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Full length article

Change in depression predicts change in bladder symptoms for women with urinary incontinence undergoing pelvic-floor muscle training

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ABSTRACT

Introduction: To examine the relationship between depression and bladder symptoms, especially the impact of change in depression on changes in bladder symptoms, for women with urge and stress urinary incontinence undergoing a course of PFMT.

Method: 106 adult females with pelvic-floor dysfunction (PFD), consecutively referred to an outpatient pelvic-floor muscle training (PFMT) programme for either urge, stress, or mixed incontinence, participated in a prospective observational study. Participants reported subjective views of their pelvic floor problems (Queensland), and their levels of depression (HADS_D), and data relating to age and BMI were collected. The trial was registered on clinicaltrials.gov (NCT02549157).

Results: There was a positive relationship between depression and bladder symptoms at intake. Levels of initial depression significantly predicted levels of bladder symptoms at completion of PFMT, and ability to complete the PFMT programme. Change in depression significantly predicted change in bladder symptoms, over and above intake patient characteristics and symptoms.

Discussion: These data imply a multidisciplinary focus, including psychological input, for PFD may be a highly effective strategy for its management.

Urge and stress urinary incontinence, along with bowel incontinence, prolapse, and sexual dysfunction, form a range of conditions often labelled as Pelvic-floor Dysfunction (PFD; Rogers et al., 2018). PFD affects around 25 % of adult females, with an estimated yearly incidence rate of 1–2 % of the population [1]. PFD is associated with a range of psychological comorbidities, especially depression and anxiety [2–4]. For example, depression is estimated to occur in 20 % of PFD cases [5]. Such comorbidities are associated with higher rates of nonattendance and nonengagement for PFD treatment, especially for pelvic-floor muscle training (PFMT) [6–9]. The consequence is that clinical outcomes of PFMT can be negatively affected by psychological symptoms [6,8,10].

The current study explored unresolved issues relating to the important association between depression and PFD. Firstly, the study sought to further document the relationship between particular aspects of PFD (urge and stress incontinence) and depression [3,5]. Secondly, it sought to document the negative impact of depression on PFMT session attendance [2], and explore whether depression negatively impacts PFMT attendance over and above PFD symptoms (bladder, bowel, prolapse, and sexual dysfunction) and patient characteristics such as age and BMI [7].

Importantly and novel, the study examined the time-lagged relationship between depression and bladder symptoms (the most pronounced set of symptoms for those with urge and stress urinary incontinence). It compared the relationship between depression at intake and bladder symptoms at completion, to the relationship between bladder symptoms at intake and depression at completion. In particular, the study explored whether a change in depression predicted a change in bladder symptoms, over and above other patient characteristics and symptoms. These data would help to establish whether depression is an important psychological variable to address during PFMT treatment for PFD, as it has for other conditions [11,12], with the potential to help improve PFD management.

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Method

Participants

122 adult females with pelvic-floor dysfunction (PFD), consecutively referred to an outpatient pelvic-floor muscle training (PFMT) programme for either urge, stress, or mixed incontinence, were approached. 106 (87 %) gave their informed consent and participated in the study. G-Power analysis suggested that, to obtain 80 % power, using a rejection criterion of $p < .05$, with medium effect size ($f^2 = 0.15$), assessing whether one variable significantly improved predictive accuracy while controlling six others, would require a sample size of 55.

The participants had a mean age of 54.17 (SD ± 9.19; range = 31–76) years, and a mean BMI of 28.80 (±7.30; range = 17–49). The patients predominately self-reported that they were Caucasian (101/106; 95 %). Ethical approval was granted to this study by the NRES - Committee Region - East Midlands, UK. The trial was registered on clinicaltrials.gov (NCT02549157).

Measures

Queensland Pelvic Floor Questionnaire (Queensland) [13] is a validated self-administered female pelvic-floor questionnaire. Sections relate to bladder dysfunction, bowel dysfunction, prolapse, and sexual dysfunction, each producing a score from 0 to 10, the sum gives overall pelvic-floor dysfunction (0–40). Greater scores represent worse function. The internal reliability of the scales (Cronbach α) range between 0.72 and 0.95.

