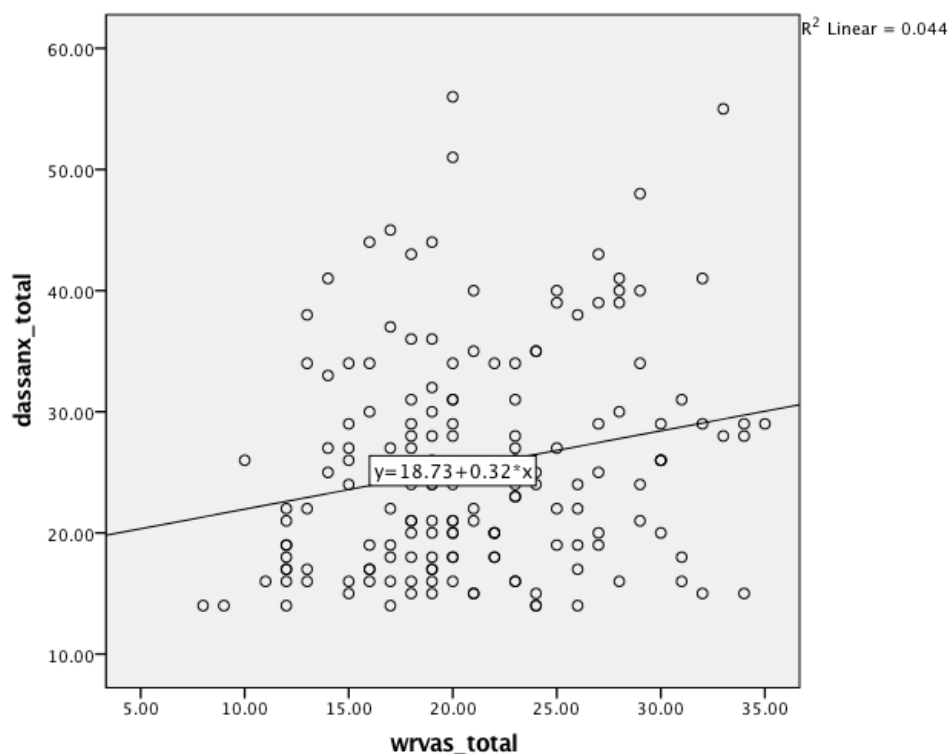
Figure 3: Scatterplot with a regression line to show the significant relationship between self-perception of disfigurement (WRVAS) and anxiety (DASS)

Research Question 4: to what extent does the perception of disfigurement predict depression?

Table 6
Summary of simple linear regression for the self-perception of disfigurement to predict depression

Variable		B	β	t	Sig (p)
Constant		18.38			
Perceived severity	visible	.39	.21	2.76	.01

Note: R^2 = 0.05

The regression model explained 5% of the variance in depression, again showing a weak model, though statistically significant (*F(1,163) = 7.62, p=.01);* the worse an individual's perception of the visible severity of their spine, the higher levels of depressive symptoms, shown in figure 4. The regression analysis indicated that for every one standard deviation the perception of disfigurement increases, depression increases by .21.

The scatterplot displays dassdep_total (y-axis, ranging from 10.00 to 60.00) against wrvas_total (x-axis, ranging from 5.00 to 35.00). A regression line is shown with equation y=18.38+0.39*x. The annotation R² Linear = 0.045 appears at the top right.
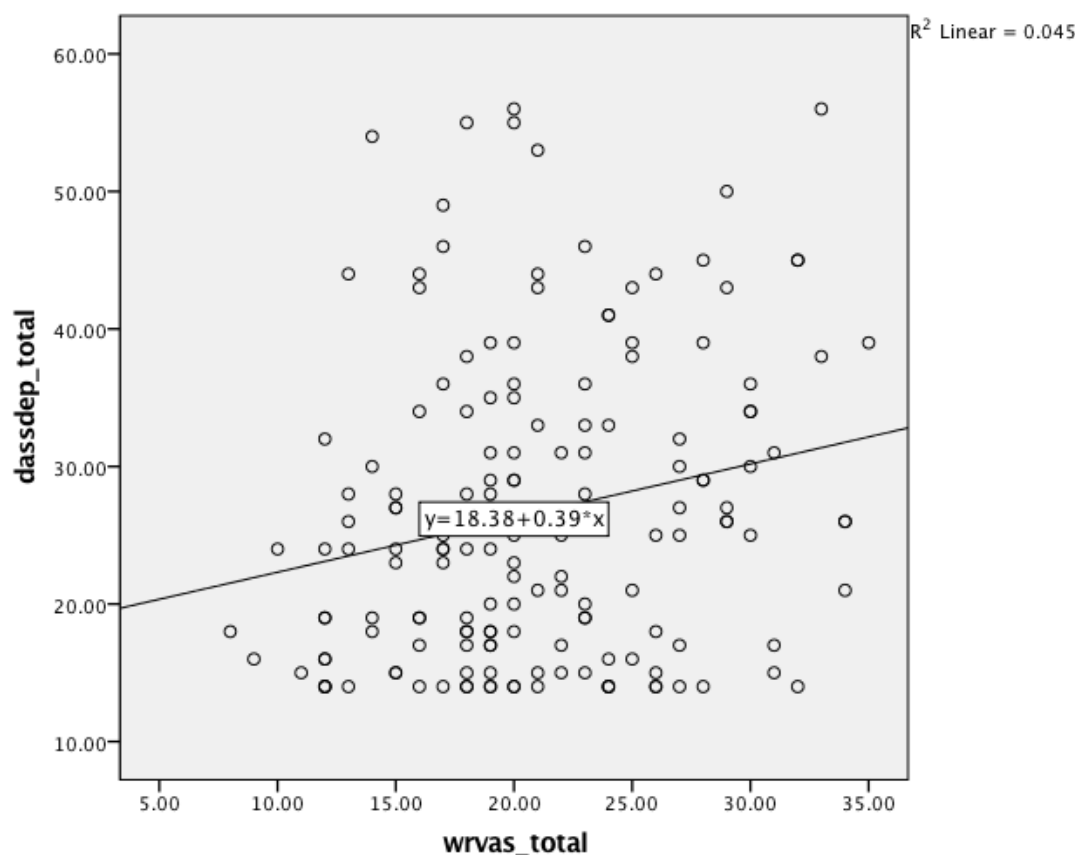
Figure 4: Scatterplot with a regression line to show the significant relationship between self-perception of disfigurement (WRVAS) and depression (DASS)

