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Tosca D. Braun  
*Brown University*

*Et al.*

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## “We really need this”: Trauma-informed yoga for Veteran women with a history of military sexual trauma

Tosca D. Braun<sup>a,b,c,d,\*</sup>, Lisa A. Uebelacker<sup>d,e</sup>, Mariana Ward<sup>f</sup>, Cathryn Glanton Holzhauser<sup>a,g</sup>, Kelly McCallister<sup>b</sup>, Ana Abrantes<sup>d,h</sup>

<sup>a</sup> VA Central Western Massachusetts, 421 N. Main St., Leeds, MA, 01053, United States

<sup>b</sup> West Springfield, MA Vet Center, 95 Ashley Ave., West Springfield, MA, 01089-1352, United States

<sup>c</sup> Centers for Behavioral and Preventive Medicine, The Miriam Hospital, 196 Richmond St., Providence, RI, 02903, United States<sup>†</sup>

<sup>d</sup> Department of Psychiatry and Human Behavior, Alpert Medical School of Brown University, Box G-BH, 700 Butler Drive, Providence, RI, 02906, United States

<sup>e</sup> Psychosocial Research, Butler Hospital, 345 Blackstone Blvd., Providence, RI, 02906, United States

<sup>f</sup> Memorial Sloan Kettering, Sloan Kettering Institute, 1275 York Ave., New York, NY, 10065, United States

<sup>g</sup> Department of Psychiatry, University of Massachusetts Medical School, 55 Lake Ave., North Worcester, MA, 01655, United States

<sup>h</sup> Behavioral Medicine and Addictions Research, Butler Hospital, 345 Blackstone Blvd., Providence, RI, 02906, United States

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### ABSTRACT

**Objectives:** Up to 70% of women service members in the United States report military sexual trauma (MST); many develop post-traumatic stress disorder (PTSD) and co-occurring disorders. Trauma-informed yoga (TIY) is suggested to improve psychiatric symptoms and shown feasible and acceptable in emerging research, yet no work has evaluated TIY in MST survivors. The current quality improvement project aimed to examine TIY's feasibility, acceptability, and perceived effects in the context of MST.

**Design:** Collective case series ( $N = 7$ ).

**Setting:** New England Vet Center.

**Interventions:** Extant TIY program (Mindful Yoga Therapy) adapted for Veteran women with MST in concurrent psychotherapy.

**Main outcome measures:** Attrition and attendance; qualitative exit interview; validated self-report measure of negative affect pre/post each yoga class, and symptom severity assessments and surveys before (T1; Time 1) and after the yoga program (T2; Time 2).

**Results:** Feasibility was demonstrated and women reported TIY was acceptable. In qualitative interviews, women reported improved symptom severity, diet, exercise, alcohol use, sleep, and pain; reduced medication use; and themes related to stress reduction, mindfulness, and self-compassion. Regarding quantitative change, results suggest acute reductions in negative affect following yoga sessions across participants, as well as improved affect dysregulation, shame, and mindfulness T1 to T2.

**Conclusions:** TIY is both feasible and acceptable to Veteran women MST survivors in one specific Vet Center, with perceived behavioral health benefits. Results suggest TIY may target psychosocial mechanisms implicated in health behavior change (stress reduction, mindfulness, affect regulation, shame). Formal research should be conducted to confirm these QI project results.

Military sexual trauma (MST) is defined as “sexual harassment that is threatening in character or physical assault of a sexual nature that occurred while the victim was in the military” by the United States Department of Defense (DoD) and Department of Veteran’s Affairs

(VA).<sup>1</sup> MST includes sexual assault, activities of a sexual nature that occurred without consent, and offensive sexual remarks and advances, and may occur while off-base or while on military duty.<sup>2</sup> Up to one-third of U.S. women Veteran VA users have screened positive for MST,<sup>3</sup>

\* Corresponding author. Present address: The Miriam Hospital, 196 Richmond St., Providence, RI, 02903, United States.

E-mail addresses: [tosca\\_braun@brown.edu](mailto:tosca_braun@brown.edu) (T.D. Braun), [LUebelacker@butler.org](mailto:LUebelacker@butler.org) (L.A. Uebelacker), [mariana.ward@uconn.edu](mailto:mariana.ward@uconn.edu) (M. Ward), [cathryn.holzhauser@va.gov](mailto:cathryn.holzhauser@va.gov) (C.G. Holzhauser), [Kelly.McCallister@va.gov](mailto:Kelly.McCallister@va.gov) (K. McCallister), [ana\\_abrantes@brown.edu](mailto:ana_abrantes@brown.edu) (A. Abrantes).

<sup>†</sup> Present address.

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although women Veterans in a recent anonymous survey reported rates as high as 70%.<sup>4</sup> MST is associated with increased medical diagnoses,<sup>5,6</sup> elevated rates of psychopathology including post-traumatic stress disorder (PTSD), major depressive disorder, generalized anxiety disorder, and suicidality,<sup>3</sup> and heightened chronic pain,<sup>7,8</sup> fibromyalgia,<sup>9</sup> sleep disorders,<sup>8</sup> psychotropic medication utilization,<sup>3</sup> substance use disorders,<sup>10,11</sup> eating pathology,<sup>12</sup> and cardiovascular risk factors such as smoking,<sup>10</sup> obesity,<sup>13</sup> and sedentary behavior.<sup>14</sup>

The DoD and the VA have an increased interest in examining the integration of complementary and integrative health modalities such as acupuncture and yoga into treatment as usual,<sup>15,16</sup> including for MST.<sup>17</sup> Survivors have articulated a need for a broader range of MST therapies in women-only settings,<sup>18</sup> and yoga has been reported among the therapies most helpful for management of MST-related symptoms in early qualitative research.<sup>2,19</sup> Hatha yoga is a multi-faceted practice with origins in ancient India and Hinduism<sup>20</sup>; modern variants commonly “emphasize physical postures (*asana*), breathing techniques (*pranayama*), and meditation (*dhyana*).”<sup>21</sup>