Hospital Anxiety and Depression Scales (HADS) [14] is a widely-used measure of anxiety and depression, with strong test–retest reliability and validity. It focuses on psychological symptoms, excluding somatic symptoms to avoid overlap with physical symptoms. The HADS consists of 14 questions: 7 for anxiety, and 7 for depression, with each question scored from 0 to 3. For this study, only the depression (HADS_D) scale was analysed. There are four symptom categories: normal (0–7), mild (8–10), moderate (11–14), and severe (15–21). The internal reliability of the depression scale used in the current analysis (Cronbach α) was 0.89.

Intervention

The PFMT programme was delivered over six 60-min sessions to groups of patients (5–6 patients per group), with two individual appointments, spaced over the course of six months. The programme provided training in pelvic-floor exercises, identifying and isolating the correct muscle group, and education regarding pelvic-floor anatomy and function. Sessions were led by a clinical physiotherapy specialist, a senior physiotherapist in women's health, or a surgical nurse specialist. Every session provided training in pelvic-floor exercises, and advice about behavioural management of continence (fluid intake, bladder drill, 'the knack', double voiding, and helpful activities). Patients were asked to practice pelvic-floor exercises on a daily basis. At the start, patients were advised to perform five rapid pelvic-floor muscle squeezes, holding each squeeze between 1 and 3 s before releasing. Patients were encouraged to progressively increase the number and duration of squeezes over the course of the programme, with a goal to accomplish 10 long squeezes, for 10 s, followed by 10 short squeezes, at least two to three times a day. Patients were also provided with verbally-presented information during the sessions regarding: (1) the anatomy and function of the pelvic-floor muscles; (2) back and spinal care, as well as posture; (3) medical and surgical management of pelvic-floor conditions, emphasising conservative and non-surgical options; (4) psychosexual issues; (5) anatomy of the intestines and bowel, and colorectal problems; and (6) physiotherapy management of PFD, and available aids. Individual appointments were taken by a clinical physiotherapy specialist, and were held usually at the start and end of the group sessions. Individual appointments established patient needs, and could involve examination of vaginal muscles and tissues, and determination of pelvic-floor strength, to assess the quality of pelvic-floor exercises that the patient was performing.

Procedure

In a prospective observational study, consecutive patients with PFD, referred to a hospital outpatient physiotherapy department, were approached about their participation. The inclusion criteria were that they: had been referred by a health practitioner (GP, consultant/registrar, or continence nurses) for a PFD issue (urinary or bowel incontinence and/or prolapse); were over 18 years old; and could understand the English language. The referred patients were placed on a waiting list for the hospital outpatient PFMT service, and invited to attend the first group session of an available set of PFMT classes. Data collection occurred over a period of two years (2018–19).

At the start of this intervention, participants completed the questionnaires to assess their subjective view of their level of depression (HADS_D) and pelvic problems (Queensland). During this they could consult a clinically trained psychologist if they had any questions. Data relating to other demographic characteristics (e.g., age, BMI) were collected from the participants. Patients then progressed through the treatment-regime, as described above, and their attendance at PFMT group sessions was monitored. At the end of the last session, the patients again completed the Queensland and HADS_D questionnaires, and could consult the psychologist, if necessary.

Results

The self-reported symptoms at intake, for the initial 106 participants, using the Queensland were: bladder = 6.31 (±1.98; range = 2–10), bowel = 2.55 (±1.54; range = 0–7), prolapse = 1.81 (±3.07; range = 0–9), and sexual function = 1.81 (±2.21; range = 0–9). Fig. 1 shows the correlations between intake depression (HADS_D) and intake pelvic symptoms relating to bladder, bowel, prolapse, and sexual function (Queensland), along with the distributions of each variable, and the scatterplots and 95 % confidence limits of their relationships. These data show that there were significant positive correlations at intake between depression and bladder function ($p < .001$) and bowel function ($p < .001$).

