

# Exercise as medicine – the use of group medical visits to promote physical activity and treat chronic moderate depression: a preliminary 14-week pre-post study

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#### ABSTRACT

**Objective:** The evidence that regular physical activity can treat depressive disorders is increasingly robust. However, motivating patients with depression to engage in physical activity can be challenging. Interdisciplinary group medical visits (GMVs) with an integrated physical activity component may be a novel means to support patients in becoming more active.  
**Methods:** We conducted a ‘pre-post’ pilot study within a primary care setting. Participants were adults ( $\geq 18$  years) with a chronic major depressive disorder or a bipolar 2 disorder (depression; chronic). A psychiatrist and exercise therapist co-led a series of 14 weekly 2 h GMVs. Each group visit combined specific medical advice, physical activity, patient discussions and a targeted educational component. Participants also attended 11 weekly hatha yoga classes. Primary outcome was ‘steps’ as measured by accelerometer (SenseWear) as well as depression (Patient Health Questionnaire, PHQ-9) and anxiety (Generalised Anxiety Disorder, GAD-7) ratings.

**Results:** 14 of 15 participants (93.3%) completed the 14-week programme. After 3 months postintervention, median depression scales (PHQ-9) decreased 38% from 16 to 10 ( $p < 0.01$ ; IQR pre/post 8/12); and median anxiety scales (GAD-7) decreased 50% from 13 to 6.5 ( $p < 0.05$ ; IQR 8.5/9). Median daily ‘steps’ increased 71% from 3366 to 5746 (IQR 2610/6237), though this was not significant ( $p > 0.10$ ).

**Conclusions:** While other studies have examined the efficacy of GMVs in addressing chronic illnesses and the promotion of lifestyle changes, none to our knowledge have embedded physical activity within the actual patient visits. Interdisciplinary GMVs (eg, psychiatrist/exercise professional) may be a means to decrease depression and anxiety ratings within clinical care while improving physical activity.

Mood disorders, including major depressive disorder (MDD), dysthymic disorders and bipolar 2 disorder (depression) are an

#### Clinical implications

- Group medical visits may be a means to overcome the motivation factor in promoting physical activity in patients with chronic depression.
- Physical activity results in an improvement in depression and anxiety rating scales in patients with chronic depression.

#### Limitations

- The small sample size may not represent the larger population.
- The absence of a control group limits the conclusions that can be drawn from this study.
- Participants who volunteered for this project are but a small subset of patients suffering from a chronic mood disorder.

undisputed global problem, with a lifetime prevalence of more than 15%.<sup>1 2</sup> Chronic depression (defined as an episode lasting more than 2 years) occurs in approximately 20% of all sufferers of mood disorders. The impact of chronic depression on a patient’s social functioning, medical health and occupational functioning is significant and well documented.<sup>3</sup>

The benefits of regular modest physical activity (PA) are well documented over the past two decades. Modest PA can significantly decrease the risk of cardiovascular disease, several cancers, diabetes and influenza, among others. Regular PA increases bone density, promotes better sleep and can assist with weight control.<sup>4 5</sup> Furthermore, regular PA can decrease the risk of a depressive episode as well as improve depressive symptoms.<sup>6</sup>

PA as a treatment intervention for depression provides comparable benefits, rates of response and remission rates to antidepressants.<sup>5–13</sup> A 2014 systematic review concluded that PA has a significant potential for reducing depressive symptoms in people with a mental illness.<sup>7</sup> A Cochrane review examined the effectiveness of exercise in treating depression<sup>14</sup> and the results of 39 relevant randomised controlled trials and over 2300 participants confirmed a moderate effect for exercise when compared with standard, placebo, pharmacological, psychological, or other active treatments or no treatment.