Trauma-informed yoga (TIY) is a therapeutic form of yoga recommended as an effective affect regulation intervention for women trauma survivors.<sup>22</sup> TIY integrates mindfulness training with breathing, physical activity, and relaxation and trauma-relevant features such as safety, empowerment, collaboration, and trustworthiness.<sup>23–27</sup> For example, TIY often includes soft lighting and minimal noise, with no mirrors or hands-on assists. Instructors adopt a welcoming tone and slow pace while using clear and simple instructions that encourage student autonomy.<sup>23,28</sup> Among trauma survivors, a recent quantitative review observed yoga’s effects on PTSD, depression, and anxiety symptoms to be equivocal,<sup>29</sup> although a recent meta-analysis found that yoga, adjunctive to treatment-as-usual of medication and/or psychotherapy, was effective in improving trauma-related symptoms across psychiatric diagnoses.<sup>30</sup> Both reviews included all forms of yoga, including non-TIY, and reported across genders. More recently, a large RCT with mixed-gender TIY classes (34% female, 13% of TIY condition reporting MST) observed significantly greater improvement in PTSD symptoms immediately post-TIY compared to the active control group, with equivalent results at 7-month follow-up in both groups.<sup>31</sup> Having TIY with Veteran women only may be especially important in the context of MST, given expressed concerns of discomfort, unsafety, or revictimization in predominantly male VA settings.<sup>18,19</sup>

A 2016 narrative review on TIY specifically for women trauma survivors concluded TIY reduces affective distress, including depression and PTSD symptoms.<sup>22</sup> Although recent evidence suggests TIY may be more efficacious in reducing PTSD symptoms for women who report fewer (i.e., one) adult-onset interpersonal traumas than for those who report two or more,<sup>32</sup> the feasibility and acceptability of TIY in women trauma survivors has been consistently demonstrated,<sup>25,33–37</sup> with preliminary evidence in Veteran women. In a recent trial, Veterans with PTSD in gender-specific TIY ( $n=7$  women; of 41% with MST in overall sample, 85% were women) reported improvement in PTSD, depression, and sleep.<sup>38</sup> One pilot randomized trial (RCT) in an all-women Veteran sample observed reductions in PTSD<sup>39</sup> and improved health behaviors, including reduced alcohol use, as well as increased enrollment in psychotherapy for PTSD following a TIY program,<sup>40</sup> although this study did not assess MST.<sup>39</sup> We are aware of one yoga-related pilot study that has explicitly sampled Veteran women with a history of MST, which observed an iRest protocol (yoga nidra, a form of guided imagery or “yogic sleep”) associated with improved symptoms of PTSD, less self-blame, and depression, as well as qualitative reports of stress management, improved sleep, and increased feelings of joy.<sup>41</sup> More data is thus needed to elucidate the feasibility and acceptability of TIY in this population, as well as perceived effects on behavioral health.

Yoga may contribute to improved depression and PTSD in trauma survivors through targeting transdiagnostic psychosocial process constructs. For instance, affect dysregulation and shame are implicated to underpin the development of psychiatric sequelae (PTSD, depression,

anxiety) following sexual assault,<sup>42,43</sup> and these factors are suggested to improve during yoga in prior research with Veterans.<sup>31,41,44</sup> Low dispositional mindfulness has also been shown a vulnerability factor for the development of trauma-related symptomatology,<sup>45</sup> and mindfulness may improve during yoga in Veterans.<sup>33,46</sup> Reduction of acute negative affect (e.g., state anxiety) during yoga may also contribute to improved behavioral health in Veteran women with MST. Among women trauma survivors acute negative affect is a mechanism linking PTSD to momentary disordered eating<sup>47</sup> and daily alcohol use,<sup>48</sup> and yoga is implicated to induce immediate reductions in negative affect in other populations.<sup>49–51</sup> We are unaware of research that has yet examined changes in affect dysregulation, shame, mindfulness, or acute negative affect during TIY among Veteran women MST survivors.

This quality improvement (QI) project piloted an adaptation of an existing, manualized TIY program – Mindful Yoga Therapy<sup>26</sup> – with Veteran women with a history of MST at a New England Vet Center. This QI project used a collective case study design. Our aims included evaluating the preliminary feasibility, acceptability, and effectiveness of Mindful Yoga Therapy in two cohorts (one 12-week, one 8-week), and better understanding Veteran women’s lived experiences thereof. We also explored whether transdiagnostic process constructs associated with trauma-related psychopathology – affect dysregulation, shame, and mindfulness – showed visual change from pre- to post-treatment, including changes in acute negative affect (i.e., state anxiety) before and after each yoga session.

## 1. Material and methods

The present QI project used a collective case study design to amplify the subjective experiences and voices of Veteran women with MST, and to elicit feedback to adapt the yoga program for future cohorts in this specific New England Vet Center setting.

### 1.1. Participants

Veteran women with a history of MST and enrollment in current mental health treatment were enrolled. We present data from seven participants, including five program completers, drawing from two cohorts. Aliases are used to ensure confidentiality. Cohort A ran 12 weeks and enrolled six participants; four completed (i.e., attended the final session; Carla, Kimberly, Nicole, and Sandra) and two did not (Daphne and Sam). Cohort B ran a briefer 8 weeks due to the facilitator’s availability. Of six participants in Cohort B, four enrolled in a different mind-body QI project, two of these from Cohort A (and thus ineligible), and two whom declined to participate in the TIY program evaluation component. The remaining two were engaged in TIY alone and of these, only one elected to participate in the QI project and is reported here (Kathleen). To protect confidentiality we report only general demographic characteristics. The seven participants included Veterans who identified racially as Black or White and represented a range of ages (27–57 years of age) and service branches. All participants reported non-Hispanic/Latino/a ethnicity.

All Veterans whose data are reported (i.e., all “completers,”  $n = 5$ ) attended at least 75% of sessions (i.e., nine sessions for Cohort A, six sessions for Cohort B). All reported MST as their Criterion A traumatic stressor. The reported frequency of MST events ranged from one to “many,” with four reporting two or more instances. Severity of MST ranged from sexual harassment to completed rape. Regarding other interpersonal traumas, four women also reported childhood trauma (physical and/or sexual assault); two reported adulthood sexual and/or physical assault outside of military service timeframe.

Women reported diagnoses of psychiatric comorbidities, including PTSD, depression, generalized anxiety disorder, bipolar disorder, alcohol use disorder, binge eating disorder, and trichotillomania. Their engagement in psychotherapy ranged from six months to over ten years, with frequency of appointments ranging from once-weekly to once per

month. Veteran therapists reported utilizing therapeutic approaches that were trauma-informed, empirically-supported, and integrative. At the time of enrollment, no Veterans reported having completed a VA-approved evidence-based therapy for PTSD (e.g., prolonged exposure [PE], cognitive processing therapy [CPT]), although two had previously initiated PE or CPT and prematurely discontinued. Participant levels of yoga experience ranged from yoga naive (i.e., no prior yoga experience; Carla, Kimberly, Sandra, Kathleen) to a 200-h level trained yoga instructor (i.e., the standard Yoga Alliance credential for yoga instruction) who practiced yoga daily (Nicole).