Of the 106 participants who completed the study at baseline, 56 (53 %) attended all 6 sessions of the PFMT course, and 50 (47 %) did not. Fig. 2 shows the group-mean (and standard deviation) of intake symptoms for the patients who did (completer) and did not (non-completer) finish all 6 of their PFMT sessions. To determine whether any of the baseline variables were related to completion (attending all 6 sessions), a logistic regression was conducted on completion (0 = non-completer; 1 = completer), with intake depression (HADS_D), bladder, bowel, prolapse, and sexual function (Queensland), as well as age and BMI, as predictors. As can be seen in Fig. 2, this revealed a significant model, $-2LL = 105.91$, $X^2(7) = 39.42$, $p < .001$. Of the individual predictors, intake depression negatively predicted completion ($\beta = -0.343$, $p < .001$, $OR = 0.709$), but no other variable was significantly related to completion (all $ps > 0.10$).

Table 1 shows the mean (standard deviation) for depression (HADS), and bladder, bowel, prolapse, and sexual function (Queensland) at intake and completion, along with the related t-test and effect size for the 56 participants who completed PFMT. There were reductions in all of these variables across the PFMT programme, and significant reduction in bladder symptoms, bowel symptoms, and prolapse symptoms.

Time-lagged correlations were conducted between depression at intake and bladder symptoms at completion, which showed a significant positive relationship, $r = 0.269$, $p = .045$. However, a time-lagged correlation between bladder symptoms at intake and depression at completion was not significant, $r = 0.051$, $p = .268$. These relationships