Psychiatric treatment for mood disorders is conventionally delivered through one-to-one consultations between a patient and psychiatrist or family physician. These consultations rarely include a PA ‘prescription’, and efforts to promote PA within traditional medical settings are fraught with challenges.<sup>15–19</sup>

To help patients incorporate PA as part of their psychiatric treatment, we combined Noffsinger’s ‘group medical visit’ (GMV) strategy with a PA promotion component.<sup>20–21</sup> The evidence for GMVs in various medical settings is detailed elsewhere.<sup>21–26</sup> Briefly, the theoretical rationale for this approach is a multifactorial ‘interdisciplinary model’,<sup>27</sup> including medication/treatment monitoring, patient education, coaching, social support, goal setting and motivation for improving person’s self-perception to uptake PA.<sup>28–30</sup>

We have completed a preliminary study of a 14-week intervention that linked GMVs with exercise classes to

motivate patients diagnosed with a chronic mood disorder to engage in regular PA as measured by pre–post ‘step counts’. Our objective was to investigate the impact of PA-focused GMVs on PA and symptoms of depressive and anxiety.

## METHODS

### Setting

GMVs were conducted in a meeting room and a small gym located at the Centre for Hip Health & Mobility (University of British Columbia (UBC); Vancouver, British Columbia, Canada).

### Participants

We recruited participants (>18 years) from British Columbia’s Lower Mainland (Vancouver), primarily through the regional Mood Disorders Association of British Columbia (MDABC) office and local mental health support organisations such as the Canadian Mental Health Association (CMHA). The inclusion criteria were a confirmed diagnosis (RAR) of MDD, chronic or bipolar 2 disorder (depression) via Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM IVR) criteria. Chronic was defined as having symptoms for more than 2 years. No structured diagnostic interview was completed, but the psychiatrist making the diagnosis (RAR) had significant experience in the assessment, treatment and research work with mood and anxiety disorders. Respondents were excluded from participation if they had *active* psychotic symptoms or a *primary* active diagnosis of substance abuse. Recruitment responses are reported in figure 1.

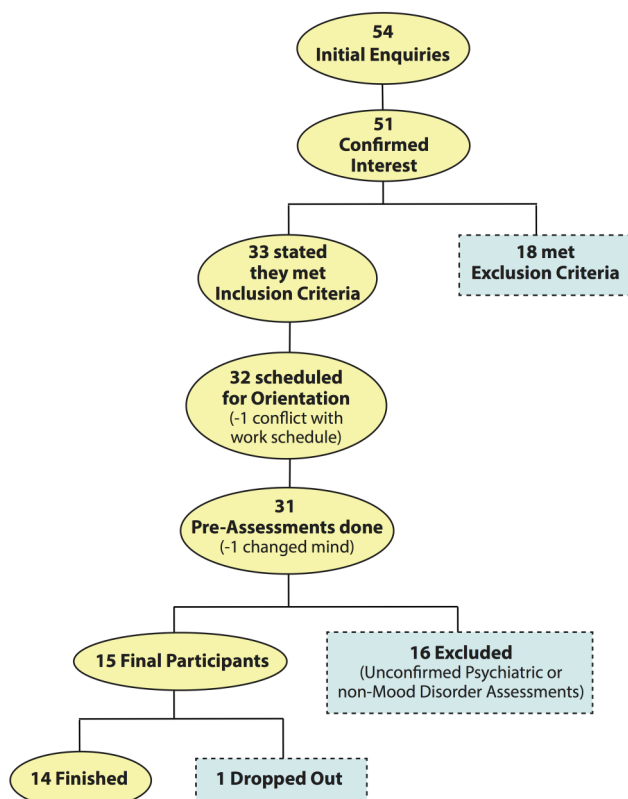
All patients were screened with the Physical Activity Readiness Questionnaire (PAR-Q). Any patient who scored 1 (yes) or more were questioned further and their family physician was contacted, the details of the programme and the PA expectations of participants were explained to the family physician, and we requested a written note from the physician that their patient’s concomitant medical condition was not an exclusion to participating in our programme. Researchers prepared a list of appropriate, available and affordable resources and counselling services, which they handed to every participant at the start of the intervention.

Ethics approval was obtained from UBC’s Behavioural Research Ethics Board obtained and each participant provided written informed consent.