## 1.2. Procedure

The investigator [first author] sent systemwide emails to VA and Vet Center therapy providers regarding the program. Interested therapists were asked to refer eligible and interested patients. The investigator also conducted a preliminary face-to-face clinical interview with all potentially eligible participants. The QI project comprised three components. First, assessments administered as part of routine clinical care (i.e., symptom assessments) were supplemented with self-report measures to elucidate potential mechanisms of change (i.e., mindfulness, affect dysregulation, shame; see Measures below). Assessments were collected prior to the first yoga session (T1; pre-treatment) and at 12 weeks following the final yoga session (T2; post-treatment). Second, participants filled out a brief assessment before and after each yoga class to assess state changes in negative affect. Third, for program evaluation purposes, the lead author conducted qualitative exit interviews within two weeks following program completion. Interviews were 30–45 min long. One Veteran consented to her interview being audio recorded, and all provided permission for transcription of notes during the interview.

No incentives were provided to participants; participation was presented as an elective and potentially beneficial adjunct to psychotherapy. This QI project took place within an existing behavioral health program at the Vet Center as approved by the affiliated VA Research Office, the heads of which determined institutional review board (IRB) approval was not required. Similar methods have been utilized in other program evaluations and naturalistic observational studies with Veterans.<sup>52,53</sup>

## 1.3. Intervention

Mindful Yoga Therapy is a TIY protocol developed for use with Veterans with PTSD.<sup>26</sup> Classes in the present study were once-weekly and 75 min in length. Mindful Yoga Therapy is designed to provide tools for coping with post-traumatic stress that Veterans can carry into daily life, emphasizing the development of breathing, mindfulness, and relaxation skills. In the evaluated intervention, each 75-minute class included a 10–15 minute opening segment (breathing exercises and meditations) in a supine position, 45–50 min of yoga postures (with intensity of postures increasing from gentle to moderate over the intervention), and 8–15 min of final resting pose and meditation.

The first author, a certified yoga therapist (C-IAYT) and experienced registered Kripalu yoga instructor (E-RYT-200), facilitated the yoga intervention. Classes were hosted at the Vet Center, where one Veteran also underwent therapy. To adapt the intervention to address clinical targets common among MST survivors, the interventionist consulted regional VA and Vet Center clinicians with expertise in working with Veteran women MST survivors, including the fifth author and a member of the VA national MST team. Clinician-suggested themes included increasing assertiveness, autonomy, distress tolerance, and self-compassion, and setting boundaries. The facilitator of this program integrated these themes with the existing Mindful Yoga Therapy curriculum and encouraged participants to note parallels between each theme and their “on the mat” yoga practice with life experience “off the mat.”

To prompt assertiveness and autonomy, the facilitator encouraged participants to identify needs and articulate in-class (e.g., requesting an

adaptation to a posture). Each class, the facilitator offered three-minute segments of “free-flow” during which women engaged any yoga posture they wished. The facilitator taught boundary setting by encouraging women to explore “the edge” of physical sensation – women were instructed to neither push into their maximum capacity or pain, nor to hold back from moderate challenge. The facilitator instructed women to sense the boundaries of yoga postures in their bodies and in space, and to draw parallels with identifying and setting boundaries in their lives “off the mat.” The facilitator encouraged mindfulness, breathing, and relaxation to promote distress tolerance in challenging poses. Finally, the facilitator encouraged self-compassion: they asked participants to adopt an inner voice of caring and kindness, as well as appreciation for the functionality and mobility of their bodies.

## 1.4. Intake assessments

### 1.4.1. Preliminary semi-structured clinical interview

This interview was administered as standard of care for all Veterans enrolling in Vet Center care. Data collected included gender, age, race and ethnicity, branch of service, lifespan history of trauma including sexual assault and degree of severity (i.e., completed or attempted rape is considered more severe than sexual harassment), childhood trauma, and mental health diagnoses.

### 1.4.2. Yoga therapy initial intake questionnaire

Survey adapted from standard wellness studio intake form queried level of yoga experience, readiness for physical activity, and potentially contraindicating physical health conditions. Items were not psychometrically validated.

## 1.5. Quantitative measures

### 1.5.1. Pre- and post-treatment measures

**1.5.1.1. Posttraumatic Stress Disorder (PTSD).** All Veterans had VA- or Vet Center-established diagnoses of PTSD. *DSM-5* PTSD symptom severity and Criterion A was assessed using the Posttraumatic Stress Checklist (PCL-5; 20 items) with Life Events Checklist and Criterion A for *DSM-5* (LEC-5; 27 items).<sup>54</sup> A cut-point of 31–33 on the PCL-5 indicates probable PTSD with change of 5–10 points and 10–20 points indicating reliable and clinically meaningful change, respectively. In prior research, the PCL-5 has demonstrated excellent internal consistency ( $\alpha = .96$ ) and convergent and discriminant validity.<sup>55</sup>

**1.5.1.2. Depression.** Depressive symptoms were assessed with the nine-item Patient Health Questionnaire-9 (PHQ-9).<sup>56</sup> Scores of 5, 10, 15, and 20 represent cut points for mild, moderate, moderately severe, and severe depression, respectively.<sup>57</sup> A 5-point change is clinically significant. The PHQ-9 has demonstrated good internal consistency ( $\alpha = .89$ ) and good construct and external validity.<sup>56</sup>

**1.5.1.3. Internalized shame.** Painful internal feelings of self-conscious negative affect were assessed using the 30-item internalized shame scale (ISS).<sup>58</sup> Scores of 50 or higher indicate a relatively high level of internalized shame. The ISS has demonstrated excellent internal consistency ( $\alpha = .97$ ) and good construct validity.<sup>59</sup>

**1.5.1.4. Affect dysregulation.** Impairments in emotion regulation abilities were assessed using the 36-item Difficulties in Emotion Regulation Scale (DERS).<sup>60</sup> Scores range from 36 to 180 with higher scores representing more dysregulation. The DERS has been shown to have excellent internal consistency ( $\alpha = .97$ ) and has demonstrated construct and predictive validity.<sup>60</sup>

**1.5.1.5. Mindfulness.** Mindfulness was assessed with the 5-item Acting

with Awareness (AWA) subscale of the Five-Factor Mindfulness Questionnaire Short Form (FFMQ-SF).<sup>61</sup> AWA has been found indicative of an overarching mindfulness construct and is correlated with the Mindful Attention Awareness Scale.<sup>62</sup> The FFMQ-SF validation study showed this subscale to have good internal consistency ( $\alpha = .86$ ) and demonstrated construct validity.<sup>61</sup>