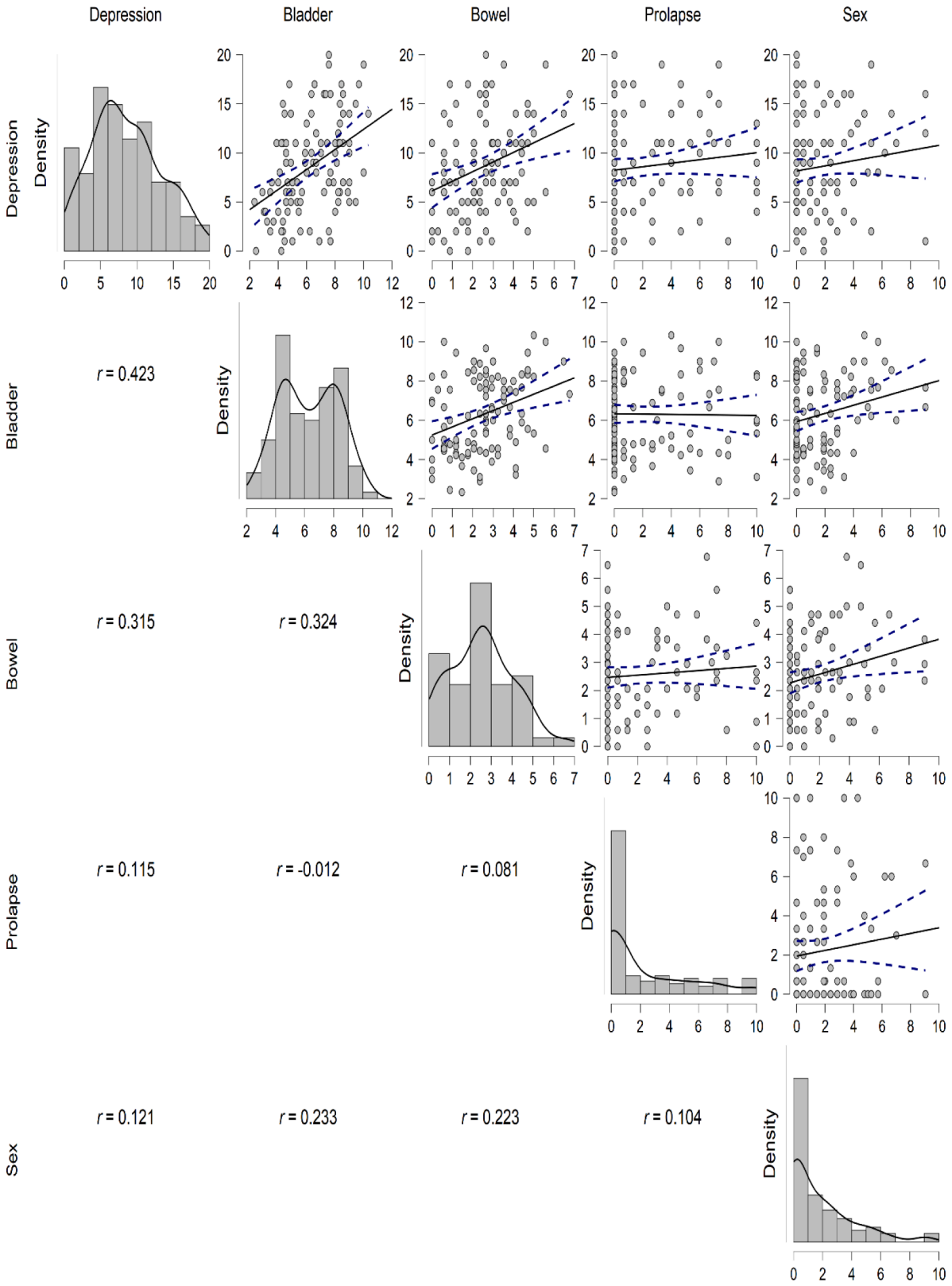

Fig. 1. Pearson correlations between intake depression (HADS_D) and intake pelvic symptoms relating to bladder, bowel, prolapse, and sexual function (Queensland), along with the distributions of each variable, and the scatterplots and 95% confidence limits of their relationships.

can be seen in the top and bottom panels, respectively, of Fig. 3.

In order to determine whether the change in depression predicted a change in bladder symptoms, a hierarchical multiple regression was conducted to predict the change in bladder symptoms (completion – intake). In the first step, age, BMI, and depression, bladder, bowel, prolapse, and sexual function scores at intake were added. In the second step, the change in depression scores (completion minus intake) was added to see if the change in depression produced a significant

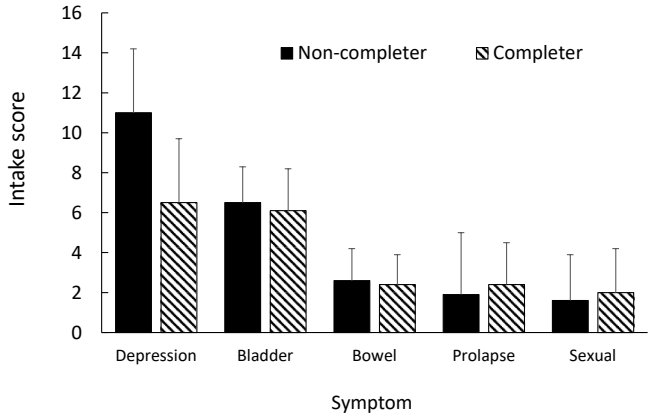

Fig. 2. Group means for the symptom variables at intake for the patients who did not (non-completer) and did (completer) finish the PFMT treatment sessions. Error bars = standard deviations.

Table 1
Mean (standard deviation) for depression (HADS), and bladder, bowel, prolapse, and sexual function (Queensland) at intake and completion, along with the related *t*-test and effect size, for the patients who completed the study ($N = 56$).

	Intake	Completion	$t(55)$	d[95 %CI)
Depression	6.48 (4.21)	5.78 (3.89)	1.67	0.223[−0.043:0.487]
Bladder	6.14 (2.07)	2.28 (1.45)	12.74***	1.70[1.288:2.111]
Bowel	2.44 (1.48)	2.07 (1.15)	2.69**	0.360[088:0.629]
Prolapse	2.49 (3.09)	1.46 (1.85)	2.62**	0.351[0.079:0.619]
Sex	2.00 (2.16)	1.89 (2.43)	< 1	0.060[−0.203:0.322]

*p <.05.
** p <.01.
*** p <.001.

improvement in accuracy of prediction of change in bladder symptoms, over and above the intake variables. Step 1 in the model was significant, $F(7,48) = 11.24$, p <.001, $R^2 = 0.626$, with bladder symptoms alone being a significant positive predictor of bladder symptom change ($\beta = -0.901$, $t = 8.03$, p <.001), all other $ps > 0.20$. The addition of change in depression score produced a significant model, $F(8,47) = 18.99$, p <.001, $R^2 = 0.747$. This was a significant increase in the R^2 value, $F(1,47) = 22.03$, p <.001. Of the individual predictors, change in depression ($\beta = 0.316$, $t = 4.69$, p <.001), intake depression ($\beta = 0.126$, $t = 2.30$, p =.026), and intake bladder symptoms ($\beta = -0.780$, $t = 8.07$, p <.001) predicted change in bladder symptoms, all other $ps > 0.10$.