### Study design

We conducted weekly 2 h GMVs over 14 weeks along with additional weekly 45 min gentle hatha yoga classes for 11 weeks (weeks 3–14 due to availability of yoga therapist). The study used a pre/post (14 weeks) design.

A psychiatrist (RAR) and an exercise therapist co-led each GMV, which combined specific medical advice,



**Figure 1** Flow chart for recruitment.

medication management, open discussion of patient concerns, a targeted educational component to guide participants' self-management or 'patient activation' around PA, as well as a PA component.

Thematic content for the 14 weekly group discussions was based on Steven Blair's successful study, Project Active<sup>4</sup> and subsequent book, *Active Living Every Day*.<sup>31</sup> Blair *et al's* book provided a tested, reliable, relevant and accessible framework around which to structure an intervention.

The view behind our intervention was to support individuals in feeling highly responsible for their health and thus, transform them from being the passive receivers of a healthcare provider's advice and recommendations to proactively seeking out strategies and tools that would further their own well-being.

The 2 h session was divided into three sections:

- ▶ Group check in/out; enter patients weekly step count into database; review and outline the day's group programme—20 min;
- ▶ Group discussion, regarding selected topics including psychiatric issues—50 min;
- ▶ PA component—50 min.

During the PA component, participants went for a group walk on alternate weeks, emphasising that 150 min weekly of moderate activity (eg, brisk walking) was all that is necessary to obtain the medical benefits offered by regular PA. On alternate weeks, participants stayed in the gym and were taught techniques and exercises that they could employ in their everyday lives to become more physically active without having to attend special classes, set aside time, or make concerted efforts to 'exercise' (eg, in one session, called 'commercial exercises', participants were given a series of brief (<5 min) upper and lower body activities they could do in their home during a television commercial in lieu of sitting still, eating a snack, etc). We also wanted to provide participants with tools and a framework that would help sustain them through the drops in motivation, interest and energy that accompany the low cycles of any fitness regime.

Group exercises included aerobic training of cardio-respiratory functioning, circuit training with simple tasks, for example, ergometer bicycling, resistance bands, light weightlifting, stepping, ball work and walking on treadmill, and an introduction to high-intensity interval training. A certified yoga therapist taught the gentle hatha yoga classes. We recorded participant attendance at each group visit/yoga class.

The ideal group size for any therapeutic intervention is considered 6–12 people.<sup>32</sup> Accordingly, we split our population into two sections each week whereby one group of 6–10 participants did the 50 min PA component while the other group did the 50 min GMV; and then the two groups were reversed during the subsequent 50 min time block. The participants were randomised each week, so that all participants interacted with each other over the 14-week programme.

During the GMVs, a similar format was used:

- ▶ A reciting of our refrain about the benefits of PA (see online supplementary appendix A) followed by a brief interesting study in recent exercise research (eg, How much weight will you gain over the Christmas holidays according to research studies? Is sweating important when you exercise? Etc)—5–10 min;
- ▶ Reviewing each patient's weekly short-term goals (eg, increase from two 20 min walks to three 30 min walks per week)—15 min;
- ▶ Develop long-term goals for when step-by-step ends (eg, 30 000 'steps' on step counter per week)—10 min;
- ▶ A group activity dealing with 'resistance' to exercise was initiated (eg, divide into groups of three, pick an envelope out of the hat and give counterarguments to what is written inside the envelope (eg, I am too tired to exercise today)—15 min.

Participants were requested to commit to

- ▶ Recording their daily steps with a pedometer (Fitbit Zip (<http://www.fitbit.com>); San Francisco, California, USA);
- ▶ Completing a paper evaluation of each weekly session.

Subsidised parking or public transit tickets were provided to participants who requested them.

### Descriptive variables

Demographic data included gender, age, weight (kg), height (m), hips (cm), waist (cm) and body mass index (BMI).