### 1.5.2. Pre-post yoga class measure

**1.5.2.1. State trait anxiety.** State anxiety was assessed using the 6-item state version of the State-Trait Anxiety Inventory (STAI-6).<sup>63</sup> The STAI-6 validation study indicated good internal consistency ( $\alpha = .82$ ) and concurrent validity.<sup>63</sup>

### 1.6. Qualitative interview

The interview protocol was designed in consultation with an MST treatment expert (fifth author) to capture salient program evaluation themes for this population and setting. The protocol included semi-structured and open-ended questions<sup>64</sup> on program feasibility and acceptability, and experiences and any shifts participants noticed in themselves and their lives during the TIY program. The protocol also included theme-specific probes designed to elicit targeted responses per Stake's (1995) recommendation, affording uniformity and adaptability in each interview.<sup>65</sup> As needed, interview questions were modified throughout the administration process using participant input and field notes. This work presents on responses to interview questions and themes pertaining to mental health, behavioral medicine, physical health, and theorized process constructs. We also report program evaluation themes of likely interest to other sites or future researchers (e.g., concerns about yoga initiation, views on women Veteran only classes). The interview protocol can be viewed in Supplementary Materials.

The first author conducted the interviews, with three occurring in-person and two over the phone. Field notes were taken during and immediately after each interview. The single audio recorded session was transcribed verbatim and augmented with field notes. For those electing not to be audio recorded, their words were transcribed verbatim as much as possible, efforts were made not to summarize, and the script was prepared immediately (same day) to reduce recall bias.<sup>66</sup>

### 1.7. Data analysis

#### 1.7.1. Quantitative metrics

Symptom severity assessments are reported in terms of clinically meaningful change from T1 to T2 in clinical vignettes, as well as graphically by participant to visualize trajectories over time. Additionally, results for measures of process constructs (shame, affect dysregulation, mindfulness) at T1 and T2, and changes in acute negative affect pre- to post-yoga sessions across cohorts (both 12- and 8-week cohorts), are depicted graphically.

#### 1.7.2. Qualitative exit interview

Thematic analysis was used to analyze women's responses.<sup>67</sup> The following steps were initially implemented by the first author: (1) Become acquainted with the data, (2) Compile a list of codes, (3) Create a list of themes. When reporting results, all potentially identifiable information was removed. To minimize bias given that the first author both conducted the qualitative interviews and facilitated the TIY intervention, and to ensure credibility and replicability, a peer review process was used in which the fourth and fifth authors reviewed the data and coding to confirm categories and refine the most accurate labels.<sup>68,69</sup>

### 1.8. Triangulation to reduce Bias and improve data saturation

The first author conceived and implemented all aspects of this QI project, including facilitating the yoga sessions. Triangulation – a methodology referring to the use of multiple external methods to collect and analyze data – minimizes bias from a single-person point of view and ensures data saturation.<sup>70</sup> Two forms of triangulation were used in the present study: 1) data triangulation was used when more than a single source of data (symptom screeners, therapist report, qualitative interview) evaluated the same characteristic; and 2) investigator triangulation ensured several authors (fourth and fifth) reviewed qualitative interview themes. Regarding participants' therapist consultation, during and subsequent to the TIY program on at least two occasions, the first author queried therapists as to the general types of changes reported by or observed in their clients in therapeutic sessions during the QI project.

## 2. Results

In Cohort A, two participants discontinued the program (Daphne and Sam). Daphne discontinued after becoming a primary caregiver for a family member in week seven after attending five classes, while Sam moved away unexpectedly in week ten after attending eight sessions. Carla, Kimberly, and Sandra each attended nine classes (75%), while Nicole attended 11 (91.7%). In Cohort B, Kathleen, the one participant in this QI project, attended six classes (75% of eight total), for an attendance rate of 78.3% across both cohorts of completers. The instructor [first author] verbally queried the incidence of musculoskeletal strains, the most common yoga-related adverse event, on a weekly basis. Veterans denied experiencing adverse events, although after program completion one Black Veteran reported that her hair braids made it difficult to relax when supine in final relaxation. Non-musculoskeletal adverse events were not queried.

### 2.1. Program evaluation themes

Please see [Table 1](#) for detail on program evaluation qualitative themes. Themes include concerns initiating yoga ( $n = 3$ ), views on women Veteran only vs. mixed-gender or community yoga classes ( $n = 4$ ), and suggestions for programmatic improvement ( $n = 4$ ). Yoga-naïve participants cited concerns about initiating the yoga program that could be potential barriers to engagement. All participants noted appreciation for the same-gender yoga classes, relating that they increased a sense of "safety," "sisterhood," and increased relaxation compared to mixed-gender community classes.

### 2.2. Case vignettes

We present vignettes to give a sense of within person themes, but we also present figures to show how changes occurred together across persons. See [Fig. 1](#) for graphical representation of changes in symptom severity and negative affect; all Veterans appeared to report a reduction in acute negative affect immediately following yoga class. Themes derived from qualitative interviews and representative quotes can be viewed in [Table 1](#).

#### 2.2.1. Case 1: Carla, yoga naive

Carla's quantitative data indicated a clinically meaningful reduction in her subthreshold PTSD symptoms (PCL-5, T1 = 24 and T2 = 5), and no change in mild depressive symptoms from pre- to post-treatment (PHQ-9, T1 = 5 and T2 = 3). In the qualitative post-treatment interview she noted "I did notice that it was improved ... I do keep a running commentary with my therapist, and I talk to her each week about where I was at. I was in the yoga program, using that, [finding it] helpful to keep me focused in the moment, helping with PTSD." One of Carla's therapists corroborated that she reported the yoga program was beneficial for PTSD symptom management. Additionally, Carla reported that