In order to determine whether the change in bladder symptoms predicted a change in depression symptoms, a hierarchical multiple regression was conducted to predict the change in depression (completion minus intake). In the first step age, BMI, and depression, bladder, bowel, prolapse, and sexual function scores at intake were added. In the second step, the change in bladder symptoms (completion minus intake) was added to see if the change in bladder symptoms produced a significant improvement in accuracy of prediction of change in depression, over and above the intake variables. Step 1 in the model was significant, $F(7,48) = 3.78$, p =.002, $R^2 = 0.360$, but with none of the individual predictors being significant in themselves, all $ps > 0.06$). The addition of change in depression score produced a significant model, $F(8,47) = 7.54$, p <.001, $R^2 = 0.567$. This was a significant increase in the R^2 value, $F(1,47) = 22.03$, p <.001. Of the individual predictors, change in bladder symptoms ($\beta = 1.026$, $t = 4.69$, p <.001), intake depression ($\beta = -0.261$, $t = 2.74$, p =.009), intake bladder symptoms ($\beta = 0.554$, $t = 2.09$, p =.042), and intake bowel symptoms ($\beta = -0.465$, $t = 2.06$, p =.045) predicted change in bladder symptoms, all other $ps > 0.10$.

Discussion

The current study examined the relationship between depression and bladder symptoms, and especially the impact of change in depression on changes in bladder symptoms, for women with urge and stress urinary incontinence undergoing a course of PFMT. There was a positive relationship between depression and bladder symptoms at intake. Levels of initial depression significantly predicted levels of bladder symptoms at completion of the PFMT. In contrast, initial levels of bladder symptoms did not predict levels of depression at PFMT completion. Only levels of depression, but not PFD, predicted completion of the PFMT programme. Finally, the change in depression was a significant predictor of change in bladder symptoms, over and above intake patient characteristics and symptoms. However, change in bladder symptoms also predicted change on depression symptoms over and above intake patient characteristics and symptoms.

These data corroborate findings from several previous investigations of the relationship between depression and bladder symptoms for women with urinary incontinence [3,5]. They demonstrate the importance of this psychological variable for predicting attendance at PFMT appointments [2,7]. The novel findings related to the predictive relationship between depression and bladder symptoms at completion of the PFMT. Those with higher levels of depression at intake displayed worse bladder symptoms at completion (but not vice versa). This has not, to our knowledge, been demonstrated previously for PFD, although it has been shown for other health conditions [11,12]. It was also the case that the change in depression, irrespective of the initial levels of depression or the initial physical symptoms, predicted change in bladder symptoms after PFMT. These findings suggest that depression is a variable that would benefit from attention in any multidisciplinary approach to PFD [15].

It should be noted that change in bladder symptoms also predicted change in level of depression, irrespective of initial bladder symptoms or other patient intake characteristics or symptoms. Coupled with the relationship between bladder symptoms and depression [3,5], this makes it hard to unambiguously suggest that depression alone is driving change in bladder symptoms, without a mediating impact of change of bladder symptoms. It is certainly the case that both symptoms of bladder dysfunction, and levels of depression, are interdependent on one another, and a change in one will affect a change in the other. However, that depression alone predicts compliance with PFMT, and that depression predicts later bladder symptoms, but not vice versa, a focus on managing depression during PFMT may improve the effectiveness of this treatment for PFD [16].

There are limitations that need to be considered for this study. Although adequately powered to detect statistical difference, the sample was quite small, and that needs to be kept in mind when interpreting the relationships. The loss to follow up likely impacts the conclusions that can be drawn, especially since follow up was statistically associated with baseline severity of depression scores. Perhaps future studies might take symptoms at each monthly point during treatment (using shorted depression scales). Moreover, the focus on urge and stress urinary incontinence will limit the degree to which these results could be generalised to other PFD conditions, such as faecal incontinence and prolapse. It could be that different forms of urinary incontinence, such as bowel incontinence, or overactive bladder, might be differentially prone to depression, and might show different relationships between depression and changes in the PFD symptoms. Future research could consider these possibilities by using a wider inclusion criterion, and increasing the sample size to accommodate a more fine grained analysis. Additionally, the current study did not record other aspects of the patients' personal history, such as their obstetric history, medication use, or the presence of other comorbidities. Again, future studies may consider taking such information, and by increasing the sample size, assessing the degree to which these factors impact the relationship between depression and change in PFD symptoms.