Discussion

The present study aimed to investigate the psychological impact of scoliosis, assessing the relationship between the predictor variables of severity and self-perception of disfigurement, and the criterion variables Health Related Quality of Life, Depression, Anxiety and Body Image concerns in an adult sample. Pearson's correlation coefficients indicated relationships between the variables; both severity and self-perception significantly correlated with body image concerns, whilst self-perception of disfigurement also correlated with health related quality of life, depression, and anxiety, suggestive of the negative influence an individual's perception of their body and therefore self-worth has on psychological factors. Thus, four regression analyses arose, with regards to the impact scoliosis has on each criterion variable, indicating the psychological impact of living with scoliosis.

Both severity and self-perception of disfigurement negatively correlated with body image concerns, though a multiple regression analysis found only self-perception to have a sufficient impact. Glowacki et al (2013) suggested that the trunk shape present in individuals with scoliosis can lead to a vast array of responses, including a negative body image. The present study supports the idea that individuals with scoliosis are prone to be discontent with their appearance; participants scored particularly high on questions regarding feeling self-conscious and embarrassed by their back shape, with the results thus confirming the alarming idea that patients with scoliosis tend to display

low levels of self-esteem, and emit feelings of shame (Carrasco and Ruiz, 2014). The finding that the patient's self-perception of their disfigurement was more influential in body image concerns than a clinical evaluation of the severity can be explained by the view of Liskey-Fitzwater et al (1993) whereby psychological distress stems from an individual's perception of their appearance, in terms of how others view them. A significant relationship was also found between self-perception of disfigurement and a poor health related quality of life, with a significant regression model being produced by a simple linear regression, supporting the view of Zhang et al (2011); the presence of body image concerns and a lack of self-esteem can have a profound impact on their emotional health, leading to a deterioration in the individual's perception of their quality of life. A feeling of self-consciousness and concern about one's body is instrumental in limiting the social activities of individuals with scoliosis, thus lowering their health related quality of life (Danielsson, et al., 2001).

A significant positive relationship was found between self-perception of disfigurement and depression, with a significant regression model being produced by a simple linear regression. Similarly, Chang et al (2016) found that individuals with scoliosis display higher rates of depression than the general population, likely to be related to the often chronic back pain accompanying scoliosis. As depression relates to a magnification of pain symptoms (Choi et al, 2014), this highlights the issue of cause and effect, posing the question of whether individuals are prone to depression because of the pain or whether they feel and acknowledge the pain more because they are depressed. Depression is also related to less positive treatment outcomes (Burns et al, 1998), therefore the results of the current study present a need for emotional rehabilitation as well as physical rehabilitation within treatment for scoliosis. That said, it is still important to note the issues with studying depression, in terms of the multidimensional definition, and therefore multidisciplinary methods of assessing depression, thus this should be considered when interpreting the current findings and drawing comparisons with previous literature.