**Table 1**  
Summary of qualitative interview themes and representative quotes (n = 5 Veterans interviewed).

Program Evaluation Themes	
Concerns of initiating yoga (n = 3)	Two yoga-naïve Veterans indicated having concerns about whether yoga would be appropriate for their body size and level of physical ability, including flexibility and balance, as well as lack of yoga experience. One also expressed a primary concern being the time commitment.
Women Veteran only vs. community mixed-gender yoga (n = 4)	Veterans noted feeling a sense of “sisterhood” and “level of safety” with the other MST survivors, as well as enjoying the “low-stakes interaction.” Relative to yoga classes in the community, they noted appreciating the women Veteran-only setting for its increased sense of safety, lack of hands-on physical adjustments, and emphasis on self-compassion. Nicole shared this helped her drop self-other comparisons: “Having that safe space [in yoga, away from self-other comparisons] it felt right. Sometimes I had my eyes closed the whole time and didn’t know what was going on. The fact that it didn’t matter and I felt that safe was amazing.” Veterans requested more advice on developing a home practice, extension of class time to two hours, and/or increased frequency of classes per week. Additional suggestions included more time for social interaction and an increased focus on physical alignment for appropriate expression of the yoga postures. Two Veterans also appreciated the evening class time.
Suggestions for improvement (n = 4)	Three Veterans reported yoga days were their favorite day of the week. “My favorite part was knowing that I had the group to go to, knowing that Thursday afternoon was a sacred time” - Carla I was much more calm, even Thursdays leading up to yoga, I would say, “I have yoga tonight, it’s going to be a good day!” - Nicole “I enjoyed it immensely, I love yoga. [Yoga days] were my favorite day of the week, because of therapy and then I got to relax ... It kind of took me out of the world for an hour or so and that was what was very calming for me” – Kimberly
Favorite day because of yoga (n = 3)	
Theorized Process Construct Themes	
Stress reduction and relaxation (n = 5)	All Veterans reported stress reduction while four reported relaxation. Regarding acute stress reduction, all (n = 5) but Carla reported experiencing reduced stress immediately following yoga class. Carla reported reduced stress over time. “I felt as the time went on that the stress went down. I noticed it with fewer headaches, stomachaches, abdominal symptoms.” – Carla Nicole indicated that the most notable skill she learned was to “take it down, relax and unwind ... that gentle, calm, safe space to practice a really relaxing yoga class, was just what I needed. I felt more calm and peaceful with everything and all the chaos in my life.” Carla, Kimberly, Nicole, and Sandra reported perceived increases in mindfulness. “I noticed stuff about my mindfulness meditation spill over. Sometimes if I get frustrated, I can take a deep breath and refocus my thoughts, kind of let things pass ... let go of things.” – Kimberly “Things were going better in my life, I wasn’t so stressed out over things, I was able to focus a little bit better too [on] regular daily tasks that sometimes I’m mindless with.” - Sandra Kimberly, Nicole, Sandra, and Kathleen reported improved self-compassion. “[I gained] an increased awareness of needing to be compassionate with myself, kind of like putting
Mindfulness (n = 4)	
Self-compassion (n = 4)	

**Table 1 (continued)**

Affect regulation (n = 4)	it my radar, oh yeah, take care of yourself. . I was like, I need to take this act of self-care today, because I do feel better [after].” - Kathleen Kimberly, Nicole, Sandra, and Kathleen cited improved affect regulation – including the use of cognitive reappraisal, mindfulness, self-compassion, and specific yogic strategies such as breathing to soothe difficult emotions. “I remember lying there at the beginning [of yoga] hoping no one would hear me crying. I didn’t want to cry [after painful situation], I wanted to be strong for [loved one] ... that yoga class was the first time when I was really just like hey, I can relax and let my guard down.” – Nicole “Even when you have a horrible day at work and you’re so angry, it [yoga] tones that down so much.” – Kathleen Nicole and Sandra also reported using yoga-related techniques in their daily lives “off the mat” to regulate negative affect. “I’ll go into a down dog when I’m feeling tense. I’ll take a pose or two and ... do some breathing ...” – Nicole “I still try to [practice self-compassion], when I see myself going down that [harsh] mental path [of self-criticism], I try to do some things to counteract it” - Sandra Kimberly, Nicole, Sandra, and Kathleen reported either initiating a new relationship or improved relationship quality which they related to feeling less stressed and irritable, and more compassionate. “My running level of stress is less and therefore I am less bitchy at my partner and ... more aware of it ... [Now] I’ll look to see if I can squeeze yoga in to rein that [stress level] in, because it does trickle over to everything to how you talk to your boyfriend, to how patient you are with your niece and nephew. And it affects everyone.” – Kathleen “I’m remembering to be kinder to everyone around me, and knowing that everybody’s going through something and just to not always judge.” - Sandra Nicole, Sandra, and Kathleen reported improved body image secondary to yoga participation. “I’m learning to like my thick thighs, they carry me everywhere and they are very strong” – Kathleen “I’ve noticed [since yoga] I’m not as hard on myself [related to recent weight gain]. [I say], ‘it’s ok, your clothes still fit, what are you stressing about?’” - Nicole
Interpersonal relationships (n = 4)	
Body image (n = 3)	
Behavioral Medicine and Physical Health Themes	
Alcohol (n = 1)	Kathleen shared substantially reducing her alcohol intake the nights she practiced yoga secondary to feeling more relaxed. After yoga days, I definitely will cut back on alcoholic beverages because by the time I get home [from yoga] I’m already relaxed ... maybe I’ll have one [beer] but not the three or four in the typical 4–5 hours after work [I usually have weeknights]” Carla and Kimberly indicated improved dietary quality, both implicating mindful eating as a potential contributor. Kimberly also related this to decreased irritability (i.e., emotional eating) post-yoga: “[Yoga] helped me be more mindful about what I eat ... When I’d get home from yoga I’d always be very relaxed, we’d [spouse] get something nice and healthy to eat and hang out together. Because I’m less irritable then.” - Kimberly “I’ve changed how I’m eating. I’ve started eating more vegetables and fruits, so I don’t know if
Diet (n = 2)	

(continued on next page)

Table 1 (continued)