- ▶ *Height (m)*: wall-mounted stadiometer (Rosscraft Inc, White Rock, British Columbia, Canada) using standard techniques;
- ▶ *Weight (kg)*: electronic scale (Seca Model 242, Hanover, Maryland, USA) with their feet together. Weight was recorded to nearest 0.1 kg. For height and weight, duplicate measures are taken unless measures differed by  $\pm 0.4$  cm (height) or  $\pm 0.2$  kg (weight), when a third measure was taken. BMI was calculated as  $\text{weight}/\text{height}^2$ ;
- ▶ *Waist circumference (cm)*: we use a flexible steel tape (Rosscraft Inc). We obtained two measures during minimal respiration and recorded to the nearest 0.1 cm. We performed a third measure if the difference between the first two measures was greater than 0.2 cm. We used the mean of 2 and the median of 3 measurements for analysis of all measures.

### Primary outcome measures

1. *Physical activity*—PA levels were measured by 'steps' (SenseWear accelerometer; <http://sensewear.bodymedia.com>, Pittsburgh, Pennsylvania, USA). Participants were instructed in how to use the SenseWear armband (SWA), which they were to wear for 7 days. SenseWear tracked total number of steps and average energy expenditure (EE; kcal/min; 3233). 'Steps' were measured at baseline, 14 weeks, and 3 and 6 months postintervention.

2. *Depression*—We tracked depression, using the Patient Health Questionnaire (PHQ-9) at baseline, 14 weeks, and 3 and 6 months postintervention. The PHQ-9 is a multipurpose instrument for screening, diagnosing, monitoring and measuring the severity of depression.<sup>33 34</sup>
3. *Anxiety*—Anxiety was measured at baseline, 14 weeks, and 3 and 6 months postintervention using the Generalised Anxiety Disorder 7-item (GAD-7) scale. The GAD-7 has a sensitivity of 89% and a specificity of 82% for GAD.<sup>35 36</sup>

### Secondary outcome measures

Participants also completed the International Physical Activity Questionnaire (IPAQ) long form,<sup>37</sup> a version of the Physical Activity Enjoyment Scale (PACES)<sup>38</sup> adapted by Marcus and Forsyth,<sup>39</sup> the Physical Activity Confidence (Self-Efficacy) questionnaire,<sup>39</sup> the Decisional Balance (perceived barriers of and to PA), Social Support (family/friends; levels of support), and Outcome Expectations for Exercise (perceived benefits).<sup>39</sup> Once again these measurements were obtained at baseline, 14 weeks, and 3 and 6 months postintervention

### Statistical analysis

All variables are not normally distributed, except weight and BMI; therefore, we used a non-parametric test (Wilcoxon ranked-sum) for all data, except weight and BMI (t test assuming unequal variances (heteroscedastic)), which were normally distributed. We used  $\alpha=0.05$  as the measure of statistical significance. Dropouts were not included in the postintervention analysis.

## RESULTS

### Patient profiles

This was a group of 15 patients with chronic refractory mood disorder. Thirteen patients (87%) had a diagnosis of MDD, recurrent (chronic) and two patients were diagnosed as bipolar 2 disorder (depressed; chronic). All patients had had a minimum of three (3) adequate trials of antidepressant medications and the bipolar patients had had trials of at least three different mood stabilisers. More than half of the patients had received trials of six or more medication interventions. Fourteen of the 15 recruited patients had previously received a minimum 10-week course of cognitive behavioural therapy and seven of the sample had also received an

additional previous course of interpersonal psychotherapy.

The mean duration of depressive symptoms in the sample was 3.5 years. Other than minor medication adjustments due to emergence of side effects or adjustment of hypnotics, no new antidepressant, antianxiety or mood stabilising medication was introduced during the PA trial and no additional courses of psychotherapy were initiated during the trial.

All participants were screened with a PAR-Q and only if there was a ticked 'yes' box did we then request and receive a physician's note before their enrolment and participation in the trial.

### Patient retention

Fifteen patients were enrolled as a single cohort in the study; 14 patients completed the 14-week programme. Recruitment responses are reported in figure 1. Attendance rates were also quite high with an average attendance of 11.6/14 sessions (83%). Attendance in the 11 yoga classes was also quite high with a mean attendance of 8.8 yoga classes per participant. The participant who dropped out did not voluntarily offer a reason for this and we did not have ethical approval to make further contact to enquire about the reasons.