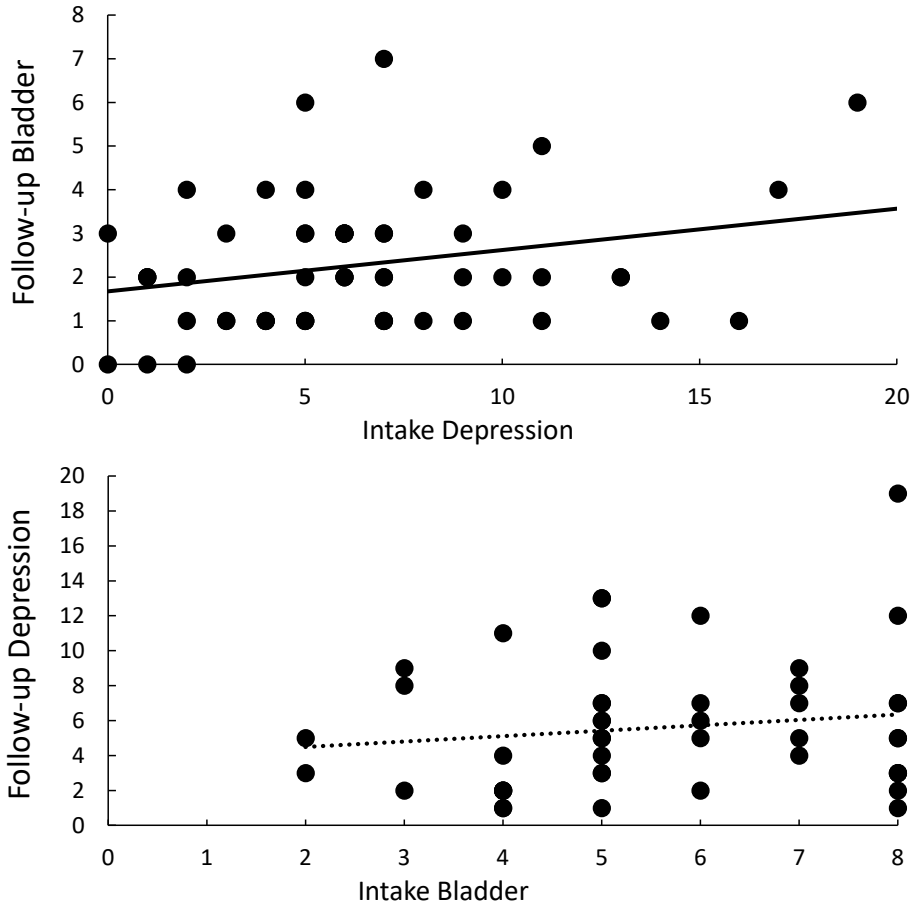

Fig. 3. Scatterplots of relationship between intake depression and follow-up bladder symptoms (top panel), and intake bladder symptoms and follow-up depression (bottom panel), along with the regression line.

The sample also was undergoing a particular form of intervention (PFMT), and these data may not be applicable to patients undergoing other forms of treatment. The current sample had sought care for PFD, had access to such care, were recommended for PFMT; and attended an appointment for PFMT at this specific practice location, which may limit the generality of the findings. Recently, research in pain education for lower back pain, urgency, and pelvic organ prolapse suggested a shift from classes educating patients about anatomy and pathology to a focus on understanding how the nervous system process sensations. This shift has resulted in some success in changing levels of lower back pain, and sensations of POP and urgency [17]. It may be interesting to see whether patients undergoing this form of treatment would show different impacts of depression, as multimodal approaches, including psychosocial and multidisciplinary treatments are important [15,16].

In summary, the current data noted an important relationship between depression and bladder symptoms: depression predicted PFMT completion, and bladder symptoms at completion. In addition, improvement in depression predicted improvement in bladder symptoms above other variables. Coupled with previous findings emphasising the importance of psychological variables in the successful treatment of PFD, these current data imply that a multidisciplinary focus, including psychological input, on PFD may be a highly effective strategy for its management.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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