Exercise (n = 2)	<p>that's because of the yoga that I'm being more mindful" – Carla program.</p> <p>"I did more exercise all around when I was doing yoga because I was active, so it was easier to kind of continue that business." – Kimberly</p> <p>"When I generally stop doing yoga, it's because I'm sinking into that not good me, the me I don't want to be, and my yoga practice is usually the last thing to go when I kind of just let myself go. I've noticed that but I've also noticed that yoga is the thing that always brings me back. And then when I start feeling better everything else starts falling into place too and I have more energy to do exercise" - Nicole</p> <p>Nicole and Kimberly reported increases in non-yoga physical activity during the yoga intervention.</p> <p>Improved sleep quality was cited by Nicole, Sandra, and Kathleen, who attributed this to practicing meditation and relaxation exercises learned in-class before bed, as well as to feeling more calm overall.</p> <p>"I don't sleep when I'm stressed unless I'm heavily medicated. I don't think I have taken sleep medicine in months at this point and I'm sleeping like a baby throughout the night." – Nicole</p>
Sleep (n = 3)	<p>"I've found it easier to fall asleep, progressively going through the yoga class ... the meditation has helped with the pre-sleep time process ... I truly think it's something that if you don't practice it, it's a skill you lose. So in the 9 weeks of making that part of my routine again I've exercised that muscle, so lying in bed at night, I'm like, nope, nope, quiet your mind, quiet your mind ... it's not a switch for sure but it definitely works." – Kathleen</p>
Medication use (n = 3)	<p>Carla, Nicole, and Sandra reported reduction or cessation of their use of anti-depressant, sleep, and anti-anxiety medications, respectively. Nicole (see sleep, above) and Sandra directly linked their reduction in medication use to yoga's beneficial effects on their mood and stress levels.</p> <p>We really need this; they keep pushing pills on us ... Yoga is more of a lifestyle; it made us stop thinking about all ... all the issues that we're here for. It puts you in a better state of mind, more focused, kinder to people, to yourself, to your whole body... Knowing that you can be calm and peaceful and ... I guess Zen is the best word ... I felt calmer with the yoga than I ever did with [anti-anxiety] pills. - Sandra</p>
Pain, Fibromyalgia (n = 2)	<p>Carla and Sandra reported reduced pain levels following yoga.</p> <p>"Each week I think I showed up with knee and hip pain; the hip pain I had week 1, and its gone now because I've been doing stretches every day I learned that you taught us. Knee pain is arthritic, that's not going to go away, but I'd show up with it, and it would get better by the end of session" – Carla</p>
Increased energy (n = 2)	<p>"I saw [my pain] going down because I was moving more which was good because I have fibromyalgia." - Sandra</p> <p>Sandra and Nicole (see physical activity, above) reported increased energy related to yoga that supported reduced depression and increased physical activity, respectively.</p> <p>"When I left [class], I felt like I had energy. I was calm, I wasn't stressed, but I had energy to do things, so it activated the good stuff. It helped counteract my depression" - Sandra</p>

her psychiatrist was tapering off her anti-depressants, although she did not specify why the taper was occurring. Regarding potential mechanisms of change, in her interview Carla reported experiencing stress reduction, improved mindfulness, and gains in flexibility that she related to reduction in physical pain. She also reported eating more fruits and vegetables, although she wasn't sure if that was due to yoga.

### 2.2.2. Case 2: Kimberly, yoga naïve

Kimberly's quantitative data indicated a clinically meaningful increase in PTSD symptoms (PCL-5, T1 = 17, T2 = 35). In the qualitative interview she inferred this increase may relate to CPT initiation during the TIY program; "I've been a little bit more irritable and triggered ... since starting trauma [CPT] therapy." There was no change in her moderate depressive symptoms (PHQ-9, T1 = 10, T2 = 9). The Veteran's therapist corroborated her report and perceived Kimberly's willingness to initiate exposure therapy as related to the yoga class, which provided her with emotion regulation and coping skills to prepare her for trauma processing therapy. Regarding potential mechanisms of change, despite PTSD symptom increases, in her interview Kimberly reported stress reduction and improvement in self-compassion, as well as mindfulness. She indicated that yoga helped her be more "mindful" of her diet, which she attributed to increased relaxation and less irritability (i.e., less emotional eating). Kimberly also engaged in more non-yoga exercise during the program and reported reduced irritability with her partner.

### 2.2.3. Case 3: Nicole, yoga instructor

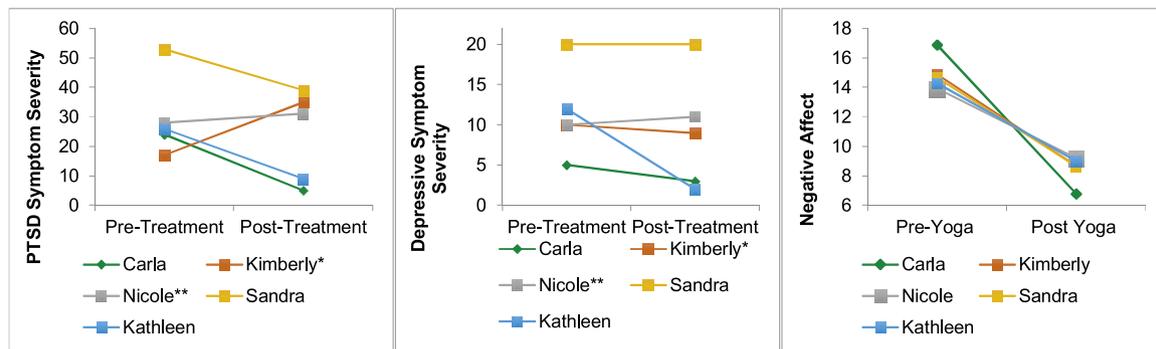
On symptom severity measures, Nicole's responses indicated no clinically significant changes in her subthreshold PTSD (PCL-5, T1 = 28, T2 = 31) or depressive symptoms (PHQ-9, T1 = 10, T2 = 11). Yet she described improvement in anxiety; "I am super anxious about everything, especially being around people. This definitely made it much better and easier, and I wasn't ... finding myself worked up over all these things anymore that normally would have made me lose my mind." Nicole's therapist indicated that she reported fewer anxiety symptoms as a result of the yoga program. Regarding potential mechanisms of change, Nicole reported that the yoga class reduced her stress levels, with effects rippling to improved sleep and reduced sleep medication. She also started training for a marathon during the yoga program. She reported using class time to cultivate mindfulness and self-compassion when she noticed mind-wandering, as well as cognitive reappraisal. During the yoga program Nicole also reported that she was less self-critical of her body image, and initiated a new relationship, which she attributed to feeling more relaxed.

### 2.2.4. Case 4: Sandra, yoga naïve

Sandra's PTSD symptoms evidenced a clinically meaningful reduction from pre- to post-treatment (PCL, T1 = 24 and T2 = 5, respectively). Although her depression symptom severity showed no change (PHQ-9, T1 and T2 = 20), she reported qualitative improvement; "My depression went down during the classes, I was feeling better and engaging and doing things with people." The Veteran's therapist noted that Sandra reported improved depression and behavioral activation. Regarding potential mechanisms of change, Sandra indicated improved stress as well as mindfulness. She also described using self-compassion to counteract harsh and self-critical thoughts, which she related to improved relational skills. Sandra reported a modest improvement in her sleep quality, and that the yoga alleviated pain related to her fibromyalgia. She described experiencing yoga as far more effective in inducing a state of calm when compared to the PRN (*pro re nata*) anti-anxiety pills she took for a number of years and discontinued, noting a preference for the acute effects of yoga on regulating her mood.