### Descriptive variables

We have summarised descriptive variables in table 1. We characterised participants' demographic data using mean $\pm$ SD, or median where appropriate. Average mean age was 54.5 years (N=15; 42–72;  $\pm$ SD8.7). Nine of the 15 participants who started were women; of the 14 participants who finished the intervention 8 were women. Baseline and 3-month postintervention mean average weights (kg) were 90.7 (N=15;  $\pm$ 29.6) and 90.3 (N=14;  $\pm$ 29.6), respectively. Average mean BMIs (kg/m<sup>2</sup>) for baseline and 3-month postintervention were 31.5 (N=15;  $\pm$ 9.6) and 30.9 (N=14;  $\pm$ 9.4).

*Changes from baseline to 3 months postintervention* for primary and secondary variables are summarised in table 2. Variations in respondents (N) were due to incomplete data. After 3 months postintervention median depression scales (PHQ-9) decreased 38% from 16 to 10 ( $p<0.01$ ; IQR pre/post 8/12); and median anxiety scales (GAD-7) decreased 50% from 13 to 6.5 ( $p<0.05$ ; IQR pre/post 8.5/9). Median daily 'steps' increased 71% from 3366 to 5746 ( $p>0.10$ ; IQR pre/post 2610/6237), though this was not significant

**Table 1** Pre/post descriptive variables

Variable	Pre (N=15)		Post (N=14)	
Age (years, range, $\pm$ SD)	54.5 (42–72)	8.7	NA	
Gender (% female)	60%		57%	
Weight (kg) (mean, $\pm$ SD)	90.7	29.6	90.3	29.6
BMI (kg/m <sup>2</sup> ) (mean, $\pm$ SD)	31.5	9.6	30.9	9.4
BMI, body mass index.				



**Table 2** Pre/post measures

Variable	Pre (median)	IQR	N=	Post (median)	IQR	N=	p Value
Depression (PHQ-9)	16	8	14	10	12	14	<0.01
Anxiety (GAD-7)	13	8.5	14	6.5	9	14	<0.05
Steps (SenseWear accelerometer)	3366	2610	14	5746	6237	14	>0.10
Average Energy Expenditure (calories/day)	2525	985	13	2773	1354	13	>0.10
Confidence (Self-Efficacy) (5-level Likert scale)*	2.3	1.0	14	3.2	0.8	14	<0.01
Physical Activity Enjoyment (5-level Likert scale)*	71.0	13.5	14	76.5	11.0	14	<0.10
Social Support—Family (5-level Likert scale)*	20.5	21.5	14	22.0	7.5	14	<0.10
Social Support—Friends (5-level Likert scale)*	23.5	11.0	14	25.0	10.0	14	>0.10
Decisional Balance (5-level Likert scale)*	1.6	2.0	13	2.4	1.5	13	>0.10
Outcome Expectation (5-level Likert scale)*	3.8	1.6	14	4.0	1.5	14	>0.10
Attendance/GMV (N=14) (people, range)	NA			11.6 (9–14)	2.0	NA	NA
Attendance (GMVs/person, range)	NA			11.6 (9–14)	2.5	NA	NA
Attendance/hatha yoga class (N=11) (people, range)	NA			8.6 (6–13)	2.0	NA	NA
Attendance (hatha yoga classes/person, range)	NA			5.9 (0–11)	5.5	NA	NA

\*From *Motivating People to Be Physically Active*, by BH Marcus & LAH Forsyth, 2003, Human Kinetics, Champaign, IL. GAD, Generalised Anxiety Disorder; GMV, group medical visit; NA, not available; PHQ, Patient Health Questionnaire.

( $p > 0.10$ ). We also saw significant improvements in median patient self-rating confidence scale (2.3→3.2;  $p < 0.01$ ; IRQ pre/post 1.0/0.8); median PA enjoyment rating (71.0→76.5;  $p < 0.10$ ; IRQ pre/post 13.5/11.0); and median social support—family (20.5 →22.0;  $p < 0.10$ ; IRQ pre/post 21.5/7.5).