A significant positive relationship was also found between self-perception of disfigurement and anxiety, with a simple linear regression indicating a significant model, in line with the findings of Misterska et al (2013) that anxiety is a common feature of individuals with scoliosis. Tomaszewski and Janowska (2012) found patients often felt they were unable to express their feelings, possibly through fear of being a burden on family and friends, with this likely to lead to increased levels of anxiety. Previous research suggests that anxiety in relation to scoliosis is primarily a result of not knowing whether the spinal deformity will advance in the future (Hawes, 2002); individuals with scoliosis may benefit from psychological interventions that encourage them to focus on the here and now, such as a mindfulness-based intervention, aiming to focus on present events and experiences (Brown and Ryan, 2003); the mindfulness based stress regulation intervention has been found to reduce levels of stress, depression and anxiety (Segal et al, 2002), likely due to the development of reflective responses to unpleasant situations through a change in perspective that prevent rumination on both the past and future (Shapiro and Carlson, 2009), a common characteristic of anxiety.

Although significant results were found for all research questions, it is important to note that causal relationships cannot be assumed, due to the correlational design of the study. Although the results are indicative that suffering from scoliosis has a major

influence on psychological health in terms of body image concerns, health related quality of life, depression, and anxiety, the exact impact is not entirely clear. It is possible that individuals in the study were depressed or anxious which led them to have a worse perception of their body, rather than the contrary; relationships have consistently been found between depression and self-worth (Sturman, 2009), so this may have had an impact on the way in which certain participants viewed themselves in terms of the self-perception of disfigurement measure. In order to control for the correlational design, a number of regression analyses were conducted, though this does not change the nature of the design, but rather enhanced variance explanations between the variables.

The study does pose a number of methodological issues; though established questionnaires were selected in order to measure all variables effectively, all measures were self-report and delivered in an online format. Although entailing numerous benefits, the true sample and background of the participants is not known to the researcher, with it also being possible that participants may have answered questions dishonestly. However, given that it was a specific sample, in terms of people suffering from scoliosis, this was the ideal method to collect data, allowing data to be collected nationwide, rendering the results generalizable to the wider population. Recruiting participants in the form of an online questionnaire through social media has the capability to yield sizeable sample sizes (Cassese et al, 2013), with the popularity of Facebook, along with the usefulness of the online support group in helping people with scoliosis, made this recruitment method advantageous. The WRVAS has also been found by previous authors to be lacking in face validity, in individuals with curves differing from the right thoracic curve depicted in the measurement items, such as a double curve, a left curve or a lumbar curve (Tones and Moss, 2007). However, associations were found between the Cobb angle and the patients' self-perception, suggesting that the patients self-perception is an accurate representation of the severity of their scoliosis.

The present study can however be held in high esteem for addressing the psychological impact of scoliosis in terms of adult participants, an aspect that previous research has neglected, whereby there has been a tendency to focus on adolescent participants, though previous research has shown that older individuals experience poorer psychological outcomes than patients treated during childhood (Anderson et al, 2002), so there appears a need to assess the psychological impact to adults to clarify why poor outcomes exist. All research questions produced significant results, therefore a number of practical implications can be suggested from the present research. Providing psychological treatment to individuals with scoliosis may serve to help reduce the levels of body image concern, health related quality of life, depression and anxiety. This may impact on the patient's adjustment to treatment, in improving compliance with bracing or preventing psychosocial difficulties following surgery (Koch et al, 2001). It is perhaps important to note that it is primarily a patient's self-perception that is having a psychological impact, supporting the work of Liskey-Fitzwater, et al (1993), therefore it would be logical to suggest that with the appropriate emotional support, though the severity will still be the same and the patients will still face the same day to day challenges, the psychological impact could be reduced. Cognitive Behavioural Therapy may be an effective method of treatment, aiming to reduce cognitive processing biases, in counteracting dysfunctional assumptions and unconditional beliefs present within individuals (Beck, 1976), preventing individuals

from believing that others view them in a negative light due to their condition. Future research may seek to carry out a longitudinal study, to allow a long term assessment of the condition. The effect of scoliosis varies from day to day, such as the degree of pain experienced, which may have implications on the findings, in that they may give different responses accordingly. People who have had surgery recently for example, may currently be experiencing a substantial degree of pain, therefore it may be beneficial to assess people regularly across a larger time scale to account for this. Future research should also aim to recruit a more equal distribution of males and females, especially as gender is a prominent problem in the measurement of body image (Tones and Moss, 2007).

To summarise, the present research appears consistent with the findings of the extensive body of previous literature, whilst enhancing the literature with regards to the use of adult participants. Results show the presence of scoliosis to be instrumental in determining levels of psychological distress. Specifically, this study indicates that an individual's self-perception of the disfigurement is particularly influential in determining an individual's psychological stress, providing clear evidence that a poorer perception of their back shape is associated primarily with body image concerns, as well as a poor health related quality of life, and higher levels of depression and anxiety symptoms, in line with previous research. This is particularly vital as far as practical implications are concerned, since the perception of the visible impairment constitutes a potential risk factor for psychological distress, it should be accounted for when considering the use of psychological screening; more attention should be paid to the psychological impact of scoliosis and the associated treatments, implicating the need for psychological treatment in supporting clinical treatment.

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