### 2.2.5. Case 5: Kathleen, yoga naïve

On symptom screeners, Kathleen's subthreshold PTSD scores showed a clinically meaningful reduction (PCL-5, T1 = 26, T2 = 9) and her moderate depression clinically significantly reduced, entering remission



**Fig. 1.** Changes in PTSD and depressive symptoms from pre- to post-treatment (12 weeks), and changes in negative affect from pre- to post-yoga class (averaged across all classes attended), by participant. Note that Kathleen was in an 8-week cohort.

\* Kimberly was in exposure therapy for PTSD at T2, underlying her PTSD symptom increase and potentially contributing to her stable depressive symptoms. \*\*Nicole is a daily yoga practitioner and this may have contributed to ceiling effects on symptom severity assessments.

(PHQ-9, T1 = 12, T2 = 2). She noted, “PTSD, depression, anxiety, and trichotillomania – I think they’ve all improved.” The Veteran’s therapist corroborated that Kathleen reported improved symptom severity that she had related to yoga participation. Regarding potential mechanisms of change, Kathleen reported overall stress reduction and affect regulation, noting the meditation and relaxation exercises were particularly helpful in regulating her difficult emotions and her sleep. She also noted increased self-compassion related to practicing body self-compassion during yoga. Kathleen described these changes occurred alongside a notable reduction in her alcohol intake the nights following yoga practice, as well as improved body image and less conflict with her partner due to reduced stress and irritability.

**2.3. Change in measures assessing psychosocial process constructs**

The Veterans’ reported improvements in affect dysregulation and mindfulness are largely confirmed by visual review of self-report measures at pre- and post-treatment (see Fig. 2). Trends across scores align with participant report in qualitative interviews. Visual review of mindfulness scores indicates a consistent upward trend excepting Kathleen’s, the only participant who did not report increased mindfulness in her interview. Last, visual review of shame scores suggests a consistent downward slope across participants from pre- to post-treatment.

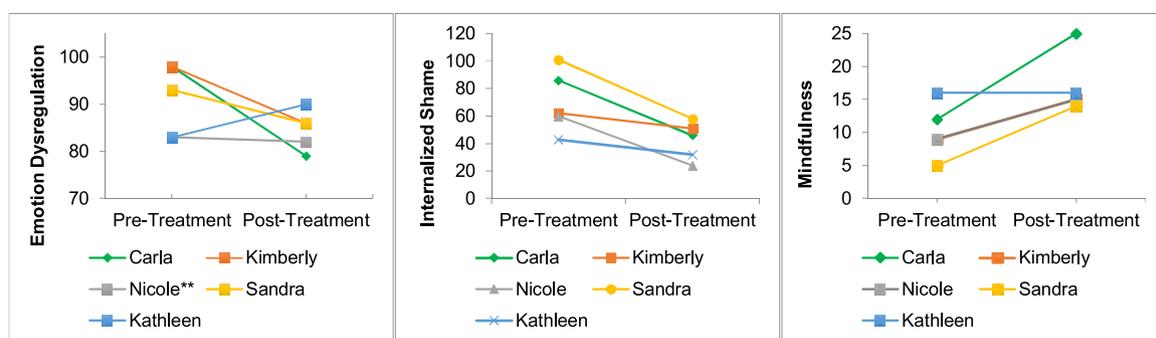
**3. Discussion**

The objective of this QI/QA project using a collective case series design was to explore the preliminary feasibility and acceptability of trauma-informed yoga (TIY) for women Veterans with a history of MST at a New England Vet Center. Our pilot data suggest the TIY was both

feasible and acceptable to Veteran women. Of the seven women who initially enrolled in TIY, five completed, and those who discontinued did so for reasons unrelated to the intervention. Completers attended nearly 80% of yoga classes on average and consistently reported classes were beneficial for their well-being.

In exit interviews, Veteran women reported TIY was acceptable and expressed universal appreciation for the women Veteran-only classes. Some noted concerns about yoga initiation that may prove a potential barrier to engagement, that can be addressed in future work by using advertising and recruitment materials that emphasize body positivity and inclusivity of all body shapes/sizes, races/ethnicities, and ability levels.<sup>71</sup> Women also recommended a number of programmatic adaptations. The request for more support developing a home practice can be addressed through development of a home practice routine delivered through videos, audio, and/or posture sheets as done in our prior work.<sup>72,73</sup> Additionally, the request for evening classes, increased frequency of yoga classes – from once, to several times per week – and/or lengthier class times, is recommended to optimize women Veteran-centered care. Further, the addition of check-ins before or after class would address the request for increased social interaction. Based on Veteran feedback an emphasis on physical alignment in yoga postures by future instructors is recommended, as well as explicit adaptations for supine positions among Veterans of Color and women who may have braided hairstyles. Last, the addition of individualized yoga therapy coaching sessions (virtual or live) may enhance Veterans’ motivation and support development of yoga therapy skills for home practice, optimizing affect regulation for life “off the [yoga] mat.”

Consistent with prior research,<sup>39</sup> Veteran women reported in interviews that TIY was helpful in managing symptoms of PTSD and depression; reports were confirmed through therapist consultation and symptom severity assessments. Simultaneously, women described



**Fig. 2.** Changes in emotion dysregulation, internalized shame, and mindfulness from pre- to post-treatment (12 weeks), by participant. Note that Kathleen was in an eight-week cohort.

\*\*Nicole is a daily yoga practitioner and this may have contributed to ceiling effects on affect dysregulation.

reduction in acute negative affect and improved mood following yoga class, corroborated through reduced anxiety observed following each class (Fig. 1). One Veteran's therapist reported that the distress tolerance benefits of TIY aided her client in initiating exposure therapy for PTSD, aligning with a recent pilot study of TIY that found Veteran women who took TIY more likely to enroll in PTSD treatment than those who did not, although the MST status of Veterans in this study was unknown.<sup>40</sup>

### 3.1. Behavioral medicine, medication intake, and physical health

Health behavior change was not an emphasis of the TIY program, although all Veterans reported improvement upon being directly queried. Most reported improved sleep and reduction or cessation of anti-depressant, sleep, and anti-anxiety medications, and several participants directly linked these benefits to yoga's regulating effects on their mood and stress levels, consistent with extant research showing yoga beneficially affects these domains.<sup>50,74-77</sup> Two women cited improvement in chronic pain and fibromyalgia, aligning with growing evidence that suggests yoga may improve these conditions and related symptoms.<sup>78,79</sup> Improvements in diet (related to mindful eating) and non-yoga physical activity (related to becoming more comfortable with yoga as exercise) were also reported by two Veterans. Indeed, an emerging evidence base associates yoga practice with improvement in diet and physical activity,<sup>80-82</sup> effects referred to as "gateway" or ripple effects, whereby yoga's effects transfer to other behavioral domains.