## DISCUSSION

We designed our study to increase PA in patients with chronic depression, using a model of care whereby a psychiatrist and exercise therapist co-led group sessions. The study aligned with the interdisciplinary approach recommended by Tulloch *et al*<sup>27</sup> and it incorporated key aspects of the Chronic Care Model, including “self-management, support and education, inter-professional team-based care...medication adjustment...and coaching”.<sup>30</sup> Gentle hatha yoga classes led by a certified yoga therapist reinforced the interdisciplinary aspect of care delivery.<sup>30</sup> This interdisciplinary approach is not standard in Canada, but may be one way to address some ‘gaps in care’ identified in the current mental healthcare model.<sup>30</sup>

Study participants experienced significant increases in levels of PA (as measured by steps), confidence and enjoyment. By 3 months postintervention, participants had moved beyond a ‘sedentary lifestyle’ ( $\leq 5000$  steps/day) to a daily step count average (5746) comparable to those for US adults (5100–6500 steps/day).<sup>40</sup> Even though participants did not meet the recommended minimum threshold levels of 7000–8000 steps/day for healthy adults,<sup>40</sup> they did meet those for individuals with chronic illnesses (of which one could reasonably include those with a chronic mood disorders).<sup>41</sup> Recognising that ‘special populations’ may be more limited in their everyday activities and that such individuals could still benefit from being active, suggestions of between 4600 and 8500 steps/day have been offered.<sup>41</sup>

These findings are congruent with the concept of a graduated levels of progressive activity, in which ‘some

activity is better than none, that increased levels of activity should be approached progressively, and that health may be optimised at higher levels, although some relatively important health benefits may be realised even with improvements over the lowest levels’.<sup>42</sup>

Participants also experienced 38% and 50% decreases, respectively, in depression and anxiety ratings. While no patient achieved ‘full remission’ from the symptoms of their chronic illness, the majority subjectively endorsed that they were improved and ratings scales were more consistent with mild rather than moderate or severe symptoms of depression and anxiety.

While other studies have examined the efficacy of GMVs in addressing chronic illnesses and the promotion of lifestyle changes,<sup>21–25</sup> none to the best of our knowledge have embedded PA within the actual patient visit. Our innovation was in the use of GMVs as a means to promote PA uptake and adherence. Our study was also one of few to examine the impact of GMVs in reducing anxiety and/or mood disorders.

In a study of exercise in patients with anxiety and depression, ‘patients with anxiety and/or depressive disorders who participated in a structured, supervised exercise program achieved a higher level of PA and  $VO_2\max$ ’.<sup>43</sup> Given that in their intervention patients exercised in groups, the authors theorised that “this may have introduced a bias towards increased effect of the intervention *because of heightened motivation as a result of the social interaction among the participants*” (our emphasis)—a key benefit of GMVs.

Psychiatric care for anxiety and mood disorders is conventionally delivered through one-to-one consultations and follow-up visits between a patient and psychiatrist and/or family physician. These consultations do not include PA and efforts to promote exercise within traditional clinical settings have the challenges of lack of practitioner resources, reimbursement, time and confidence, as well as poor patient retention in exercise programmes.<sup>15–19</sup>

Despite our small sample, the participants' attendance rate of 86% (14 weekly visits) and the study's retention rate of 89% are encouraging. Subsidised public transit and parking contributed to the attendance and retention rates, according to informal oral and written feedback from the participants.

### Limitations

The small sample size may not represent the larger population of people with chronic moderate mood disorders. The absence of a control group limits the conclusions we can draw. For example, having volunteered, the participants already demonstrated a willingness to become physically active, which the larger population may not possess. This limits the generalisability of our findings.