### 3.2. Possible process constructs that may underlie change

All participants reported stress reduction and most indicated improved relaxation, mindfulness, self-compassion, and body image. Most women reported improved affect regulation, including cognitive reappraisal and use of yogic strategies such as breathing or yoga postures to soothe difficult emotions, and several women related this to improved interpersonal functioning. These findings reflect the broader literature on TIY's affect regulation properties for trauma survivors,<sup>22</sup> and extend these findings by integrating participant qualitative reports with quantitative measures among women Veterans with MST.

Last, our report of reduced shame during yoga in Veteran women with MST extends prior qualitative reports of lessened shame in civilian women survivors and people who smoke.<sup>25,83</sup> Reduced shame during yoga suggests a potential mechanism through which yoga may improve PTSD and/or risk behaviors, given evidence linking shame to eating pathology,<sup>84</sup> suicidality,<sup>85</sup> substance use,<sup>86</sup> and increased risk of sexual revictimization<sup>87</sup> in trauma survivors. Moreover, shame is implicated a key mechanism of the adverse effects of self-stigma (i.e., internalization of socially stigmatizing beliefs and application of these beliefs towards oneself; self-blame) on behavioral health.<sup>42,88</sup> Self-stigma related to sexual assault and mental health is common among Veteran women with MST related to military culture and victim blaming,<sup>89-91</sup> and likely interacts with other socially stigmatized identities to impact health. Self-stigma is strongly implicated to magnify the effects of trauma on poor behavioral health in sexual assault survivors<sup>42,92</sup> and Veterans, including reduced help-seeking,<sup>93,94</sup> and is thus an important clinical target. Given our finding of reduced shame and emerging research implicating yoga in the reduction of self-stigma within Veterans,<sup>31,41</sup> future work would benefit from examining whether TIY improves self-stigma and shame in MST survivors.

### 3.3. Adult-onset trauma exposure and TIY

Our findings add nuance to recent evidence suggesting that TIY may be less efficacious (compared to an active control) in reducing PTSD symptoms for civilian women with two or more (vs. one) adult-onset interpersonal traumas.<sup>32</sup> Consistent with prior research,<sup>89,95</sup> most Veteran women in our study reported two or more instances of MST,

coupled with a range of other adult- and childhood-onset interpersonal traumas. Yet, most Veterans with clinically elevated PTSD symptoms reported qualitative benefit and evidenced clinically meaningful reductions. Future work would benefit from examining whether any effects of TIY on PTSD symptoms in Veteran women with MST are moderated by cumulative trauma exposure.

## 4. Limitations

This QA/QI project was not designed as a research study, rather to elucidate themes for programmatic improvement among Veteran women with MST in the specific setting of a New England Vet Center. As such, our findings are non-generalizable, and we lack data on feasibility of measurement instruments (e.g., burden of data collection), which warrants rectification in formal research. Moreover, as this was not a research study, there was no use of a control group or randomization, precluding causal inference – the observed benefits may thus relate to psychotherapy, non-specific factors, or regression to the mean. Additionally, we did not administer the gold-standard PTSD assessment, the Clinician-Administered PTSD Scale (CAPS),<sup>96</sup> because Veterans had already been diagnosed with PTSD by their VA and Vet Center providers. Nonetheless, future work that formally researches this approach would benefit from using the CAPS and other structured, clinician-administered diagnostic assessments to elucidate objective symptom change. Regarding data saturation (i.e., the point at which when there is enough qualitative data to replicate the study), our *n* of 5 is modest. However, data saturation can be achieved with as few as six participants,<sup>97</sup> and prior case series of TIY with trauma survivors have enrolled as few as four participants, observing consistent qualitative themes.<sup>36,44</sup> Last, one participant was a yoga instructor. While this may be viewed a limitation, from a program evaluation standpoint her stated benefit from the program suggests TIY may be useful across a broad range of yoga experience levels.

## 5. Conclusions/future directions

Veteran women with a history of MST in our program evaluation reported TIY was feasible, acceptable, and indicated strong perception of benefit, including broad-ranging improvements in mental, behavioral, and physical health. Our findings reflect and extend the literature on TIY's emerging broad-ranging improvements for trauma survivors,<sup>22,40</sup> as well as reports by Veteran women who have identified yoga as among the therapies most helpful for MST-related symptoms.<sup>2</sup> The process constructs cited as improved in our study – including stress reduction, affect regulation, and reduced shame – may facilitate yoga's "gateway effects"<sup>98</sup> to improved behavioral and physical health as well as psychopathology. While findings from this naturalistic observational study are at best hypothesis generating, given the collective case series design, our findings are the first to pilot TIY in among Veteran women with MST, and offer preliminary support for TIY's utility in promoting well-being in this population.

In aggregate, our findings strongly support future research to better understand TIY's impact on the health of Veteran women with MST. Relative to specialized healthcare TIY is low cost with potential to be readily disseminable, and may emerge a low-cost health promotion intervention adjunct to standard of care for this population in VA, Vet Center, and other healthcare settings in the U.S. and internationally pending future research. Such work is particularly needed given requests by U.S. Veteran women to expand the range of available MST therapies in women-only settings, as well as the VA's initiatives to improve Veteran-centered and holistic care.<sup>19</sup>

## Author statement

All authors made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis

and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted.

Dr. Tosca Braun conceptualized the QI project, acquired and curated the data, conducted data analysis, determined the methodology, administered the project including intervention, wrote the original draft and reviewed and edited the revision.

Dr. Lisa Uebelacker assisted data curation, analysis, and interpretation, drafted the original article and assisted revision.

Ms. Mariana Ward assisted data curation and analysis, and helped draft the original draft.

Dr. Cathryn Glanton Holzhauser assisted determination of project methodology, data curation, formal analysis, and reviewed/edited the original draft.

Dr. Kelly McCallister assisted project conceptualization and methodology, supervised the project, provided resources for project administration, formal analysis, and reviewed/edited the original draft.

Dr. Ana Abrantes assisted interpretation of the data and reviewed/edited the original draft.

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These contents do not represent the views of the U.S. Department of Veterans Affairs or the United States Government

## Declaration of Competing Interest

The second author's spouse is employed by Abbvie Pharmaceuticals.

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## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ctim.2021.102729>.

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