In addition, it is not clear which component of our programme resulted in improvement for our participants. Exit interviews with our participants suggested a number of factors might have led to programme retention and the improvements in PA, depression and anxiety. These factors included an interdisciplinary team with specialised professionals with expertise in relevant areas. When asked, 'how much did having a psychiatrist in the programme contribute to your success and/or that of the programme?' participants stated that it was 'essential', 'huge', 'key', 'very important'. Having a psychiatric professional who "understood what I was going through...was an absolutely crucial part". Participants acknowledge the validation of PA by a psychiatrist (and not just prescribing medication) was important.

When asked whether a family physician could successfully lead the GMVs, participants were overall reluctant to agree, stating the general practitioner's lack of psychiatric expertise and insights as primary barriers to success. Similarly, the presence of an exercise therapist with *expertise* in PA was identified as a facilitator of success.

Some participants indicated that they did not know whether it was the presence of the expert professionals per se or the specific individuals involved that contributed to their success. In either case, certain characteristics of a 'successful' facilitator were identified: (1) the need for specialised expertise, insights and awareness of the relevant issues; and (2) a supportive, compassionate, approach with (3) an appreciation for the specific challenges that the population faces.

We consciously tried to create an environment that 'met the participants where they were'—one that was supportive, welcoming, non-judgmental, flexible and progressive. Participants in varying ways and degrees identified the programme's structure and environment as key elements for success as well as the offering of multiple types of PA, so each patient could find the type of PA that suited his or her needs.

Similarly, participants found support, encouragement and commonality, within the group-based format. "It was great to hear other people's opinions and to know

everyone's going through something similar." "The group dynamic is very important. Rough weeks, successes, and ups and downs are being shared in a group." Further, several patients jokingly stated they became 'addicted' to their Fitbit pedometer, which pushed them to do more steps each day (I was at 8800 steps one evening so I did an extra walk to get over 10 000.) The use of a pedometer in terms of motivating individuals to become more active has been noted by others.<sup>44</sup>

Within future interventions, we would (1) utilise a GMV format with an interdisciplinary team of specialised experts; (2) create a framework and structure that 'met participants where they were at' and progressed them along at a challenging though not overwhelming pace; and (3) incorporate PA sensors/pedometers, such as Fitbit or Tractivity. In addition, we would change the week-to-week structure to accommodate more medical/medication management. Our original intention was to have medication 'check ins' during each session; given limited time, we reduced this to once every three sessions. One participant noted that they felt they did not have a 'real GMV' until we discussed medications. S/he felt that it was 'having the medical aspect was very important' and that it created 'compassion' and connection between participants—"after that class everyone was talking to each other."

We note that our SWA step counts significantly increased (71%) with little change in EE. The SWA EE measurements are associated with varying degrees of validation.<sup>45–48</sup> Among many PA monitors, the underestimation of EE "continues to be a problem...due to the inherent challenges of capturing low-intensity activities of daily living, which contribute to TEE (total energy expenditure) but are difficult to detect with accelerometer technology".<sup>47</sup> In a recent, systematic review of activity monitors, all accelerometers underestimated steps during slow walking with more accurate estimates of steps reported at higher speeds (13% under to 2% overestimation). One study reported a '35% underestimation using SWA'.<sup>49</sup> Given these results, the authors can only question the reliability of the SWA EE data. We have discussed this apparent discrepancy with the makers of the SWA (BodyMedia; Pittsburgh, Pennsylvania, USA) and they did not provide an explanation.

### CONCLUSION

The promotion of PA through GMVs as well as the inclusion of a PA component within group patient visits is worthy of further investigation. Future studies need larger numbers of patients. Another test of the model would be in a randomised controlled study of GMVs versus conventional one-to-one care model.

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**Contributors** DJA oversaw the design and realisation of the study and was lead author on the manuscript. RAR advised on study design and recruitment, co-led the group medical visits, and advised and co-edited the final manuscript. JCD oversaw the statistical analysis and advised on the final manuscript. SV contributed to the implementation and final design of the study, including the management of recruitment and participant engagement. KMK provided overall supervision of the study, advising on design, implementation, statistical analysis and the final manuscript. All authors have approved the final article.

**Competing interests** None declared.

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**Data sharing statement** The authors are open to data sharing as may be indicated for a meta-analysis, for example, in the future.

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